8. ULUSLARARASI BOĞAZİÇİ BİLİMSEL ARAŞTIRMALAR KONGRESİ

12-13 EYLÜL 2025

İSTANBUL

EDİTÖRLER:

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KONGRE KİTABI

INDEX

CONGRES ID		III-VIII
PROGRAM		VIII-XXXI
GALLERY		XXXII-XXXV
ACADEMIC INCENTIVE		XXXVI
NOTIFICATIONS		XXXVII-XLVI

CONGRESS ID

CONGRESS TITLE
8. INTERNATIONAL BOĞAZİÇİ SCIENTIFIC RESEARCH CONGRESS

DATE AND PLACE
12-13 SEPTEMBER 2025 İSTANBUL ONLINE PRESENTATIONS

ORGANIZATION
ISARC INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

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12-13 SEPTEMBER 2025

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12.09.2025
FRIDAY / 10:00-12:00

SESSION-1 HALL-1

MODERATOR: Assoc. Prof. Dr.Feride ÖNCAN SÜMER

AUTHORS	AFFILIATION	TOPIC TITLE
Caner YERLİ Talip ÇAKMAKCI Prof. Dr. Üstün Şahin	Van Yüzüncü Yıl University TÜRKİYE	Water Footprint Of Tomato: The Case Of Van Province (Turkey)
Can Berk GÜL Hazal BELLİ Caner YERLİ	Van Yüzüncü Yıl University TÜRKİYE Atatürk University TÜRKİYE	Effects Of Sewage Sludge And Biocar Applications On Pepper(Capsicum Annuum L.) Growth Under Drought Conditions
Assoc. Prof. Dr.Gökhan BAKTEMUR Res. Assist. Dr.Ecem KARA Prof. Dr.Hatıra TAŞKIN	Sivas Bilim ve Teknoloji University TÜRKİYE Çukurova University TÜRKİYE	Morphological Responses Of Acur Plant To Nacl Stress
Res. Assist. Dr.Ecem KARA Prof. Dr.Hatıra TAŞKIN Assoc. Prof. Dr.Gökhan BAKTEMUR	Sivas Bilim ve Teknoloji University TÜRKİYE Çukurova University TÜRKİYE	Morphological Responses Of The Plant Rumex Acetosa L. To Salt Stress Under In Vitro Conditions
Gülhan Tunç Osman Telli	Ege University TÜRKİYE Kırklareli University TÜRKİYE	Dna Barcoding Of Fungi In Commercial Drinking Water: Mycotoxin Production Potential And International Case Studies

12.09.2025
FRIDAY / 10:00-12:00

SESSION-1 HALL-2

MODERATOR: Assoc. Prof. Dr.Bedrettin BASUGUY

AUTHORS	AFFILIATION	TOPIC TITLE
Ayhan IŞIK	Karabuk University TÜRKİYE	The Legacy Of Ahl Al-Bayt: An Examination Of The Estate Records Of Sayyids In The Ottoman Empire
Ayhan IŞIK	Karabuk University TÜRKİYE	The Ahl Al-Bayt Under The Testimony Of Justice: Legal Procedures Regarding Sayyids In The Ottoman Qadi Registers
Assoc. Prof. Dr.Bedrettin BASUGUY	Bingöl University TÜRKİYE	An Original Source In Yemeni Historiography: Ibn Al-Mujāwir's Tārīkh Al-Mustabṣir
Hakan CAN	Bingöl University TÜRKİYE	Anwar Jundi's Critiques Of Western-Centric Historical Understanding In The Context Of His Work Al-Tarikh Fi Mafhum Al-Islam
Assist. Prof. Dr.Abdurrahman GÜLMEZ	Gümüşhane University TÜRKİYE	Religious And School Life In The City Of Kharazm (1097-1231)

12.09.2025
FRIDAY / 10:30-12:30

SESSION-2 HALL-3
MODERATOR: Lect. Dr.Ahmet Alperen PALABIYIK

AUTHORS	AFFILIATION	TOPIC TITLE
Assist. Prof. Dr. Selahattin AYDEMİR Assoc. Prof. Dr. Abdurrahman EKİCİ	Van Yüzüncü Yıl University TÜRKİYE	The Effect Of Postbiotic Treatment On The Viability Of Echinococcus Granulosus Protoscoleces
Assoc. Prof. Dr. Erhan Şensoy	Karamanoğlu Mehmetbey University TÜRKİYE	The Use Of Immunohistochemistry In Diagnostic Pathology: Current Biomarkers And High-Sensitivity Diagnostic Methods
Assoc. Prof. Dr. Erhan Şensoy	Karamanoğlu Mehmetbey University TÜRKİYE	Zebrafish (Danio Rerio) In Histology: Applications, Advantages, And Future Perspectives
Fatma AZİZOĞLU Banu TERZİ	Haliç University TÜRKİYE Akdeniz University TÜRKİYE	Lean Management In Nursing Services: Practices, Impacts, And Sustainability
Fatma AZİZOĞLU Banu TERZİ	Haliç University TÜRKİYE Akdeniz University TÜRKİYE	Servant Leadership In Nursing: A Conceptual Review
Lect. Dr.Ahmet Alperen PALABIYIK	Ardahan University TÜRKİYE	Exercise-Induced Metabolic Shifts: A Focus On Energy Sources And Regulation

12.09.2025
FRIDAY / 10:30-12:30

SESSION-2 HALL-4

MODERATOR: Assoc. Prof. Dr.Feyza Çağla ORAN

AUTHORS	AFFILIATION	TOPIC TITLE
Assoc. Prof. Dr.Feyza Çağla ORAN	Tekirdağ Namık Kemal University TÜRKİYE	An Examination Of The Concept Of Climate Refugees In The Context Of Disaster Management Risks
Assoc. Prof. Dr.Feyza Çağla ORAN	Tekirdağ Namık Kemal University TÜRKİYE	Assessment Of Forest Fire Trends In Turkey Between 2009 And 2025 And Disaster Management Processes
Assist. Prof. Dr. Behram Barlas	Beykent University TÜRKİYE	Retrospective Evaluation Of Medical And Surgical Treatment Approaches In Ectopic Pregnancy In Terms Of Clinical Outcomes
Dr. Ömer SONKAYA	Aksaray University TÜRKİYE	Design And Synthesis Of A Therapeutic Agent Conjugated With Magnetic Graphene Oxide
Dr.Gözde MÜTEVELİZADE	Celal Bayar University TÜRKİYE	Impact Of The Covid-19 Pandemic On Nuclear Medicine Operations And Oncological Outcomes: A Single Institutional Experience
Sakine ERGÜN Assoc. Prof. Dr. İbrahim KOÇ	Mardin Artuklu University TÜRKİYE	Information And Application Infrastructure Of Agricultural Pesticide Dealers: A Survey Study On Mardin Province
Ufuk YER Deniz CANBOLAT GÜLTEKİN Serap ULU DELİCE Özgür GÜRBÜZOĞLU Lect. Mesut NAMLI	Atatürk University TÜRKİYE Artvin Coruh University TÜRKİYE	Investigation Of Years-Dependent Quality Parameters In Forest Flower Honeys Obtained From The Murgul Kabaca Valley

12.09.2025
FRIDAY / 10:30-12:30

SESSION-2 HALL-5

MODERATOR: Prof. Dr. Cengiz SARIKÜRKCÜ

AUTHORS	AFFILIATION	TOPIC TITLE
Dr. Halil Erdem AKOGLU	Niğde Ömer Halisdemir University TÜRKİYE	Adaptation Of The Mobile Application Participation Scale Into Turkish: A Validity And Reliability Study
Ünal SAKİ	Agri Ibrahim Çeçen University TÜRKİYE	The Impact Of Managers' Leadership Skills In Fitness Businesses On Crisis Management
Prof. Dr. Cengiz SARIKÜRKCÜ	Afyonkarahisar Health Sciences University TÜRKİYE	Evaluation Of The Biological Activities And Phytochemical Profile Of Cladanthus Mixtus Extracts
Prof. Dr. Cengiz SARIKÜRKCÜ	Afyonkarahisar Health Sciences University TÜRKİYE	Investigation Of Enzyme Inhibition Activities And Biological Potential Of Stachys Longiflora Extracts
Assoc. Prof. Dr. Serkan KÖKSOY	Burdur Mehmet Akif Ersoy University TÜRKİYE	The Problem Of Unused Or Leftover Medicines In Developing Or Undeveloped Countries
Lect.Gülistan Uymaz Aras	Ardahan University TÜRKİYE	The Role Of Nurses In Early Diagnosis Of Critically Ill Patients
Lect.Gülistan Uymaz Aras	Ardahan University TÜRKİYE	The Effectiveness Of Nursing Interventions In Postoperative Wound Healing

12.09.2025
FRIDAY / 10:30-12:30

SESSION-2 HALL-6

MODERATOR: Assist. Prof. Dr.Mevra ASLAN ÇAKIR

AUTHORS	AFFILIATION	TOPIC TITLE
Assist. Prof. Dr.Mevra ASLAN ÇAKIR	Erzincan Binali Yıldırım University TÜRKİYE	Characterization Of Tantalum Oxide Film Produced By Dc Magnetron Sputtering Method
Mehmet İskender ÖZSOY	Sakarya University TÜRKİYE	Carrying Out The Drop Weight Impact Tests Of Carbon And Basalt Fiber Reinforced Polymer Composites
Mehmet İskender ÖZSOY	Sakarya University TÜRKİYE	Evaluation Of Tensile Properties Of Carbon/Basalt Fiber Hybrid Epoxy Composites Subjected To Hygrothermal Aging
Ali Berk TAVACI Onur BİLGEN	Gazi University TÜRKİYE	The Effect Of Ballistc Testing On The Microstructure Of Armor Steel
Onur BİLGEN Ali Berk TAVACI	Gazi University TÜRKİYE	Effect Of Welding Duration On The Ballistic Performance Of Armor Steels
Lect. Erdem YÜCESAN Özge Nalan BİLİŞİK	Istanbul Kültür University TÜRKİYE Yıldız Technical University TÜRKİYE	Content-Based (Tf-Idf) Similar Product Recommendations: Machine Learning-Based Recommendation System Application For B2b Pharmacy Marketplace
Dr. Orçun GÜNDOĞAN Dr. Davut PEHLİVAN Dr. Ferhat EKİN	Van Yüzüncü Yıl University TÜRKİYE Mersin University TÜRKİYE	Current Situation And Future Potential Of Van And Lake Van Transportation: A Scenario-Based Evaluation

12.09.2025
FRIDAY /10:30-12:30

SESSION-2 HALL-7
MODERATOR: Assist. Prof. Dr.Seyma BEKLİ

AUTHORS	AFFILIATION	TOPIC TITLE
Assist. Prof. Dr.Seyma BEKLİ	Abdullah Gul University TÜRKİYE	Route Optimization For Employee Transportation Considering Station Preferences
Assist. Prof. Dr.Seyma BEKLİ	Abdullah Gul University TÜRKİYE	Flow Shop Scheduling With Consideration Of Worker Competency And Preference List
Assist. Prof. Dr.Sema AYSAL	Karabuk University TÜRKİYE	Assessment Of The Effect Of Forest Fires On Wood Properties: A Review
Assist. Prof. Dr.Sema AYSAL Elif Sena EKEMEN	Karabuk University TÜRKİYE	Microencapsulation Of Lemon Oil And Its Inhibitory Effect Against Wood-Decaying Fungi
Dr.Kenan ÖZEL Dr.Abdullah ATILGAN Dr.Abdullah YILDIZ	Ankara University TÜRKİYE Ankara Yıldırım Beyazit University TÜRKİYE	Performance Analysis Of Lead-Free P-N Homojunction Fasni 3 -Based Perovskite Solar Cells
Dr.Abdullah ATILGAN Dr.Kenan ÖZEL Dr.Abdullah YILDIZ	Ankara Yildirim Beyazit University TÜRKİYE	Green Alternatives In Perovskite Photovoltaics: Evaluating Csgei 3 As A Lead-Free Substitute For Cspbi 3

12.09.2025
FRIDAY /10:30-12:30

SESSION-2 HALL-8
MODERATOR: Prof. Dr. Betül GÜROY

AUTHORS	AFFILIATION	TOPIC TITLE
Dr. Jülide YÜZBAŞI	Cukurova University TÜRKİYE	Solid Model-Based Analysis Of Material Property Variations On The Structural Response Of High-Rise Buildings With Diaphragm Discontinuities
Dr. Ahmet ALATAŞ	Manisa Celal Bayar University TÜRKİYE	A Theoretical Study On The Use Of Data Mining Methods In Financial Fraud Risk Detecti
Elnaz NAJATISHENDI Tolga GÖRÜM Seçkin FIDAN Fusun BALIK ŞANLI	Yıldız Teknik University TÜRKİYE Ankara University TÜRKİYE	Automatic Coordination Of Address Data In Turkey: A Nominatim-Based Python Application
Prof. Dr. Betül GÜROY	Yalova University TÜRKİYE	Algal Nexus Approach: Cross-Sectoral Applications And The Vision Of Carbon Neutrality
Asst. Prof. Dr. Özgür BİLİCİ	Atatürk University TÜRKİYE	Chromitite Vein Formation Within Orthopyroxenite: A Rare Example From The Lycian Ophiolite (Sw Turkey)

12.09.2025
FRIDAY / 11:00-13:00

SESSION-3 HALL-9
MODERATOR: Assist. Prof. Dr. Derya ÇAKICI

AUTHORS	AFFILIATION	TOPIC TITLE
Ayşe AKSOY Erdinç ALACA	Ankara Yıldırım Beyazıt University TÜRKİYE	Content And Physical Characteristics Of Children's Picture Books And Their Effects On Children's Reading Behavior
Özlem ÇEZİKTÜRK	Marmara University TÜRKİYE	Teaching Transformational Geometry Using Japanese Historical Wasan Geometry
Assist. Prof. Dr. Derya ÇAKICI	Trabzon University TÜRKİYE	An Analysis Of Cevat Rifat Atilhan's National Revolution Magazine And Its Anti-Semitism
Assist. Prof. Dr. Levent Kaya	Yıldız Technical University TÜRKİYE	Muzaffer Sarisözen Of Turkish Sufi Music: Safer Dal
Assist. Prof. Dr.Çiğdem ÖZDEMİR	Giresun University TÜRKİYE	Transfer Of Art Through Open-Air Museums: The Example Of The Moai Statues
Gökhan BODUROĞLU	Hitit University TÜRKİYE	Migration And Substance Addiction: An Evaluation On Syrian Migrant Children In Türkiye
Assoc. Prof. Dr. Devrim Baran	Trakya University TÜRKİYE	Rethinking Design Education In The Age Of Artificial Intelligence: "A Design For A Faculty Of Design/Proposal"

12.09.2025
FRIDAY / 11:00-13:00

SESSION-3 HALL-10
MODERATOR: Assist.Prof.Volkan DEMIR

AUTHORS	AFFILIATION	TOPIC TITLE
Hatice TOPAL	Karamanoğlu Mehmetbey University TÜRKİYE	The Elif-Nâme Tradition In Turkish Literature And A Different Style: İsmail Hakki's Elif-Nâmeler
Bekir Ercan DOĞAN	Sivas Science and Technology University TÜRKİYE	Bridging The Gap, Building The Future: A Hybrid Model For Teaching Vocabulary To Engineering Students For Real-World Success
Sümeyra BATI	Karamanoğlu Mehmetbey University TÜRKİYE	A Bibliographic Study On The Poetic Forms Of Divan Literature
Saniye Nur ERGAN	Ordu University TÜRKİYE	Tracing Mathematical Experience Through Student Drawings
Merve BAKIRTAŞ	Acıbadem Mehmet Ali Aydınlar University TÜRKİYE	Women's Conceptualization And Perception Of Domestic Violence: An Awareness Study
Assist.Prof.Volkan DEMIR Assist.Prof.Bülent TANSEL Assist.Prof.Bahar AKOĞLU Dr.Selin ERYÜREK	İstanbul Gelişim University TÜRKİYE İstanbul Nişantaşı University TÜRKİYE	The Silent Echo Of Art: The Effect Of Art Therapy On The Social Skills And Psychological Well-Being Of Individuals With Hearing Impairments

12.09.2025
FRIDAY / 11:00-13:00

SESSION-3 HALL-11

MODERATOR: Assist. Prof. Dr. Esra CEBECİ MAZLUM

AUTHORS	AFFILIATION	TOPIC TITLE
Ph.D.Bülent ONAYLI	Trakya University TÜRKİYE	Securitization Of Wildfires In The Context Of Environmental Security
Dr. Şirvan ÖNCE ÇOLAK	Independent Researcher TÜRKİYE	Rereading The Public Sphere: A Critical View Of Eastern And Western Literature On The Axis Of De-Westernization
Assist. Prof. Dr.Hakkı ÖZBAŞ	Tarsus University TÜRKİYE	The Role Of International Trade In Countries' Growth Strategies:The Examples Of China, South Korea, And Turkey
Assoc. Prof. Dr.Nural Yıldız Ertuğrul TÜRKSEVER	Trakya University TÜRKİYE	Complexity And Consumer Behavior
Assist. Prof. Dr. Esra CEBECİ MAZLUM	Selçuk University TÜRKİYE	The Effects Of Energy Consumption And Economic Growth On Water Footprint In Brics-T Countries

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FRIDAY / 11:00-13:00

SESSION-3 HALL-12

MODERATOR: Assoc. Prof. Dr. Sevcan YILDIZ

AUTHORS	AFFILIATION	TOPIC TITLE
Ebru KARABUDAK Assist. Prof. Dr.Ali Korhan ÖZEN	Doğuş Bilgi İşlem ve Teknoloji Hizmetleri TÜRKİYE İstanbul Gelişim University TÜRKİYE	Psychological Factors In Individual Investment Preferences: Avoidance Of Uncertainty And Stress
PhD.Okan AVUNDUK Serkan ARAS	Yalova University TÜRKİYE Dokuz Eylül University TÜRKİYE	Prediction Of Unemployment Rate Using Macroeconomic Indicators With Machine Learning Methods
Fatma KILIÇ Dr. Emre Hayri BARAZ	Kayseri University TÜRKİYE	Socioeconomic Resilience Indicators In Single-Parent Families: A Qualitative Study On Public Sector Employees In Kayseri
Sümeyye GÖKÇENOĞLU	Institute of Social Sciences TÜRKİYE	A Bibliometric Analysis Of Health Tourism Literature: Economic Impacts And Policy Implications
Dr. Murat ALICIGÜZEL	Directorate General of Promotion TÜRKİYE	The Strategic Importance Of French In The Turkish Education System: An Analysis From The Perspective Of Turkey's Global Engagement
Dr. Murat ALICIGÜZEL	Directorate General of Promotion TÜRKİYE	Ai-Supported Language Learning: Threat Or Opportunity?
Assoc. Prof. Dr. Sevcan YILDIZ Yasin Oğuz Özmenekşe	Akdeniz University TÜRKİYE	Traces Of The Past In Traditions: From The Entrance To Jerusalem To The Red Carpet
Assoc. Prof. Dr. Sevcan YILDIZ Yasin Oğuz Özmenekşe	Akdeniz University TÜRKİYE	Traces Of The Past In Traditions: From Tumuli To Earth

12.09.2025
FRIDAY / 11:00-13:00

SESSION-3 HALL-13
MODERATOR Assoc. Prof. Dr. Yılmaz SARIER

AUTHORS	AFFILIATION	TOPIC TITLE
Assoc. Prof. Dr. Yılmaz SARIER Prof. Dr. Kürşat YENİLMEZ Prof. Dr. Ersin KARADEMİR Prof. Dr. Hüseyin Bahadır YANIK Assoc. Prof. Dr.Emre EV ÇİMEN Assoc. Prof. Dr. Mehmet ERSOY	Odunpazarı İlçe Milli Eğitim Müdürlüğü,Ar-Ge Birimi TÜRKİYE Eskişehir Osmangazi University TÜRKİYE Anadolu University TÜRKİYE	Where Is Mathematics? Mathematics Is Everywhere!
Dr. Ahmet POLATOĞLU	Atatürk University TÜRKİYE	Short And Mid-Term Periodicities In Cosmic Ray Intensity And Solar Wind Speed During Solar Cycle 24
Halil Beytullah YILMAZ Ahmet ERTEK	Kastamonu University TÜRKİYE	Airport Safety And Quality Management Following Apron Accidents
Sudenur GÜZEL Ayça DEMİRCİ Melisa KARATAŞ Sena AYDIN Prof. Dr. Eyüp SEVIMLI	İstanbul Medeniyet University TÜRKİYE	An Examination Of Mathematics Teacher Candidates' Opinions On The Use Of Web 2.0 Tools In The Field Of Algebra Learning Within The Context Of Their Technological-Pedagogical Context Knowledge

12.09.2025
FRIDAY / 11:30-13:30

SESSION-4 HALL-14
MODERATOR Dr FETTOUCH Houari

AUTHORS	AFFILIATION	TOPIC TITLE
TASKEEN FATIMA	HAJVERY UNIVERSITY PAKISTAN	The Clinical Significance Of Normal Physiological Blood Parameters In Health Assessment
TASKEEN FATIMA	HAJVERY UNIVERSITY PAKISTAN	An Overview Of Cad; Etiological Factors & Surgical Managements
Adel DELIOU Meriem DEHBI Sofiane BOULKROUNE Mohamed CHAOUR Khmissi BELKAID Abdelkader FIDJAH	Laboratory LAMJ, University ALGERIA	Elastic Behavior Of A Symmetric Unidirectional Composite Laminated E-Glass/Epoxy
Ismail Olaniyi MURAINA Moses Adeolu AGOI Solomon Onen ABAM Bashir Oyeniran AYINDE Wasiu Olatunde OLADAPO	Lagos State University NIGERIA	Artificial Intelligence In Academic Performance Optimization: A Systematic Literature Review
Dr FETTOUCH Houari	University of Mostaganem ALGERIA	On Zeros And Growth Of Solutions Of Second Order Linear Differential Equations
BENFRID Abdelmoutalib	Djillali Liabès University ALGERIA	Earthquakes In The Mediterranean: Between History And Regulations
Maryem ARRAJI Khaoula EL BARBI Mohamed CHAHBOUNE	Hassan First University MOROCCO	Measurement Of Medication Adherence Among Type Ii Diabetes Patients Attending Primary Healthcare Facilities In Morocco
Prof. Dr. med. Manole COJOCARU Major Gheorghe GIURGIU	Titu Maiorescu University ROMANIA	Natural Modulation Gut Microbiota In Psychopatological Stress: Impact Of Deniplant Nutraceuticals
Dr.Saloni Sharma Suhani Sharma	Deemed to be University INDIA	Advancing Regenerative Medicine: Current Status And Future Prospects Of Stem Cell Therapy

12.09.2025
FRIDAY / 11:30-13:30

SESSION-4 HALL-15
MODERATOR Associate Prof. PhD. Brînduşa Mihaela RADU

AUTHORS	AFFILIATION	TOPIC TITLE
Tahreer Farouk	Greater Amman Municipality JORDAN	Transforming Al-Dubati House Into A Heritage Villa In Jordan
Associate Prof. PhD. Brînduşa Mihaela RADU	Romanian Academy ROMANIA	Education For Sustainable Development For A Safer Future
Associate Prof. PhD. Brînduşa Mihaela RADU	Romanian Academy ROMANIA	Eu Structural Funds And Regional Policy
Badejo, Olayemi Aderanti Oladapo, Wasiu Olatunde Alaka Micheal Olusegnn Ogunlusi Raphael Olushola	Lagos State University NIGERIA	Green Chemistry: Trends Towards Industrial Sustainability: A Systematic Review
Dr. Mohammad Waheeb	Hashemite University JORDAN	Touristic Trails Along Zarqa River In The South Levant –Jordan
Fouad Boughanzai Rochdi Daibi Anouar Boughanzai Youssef Ouhassan Rania Majdoubi Abdelkader Hadjoudja	Ibn Tofail University MOROCCO	The Professional Development Nexus: Connecting Technology Acceptance To Teacher Excellence
El.Majdi S. Zerraf Fouad Alloun Said Belaaouad	Hassan II University MOROCCO Mohammed V University MOROCCO	Synthesis And Theoretical/Structural Investigations Of $Na_{0.5}M_{0.25}Ti_2(PO_4)_3$ (M = Zn, Ni)
V.Vijitha S.Madhumitha M.Rahul S.Punithavalli Prof.K.Rajaganapathy	Bharath Institute of Higher Education and Research INDIA	Neonatal Sepsis – Classification, Diagnostic Approach And Management In Nicu

12.09.2025
FRIDAY / 11:30-13:30

SESSION-4 HALL-16
MODERATOR Assist. Prof.K.R.Padma

AUTHORS	AFFILIATION	TOPIC TITLE
Peter Adebisi Adeoye Adebukola Rasheedat Salawu Olutayo Israel Falodun	University of Ibadan NIGERIA	Multidrug Resistant Gram- Possitive Cocci Bacteria Isolated From Fomites In Selected Health Care Centres In Ibarapa East Local Government, Oyo State, Nigeria
A.Ashwini R.Devi Dr.R.Srinivasan	Bharath Institute of Higher Education and Research INDIA	A Short Review On Cancer Nanotechnology ;Current Status And Perspectives
Assoc. prof. M. As. Michailov, PhD, eng.	-	An Opinion About The Idea Of Human's Wellbeing
Amirul Hakim bin Shahrulanuar Muhammad Zulhilmi bin Mohammad Zalani Mohammad Shahrul Nizam bin Mohd Fauzi Pravinnat Arumugam Sunatrah Abdullahyi	Politeknik Tun Syed Nasir Syed Ismail MALAYSIA	Optimization Of Oil Removal By Adsorbent-Based Pineapple Peel Waste
M.Pharm Ashwini.A	SRI RAMACHANDRA INSTITUTE CHENNAI	Formulation And Evaluation Clitoria Ternatea Linn. Alcoholic Extract Antipigment Cream
Dr Saima Shaheen Prof.Dr Nabila Sher	Khyber Girls Medical College PAKISTAN	Thyroid Hormone Levels And Their Association With Plasma Zinc Levels Among Adolescent Afghan Refugees;A Cross-Sectional Study
Assist.Prof.N.G. Kalyani Reddy Assoc. Prof.Dr.K.Dayana Assist.Prof.Chayaraju BalaSai Assist.Prof.K.Tharani	G Pulla Reddy Engineering College INDIA	Robots In Construction: Enabling Technology, Applications, And Challenges
Assist.Prof.N.G. Kalyani Reddy Assoc. Prof.Dr.K.Dayana Assist.Prof.Chayaraju BalaSai Assist.Prof.K.Tharani	G Pulla Reddy Engineering College INDIA	Concrete production using waste water
Adesanmi, Moses Ademola	-	Silences And Omissions: What Is Left Unsaid About Agriculture In Tinubu's 2025 Budget Speech
REDA Rodolfo ZANZA Alessio GUARNIERI Renzo SAVO Francesca TESTARELLI Luca	Sapienza University ROMANIA	Clinical And Biochemical Evaluation Of Two Different Types Of Implant Screw Retained Single Crowns

12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-17
MODERATOR Oheiku Aisha AVOSUAHI, PhD

AUTHORS	AFFILIATION	TOPIC TITLE
Oheiku Aisha AVOSUAHI, PhD	University of Abuja NIGERIA	Assessment Of Climate Change Synthesis And Health Resilience Among Women In North Central Nigeria: A Systematic Review
Faisal NAZIR	The University Of Agriculture PAKISTAN	Production And Characterization Of Carbon Nanotubes From Biochar Under Microwave Irradiation
Mohamed SOLTANE Mourad OUSSALAH Aissa BELMEGUENAI	Yahia Fares University ALGERIA 20 August 1955 University ALGERIA	Polar Frequency Analysis Features Studies Based Faces Biometrics Verifications Systems
Sadik DANI Hassane ABD-DADA Ahmed El ANNAOUI Aziz EZZINE Abdelmajid HADDIOUI Said BOUDA	Sultan Moulay Slimane University MOROCCO	Characterization Of Genetic Resources Of White Mulberry (Morus Alba L.) Based On Phenotypic Traits In Morocco
S. Leporale, M. Cianfriglia, R. Moramarco V. Martini, C. Marocco, C. Bramucci F. Sestito, R.Reda, L. Testarelli T. Testori, G. Perrotti	Sapienza University ROMANIA University of Milan ROMANIA University of Michigan ROMANIA	Vertical Dimension Assessment In Orthognathic Surgery Through Total Face Approach
F.Evolo, L.Adamo, S.Leporale, A.Antonelli N.Carrai, G.Ferri, L.Testarelli M.Galli, G. Miccoli, R.Palumbo L. Lucente, R. Reda	Sapienza University ROMANIA	Radiographic, Clinical, And Biochemical Assessment Of Screw-Retained Versus Cement-Retained Cr-Co-Ceramic Implant-Supported Single Crowns: A Cohort Study
S. Leporale, M. Cianfriglia, R. Moramarco V. Martini, C. Marocco, C. Bramucci F. Sestito, R.Reda, L. Testarelli, T. Testori G. Perrotti	Sapienza University ROMANIA University of Milan ROMANIA University of Michigan ROMANIA	A Radiation-Free Approach To Volumetric Rendering For Soft Tissue
Assist. Prof.K.R.Padma	Women University PAKISTAN	Revolutionizing Chronic Disease Management With Ai-Driven Predictive Analytics

12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-18
MODERATOR Dr.B.MAHADEVAN

AUTHORS	AFFILIATION	TOPIC TITLE
Bensakhria Sara PR.BenkhelifaMohammed	Abdelhamid Ibn Badis University ALGERIA University of Mostaganem ALGERIA	Effects Of Direct Seeding On The Physiological Parameters Of Soft Wheat (Triticum Sativum L., Variety Aïn Abid)
Amina Ahmad Aminu Musa Alhassan Ph.D	Ahmadu Bello University NIGERIA	Who Is A Journalist In A Changing Nigeria? Navigating Ethics, Influence And Responsibilty In The Digital Age'
Muhammad Usman	University of Malakand PAKISTAN	An Innovative Analytical Result Of Two-Dimensional Heat Equation Using Joint Mechanism Of Natural Transform And Adomian Decomposition Method
Dr.B.MAHADEVAN Ms. M SANGEETHA Ms.SUDHARSHANA.U Ms.V.DEEPIKAA	Vellalar College for Women INDIA	Awareness And Implementation Of Modern Cultivation Technologies In Paddy Farming In Thanjavur District
Divya O M Dr Sagaya Aurelia P	CHRIST University INDIA	Interpretable Fusion Of Acoustic Features For Multiclass Voice Disorder Detection
Rizwana Raheel Humaira Majeed Khan	Women University PAKISTAN	Protective Antioxidant And Anti-Inflammatory Effects Of Isofurfural Against Drug-Induced Injury In Rats
Assist. Prof.,Dr. P. Sathish Assoc. Prof.Dr. J. Jeyakodi Moses Assoc. Prof.Dr. S. Kalaiselvan	PSG College of Technology INDIA	Eco-Conscious Chromatic Enhancement Of Silk Substrates With Phyto-Derived Chromophores: A Comprehensive Evaluation Of Chromatic Strength, Fastness Characteristics, And Antimicrobial Efficacy For Sustainable Textile Engineering
Rajendra Kumar Prajapati Shiv Lal Shanti Lal Meena	Rajasthan Technical University INDIA	Efficiency Empowerment Of Solar Energy Storage Systems Using Artificial Intelligence
Sumayya Akram Prof. Dr. Matloob Ahmad Dr. Sana Aslam	Government College University PAKISTAN	Exploring Catalytic Strategies For N-Arylation Of Benzimidazole

12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-19
MODERATOR Aziz Ezzine

AUTHORS	AFFILIATION	TOPIC TITLE
Aziz Ezzine Ahmed El Annaoui Sadik Dani Abdelmajid Haddioui Said Bouda	Sultan Moulay Slimane University MOROCCO	Phenotypic Diversity Of Natural Populations Of Chamaerops Humilis L. In Morocco
Katia BENYAKOUB Mourad KEDDAM Brahim BOUMAALI Michal KULKA	Poznan University POLAND	Kinetic Modelling Of Powder-Pack Boronized 4cr5mosiv1 Steel By Two Distinct Approaches
Daritza del Carmen Arcia González Gloria Auristela Hernández Pérez	Universidad Juárez MEXICAN	Claudia Sheinbaum Pardo: A Legal And Gender Analysis Of The Leadership Of The First Female President Of Mexico.”
Manal Elzain Mohamed Abdalla Muhammad Kamran Anns Uzair	King Khalid university SAUDI ARABIA Shenzhen University CHINA Govt College University PAKISTAN	The Geometry Of Economic Optimization: Novel Applications Of Hilbert And Banach Spaces To Growth And Decision Analysis
Fatimazahra Jouga Fatima Mourabiti Souraya Sakoui Reda Derdak Abdelaziz Soukri Bouchra El khalfi	Hassan II University MOROCCO Chouaïb Doukkali University MOROCCO	Isolation And Characterization Of A Marine Bacterium With Antibacterial Activity Against Vibriosis Pathogens In Aquaculture
Pierre Rostan Alexandra Rostan	American University IRAQ	Comparing Japan’s Post-Covid Economy To Germany’s Economy
Habibur Rahman Bayezid Most. Sabila Nazowa Md. Rabbi Hasan Md. Rajebul Islam Md. Mizanur Rahman Tasnia Munir Elma Rakesh Kumar Mahanta	Dhaka International University BANGLADESH University of Rajshahi BANGLADESH Habiganj Agricultural University BANGLADESH	Phytochemical, Antibacterial, Antioxidants Analysis And Pharmacological Investigation Of Extract From Phrynium Placentarium Leaves
Ahmed Attahiru Abubakar Umar Birnin-Yauri Bashar Attahiru	Kebbi State University NIGERIA	Advances In Polymer Chemistry For Sustainable Development

12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-20
MODERATOR Dr. Farah Rashed

AUTHORS	AFFILIATION	TOPIC TITLE
Salma Fariha Md. Tariqul Islam	University of Rajshahi BANGLADESH	Comparative Analysis Of The Biochemical And Microbiological Quality Of Nga-Pi From Production And Retail Sources In Cox's Bazar District, Bangladesh
Dr. Farah Rashed Dr. Md. Fahim Bhuiyan Abak Dr. Hasnim Naznin Hima	Mymensingh Medical College BANGLADESH Shaheed Tajuddin Ahmad Medical College BANGLADESH	Air Pollution And Its Association With Respiratory Diseases In Bangladesh And India: A Systematic Review
Dr Sagaya Aurelia	CHRIST University INDIA	Explainable Artificial Intelligence (Xai) For Reliable Internet Of Things
Clementina Hashimu Bulus (PhD) Dapels Banse Longse	Faculty of Education University NIGERIA	Effects Of Peer Assessment On Students' Achievement In Mathematics In Senior Secondary Schools In Jos North, Plateau State, Nigeria
Dr. Raf Raf Shakil Ansari	Sharda University INDIA	A Study Of Rights Of Muslim Women And Challenges Of Islamic Fundamentalism In Noor Zaheer's 'My God Is A Woman'
Abdur Rahman Al Mamun Rubel Mia Mst Hedaetun Nahar Hira	Hajee Mohammad Danesh Science and Technology University BANGLADESH	Revolutionizing Drought Tolerance In Staple Crops: Integrating Crispr-Cas9 With Traditional Plant Breeding Techniques For Climate-Resilient Agriculture
Md. Alomgir Hossan Md. Al-Amin	University of Rajshahi BANGLADESH Abdul Wadud Shah Degree College BANGLADESH	Political Participation And Marginalization Of Indigenous People: A Case Study On The Santal Community In Bangladesh
Shikath Ghosh Bidhan Chandra Halder	Hajee Mohammad Danesh Science and Technology University BANGLADESH	Effect Of Foliar Spray Of Zinc On Growth And Yield Of Knolkhol
Adesanmi, Moses Ademola	Federal Polytechnic NIGERIA	A Critical Stylistics Study Of Dissent In Soyinka's 'Madmen And Specialists'

12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-21
MODERATOR Dr. Rizwan Qaiser Danish

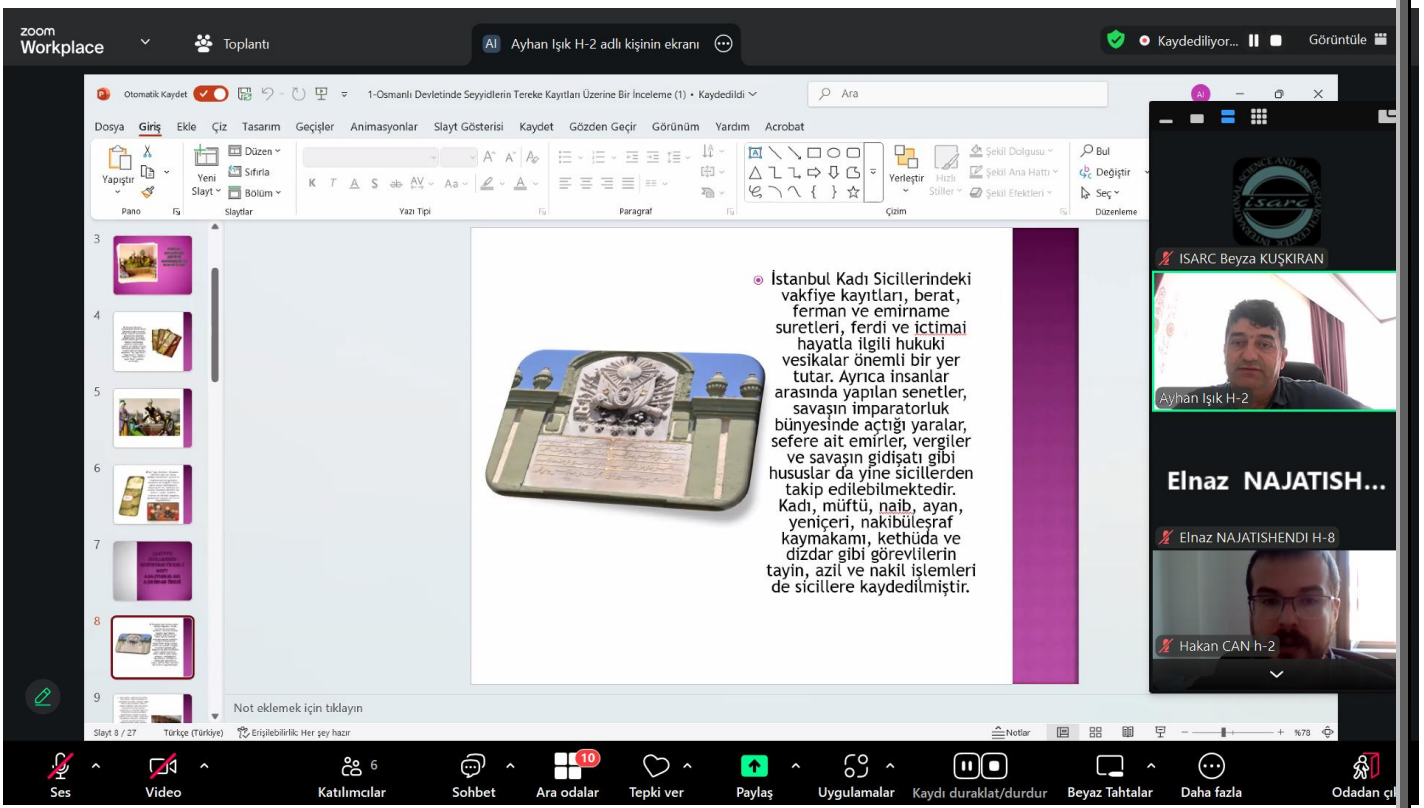
AUTHORS	AFFILIATION	TOPIC TITLE
Sumayya Akram Prof. Dr. Matloob Ahmad Dr. Sana Aslam	Government College University PAKISTAN	Updated Insights Into The Anti-Covid-19 Activity Of Heterocyclic Compounds
Dr. Rizwan Qaiser Danish Moaz Ahmad Anila Shahzadi	University of the Punjab PAKISTAN	Ethical Leadership And Employee Agility In Banking Sector: The Mediating Role Of Adaptive Performance
Anila Shahzadi Dr. Rizwan Qaiser Danish	University of the Punjab PAKISTAN	Impact Of Ai Powered Digital Assistants To Customer Luxury Brands Online Experience
LAFTANI Yasmine CHATIB Baylassane	Cadi Ayyad University MOROCCO	Advanced Oxidation Processes For Efficient Azo Dye Degradation: Experimental And Toxicity Insights
Amritha LJ Sreejith J	-	"The Evolving Landscape Of International Financial Regulation"
Mahazabin Hossain Nushrat Sharmin Tasnia Munir Elma Most. Mokarroma Md Nayamot Ullah Asraf Md. Mizanur Rahman Md. Yeamin Hossain	University of Rajshahi BANGLADESH	Exploring The Fish Marketing System In Dhaka: Efficiency, Constraints And Policy Implications
Dr. Md. Fahim Bhuiyan Abak Dr. Farah Rashed Dr. Hasnim Naznin Hima	Shaheed Tajuddin Ahmad Medical College BANGLADESH Mymensingh Medical College BANGLADESH Beximco Pharmaceutical Ltd BANGLADESH	Precision Medicine In Psychiatry: Biomarkers, Genomics, And The Future Of Personalised Mental Health Care
Moniba Sharif Abid Mahmood Aqsa Kanwal Rimsha Saher Nasir Rasool	Government College University PAKISTAN	Facile Synthesis Of 4'amino-[1,1'-Biphenyl]-4-Sulfonamide Molecules Via Chan-Lam Coupling: A Dual In-Vitro And In-Silico Approach To Carbonic Anhydrase (Ca) Inhibitors
Soukaina Hamou Mustapha Moufassih Ousama Tarahi Said Agounad Hafida Idrissi Azami	Ibn Zohr University MOROCOO	A New Hybrid Method For More Accurate Ssvep Target Identification
Sakineh Sojoodi	University of Tabriz IRAN	Regulating E-Commerce Businesses: Challenges, Opportunities, And The Path To Effective Governance

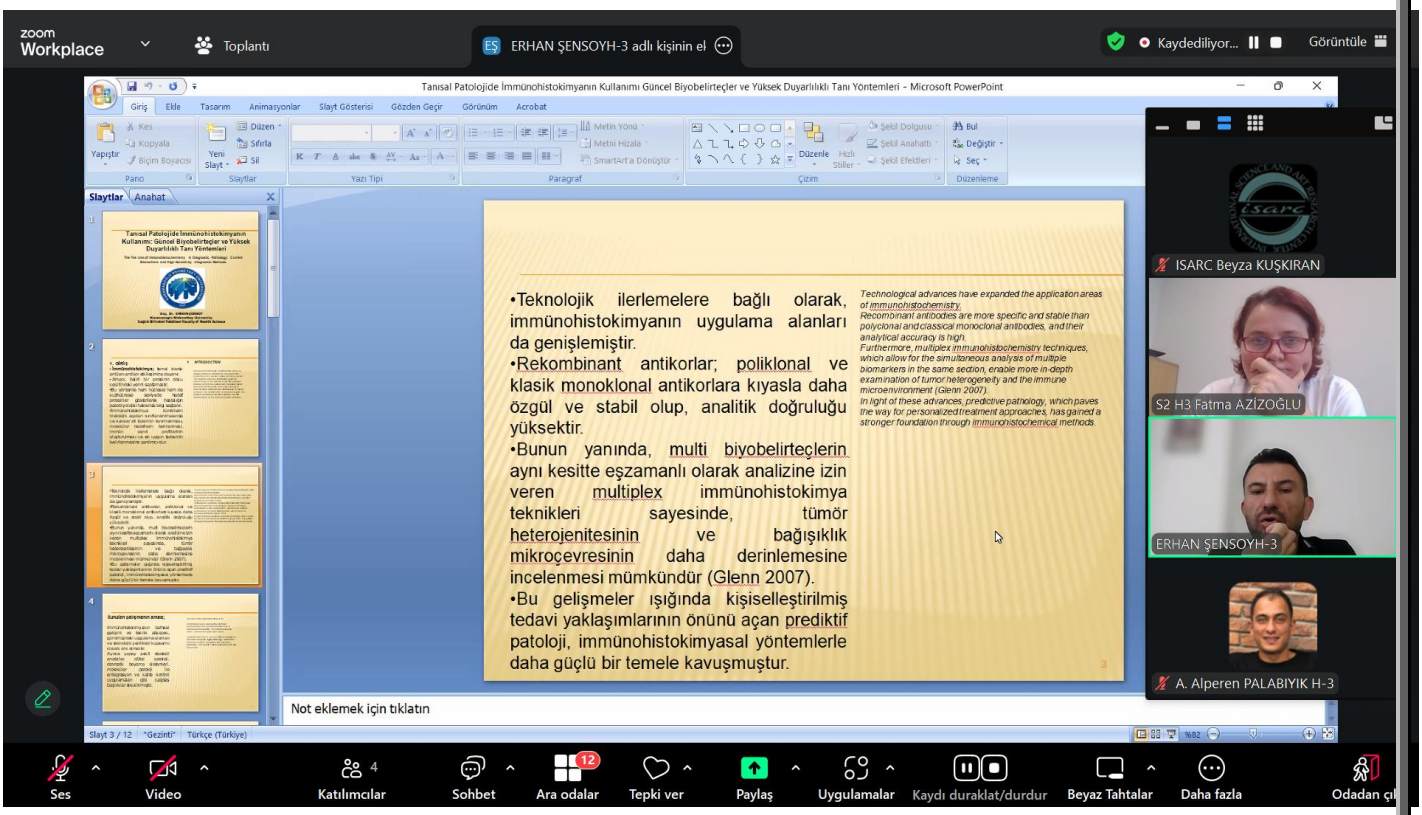
12.09.2025
FRIDAY / 12:00-14:00

SESSION-5 HALL-22
MODERATOR ABDURRAHMAN IBRAHIM

AUTHORS	AFFILIATION	TOPIC TITLE
Abdurrahman Ibrahim Usman Samaila Ibrahim Samaila	Umaru Musa Yar'adua University NIGERIA	Identification Of Fungi Responsible For The Decomposition Of Soil Organic Matter
Halliru Sani Musbahu Salisu		Role Of Computer In Fraud Detection And Prevention In The Nigerian Banking Sector
Usman Samaila Ibrahim Samaila Amina Taneem Hussaini	Umaru Musa Yar'adua University NIGERIA	Green Hybrid Nanoparticles For Biomedical Applications
HANINE Sanae	Hassan First University MOROCCO	What Governance Of The Blue Economy In Africa?
Seema Sadiq Abdul Haque	-	Corona Crisis And Its Challenges
Abdurrahman Ibrahim Usman Samaila Ibrahim Samaila	Umaru Musa Yar'adua University NIGERIA	Identification Of Fungi Responsible For The Decomposition Of Soil Organic Matter
Ibrahim Samaila Usman Samaila Muhammadu Marwana Yusuf	Umaru Musa Yar'adua University NIGERIA	The Application Of Nanoparticles As A Therapeutic Agent
Md. Shohag Mia Khondoker Md Zulfiker Rahman Mohammad Abdur Razzak	Jahangirnagar University BANGLADESH	The Aquatic Bug Diplonychus Annulatus: A Promising Biocontrol Agent Against Disease Vector Mosquitoes
Md. Arafat Jaman Begum Fatema Zohara Md. Faruk Islam Emon Ahmed	"Hajee Mohammad Danesh Science and Technology University BANGLADESH" Bangladesh Agricultural University BANGLADESH	"Potential Impact Of Dietary Phytoestrogen On The Growth And Reproductive Performance Of Male And Female Chickens".
Ikilima muhammad Ibrahim samaila	Umaru Musa Yar'adua University NIGERIA	Industrial Chemistry Approaches In The Synthesis And Manufacture Of Pharmaceuticals

PHOTO GALLERY

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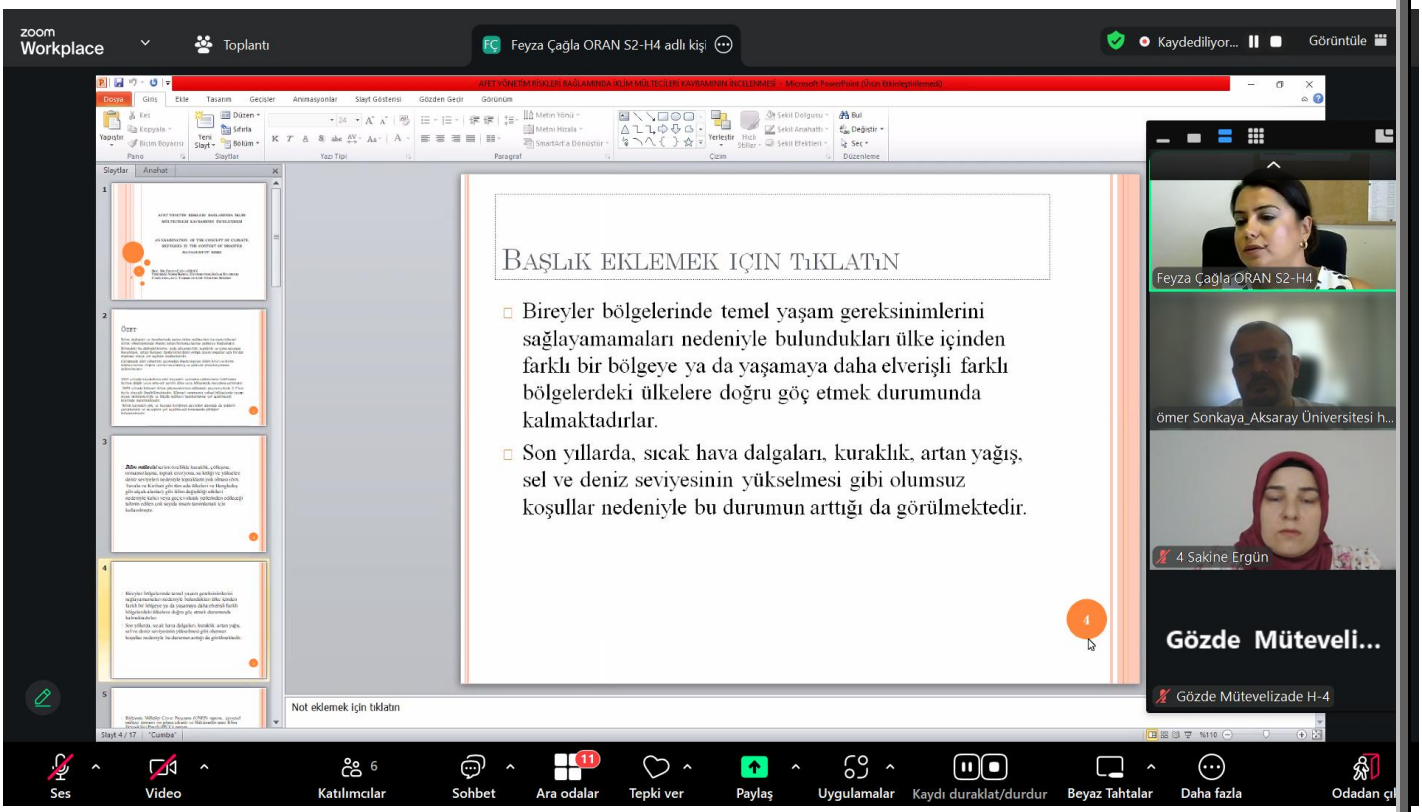
Toplantı
ERHAN ŞENSOYH-3 adlı kişinin el
Kaydediliyor...
Görüntüle
Tanısal Patolojide İmmünohistokimyanın Kullanımı Güncel Biyobelirteçler ve Yüksek Duyarlılıklı Tanı Yöntemleri - Microsoft PowerPoint
•Teknolojik ilerlemelere bağlı olarak, immünohistokimyanın uygulama alanları da genişlemiştir.
•Rekombinant antikorlar; poliklonal ve klasik monoklonal antikorlara kıyasla daha özgül ve stabil olup, analitik doğruluğu yüksektir.
•Bunun yanında, multi biyobelirteçlerin aynı kesitte eşzamanlı olarak analizine izin veren multiplex immünohistokimya teknikleri sayesinde, tümör heterojenitesinin ve bağışıklık mikroçevresinin daha derinlemesine incelenmesi mümkündür (Glenn 2007).
•Bu gelişmeler ışığında kişiselleştirilmiş tedavi yaklaşımlarının önünü açan prediktif patoloji, immünohistokimyasal yöntemlerle daha güçlü bir temele kavuşmuştur.
Technological advances have expanded the application areas of immunohistochemistry.
Recombinant antibodies are more specific and stable than polyclonal and classical monoclonal antibodies, and their analytical accuracy is high.
Furthermore, multiplex immunohistochemistry techniques, which allow for the simultaneous analysis of multiple biomarkers in the same section, enable more in-depth examination of tumor heterogeneity and the immune microenvironment (Glenn 2007).
In light of these advances, predictive pathology, which paves the way for personalized treatment approaches, has gained a stronger foundation through immunohistochemical methods.
Not eklemek için tıklatın
ISARC Beyza KUŞKIRAN
S2 H3 Fatma AZİZOĞLU
ERHAN ŞENSOYH-3
A. Alperen PALABIYIK H-3
Ses
Video
Katılımcılar
Sohbet
Ara odalar
Tepki ver
Paylaş
Uygulamalar
Kaydı duraklat/durdur
Beyaz Tahtalar
Daha fazla
Odadan çı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Toplantı
Feyza Çağla ORAN S2-H4 adlı kişi
Kaydediliyor...
Görüntüle
BAŞLIK EKLEMEK İÇİN TIKLATIN
Bireyler bölgelerinde temel yaşam gereksinimlerini sağlayamamaları nedeniyle bulundukları ülke içinden farklı bir bölgeye ya da yaşamaya daha elverişli farklı bölgelerdeki ülkelere doğru göç etmek durumunda kalmaktadırlar.
Son yıllarda, sıcak hava dalgaları, kuraklık, artan yağış, sel ve deniz seviyesinin yükselmesi gibi olumsuz koşullar nedeniyle bu durumun arttığı da görülmektedir.
Not eklemek için tıklatın
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4 Sakine Ergün
Gözde Müteveli...
Gözde Mütevelizade H-4
Ses
Video
Katılımcılar
Sohbet
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Paylaş
Uygulamalar
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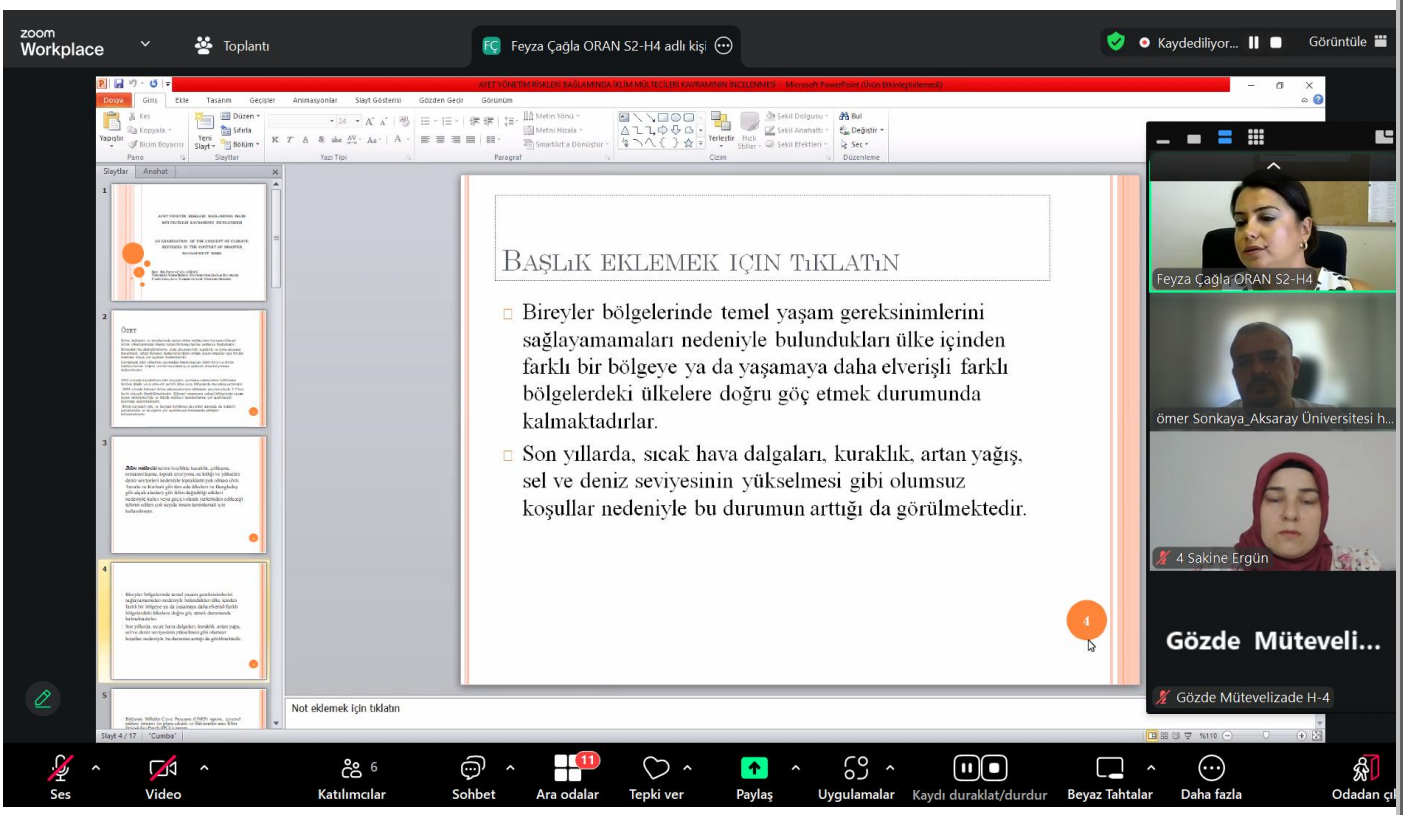
Beyaz Tahtalar
Daha fazla
Odadan çı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Feyza Çağla ORAN S2-H4 adlı kişi
Kaydediliyor...
Görüntüle
BAŞLIK EKLEMEK İÇİN TIKLATIN
Bireyler bölgelerinde temel yaşam gereksinimlerini sağlayamamaları nedeniyle bulundukları ülke içinden farklı bir bölgeye ya da yaşamaya daha elverişli farklı bölgelerdeki ülkelere doğru göç etmek durumunda kalmaktadırlar.
Son yıllarda, sıcak hava dalgaları, kuraklık, artan yağış, sel ve deniz seviyesinin yükselmesi gibi olumsuz koşullar nedeniyle bu durumun arttığı da görülmektedir.
Not eklemek için tıklatın
Feyza Çağla ORAN S2-H4
ömer Sonkaya_Aksaray Üniversitesi h...
4 Sakine Ergün
Gözde Müteveli...
Gözde Mütevelizade H-4
Ses
Video
Katılımcılar
Sohbet
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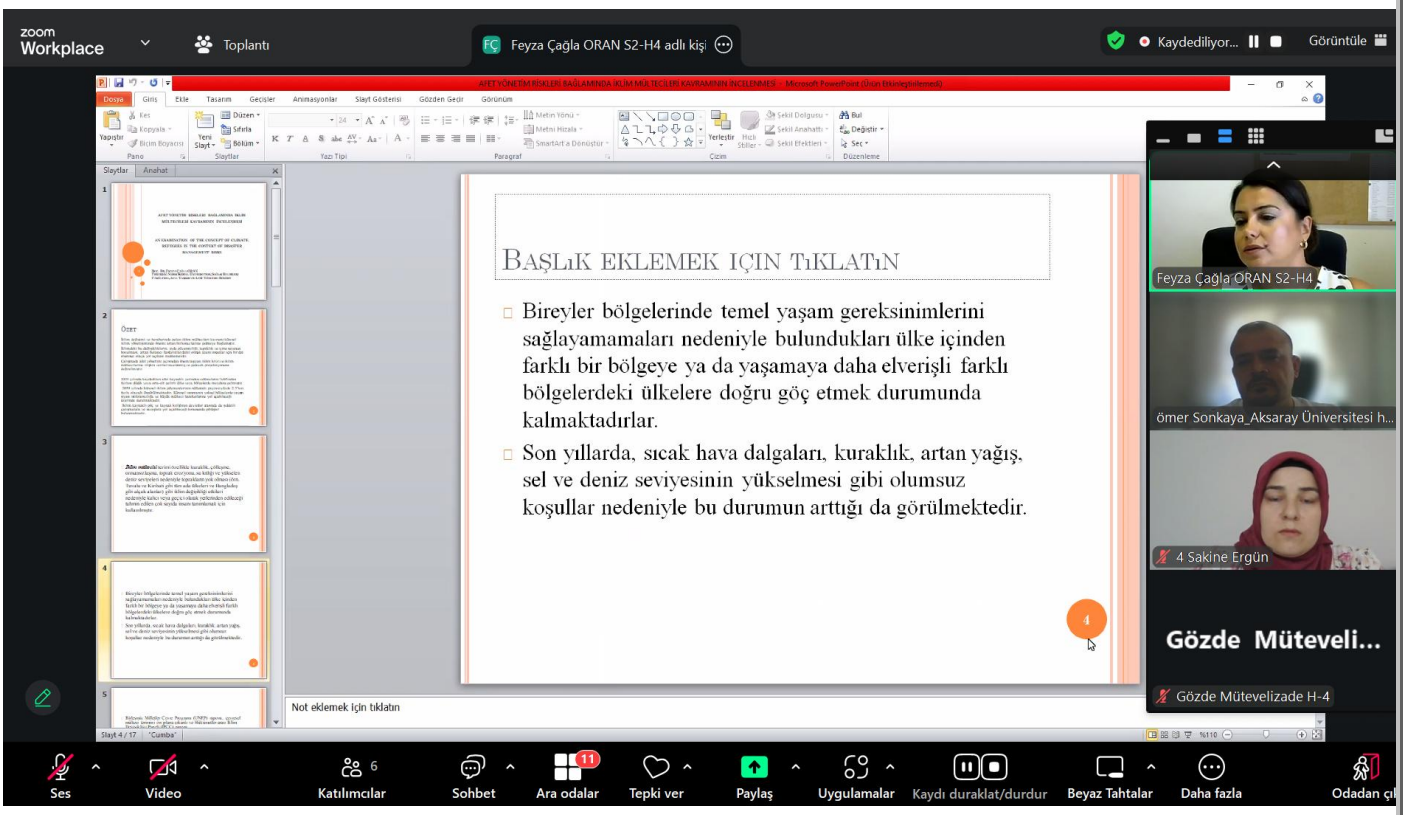
Uygulamalar
Kaydı duraklat/durdur
Beyaz Tahtalar
Daha fazla
Odadan çık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Toplantı
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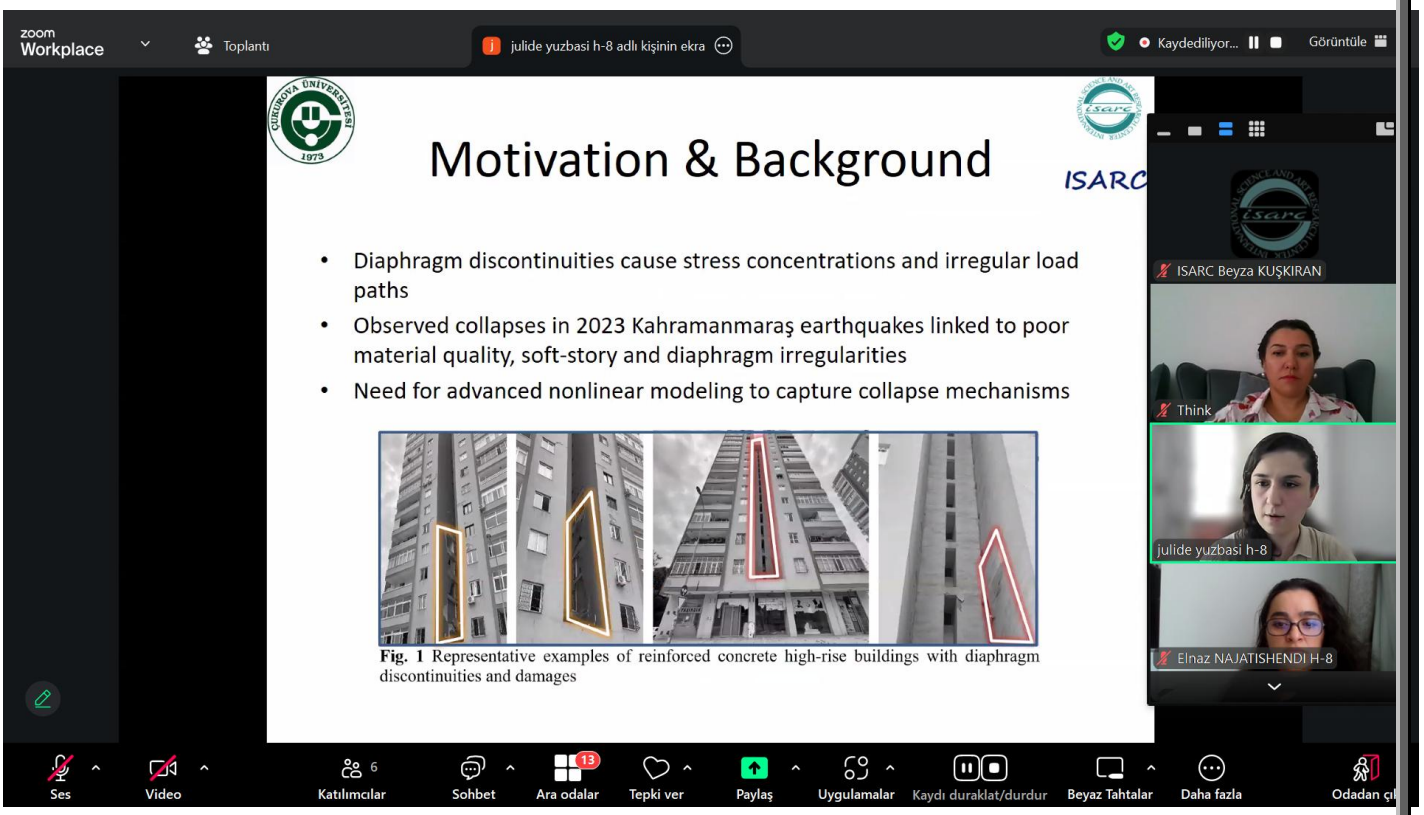
Kaydediliyor...
Görüntüle
BAŞLIK EKLEMEK İÇİN TIKLATIN
Bireyler bölgelerinde temel yaşam gereksinimlerini sağlayamamaları nedeniyle bulundukları ülke içinden farklı bir bölgeye ya da yaşamaya daha elverişli farklı bölgelerdeki ülkelere doğru göç etmek durumunda kalmaktadırlar.
Son yıllarda, sıcak hava dalgaları, kuraklık, artan yağış, sel ve deniz seviyesinin yükselmesi gibi olumsuz koşullar nedeniyle bu durumun arttığı da görülmektedir.
Not eklemek için tıklatın
Feyza Çağla ORAN S2-H4
ömer Sonkaya_Aksaray Üniversitesi h...
4 Sakine Ergün
Gözde Müteveli...
Gözde Mütevelizade H-4
Ses
Video
Katılımcılar
Sohbet
Ara odalar
Tepki ver
Paylaş
Uygulamalar
Kaydı duraklat/durdur
Beyaz Tahtalar
Daha fazla
Odadan çık


zoom Workplace
Toplantı
julide yuzbasi h-8 adlı kişinin ekra
Kaydediliyor...
Görüntüle
Motivation & Background
ISARC
Diaphragm discontinuities cause stress concentrations and irregular load paths
Observed collapses in 2023 Kahramanmaraş earthquakes linked to poor material quality, soft-story and diaphragm irregularities
Need for advanced nonlinear modeling to capture collapse mechanisms
Fig. 1 Representative examples of reinforced concrete high-rise buildings with diaphragm discontinuities and damages
ISARC Beyza KUŞKIRAN
Think
julide yuzbasi h-8
Elnaz NAJATISHENDI H-8
Ses
Video
Katılımcılar
Sohbet
Ara odalar
Tepki ver
Paylaş
Uygulamalar
Kaydı duraklat/durdur
Beyaz Tahtalar
Daha fazla
Odadan çı

zoom Workplace
Toplantı
şirvan önce 11 adlı kişinin ekranı
Kaydediliyor...
Görüntüle
THE WEST AND THE REST
(BATI VE GERİ KALANLAR)
Batı ve Doğu sadece birer coğrafi konum değil, tarihsel bir yarışı simgeleyen iki ayrı dünya görüşüdür.
Batı, tarihsel bir yapı, bir fikirdir ve ideolojik bir işlevi vardır.
Batı Hegemonyası
The West and The Rest: Discourse and Power (Hall, 1992)
de-Westernizasyon
Batı'nın hegemonik tutumuna karşı söylem ve eylemlerin tümü / hegemonyadan arınm çabası
9 atanmamış katılımcı
ISARC Beyza KUŞKIRAN
şirvan önce 11
Hakkı ÖZBAŞ s3...
Hakkı ÖZBAŞ s3 H-11
E
Ertuğrul Türksever
Ses
Video
Katılımcılar
Sohbet
Ara odalar
Tepki ver
Paylaş
Uygulamalar
Kaydı duraklat/durdur
Beyaz Tahtalar
Daha fazla
Odadan çı

INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

REF: AKADEMİK TEŞVİK **24.09.2025**

İLGİLİ MAKAMA

8. ULUSLARARASI BOĞAZİÇİ BİLİMSEL ARAŞTIRMALAR KONGRESİ 12-13 EYLÜL 2025 tarihleri arasında İSTANBUL'da ve online olarak 15 farklı ülkeden (Türkiye:76 ve diğer Ülkeler:85 ; Toplam:161 akademisyen/araştırmacıların katılımı ile gerçekleşmiştir. Kongre, 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen '' Tebliğlerin sunulduğu yurt içinde veya yurtdışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışından en az 5 ülkeden farklı tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır. '' değişikliğine uygun düzenlenmiştir. Bilgilerinize arz edilir.
Saygılarımla

Sefa Salih BİLDİRİCİ
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NOTIFICATIONS

AUTHOR	TITLE	No
Abdurrahman GÜLMEZ	RELIGIOUS AND SCHOOL LIFE IN THE CITY OF KHARAZM (1097-1231)	1-9
Mohamed SOLTANE Mourad OUSSALAH Aissa BELMEGUENAI	POLAR FREQUENCY ANALYSIS FEATURES STUDIES BASED FACES BIOMETRICS VERIFICATIONS SYSTEMS	10-25
Ayhan IŞIK	THE HERITAGE OF AHL AL-BAYT:A REVIEW ON THE ESTATE RECORDS OF THE SAYYIDS IN THE OTTOMAN EMPIRE	26-55
Ayhan IŞIK	AHL AL-BAYT IN THE TESTIMONY OF JUSTICE:LEGAL PROCEDURES REGARDING SAYYIDS IN OTTOMAN JUDICIAL REGISTERS	56-63
Halliru Sani Musbahu Salisu	ROLE OF COMPUTER IN FRAUD DETECTION AND PREVENTION IN THE NIGERIAN BANKING SECTOR	64
Gülhan Tunç Osman Telli	DNA BARCODING OF FUNGI IN COMMERCIAL DRINKING WATER: MYCOTOXIN PRODUCTION POTENTIAL AND INTERNATIONAL CASE STUDIES	65-66
Ömer SONKAYA	DESIGN AND SYNTHESIS OF A THERAPEUTIC AGENT CONJUGATED WITH MAGNETIC GRAPHENE OXIDE	67-68
Rizwana Raheel Humaira Majeed Khan	PROTECTIVE ANTIOXIDANT AND ANTI-INFLAMMATORY EFFECTS OF ISOFURFURAL AGAINST DRUG-INDUCED INJURY IN RATS	69
Pierre Rostan Alexandra Rostan	COMPARING JAPAN'S POST-COVID ECONOMY TO GERMANY'S ECONOMY	70
Sümeyye GÖKÇENOĞLU	A BIBLIOMETRIC ANALYSIS OF HEALTH TOURISM LITERATURE: ECONOMIC IMPACTS AND POLICY IMPLICATIONS	71
A.Ashwini R.Devi R.Srinivasan	A SHORT REVIEW ON CANCER NANOTECHNOLOGY;CURRENT STATUS AND PERSPECTIVES	72-76
Divya O M Sagaya Aurelia P	INTERPRETABLE FUSION OF ACOUSTIC FEATURES FOR MULTICLASS VOICE DISORDER DETECTION	77
Sumayya Akram Matloob Ahmad Sana Aslam	EXPLORING CATALYTIC STRATEGIES FOR N-ARYLATION OF BENZIMIDAZOLE	78
Md. Arafat Jaman Begum Fatema Zohara Md. Faruk Islam Emon Ahmed	“POTENTIAL IMPACT OF DIETARY PHYTOESTROGEN ON THE GROWTH AND REPRODUCTIVE PERFORMANCE OF MALE AND FEMALE CHICKENS”	79
Ikilima muhammad Ibrahim samaila	INDUSTRIAL CHEMISTRY APPROACHES IN THE SYNTHESIS AND MANUFACTURE OF PHARMACEUTICALS	80-85
Sumayya Akram Matloob Ahmad Sana Aslam	UPDATED INSIGHTS INTO THE ANTI-COVID-19 ACTIVITY OF HETEROCYCLIC COMPOUNDS	86
S. Leporale M. Cianfriglia R.Moramarco V. Martini C. Marocco F. Sestito R. Reda L. Testarelli C. Bramucci T. Testori G. Perrotti	VERTICAL DIMENSION ASSESSMENT IN ORTHOGNATHIC SURGERY THROUGH TOTAL FACE APPROACH	87-88

S. Leporale M. Cianfriglia R.Moramarco V. Martini C.Marocco F. Sestito R. Reda L. Testarelli C. Bramucci T. Testori G. Perrotti	A RADIATION-FREE APPROACH TO VOLUMETRIC RENDERING FOR SOFT TISSUE	89
F.Evolo L.Adamo S.Leporale A.Antonelli N.Carrai G.Ferri L.Testarelli M.Galli G.Miccoli R.Palumbo L.Lucente R.Reda	RADIOGRAPHIC, CLINICAL, AND BIOCHEMICAL ASSESSMENT OF SCREW-RETAINED VERSUS CEMENT-RETAINED CR-CO-CERAMIC IMPLANT-SUPPORTED SINGLE CROWNS: A COHORT STUDY	90
El.Majdi S. Zerraf Said Belaaouad Fouad Alloun	SYNTHESIS AND THEORETICAL/STRUCTURAL INVESTIGATIONS OF $NA_{0.5}M_{0.25}TI_2(PO_4)_3$ (M = ZN, NI)	91
Saloni Sharma Suhani Sharma	ADVANCING REGENERATIVE MEDICINE: CURRENT STATUS AND FUTURE PROSPECTS OF STEM CELL THERAPY	92-106
Ismail Olaniyi MURAINA Moses Adeolu AGOI Solomon Onen ABAM Bashir Oyeniran AYINDE Wasiu Olatunde OLADAPO	ARTIFICIAL INTELLIGENCE IN ACADEMIC PERFORMANCE OPTIMIZATION: A SYSTEMATIC LITERATURE REVIEW	107
Habibur Rahman Bayezid Sabila Nazowa Rabbi Hasan Rajebul Islam Mizanur Rahman Tasnia Munir Elma Rakesh Kumar Mahanta	PHYTOCHEMICAL, ANTIBACTERIAL, ANTIOXIDANTS ANALYSIS AND PHARMACOLOGICAL INVESTIGATION OF EXTRACT FROM PHRYNIUM PLACENTARIUM LEAVES	108-124
Katia BENYAKOUB Mourad KEDDAM Brahim BOUMAALI Michal KULKA	KINETIC MODELLING OF POWDER-PACK BORONIZED 4CR5MOSIV1 STEEL BY TWO DISTINCT APPROACHES	125
Salma Fariha Tariqul Islam	COMPARATIVE ANALYSIS OF THE BIOCHEMICAL AND MICROBIOLOGICAL QUALITY OF NGA-PI FROM PRODUCTION AND RETAIL SOURCES IN COX'S BAZAR DISTRICT, BANGLADESH	126
Sadik DANI Hassane ABD-DADA Ahmed El Annaoui Aziz Ezzine Abdelmajid HADDIOUI Said BOUDA	CHARACTERIZATION OF GENETIC RESOURCES OF WHITE MULBERRY (MORUS ALBA L.) BASED ON PHENOTYPIC TRAITS IN MOROCCO	127
Fatimazahra Jouga Fatima Mourabiti Souraya Sakoui Abdelaziz Soukri Bouchra El khalfi Reda Derdak	ISOLATION AND CHARACTERIZATION OF A MARINE BACTERIUM WITH ANTIBACTERIAL ACTIVITY AGAINST VIBRIOSIS PATHOGENS IN AQUACULTURE	128

TASKEEN FATIMA	THE CLINICAL SIGNIFICANCE OF NORMAL PHYSIOLOGICAL BLOOD PARAMETERS IN HEALTH ASSESSMENT	129
TASKEEN FATIMA	AN OVERVIEW OF CAD; ETIOLOGICAL FACTORS SURGICAL MANAGEMENTS	130
Fouad Boughanzai Rochdi Daibi Anouar Boughanzai Youssef Ouhassan Rania Majdoubi Abdelkader Hadjoudja	THE PROFESSIONAL DEVELOPMENT NEXUS: CONNECTING TECHNOLOGY ACCEPTANCE TO TEACHER EXCELLENCE	131
Shohag Mia Khondoker Md Zulfiker Rahman Mohammad Abdur Razzak	THE AQUATIC BUG DIPLONYCHUS ANNULATUS: A PROMISING BIOCONTROL AGENT AGAINST DISEASE VECTOR MOSQUITOES	132
REDA Rodolfo ZANZA Alessio GUARNIERI Renzo SAVO Francesca TESTARELLI Luca	CLINICAL AND BIOCHEMICAL EVALUATION OF TWO DIFFERENT TYPES OF IMPLANT SCREW RETAINED SINGLE CROWNS	133- 134
Murat ALICIGÜZEL	THE STRATEGIC IMPORTANCE OF FRENCH IN THE TURKISH EDUCATION SYSTEM: AN ANALYSIS FROM THE PERSPECTIVE OF TURKEY'S GLOBAL ENGAGEMENT	135- 136
Murat ALICIGÜZEL	AI-SUPPORTED LANGUAGE LEARNING: THREAT OR OPPORTUNITY?	137- 138
Amirul Hakim bin Shahrulanuar Muhammad Zulhilmi bin Mohammad Zalani Mohammad Shahrul Nizam bin Mohd Fauzi Pravinnat Arumugam Sunatrah Abdullahyi	OPTIMIZATION OF OIL REMOVAL BY ADSORBENT-BASED PINEAPPLE PEEL WASTE	139
Badejo, Olayemi Aderanti Alaka Micheal Olusegnn Ogunlusi Raphael Olushola Oladapo, Wasiu Olatunde	GREEN CHEMISTRY: TRENDS TOWARDS INDUSTRIAL SUSTAINABILITY: A SYSTEMATIC REVIEW	140
Fahim Bhuiyan Abak Farah Rashed Hasnim Naznin Hima	PRECISION MEDICINE IN PSYCHIATRY: BIOMARKERS, GENOMICS, AND THE FUTURE OF PERSONALISED MENTAL HEALTH CARE	141
Anila Shahzadi Rizwan Qaiser Danish	IMPACT OF AI POWERED DIGITAL ASSISTANTS TO CUSTOMER LUXURY BRANDS ONLINE EXPERIENCE	142
Rizwan Qaiser Danish Moaz Ahmad Anila Shahzadi	ETHICAL LEADERSHIP AND EMPLOYEE AGILITY IN BANKING SECTOR: THE MEDIATING ROLE OF ADAPTIVE PERFORMANCE	143
Clementina Hashimu Bulus Dapels Banse Longse	EFFECTS OF PEER ASSESSMENT ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SENIOR SECONDARY SCHOOLS IN JOS NORTH, PLATEAU STATE, NIGERIA	144-155
Ahmed Attahiru Abubakar Umar Birnin-Yauri Bashar Attahiru	ADVANCES IN POLYMER CHEMISTRY FOR SUSTAINABLE DEVELOPMENT	156-161
B.MAHADEVAN M SANGEETHA SUDHARSHANA.U V.DEEPIKAA	AWARENESS AND IMPLEMENTATION OF MODERN CULTIVATION TECHNOLOGIES IN PADDY FARMING IN THANJAVUR DISTRICT	162
Ahmet Alperen PALABIYIK	EXERCISE-INDUCED METABOLIC SHIFTS: A FOCUS ON ENERGY SOURCES AND REGULATION	163-195

Farah Rashed Md. Fahim Bhuiyan Abak Hasnim Naznin Hima	AIR POLLUTION AND ITS ASSOCIATION WITH RESPIRATORY DISEASES IN BANGLADESH AND INDIA: A SYSTEMATIC REVIEW	196
M. As. Michailov	AN OPINION ABOUT THE IDEA OF HUMAN'S WELLBEING	197-202
Ibrahim Samaila Usman Samaila Muhammadu Marwana Yusı	THE APPLICATION OF NANOPARTICLES AS A THERAPEUTIC AGENT	203-206
Seema Sadiq Abdul Haque	CORONA CRISIS AND ITS CHALLENGES	207
Muhammad Usman	AN INNOVATIVE ANALYTICAL RESULT OF TWO-DIMENSIONAL HEAT EQUATION USING JOINT MECHANISM OF NATURAL TRANSFORM AND ADOMIAN DECOMPOSITION METHOD	208
Oheiku Aisha Avosuahi	ASSESSMENT OF CLIMATE CHANGE SYNTHESIS AND HEALTH RESILIENCE AMONG WOMEN IN NORTH CENTRAL NIGERIA: A SYSTEMATIC REVIEW	209
Ayşe AKSOY Erdinç ALACA	CONTENT AND PHYSICAL CHARACTERISTICS OF CHILDREN'S PICTURE BOOKS AND THEIR EFFECTS ON CHILDREN'S READING BEHAVIOR	210-211
Gökhan BAKTEMUR Ecem KARA Hatıra TAŞKIN	MORPHOLOGICAL RESPONSES OF ACUR PLANT TO NaCl STRESS	212-218
Ecem KARA Hatıra TAŞKIN Gökhan BAKTEMUR	MORPHOLOGICAL RESPONSES OF THE PLANT Rumex acetosa L. TO SALT STRESS UNDER IN VITRO CONDITIONS	219-225
Onur BİLGEN Ali Berk TAVACI	EFFECT OF WELDING DURATION ON THE BALLISTIC PERFORMANCE OF ARMOR STEELS	226-236
Ali Berk TAVACI Onur BİLGEN	THE EFFECT OF BALLISTC TESTING ON THE MICROSTRUCTURE OF ARMOR STEEL	237- 244
Ahmet ALATAŞ	A THEORETICAL EXAMINATION ON THE USE OF DATA MINING METHODS IN DETECTING FINANCIAL FRAUD RISK	245- 251
Seyma BEKLİ	FLOW SHOP SCHEDULING WITH CONSIDERATION OF WORKER COMPETENCY AND PREFERENCE LIST	252-253
Seyma BEKLİ	ROUTE OPTIMIZATION FOR EMPLOYEE TRANSPORTATION CONSIDERING STATION PREFERENCES	254- 255
Ahmet POLATOĞLU	SHORT AND MID-TERM PERIODICITIES IN COSMIC RAY INTENSITY AND SOLAR WIND SPEED DURING SOLAR CYCLE 24	256- 263
Özlem ÇEZİKTÜRK	TEACHING TRANSFORMATIONAL GEOMETRY USING JAPANESE HISTORICAL WASAN GEOMETRY	264- 285
Bekir Ercan DOĞAN	BRIDGING THE GAP, BUILDING THE FUTURE: A HYBRID MODEL FOR TEACHING VOCABULARY TO ENGINEERING STUDENTS FOR REAL-WORLD SUCCESS	286- 287
Daritza del Carmen Arcia González Gloria Auristela Hernández Pérez	CLAUDIA SHEINBAUM PARDO: A LEGAL AND GENDER ANALYSIS OF THE LEADERSHIP OF THE FIRST FEMALE PRESIDENT OF MEXICO."	288- 289
Aziz Ezzine Ahmed El Annaoui Sadik Dani Abdelmajid Haddioui Said Bouda	PHENOTYPIC DIVERSITY OF NATURAL POPULATIONS OF CHAMAEROPS HUMILIS L. IN MOROCCO	290

Moniba Sharif Abid Mahmood Aqsa Kanwal Rimsha Saher Nasir Rasool	FACILE SYNTHESIS OF 4'-AMINO-[1,1'-BIPHENYL]-4-SULFONAMIDE MOLECULES VIA CHAN-LAM COUPLING: A DUAL IN-VITRO AND IN-SILICO APPROACH TO CARBONIC ANHYDRASE (CA) INHIBITORS	291
Mahazabin Hossain Nushrat Sharmin Tasnia Munir Elma Mokarroma Nayamot Ullah Asraf Rakesh Kumar Mahanta Mizanur Rahman Yeamin Hossain	EXPLORING THE FISH MARKETING SYSTEM IN DHAKA: EFFICIENCY, CONSTRAINTS AND POLICY IMPLICATIONS	292-293
BENFRID Abdelmoutalib	EARTHQUAKES IN THE MEDITERRANEAN: BETWEEN HISTORY AND REGULATIONS	294-298
Çiğdem ÖZDEMİR	TRANSFER OF ART THROUGH OPEN-AIR MUSEUMS: THE EXAMPLE OF THE MOAI STATUES	299-307
Adel DELIOU Meriem DEHBI Sofiane BOULKROUNE Mohamed CHAOUR Khmissi BELKAID Abdelkader FIDJAH	ELASTIC BEHAVIOR OF A SYMMETRIC UNIDIRECTIONAL COMPOSITE LAMINATED E-GLASS/EPOXY	308
Can Berk GÜL Hazal BELLİ Caner YERLİ	EFFECTS OF SEWAGE SLUDGE AND BIOCAR APPLICATIONS ON PEPPER (Capsicum Annuum L.) GROWTH UNDER DROUGHT CONDITIONS	309-321
Caner YERLİ Talip ÇAKMAKCI Üstün ŞAHİN	WATER FOOTPRINT OF TOMATO: THE CASE OF VAN PROVINCE (TURKEY)	322-328
Saima Shaheen Nabila Sher	THYROID HORMONE LEVELS AND THEIR ASSOCIATION WITH PLASMA ZINC LEVELS AMONG ADOLESCENT AFGHAN REFUGEES; A CROSS-SECTIONAL STUDY	329
Mevra ASLAN ÇAKIR	CHARACTERIZATION OF TANTALUM OXIDE FILM PRODUCED BY DC MAGNETRON SPUTTERING METHOD	330-337
Manal Elzain Mohamed Abdalla Muhammad Kamran Anns Uzair	THE GEOMETRY OF ECONOMIC OPTIMIZATION: NOVEL APPLICATIONS OF HILBERT AND BANACH SPACES TO GROWTH AND DECISION ANALYSIS	338
Bensakhria Sara PR.BenkhelifaMohammed	EFFECTS OF DIRECT SEEDING ON THE PHYSIOLOGICAL PARAETERS OF SOFT WHEAT (TRITICUM SATIVUM L., VARIETY AÏN ABID)	339
Behram Barlas	RETROSPECTIVE EVALUATION OF MEDICAL AND SURGICAL TREATMENT APPROACHES IN ECTOPIC PREGNANCY IN TERMS OF CLINICAL OUTCOMES	340-342
Elnaz NAJATISHENDI Tolga GÖRÜM Seçkin FIDAN Fusun BALIK ŞANLI	AUTOMATIC GEOCODING OF ADDRESS DATA IN TURKEY: A NOMINATIM-BASED PYTHON APPLICATION	343-350
Saniye Nur ERGAN	TRACING MATHEMATICAL EXPERIENCE THROUGH STUDENT DRAWINGS	351-352
Sakine ERGÜN İbrahim KOÇ	INFORMATION AND APPLICATION INFRASTRUCTURE OF AGRICULTURAL PESTICIDE DEALERS: A SURVEY STUDY ON MARDIN PROVINCE	353-354
Sagaya Aurelia	EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI) FOR RELIABLE INTERNET OF THINGS	355

Fatma AZİZOĞLU Banu TERZİ	LEAN MANAGEMENT IN NURSING SERVICES: APPLICATIONS, EFFECTS AND SUSTAINABILITY	356-359
Fatma AZİZOĞLU Banu TERZİ	SERVANT LEADERSHIP IN NURSING: A CONCEPTUAL REVIEW	360- 363
Fatma KILIÇ Emre Hayri BARAZ	SOCIOECONOMIC RESILIENCE INDICATORS IN SINGLE–PARENT FAMILIES: A QUALITATIVE STUDY ON PUBLIC SECTOR EMPLOYEES IN KAYSERI	364- 371
FETTOUCH Houari	ON ZEROS AND GROWTH OF SOLUTIONS OF SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS	372- 373
Serkan KÖKSOY	THE PROBLEM OF UNUSED OR LEFTOVER MEDICINES IN DEVELOPING OR UNDEVELOPED COUNTRIES	374- 377
Usman Samaila Ibrahim Samaila Amina Taneem Hussaini	GREEN HYBRID NANOPARTICLES FOR BIOMEDICAL APPLICATIONS	378
Gökhan BODUROĞLU	MIGRATION AND SUBSTANCE ADDICTION: AN EVALUATION ON SYRIAN MIGRANT CHILDREN IN TÜRKİYE	379- 380
Gözde MÜTEVELİZADE	IMPACT OF THE COVID-19 PANDEMIC ON NUCLEAR MEDICINE OPERATIONS AND ONCOLOGICAL OUTCOMES: A SINGLE INSTITUTIONAL EXPERIENCE	381- 387
Halil Erdem AKOĞLU	ADAPTATION OF THE MOBILE APPLICATION PARTICIPATION SCALE INTO TURKISH: A VALIDITY AND RELIABILITY STUDY	388- 389
Gülistan UYMAZ ARAS	THE ROLE OF NURSES IN EARLY DIAGNOSIS OF CRITICALLY ILL PATIENTS	390- 394
Gülistan UYMAZ ARAS	THE EFFECTIVENESS OF NURSING INTERVENTIONS IN POSTOPERATIVE WOUND HEALING	395- 399
K.R.Padma	REVOLUTIONIZING CHRONIC DISEASE MANAGEMENT WITH AI-DRIVEN PREDICTIVE ANALYTICS	400
Bedrettin BASUGUY	AN ORIGINAL SOURCE IN YEMENI HISTORIOGRAPHY: IBN AL-MUJĀWIR'S TĀRĪKH AL-MUSTABṢIR	401- 402
Abdurrahman Ibrahim Usman Samaila Ibrahim Samaila	IDENTIFICATION OF FUNGI RESPONSIBLE FOR THE DECOMPOSITION OF SOIL ORGANIC MATTER	403
N.G. Kalyani Reddy Chayaraju BalaSai K.Tharani K.Dayana	CONCRETE PRODUCTION USING WASTE WATER	404- 411
Sevcan YILDIZ Yasin Oğuz Özmenekşe	TRACES OF THE PAST IN TRADITIONS: FROM THE ENTRANCE TO JERUSALEM TO THE RED CARPET	412- 417
Sevcan YILDIZ Yasin Oğuz Özmenekşe	TRACES OF THE PAST IN TRADITIONS: FROM TUMULI TO EARTH	418- 422
Nural YILDIZ Ertuğrul TÜRKSEVER	COMPLEXITY AND CONSUMER BEHAVIOR	423- 432
Derya ÇAKICI	AN ANALYSIS OF CEVAT RİFAT ATİLHAN'S NATIONAL REVOLUTION MAGAZINE AND ITS ANTI-SEMITISM	433- 447
Ebru KARABUDAK Ali Korhan ÖZEN	PSYCHOLOGICAL FACTORS IN INDIVIDUAL INVESTMENT PREFERENCES: AVOIDANCE OF UNCERTAINTY AND STRESS	448- 449
LAFTANI Yasmine CHATIB Baylassane	ADVANCED OXIDATION PROCESSES FOR EFFICIENT AZO DYE DEGRADATION: EXPERIMENTAL AND TOXICITY INSIGHTS	450
Okan AVUNDUK Serkan ARAS	PREDICTION OF UNEMPLOYMENT RATE USING MACROECONOMIC INDICATORS WITH MACHINE LEARNING METHODS	451- 452

Sümeyra BATI	A BIBLIOGRAPHIC STUDY ON THE POETIC FORMS OF DIVAN LITERATURE	453- 487
Manole COJOCARU Major Gheorghe GIURGIU	NATURAL MODULATION GUT MICROBIOTA IN PSYCHOPATOLOGICAL STRESS: IMPACT OF DENIPLANT NUTRACEUTICALS	488
Yılmaz SARIER Kürşat YENİLMEZ Ersin KARADEMİR Hüseyin Bahadır YANIK Emre EV ÇİMEN Mehmet ERSOY	WHERE IS MATHEMATICS? MATHEMATICS IS EVERYWHERE!	489- 490
Sudenur GÜZEL Ayça DEMİRCİ Melisa KARATAŞ Sena AYDIN Eyüp Sevimli	ANALYSIS OF MATHEMATICS TEACHER CANDIDATES' VIEWS ON THE USE OF WEB 2.0 TOOLS IN THE ALGEBRA LEARNING WITHIN THE CONTEXT OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE	491- 499
Maryem ARRAJI Khaoula EL BARBI Mohamed CHAHBOUN	MEASUREMENT OF MEDICATION ADHERENCE AMONG TYPE II DIABETES PATIENTS ATTENDING PRIMARY HEALTHCARE FACILITIES IN MOROCCO	500
Merve BAKIRTAŞ	WOMEN'S CONCEPTUALIZATION AND PERCEPTION OF DOMESTIC VIOLENCE: AN AWARENESS STUDY	501-502
V.Vijitha S.Madhumitha M.Rahul S.Punithavalli K.Rajaganapathy	NEONATAL SEPSIS – CLASSIFICATION, DIAGNOSTIC APPROACH AND MANAGEMENT IN NICU	503
Raf Raf Shakil Ansari	A STUDY OF RIGHTS OF MUSLIM WOMEN AND CHALLENGES OF ISLAMIC FUNDAMENTALISM IN NOOR ZAHEER'S 'MY GOD IS A WOMAN'	504- 510
Özgür BİLİCİ	CHROMITITE VEIN FORMATION WITHIN ORTHOPYROXENITE: A RARE EXAMPLE FROM THE LYCIAN OPHIOLITE (SW TURKEY)	511
Halil Beytullah YILMAZ Ahmet ERTEK	AIRPORT SAFETY AND QUALITY MANAGEMENT FOLLOWING APRON ACCIDENTS	512- 513
Orçun GÜNDOĞAN Davut PEHLİVAN Ferhat EKİN	CURRENT SITUATION AND FUTURE POTENTIAL OF VAN AND LAKE VAN TRANSPORTATION: A SCENARIO-BASED EVALUATION	514- 522
Ünal SAKİ	THE IMPACT OF MANAGERS' LEADERSHIP SKILLS IN FITNESS BUSINESSES ON CRISIS MANAGEMENT	523- 532
Julide YUZBASI	SOLID MODEL-BASED ANALYSIS OF MATERIAL PROPERTY VARIATIONS ON THE STRUCTURAL RESPONSE OF HIGH-RISE BUILDINGS WITH DIAPHRAGM DISCONTINUITIES	533- 548
Volkan DEMIR Bülent TANSEL Bahar AKOĞLU Selin ERYÜREK	THE SILENT ECHO OF ART: THE EFFECT OF ART THERAPY ON THE SOCIAL SKILLS AND PSYCHOLOGICAL WELL-BEING OF INDIVIDUALS WITH HEARING IMPAIRMENTS	549-565
Betül GÜROY	ALGAL NEXUS APPROACH: CROSS-SECTORAL APPLICATIONS AND THE VISION OF CARBON NEUTRALITY	566-600
Feyza Çağla ORAN	AN EXAMINATION OF THE CONCEPT OF CLIMATE REFUGEES IN THE CONTEXT OF DISASTER MANAGEMENT RISKS	601-609
Feyza Çağla ORAN	ASSESSMENT OF FOREST FIRE TRENDS IN TURKEY BETWEEN 2009 AND 2025 AND DISASTER MANAGEMENT PROCESSES	610-621

Hakan CAN	ANWAR JUNDI'S CRITIQUES OF WESTERN-CENTRIC HISTORICAL UNDERSTANDING IN THE CONTEXT OF HIS WORK AL-TARIKH FI MAFHUM AL-ISLAM	622-632
Hatice TOPAL	THE ELİF-NÂME TRADITION IN TURKISH LITERATURE AND A DİFFERENT STYLE: İSMAİL HAKKI'S ELİF-NÂMELER	633-648
Bülent ONAYLI	SECURITIZATION OF WILDFIRES IN THE CONTEXT OF ENVIRONMENTAL SECURITY	649-654
Cengiz SARIKÜRKCÜ	EVALUATION OF THE BIOLOGICAL ACTIVITIES AND PHYTOCHEMICAL PROFILE OF CLADANTHUS MIXTUS EXTRACTS	655-664
Cengiz SARIKÜRKCÜ	INVESTIGATION OF ENZYME INHIBITION ACTIVITIES OF STACHYS LONGIFLORA EXTRACTS	665-670
Mehmet İskender ÖZSOY	CARRYING OUT THE DROP WEIGHT IMPACT TESTS OF CARBON AND BASALT FIBER REINFORCED POLYMER COMPOSITES	671-681
Mehmet İskender ÖZSOY	EVALUATION OF TENSILE PROPERTIES OF CARBON/BASALT FIBER HYBRID EPOXY COMPOSITES SUBJECTED TO HYGROTHERMAL AGING	682-691
Erhan ŞENSOY	THE USE OF IMMUNOHISTOCHEMSITRY IN DIAGNOSTIC PATHOLOGY: CURRENT BIOMARKERS AND HIGH-SENSITIVITY DIAGNOSTIC METHODS	692-698
Erhan ŞENSOY	ZEBRAFISH (DANIO RERIO) IN HISTOLOGY: APPLICATIONS, ADVANTAGES, AND FUTURE PERSPECTIVES	699-704
Kenan ÖZEL Abdullah ATILGAN Abdullah YILDIZ	PERFORMANCE ANALYSIS OF LEAD-FREE p-n HOMOJUNCTION FASnI3-BASED PEROVSKITE SOLAR CELLS	705-710
Abdullah ATILGAN Kenan ÖZEL Abdullah YILDIZ	GREEN ALTERNATIVES IN PEROVSKITE PHOTOVOLTAICS: EVALUATING CsGeI3 AS A LEAD-FREE SUBSTITUTE FOR CsPbI3	711-717
Alomgir Hossan Al-Amin	POLITICAL PARTICIPATION AND MARGINALIZATION OF INDIGENOUS PEOPLE: A CASE STUDY ON THE SANTAL COMMUNITY IN BANGLADESH	718
Selahattin AYDEMİR Abdurrahman EKİCİ	THE EFFECT OF POSTBIOTIC TREATMENT ON THE VIABILITY OF ECHINOCOCCUS GRANULOSUS PROTOSCOLECES	719-720
Brîndușa Mihaela RADU	EDUCATION FOR SUSTAINABLE DEVELOPMENT FOR A SAFER FUTURE	721
Brîndușa Mihaela RADU	EU STRUCTURAL FUNDS AND REGIONAL POLICY	722
Sakineh Sojoodi	REGULATING E-COMMERCE BUSINESSES: CHALLENGES, OPPORTUNOTIES, AND THE PATH TO EFFECTIVE GOVERNANCE	723-734
Peter Adebisi Adeoye Adebukola Rasheedat Salaw Olutayo Israel Falodun	MULTIDRUG RESISTANT GRAM- POSSITIVE COCCI BACTERIA ISOLATED FROM FOMITES IN SELECTED HEALTH CARE CENTRES IN IBARAPA EAST LOCAL GOVERNMENT, OYO STATE, NIGERIA.	735
Rajendra Kumar Prajapati Shiv Lal Shanti Lal Meena	EFFICIENCY EMPOWERMENT OF SOLAR ENERGY STORAGE SYSTEMS USING ARTIFICIAL INTELLIGENCE	736-743
P. Sathish J. Jeyakodi Moses S. Kalaiselvan	ECO-CONSCIOUS CHROMATIC ENHANCEMENT OF SILK SUBSTRATES WITH PHYTO-DERIVED CHROMOPHORES: A COMPREHENSIVE EVALUATION OF CHROMATIC STRENGTH, FASTNESS CHARACTERISTICS, AND ANTIMICROBIAL EFFICACY FOR SUSTAINABLE TEXTILE ENGINEERING	744-745

Sema AYSAL	ASSESSMENT OF THE EFFECT OF FOREST FIRES ON WOOD PROPERTIES: A REVIEW	746-755
Sema AYSAL	MICROENCAPSULATION OF LEMON OIL AND ITS INHIBITORY EFFECT AGAINST WOOD-DECAYING FUNGI	756-764
Adesanmi, Moses Ademola	A CRITICAL STYLISTICS STUDY OF DISSENT IN SOYINKA'S 'MADMEN AND SPECIALISTS'	765
Adesanmi, Moses Ademola	SILENCES AND OMISSIONS: WHAT IS LEFT UNSAID ABOUT AGRICULTURE IN TINUBU'S 2025 BUDGET SPEECH	766
Shikath Ghosh Bidhan Chandra Halder	EFFECT OF FOLIAR SPRAY OF ZINC ON GROWTH AND YIELD OF KNOLKHOL	767
Soukaina Hamou Mustapha Moufassih Ousama Tarahi Said Agounad Hafida Idrissi Azami	A NEW HYBRID METHOD FOR MORE ACCURATE SSVEP TARGET IDENTIFICATION	768
Esra CEBECİ MAZLUM	THE EFFECTS OF ENERGY CONSUMPTION AND ECONOMIC GROWTH ON WATER FOOTPRINT IN BRICS-T COUNTRIES	769
Şirvan ÖNCE ÇOLAK	REREADING THE PUBLIC SPHERE: A CRITICAL VIEW OF EASTERN AND WESTERN LITERATURE ON THE AXIS OF DE-WESTERNIZATION	770-784
Ufuk YER Deniz CANBOLAT GÜLTEKİN Serap ULU DELİCE Özgür GÜRBÜZOĞLU Mesut NAMLI	INVESTIGATION OF YEARS-DEPENDENT QUALITY PARAMETERS IN FOREST FLOWER HONEYS OBTAINED FROM THE MURGUL KABACA VALLEY	785-792
Amritha LJ Sreejith J	"THE EVOLVING LANDSCAPE OF INTERNATIONAL FINANCIAL REGULATION"	793
Faisal Nazir	PRODUCTION AND CHARACTERIZATION OF CARBON NANOTUBES FROM BIOCHAR UNDER MICROWAVE IRRADIATION	794
Tahreer Farouk	TRANSFORMING AL-DUBATI HOUSE INTO A HERITAGE VILLA IN JORDAN	795
Abdur Rahman Al Mamun Rubel Mia Hedaetun Nahar Hira	REVOLUTIONIZING DROUGHT TOLERANCE IN STAPLE CROPS: INTEGRATING CRISPR-CAS9 WITH TRADITIONAL PLANT BREEDING TECHNIQUES FOR CLIMATE-RESILIENT AGRICULTURE	796-797
Levent KAYA	MUZAFFER SARISÖZEN OF TURKISH SUFI MUSIC: SAFER DAL	798-799
Hakkı ÖZBAŞ	THE IMPORTANCE OF INTERNATIONAL TRADE IN COUNTRIES' GROWTH STRATEGIES: THE EXAMPLE OF CHINA, SOUTH KOREA AND TÜRKİYE	800-817
HANINE Sanae	WHAT GOVERNANCE OF THE BLUE ECONOMY IN AFRICA ?	818
Amina Ahmad Aminu Musa Alhassan	WHO IS A JOURNALIST IN A CHANGING NIGERIA? NAVIGATING ETHICS, INFLUENCE AND RESPONSIBILTY IN THE DIGITAL AGE'.	819-825
Devrim Baran	RETHINKING DESIGN EDUCATION IN THE AGE OF ARTIFICIAL INTELLIGENCE: "A DESIGN FOR A FACULTY OF DESIGN/PROPOSAL"	826-827
Erdem YÜCESAN Özge Nalan BİLİŞİK	CONTENT-BASED (TF-IDF) SIMILAR PRODUCT RECOMMENDATIONS: MACHINE LEARNING-BASED RECOMMENDATION SYSTEM APPLICATION FOR B2B PHARMACY MARKETPLACE	828-829

Mohammed Waheeb	TOURISTIC TRAILS ALONG ZARQA RIVER IN THE SOUTH LEVANT – JORDAN	830
Abdurrahman Ibrahim Usman Samaila Ibrahim Samaila	IDENTIFICATION OF FUNGI RESPONSIBLE FOR THE DECOMPOSITION OF SOIL ORGANIC MATTER	831
LAFTANI Yasmine CHATIB Baylassane	ADVANCED OXIDATION PROCESSES FOR EFFICIENT AZO DYE DEGRADATION: EXPERIMENTAL AND TOXICITY INSIGHTS	832
Bensakhria Sara BenkhelifaMohammed	EFFECTS OF DIRECT SEEDING ON THE PHYSIOLOGICAL PARAMETERS OF SOFT WHEAT (TRITICUM SATIVUM L., VARIETY AÏN ABID)	833
M.Pharm Ashwini.A	FORMULATION AND EVALUATION CLITORIA TERNATEA LINN. ALCOHOLIC EXTRACT ANTIPIGMENT CREAM	834

HAREZM ŞEHRİNDE DİN VE İLMİ HAYAT (1097-1231)

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Özet

Bu çalışma, 1097-1231 yılları arasında Harezmşahlar döneminde Harezm şehrindeki dinî ve ilmî hayatı incelemektedir. Coğrafi konumu nedeniyle farklı medeniyet ve kültürlere ev sahipliği yapan Harezm, İslamiyet'in bölgeye girişinden itibaren dinî ve ilmî faaliyetlerin merkezi hâline gelmiştir. Dinî yapı bakımından şehir, Zerdüştlük, Hristiyanlık, Yahudilik ve İslamiyet gibi farklı inançlara sahne olmuş; özellikle İslamiyet'in yayılmasıyla birlikte Sünnî-Hanefî geleneği hâkim konuma gelmiştir. Şafiîlik, İsmaillik ve İsnâaşeriyye gibi mezhepler de bölgede varlık göstermiştir. Kelam sahasında Eş'arîlik ve Mu'tezile tartışmaları öne çıkmış; Zemahşerî gibi âlimler ilmî canlılığın simgesi olmuştur. İlmî hayat açısından Harezm, medreseleri, ulema sınıfı ve kitap kültürüyle dikkat çekmiş; fıkıh, hadis ve kelam gibi dinî ilimlerin yanı sıra matematik, astronomi, tıp ve coğrafya gibi aklî ilimlerde de önemli gelişmeler yaşanmıştır. Birûnî, Zemahşerî, Cürcânî ve Harezmî gibi şahsiyetler bu dönemde öne çıkmıştır. Harezmşah sultanlarının bilime ve âlimlere gösterdiği himaye, ilmî üretkenliği desteklemiş ve şehri dönemin en önemli kültür merkezlerinden biri hâline getirmiştir. Harezmşahlar dönemi, farklı din ve mezheplerin bir arada yaşadığı, ilmî tartışmaların yoğunlaştığı ve aklî-dinî ilimlerin eşzamanlı olarak geliştiği bir kültürel zenginlik dönemi olarak değerlendirilmektedir.

Bu çalışmada doğru ve güvenilir bilgilere ulaşabilmek amacıyla İslam tarihinin klasik kaynaklarına müracaat edilmiştir. Ayrıca nesnelliği temin etmek ve literatüre katkı sağlamak amacıyla modern kaynaklardan da istifade edilmiştir.

Anahtar Kelimeler: İslam Tarihi, Harezm, Din, Mezhep, Cürcanî

RELIGIOUS AND SCHOOL LIFE IN THE CITY OF KHARAZM (1097-1231)

Abstract

This study examines the religious and scholarly life in the city of Khwarazm during the reign of the Khwarazm Shahs between 1097 and 1231. Due to its geographical location, Khwarazm hosted diverse civilizations and cultures and became a center of religious and scholarly activity from the time of Islam's arrival in the region. In terms of religious structure, the city hosted diverse faiths, including Zoroastrianism, Christianity, Judaism, and Islam; the Sunni-Hanafi tradition, particularly with the spread of Islam, became dominant. Sects such as Shafi'i, Ismailism, and Twelver Shiites also had a presence in the region. In the field of theology, the Ash'arite and Mu'tazilite debates were prominent, and scholars such as Zamakhshari became symbols of scholarly vitality. In terms of scholarly life, Khwarazm was notable for its madrasas, ulema class, and book culture. Significant advancements were made in religious sciences such as jurisprudence, hadith, and theology, as well as in rational sciences such as mathematics, astronomy, medicine, and geography. Figures such as Biruni, Zamakhshari, Jurjani, and

Khwarazmi rose to prominence during this period. The patronage shown by the Khwarazmian sultans to science and scholars fostered scholarly productivity and transformed the city into one of the most important cultural centers of the period. The Khwarazmian period is considered a period of cultural richness, a time when different religions and sects coexisted, scholarly debates intensified, and rational and religious sciences developed simultaneously.

This study utilizes classical sources of Islamic history to obtain accurate and reliable information. Modern sources were also utilized to ensure objectivity and contribute to the literature.

Keywords: Islamic History, Khwarezm, Religion, Sect, Jurjani

Giriş

Harezm, Avesta metinlerinde Aryani toplulukların ilk yaratıldığı ve yaşadığı yer olarak geçmektedir. (Husrevbeygi, 2007) Farsça sözlükte "Harezm" terimi, "Har" kolay, basit, zahmetsiz; "rezm" ise savaş anlamına gelmektedir; yani "kolay savaş" anlamını taşımaktadır. Bu adlandırma, İran şahı Keyhüsrev (M.Ö. 2712-2652) ile Efrâsiyâb arasındaki savaşların Harezm topraklarında gerçekleşmesiyle ilişkilendirilmektedir. (Zerkelî, 1396) Böylece Harezm'in tarihi milattan önceki dönemlere kadar uzanmaktadır.[1]

Ortaçağ'da Harezm'in başlıca şehir ve kasabaları, Amuderya (Ceyhun) Nehri'nin sağ tarafında yer alan eski başşehir Kâs, sol tarafında yer alan ikinci başşehir Gürgenç (Cürcâniye) ve Moğol istilâsından sonraki merkezi Hîve (Hîvak) ile Hezâresb, Dergân, Berkan, Kerder, Zemahşer, Cigerbend, Sedver (Sedûr), Kerderânhâs, Zerdûh, Ertehuşmisen, Derhâs, Beratigin, Çağmîn, Hâmcerd, Gâvhâne, Nevkefâğ, Medminiye ve Git'tir.[2] (Azb, 1430) Harezm, geniş bir bölge olup Aral Gölü'nün güney kesimini kapsamaktadır. Bölgenin Tahiriye'den Garameğşe köyüne kadar Ceyhun Nehri boyunca uzanan kısmı fazla gelişmemişken, Garameğşe'den Harezm'e kadar uzanan nehrin iki yakası oldukça gelişmiş ve zengin yerleşimlere sahiptir. (Bîrûnî, 1363; İbn Havkal, 1387) Günümüzde bu bölge, İran, Türkmenistan, Özbekistan ve Tacikistan sınırları içerisinde yer almaktadır. (Hamâvî, 1383)

Harezm tarihinde Medler, Persler, Slevkoslar, Partlar, Sâsânîler, İslam Devleti, Emeviler, Abbasiler, Selçuklular ve Harzemşahlılar (1097-1231) hâkimiyet kurmuştur. Bölgede Esbicab, Fergana ve Maverraünnehir de dâhil olmak üzere Türkistan toprakları uzanmaktadır. Buhara ile Harezm arası yaklaşık 12 merhale (fersah)[3] mesafededir.(Kiyânî Nejâd, 1366) İslamiyet'in Harezm'e girişi Emeviler döneminde gerçekleşmiş, Kuteybe b. Müslim'in 712 yılında yaptığı seferde Afrigoğulları hariç bölgedeki tüm yönetimler sona erdirilmiştir. Selçuklulardan sonra 1097 yılında Kutbüddin Muhammed önderliğinde Hârizmşahlar Devleti kurulmuştur. (Taneri, 1997)

Harezm şehrine ilişkin mevcut kaynakların büyük kısmı Ortaçağ dönemine ait olup Farsça olarak kaleme alınmıştır. Bu kaynaklarda bilgiler genellikle kısa ve dağınık bir biçimde sunulmakta, dolayısıyla bunların bir araya getirilmesi ve bütüncül bir değerlendirme yapılması güçleşmektedir.

[1] Harezm, Avesta'da İran ve Yec olarak geçmektedir. Avrupa ve Rus araştırmacılar Zerdüşt'ün Orta Asya ve Belh ya da Hârezm'de ortaya çıktığını savunurlar. Bknz. Huşeng Husrevbeygi, "Coğrafyay-i Tarihi Harezm", Pejuheşhayi Tarih-i İran ve İslam 1 (2007), 75.

[2] Harezm'in coğrafyası ve yolları için bakınız, Ebü'l-Kāsım Muhammed b. Alî en-Nasîbî el-Bağdâdî İbn Havkal, SefernameİbnHavkal İran der Sûretü'l-arz, çev. Cafer Şe'ar (Tahran: Emir Kebir, 1387), 206-209

[3] 1 fersah 5685 m'dir. 12 fersah 68 km'dir.

11. yüzyılın sonlarında, Büyük Selçuklu Devleti'nin zayıflamaya başladığı dönemde, 1097 yılında Sultan Berkyaruk, Taştdâr[4] ve Anuş Tegin'in oğlu Kutbüddin Muhammed'i Hârizm şehrine vali olarak tayin etmesiyle Hârizmşahlar Devleti tarih sahnesine çıkmıştır. (Hamâvî, 1383) 1097-1231 yılları arasında Hârizmşahlar, Harezm'den Kabil'e kadar ve İran coğrafyasının tamamına hâkim olmuş, 134 yıl süren yönetimleri boyunca altı sultanın tahtta yer almasını sağlamışlardır. (Nesavî, 1388) Bu süre zarfında Büyük Selçuklular, Abbasiler, Karahitaylar, Gurlular, Irak Selçukluları ve Moğollarla mücadele etmişlerdir. 1230 yılında Anadolu Selçukluları ile yapılan Yassıçimen Savaşı'nı kaybetmeleriyle Hârizmşahlar Devleti sona ermiştir. (Taneri, 1997)

Hârizmşahlar döneminde Harezm'de dini ve kültürel faaliyetler, Büyük Selçuklular döneminde olduğu gibi devam etmiş ve bölge, Ortaçağ İslam dünyasında hem siyasi hem kültürel hem de ilmî açıdan merkezi bir konumda olmuştur.

Hârezm'de Dinî Hayat

Hârezm'de Zerdüştlük, Hristiyanlık, Yahudilik ve İslamiyet gibi çeşitli dinler mevcuttu. Bu dinlerden biri olan Zerdüştlük, Hârezm'de eski dönemlerden beri varlığını sürdüren ve özellikle Sâsânîler döneminde İran coğrafyasında hâkimiyet kuran bir inanç sistemiydi. (Barthold, 1376) Hârezm, birçok alanda olduğu gibi dinî açıdan da İran'ın etkisi altında kalmıştır. Nitekim İslam kaynaklarında Hârezm'deki Zerdüşt inancına dair bazı efsanelerden söz edilmekte (Mesʿûdî, 1374) ve bölgede ateşperestlere ait bir tapınak bulunduğu belirtilmektedir. (Şehristânî, 1350) Zerdüştlük, İslamî dönemde de varlıklarını sürdürerek (Bîrûnî, 1363) önemli bayramlarını kutlamaya devam etmişlerdir. (Bîrûnî, 1363) Bunlar takvim olarak ise Avesta takvimini kullanmışlardır. (Nâcî, 1386)

Hârezm'deki bir diğer din Hristiyanlıktı. Bölgede yaşayan Hristiyanlar "*Melkâiyye*"[5] olarak adlandırılmaktaydı. (Bîrûnî, 1363) Hristiyanlar, eski dönemlerden beri kutladıkları bazı özel törenlerini burada da sürdürmüşlerdir. Bunlardan biri, Mayıs ayının dördüncü gününde kiliseye kırmızı güller götürülerek icra edilen 'Kırmızı Gül Bayramı'dır. Bir diğer bayramları ise Hz. Eyyûb'u anmak amacıyla Mayıs ayının altıncı gününde kutlanan "*Ayar Bayramı*"dır. (Bîrûnî, 1363)

Hârezm'de varlık gösteren bir diğer din Yahudilikti. Yahudiler, Hazar ve Hârezm bölgelerinde az da olsa bulunmaktaydı. (Barthold, 1376) Bu dini grup ekonomik bakımdan güçlü ve etkili bir konuma sahipti. (Bosworth, 1385)

Bölgedeki dinlerden biri de İslamiyet'ti. Hârezm'de İslam ilk defa bölgenin kuzey ve doğu topraklarında yayılmaya başlamıştı. Müslüman tebliğciler ve fakihler, Dârü'l-Kâfir tarafına giderek Türkler arasında İslam'ı tebliğ etmişlerdir.(Bosworth, 1385) Ayrıca sûfîler de Hârezm'den Türklerin arasına giderek İslamiyet'i yaymaktaydılar. (Bosworth, 1385) Halifenin resmi elçisi İbn Fadlan, Slavlara dini tebliğ etmek amacıyla gönderilmişti. Horasan, Mâverâünnehir ve Hârezm çevresindeki kabilelerin İslam'a geçmesinde etkili olan faktörlerden biri de Müslüman tüccarların bu bölgelerle yürüttüğü ticari faaliyetlerdi. (Fran, 1376)

Sonuçta Hârezm bölgesine yayılarak hâkim konuma gelen tek din İslam olmuştur. Hârezm şehirlerinde ve kırsalında halkın çoğunluğu Müslümandı. İslam'ın farklı mezheplerine mensup olan Hârezm halkının büyük bölümü Sünni olup Horasan'ın da etkisiyle Hanefî mezhebini

[4] Hükümdarların ellerini yıkamaları ve abdest almaları için önlerine leğen-ibrik getirip hizmet eden saray görevlilerine Taşt-dâr ve İbrik-dâr denilmekteydi. Bknz. Erdoğan Merçil, TDV "Taşt-dâr " 2011 cilt 40 ss.161-162

[5] Melkâî, 1054 yılında kilisenin Katolik ve Ortodoks olarak ikiye ayrılmasına kadar bu iki ana kiliseye bağlı olanların tamamını ifade eder. Bknz. Mustafa Sinanoğlu, "Melkâîyye" TDV 2004 cilt 29, s.84-85

benimsemişti. (Hamâvî, 1383) Hanefiliğin bölgede yaygınlaşmasının sebebi, diğer mezheplere göre şartlarının daha esnek olmasıydı. (Bosworth, 1385) Nitekim Hârezm'deki mahkemeler Hanefî ve Şafiî fıkhına göre hüküm vermekteydi. (Lambton, 1386)

Hârezm'deki diğer bir mezhep Şafiîlikti. Özellikle Hîve ve Burgan şehirlerinde Şafiîlik yaygındı. (İbnü'l-Esîr, 1371) Selçuklular döneminde Şafiîliğin bütün Selçuklu topraklarında yayılmasının temel nedeni, vezir Nizâmülmülk'ün Şafiî mezhebinden olmasıdır. (İbnü'l-Esîr, 1371) İslam'ın dört mezhebinden ikisi olan Hanefîlik ve Şafiîlik, Moğolların öncesinde de sonrasında da Hârezm'de varlıklarını sürdürmüşlerdir. (İbn Battûta, 1376) Bu mezheplerin kendilerine ait cami ve medreseleri bulunmaktaydı.

Hârezm'deki bir diğer mezhep İsmâilîlikti. Hicrî IV. yüzyılda bölgede bulunan İsmâilîlerin lideri "Şeyhî" adlı bir kimseydi ve buradaki İsmâilîlere, Bağdâdî denilmekteydi. (Bîrûnî, 1363) Gazneli Mahmud'un Hârezm'e saldırısı sırasında İsmâilîler büyük bir darbe almışlardı.(Nâcî, 1386) Ancak bu grubun Hârezm'de tamamen ortadan kaldırıldığını gösteren kesin bir kanıt bulunmamaktadır. Hârezmşah hükümdarları ise İsmâilîlere karşı denge siyaseti izlemişlerdir. İlk dönemlerde Hârezm'deki İsmâilîlere hoşgörüyle yaklaşarak onları amaçları doğrultusunda kullanmışlardır. Nitekim Sultan Atsız, Sultan Sencer'e suikast düzenlemek üzere iki İsmâilî'yi görevlendirmiştir.(Mîrhând, 1380) Atsız'dan sonra ise Hârezmşahlar, İsmâilîlerle çatışma politikasını benimsemiş; Sultan Tekiş döneminde İsmâilî karşıtı faaliyetler yürütülmüştür. (Cüveynî, 1388) Arslan, Geşâyî Kalesi'ndeki İsmâilîleri saldırarak kaleyi dört ay boyunca kuşatma altında tutmuş; bunlardan bazıları teslim olmuş, bazıları ise Alamut Kalesi'ne kaçmıştır. (Mîrhând, 1380)

Hârezm'de İsnâaşeriyye (On İki İmam Şiîliği) de mevcuttu. İmam Rızâ'nın çocuklarından birinin Cürcâniyye'de defnedildiği, kabrinin "Kızıl Mezar" olarak bilindiği ve Şiîlerin bu türbede adaklar adadıkları kaydedilmektedir. (Kazvînî, 1373) İsnâaşeriyye, Şiîliğin en ılımlı kolu olduğundan İsmâilîlere uygulanan baskılara maruz kalmamış; Sünnî idarecilere karşı barışçıl bir tavır sergiledikleri için Hârezm'de huzur içinde varlıklarını sürdürmüşlerdir. (Bosworth,1385)

Hârezm'de Eşʿarîlik fikirleri de etkiliydi. Fahreddin Râzî, Cürcâniyye'de verdiği derslerde sorulan meseleleri hem Muʿtezilî hem de Eşʿarî bakış açısıyla açıklamaktaydı. (Kazvînî, 1373) Nizâmülmülk Tûsî'nin vezirliği döneminde Eşʿarîlik Horasan'da güç kazanmıştı. (Sâberî, 1383)

Doğu'nun dinî kutup merkezi sayılan Horasan'da Muʿtezile azınlıkta olmakla birlikte etkiliydi ve Nîşâbur'da da varlık göstermekteydi. (Bosworth, 1385)Hârezmşahların desteğiyle Muʿtezile Hârezm ve Cürcâniyye'de gelişme imkânı bulmuş, halk arasında da rağbet görmüştü. (Gilmartin, 1382) Nitekim Cürcâniyyelilerin çoğu kelâm ilmine aşinaydı (Kazvînî, 1373) ve Hârezmliler bu alanda maharetliydi. (Kâzî, 1972) 6. yüzyılda Hârezm'de açıkça Muʿtezile propagandası yapan ilk kişi Ebû Mudar Mahmûd b. Cerîr ed-Dabbî el-İsfahânî idi. (Zerkelî, 1396) Daha sonra Hârezmli talebesi Zemahşerî, bu mezhebin bölgede kökleşmesini sağlamıştır. (Hamevî, 1383) Fahreddin Râzî ile Muʿtezilî âlimler arasında yapılan tartışmalar neticesinde Râzî'ye baskılar yapılmış ve bu sebeple Hârezm'i terk etmek zorunda kalmıştır. (Gilmartin, 1382) Sultan Muhammed Hârezmşah'ta Muʿtezile'ye meyletmişti. (Kesâî, 1379) Ancak Moğol saldırılarıyla birlikte Muʿtezile büyük bir darbe almıştır. (Sâberî, 1383)

Hârezm'de kültürel çatışmaların yaşanmaması, ilmî ve kültürel faaliyetlerin artmasına zemin hazırlamıştır. Refah ve kültürel gelişimin hâkim olduğu bu ortamda pek çok âlim ve ulema yetişmiş, halk ilmî tartışmalara serbestçe katılabilmiştir. Bu gelişmelerin en önemli dayanağı, ticaretin sağladığı zenginlik olmuştur.(Frank, 1376) Hârezmliler ilme düşkün bir toplumdu. (Makdisi, 1981) Bölgede her zaman dinî ilimleri öğreten âlimler bulunmakta, halk özellikle fıkıh ve dinî ilimlere büyük bir ilgi göstermekteydi. Kur'an kıraati hususunda maharetli olan

Hârezmliler, (Makdisî, 1981) kelâm ilmine de aşinaydılar. (Kazvînî, 1973) Ayrıca Hârezm büyüklerinin evlerinde ilmî sohbetler yapılır, kitaplar okunur ve dinî müzakereler gerçekleştirilirdi. (Bağdâdî, 1915) Bu mekânlardan Yakub b. Salih ve Sadr el-Fazl'ın evleri öne çıkmaktaydı. (Azb, 1430)

Hârezmliler edebiyat ve fıkıh alanında da temayüz etmişlerdi. (Makdisî, 1981) Dindar olmalarının yanı sıra seyyah kimlikleri de Hârezm'in ticaret bakımından gelişmesine katkı sağlamıştır. Toplumsal hayatta cenaze merasimleri özel bir yere sahipti. Sultan Tekiş Hârezm dışında vefat edince cenazesi törenle Hârezm'e getirilmiş ve onun için büyük bir türbe inşa edilmiştir.(İbnü'l-Esîr, 1371) Aynı şekilde evlilik merasimleri de önemsenmiş; Sultan Muhammed'in kızının İstendar ile evliliğinde görkemli bir düğün düzenlenmiştir. (Marʿaşî, 1989)

11. ve 12. yüzyıllarda Hârezm'de aklî ilimlerden ziyade dinî ilimler ön planda gelişmiştir.(Kiyânî Nejâd, 1366) Bölgenin artan refah seviyesiyle birlikte Hârezm, dinî ilimlerin merkezi hâline gelmiştir. (Makdisî, 1981) Bu merkezlerde kaleler ve hisarlarda dahi dinî ilimler ve fıkıh öğretilmekteydi. (Azb, 1430) Kur'an, hadis, ahbâr, usûlü'd-dîn ve aklî ilimler de müfredatta yer almaktaydı. (Azb, 1430) Bu dönemde yazı ve kâğıt üretimi büyük önem kazanmış; Cürcâniyye ve Hârezm'de cami çevrelerinde kâtiplik ve kâğıt imal merkezleri kurulmuştur. Bu merkezlerde çok sayıda dinî ve ilmî eser telif edilerek diğer bölgelere gönderilmiştir.(Azb, 1430)

Hârezmşahlar Devleti ilmi her zaman desteklemiştir. Sultan Anuştegin âlimlere saygı gösteren bir hükümdardı. (el-Beyzâvî, 2003) Sultan Muhammed aklî ilimlere önem vermiş (Sebkî, bi tarih) ve Farsça şiirler yazmıştır. (Cûzcanî, 1984) Sultan Tekiş derin fıkıh bilgisine sahipti; (Azb, 1430) Sultan Atsız ise hem âlim hem de şair kimliğiyle tanınmıştır. (Cüveynî, 1983) Hârezm sultanlarının Cürcâniyye'deki sarayları ilmî ve dinî tartışmaların merkezî mekânlarıydı. (Azb, 1430) Cüveyni'ye göre Cürcâniyye, büyüklerin ve âlimlerin payitahtı konumundaydı. (Cüveynî, 1988) Atsız'ın sarayında Zemahşerî, Reşîdüddin Vatvât ve tabip Cürcânî gibi önemli âlimler bulunmaktaydı. (Azb, 1430)

Hârezmşahlar Kur'an ve Kur'an ilmine büyük önem vermiş, (Azb, 1430) din âlimlerini koruyarak onlar için medreseler ve vakıflar kurmuşlardır. (Bağdadî, 1315) Örneğin Deskan Eğsak köyündeki Hâtun Cihan Medresesi ulema için vakfedilmiş bir kurumdu. (Nesavî, 1388) Bu iltifatın neticesinde ulema sınıfı, Hârezmşahlar döneminde siyasî ve diplomatik meselelerde etkin rol oynamış; devletlerarası barış görüşmelerinde arabuluculuk yapmışlardır. Nitekim Sultan Tekiş, Gurlu hükümdarı Gıyâseddin Muhammed b. Sam'a barış heyeti olarak bir grup fakihi göndermiştir. (İbn Haldun, 1963) Ulema zaman zaman savaşların sona erdirilmesinde de etkili olmuştur. 1141'de Sultan Atsız Serahs'ı kuşattığında, bölgenin din âlimi Ebû Muhammed ez-Ziyâdî araya girerek bu girişimi engellemiştir. (İbn Haldun, 1963) Dolayısıyla Hârezm sultanları, siyasî meşruiyetlerini güçlendirmek amacıyla ulemadan sürekli faydalanmışlardır. Özellikle Sultan Muhammed, iktidarını meşrulaştırmak için gayrimüslimlere karşı gaza ve cihat hareketlerini sıkça kullanmıştır. (İbnü'l-Esîr, 1971)

Harezm'deki ilmi gelişmeler, dönemin siyasi olaylarına göre farklılık göstermekteydi. Bazı ilim dallarının gelişimi ise oldukça eskiye dayanmaktadır. Örneğin matematiğin tarihi İslamiyet'in birinci yüzyılına kadar uzanır. 6. ve 7. yüzyıllarda Harezmşahlar döneminde yaşamış matematikçiler arasında Timurtaş öne çıkmaktadır. (Azb, 1430) Moğolların Harezm'e saldırılarında öldürülen Muhammed b. Muhammed b. Ömer ve Ebu Ali Şerafeddin Ceğminî Harezmî, eserleri arasında Risālah fī al-Ḥisāb ve Kitāb Sharḥ al-Ṭuruq fī al-Ḥisāb fī Masāʾil yer almaktadır. (Zerkelî, 1396)

Astronomi de Harezm'de kadim bir geçmişe sahiptir. Zerdüştler, bayramlarının tam zamanını belirlemek için Ay'ın hareketlerini ve takvimi iyi bilmekteydiler; dolayısıyla Araplardan daha

iyi bir takvim bilgisine sahiptiler. (Bîrûnî, 1363) Astrolojiyi bilmek, takvim bilgisini kavramak için gerekliydi. İslamiyet ile birlikte astroloji daha da önem kazandı, çünkü namaz vakitleri ve kıble yönünün belirlenmesi için gece ve gündüz hareketlerinin bilinmesi gerekiyordu. (Kandi, 1987) Astronomiyle uğraşan Müslüman âlimler gök cisimlerinin hareketlerini izlemişlerdir. (Kendî, 1987) Biruni de önde gelen bir astronomdu. Harezmî, matematiğin yanı sıra astronomiyi de iyi bilmekteydi; astrolojisi İslam dünyasında kabul görmüş ve kullanılmıştır. (Zidan, 2012)

Harezmşahlar döneminde matematik ve astronomiyle ilgilenen Ceğminî, Quvvat al-Kavākib ve Ḍuʿafahā adlı eseri kaleme almıştır. (Zerkelî, 1396) Astronomiyle uğraşan diğer âlim Ebu Muzaffer Nişaburi, Harezmşah sultanı İl Arslan'ın himayesinde yaşamıştır. (Azb, 1430) Sultan Muhammed döneminde Farsça yazdığı Ağbār-i Nucûmî adlı eserini de kaleme almıştır. (Azb, 1430)

Harezm'de tıp çalışmaları cerrahlığın gelişmesine katkı sağlamıştır. Burada bir cerrah ve öğrencisi guatr ameliyatını gerçekleştirmiştir. (Lanjatović, 2010) Tıp alanındaki önemli isimler arasında Şehabeddin Ğeyoki (Azb, 1430) ve Cürcani yer almaktadır. Cürcani (d. 490-ö. 531 H.), Harezmşahlar döneminde yaşamış büyük bir hekimdir; hadis, astronomi ve astrolojiye vakıftı. (Azb, 1430) 504 yılında Muhammed Harezmşah'ın hizmetine girerek Harezm'de birçok kişiyi tedavi etmiştir. (Curcânî, 1380) Zeğire Harezmşahî adında bir tıp kitabı kaleme almış, Sultan Atsız'ın vezirinin tavsiyesi üzerine Farsçaya tercüme edilmiştir. (Azb, 1430) Cürcanî, tıbbın yanı sıra eczacılık konusunda da yetkin olup H. 506 yılında bu eserin özetini Sultan Atsız'a sunmuştur. (Curcânî, 1380) Eserleri arasında Tıb al-Müluk, Red al-'Alī fī Felsefe, Zübde al-Tıb ve Tadbīr yum Walīle yer almaktadır. (Zerkelî, 1396)

11.yüzyılda yaşamış Ğeyveli Ğerki (ö. 1154), matematikçi ve coğrafyacıdır. Toprakların coğrafi uzunluğunu ve genişliğini hesaplamıştır. Eseri Muntehā al-Idrāk min Taqsīm al-Aflāk astronomiyle de ilgilenmektedir. (Kracakovskî, 1379) Coğrafyacılardan diğerleri Umrani, (Azb, 1430) Moğol saldırılarından önce Harezm'e giden Yakut Hemevi, (Hamâvî, 1383) Ebu Rayhan Biruni, (Kracakovskî, 1379) Arslan Harezmî ve 1147 yılında Harezm'e seyahat eden seyyah İdrisi'dir. (Kracakovskî, 1379)

Harezm'de tarih yazıcılığı çok eskiye dayanmaktadır. (Bîrûnî, 1363) İslam devletlerinin saldırıları sırasında Harezm tarihini bilen çok kişi öldürülmüş, tarihçilik ciddi şekilde etkilenmiştir. İslamiyet'in Harezm'e gelişi sonrası Ebu Reyhan Biruni, Harezm'in İslam öncesi ve sonrası dönemini kaleme almıştır. (Bîrûnî, 1363) Abdul Gaffar Farî ise Harezmli olmamakla birlikte bu bölgede yaşamış ve tarih yazıcılığı yapmıştır. (Hamâvî, 1383; Zerkelî, 1396) Muzaffer Harezmî, dinî ilimlerin yanında tarih bilgisine sahip bir tarihçi olarak Târîkh-i Harezm adlı eserini kaleme almıştır. (Hamâvî, 1383)

Felsefe de İslami dönemde Harezm'de gelişmiştir. Yunan felsefesine hâkim olan Ebu Reyhan, filozoflar arasında öne çıkmıştır. (Zerkelî, 1396) Hârezmşahlar döneminde Sadr el-Efzâl'ın evinde misafir olarak kalan Abbas bin Arslan, felsefi sohbetlere katılmıştır. (Azb, 1430) Ebul Kasım Harezmî (Şems al-Meşrak) (Hamâvî, 1383) ve Şehristanî (Zerkelî, 1396) da felsefe ile ilgilenmişlerdir.

Moğolların özellikle Cürcaniye'ye saldırıları sırasında Harezm'de birçok âlim öldürülmüş, kurtulanlar ise buradan göç etmiştir. Öldürülenler arasında Şahabeddin Ğeyoki, (Nesavî, 1388) Habeh Ullah Rumî Kari(Bağdadî, 1315) ve El-Ömeri (Nesavî, 1388) yer almaktadır. Ulema ve âlimlerden bazıları Moğolların saldırılarından korunmak için Anadolu (Asya-i Seğir) gibi uzak ve güvenli bölgelere, (Kafesoğlu, 1984) bazıları da Hindistan ve Mısır'a kaçmıştır. (Kracakovskî, 1379) Harezmlilerin bir kısmı da Mısır ve Suriye'ye sığınmıştır. (Hanbeli, 1406)

Hârezmli Mahmud Yalvaç ise Cengiz'e katılmış ve daha sonra Hanbalık hâkimi olmuştur. (Kracakovskî, 1379) Çin kaynaklarında ismi geçmemektedir; bu kaynaklarda Yeluchutsai adında bir kişiden bahsedilmektedir. (Bertschneider, 1381) Moğol saldırısıyla Harezm'deki âlimler ya ayrılmış ya da öldürülmüş ve bilimin Harezm'deki ışığı sönmüştür. Bundan sonra Harezm'de sadece tasavvuf bir yere kadar gelişme göstermiştir. (Azb, 1430)

Sonuç

Harezm, tarihî süreç boyunca farklı dinlerin, mezheplerin ve entelektüel faaliyetlerin bir arada var olduğu bir merkez olmuştur. Bölgedeki Zerdüştlük, Hristiyanlık, Yahudilik ve İslamiyet, hem toplumsal yapıyı şekillendirmiş hem de kültürel etkileşimin ve hoşgörünün zeminini oluşturmuştur. İslamiyet'in bölgeye yayılmasıyla birlikte Hanefi ve Şafiî mezhepleri hâkim olmuş, buna karşın İsmailliler ve İsnâaşeriyye gibi azınlık mezhepler barışçıl bir şekilde varlıklarını sürdürmüşlerdir. Bu durum, Harezm'in hem dini çoğulculuğunu hem de mezhepler arası uzlaşı kültürünü göstermektedir. Ekonomik refah ve Harezmşahlar'ın ilme verdikleri destek, bölgedeki kültürel ve bilimsel gelişimi güçlendirmiştir. Matematik, astronomi, tıp, coğrafya, tarih ve felsefe alanlarında yetişen âlimler (Biruni, Ceğminî, Cürcani gibi) sadece Harezm'in değil, tüm İslam dünyasının bilimsel mirasına katkıda bulunmuşlardır. Bu durum, Harezm'in Ortaçağ İslam dünyasında bir entelektüel merkez olarak işlev gördüğünü göstermektedir. Buna karşın Moğol istilaları, Harezm'in ilmî ve kültürel yapısında ciddi bir kırılma yaratmış, birçok âlimin ölümü veya göçüyle bilimsel faaliyetler büyük ölçüde durmuş ve bölgedeki ilmî üretim tasavvuf merkezli bir sınırlı gelişmeye evrilmiştir. Ancak bu yıkıcı döneme rağmen, Harezm'in uzun süreli bilimsel, kültürel ve dini mirası sonraki dönemlerde de etkisini sürdürmüş, bölgenin Ortaçağ İslam dünyasındaki merkezi rolünü pekiştirmiştir.

Sonuç olarak, Harezm'in tarihî örüntüsü; dini çeşitlilik, kültürel refah, ilmî üretkenlik ve ekonomik güçle desteklenen bir toplumsal yapı olarak ortaya çıkmaktadır. Bu özellikler, Harezm'i sadece bir coğrafi bölge değil, Ortaçağ İslam medeniyetinde bilim, kültür ve dinin kesiştiği önemli bir merkez hâline getirmiştir.

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POLAR FREQUENCY ANALYSIS FEATURES STUDIES BASED FACES BIOMETRICS VERIFICATIONS SYSTEMS

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Abstract—Face recognition has long been a goal of computer vision, but only in recent years reliable automated face recognition has become a realistic target of biometrics research. In this paper the contribution of classifier analysis to the Face Biometrics Verification performance is examined. It refers to the paradigm that in classification tasks, the use of multiple observations and their judicious fusion at the data, hence the decision fusions at different levels improve the correct decision performance. The fusion tasks reported in this work were carried through fusion of two well-known face recognizers, ICA I and ICA II. It incorporates the decision at matching score level, a novel fusion strategy is employed; the Likelihood Ratio Fusion within scores. This strategy increases the accuracy of the face recognition system and at the same time reduces the limitations of individual recognizer. The performances of the analysis studies were tested based Indian face database (IFD2002) and the simulation results are showed significant performance achievements.

Keywords—Classifier; Fusion; Biometrics; Face Verification; PCA; LDA; ICA; Polar Frequency Analysis; Likelihood Parameter Estimate.

INTRODUCTION

BIOMETRIC is a Greek composite word stemming from the synthesis of bio and metric, meaning life measurement. In this context, the science of biometrics is concerned with the accurate measurement of unique biological characteristics of an individual in order to securely identify them to a computer or other electronic system. Biological characteristics measured usually include fingerprints, voice patterns, retinal and iris scans, face patterns, and even the chemical composition of an individual's DNA [1]. Biometrics authentication (BA) (*Am I whom I claim I am?*) involves confirming or denying a person's *claimed identity* based on his/her physiological or behavioral characteristics [2]. BA is becoming an important alternative to traditional authentication methods such as keys (“something one has", i.e., by possession) or PIN numbers (“something one knows", i.e., by knowledge) because it is essentially “who one is", i.e., by biometric information. Therefore, it is not susceptible to misplacement or forgetfulness [3]. These biometric systems for personal authentication and identification are based upon physiological or behavioral features which are typically distinctive, although time varying, such as fingerprints, hand geometry, face, voice, lip movement, gait, and iris patterns. Multi-biometric systems, which

consolidate information from multiple biometric sources, are gaining popularity because they are able to overcome limitations such as non-universality, noisy sensor data, large intra-user variations and susceptibility to spoof attacks that are commonly encountered in mono-biometric systems.

The ultimate goal of designing pattern recognition systems is to achieve the best possible classification performance for the task at hand. This objective traditionally led to the development of different classification schemes for any pattern recognition problem to be solved. The results of an experimental assessment of the different designs would then be the basis for choosing one of the classifiers as a final solution to the problem. It had been observed in such design studies, that although one of the designs would yield the best performance, the sets of patterns misclassified by the different classifiers would not necessarily overlap. This suggested that different classifier designs potentially offered complementary information about the patterns to be classified which could be harnessed to improve the performance of the selected classifier.

On the other hand, the appearance-based approach, such as PCA, LDA and ICA based methods, has significantly advanced face recognition techniques. Such an approach generally operates directly on an image-based representation. It extracts features into a subspace derived from training images. In addition those linear methods can be extended using nonlinear kernel techniques to deal with nonlinearity in face recognition. Although the kernel methods may achieve good performance on the training data, it may not be so for unseen data owing this to their higher flexibility than linear methods and a possibility of over fitting therefore.

Some works based on multi-classifiers biometric verification systems has been reported in literature. **Sanun Srisuk et al. [4]** Introduce a new face representation, based on the shape Trace transform (STT), for recognizing faces in an authentication system. Which offers an alternative representation for faces that has a very high discriminatory power. It estimate the dissimilarity between two shapes by a new measure proposed, the Hausdorff context. Thier research demonstrates that the proposed method provides a new way for face representation. The system was verified with experiments based on the XM2VTS database. **Ben-Yacoub et al. [5]** evaluated five binary classifiers on combinations of face and voice modalities (XM2VTS database). They found that (i) a support vector machine and bayesian classifier achieved almost the same performances; and (ii) both outperformed Fisher's linear discriminent, a C4.5 decision tree, and a multilayer perceptron. **Josef Kittler et al. [6]** develop a common theoretical framework for combining classifiers which use distinct pattern representations and show that many existing schemes can be considered as special cases of compound classification where all the pattern representations are used jointly to make a decision. Thiers experimental comparison of various classifier combination schemes demonstrates that the combination rule developed under the most restrictive assumptions the sum rule outperforms other classifier combinations schemes. And a sensitivity analysis of the various schemes to estimation errors is carried out to show that this finding can be justified theoretically. **Borut Batagelj et al. [7]** present a comparative study for Face recognition applications based on the most popular appearance-based face recognition projection methods (PCA, LDA and ICA). And tested in equal working conditions regarding preprocessing and algorithm implementation on the FERET data set with its standard tests. They report that the L1 metric gives the best results in combination with PCA and ICA1, and COS is superior to any other metric when used with LDA and ICA2. **Xiaoguang Lu et al. [8]** Studies Face recognizers based on different representations of the input face images that have different sensitivity to these variations. Therefore, a combination of different face classifiers which can integrate the complementary information should lead to improved classification accuracy. It uses the sum rule and RBF-based integration strategies to combine three commonly used face classifiers based on PCA, ICA and LDA representations. The experiments conducted on a face database containing 206 subjects (2,060 face images) show that the proposed classifier combination approaches outperform individual classifiers. **Brain C. Becker et al. [9]** present a

method to automatically gather and extract face images From facebook, resulting in over 60.000 faces representing over 500 users. From these natural faces datasets, they evaluate a variety of well-known face recognition algorithms (PCA, LDA, ICA and SVMs) against holistic performance metrics of accuracy, speed and memory usage, and storage size. SVMs perform best with ~65% accuracy, but lower accuracy algorithms such as IPCA are orders of magnitude more efficient in memory consumption and speed. **Kresimir Delac et al. [10]** present an independent, comparative study of three most popular appearance-based face recognition algorithms (PCA, ICA and LDA) in completely equal working conditions based on FERET database. In which the motivation was the lack of direct and detailed independent comparisons in all possible algorithm implementations. It will be shown that no particular algorithm-metric combination is the optimal across all standard FERET tests and that choice of appropriate algorithm-metric combination can only be made for a specific task. **Kalyan Veramachaneni et al. [11]** focus on designing decision-level fusion strategies for correlated biometric classifiers. In this regard, two different strategies are investigated. In the first strategy, an optimal fusion rule based on the likelihood ratio test (LRT) and the Chair Varshney Rule (CVR) is discussed for correlated hypothesis testing where the thresholds of the individual biometric classifiers are first fixed. In the second strategy, a particle swarm optimization (PSO) based procedure is proposed to simultaneously optimize the thresholds and the fusion rule. Results are presented on (a) a synthetic score data conforming to a multivariate normal distribution with different covariance matrices, and (b) the NIST BSSR dataset. They observe that the PSO-based decision fusion strategy performs well on correlated classifiers when compared with the LRT-based method as well as the average sum rule employing z-score normalization. **Hazim Kemal Ekenel et al. [12]** examine a contribution of multi-resolution analysis to the face recognition performance based on CMU, PIE, FERET and Yale databases. Significant performance gains are attained, especially against illumination perturbations. The classification performance is improved by fusing the information coming from the sub-bands that attain individually high correct recognition rates.

This paper proposes a system which analyses face biometrics verification systems using ICA I and ICA II recognizers, based Indian face database (IFD2002) [13]. These two recognizers are capable of considering the problem of dimensionality by eliminating redundant features and reducing the feature space. The system can handle variations (illumination, pose, etc.) up to a significant level. The integrated system can overcome the drawbacks of individual recognizers. The paper is organized as follows: Section 2 briefly describes the Biometrics Face Recognition, face detection and face verification. Section 3 presents the Multimodal decision fusion concept. Section 4 describes the simulation results and Section 5 concludes the paper.

I. BIOMETRICS FACE RECOGNITION

Face recognition, authentication and identification are often confused. Face recognition is a general topic that includes both face identification and face authentication (also called verification). On one hand, face authentication is concerned with validating a claimed identity based on the image of a face, and either accepting or rejecting the identity claim (one-to-one matching). On the other hand, the goal of face identification is to identify a person based on the image of a face. This face image has to be compared with all the registered persons (one-to-many matching). Thus, the key issue in face recognition is to extract the meaningful features that characterize a human face. Hence there are two major tasks for that: Face detection and face verification.

II.1 Face Detection

Face detection is concerned with finding whether or not there are any faces in a given image (usually in gray scale) and, if present, return the image location and content of each face. This is

the first step of any fully automatic system that analyzes the information contained in faces (e.g., identity, gender, expression, age, race and pose). While earlier work dealt mainly with upright frontal faces, several systems have been developed that are able to detect faces fairly accurately with in-plane or out-of-plane rotations in real time. For biometric systems that use faces as non-intrusive input modules, it is imperative to locate faces in a scene before any recognition algorithm can be applied. An intelligent vision based user interface should be able to tell the attention focus of the user (i.e., where the user is looking at) in order to respond accordingly. To detect facial features accurately for applications such as digital cosmetics, faces need to be located and registered first to facilitate further processing. It is evident that face detection plays an important and critical role for the success of any face processing systems.

On the results presented on this paper only size normalization of the extracted faces was used. All face images were resized to 130x150 pixels, applying a bi-cubic interpolation. After this stage, it is also developed a position correction algorithm based on detecting the eyes into the face and applying a rotation and resize to align the eyes of all pictures in the same coordinates. The face detection and segmentation tasks presented in this paper was performed based on 'Face analysis in Polar Frequency Domain' proposed by Yossi Z. et al. [14]. First it extracts the Fourier-Bessel (FB) coefficients from the images. Next, it computes the Cartesian distance between all the Fourier-Bessel transformation (FBT) representations and re-defines each object by its distance to all other objects. Images were transformed by a FBT up to the 30^{th} Bessel order and 6^{th} root with angular resolution of 3˚, thus obtaining to 372 coefficients. These coefficients correspond to a frequency range of up to 30 and 3 cycles/image of angular and radial frequency, respectively.

Polar Frequency Analysis:

The FB series is useful to describe the radial and angular components in images [14]. FBT analysis starts by converting the coordinates of a region of interest from Cartesian (x, y) to polar (r, θ). The $f(r, \theta)$ function is represented by the two-dimensional FB series, defined as:

$$f(r,\theta) = \sum_{i=1}^{\infty}\sum_{n=1}^{\infty} A_{n,i} J_n(\alpha_{n,i}\, r)\cos(n\theta) + \sum_{i=1}^{\infty}\sum_{n=1}^{\infty} B_{n,i} J_n(\alpha_{n,i}\, r)\sin(n\theta) \quad (1)$$

Where J_n is the Bessel function of order n, $f(R, \theta) = 0$ and $0 \le r \le R$. $\alpha_{n,i}$ is the i^{th} root of the J_n function, i.e. the zero crossing value satisfying $J_n(\alpha_{n,i}) = 0$ is the radial distance to the edge of the image. The orthogonal coefficients $A_{n,i}$ and $B_{n,i}$ are given by:

$$A_{0,i} = \frac{1}{\pi R^2 J_1^2(\alpha_{n,i})} \int_{\theta=0}^{\theta=2\pi} \int_{r=0}^{r=R} f(r,\theta) r J_n\left(\frac{\alpha_{n,i}}{R} r\right) dr\, d\theta \quad (2)$$

if $B_{0,i} = 0$ *and* $n = 0$;

$$\begin{bmatrix} A_{n,i} \\ B_{n,i} \end{bmatrix} = \frac{2}{\pi R^2 J_{n+1}^2(\alpha_{n,i})} \int_{\theta=0}^{\theta=2\pi} \int_{r=0}^{r=R} f(r,\theta) r J_n\left(\frac{\alpha_{n,i}}{R} r\right) \begin{bmatrix} \cos(n\theta) \\ \sin(n\theta) \end{bmatrix} dr\, d\theta \quad (3)$$

if n > 0.

An alternative method to polar frequency analysis is to represent images by polar Fourier transform descriptors. The polar Fourier transform is a well-known mathematical operation where, after converting the image coordinates from Cartesian to polar, as described above; a conventional Fourier transformation is applied. These descriptors are directly related to radial and angular components, but are not identical to the coefficients extracted by the FBT.

II.2 Face Verification

Feature Extraction

A. Principal Component Analysis (PCA)

Principal component analysis (PCA) [15] is based on the second-order statistics of the input image, which tries to attain an optimal representation that minimizes the reconstruction error in a least-squares sense. Eigenvectors of the covariance matrix of the face images constitute the eigenfaces. The dimensionality of the face feature space is reduced by selecting only the eigenvectors possessing largest eigenvalues. Once the new face space is constructed, when a test image arrives, it is projected onto this face space to yield the feature vector – the representation coefficients in the constructed face space. The classifier decides for the identity of the individual, according to a similarity score between the test image's feature vector and the PCA feature vectors of the individuals in the database.

PCA is closely related to the Karhunen-Loève Transform (KLT) [16][17], which was derived in the signal processing context as the orthogonal transform with the basis $\Phi = [\phi_1, \dots, \phi_N]^T$ that for any $k \leq N$ minimize the average L_2 *reconstruction error* for data points x

$$\epsilon(x) = \|x - \sum_{i=1}^{k} (\phi_i^T x)\phi_i\|. \quad (4)$$

One can show that, under the assumption that the data is zero-mean; the formulations of PCA and KLT are identical. Without loss of generality we will hereafter assume that the data is indeed zero-mean, that is, the mean face $\bar{x}$ is always subtracted from the data.

The basis vectors in KLT can be calculated in the following way. Let X be the $N \times M$ data matrix whose columns $x_1, \dots, x_M$ are *observations* of a signal embedded in $\mathbb{R}^N$; in the context of face recognition, M is the number of available face images and $N = mn$ is the number of pixels in an image. The KLT basis Φ is obtained by solving the eigenvalue problem $\Lambda = \Phi^T \sum \Phi$, where $\sum$ is the covariance matrix of the data

$$\sum = \frac{1}{M} \sum_{i=1}^{M} x_i x_i^T , \quad (5)$$

$\Phi = [\phi_1, \dots, \phi_m]^T$ is the eigenvector matrix of $\sum$, and Λ is the diagonal matrix with eigenvalues $\lambda_1 \geq \cdots \geq \lambda_N$ of $\sum$ on its main diagonal, so that ϕ_j is the eigenvector corresponding to the j-th largest eigenvalue. Then it can be shown that the eigenvalue λ_i is the variance of the data projected on ϕ_i.

Thus, to perform PCA and extract k principal components of the data, one must project the data onto Φ_k - the first k columns of the KLT basis Φ, which correspond to the k highest eigenvalues of $\sum$. This can be seen as a linear projection $\mathbb{R}^N \rightarrow \mathbb{R}^k$ that retains the maximum energy (i.e. variance) of the signal. Another important property of PCA is that it *de-correlates* the data: the covariance matrix of $\Phi_k^T X$ is always diagonal.

The main properties of PCA are summarized by the following:

$$x \approx \Phi_k y , \quad \Phi_k^T \Phi_k = I , \quad E\{y_i y_j\}_{i \neq j} = 0 \quad (6)$$

Namely, approximate reconstruction, ortho-normality of the basis Φ_k and de-correlated principal components $y_i = \phi_i^T x$, respectively. Where PCA is successful in finding the principal manifold where it is less successful, due to clear nonlinearity of the principal manifold.

PCA may be implemented via Singular Value Decomposition (SVD): The SVD of a $M \times N$ matrix $X\,(M \geq N)$ is given by

$$X = U\,D\,V^T, \tag{7}$$

Where the $M \times N$ matrix U and the $N \times N$ matrix V have ortho-normal columns, and the $M \times N$ matrix D has the singular values of X on its main diagonal and zero elsewhere. It can be shown that$U = \Phi$, so that SVD allows efficient and robust computation of PCA without the need to estimate the data covariance matrix $\sum$ in Eq. (5). When the number of examples M is much smaller than the dimension N.

B. Linear Discriminate Analysis (LDA)

Linear Discriminate Analysis (LDA) also called Fisher Linear Discriminant (FLD) [18][19] is an example of a class specific subspace method that finds the optimal linear projection for classification. Rather than finding a projection that maximizes the projected variance as in principal component analysis, FLD determines a projection, $y = \Phi_F^T x,$ that maximizes the ratio between the between class scatter and the within-class scatter. Consequently, classification is simplified in the projected space.

Consider a c-class problem, with the between-class scatter matrix given by:

$$S_B = \sum_{i=1}^{c} N_i(\mu_i - \mu)(\mu_i - \mu)^T \tag{8}$$

And the within-class scatter matrix by:

$$S_W = \sum_{i=1}^{c} \sum_{x_k \in X_i} (x_k - \mu_i)(x_k - \mu_i)^T \tag{9}$$

Where μ is the mean of all samples, μ_i is the mean of class *i*, and N_i is the number of samples in class *i*. The optimal projection Φ_F is the projection matrix which maximizes the ratio of the determinant of the between-class scatter to the determinant of the within-class scatter of the projections,

$$\Phi_F = arg\max_{\Phi} \frac{|\Phi^T S_B \Phi|}{|\Phi^T S_W \Phi|} = [w_1\, w_2 \ldots w_m] \tag{10}$$

Where $\{w_i | i = 1,2,\ldots,m\}$ is the set of generalized eigenvectors of S_B *and* S_W, corresponding to the *m* largest generalized eigenvalues $\{\lambda_i \mid i = 1,2,\ldots,m\}$. However, the rank of S_B is *c-1* or less since it is the sum of *c* matrices of rank one or less. Thus, the upper bound on *m* is *c-1*. To avoid the singularity, one can apply PCA first to reduce the dimension of the feature space to *N-c*, and then use FLD to reduce the dimension to c-1. This two-step procedure is used in computing "Fisher Faces".

C. Independent Component Analysis (ICA)

Independent component analysis (ICA) [20][21][22][23] is a statistical method for linear transforming an observed multidimensional random vector X into a random vector Y whose

components are stochastically as independent from each other as possible. Several procedures to find such transformations have been recently developed in the signal processing literature relying either on Comon's [24] information-theoretic approach or Hyvärinen's maximum negentropy approach [25]. The basic goal of ICA is to find a representation Y = *M*X (*M* not necessarily a square matrix) in which the transformed components Y_i are the least statistically dependent. ICA leads to meaningful results whenever the probability distribution of X is far from Gaussian and this is the case that we are interested in this paper. For the face recognition task were proposed two different architectures: Architecture I - has statistically independent basis images (ICA I) and Architecture II assumes that the sources are independent coefficients (ICA II). These coefficients give the factorial code representation. The Architecture I provide a more localized representation for faces, while ICA Architecture II, like PCA in a sense, provides a more holistic representation. ICA I produces spatially localized features that are only influenced by small parts of an image, thus isolating particular parts of faces. For this reason ICA I is optimal for recognizing facial actions and suboptimal for recognizing temporal changes in faces or images taken under different conditions. Preprocessing steps of the methods ICA involves a PCA process by vertically centering (for ICA I), and whitened PCA process by horizontally centering (for ICA II). ICA Architecture I include a PCA by vertically centering (PCA I):

$$P_v = X_v V^T \wedge^{-1/2} \quad (11)$$

Where X_v is the vertically-centered training image column data matrix. Symbols $\wedge$ and $\vee$ correspond to largest eigenvalues and eigenvectors of S_T matrix respectively:

$$S_T = \sum_{i=1}^{M} (x_i - \mu_v).(x_i - \mu_v)^T, \quad \mu_v = \frac{1}{N}\sum_{j=1}^{N} x_i \quad (12)$$

In contrast to standard PCA, PCA I removes the mean of each image while standard PCA removes the mean image of all training samples. ICA Architecture II includes a whitened PCA by horizontally centering (PCA II):

$$P_w = P_h.\left(\frac{1}{M}\wedge\right)^{-1/2} = \sqrt{M} X_h \wedge \vee^{-1}, \quad (13)$$

Where P_h is the projection matrix of standard PCA method.

$$P_h = X_h \wedge \vee^{-1/2}. \quad (14)$$

Matrix X_h contains in rows horizontally-centered training images. PCA II is actually the whiten version of standard PCA.

II. Multimodal Biometric Fusion Decision

The process of biometric user authentication can be outlined by the following steps [26]: a) acquisition of raw data, b) extraction of features from these raw data, c) computing a score for the similarity or dissimilarity between these features and a previously given set of reference features and d) classification with respect to the score, using a threshold. The results of the decision processing steps are *true* or *false* (or *accept/reject*) for verification purposes or the user identity for identification scenarios.

The fusion of different signals can be performed 1) at the raw data or the feature level, 2) at the score level or 3) at the decision level. These different approaches have advantages and

disadvantages. For *raw data* or *feature level* fusion, the basis data have to be compatible for all modalities and a common matching algorithm (processing step c) must be used. If these conditions are met, the separate feature vectors of the modalities easily could be concatenated into a single new vector. This level of fusion has the advantage that only one algorithm for further processing steps is necessary instead of one for each modality. Another advantage of fusing at this early stage of processing is that no information is lost by previous processing steps. The main disadvantage is the demand of compatibility of the different raw data of features. The fusion at *score level* is performed by computing a similarity or dissimilarity (distance) score for each single modality. For joining of these different scores, normalization should be done. The straightforward and most rigid approach for fusion is the decision level. Here, each biometric modality results in its own decision; in case of a verification scenario this is a set of *true's* and *falsies*. From this set a kind of voting (majority decision) or a logical *AND* or *OR* decision can be computed. This level of fusion is the least powerful, due to the absence of much information. On the other hand, the advantage of this fusion strategy is the easiness and the guaranteed availability of all single modality decision results. In practice, score level fusion is the best-researched approach, which appears to result in better improvements of recognition accuracy as compared to the other strategies.

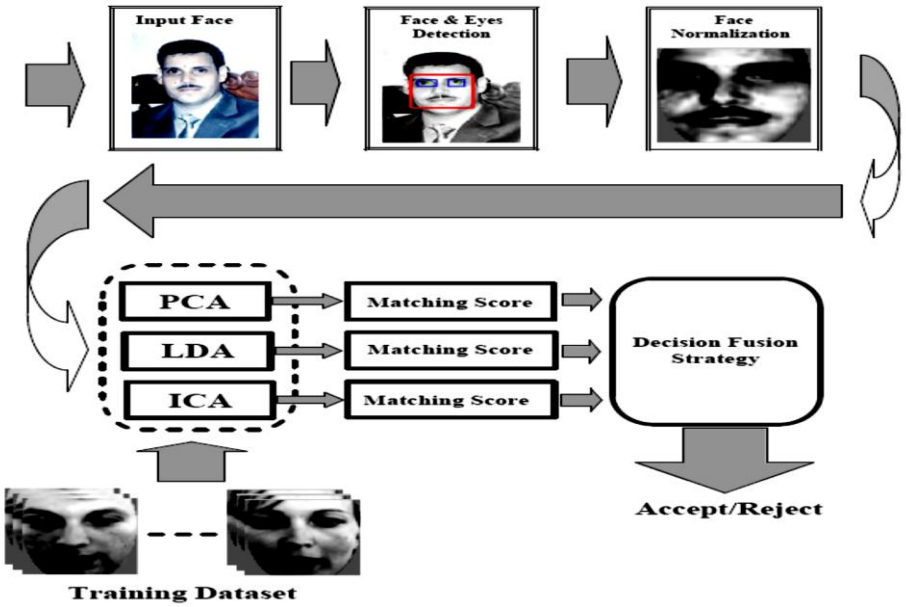


Fig. 1. Multi-Classifier Face Verification System Framework.

A. Theoretical Analysis for Decision Level Fusion

The fusion scheme using these two modalities is denoted by *S*. Verification system based only on modality one is denoted by S_1, while on modality two by S_2 [27]. If Γ is an algorithm, then the task is to find which acts on independent sources so that the output is maximized. It can be written as:

$$\hat{\Gamma} = \max_{\Gamma \in \Omega} \Gamma\,(S_1, S_2). \tag{15}$$

The performance indices in biometrics authentication system are false acceptance rate denoted FAR which means wrongly identifying an impostor to be an enrollee, and false rejection rate denoted by FRR which means wrongly identifying an enrollee as an imposter.

$$FAR(t) = P(\hat{w}_1|w_0) = \int_{R_1} p(X|w_0)\,dX = 1 - \int_{R_0} p(X|w_0)\,dX\,,$$

(16)

$$FRR(t) = P(\hat{w}_0|w_1) = \int_{R_0} p(X|w_1)\, dX \quad (17)$$

Where w_1 denotes the genuine user while w_0 denotes the imposter one. R_0 and R_1 are two exclusive sets in real axis. Both FAR and FRR are desirable to be as low as possible in authentication system. For any biometrics authentication system, whatever classifier takes, there exists a great risk of error. From the viewpoint of Bayesian decision theory, this is represented by the following equations for a two class problem,

$$E(t) = C_r \times FRR(t) + C_a \times FAR(t), \quad (18)$$

$$E_i(t_i) = C_r^i \times FRR^i(t_i) + C_a^i \times FAR^i(t_i),\ for\ i = 1,..,N \quad (19)$$

Where, N is the total modalities number, C_r denotes the loss function pertinent to the false rejection, and C_a denotes the loss function for the false acceptance. For simplicity, it assume that $C_a = C_a^i\ and\ C_r = C_r^i$.

B. *Decision Level Fusion*

The integrated system is denoted by Ψ. The outputs by individual systems Ψ_1 and Ψ_2, are called scores, which stand for the probability of claimant to be a genuine or an imposter. For any fusion strategies, an error is expressed as (18) and (19). If it assumes that $E_1(t_1) \le E_2(t_2) \le .. \le E_N(t_N)$, then it is easily known it is sufficient to prove that $E(t) \le E_1(t_1)$. For a two-modality and Bayesian rule Fusion:

$$\begin{array}{ll} \text{Decide} & w_0, \text{ if } (X_1, X_2) \in R \\ \text{Decide} & w_1, \textit{ otherwise} \end{array} \quad (20)$$

Where $R = \{(X_1, X_2) | C_r p(X_1, X_2|w_0) \ge C_a p(X_1, X_2|w_1)\}$.
Since Ψ_1 and Ψ_2 are independent, it have:

$$p(X_1, X_2|w_0) = p_1(X_1|w_0)p_2(X_2|w_0), \quad (21)$$

&

$$p(X_1, X_2|w_1) = p_1(X_1|w_1)p_2(X_2|w_1), \quad (22)$$

Then:

$$\begin{aligned} FAR(t) &= 1 - \int_{R_0} p(X_1, X_2|w_0) dX_1 dX_2 \\ &= 1 - \int_{R_0} p_1(X_1|w_0) dX_1 \int_{R_0} p_2(X_2|w_0) dX_2 \\ &= 1 - \left(1 - FAR^1(t_1)\right)\left(1 - FAR^2(t_2)\right). \end{aligned} \quad (23)$$

&

$$\begin{aligned} FRR(t) &= 1 - \int_{R_0} p(X_1, X_2|w_1) dX_1 dX_2 \\ &= 1 - \int_{R_0} p_1(X_1|w_1) dX_1 \int_{R_0} p_2(X_2|w_1) dX_2 \end{aligned} \quad (24)$$

$= FRR^1(t_1)FRR^2(t_2)$.

From the Equations (23) & (24) it can be obviously seen that:
$FAR(t) = FAR^1(t_1)$ & $FAR(t) = FAR^2(t_2)$. Thus the two combined modalities cannot improve the false acceptance rate by the Bayesian decision rule. Otherwise $FRR(t) = FRR^1(t_1)$ and $FRR(t) = FRR^2(t_2)$. Hence the false rejection rate of the combined system is reduced compared to individual sub-classifiers.

C. *Maximum Likelihood Parameter Estimation*

Given a set of observation data in a matrix X and a set of observation parameters θ the ML parameter estimation aims at maximizing the likelihood $L(\theta)$or log likelihood of the observation data $X = \{X_1, \dots, X_n\}$

$$\hat{\theta} = arg\max_{\theta} L(\theta). \tag{25}$$

Assuming that it has independent, identically distributed data, it can write the above equations as:

$$L(\theta) = p(X|\theta) = p(X_1, \dots, X_n|\theta) = \prod_{i=1}^{n} p(X_i|\theta). \tag{26}$$

The maximum for this function can be find by taking the derivative and set it equal to zero, assuming an analytical function.

$$\frac{\partial}{\partial\theta} L(\theta) = 0. \tag{27}$$

The incomplete-data log-likelihood of the data for the mixture model is given by:

$$L(\theta) = log(X|\theta) = \sum_{i=1}^{N} log(x_i|\theta) \tag{28}$$

Which is difficult to optimize because it contains the log of the sum. If it considers *X* as incomplete, however, and posits the existence of unobserved data items $Y = \{y_i\}_{i=1}^{N}$ whose values inform us which component density generated each data item, the likelihood expression is significantly simplified. That is, it assume that $y_i \in \{1..K\}$ for each *i*, and $y_i = k$ if the *i*-th sample was generated by the *k*-th mixture component. If it knows the values of *Y*, it obtains the complete-data log-likelihood, given by:

$$L(\theta, Y) = \log p(X, Y|\theta) \tag{29}$$

$$= \sum_{i=1}^{N} \log p(x_i, y_i|\theta) \tag{30}$$

$$= \sum_{i=1}^{N} \log\big(p(y_i|\theta)p(x_i|y_i, \theta)\big) \tag{31}$$

$$= \sum_{i=1}^{N} \big(\log p_{y_i} + \log g\big(x_i|\mu_{y_i}, \Sigma_{y_i}\big)\big) \tag{32}$$

Which, given a particular form of the component densities, can be optimized using a variety of techniques [28].

III. Experiments and Results Discussion

The experiments were performed using Indian face database [13]:

INDIAN FACES DATABASE 2002 (IFD2002) [13] this database contains human face images of 60 subjects (640x480 JPEG files format) with eleven different poses for each individual in which thirty nine are males and twenty two are females, the images were captured in February, 2002 in the campus of Indian Institute of Technology Kanpur. All the images have a bright homogeneous background and the subjects are in an upright, frontal position. For each individual, it have included the following pose for the face: looking front, looking left, looking right, looking up, and looking up towards left, and looking up towards right, looking down. In addition to the variation in pose, images with four emotions - neutral, smile, laughter, sad/disgust - are also included for every individual.

For both Independent Component Analysis Architectures I and II, it employed two novel processing design algorithmic analyses and generates scores using three different similarity measures algorithms (Cosine Similarity, City Block and Square Euclidean Distances Similarity) [29][30], and the performance of the analysis design for the likelihood ratio are based on EER (Equal Error Rate) of the ROC (Receptive Operation Characteristics) plotting evaluation.
For algorithmic processing design one (One Image Processing): at the preprocessing phase each representation of the databases training and testing is normalized (divided on the square root of its power); at the fundamental processing phase, it computing the scores (Similarity Distances Measures) of the testing normalized representation with normalized training representation; for IFD2002 Face Databases in which 60% of the data size are used for training and 40% of the data size are used for testing: that gives 4x6=24 Similarity Distances for each user; Thus 60x(4x6)=1440 target scores. Thus the target scores, noted (tscores) are built using Normal Law of probability $N(tscores, tm, ts^2)$ of the mean tm and standard deviation ts. Then, computing the scores of Distances Similarity Measures between the normalized representations of the test users with the normalized representation of the training users; Thus, it gives 4x6x59=1416 scores for each user; hence the total non-target scores are 60x(4x6x59)=84960 for IFD2002. These non-target scores, noted (nscores), are built using Normal Law of probability $N(nscores, nm, ns^2)$ of the mean nm and standard deviation ns.

Than; computing the Logarithmic Ration of the Likelihood for tscores and nscores with:

$$LR_{tscores} = \log\left(N(tscores, tm, ts^2)\right) - \log\left(N(tscores, nm, ns^2)\right)$$

&

$$LR_{nscores} = \log\left(N(nscores, tm, ts^2)\right) - \log\left(N(nscores, nm, ns^2)\right)$$

Than; Evaluated the ROC and the EER.

For algorithmic processing designs two (Multi-Image Processing): at the preprocessing phase each representation of the databases training and testing is normalized (divided on the square root of its power); at the fundamental processing phase, it computing the scores (Similarity Distances Measures) of the testing normalized representation with normalized training representation; in which 60% of the data size are used for training and 40% of the data size are used for testing: that gives 4x6=24 Similarity Distances for each user; for its user it computing the mean of its 24 Distances, thus it gives a 24x60=1440 target scores for IFD2002. These target scores, noted

(mtscores), are built using Normal Law of probability $N(\text{mtscores}, \text{mtm}, \text{mts}^2)$ of the mean mtm and standard deviation mts. Then, computing the scores of Distances Similarity Measures between the normalized representations of the test users with the normalized representation of the training users; Thus, it gives 60x(4x6x59)= 84960 non-target scores. These non-target scores, noted (mnscores), are built using Normal Law of probability $N(\text{mnscores}, \text{mnm}, \text{mns}^2)$ of the mean mnm and standard deviation mns.

Than; computing the Logarithmic Ration of the Likelihood for tscores and nscores with:

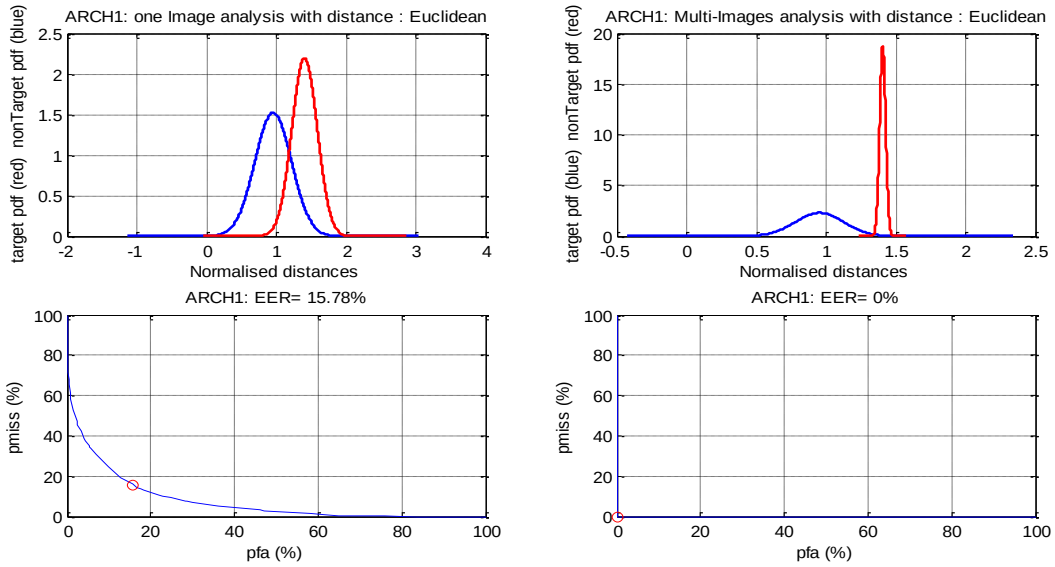
$$LR_{tscores} = \log\left(N(\text{mtscores}, , \text{tm}, \text{mts}^2)\right) - \log\left(N(\text{mtscores}, \text{mnm}, \text{mns}^2)\right)$$

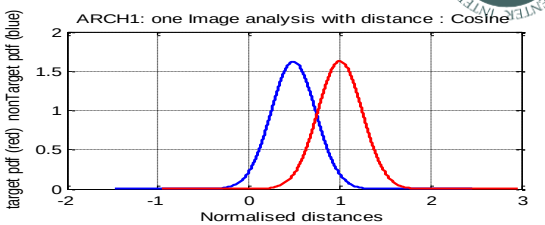
&

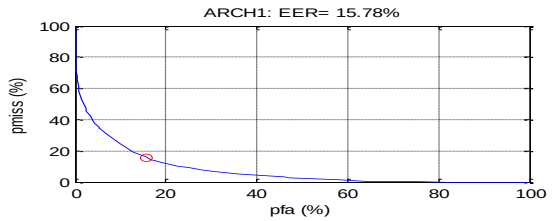
$$LR_{nscores} = \log\left(N(\text{mnscores}, \text{mtm}, \text{mts}^2)\right) - \log\left(N(\text{mnscores}, \text{mnm}, \text{mns}^2)\right)$$

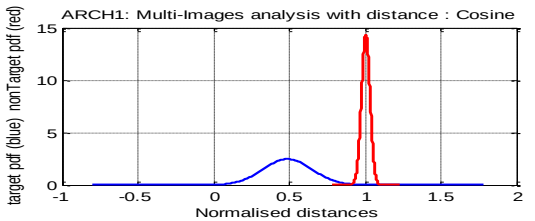
Than; Evaluated the ROC and the EER.

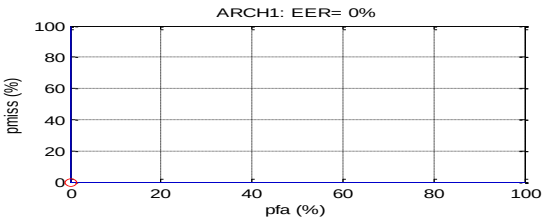
The Fig. 2., show the Verification Analysis Studies using Indian Face databases (IFD2002) for Independent Components Analysis Classifier Fusion of Likelihood Ratio.

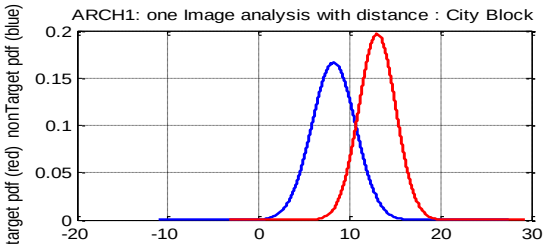


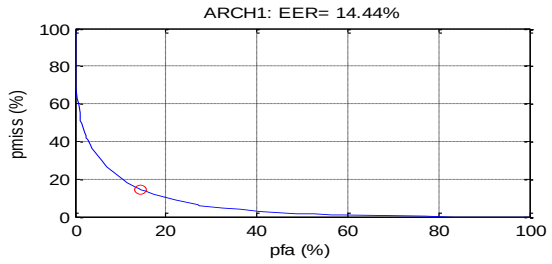

ARCH1: one Image analysis with distance : Cosine
target pdf (red) nonTarget pdf (blue)
Normalised distances

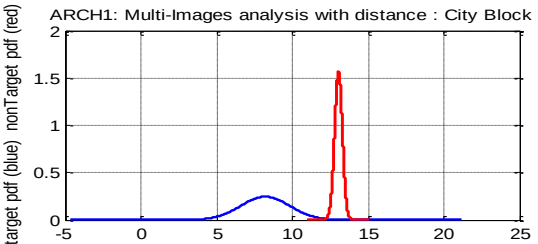

ARCH1: EER= 15.78%
pmiss (%)
pfa (%)

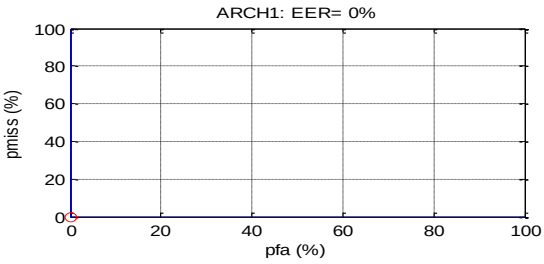

ARCH1: Multi-Images analysis with distance : Cosine
target pdf (blue) nonTarget pdf (red)
Normalised distances

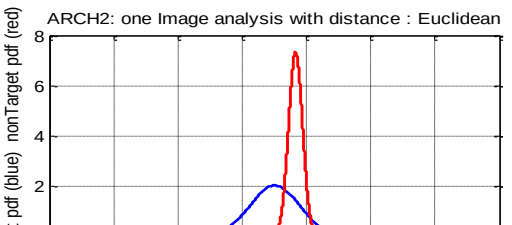

ARCH1: EER= 0%
pmiss (%)
pfa (%)

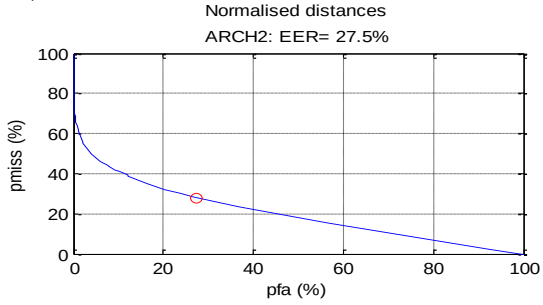

ARCH1: one Image analysis with distance : City Block
target pdf (red) nonTarget pdf (blue)
Normalised distances

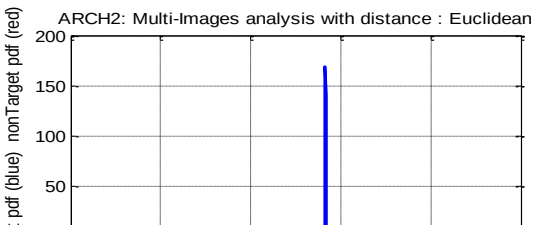

ARCH1: EER= 14.44%
pmiss (%)
pfa (%)

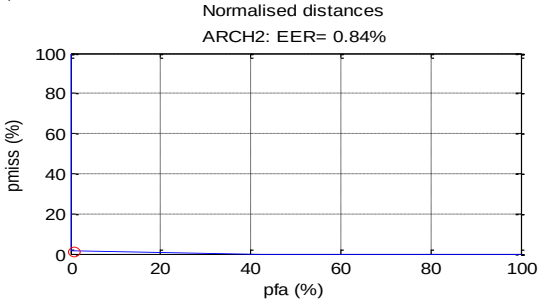

ARCH1: Multi-Images analysis with distance : City Block
target pdf (blue) nonTarget pdf (red)
Normalised distances


ARCH1: EER= 0%
pmiss (%)
pfa (%)


ARCH2: one Image analysis with distance : Euclidean
target pdf (blue) nonTarget pdf (red)
Normalised distances


ARCH2: EER= 27.5%
pmiss (%)
pfa (%)


ARCH2: Multi-Images analysis with distance : Euclidean
target pdf (blue) nonTarget pdf (red)
Normalised distances


ARCH2: EER= 0.84%
pmiss (%)
pfa (%)

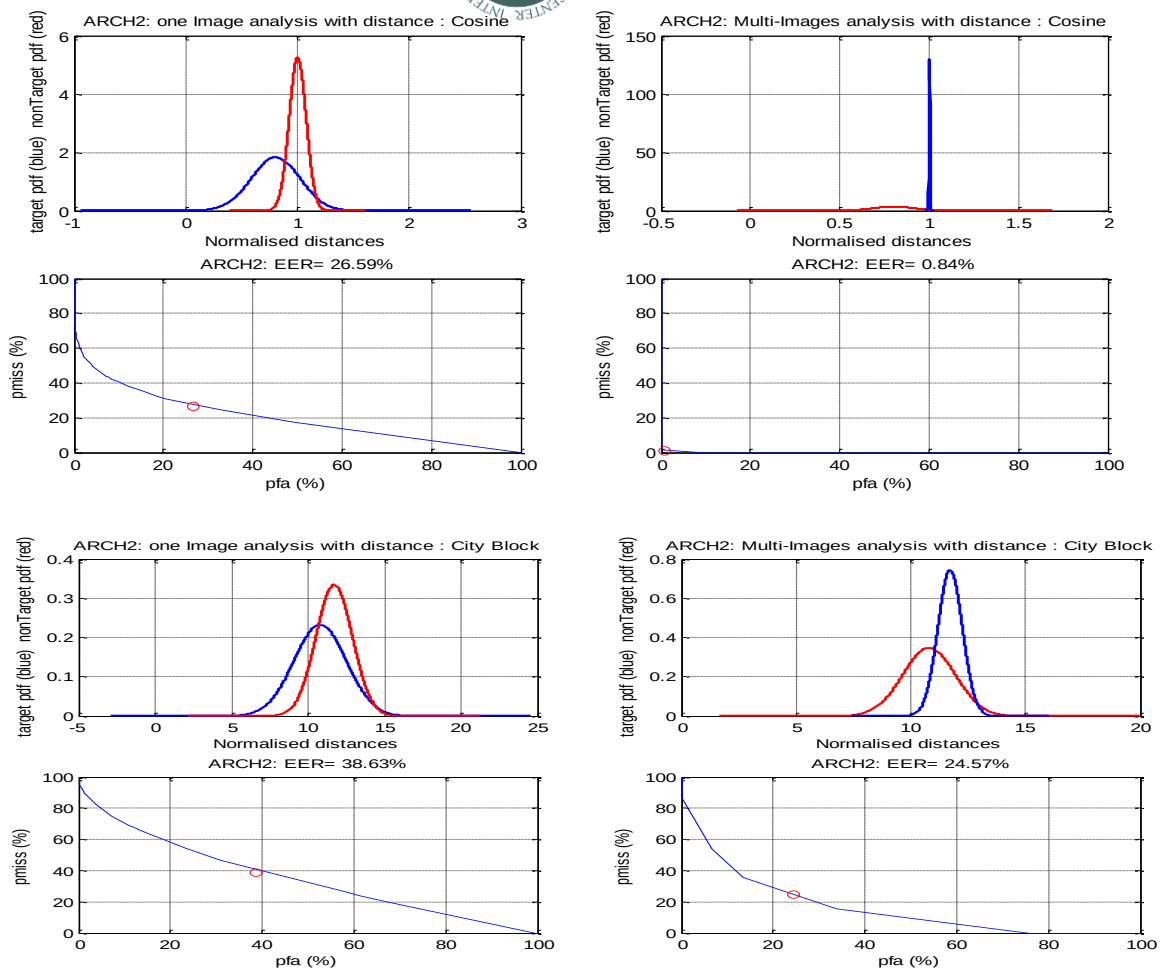


Fig. 2. Verification Analysis Studies using Indian Face databases (IFD2002) for Independent Components Analysis Classifier Fusion of Likelihood Ratio.

CONCLUSION

The paper has presented a human authentication method of Biometric face based Independent Component Analysis Architectures I and II; single biometric authentication has the fundamental problems of high FAR and FRR. It has presented a framework for novel fusion strategy within the scores at the score level. The likelihood ratio based fusion rule within the scores of the classifier achieves a significant recognition rates. As a result presented an EER=14.44%. And EER=0.00%. Respectively, for algorithmic design fusion of Likelihood Ratio within scores are achieved based Cosine Measures Similarity. Thus, Based on the experimental results, it has shown that EER can be reduced down significantly.

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EHL-İ BEYT'İN MİRASI: OSMANLI DEVLETİ'NDE SEYYİDLERİN TEREKE KAYITLARI ÜZERİNE BİR İNCELEME

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ÖZET

Osmanlı Devleti'nde miras hukukunda, ölen kişinin geride bıraktığı malları ifade etmek için "muhallefât" kavramı kullanılmakla birlikte, "metrukât" veya "tereke" terimleri de yaygındır. Devlet görevlilerinin miras taksimi "kassâm" unvanlı memurlar eliyle yürütülürken, sivil halkın miras işlemleri ise bireysel talepler doğrultusunda şekillenmiştir. Bu çerçevede tutulan tereke defterleri, Osmanlı-Türk aile kurumunu inceleyen araştırmalar için temel kaynaklar arasında yer alır. Söz konusu siciller, aile yapısı ve ekonomik durumdan mutfak kültürü, giyim-kuşam ve mesken özelliklerine; beslenme alışkanlıkları, takı ve süs anlayışı ile eğitim-kültür seviyesine kadar geniş bir yelpazede veri sunar. Böylece terekeler, bireylerin eşya ve aile ilişkilerini kayıt altına almakla kalmayıp, gündelik hayatı, servetin dağılımını, statü-mülkiyet ilişkilerini, maddi kültürü, tüketim alışkanlıklarını ve toplumsal sınıfları da aydınlatmaktadır. Özellikle seyyidlere ait tereke kayıtları, yalnızca kişisel servetleri değil, aynı zamanda toplumsal statüleri, sosyal bağları ve kimlik inşa süreçlerini anlamak için de önemli ipuçları verir. Bu yönüyle çalışma, Osmanlı döneminde seyyidlere dair literatüre arşiv temelli özgün katkı sunmakta; aynı zamanda tarih, hukuk, sosyoloji ve kimlik araştırmalarına disiplinlerarası bir perspektif kazandırmaktadır. Araştırmada, Şeriyye Sicillerinin muhtevası ele alınarak Osmanlı tereke ve muhallefât sicillerinin önemi ortaya konmuş; Hz. Peygamber'in soyundan gelen seyyidlerin tereke kayıtları incelenmiş ve bu kayıtların Osmanlı Ehl-i Beyt tarihi açısından sunduğu zengin içerik ile seyyidlerin mal varlıklarını tespit etme imkânı vurgulanmıştır.

Anahtar Kelimeler: İslam Mezhepleri, Ehl-i Beyt, Kadı Sicilleri, Tereke, Seyyid.

THE HERITAGE OF AHL AL-BAYT:A REVIEW ON THE ESTATE RECORDS OF THE SAYYIDS IN THE OTTOMAN EMPIRE

In Ottoman inheritance law, the term "muhallefât" is used to refer to the property left behind by the deceased, while the terms "metrukât" or "tereke" (estate records) are also common. While inheritance division for government officials is carried out by officials with the title of kassâm, the inheritance procedures of civilians are shaped according to individual requests. The estate records kept within this context hold a place among the primary sources for studies examining the Ottoman-Turkish family institution. These records provide a wide range of data, from family structure and economic status to kitchen culture, clothing, and housing characteristics; from eating habits and jewelry and decoration preferences to education and cultural level. Thus, estate records not only record individuals' possessions and family relationships, but also shed light on daily life, the distribution of wealth, status-property dynamics, material culture, consumption habits and social classes. In particular, the estate

records of sayyids provide important clues not only about their personal wealth but also about their social status, social relations, and identity-building processes. In this respect, the research offers an original contribution to the literature on Ottoman sayyids based on archival sources; it also provides an interdisciplinary perspective on history, law, sociology, and identity studies. In this research, the importance of Ottoman estate and inheritance records has been presented by examining the contents of the Court Records; the estate records of the sayyids descended from the Prophet Muhammad have been examined and with the rich contents of these records in terms of Ottoman Ahl Al-Bayt history, the opportunity to trace the wealth of the sayyids has been emphasized.

Keywords: Islamic Sects, Ahl Al-Bayt, Court Records, Estate Records, Sayyid.

Giriş

Şeriyye sicilleri, Osmanlı tarihinin sosyal, hukukî ve kültürel dokusunu anlamada kuşkusuz en önemli birincil kaynaklardandır. Kadı mahkemelerinde tutulan bu resmî kayıtlar; evlenme, boşanma, alım-satım, vekâlet ve ceza davalarının yanı sıra tereke ve muhallefât kayıtlarını da içermektedir. Böylece hem bireylerin kişisel hayatına hem de toplumun hukukî, ekonomik ve kültürel düzenine ışık tutmaktadır. Tereke kavramı, bir kimsenin vefatından sonra geride bıraktığı menkul ve gayrimenkul malların tümünü ifade etmekte ve Osmanlı hukuk sisteminde miras taksiminin en kritik aşamasını teşkil etmektedir. Kadılar tarafından titizlikle kaydedilen bu veriler, yalnızca miras hukukunun işleyişini belgelemekle kalmamakta; aynı zamanda dönemin sosyal ve ekonomik hayatına dair son derece zengin etnografik bilgiler de sunmaktadır.

Tereke defterleri, ölen kişinin kimliği, mesleği, görev yaptığı yer, vefat tarihi, mirasçıları, ev eşyaları, borçları ve alacakları gibi ayrıntılı bilgileri ihtiva eder. Bu yönüyle defterler, yalnızca mal varlığının tespitiyle sınırlı kalmayıp; aile yapısı, tüketim alışkanlıkları, servet dağılımı, toplumsal statü ve entelektüel ilgi alanlarına dair derinlemesine veriler sunan sosyal tarih kaynaklarıdır. Kitap koleksiyonlarından mutfak eşyalarına, giysilerden silahlara kadar kaydedilen her unsur, Osmanlı toplumunun maddi kültürünü yeniden inşa etme imkânı verir. Böylelikle tereke kayıtları, tarihçiler için olduğu kadar sosyologlar, hukukçular ve antropologlar için de vazgeçilmez bir araştırma malzemesi niteliği taşımaktadır.

Bu çalışma, şeriyye sicillerinde yer alan geniş kayıt külliyatı içinde özel bir yere sahip olan seyyid terekelerine odaklanmaktadır. Hz. Peygamber'in soyundan gelen seyyidler, Osmanlı toplumunda dini meşruiyetin taşıyıcıları ve sosyal düzenin önemli aktörleri olarak ayrıcalıklı bir statüye sahiptir. Tereke kayıtlarının incelenmesi, seyyidlerin ekonomik güçlerini, toplumsal konumlarını, ilmî ve kültürel ilgilerini ve sosyal ilişki ağlarını ortaya koyma açısından eşsiz bir imkân sunmaktadır. Bu çerçevede çalışma, seyyid terekelerini analiz ederek Osmanlı'daki Ehl-i Beyt mensuplarının gündelik yaşamını, servet birikimlerini ve kimlik inşa süreçlerini disiplinlerarası bir perspektifle ele almaktadır.

Bu çalışma öncelikle şeriyye sicillerinin muhtevası ve Ehl-i Beyt araştırmaları açısından taşıdığı önem üzerinde durulmakta, ardından Osmanlı tereke sistemi ile seyyid terekelerinin yapısı ayrıntılı biçimde ele alınmaktadır. Çalışmanın sonunda ise İstanbul şeriyye sicillerinden seçilen Rumeli Kazaskeri Seyyid Mehmed Atâullah Beyefendi b. Seyyid Mehmed Raşid Efendi'nin tereke kaydı transkripsiyon ve değerlendirme eşliğinde sunularak somut bir örnek üzerinden tartışma derinleştirilmektedir. Böylece makale, Osmanlı miras hukukuna ve seyyidlik kurumuna dair literatüre arşiv temelli özgün bir katkı sunmayı; aynı zamanda tarih, hukuk, sosyoloji ve kimlik araştırmalarına yeni bir perspektif kazandırmayı hedeflemektedir.

Bu yönüyle çalışma, İslam Mezhepleri Tarihi ve Ehl-i Beyt araştırmalarında ihmal edilmiş bir alana kapı aralamaktadır.

Şeriyye Sicillerinin Muhteveası ve Ehl-i Beyt Araştırmaları Açısından Önemi

Osmanlı Devleti, kendisinden önceki İslâm devletlerinden tevarüs ettiği 'kadılık kurumunu' geliştirerek onu devletin vazgeçilmez bir hukuk sistemi hâline getirmiştir. Yönetim yapısında kadılar ve nâibler birinci derecede yetkili konumda bulunmuştur. Şeriyye mahkemelerinde tutulan zabıtlar ise 'Şeriyye Sicili', 'Kadı Sicili', 'Sicill-i Mahfûz', 'Kadı Defteri' veya kısaca 'Sicil' olarak adlandırılmıştır (Özdemir, 1986, s. 179-187).

Kadı sicilleri, her türlü dava zabıtlarını; ilam, hüccet, vakfiye ve tereke başta olmak üzere İslâm fıkhının temel konularını içeren resmî tutanaklarla birlikte merkezden gönderilen ferman, berat ve buyruldu gibi belgelerin suretlerini de ihtiva etmektedir. Şeriyye sicillerinden farklı disiplinlerin de istifade etmesi mümkündür. Özellikle bir beldenin tarihinin araştırılmasında, idarî, askerî, malî ve demografik hususiyetlerin gün yüzüne çıkarılmasında bu belgeler birinci el kaynak niteliği taşımaktadır (Bayındır, 1986, s. 1; İnalcık, 1997, s. 693-703).

Şeriyye sicillerinde ayrıca cami, mescit, mektep, medrese, türbe, imaret, hankâh, kervansaray, çarşı, han, hamam ve mevlevihâne gibi vakıf yapıları hakkında da ayrıntılı bilgiler bulunmaktadır. Bu kayıtlarda söz konusu yapıların faal oldukları dönemler, bânilerinin isimleri, inşa ve tamir tarihleri, görevlileri ve vakıf gelirleri yer almakta; böylece dönemin ekonomik düzeyi hakkında önemli ipuçları sunulmaktadır (Denktaş, 2005; Akgündüz, 2009).

Şeriyye sicilleri, muhteva zenginliğiyle Osmanlı tarihinin siyasî, içtimaî ve iktisadî alanlardaki araştırmalar için güvenilir bir kaynak teşkil etmektedir. Bu sicillerin sağladığı en önemli verilerden biri de Osmanlı Devleti'nin miras sistemine ilişkindir. Hukuk alanının hemen her safhasına ışık tutan bu kayıtlar sayesinde, Osmanlı mahkemelerine intikal eden pek çok hususu ayrıntılarıyla takip etmek mümkündür (Işık, 2019, s. 234).

Şeriyye sicillerinin muhtevası incelendiğinde, İslâm mezhepleri açısından en dikkat çekici kayıtların başında Hz. Peygamber'in nesline dair olanlar gelmektedir. Seyyidlerin gündelik hayatlarına, evlenme, boşanma, alım-satım, veraset ve miras gibi hukukî süreçlerde mahkemelere yansıyan davalarına, toplum yararına kurdukları vakıflara, halkla ve kendi aralarındaki anlaşmazlıklara dair pek çok bilgiye bu sicillerden ulaşmak mümkündür. Bu yönüyle şeriyye sicilleri, Ehl-i Beyt araştırmalarında birinci elden başvurulacak kaynaklar arasında yer almaktadır (Yıldız, 2023, s. 286-290).

Osmanlı Devleti'nde Seyyidlerin Terekeleri

Osmanlı Devleti'nde miras hukuku alanında, ölen kişinin geride bıraktığı malları ifade etmek için 'muhallefât' kelimesi kullanılmakla birlikte, bunun yerine 'metrukât' veya 'tereke' terimleri de tercih edilmiştir. Osmanlı hukuk sisteminde mirasın taksimi, kassâm unvanlı devlet görevlileri tarafından yapılırken; sivil halkın miras yazımı ve paylaştırma işlemleri ise çoğunlukla ilgili kişilerin kendi talepleri doğrultusunda şekillenmiştir (Özcan, 2005, s. 406-407; Tuş, 1999, s. 157-191).

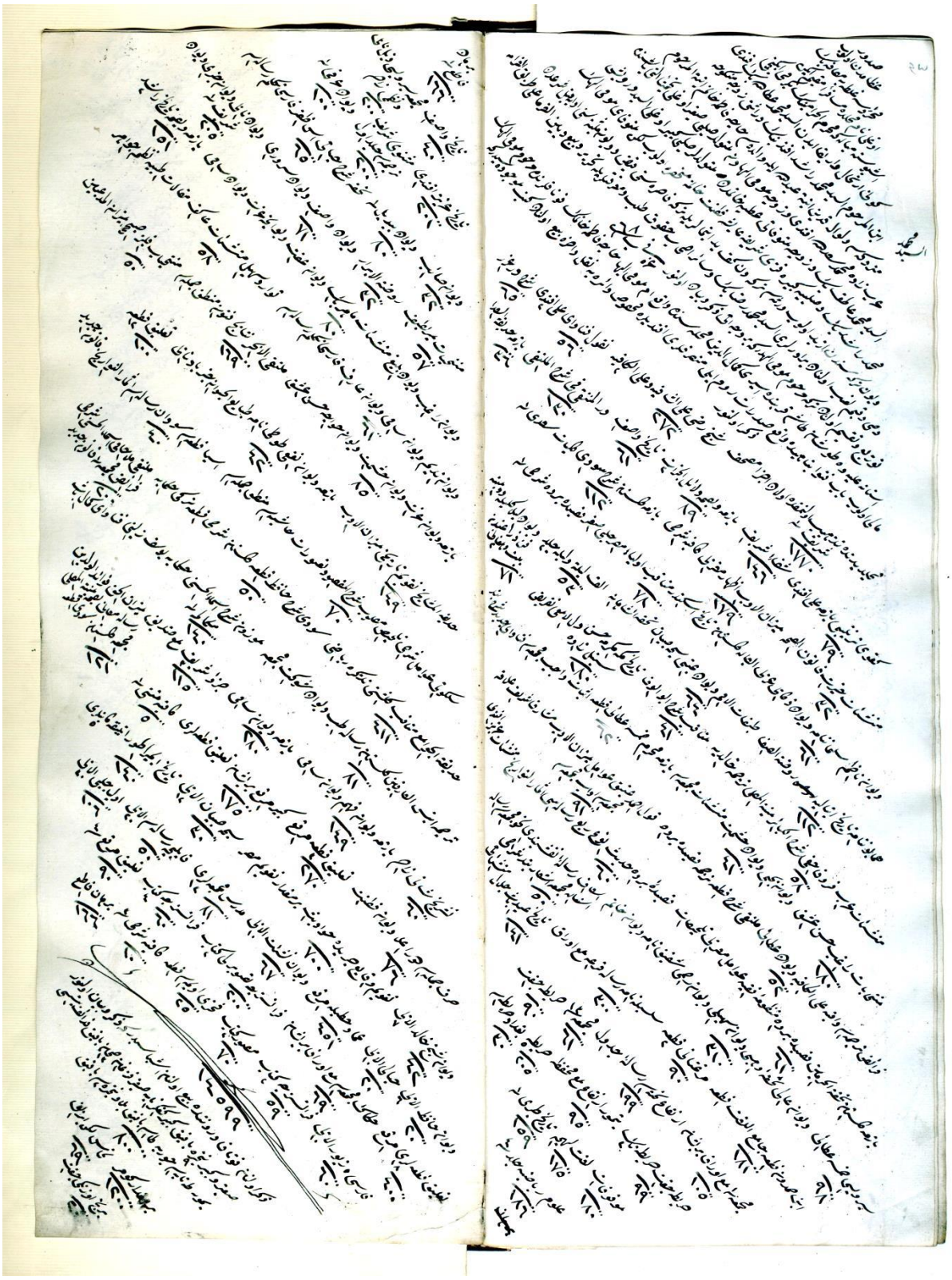
Terekenin tespiti, yazımı ve taksimi belli aşamalardan oluşmaktadır. Mahkeme tarafından görevlendirilen ve mirasın yazımından sorumlu olan kassâm, vefat eden kişinin mal varlığını tespit etmek üzere ölümün gerçekleştiği yere giderdi. Tereke yazımı üç bölüm hâlinde düzenlenmekteydi: Birinci bölümde, kişinin kimlik ve ikamet bilgileri kaydedilirdi. Buna göre şahsın ikamet ettiği veya misafir olarak bulunduğu şehir, mahalle, sokak ve hane bilgileri yazılır, kişinin ölüm şekli biliniyorsa bu da belgeye ilave edilirdi. Ayrıca ölen kişinin kimliği, unvanı, mensup olduğu zümre, mesleği, vefat tarihi ve tespit edilen mirasçıları da bu kısımda

belirtilirdi. İkinci bölüm, kişinin mal varlığının ayrıntılı şekilde kaydedildiği kısımdır (Kaplan, 2025, s. 106-110). Malların cinsi, sayısı ve değerleri tek tek yazılırdı. Üçüncü bölümde ise teçhiz, tekfin, ıskat, it‘âm-ı fukarâ, resm-i kısmet ve benzeri işlemler için yapılan masraflar ile nafaka ve mehir gibi borçlar ve varsa alacaklar kaydedilirdi (Özcan, 2005, s. 406-407; Türkal, 2019, s. 283-295). Son bölümde ise mirastan pay sahibi olan eş, kız ve erkek çocuklar, anne, baba, kardeşler ve diğer akrabalar akrabalık dereceleriyle birlikte kaydedilirdi. İslâm hukukuna göre kız ve erkek çocuklar ile kardeşlerin, üvey çocukların mirastan farklı oranlarda pay almaları sebebiyle bu hususlar defterlerde açıkça belirtilirdi. Hatta anne karnındaki çocuğun payı dahi ayrıca kaydedilir ve metin kısmında bu durum özellikle ifade edilirdi (Çakır, 2012, s. 41-60).

Miras paylaşımı konusunda yalnızca Müslümanlar değil, gayrimüslimler de şeriyye mahkemelerine başvurmuşlardır. Bu sebeple tereke defterlerinde her iki gruba ait kayıtlara rastlanmaktadır. Ayrıca devlet kademelerinde görev yapan veya mahkemeye intikal eden veraset davalarına konu olan seyyidlerin terekeleri kassâm tarafından yazılarak şeriyye sicillerine kaydedilmiştir (Kaplan, 2025, s. 110). Bunun dışında kalan seyyidlerin mirasları sicillere yansımadığından, bütün seyyidlerin mirasları hakkında tam bir bilgiye ulaşmak ve kapsamlı yorumlar yapmak pek mümkün değildir (Yıldız, 2023, s. 370-386).

Rumeli Kazaskeri Seyyid Mehmet Ataullah Beyefendi'nin Terekesi

Hz. Peygamber'in neslinden Rumeli Kazaskeri Seyyid Mehmet Ataullah Beyefendi'nin Terekesinin Şeriyye Sicillerindeki Kaydı (Şeriyye Sicilleri Arşivi, Kısmet-i Askeriye Mahkemesi, No. 1664, 34-38.)



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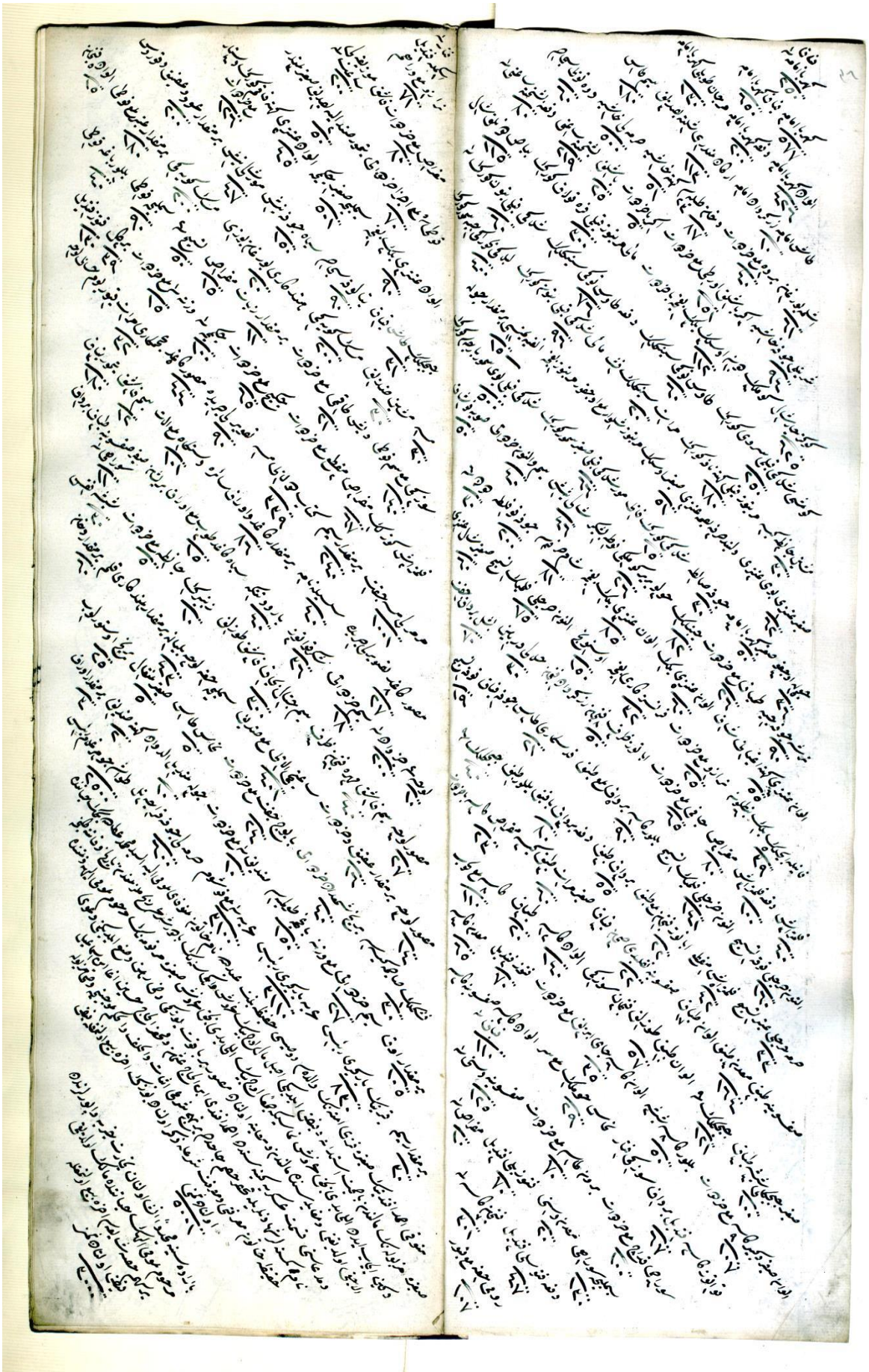


Rumeli Kazaskeri Seyyid Mehmet Ataullah Beyefendi'nin Terekesinin Transkripsiyonu

[Özet:] Galata'da borçlu olarak vefat eden Rumeli Kazaskeri Seyyid Mehmet Ataullah Beyefendi b. Seyyid Mehmet Raşit Efendi'nin varisleri olan zevcesi Dilvale Kadın bt. Abdullah ile validesi Hacı Fatma Hanım bt. Arapzade Mehmet Sadullah Efendi ve çocukları Seyyid Mehmet Atıf Bey, Seyyid Derviş Mehmet Raşit, Şerife Ayşe Fıtnat'ın murislerinin borçlarından dolayı terekeden keff-i yed etmeleriyle satılıp, bedeli borçlularına taksim edilen terekesi.

Sudûr-ı izâmdan olup mahrûse-i Galata'ya muzâfe Beyoğlu nâm mahalde misâfiren mukīm iken işbu sene-i mübâreke Muharremü'l-harâm'ının yirmi ikinci günü irtihâl-i dâr-ı bekā eden es-Seyyid Mehmed Ataullah Beyefendi b. el-merhûm es-Seyyid Mehmed Raşid Efendi'nin verâseti zevce-i menkûha-i metrûkesi Dilvale kadın bt. Abdullah ile vâlidesi Hâce Fatma Hanım bt. el-merhûm Arabzâde Mehmed Sadullah Efendi ve zevce-i mûmâileyhâdan mütevellid sulbî sagīr oğlu tahmînen altı yaşında es-Seyyid Mehmed Atıf Bey ve zevce-i müteveffâtı Atiyye Hanım'dan mütevellidler sulbî kebîr oğlu es-Seyyid Derviş Mehmed Raşid Bey ve sulbiye kebîre kızı Şerife Ayşe Fıtnat Hanım'a münhasıra olup lâkin müteveffâ-yı mûmâileyhin düyûnu terekesinden ezyed olup veresesi terekeden keff-i yed etmeleriyle tereke-i kāsırasını kabz ve düyûn-ı müsbetesini edâya kıbel-i şer'den vasî ve kayyım nasb olunan biraderleri es-Seyyid Mehmed Rıza Bey ve sâir ashâb-ı hukûk taleb ve ma'rifetleriyle tahrîr ve bey' ve beyne'l-guremâ alâ-tariki'l-garâme tevzî' ve taksîm olunan tereke-i merhûm-ı mûmâileyhdir ki ber-vech-i âtî zikr u beyân olunur.

Fî Gurre-i B. sene [1]268/[21 Nisan 1852].

Asitâne-i aliyye'de Tavşantaşı kurbünde Esirî Kemaleddin mahallesinde vâki' ümm-i mûmâileyhâ Hâce Fatıma Hanım'ın konaklarında merhûm-ı mûmâileyhin malı olup Bâb-ı Fetvâpenâhî'de vâki' Sadâret-i Rumeli mutasarrıfları efendilere mahsûs dâireye nakl ve âhara bey' olunan kütüb-i mevcûdesidir ki zikr olunur.

Mücellid yedinde tezhîb olunmakta olan eczâ-yı Mushaf-ı şerîf 1770 guruş	Şeyh Razî ale'ş-Şâfiye ve ale'l-Kâfiye 2 272 guruş	Nukūl-ı Fetâvâ-yı Ali Efendi 2 aded 56 guruş	Şerh-i der-Gurer 1 aded 65 guruş	Kefevî tertîbi yazma Ali Efendi 1 aded 79 guruş
Şifâ-i Şerîf 1 aded 146 guruş	Yazma ve basma Delâilü'l-Hayrât 2 aded 89 guruş	Târîh-i Vâsıf 1 aded 61 guruş	Dürrü'l-Müntekā fî Şerhi'l-Mültekā 1 aded 130 guruş	Yazma Hadîkatü's-Süedâ 1 aded 36 guruş
Münşeât-ı Hayret 1 aded, Kānûnu's-Sıhha 1 aded 32 guruş	Mîzânü'l-edeb 1 aded, İzhâr Muğrebî 1 aded, Kâfiye Şerhi 1 aded 179 guruş	Yazma Gülistân Şerh-i Sûdî 1 aded, Külliyât-ı Sa'dî 1 aded 112 guruş	Dîvân-ı Nâzım 1 aded, Süleymannâme 1 aded, Dîvân-ı Zekâî 1 aded, Arabiyyü'l-ibâre Gülistân 1 aded 61 guruş	Târîh-i İskender 1 aded, Menâkıb-ı Evliyâ Hızır Çelebi 1 aded sagīr, Kasîde-i Bürde Şerhi 1 aded 78 guruş

Hümâyûnnâme 1 aded, Târîh-i İtalya 1 aded, Ravzatü's-safâ 1 aded 112 guruş	Tabakâtü'l-ümem 1 aded, Dîvân-ı Aynî 1 aded, Sebha-i Sıbyân 1 aded, Tuhfetü'ş-şâhâne 1 aded 64 guruş	Elf-i Leyleti Delîle 20 cild 53 guruş	Dîvân-ı Leyla, Kelîle ve Dimne 1 aded, Fenn-i Zirâ'at'den Beyt ve Hâkânî 71 guruş	Münşeât-ı Arab 1 aded, Furûk-ı Hakkî 1 aded, Şerhu'l-kebâir 1 aded, Münyetü'l-Musallî 1 aded, Tercüme-i Hâlidiye 1 aded 58 guruş
Menâkıb-ı Şerh-i Ebu'l-Vefâ 1 aded 41 guruş	Târîh-i Mekke-i Mükerreme 1 aded, Hüsn ü Dil Lâmi'î 1 aded, Takrîz-i Sünbülzâde 1 aded 180 guruş	Müntehabât-ı Râgıb 1 aded, Hüsn-i Aşk 1 aded 180 guruş	Dîvân-ı Yahya 1 aded, Dîvân-ı Haşmet 1 aded, Münşeât Mecmu'ası 1 aded 41 guruş	Yazma Muharrem 1 aded, Hamse Atâî 1 kıt'a, İsbât-ı Vâcib Mecmu'ası 1 aded, Fetâvâ-yı Cedîd Şerh-i Bend 1 aded 62 guruş
Ferâiz Tercümesi 1 aded, Vâfiye ale'l-Kâfiye 1 aded, Dîvân-ı Atâî 1 aded, Mültekâ şerhi 1 kıt'a, Tercüme-i Kasîde-i Bürde 1 aded 52 guruş	Kul Ahmed 1 aded, Atîk Avâmil 1 aded, Mîzânü'l-edeb 1 aded, Meşârik-i Şerîf 1 aded, Alâka Mecmu'ası 1 aded, Âdâb Mecmu'ası 1 aded 91 guruş	Yazma Gülistân 1 aded, Tuhfetü'l-Haremeyn 1 aded, Kasîde-i Bürde 1 aded, Manzûme-i Fıkıh 1 aded, Avâmil-i Mu'rebî 1 aded, Telhîsât 1 aded 61 guruş	Kasîde-i Bürde 1 aded, Hadîs-i Nev', 1 aded, Rub' Risâlesi 1 aded, Esmârü't-Tevârîh 1 aded, Münşeât-ı Azîz Efendi 1 aded 60 guruş	Siyer-i Veysî 1 aded, Hamse-i Atâî 1 aded, Dîvân-ı Âlî 1 aded, Tuhfe-i Vehbî 1 aded 98 guruş
Dîvân-ı Süheylî 1 aded, Dîvân-ı Rahmi 1 aded, Şefîknâme 1 aded, Dîvân-ı Hâtem 1 aded 310 guruş	İs'âf 1 aded, Risâle-i Nakşibendî 1 aded, Nahiv Mecmu'ası 1 aded, Risâle 1 aded, İsti'âre 1 aded, Mecmû'a-i eş'âr 1 aded, Bend-i Şerâhî 1 aded 50 guruş	İbni Hamdûn 1 kıt'a, Câmi'u'l-lügat 1 kıt'a 181 guruş	Murgtânî 2 kıt'a 90 guruş	Silsilenâme 1 aded, Riâle-i Kur'a 1 aded ma'a-evrâk 300 guruş

Târîh-i Abdi Paşa 1, Celâl Münşeâtı 1 aded 141 guruş	Mecmû‘a 1 aded ma‘a-evrâk-ı perîşân 105 guruş	İrtifâ‘ tahtası 1 aded, Risâle-i Cedvel 1 aded 199 guruş	Mecmû‘a 13 aded 61 guruş	Harîta 1 çift 90 guruş
Harîta 1 çift, Harîta 3 tek 99 guruş	Demir irtifâ‘ 1 aded ma‘a-mahfaza 95 guruş	Harîta 5 aded 205 guruş	Bağdad harîtası 1 aded 30 guruş	Mevkūfât 1 aded 180 guruş
Lügat-i Lehçe 1 aded 175 guruş	Târîh-i Taberî 1 aded 159 guruş	Ulûm-ı Riyâziye 4 cild 186 guruş	Burhân-ı Kâtı‘ 1 aded 166 guruş	Târîh-i Vâsıf 1 aded 40 guruş
Mecmu‘a-i Siyer-i Veysî Zeyl-i Nâbî ve Nazmîzâde 200 guruş	Târîh-i Aziz Efendi 1 aded 201 guruş	Mesnevî-i Şerîf tercümesi cild-i evvel 1 aded 200 guruş	Dîvân-ı Örfî 1 aded 100 guruş	Dîvân-ı Sâib 1 aded 32 guruş
Dîvân-ı Bîdil 1 aded 80 guruş	Tuhfe Şerh-i Hayâtî 1 aded, Üss-i Zafer 1 aded, Fârisî Tekellüm Risâlesi 1 aded 65 guruş	Müntehabât-ı Mîr Latif 1 aded 57 guruş	Ravzatü’l-ebrâr 1 aded 32 guruş	Divân-ı Vâsıf 1 aded, Dîvân-ı Sürûrî 1 aded 71 guruş
Dîvân-ı Nâbî 1 aded, Dîvân-ı Hayri 1 aded, Dîvân-ı Şerîf 1 aded 205 guruş	Dîvân-ı Râgıb 1 aded, Dîvân-ı Belîğ 1 aded, Münşeât-ı Mâhir Bey 1 aded, Dîvân-ı İffet 1 aded, Dîvânçe-i İzzet 1 aded, Dîvân-ı Sâmî 1 aded 80 guruş	Yazma ve basma Târîh-i Râşid 2 aded 151 guruş	Dîvân-ı Nedim 1 aded, Dîvân-ı Sâmî 1 aded, Dîvân-ı Ârif 1 aded, Fârisî Tekellüm Risâlesi 1 aded 61 guruş	Sevâr ve Süheyl 1 aded, Münşeât-ı Âkif 1 aded, Makālât-ı Tıbbiye 1 aded, Nazm-ı Cevâhir 1 aded 58 guruş
Yazma Dîvân-ı İzzet 1 aded, Dîvân-ı Haşmet 1 aded, Dîvân-ı	Mültekâ’l-Ebhur 1 aded, Netâyic-i Fünûn 1 aded, Mantık	Müntehâbât-ı Kalenber 1 aded, Subhi 1 aded, Mîzânü’l-Müdde‘îyeyn	Hadîkatü'l-Meşâyih, Takvîm Târîhi 1 aded; Mîzânü’l-edeb 1 aded 149 guruş	Yazma Dîvân-ı Nef‘î 1 aded, Tûtînâme 1 aded, Tabâyi‘u’l-hayvân 1 aded, Hayrâbâd-ı Nâbî 1 aded

Hoca Hasan Aşkî 1 aded 85 guruş	Cümlesi 1 aded 169 guruş	50 guruş		42 guruş
Ta‘lîk 12 kıt‘a 100 guruş	Siyelkûtî 1 aded, Avâmil Şerhi 1 aded, Telhîs 1 aded, Matlûb Şerhü’l-maksûd 1 aded, Tasavvurât Hâşiyesi 1 aded, Mantık Cümlesi 1 aded 70 guruş	Asya Kıt‘ası 1 aded, Sûdan Risâlesi 1 aded, Esmârü’t-tevârîh 1 aded, Kānûn-ı Cedîd 1 aded 40 guruş	Hadîkatü'l-Cevâmi‘ 1 aded, Menâkıb-ı Gülşenî 1 aded, Tezkire-i Riyâzî 1 aded 411 guruş	Sûdî Şerh-i Hâfız 1 kıt‘a, Gülistân Şerhi 1 kıt‘a, Türkî Hikâye 1 aded 50 guruş
Mültekâ 1 aded, Molla Câmî 1 aded, Esmâü'l-hüsnâ şerhi 1 aded, Ferâiz Mecmu‘ası 1 aded, Kānûn-ı Cedîd 200 guruş	Tercüme-i Enîsü'l-ârifîn 1 aded, Gülistân 1 aded, Risâle-i Tıb 1 aded, Dîvân-ı Şevket 1 aded, Mecmû‘a 1 aded 81 guruş	Mevzûn Şerh-i Esmâü'l-hüsnâ 1 aded, Hikâye-i Yusuf-Züleyha 1 aded, Fetâva-yı Kemal Paşa 1 aded, Mükâleme 1 aded 140 guruş	Teşrîh-i Şânîzâde 1 aded 60 guruş	Yazma Dîvân-ı Fehim 1 aded, Dîvân-ı Sâmî 1 aded 149 guruş
Yazma Dîvân-ı Sâmî 280 guruş	Cüz-i şerîf 30 aded ma‘a-sandık 115 guruş	Mîzânü’l-hak 1 aded, Fevâidü’l-Veledeyn 1 aded, Risâle-i Ma‘ânî 1 aded, Basma Münyetü'l-Musallî 1 aded, Mecmû‘a 1 aded, Gülistân 1 aded, Sûdî 1 kıt‘a 121 guruş	Sarf Cümlesi 1 aded, Devr-i A‘lâ 1 aded, Dîvân-ı Fıtnat 1 aded 76 guruş	Ta‘lîk 2 kıt‘a, Murakka‘ 1 aded 270 guruş

Kebîr Murakka‘ 1 aded, perîşân ta‘lîk kıt‘aları 175 guruş	Kâfiye Metni 1 aded 5 guruş	Dîvân-ı Şeyh Hâlid alayı 7 aded 42 guruş	Takvîm-i Vekâyi‘ 1 aded, Cerîde-i Havâdîs 1 aded, bir mikdâr Takvîm-i Mısır 700 guruş	Subha-i Sıbyân alayı 12 aded 30 guruş
Târîh-i İmparator-ı Atîka Kâtibleri 5 aded 140 guruş	Dîvân-ı Hâfız alayı 6 aded 20 guruş	Hayâlî alayı 10 aded 20 guruş	İmâd hattıyla murakka‘ 1 aded 451 guruş	Dîvân-ı Neşet alayı 10 aded 67 guruş
Müderris mecmu‘aları 12 aded 81 guruş	Kaplıca Risâlesi alayı 20 aded 50 guruş	Evliyâ Çelebi alayı 20 aded 106 guruş	Ta‘lîk kıt‘aları 18 aded, Murakka‘ 1 aded 400 guruş	Hakkâk Mecmu‘ası 1 aded ma‘a-evrâk-ı perîşân 69 guruş
Fransızca Tasvîrli Kitâb 2 aded 200 guruş	Fransızca Kitâb 4 aded 60 guruş	Ta‘lîk Murakka‘ 4 aded 90 guruş	Fârisî Zîver alayı 10 aded 60 guruş	Fransızca kitâb 2 aded 59 guruş
Musavver kitâb 2 aded 70 guruş	Fahri Oyması 1 kıt‘a 25 guruş	Kâfiye Şerhi 3 aded 10 guruş	Burhân-ı Kâtı‘ 1 aded 166 guruş	
Yekûn: 14.599 guruş				

Zikr olunan konak derûnunda bey‘ olunan eşyâsıdır ki zikr u beyân olunur.

Sagīr ve kebîr tencere 9 aded bâ-kapak, kebîr kefkir 1 aded, tâbe 1 aded, sagīr kazan 1 aded, sahan 13 aded bâ-kapak, kadayıf tepsisi 1 aded, yumurta tâbesi 1 aded, çorba tası 1 aded bâ-kapak, pilav tenceresi 2 aded bâ-kapak 800 guruş	Bir mikdâr kömür 1200 guruş	Nuhâs leğen ibrik 1 aded 69 guruş	Pirinç üzengi 1 çift 20 guruş	Balta 1 aded, satır 1 aded, bâ-hurdevât 60 guruş

Müsta‘mel şamdan maa hırdavât 5 adet 21 guruş Kebîr şam‘dân 1 çift 80 guruş	Şam‘dân 2 aded bâ-hurdevât 130 guruş	Kontuz 1 aded ma‘a-hurdevât 7,5 guruş	Arûsek rahle 1 aded 50 guruş	Kapı perdesi 1 aded ma‘a-hurdevât 18 guruş
Köhne nuhâs mangal 1 aded, leğen 2 aded, ibrik 3 aded, def‘a mangal 1 aded 176 guruş	Seferî tas 1 aded 60 guruş	Elvân çubuk 12 aded 65 guruş	Vasat çamaşır leğeni 1 aded 126 guruş	Köhne pirinç sagīr sini 1 aded, sagīr nuhâs sini 2 aded, leğen 1 aded ma‘a-hurdevât 100 guruş
Def‘a çamaşır leğeni 1 aded 126 guruş	Nuhâs mangal 1 aded 70 guruş	Def‘a nuhâs mangal 1 aded 51 guruş	Nuhâs çay ibrik 1 aded 17 guruş	Üstunç 1 aded 150 guruş
Vasat pirinç sini 1 aded 210 guruş	Sagīr sini 1 aded, kadayıf tepsisi 2 aded, mangal kapağı 1 aded 115 guruş	Kebîr nuhâs mangal 1 aded ma‘a-zarf 200 guruş	Sarı teneke, leğen ibrik 1 aded 90 guruş	Nuhâs leğen ibrik 2 aded, sarı leğen 1 aded 140 guruş
Sarı leğen ibrik 1 aded 50 guruş	Bosnakârî fener 1 aded 63 guruş	Sarı leğen ibrik 1 aded 90 guruş	Sadefli sagīr iskemle 1 aded 31 guruş	Efrencî cüzdan 1 aded 42 guruş
El leğeni 1 aded 50 guruş	Sersez mirât 1 aded 11,5 guruş	Sineklik 4 aded, yelpaze 1 aded 15 guruş	Sırmalı yelpaze 1 aded 10 guruş	Eczâlı piştov 1 çift 120 guruş
Nakşî sikkesi 1 aded, fes 1 aded 31 guruş	Tatlı kaşığı 21 aded 46 guruş	Siyah canfes şemsiye 1 aded 33 guruş	Terazi 1 aded ma‘a-derâhim, çizme 1 aded, cüzdân kahve tası 1 aded 80 guruş	Şal mengenesi 10 guruş
Pirinç mangal 1 aded, bâ-tahta 510 guruş	Filinta tüfek 1 aded 520 guruş	Çifte filinta tüfek 300 guruş	Şeyhâne tüfek 1 aded 160 guruş	Satranç tahtası 1 aded 50 guruş

Sîmlice tabanca ma‘a-kubûr 1 çift 510 guruş	Kemankeş takımı 1 aded 1250 guruş	Bir mikdâr evânî-i nuhâsiye 370 guruş	Seferî sagīr tas 1 aded 25 guruş	Siroz heybe 1 aded 60 guruş
Çekmece 1 aded 51 guruş	Pirinç mangal 1 aded ma‘a-tahta 511 guruş	Tas 3 aded, kutu 1 aded 150 guruş	Penbe şilte 2 aded, erkân 1 aded, yün memlû yasdık 3 aded, bir mikdâr penbe 410 guruş	Deri sandık 1 aded 10 guruş
Mitil yorgan 3 aded 75 guruş	Tennûr yorganı 1 aded, kapı perdesi 1 aded, yasdık 2 aded ma‘a-çarşeb ve hurdevât 62 guruş	Elvân yorgan 4 aded ma‘a-çarşeb, cibinlik 1 aded, baş yasdık 1 aded 156 guruş	Çuka sofra 1 aded, erzak 1 aded, fanila 1 parça 70 guruş	Mercanlı ustura 3 aded, mikrâs 1 aded, cüzdan 1 aded, fûta 1 aded, havlu 1 aded 100 guruş
Hindkârî hasır seccâde 1 aded 30 guruş	Kudüskârî seccâde 1 aded 51 guruş	Beyaz makrama 11 aded, peşkir 1 aded 32 guruş	Frenkkârî sofra 1 aded, peşkir 1 aded 190 guruş	Beyaz battaniye 1 aded 75 guruş
Meşin çanta 1 aded, tombak tas 1 aded 50 guruş	Hurç 1 çift 175 guruş	Leylâkî çuka salta 1 aded, şalvar 1 aded 110 guruş	Mertabani çuka şalvar 1 aded 75 guruş	Kuru krinkilî çuka biniş 1 aded 150 guruş
Tuti kuşu 1 re’s ma‘a-kafes 159 guruş	Mizan-ı hava 1 aded 20 guruş	Patiska haftân 2 aded, şâlî anteri 1 aded, fanila don 1 aded, salta 1 aded 40 guruş	Köhne berber gömleği 1 aded, makrama 1 aded, boğça 1 aded 10 guruş, 10 para	Basma tehî yasdık 14 aded, mak‘ad 1 aded 22 guruş
Boyama tehî yasdık 12 aded, tehî basma şilte yüzü 3 aded 72 guruş	Basma anteri 1 aded, fes 1 aded, yemeni 2 aded, boğça 1 aded 30 guruş	Havlu 2 aded, fûta 1 aded, boğça 1 aded 70 guruş	Sahhare 1 aded 26 guruş	Gömlek 8 aded, don 2 aded, boğça 1 aded 60 guruş
Havlu 9 aded, boğça 1 aded 60 guruş	Köhne semâver 1 aded 20 guruş	Kebîr pirinç sini 1 aded 700 guruş	Havlu 9 aded, boğça 1 aded, sofra 1 aded 40 guruş	Havlu 5 aded, boça 1 aded bâ-hurdevât 15 guruş

Şalâkî kaplı kakum kürk 1 aded 130 guruş	Nuhâs sini 1 aded 315 guruş	Şâlîcebe 1 aded, salta 2 aded 55 guruş	Şâlî şalvar 1 aded, salta 1 aded 21 guruş	Arakiye 2 aded, eldiven 1 çift 15 guruş
Şâlî cebe 1 aded, salta 1 aded 50 guruş	Beyaz çuka cebe 1 aded 50 guruş, 10 para	Köhne şalâkî kürk kabı 1 aded, merinoz kürk kabı 1 aded, boğça 1 aded 10 guruş, 10 para	Demir çenberli sandık 1 aded 51 guruş	Köhne donluk şal 1 aded 306 guruş
Tirşe çubuklu donluk parça şal 1 aded 800 guruş	Som tarak 1 aded, bâ-kîse 20 guruş	Benaluka sof seccâde 1 aded 62 guruş	Destâr 2 aded, boğça 1 aded, beyaz hırka 1 aded 41 guruş	Cibinlik 1 aded, boğça 1 aded, bir mikdâr kaytan 25 guruş
Sîmlice hokka 3 aded, ma‘den tabak tepsi 1 aded 190 guruş	Mangal göbeği 2 aded, sarı kebîr tas 1 aded ma‘a-hurdevât 60 guruş	Mirâtlı masa 1 aded 200 guruş	Sandalye 1 aded 39 guruş	Kırbaç 2 aded, demir arşın 1 aded 21 guruş
Levha 3 aded 47 guruş	Koltuk sandalye 1 aded 60 guruş	Leylâkî şalâkî kaplı bahâriye kürk 1 aded 260 guruş	Sandalye minderi 2 aded 5 guruş	Kebîr mîzân-ı hava 1 aded 80 guruş
Dolab 1 aded ma‘a-hurdevât 40 guruş	Pirinç şam‘dân 1 çift Tabla 2 aded 107 guruş	Şerbet bardağı 21 aded, sagīr tabak 10 aded, polat tepsi 1 aded 54 guruş	Ma‘den kavanoz 3 aded ma‘a-hurdevât 32 guruş	Köhne tabak 2 aded, polat tepsi 1 aded 17,5 guruş
Askı kandil 1 aded, fotuz 1 aded 10 guruş	Meksûr kâse 14 aded, çay ibrik 24,5 guruş	Elmas traş bardak 1 aded bâ-tabak, sâde billûr tabak 6 aded 20 guruş	Eczâ sandık 1 aded ma‘a-şişe 12 aded 30 guruş	Revgan-ı şem‘ 45 kıyye 13 fî 585 guruş
Mısır balkamî tas 3 parça 10 guruş	Köhne minder 1 aded, yasdık 1 aded 21 guruş	Hasır kanape 1 aded 20 guruş	Dolab 1 aded 5 guruş	Anbar 1 aded ma‘a-hurdevât 50 guruş

Meksûr fener 2 aded 3,5 guruş	Tahta sandık 1 aded 40 guruş	Sahhâre 1 aded 5 guruş	Oturak kahve değirmeni 1 aded, kandil 1 aded ma'a-hurdevât 40 guruş	Melise 2 aded 36 guruş	Kandil 3 aded bâ-hurdevât 8 guruş
Anbar 1 aded, köhne tahta sandık 1 aded, tahta ta'âm sofrası 1 aded 21 guruş	Meksûr masa tas 2 aded 25 guruş		Billûr bardak 2 aded bâ-tabak 24 guruş	Tabak 3 aded, Saksonya kâse 1 aded bâ-kabak 80 guruş	Benaluka yasdık 1 aded, yün memlû minder 1 aded 272 guruş
Tahta sandık 1 aded 40 guruş	Frenk mumu 6 deste 42 guruş		Şırınga ma'a-hurdevât 20 guruş	Destere 3 aded, keser 1 aded bâ-hurdevât 54 guruş	Sâ'atçi âlâtı hurdevâtı 20 guruş
Boya takımı 29 guruş	Fotuz-ı kandil 1 çift 70 guruş		Sâ'atçi âlâtı hurdevât 85 guruş	Vezne ma'a-hurdevât 15 guruş	Hindkârî kemik çekmece hurdevâtı 30 guruş
Mirât 2 aded 201 guruş	Sürahi 2 aded, polat 1 aded bâ-hurdevât 40 guruş		Tonya nargile 3 aded 151 guruş	Meksûr tabak 3 aded bâ-hurdevât 8 guruş	Kâse 4 aded, polat 1 aded bâ-hurdevât 31 guruş
Hindkârî tabak 5 aded, kâse 1 aded 130 guruş	Saksonya sahan 1 aded, Hindkârî tabak 1 aded, billûr tabak 1 aded 70 guruş		Billûr kâse 1 aded ma'a-hurdevât 36 guruş	Fotuz 3 aded 41 guruş	Meksûr iskemle 2 aded 12 guruş
Sürahi 4 aded, pirinç tepsi 1 aded bâ-hurdevât 40 guruş	Billûr saksı 2 aded 20 guruş		Kâğıd züfâf 1 aded 40 guruş	Tunç havan 1 aded, taş havan ma'a-el 51 guruş	Frenk şam'dânı 1 çift 80 guruş
Beyaz tabak 23 aded ma'a-sepet 82 guruş	Saksonya şişe tabak 11 aded bâ-kapak 140 guruş		Tombak askı 1 aded, enfiye kutusu 1 aded, tabla 1 aded, hokka 1 aded 80 guruş	Sürahi 1 aded 15 guruş	Sünbülî kebîr şişe 1 aded, bir mikdâr çiçek suyu 17 guruş

Eczâ sandığı ma‘a-şişe 160 guruş	Maî tabak ve sahan 10 aded, kapak 9 aded 43 guruş	Saksonya kâse 2 aded, tabak 1 aded 59 guruş	Tavla tahtası 1 aded 120 guruş	Kavanoz 1 aded, tabak 1 aded, kahve değirmeni 1 aded, polat 1 aded, bâ-hurdevât 26 guruş
Elvân tabak 4 aded, kâse 2 aded, polat 1 aded ma‘a-hurdevât 30 guruş	Şişe tesbih 4 aded 30 guruş	Tesviye derece 1 aded, çifte gözlük 1 aded 31 guruş	Pirinç köhne sâ‘at 1 aded 21 guruş	Boynuz takım 7 aded, şerit askı 1 aded 40 guruş
Kalemtraş 2 aded, kutu 1 aded 20 guruş	Gözlü yüzük 1 aded, ustura 2 aded, sandık 1 aded bâ-hurdevât 55 guruş	Enfiye kutusu 1 aded bâ-hurdevât 10 guruş	Saksonya hokka 1 aded, ma‘den tepsi 1 aded, fincan 2 aded, abanoz zarf 2 aded, dolab 1 aded 52 guruş	Sagīr Tonya nargile 1 aded 40 guruş
Yazıhâne çekmece 1 aded 100 guruş	Ceviz dolab 1 aded ma‘a taş 101 guruş	Cam dolab 1 aded 31 guruş	Duhân boğça 2 aded 130 guruş	Melise 1 aded ma‘a taş 1 aded 190 guruş
Melise 1 aded, çiçeklik 1 aded 100 guruş	Sîm zarf 7 aded, kem‘ayâr sîm zarf 2 aded bâ-fincan, nuhâs pullu pûşîde 1 aded, polat 1 aded 161 guruş	Bez döşek 1 aded 60 guruş	Penbe yüz yasdık 4 aded 31 guruş	Yorgan 3 aded bâ-çarşeb 80 guruş
Sîmlice sagīr çalar sâ‘at 1 aded ma‘a-top 300 guruş	Tehî çatma yasdık 21 aded, mak‘ad 1 aded, bir mikdâr saçak 50 guruş	Sîm tokalı çuka şirak 1 aded ma‘a-şilte 1 aded 550 guruş	Sîmlice som kabzalı bıçak 1 aded 103 guruş	Bir mikdâr penbe 34 guruş
Sîmlice başlık 1 aded 620 guruş	Sîm ser 1 aded, billûr nargile 1 aded bâ-marpiç 150 guruş	Altın basma sâ‘at 1 aded 820 guruş	Benaluka seccâde 1 aded 62 guruş	Sâf seccâde 1 aded 101 guruş
Hilâlî serli nargile 1 aded	Tabak 9 aded, kâse 2 aded	Taş şam‘dân 2 aded	Sîm halkalı çekmece 1 aded	Saksonya bardak 2 aded ma‘a-kapak

ma‘a-tabak ve marpiç 2 aded 58 guruş	17 guruş	10 guruş	100 guruş	69 guruş
Tavla tahtası 1 aded 90 guruş	Halı seccâde 1 aded 40 guruş	Sagīr şerîfe 1 aded 30 guruş	Kayık takımı çuka yasdık 2 aded, şilte 1 aded 120 guruş	Penbe şilte 2 aded 181 guruş
Baş yasdık 3 aded, yüz yasdık 4 aded, pencere perdesi 2 aded 55 guruş	Mirât 1 aded 131 guruş	Penbe şilte 2 aded, yüz yasdık 2 aded 115 guruş	Basma yorgan 4 aded 150 guruş	Yüz yorgan 2 aded bâ-çarşeb 145 guruş
Yorgan 1 aded, yüz yasdık 9 aded 70 guruş	Laciverd toplu kehribâ imâme 2 aded 173 guruş	Kabak kehribâ imâme 1 aded 250 guruş	Kehribâ imâme 2 aded 577 guruş	Kabak kehribâ imâme 1 aded 650 guruş
Elvân kehribâ imâme 2 aded 426 guruş	Def‘a kehribâ imâme 3 aded 200 guruş	Mercan toplu kehribâ imâme 2 aded 130 guruş	Taş imâme 1 aded, zergerdân imâme 1 aded 10 guruş	Erkân minderi 1 aded, şilte yasdık 2 aded 113 guruş
Sîm tas 1 aded 180 guruş	İşleme yorgan 1 aded 61 guruş	Perde 1 aded ma‘a hurdevât 40 guruş	Duhân tablası 23 aded 87 guruş	Köhne hâşiye 1 aded 51 guruş
Sırmalı hâşiye 1 aded 500 guruş	Deve tüyü seccâde 1 aded 60 guruş	Şeritli çuka hâşiye 1 aded 94 guruş	Eyer 2 aded, başlık 1 aded, örtü 1 aded ma‘a hurdevât 151 guruş	Eyer 1 aded bâ-hurdevât 5 guruş
Başlık 1 aded 25 guruş	Peştahta sâ‘ati 1 aded 219 guruş	Def‘a peştahta sâ‘ati 1 aded 80 guruş	Güvez çârşâl 1 aded 625 guruş	Gömlek 4 aded, don 10 aded, üstlük 3 aded, yelek 3 aded, boğça 1 aded bâ-hurdevât 112 guruş
Maî merinoz kaplı karakulak kürk 1 aded 300 guruş	Beyaz donluk şâl 1 aded 115 guruş	Gümüşî şalâkî kaplı servi kürk 1 aded 250 guruş	Tavus tüyü sineklik 1 aded 60 guruş	Def‘a tavus tüyü sineklik 1 aded 76 guruş
Şalâkî kaplı bütün kürk 1 aded	Meşin çanta 2 aded, kîse 1 aded	Merinoz kaplı köhne nâfe kürk 1 aded	Mirât 1 aded, sineklik 1 aded	Maî şalâkî kaplı bütün kürk 1 aded

60 guruş	30 guruş	180 guruş	20 guruş	96 guruş
Leylakî buhurakî cebe 1 aded, samur kürk 400 guruş	Sagīr anteri 1 aded, boy anteri 2 aded 62 guruş	Dülbend hırka 2 aded, basma anteri 2 aded, sagīr üstlük 2 aded, merinoz şalvar 1 aded ma'a-uçkur, merinoz boğça 1 aded 51 guruş	Enfiye yemenisi 11 aded, bir mikdâr çevre 15,5 guruş	Çevre 1 aded, uçkur 4 aded 36 guruş
Sagīr kehribâ imâme 4 aded 50 guruş	Çuka salta 1 aded 30 guruş	Şalâkî kürk kabı 1 aded 15 guruş	Mor şalâkî kaplı sagīr samur kürk 1 aded 66 guruş	Şalâkî kaplı boy samur parçası kürk 500 guruş
Tirşe çuka cebe 1 aded 90 guruş	Tombak ma'a-hurdevât 26 guruş	Cibinlik 1 aded 82 guruş	Havlu 2 aded, berber gömleği 1 aded, fûta 1 aded, peşkir 1 aded 26 guruş	Şâlî biniş 1 aded 46 guruş
Sîm ve altın hurdevâtı 40 guruş	Soba kuşak 1 aded 50 guruş	Elvân anteri 2 aded köhne ağayânî 1 aded, şâkk 1 aded 55 guruş	Elvân anteri 5 aded, yelek 1 aded 60 guruş	Elvân anteri 3 aded, yelek 1 aded, boğça 1 aded 85 guruş
Şam hırkası 81 guruş	Çuka kukuleta 1 aded 200 guruş	Don 6 aded 30 guruş	Fanila içlik 5 aded, yelek 1 aded, pantolon 6 aded 39 guruş	Terazi 1 aded ma'a-hurdevât 25 guruş
Fransızkârî boğça 1 aded 32 guruş	Ustunç 1 aded 150 guruş	Altın hurçlu kalembik tesbih 1 aded 75 guruş	Sagīr şâl anteri 1 aded 60 guruş	Kalemtraş 3 aded 40 guruş
Def'a kelemtraş 3 aded 100 guruş	Mikrâs 2 aded 80 guruş	Çakı ma'a-hurdevât 65 guruş	Abanoz zarf 3 aded, fincan 8 aded, rezgerdân fincan 1 aded 50 guruş	Hilâlî dürbin 1 aded 30 guruş
Yeşil bardak 1 çift 70 guruş	Altın hurçlu kuka tesbih 1 aded	Altın hurçlu kalembik tesbih 1 aded	Billûr kâse 1 aded, bardak 5 aded ma'a tabak	Kudüskârî tas 2 aded, çuka kapak 1 aded

	160 guruş	141 guruş	90 guruş	21 guruş
Kuka tesbih 1 aded 19 guruş	Sırma huçlu anber tesbih 33 guruş	Kalemtraş 5 aded, makta‘ 1 aded 42 guruş	Abanoz fincan 1 aded ma‘a tabak 22 guruş	Bardak 4 aded, tabak 2 aded 55 guruş
Def‘a bardak 3 aded, bâ-kapak, billûr tabak 1 aded 80 guruş	Çiçeklik 9 aded 40 guruş	Saksonya tabak 2 aded, ma‘den tabak 4 aded, elvân tabak 17 aded 164 guruş	Saksonya taklîdi sahan 2 aded, kapak 4 aded 22 guruş	Sagīr mirât 1 aded, tabak 3 aded, kîse 2 aded 60 guruş
Mikrâs 1 aded, kâse 4 aded bâ-hurdevât 23 guruş	Sagīr çiçekli şişe 4 aded, tabak 4 aded 100 guruş	Çiçeklik 9 aded 121 guruş	Elvân tabak 10 aded, tuzluk 1 aded, fincan 2 aded, süzgü 1 aded 57 guruş	Elvân kâse 12 aded 140 guruş
Tabak 2 aded 20 guruş	Kâse 8 aded ma‘a küp 110 guruş	Elvân sagīr ve kebîr kâse 9 aded ma‘a-hurdevât 107 guruş	Billûr kâse 8 aded, şişe 2 aded 50 guruş	Elvân kâse 6 aded, çay ibrik 2 aded ma‘a hurdevât 35 guruş
Fotuz-ı kandil 2 aded 70 guruş	Ma‘den kâse 4 aded 65 guruş	Kavanoz 1 aded, kâse 2 aded, kandil 1 aded, bardak 1 aded, süzgü 1 aded, fener 1 aded 67 guruş	Nuhâs çömlek 1 aded ma‘a ser 29 guruş	Elvân kâse 2 aded, Saksonya kâse 2 aded, kapak 1 aded 110 guruş
Sürahi 6 aded, kadeh 8 aded ma‘a hurdevât 100 guruş	Burun tas 1 aded ma‘a hurdevât 70 guruş	Saksonya desti 1 aded 125 guruş	Sîmlice sürahi 1 aded 130 guruş	Ma‘den desti 1 aded 20 guruş
Fotuzlu kandil 2 aded 70 guruş	Mikrâs 1 aded 10 guruş	Def‘a Fotuzlu kandil 2 aded 47 guruş	Fincan 7 aded, kâse 1 aded 301 guruş	Rûmî hokka 1 aded ma‘a kubûr 107 guruş
Fener 1 aded, iskemle 1 aded, kandil 1 aded, terazi 1 aded ma‘a-derâhim	Mikrâs 1 aded ma‘a hurdevât, kaşık 80 guruş	Muzikalı sâ‘at 1 aded 200 guruş	Kutu 5 aded ma‘a-ezcâ dolabı 70 guruş	Demir sandalye 2 aded, yasdık 1 aded, sagīr minder 3 aded 50 guruş

71 guruş				
Elvân anteri 2 aded, yelek 2 aded, boğça 1 aded 90 guruş	Sîmlice sagīr çekmece 1 aded 501 guruş	Elvân anteri 5 aded 45 guruş	Köhne kakum kürk 1 aded, destâr 4 aded ma‘a hurdevât 126 guruş	Çiçeklik 3 aded, taş kapak 1 aded 31 guruş
Benaluka seccâde 1 aded 90 guruş	Siyah çuka biniş 1 aded 150 guruş	Mor şâlî biniş 1 aded 47 guruş	Bir mikdâr öd ve akîk ve kurs 200 guruş	Masa 1 aded 30 guruş
Meşin sandık 1 aded 30 guruş	Misk göbeği 1 aded 200 guruş	Hindkârî yorgan yüzü 1 aded 20 guruş	Misk göbeği 1 aded 200 guruş	Bir mikdâr anber ma‘a kutu 180 guruş
Elvân fincan 5 aded 15 guruş	Süzgü 2 aded ma‘a sîm kutu 140 guruş	Diş takımı 1 aded ma‘a-hurdevât 21 guruş	Bir mikdâr zebat 11 guruş	Mikrâs 1 aded 15 guruş
Tesbih 2 aded 50 guruş	Sîmlice kutu 1 aded 90 guruş	Billûr baga kutu 1 aded 40 guruş	Kalemtraş 2 aded, gözlük 1 aded, mikrâs 2 aded, makta‘ ma‘a-hurdevât 67 guruş	Çekiç ma‘a-hurdevât 65 guruş
Çekmece 1 aded 100 guruş	Vezne 1 aded ma‘a hurdevât 15 guruş	Pergel 2 aded 39 guruş	Fotuz-ı kandil 1 aded 130 guruş	Mermerli masa 1 çift 1001 guruş
Bir mikdâr sim 240 guruş	Kitâb dolabı 1 aded, masa 1 aded 339 guruş	Tasvîrli cerîde 1 aded 90 guruş	Musavver kâğıd 5 aded 44 guruş	Acemkârî mirât 1 aded, kubûr 1 aded, yevm-i hesâbî levha 1 aded 32 guruş
Musavver kâğıd 8 aded, tasvîrli cerîde 1 aded 27 guruş	Silsilenâme 1 aded 40 guruş	Bir mikdâr kâgıd ve evrâk-ı sâire 86 guruş	Destgâh 1 aded ma‘a âlât 101 guruş	Sîm kaşık 2 aded 12 guruş
Demir yatak 3 aded 180 guruş	Levha 2 aded 10 guruş	Cüzdan 1 aded 200 guruş	Sîm hurdevâtı 18 guruş	Şeker kavanoz 2 aded 36 guruş

Barut 1 teneke 40 guruş	Siyah kâğıd 2 top ma‘a-evrâk-ı perîşân 15 guruş	Sagīr Saksonya tabak 2 aded, bardak 1 aded, sürahi 1 aded 11 guruş	Musavver levha 4 aded 27 guruş	Sîm kaşık 1 aded, mühre 2 aded, fincan 6 aded, zarf 4 aded 40 guruş
Sîm çatal 1 aded, bıçak 1 aded, kaşık 2 aded, tuzluk 1 aded 300 guruş	Zenberek 1 aded 10 guruş	Çanta 1 aded ma‘a hurdevât 5 guruş	Şişe kafes 1 aded 30 guruş	Musavver levha 3 aded 14 guruş
Bir mikdâr akîk ve hurdevât 16 guruş	Sâ‘atçi âlâtı 1 aded ma‘a-sandık 401 guruş	Sîmlice hokka 1 aded, levha 2 aded, yelpaze 1 aded, bir mikdâr Hindkârî kalem 43 guruş	Bir mikdâr duhân 60 guruş	Fişeklik 1 aded, saçma kîsesi 1 aded 30 guruş
Pirinç şam‘dân hurdevâtı 40 guruş	Pabuç çift ma‘a hurdevât 24 guruş	Nuhâs tas 1 aded 5 guruş	Sagīr mangal 1 aded 5 guruş	Pirinç usturlab 1 aded 25 guruş
Bir mikdâr ok 105 guruş	Sîm hurdevâtı 1 aded ma‘a-vezne 27 guruş	Bahçe tulumbası 1 aded 150 guruş	Sandık 1 aded ma‘a hurdevât 10 guruş	Çevre 3 aded, mendil 1 aded, eldiven 1 aded 10 guruş
Köhne sandık 1 aded 2 guruş	Bir mikdâr evrâk 3 guruş	Bir mikdâr sîm 30 guruş	Kır binek bârgîri 1 re’s 830 guruş	Araba bârgîri 1 re’s 3110 guruş
Araba 1 aded ma‘a-koşum 3100 guruş	Sırmalı çuka ferâce 1 aded, tül 2 aded 600 guruş	Tavâşî Cevher gulâm 1 re’s 2500 guruş		

Müteveffâ Ahmed Efendi’nin sagīre kızı Emine’nin vâlidesi ve vasîsi Hafîze bt. Abdullah nâm hâtûn müteveffâ-yı mûmâileyh es-Seyyid Mehmed Ataullah Bey’in hayâtında mezbûrenin mâlından bâ-hüccet istidâne ve kabz eylediği asıl mâl üç bin guruş ve iki senelik bâ-devr-i şer‘î ribh-i mülziminden târîh-i vefâtına gelinceye değin îcâb eden elli yedi buçuk guruş neması ki cem‘an üç bin elli yedi buçuk guruş sagīre-i merkūmenin merhûm-ı mûmâileyh zimmetinde alacağı olduğunu ve mukābelesinde mâlından ve mu‘âyene olunan musavver bir yâkût yüzüğü dahi rehin vaz‘ eylediğini da‘vâ ve müdde‘âsını Kısmet-i

Askeriye ketebesinden Ahmed Efendi b. el-Hâc Osman ve Muhzır el-Hâc Hüseyin Ağa b. İsmail nâm kimesneler şehâdetleriyle mahzar-ı hasm-ı câhidde ber-nehc-i şer‘î isbât ve'l-half ve’l-hükm mûcebince vasî-i mezbûre Hafîze Hâtûn’a ma‘rifeti ve ma‘rifet-i şer‘le zikr olunan yüzük âhara bey‘ olunmağla kabz olunan kıymeti: 5001 guruş
Bâ-irâde-i seniyye müceddeden inşâ olunan Ticâret-i Hayriye vapurlarından merhûm-ı mûmâileyhin hayâtında mâlik olduğu bir sehim hisse-i şâyi‘ası âhara bey‘ olunmağla kabz olunan kıymeti: 3000 guruş
Kara Mehmed Paşazâde Mahmud Bey’in sagīre kızları Fatımatüzzehra ve Ubeyde Samia ve Nafia hanımlar vasîleri İbrahim Paşa b. Süleyman nâm kimesne merhûm-ı mûmâileyh es-Seyyid Mehmed Ataullah Bey hayâtında sagīrât-ı merkūmâtın mâllarından bâ-hüccet istidâne ve kabz ve umûruna sarfla istihlâk eylediği asıl mâl sekiz bin guruş ve üç senelik bâ-devr-i şer‘î ribh-i mülziminden târîh-i vefâtına gelinceye değin müddet-i ma‘lûmede îcâb eden iki bin üç yüz otuz altı buçuk guruş nemâsı ki cem‘an on bin üç yüz otuz altı buçuk guruş sagīrât-ı merkūmâtın merhûm-ı mûmâileyh zimmetinde alacak hakkı olduğunu ve mukābelesinde mu‘âyene olunan bir gök yâkût yüzük ve bir elmaslıca zümrüt askıyı rehin vaz‘ eylediğini da‘vâ ve müdde‘âsını teba‘adan Mehmed Ağa b. Hüseyin ve Kısmet-i Askeriye ketebesinden es-Seyyid Mehmed Galib Efendi b. es-Seyyid Mehmed Kâmil nâm kimesneler şehâdetleriyle mahzar-ı hasm-ı câhidde ber-nehc-i şer‘î ba‘de’l-isbât ve’l-hükm merhûm-ı mûmâileyhin sulbî kebîr oğlu mûmâileyh es-Seyyid Derviş Mehmed Raşid Bey rehân-ı mezkûrdan ancak elmaslıca zümrüt askı kendi mâlı ve mülkü olup adem-i icâzetiyle rehin olduğunu mürtehin vasî-i mezbûrdan kezâlik da‘vâ ve müdde‘âsını Kapıçukadârı el-Hâc Şerif Mehmed Ağa b. es-Seyyid Hasan ve el-Hâc Ahmed Ağa b. Hüseyin nâm kimesneler şehâdetleriyle vech-i vecîh-i şer‘î üzere ba‘de’l-isbât ve'l-half ve’l-hükm mûcebince yalnız zikr olunan gök yâkût yüzük vasî-i mezbûr İbrahim Bey ma‘rifeti ve ma‘rifet-i şer‘le âhara bey‘ olunmağla kabz olunan kıymeti: 1525 guruş
Bâ-irâde-i seniyye merhûm-ı mûmâileyhin arpalık ma‘âşından düyûnuna medâr olmak [üzere] ihsân-ı şâhâne buyurulan on ay müddette şehriye yedişer bin guruşdan cem‘an yetmiş bin guruş mahallinden ahz olunmak îcâb etmiş ise de ancak hayâtında ma‘âş-ı mezkûra mahsûben tedâhül tarîkiyle me’mûru tarafından bâ-sened ahz u kabz eylediği yedi bin guruş ile i‘âne-i umûmiyye ve takvîm bahâ ve sarrâfiye fürû-nihâde olundukda bâkīsi olup cânib-i Fetvâ-penâhî’den vârid olan ilmühaber mantûkunca ma‘âş-ı mezkûr me’mûru sarrâf tâifesinden Höce Artin Bâzergân’dan kabz olunan: 54.217,5 guruş

Çekmecesinde zuhûr eden nakd-i mevcûdu 1368,5 guruş	Merhûm-ı mûmâileyhin kethüdâları Eşref Efendi zimmetinde alacağı olup kabz olunan 2000 guruş	Elvân havlu 9 aded, çarşeb 1 aded, beyaz yüz yasdık 2 aded, boğça 1 aded, silecek 1 aded, peştamal 1 aded 151 guruş
Yekûn: 120.955 guruş.		

Cem‘an yekûn: 135.594 guruş.

Minhe’l-ihrâcât:

Techîz ve tekfîn 750 guruş	Bâlâda beyân olunduğu üzere dâyine-i sagīre mezbûre Emine’nin vâlidesi ve vasîsi mezbûre Hafize Hâtûn’un bi’l-vesâye isbât eylediği üç bin elli yedi buçuk guruş mukābelesinde rehin olan yâkût	Yine bâlâda beyân olunduğu üzere sagīrât-ı merkūmât Fatımatüzzehra ve Ubeyde Samia ve Nafia’nın vasîleri İbrahim Bey’in bi’l-vesâye isbât

	yüzük-i mezkûr semen-i misli olan beş bin bir guruşa âhara bey‘ ve semen-i makbûzundan deyn-i mezkûr için vasî-i mezbûre Hafîze Hâtûn’a verilen 3057,5 guruş	eylediği on bin üç yüz altmış altı buçuk guruş mukābelesinde rehin olan gök yâkût yüzük-i mezkûr semen-i misli olan bin beş yüz yirmi beş guruşa âhara bey‘ olunmakla vasî-i merkūmun alacağına mahsûben verilen semen-i yüzük-i mezkûr 1525 guruş
Zikr olunan eczâ-i Mushaf-ı şerîf’in ikmâl-i tezhîbine kadar masrûf mücellide verilen ücret 212,5 guruş	İhtisâbiye bârgîr ve nafaka ve kütüb-i mezkûrenin nakli için verilen ücret-i masârıf ve sâire 232,5 guruş	Dellâliye-i eşyâ ve kütüb ve mücevherât 1415 guruş
Yekûnü’l-ihrâcât: 7.192,5 guruş		

Sahhu’l-bâkī li’t-taksîmi alâ tarîki’l-garâme: 128.401,5 guruş.

Sagīrât-ı merkūmât Fatımatüzzehra ve Ubeyde Samia ve Nafia’nın deyn-i müsbet-i mezkûrlarına rehin-i mezkûrun semen-i mezkûru vefâ etmemekle bâkīsiyle sâir guremâya iştirâki muktezâ-yı şer‘îsi olmağla Mütebâkī meblağ: 8.811,5 guruş. Mine’l-guremâ: 2.959,5 guruş, 37 akçe.	Bâ-hüccet def‘a deyn-i müsbet vasî-i mûmâileyh İbrahim Bey an mâlı sagīrât-ı merkūmât Ubeyde ve Samia ve Nafia benât-ı el-müteveffâ Mahmud Bey bâ-şehâdet-i teba‘adan Mehmed Ağa b. Hüseyin ve Kethüdâ Mehmed Şeref Efendi b. Mehmed ve bâ-tahlîf Meblağ: 6000 guruş. Mine’l-guremâ: 2015 guruş, 50 akçe.
Deyn-i müsbet Mehmed Haydar Efendi an ciheti karz bâ-şehâdet-i kethüdâ-yı mezbûr Mehmed Şeref Efendi ve sâbık Vekîlharc Mustafa Ağa b. Ali ve bâ-tahlîf Meblağ: 3.500 guruş. Mine’l-guremâ: 1.175,5 guruş, 19 akçe.	Deyn-i müsbet Kömürcü Halil Efendi an semen-i mebî‘ bâ-şehâdet-i Vekîlharc Mehmed Ağa b. Ebûbekir ve kethüdâ-yı mezbûr Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 3.290 guruş. Mine’l-guremâ: 1.105 guruş, 14 akçe.
Deyn-i müsbet Samancı es-Seyyid Mustafa Ağa an semeni mebî‘a bâ-şehâdet-i merkūmân Vekîlharç Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 344 guruş. Mine’l-guremâ: 115,5 guruş, 6 akçe.	Deyn-i müsbet Üsküdar’da Sebzeci Murad Ağa an semeni mebî‘ bâ-şehâdet-i merkūmân Vekîlharç Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 752 guruş. Mine’l-guremâ: 252,5 guruş, 11 akçe.

Bâ-tahvîl deyn-i müsbet Kapıkethüdâsı Ali Efendi an ciheti karz bâ-şehâdet-i merkūmân Vekîlharç Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 10.150 guruş. Mine'l-guremâ: 2.409 guruş, 49 akçe.	Deyn-i müsbet kethüdâ-yı mezbûr Mehmed Şeref Efendi an ciheti deyn-i şer'î bâ-şehâdet-i vekîlharc-ı mezbûr Mehmed Ağa ve teba'adan Uzun Mehmed Ağa b. Abdülkadir ve bâ-tahlîf Meblağ: 3.500 guruş. Mine'l-guremâ: 1.175,5 guruş, 19 akçe.
Deyn-i müsbet vekîlharc-ı mezbûr Mehmed Ağa an ciheti deyn-i şer'î bâ-şehâdet-i teba'adan Osman Ağa b. İsmail ve kethüdâ-yı mezbûr Mehmed Şeref Efendi bâ-tahlîf Meblağ: 1.730 guruş. Mine'l-guremâ: 581,5 guruş, 13 akçe.	Deyn-i müsbet Yorganî Mahmud Efendi an semeni mebî' bâ-şehâdet-i Yorganî Ahmed Efendi b. Hacı Ahmed ve kethüdâ-yı mezbûr Mehmed Şeref Efendi bâ-tahlîf Meblağ: 1000 guruş. Mine'l-guremâ: 335,5 guruş, 48 akçe.
Deyn-i müsbet Haffâf el-Hâc Hüseyin Ağa an semeni mebî' bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi bâ-tahlîf Meblağ: 2.655 guruş. Mine'l-guremâ: 891,5 guruş, 38 akçe.	Bâ-hüccet deyn-i müsbet vasî es-Seyyid Mustafa Efendi an mâlı sagīre Fatımatüzzehra bâ-şehâdet-i Kısmet [ketebesinden] Mehmed Galib Efendi b. Mehmed Kâmil ve Muhzır Hasan Ağa b. (boş) ve bâ-tahlîf Meblağ: 7.564,5 guruş. Mine'l-guremâ: 2.540,5 guruş, 52 akçe.
Bâ-hüccet deyn-i müsbet vasî Hatice Sabahat kadın an mâlı sagīre Şerife Zeyneb Samiha bt. el-merhûm Nakîbü'l-eşrâf es-Seyyid Mehmed Esad Efendi bâ-şehâdet-i merkūmân Mehmed Galib Bey ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 11.600 guruş. Mine'l-guremâ: 3.896 guruş, 57 akçe.	Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Bahçıvan Mustafa Ağa an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 1.364,5 guruş. Mine'l-guremâ: 458 guruş, 40 akçe.
Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Osman Ağa an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 595 guruş. Mine'l-guremâ: 199,5 guruş, 43 akçe.	Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Uzun Mehmed Ağa b. Abdülkadir an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 543,5 guruş. Mine'l-guremâ: 182,5 guruş, 7 akçe.
Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından sâbık Vekîlharc Ahmed Ağa b. Hüseyin an ciheti deyn-i şer'î bâ-şehâdet-i	Deyn-i müsbet Lala Ali Ağa an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Kethüdâ Mehmed Şeref Efendi ve Vekîlharc Mehmed Ağa bâ-tahlîf Meblağ: 700 guruş.

merkūmân Kethüdâ Mehmed Şeref Efendi ve Osman Ağa ve bâ-tahlîf Meblağ: 2.850 guruş. Mine'l-guremâ: 957 guruş, 38 akçe.	Mine'l-guremâ: 235 guruş, 15 akçe.
Bâ-hüccet deyn-i müsbet vasî Cemile Hâtûn an mâlı sıgār Mehmed Tevfik ve Ahmed Nazif ve Mehmed Hasib ibnâ-i el-müteveffâ Canlı el-Hâc Mahmud Ağa ve bâ-şehâdet-i Kısmet ketebesinden el-Hâc Şakir Efendi b. Ahmed ve Muhzır el-Hâc Hcüseyin Ağa b. İsmail ve bâ-tahlîf Meblağ: 6.500 guruş. Mine'l-guremâ: 2.183 guruş, 44 akçe.	Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Rüstem Ağa an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Lala Ali Ağa ve kethüdâ-yı mezbûr Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 450 guruş. Mine'l-guremâ: 151 guruş, 18 akçe.
Deyn-i müsbet Hasırcı Süleyman Galib Efendi an semeni mebî' bâ-şehâdet-i merkūmân Kethüdâ Mehmed Şeref Efendi ve Vekîlharc Mehmed Ağa ve bâ-tahlîf Meblağ: 979,5 guruş. Mine'l-guremâ: 329 guruş, 2 akçe.	Bâ-hüccet deyn-i müsbet Mütevellî eş-Şeyh Hâfız Mehmed Emin Efendi an vakfı Tuluiye Kadın bâ-şehâdet-i sâbık vekîlharc-ı mezbûr el-Hâc Ahmed Ağa ve muhzır rüfekâlarından Osman Ağa b Mustafa ve bâ-tahlîf Meblağ: 5452 guruş. Mine'l-guremâ: 1.831 guruş, 41 akçe.
Deyn-i müsbet müteveffâ-yı mûmâileyhin biraderi vasî-i mûmâileyh Mehmed Rıza Bey an ciheti deyn-i şer'î bâ-şehâdet-i vekîlharc-ı sâbık mezbûr el-Hâc Ahmed Ağa ve kethüdâ-yı mezbur Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 16.500 guruş. Mine'l-guremâ: 5.542 guruş, 48 akçe.	Bâ-tahvîl deyn-i müsbet Eğribozlu müteveffâ el-Hâc Hüseyin Ağa veresesi zevcesi Emine ve sagīre kızı Feride ve sâir oğlu İsmail an ciheti mebî' bâ-şehâdet-i Bezzâzistânî Mehmed Efendi b. İbrahim ve kethüdâ-yı mezbûr Mehmed Şeref Efendi bâ-tahlîf Meblağ: 6.950 guruş. Mine'l-guremâ: 2.334,5 guruş, 3 akçe.
Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Seyis Mehmed Ağa an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 500 guruş. Mine'l-guremâ: 167,5 guruş, 54 akçe.	Deyn-i müsbet müteveffâ-yı mûmâileyhin hemşîresi Saide Hanım an ciheti deyn-i şer'î bâ-şehâdet-i İbrahim Bey b. Süleyman Hurşid ve Mehmed Raif Bey b. Mehmed Asım ve bâ-tahlîf Meblağ: 14.915,5 guruş. Mine'l-guremâ: 5.010 guruş, 19 akçe.
Deyn-i müsbet Ekmekçi Artin an semeni mebî' bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 845 guruş.	Deyn-i müsbet Francalacı Yorgi zimmî an semeni mebî' bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 555,5 guruş.

Mine'l-guremâ: 283,5 guruş, 40 akçe.	Mine'l-guremâ: 186,5 guruş, 11 akçe.
Bâ-tahvîl deyn-i müsbet sarrâf tâifesinden Höce Viçen zimmî an ciheti karz bâ-şehâdet-i Kapıçukadârı el-Hâc Şerif Ahmed Ağa b. es-Seyyid Hasan ve Nuri Bey b. Mehmed Asım ve bâ-tahlîf Meblağ: 157.650 guruş. Mine'l-guremâ: 52.955 guruş, 15 akçe.	Deyn-i müsbet Dülbenci Sarrâfoğlu Kirkor zimmî an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 2.519,5 guruş. Mine'l-guremâ: 846 guruş, 36 akçe.
Deyn-i müsbet Bakkâl Eci İlya zimmî an semeni mebî' bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 21.976 guruş. Mine'l-guremâ: 7.381,5 guruş, 36 akçe.	Deyn-i müsbet müteveffâ-yı mûmâileyhin teba'asından Uyuz David zimmî an ciheti deyn-i şerî bâ-şehâdet-i merkūmân Kethüdâ Mehmed Şeref Efendi ve Lala Ali Ağa ve bâ-tahlîf Meblağ: 1.470 guruş. Mine'l-guremâ: 493,5 guruş, 33 akçe.
Deyn-i müsbet Kuyumcu Çıracıoğlu Höce Manil zimmî an ciheti karz ve semen-i mebî' bâ-şehâdet-i kethüdâ-yı mezbûr Mehmed Şeref Efendi ve teba'adan Mustafa Ağa b. Ali vekîlharc-ı mezbûr Mehmed Ağa ve mezbûr Mehmed Haydar Efendi ve bâ-tahlîf Meblağ: 59.928 guruş. Mine'l-guremâ: 20.130,5 guruş.	Deyn-i müsbet sarrâf tâifesinden Güzeloğlu Höce Artin zimmî bâ-şehâdet-i Anadolu Muhzırı Salih Ağa b. İbrahim ve kethüdâ-yı mezbûr Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 9.000 guruş. Mine'l-guremâ: 3.023,5 guruş, 15 akçe.
Deyn-i müsbet Kumaşçı Toksuzoğlu Kaspar zimmî an semeni mebî' bâ-şehâdet-i merkūmân Mehmed Haydar Efendi ve Mustafa Ağa ve bâ-tahlîf Meblağ: 3.532,5 guruş. Mine'l-guremâ: 1.186,5 guruş, 9 akçe.	Deyn-i müsbet Çukacı Todori zimmî an semeni mebî' bâ-şehâdet-i teba'adan mezbûr Rüstem Ağa ve kethüdâ-yı mezbûr Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 2.775 guruş. Mine'l-guremâ: 932 guruş, 15 akçe.
Deyn-i müsbet Terzi Yanko zimmî an ciheti deyn-i şer'î bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 1.408 guruş. Mine'l-guremâ: 472,5 guruş, 54 akçe.	Deyn-i müsbet Ekmekçi Serkiz zimmî an semeni mebî' bâ-şehâdet-i merkūmân Vekîlharc Mehmed Ağa ve Kethüdâ Mehmed Şeref Efendi ve bâ-tahlîf Meblağ: 1.401 guruş. Mine'l-guremâ: 470,5 guruş, 12 akçe.

Kesr-i akçe: 19

Cem'an yekûn-ı düyûn: 382.257,5 guruş.

Vech-i meşrûh üzere ashâb-ı matlûb-ı merkūmûn bâlâda muharrer garâmeten hisselerini tamâmen ahz u kabz eyledikleri işbu mahalle şerh olundu.

Rumeli Kazaskeri Seyyid Mehmet Ataullah Beyefendi b. Seyyid Mehmet Raşit Efendi'nin Terekesinin Değerlendirilmesi

Seyyid Mehmed Ataullah Efendi'nin terekesi, klasik bir servet aktarımı olmaktan ziyade borç odaklı bir taksime konu olmuştur. Terekede kaydında açıkça belirtildiği üzere, müteveffânın borçları terekesinden fazla olduğu için varisler (zevce Dilvale Hanım, annesi Hacı Fatma Hanım, oğulları Seyyid Mehmet Atıf ve Derviş Mehmet Raşit, kızı Şerife Ayşe Fıtnat) "keff-i yed" etmiş, yani mirastan feragat etmişlerdir. Bu nedenle tereke satılmış, bedeli borçlulara taksim edilmiştir.

Bu durum, üst düzey bir ulemâ ve bürokrat olan Rumeli Kazaskeri'nin bile zaman zaman mali sıkıntı yaşayabildiğini, yüksek sosyal statünün her zaman ekonomik güvence anlamına gelmediğini göstermektedir. Özellikle Galata'da borçlu olarak vefat etmiş olması, dönemin kredi ve finans ilişkilerinin kadı ve kazaskerler dahil ilmiye sınıfını da etkilediğini ortaya koymaktadır.

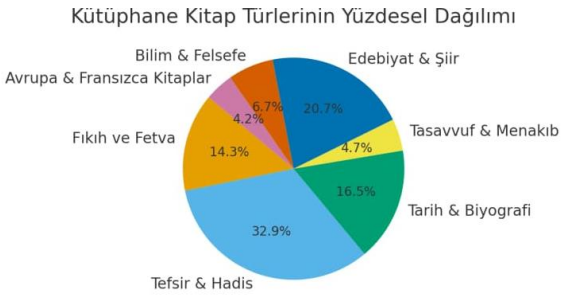
Tereke kaydı, dönemin bir âliminin entelektüel dünyasını yansıtan olağanüstü zengin bir kütüphane ve eşya envanteri içermektedir. Kütüphanesinde Mushaf, fıkıh şerhleri (Dürrü'l-Müntekā, Mültekâ şerhleri), tasavvufî eserler (Menâkıb-ı Evliyâ, Risâle-i Nakşibendî), klasik edebiyata ait örnekler (Divân-ı Nâbî, Gülistân şerhleri), tarih kitapları (Târîh-i Vâsıf, Ravzatü's-safâ, Târîh-i Taberî) ve tıp, matematik, astronomi gibi bilimsel eserler (Ulûm-ı Riyâziye, Teşrîh-i Şânîzâde) yer almaktadır. Bu çeşitlilik, seyyid olan bir kazaskerin hukukî bilgisinin yanında, edebî ve ilmî birikiminin de geniş olduğunu, aynı zamanda medrese müfredatının ötesinde bir entelektüel merak taşıdığını göstermektedir.

Terekede ayrıca çok sayıda seccade (Hindkârî, Kudüskârî, deve tüyünden seccadeler), farklı türden kürkler (samur, merinos kaplı), nargile takımları, gümüş işlemeli şamdan ve kaplar, çeşitli silahlar (tüfek, tabanca, kemankeş takımı), satranç takımı ve hatta dönemin modern eşyalarından biri olan 'muzikalı saat' yer almaktadır. Bu da kazaskerin hem geleneksel bir ulema evi düzeni kurduğunu hem de dönemin modernleşme etkilerini (Fransızca kitaplar, Avrupa tipi eşyalar) evine taşıdığını göstermektedir. Terekede binek ve araba bargirleri, arabalar ve koşum takımlarının yer alması, yüksek dereceli bir ilmiye mensubunun hem şehir içinde hem de şehir dışında seyahat imkânına sahip olduğunu göstermektedir.

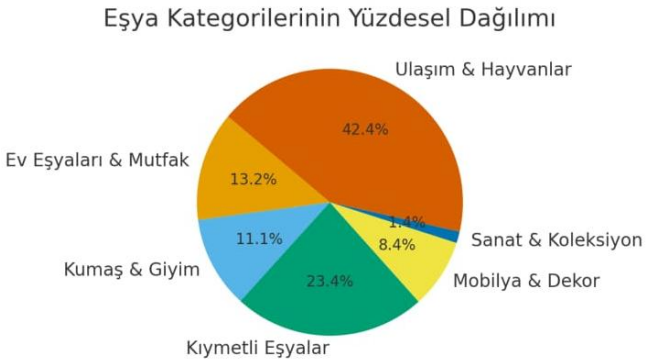
Tereke listesi, bir kazaskerin gündelik hayatını ve sosyal çevresini yeniden inşa etmeye imkân tanımaktadır. Çok sayıda fıkıh kitabı, tefsir, hadis ve fetva mecmuası, onun şer'î otoritesini güçlendiren temel sermaye niteliğindedir. "Nakşibendî risaleleri, menâkıbnâmeler ve Kasîde-i Bürde şerhleri, onun tasavvufa ilgisinin bulunduğunu göstermektedir. Kehribâr ve mercan tespihler, mücevherli eşyalar, tablolar, musavver kâğıtlar ve müzikli saatler ise estetik kaygıların ve zevk unsurlarının da önemsendiğini ortaya koymaktadır.

Bu envanter, Osmanlı'nın son döneminde seyyid olan bir kazaskerin evinin, aynı zamanda bir kütüphane, bir sanat koleksiyonu ve bir sosyal prestij mekânı işlevi gördüğünü açıkça ortaya koymaktadır.

Grafik 1. Kütüphane Kitap Türlerinin Yüzdesel Dağılımı



Grafik 2. Eşya Katagorilerinin Yüzdesel Dağılımı



Rumeli Kazaskeri Seyyid Mehmed Atâullah Bey'in tereke kaydı, Osmanlı ilmiye sınıfının sosyal, kültürel ve ekonomik hayatına dair çok katmanlı veriler sunmaktadır. Kütüphanesinin zenginliği, ev eşyalarının çeşitliliği, değerli kumaş ve kürkleri ile silah ve saat gibi lüks eşyaları; bir yandan yüksek sosyal statüyü, diğer yandan ise borçluluk sebebiyle yaşanan ekonomik baskıyı ortaya koymaktadır. Bu tereke, 19. yüzyıl Osmanlısında ilmî ve dünyevî hayatın nasıl iç içe yaşandığının güçlü bir örneğini teşkil etmektedir

Sonuç

Rumeli Kazaskeri Seyyid Mehmed Atâullah Bey'in tereke kaydı, Osmanlı ilmiye sınıfının sosyal, kültürel ve ekonomik dünyasına dair çok katmanlı veriler sunmaktadır. Söz konusu kayıt, bir seyyidin yalnızca dini ve toplumsal meşruiyetin temsilcisi olmakla kalmadığını, aynı zamanda maddi kültür ve entelektüel birikim alanında da dönemin karakteristik özelliklerini yansıttığını göstermektedir. Böylelikle seyyid kimliği hem bireysel hem de toplumsal düzeyde çok yönlü bir incelemenin merkezine yerleşmektedir.

Öncelikle, terekenin borç fazlası sebebiyle varislerin 'keff-i yed' ederek mirastan feragat etmeleri, Osmanlı'nın en yüksek ilmiye makamlarından birinde bulunan bir seyyidin dahi mali sıkıntılar yaşayabildiğini ortaya koymaktadır. Bu durum, seyyidliğin sağladığı itibara ve kazaskerlik gibi yüksek bir mevkiye rağmen ekonomik kırılganlığın yaşanabileceğini göstermektedir. Bu durum 19. yüzyıl Osmanlı mali yapısına eleştirel bir bakış açısı kazandırmaktadır. Böylece seyyidlik kurumu, sadece dini meşruiyet değil, aynı zamanda sosyal ve ekonomik gerilimler bağlamında da değerlendirilmesi gereken dinamik bir kimlik olarak karşımıza çıkmaktadır.

İkinci olarak, terekenin en zengin boyutunu kazaskerin ilmî ve entelektüel dünyasını yansıtan kütüphane oluşturmaktadır. Fıkıh ve fetva mecmualarından siyer ve tarih kitaplarına, tasavvufî risalelerden edebî divanlara kadar geniş bir yelpazede eserler, Osmanlı ulemasının bilgi birikimini ve seyyid kimliğinin ilimle bütünleşen yönünü ortaya koymaktadır. Bu çeşitlilik, medrese müfredatının ötesinde bir entelektüel profili belgelemekte; ayrıca kütüphanede yer

alan Avrupa dillerinden tercüme eserler, Batı etkisinin ilmî çevrelerdeki yaygınlığını göstermesi bakımından da önem taşımaktadır.

Üçüncü olarak, terekenin maddî kültür envanteri, Hz. Peygamber soyuna mensup bir kazaskerin gündelik yaşam pratiklerini anlamada önemli veriler sunmaktadır. Samur ve merinoz kürkler, seccadeler, gümüş işlemeli şamdanlar, nargile takımları, silahlar, satranç tahtası ve müzikli saat gibi eşyalar, Osmanlı üst sınıfının konfor ve prestij anlayışını gözler önüne sermektedir. Binek hayvanları ve arabaların kaydedilmiş olması, seyyid bir kazaskerin şehir içi ve şehirlerarası hareketliliğini göstermekte; hane halkına dair kayıtlar ise sosyal yapının çok katmanlı olduğunu ortaya koymaktadır. Böylece seyyid kimliği, yalnızca dini bir statü değil, aynı zamanda toplumsal yaşamın merkezinde yer alan bir temsil alanıdır.

Son olarak, bu tereke kaydı, bir seyyidin şahsında Osmanlı toplumunun sosyal, ekonomik ve kültürel dokusunu anlamamıza imkân veren bir ayna niteliğindedir. Servet birikimi ile borç ilişkileri, ilmî sermaye ile maddî kültür, gelenek ile modernleşme unsurları bu metinde iç içe geçmiştir. Şeriyye sicillerinde kayıtlı seyyid terekeleri, Osmanlı miras hukukunun işleyişini, toplumsal yapıyı ve entelektüel hayatın dinamiklerini anlamada özgün bir imkân sunmakta; aile tarihi, iktisat ve hukuk tarihi ile birlikte ilmî biyografi ve kimlik çalışmalarına birincil derecede kaynaklık etmektedir.

Gelecek araştırmalarda, farklı şehirlerdeki seyyid terekelerinin karşılaştırmalı analizi hem bölgesel servet dağılımı hem de seyyidlerin sosyo-ekonomik profilleri hakkında daha derinlikli sonuçlar ortaya koyacaktır. Ayrıca kütüphane envanterlerinin mukayesesi, Osmanlı ulemasının okuma alışkanlıklarının, ilmî ağlarının ve entelektüel eğilimlerinin daha bütüncül biçimde analiz edilmesine katkı sağlayacaktır. Bu yönüyle seyyid terekeleri, Osmanlı toplumunun ilmî ve kültürel hayatına dair özgün bir pencere açmaktadır.

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ADALETİN ŞAHİTLİĞİNDE EHL-İ BEYT:OSMANLI KADI SİCİLLERİNDE SEYYİDLERLE İLGİLİ HUKUKİ SÜREÇLER

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ÖZET

Kadı sicilleri, Osmanlı Devleti'nde görülen hukukî davaların yanı sıra merkezden gönderilen resmî belgelerin suretlerini de ihtiva eden temel kaynaklardır. İlâm, hüccet ve tereke kayıtları gibi mahkeme işlemlerinin yanı sıra ferman, buyuruldu ve berat suretlerinin da yer aldığı bu defterler, yalnızca hukuk tarihinin değil, Osmanlı toplumunun sosyal yapısının da anlaşılmasında büyük önem taşımaktadır. Özellikle seyyidlerle ilgili evlenme, boşanma, miras taksimi, alım satım vb. hukuki işlemler, siyâdet hüccetleri, nesebnâmeler ve Nakîbü'l-eşrâf kayıtları gibi bilgiler, kadı sicillerinin Ehl-i Beyt araştırmaları açısından özgün bir değer taşıdığını ortaya koymaktadır. Bu çalışma, seyyidlerle ilgili davaları inceleyerek Osmanlı toplumunda seyyid kimliğinin hukukî ve toplumsal boyutlarını görünür kılmaktadır. Kadı sicilleri bu yönüyle yalnızca bireysel davaları değil, aynı zamanda İslam Mezhepleri Tarihi ve Ehl-i Beyt araştırmalarında çok katmanlı analizlere imkân sağlayan birincil kaynaklar arasında yer almaktadır. Sicil kayıtlarının ayrıntılı incelenmesi, seyyid kimliğinin yalnızca manevî bir statü olmadığını, aynı zamanda ekonomik imkânlar, toplumsal ilişkiler ve gündelik hayat pratikleriyle birlikte ele alınması gereken çok boyutlu bir olgu olduğunu göstermektedir. Bu çalışma, literatürde genellikle teorik veya siyasî çerçevede tartışılan seyyidlik kurumunu, şeriyye sicillerinin ortaya koyduğu somut veriler üzerinden değerlendirerek alan yazına özgün bir katkı sunmaktadır. Gelecekte yapılacak araştırmalar için sicil kayıtlarının türlerinin, bölgesel farklılıklarının ve zaman içindeki değişimlerinin sistematik olarak incelenmesi, Ehl-i Beyt'e dair Osmanlı'daki uygulamaların daha net anlaşılmasına katkı sağlayacaktır.

Anahtar Kelimeler: İslam Mezhepleri, Ehl-i Beyt, Kadı Sicilleri, Dava, Seyyid.

AHL AL-BAYT IN THE TESTIMONY OF JUSTICE:LEGAL PROCEDURES REGARDING SAYYIDS IN OTTOMAN JUDICIAL REGISTERS

ABSTRACT

Qadi registers are primary sources containing the copies of official documents sent from the central government, in addition to those of legal cases heard in the Ottoman State. These registers, which include court proceedings such as decrees, *hujjat*s, and inheritance records, along with the copies of edicts, orders, and warrants, are of great importance not only for understanding legal history but also for understanding the social structure of Ottoman society. In particular, information such as legal transactions related to sayyids, like marriage, divorce, inheritance distribution, purchase and sale and so forth, as well as documents of sayyidship, genealogies, and the records of *naqib al-ashraf*, demonstrate the unique value of qadi registers in terms of researches on *Ahl al-Bayt*. Examining the cases involving sayyids, this study sheds light on the legal and social dimensions of the sayyid identity in the Ottoman society. In this respect, the qadi registers are among the primary sources that provide an opportunity for multilayered analyses not only in individual cases but also in the studies dealing with the

History of Islamic Sects and *Ahl al-Bayt*. A detailed scrunity of the records of qadi registers manifest that the sayyid identity is not merely a spiritual status but also a multifaceted phenomenon that should be considered alongside economic opportunities, social relations, and daily life practices. Evaluating the institution of sayyidship, which is often discussed in the literature from a theoretical or political perspective, in light of the tangible data provided by the sharia court registers, this study aims to make an original contribution. A systematic study of the types of the records in question, their regional variations, and their changes over time by the future researches will contribute to a clearer understanding of the Ottoman practices with regard to *Ahl al-Bayt*.

Key Words: Islamic Sects, Ahl al-Bayt, Court Registers, Case, Sayyid.

Giriş

Osmanlı Devleti'nin hukuk sistemi, İslâm medeniyetinin kadim geleneğini devralarak geliştirdiği ve devlet teşkilatının temel unsurlarından biri hâline getirdiği kadılık kurumu etrafında şekillenmiştir. Kadılar, davaları karara bağlayan hukukî aktör olmaları yanında, aynı zamanda devletin merkezî otoritesini taşraya yansıtan temsilciler olarak da önemli roller üstlenmişlerdir. Bu görevleri sırasında tuttukları şeriyye sicilleri, Osmanlı hukuk ve sosyal tarihinin birincil kaynakları arasında yer alır. İlâm, hüccet, tereke, vakfiye, ferman ve berat gibi farklı belge türlerini ihtiva eden bu siciller, Osmanlı toplumunun gündelik hayatına, idarî düzenine ve sosyal yapısına dair zengin veriler sunmaktadır.

Bu kayıtlar içerisinde özellikle Ehl-i Beyt mensuplarının, yani seyyidlerin hukukî süreçlerine dair belgeler dikkat çekici bir yer tutar. Seyyidlerin evlenme ve boşanma işlemlerinden tereke taksimine, alım-satım muamelelerinden halkla ve kendi aralarındaki anlaşmazlıklara kadar pek çok meselenin kadı sicillerine yansıdığı görülmektedir. Ayrıca seyyidlerin statülerini ortaya koyan siyâdet hüccetleri ve nesebnâmeler ile onların işlerinden sorumlu Nakîbü'l-eşrâf ve kaymakamlarının tayinlerine dair kayıtlar, Osmanlı toplumunda Ehl-i Beyt'in konumunu anlamak bakımından kritik bir öneme sahiptir.

Bu çalışma, Osmanlı kadı sicillerinde seyyidlerle ilgili davaların incelenmesine odaklanmaktadır. Araştırmada, kadı sicillerinin muhtevası ayrıntılı biçimde ele alınmış; seyyidlerin taraf olduğu dava türleri tespit edilmiş ve bu davalara dair örnek kayıtlar incelenerek çözümlemeler yapılmıştır. Böylelikle hem Osmanlı hukuk düzeninde seyyidlerin toplumsal konumunun nasıl şekillendiği hem de onların dinî ve hukukî ayrıcalıklarının uygulamadaki yansımaları ortaya konmuştur. Bu çerçevede çalışmanın temel amacı, Ehl-i Beyt mensuplarının Osmanlı toplumundaki statüsünü kadı sicilleri üzerinden tarihsel ve sosyolojik boyutlarıyla aydınlatmaktır.

Kadı Sicillerinin Muhtevası

Osmanlı Devleti, İslâm devlet geleneğinden devraldığı kadılık kurumunu kendi idarî yapısına uyarlayarak devlet teşkilatının en temel hukukî organlarından biri hâline getirmiştir. Kadılar ve onların vekili konumundaki nâibler, şer'î mahkemelerin işleyişinde birinci derecede yetkili merciler olarak görev yapmış; aldıkları kararlar ve yürüttükleri işlemler, 'şeriyye sicilleri' adı verilen resmî defterlere kaydedilmiştir (Özdemir, 1986, s. 179-187).

Kadı sicilleri, Osmanlı toplumunun hukukî, sosyal ve idarî hayatına dair çok yönlü kayıtlar ihtiva etmektedir. Bu sicillerde vakfiye, berat, ferman ve emirnâme suretleri ile bireysel ve toplumsal yaşama ilişkin hukukî belgeler önemli bir yer tutmaktadır. Ayrıca kişiler arasında düzenlenen senetler, imparatorluk bünyesindeki askerî seferlere dair emirler, vergi uygulamaları ve savaş süreçlerinin topluma yansımaları da bu siciller aracılığıyla takip edilebilmektedir. Bunun yanı sıra kadı, müftü, nâib, âyan, yeniçeri ağası, nakîbü'l-eşrâf kaymakamı, kethüdâ ve dizdar gibi görevlilerin tayin, azil ve nakil işlemleri de söz konusu

defterlerde kayıt altına alınmıştır (İnalcık, 1947, s. 693; Oral, 1945, s. 12; İnalcık, 1942, s. 178; Özdemir, 1977, s. 43).

Kadı sicilleri yalnızca adlî süreçlere dair belgelerle sınırlı değildir. Toplumsal hayatı ilgilendiren hemen hemen her meseleye ilişkin bilgiler barındırmaktadır. Topluma yönelik emirler, şehir yönetimine dair düzenlemeler, salgın hastalıkların seyri ve bu hastalıklar karşısında alınan tedbirler, doğal afetler ve bunların neticeleri, asker kaçakları ve eşkıyalık hadiselerine ilişkin ilam ve hüccetler, vefat eden devlet görevlilerinin terekeleri sicillerde yer almaktadır (Kaplan, 2025, s. 106-111). Ayrıca köprü, cami, han, hamam ve hastane gibi hayır kurumlarının inşa ve tamirine dair keşif defterleri; esnaf teşkilatının kefilleri ve nizamnameleri, narh defterleri ile ürün fiyatlarını ve amele ücretlerini belirleyen kararlar da bu defterlerin kapsamına girmektedir (Gürkan, 1981, s. 766; Turgal, 1938, s. 8-9; Hızlı, 1991, s. 145-148).

Özellikle İstanbul şeriyye sicilleri hem içerik hem de düzen bakımından taşra sicillerinden ayrılmaktadır. Bu defterlerde evlenme, boşanma, nafaka, vekâlet, tereke, borçlanma, vesayet, vakfiye ve tevliyet gibi davalara ait zabıtlar önemli bir yekûn tutmaktadır. Bunun yanı sıra ilmî ve askerî sınıfa mensup kişilerin miras taksimleri, su davalarına ilişkin mâ-i lezîz defterleri, yeniçeri ahidnâmeleri, dinî liderlerin mühür tatbikleri, vakıf muhasebe kayıtları ve zımmîlerin mülkiyet haklarına dair belgeler de yer almaktadır. Ayrıca şehirdeki hastaneler ve buralarda tedavi gören hastalar, medreselerle ilgili bilgiler ve eğitim kararları, ihtidâ (İslâm'a giriş) belgeleri, diplomatik elçilerin görevleri ve nüfus kayıtları gibi çok çeşitli konular da bu sicillerin zengin muhtevasını tamamlamaktadır (Şeriyye Sicilleri Arşivi, Havâss-ı Refîa Kadılığı Sicilleri, No. 258, 280, 293, 285, 323; İstanbul Kadılığı Sicilleri, No. 97, 41, 42, 80).

Dolayısıyla kadı sicilleri, hukuk tarihi yanımda; sosyal, iktisadî, askerî ve kültürel tarih araştırmalarına da ışık tutan birinci elden kaynaklardır. İçerdikleri kayıt çeşitliliği, Osmanlı toplumunun sosyal, ekonomik ve hukukî dinamiklerini bütüncül bir bakış açısıyla kavramaya imkân tanımaktadır. Bu yönüyle kadı sicilleri, tarihçiler, hukukçular, sosyologlar ve ilahiyatçılar için vazgeçilmez bir arşiv niteliği taşımaktadır.

Kadı Sicillerinde Seyyidlerle İlgili Davalar

Osmanlı kadı sicilleri, toplumsal hayatın çok katmanlı bir aynasıdır. Bu siciller, aile kurumunun işleyişinden ekonomik ilişkilerin düzenlenmesine, suç ve ceza süreçlerinden kamu düzeni uygulamalarına kadar geniş bir yelpazede bilgi sunmaktadır. Bu bağlamda seyyidlerle ilgili kayıtlar, sadece hukukî bir veri değil; aynı zamanda Osmanlı'nın meşruiyet anlayışını, sosyal hiyerarşisini ve dinî-siyasî ideallerini yansıtan birer belgedir.

Ehl-i Beyt mensupları, Osmanlı toplumsal yapısında seçkin bir zümre olarak kabul edilmiş; Hz. Peygamber'in soyundan gelmeleri sebebiyle hem halk nezdinde hem de devlet katında saygı görmüşlerdir. Bu statü, Osmanlı hukuk sisteminde de karşılığını bulmuştur. Kadı sicillerinde onların şahıslarına ve mallarına dair özel hükümler şer'î hukuka uygun biçimde kayda geçirilmiş, gerektiğinde merkezî otoriteye bildirilmiştir. Böylece Osmanlı, bir yandan Ehl-i Beyt'e gösterdiği hürmeti somutlaştırmış, diğer yandan bu statünün suiistimal edilmesini önlemiştir.

Kadı sicillerinde seyyidlerin evlilik akitleri, boşanma davaları, mehir miktarlarının tespiti ve boşanma sonrası nafaka kararları ayrıntılı biçimde kayda geçirilmiştir. Nitekim bir seyyidin boşanmış eşi ve küçük yaştaki çocukları için mahkemece belirlenen nafakanın, ailenin ekonomik durumu dikkate alınarak düzenlenmesi, Osmanlı hukukunun hem hakkaniyete hem de toplumsal barışa verdiği önemi göstermektedir. Ayrıca çocukların velayeti, evlenme yaşının uygunluğu ve şahitlerin güvenilirliği gibi hususlar da mahkeme zabıtlarında açıkça yer almaktadır (Şeriyye Sicilleri Arşivi, İstanbul Kadılığı Sicilleri, No. 78, 10a-5).

Seyyidlerin tereke kayıtları, mal paylaşımının yanında; aynı zamanda dönemin ekonomik yapısını, meslek çeşitliliğini ve seyyidlerin toplumsal sınıflar arasındaki konumunu da yansıtmaktadır. Bu defterlerde taşınır ve taşınmaz mallar tek tek listelenmiş; borçlar, alacaklar ve vakıflara yapılan bağışlar ayrıntılı biçimde kaydedilmiştir (Kaplan, 2025, s. 106-110). Böylece bir yandan Osmanlı toplumunda servet dağılımı ortaya konurken, diğer yandan seyyidlerin ekonomik gücü ile üretim ve ticaretteki rolleri de belirginleşmektedir (Yıldız, 2023, s. 486-490).

Kadı sicilleri, seyyidlerin toplumsal manada yaşadıkları ihtilafları da içermektedir. Alacak-verecek anlaşmazlıkları, komşuluk ihtilafları, saldırı veya hakaret vakaları ve kimi zaman kamu düzenini bozan fiiller, bu defterlerde kayıtlıdır. Davalarda seyyidlerin diğer bireylerle aynı şekilde yargılandığı ve gerektiğinde cezalandırıldığı görülmektedir. Bu durum, seyyidlerin ayrıcalıklı konumlarının adalet mekanizmasını gölgelemediğini, aksine hukukun üstünlüğünün korunduğunu göstermektedir (Şeriyye Sicilleri Arşivi, İstanbul Kadılığı Sicilleri, No. 78, 23b-2).

Kadı sicillerinin en dikkat çekici belgelerinden biri, siyâdet hüccetleri ve nesebnâmelerdir. Bu belgeler, bir kişinin seyyidlik iddiasının meşruiyetini kanıtlamaktadır. Nakîbü'l-eşrâf veya kaymakamının imzasıyla tasdik edilen bu belgeler hem soyun tespitini hem de devletin bu iddiaları denetim altında tuttuğunu göstermektedir. Böylece sahte seyyidlik iddialarının önüne geçilmiş, toplumda Ehl-i Beyt'in itibarı korunmuştur. (Şeriyye Sicilleri Arşivi, İstanbul Kadılığı Sicilleri, No. 334, 9-11).

Bunların haricinde seyyidlerin doktordan aldıkları darp raporları (Şeriyye Sicilleri Arşivi, Üsküdar Kadılığı Sicilleri, No. 531, 23a-4; Yıldız, 2023, s. 596-617), mahkemede üstlendikleri şahitlikler (Şeriyye Sicilleri Arşivi, İstanbul Bâb Mahkemesi Sicilleri, No. 11, 87a-2), seyyidlerin meslekleri (Şeriyye Sicilleri Arşivi, İstanbul Kadılığı Sicilleri, No. 137, 4a-1) ile vefat yerleri ve ölüm sebepleri (Şeriyye Sicilleri Arşivi, Kısmet-i Askeriye Mahkemesi Sicilleri, No. 1706, 25-26) de sicillerde önemli bir yer tutmaktadır.

Seyyidlerle ilgili dava kayıtlarının sistematik olarak incelenmesi, Osmanlı toplumunun dinî ve sosyal yapısına dair mikro-tarihsel veriler sunmaktadır. Bu kayıtlar sayesinde aile yapısı, miras hukuku uygulamaları, toplumsal hiyerarşi, dinî meşruiyet mekanizmaları ve devlet-toplum ilişkileri derinlemesine analiz edilebilmektedir. Özellikle modern sosyoloji, hukuk ve antropoloji çalışmalarında kadı sicilleri, sayısal veri analizine de imkân tanıyan birinci elden kaynaklar arasında yer almaktadır.

Kadı Sicillerinde Seyyidlerle İlgili Bir Dava

Seyyid Mehmed Efendi'nin, çocukları Seyyid Ali ve Şerife Fâtıma'ya Nafaka Tayini (Şeriyye Sicilleri Arşivi, *İstanbul Kadılığı Sicilleri*, No. 78, 10a-5.)

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معروض

قبان عسل بخار رندهٔ قرنجی الحاج اسماعیل بن عبد الله طرفندن خصوص ات الیانده
وکیل اولدیغی صالح بن عابد الواب وعلی بن احمد نامنه ثابت اولان بایعی السید
حسین ابن احمد مجلس شرع منیرده بقال دیمتری ولد بهره طلوز ذمی مواجهه سنده
موکلم مرقوم الحاج اسماعیل مسطور بهره طلوز ذمی دشنده بیک ایکیوز اون بش
سنه‌سی ربیع الاولنده بدندن وعالیدن اشتری اوقبض ایلدیکی درت بدک بایع
مشتهره باغ حلقان سکز غروش اولوز بر پاره یه مدعی اولمغله مبلغ مذکوری
مسطور دیمتری ذمیدهٔ بالوکاله حاضر طلب ایدرم دیو دعوی ایتدکده اولدخی مبلغ مذکوری
مدعی وکیل مزبورك بر وجه محرر مدعاسنی اقرار واعتراف ایتکله مومیٔ الیه
باغ مذکور حلقان سکز غروش اولوز بر پاره یه مدعی وکیل مزبور السید
حسینه اوا تسلیم مسطور دیمتری ذمی یه تنبیه اولندیغی استاسبول محکمه سندهٔ
حضور عالیلرینه اعلام اولندی ۱۵ نجی شوال الکرم

معروض

صاحبهٔ عرضحال نعیمه خاتونك زوجی الحاج خلیل افندی ایله شعبان محلسی شرع منیرده
عرضحالده مذکوره زاتك معرفه زلیخا بنت عبد الله مدعاجه شرع مزبوره زلیخا خاتون تاریخ
اعلامدن اوچ کون مقدم سلطان بایزید جامع شریفی جوسی قبوسی القصاله اسکله
الیه قوله وکوسه بغیر حق ضرب وبزدنك ویه باکره شتم ایتکله موجب شرعیسی
طلب ایدرم حجه دعوی ایتدکده اولدخی جواب بنده مدعی مزبورك قوله وکوسه
اسکله الیه بغیر حق ضربنی اقرار وشتم مدعاسنی انکار ایتکله مدعیه مزبوره یه وجه
محرر شتم مدعاسنی لدی التزکیه عدل ومقبول الشهاد ابو وکلری اخبار اولنله
فسیحی محمد بن رمضان وبیجاغچی محمد شه ابن احمد نام کسنه‌لر شهادتلرینه اقتضا ایلدیکی
برنهج شرعی اثبات ایتکلری موجبنجه مزبوره زلیخا یه شرعا تعزیر
اسلامبول محکمه سندهٔ حضور عالیلرینه اعلام اولندی ۱۴ نجی شوال

معروض

صاحبهٔ عرضحال مصر چارشوسی عطارلرندن السید عبد الله ابن السید بدایت الله محلس شرع
منیرده جوهردار مقامنه صدر رحالی عرضحالده مذکور الاسم محمد امین آغا ابن عثمان محمد نامنه
اشبو حاضر باعلمجلس قرنجی حاجی حافظ ابراهیم اوغلی محمد نامنه باشکا جهتیله قرنجی
الاصلدن اولان اشبو زغروشه مرقوم محمد امین آغا السنه‌سی ربیع الاولنده زغروشه
بشنجی کونی عطارانه کتخدالسی اوطه سنده سکز قبضه وضانه اولغله مبلغ مذکور زغروشه
مرقوم محمد امین آغا دعوی کفالتنه احاله طلب ایدرم حجه بعد الدعوی والاستنطاق اولدخی
جوابنده مدعی مزبور کفالتنه قبول اولوب مبلغ مذکوره کفالتنه انکار ایتکله مدعی مزبور
بروجه محرر مدعاسنی لدی التزکیه عدل ومقبول الشهاد ابو وکلری اخبار اولنله
محمد آغا ابن علی والحاج علی ابن عبد الله نام کسنه‌لر شهادتلرینه مراجعتله برنهج شرعی اثبات
اتیکلری موجبنجه مبلغ مذکور زغروشی محکمه الکفاله مدعی مزبوره اداو تسلیمه
مرقوم محمد امین آغایه تنبیه اولندی استاسبول محکمه سندهٔ حضور عالیلرینه اعلام
اولندی ۱۴ نجی شوال الکرم

معروض

انا طولیلو بوی اباد قضاسنه تابع نفه قریه سی اهالیسندن صاحب عرضحال یورکی اوغلی
ستانه مصطفی بن محمد باشراجی مجلس شرع منیرده قریه‌مزبوره اهالیسندن عرضحالی
ستانه سی ستانه عثمان بن ابراهیم محضرنده مزبور ستانه عثمانه تاریخ اعلامدن
اوچ یجی آی مقدم قریه‌مزبوره حی کندی صلبنجه نانه وضع ایتکله بعد البراجمع مذکور
وجهیله وصاح اموزم باشنه بغیر حق ضرب وجرح ایتکله مدعی مزبور ستانه عثمان
ناشر طعام مضغه قلل ناکملر موجب شرعیسی مزبور ستانه عثمان ذمیدهٔ حاضر طلب ایدرم
حجه‌سی الیکم مدعا مدعی مزبور عثمان ذمیدهٔ الیه‌نك انکار اوجهیله غروش
اوزرینه صلح اولدقده اولدخی صلح مذکوری بعد القبول بنول صلحیه‌ی حاوی ایراد اولنله
جرح مذکوره متعلقه دعواجه مزبور ستانه عثمان ذمیدهٔ مدعی مزبور مطالبه
ایلدم ویه بعد الاقرار والتصدیق بذل صلح مذکور اوجهیله غروش مدعی مزبور مطالبه
اداو تسلیمه مزبور ستانه عثمان ذمیدهٔ تنبیه اولندیغی استاسبول محکمه سندهٔ حضور عالیلرینه اعلام اولندی
۱۴۲ نجی شوال الکرم

معروض

حاصبه حصکیلرندن صاحبه خیال محمد حاتونك محمد نامنه مجلس شرع منیرده عرضحالی مضمونده
ذمی مواجهه سنده بیان اولنمغله مدت ایدرم مقدمه سندهٔ اولدقده مرقوم مرطوذی بیك ایکیوز اون بش
سنه‌سی محرم باشنه اسکدار یخ مضافه قره طال واطرافنده کائن ارسال ایلدیکی
ارسال ایلدیکی کمیده درت آی مرورنده قرنجی اوغلی مالی بقایا سی تحصیل ایچون کمیده
مذکور ایله ذکر اولنان کمیجی اوغلی عروش تحصیل ایچون کمیده مذکور
اقتضا ایدن اقدامه مبادرت ایلدکده مومیٔ الیه عروش بوزغروشی مرسوم مرطوذ دیدهٔ
حاضر طلب ایدرم حجه دعوای ایلدیکی اولدخی جواب بنده بروجه محرر مدعای انکار ایدوب
ماعدا نس جوابنده مذکوریه جوقه‌ایلدیکی صاتنج صراف اغلوب تام ذمیدهٔ اوتوز
بیك یدیوز سکسان پدی یدك عروشه التزام دیه‌یه اشبو سکلمه‌ی ماعدا باقی قالان اچی قرالچه‌سی
اعطا ایلدکده صلح ظهر ایتکله اولدخی تسلیم سکلمه‌ی ماعدا باقی قالان اچی قرالچه‌سی
الی عروشدن مسطور اغلوب ذمیدهٔ یه وسع وطاقتی یوقدر دیو باکه امر ایتکله بندهٔ
امریله بنا ایتکله باقی مذکوری مسطور اغلوب ذمیدهٔ یه دفع وتسلیم اعتمله بالمواجهه
طلب ایدرم دیو بندهٔ دعوی ایتدکده انکار ایدوب بو وجهله بیعتدن اصلاح اولتقدیر
کشیه واقعه اولنمدیکی حالده بنا بر توسط مصلحیندن ایله بیعتدن اصلاح اولتقدیر
بهره بیعتدن اهده دعواجه بهره بیعتدن اهدك دستر ایدای عام صحیح شرعی الجرا
واستقاط وبهره بیعتدن وجه محرر اهدك ایدك اوسی قیدیله ایدیك اوسی قید الاقرار
والتصدیق ابو وجهله قطع نزاع ایلدکلری استاسبول محکمه سندهٔ حضور عالیلرینه
اعلام اولندی ۱۴۲ نجی شوال

معروض

عرضحال ایدن قیوجی اروتمه ولد ایسا بیم ذمی مجلس شرع منیرده بعرض ولد مرقومی
یم ذمی مواجهه سنده مسطور بعرض ذمی بیك ایکیوز اون اوچ سنه‌سی ربیع الاخیرك
اون بشنجی کونی تارنجیله موضع مرقوم قطعه مبایعه مجنی نامطیع اولدخی اون بدنه
ملکی وبیعی کونی اولان اناطولیلو یلاق آباد قضاسنده واقع بدر بکلر چفتلکی نامله
معروف بر قطعه چفتلك متزلی ودرون وتنج موجوده اوه تراس قبر صغیر ایکی وایکی تراس
بوزاغی وایکی تراس طوتیای وایکی چفت قره اوکوز وایکی تراس قبر اغاجی ثمن معلومه
ومقبوضه بالبیع وتسلیم بندهٔ ذمی استتری اوقبض ایتشکین چفتلك وحیوانات
مذکوره یه حضوری ضبط ایتکله باکه تسلیم تنبیه اولنمغله مطلوب محمد حجه دعوی ایلدیکی
حضور بغوص ذمی ذمی جواب بنده قضیه سؤال محرر اوزره اولدیغنی تصدیق چفتلك
مذکوره یالبلدرونتنج اولان حیوانات محرره مرقومه یه مدعی مرسوم اروتیای ذمی طرفندهٔ
متضمن دفع کیل ایلدیکی بدلك ولد سئول ذمی یه تعلقه تسلیم تعهد ایتکله اقرار وتعهدی موجب
جاوشی میاشر تسلیم وکیل مزبوره تسلیمنی باشقه بر قطعه امر عالیلری صدوری اقتضا
ایلدیکی استانبول محکمه سندهٔ حضور عالیلرینه اعلام اولندی ۱۴ نجی شوال

معروض

استانبول جهار شنبه بازاری قرنده قوجه‌حی دروه محلی امامی رسول افندی ابن حضر دفنه
حافظ محمد سعید والسیند محرر افندی ابن حسن وحسن اغا ابن محمد والسید عبد الرحیم
افندی ابن محمد ومحمد جلال الدین افندی ابن محمد سعید والسید مصطفی بن محمد وجوقدار
عثمان بن اغا ابن محمد والسید ولی الدین ابن مصطفی والحاج محمد افندی ابن عبد الله وبکر
محمد بن حسن وفیضی الله بن علی والحاج عثمان بن حسین والسید محمد افندی ابن خلیل
نام کسنه‌لر مجلس شرع منیرده محلهٔ مزبوره ساکنه لرندن واتی معرفه‌لرینه بعضه
نانلو اینهٔ الحاج علی نام خانونه مواجهه‌سنده مزبوره شش بیچه نانلو خانونه کندو
حالنجه اولمیوب خلیع العذار وبی اللسان اولدیغندن ناعادا محمد مدنی اصفهانی اولمغله
بادعاءات کندویه تنبیه الیکمزده ایضا مظلو مزبوره هر هروحشی التماسی ایتملر بله
اعیت وراحتجز بوقدر حجه بالمواجهه شکی ومحلهٔ مزبوره هر هروحشی التماسی ایتملر بله
جیغی بعد محلهٔ مزبوره ساکنه اولمیوب اهل محلده مستول تدارك ومحلدهٔ مزبوره حضوریله
مزبور شش بیچه نانلو خانونه تنبیه اولندیغی استانبول محکمه سندهٔ حضور عالیلرینه اعلام
اولندی ۱۴ نجی شوال الکرم

معروض

عرضحال ایدن پوری ولد ابندی مجلس شرع منیرده حاضر عرضحالی مسطور معرفه اشخاص
صلحقومنیت سطوری نام نصرانیه مواجهه‌سنده مرسوم وصلحقه نصرانیه آنها عاطلم مزاورج
زوجیته مدخول بهام الکی متدخل خمارونا شرفه اشبو حاضر باعلمجلس قرنجی اوغلی
نصرانیك متزلنده متکلم اولغله سئوال اولنوب متزلنه مکاوب معروف پوری ذمی رأی
تنبیه اولنمغله مزاورده دعوی ایتدکده اولدخی جواب بنده مدعی مرسوم پوری ذمی رأی
اولدیغی اقرار واعتراف ایتکله موجبنجه زوجی مرسومك متزلنه واروب حقوق
زوجیته مراعات ایتمك اوزره صلحقومنه وصلحقه نصرانیه یه تنبیه اولندیغی استانبول
محکمه سندهٔ حضور عالیلرینه اعلام اولندی ۱۵ نجی شوال

معروض

استانبول قرم قیوداخلنده باله بنا محله سنده متکن ارکیل ولد ابراهیم بن محلس شرع
منیرده ارتیا والصحاق ذمی مواجهه‌سنده تقریر مرام ایدوب اسلامبول محکمه سنده جامع
شریف قرنده واقع اوطه لری استغلالنه تندی سلطانی اوطه لری
دیمکله معروف خانی ودرونندهٔ خانی نوقانی وتختانی التقشی باب اوطه ودهلیز خانه
وخانهٔ مذکور واخلنده قیود اراسنده کائن ایکی باب دکانلر ودخانی مرقومه‌نك اوعلو
اوزرخانهٔ مذکور اخرنده کائن ایکی باب دکانلرم موجوهم کوك شتیر اولنور
اشبو مرقوم قطعه قرمانیه عائلی سطوفه‌نجه ملك شترام اولانه الات لازمه معلومه‌لری
یر باب اوطه وتختانی یدی باب اوطه وتختانی اوزرنده یدی باب اوطه وقیود اراسنده
خانهٔ مذکورم نوقانی یدی باب اوطه وتختانی اوزرنده اون بش باب اوطه ودهلیز اراسنده
خانهٔ مذکور ایکی باب دکانلر ایکی باب دکانلر ایکی باب دکانلر اولانه الات لازمه
معلومه‌لری بونده‌ی اقدم شرع معلوم ومقبوضه آخره باعلام شرعی بیع وتسلیم
اشبو حاضر باعلمجلس قرنجی اوغلی بیك عروش ذمیدهٔ یه وسع وطاقتی یوقدر دیو
باکه امر ایتکله بندهٔ امریله بنا ایتکله باقی مذکوری مسطور اغلوب ذمیدهٔ یه دفع
وتسلیم اعتمله بالمواجهه طلب ایدرم دیو بندهٔ دعوی ایتدکده انکار ایدوب بو وجهله
بیعتدن اصلاح اولتقدیر کشیه واقعه اولنمدیکی حالده بنا بر توسط مصلحیندن ایله
بیعتدن اصلاح اولتقدیر بهره بیعتدن اهده دعواجه بهره بیعتدن اهدك دستر ایدای عام
صحیح شرعی الجرا واستقاط وبهره بیعتدن وجه محرر اهدك ایدك اوسی قیدیله
ایدیك اوسی قید الاقرار والتصدیق ابو وجهله قطع نزاع ایلدکلری استاسبول محکمه سندهٔ
حضور عالیلرینه اعلام اولندی ۱۴ نجی شوال

معروض

صاحبهٔ عرضحالی نعیمه خاتونك زوجی الحاج علی مجلس شرع منیرده عرضحالی مذکوره
زاتك معرفه استانبول قرنجی حاجی حافظ ابراهیم اوغلی محمد نامنه مواجهه‌سنده
قاچ ایلی وزاغ شنه‌سی ثلثه اقرام خانونه محضرنده مزبوره یه مدعی اولمغله مدعی مزبور
وشریك فاطمه نامیله مالکلری اولدقلرینه بحجه مشتملو اوراق صحیحه‌سی ابراز ایلدکده
بحجت فرض وتقدیر اولنوب ثلثه مبلغ مفروض مذکوری بیع بیع مکه اقتدار اولنمغله
خط ونزیل اولنمش مراد مدار ویه اقتداری اولوب قدر معروف اولوب ادا ودن الحقیقه مبلغ مذکوری
سابقا مزبور یه ویرمکله اقتداری اولوب قدر معروف اولوب ادا ودن الحقیقه مبلغ مذکوری
طرفندن الحالهٔ نظر اقدار معروف اولدیغی السید مصطفی ابن السید الحاج محمد ویکر محمد
نامی خلیل نام کسنه‌لر باحواجه‌لری علی طریق الشراکه ضبط وبر مقابله مبلغ معروض مذکور
اون درت غروش یاه بهاء مزبوره امینه خانونه ادا وتسلیم ایلمکلری اقتضا ایلدیکی
مرقوم السید محمد افندی یه تعلیم اولندیغی استانبول محکمه سندهٔ حضور عالیلرینه اعلام
اولندی ۱۴ نجی شوال الکرم

Seyyid Mehmed Efendi'nin çocukları Seyyid Ali ve Şerife Fâtıma'ya Nafaka Tayini ile İlgili Belgenin Transkripsiyonu

Nafaka-yı sagīrânın mâh be-mâh edâsı iktizâ eylediği

Ma'rûz: Müderrisin-i kirâmdan sâhib-i arzuhâl Tabib es-Seyyid Mehmed Efendi b. el-Hâc Ali meclis-i şer'-i münîrde arzuhâlde mezkûre sâbıkā zevcesi zâtı mu'arrefe Emine bt. Ahmed nâm Hatun mahzarında mezbûre Emine Hatun ile mukaddemâ zevciyet beynimizde kāime iken firâşından hâsıllar ve zevcem mezbûreden mütevellîdler olan sulbî sagīr evlâdları es-Seyyid Ali ve Şerîfe Fâtıma'nın malları olmamağla nafakaları için her birine yedişer guruşdan cem'an on dört guruşar bâ-hüccet farz ve takdîr olunup lâkin meblağ-ı mefrûz-ı mezkûru benim vermeğe iktidârım olmamağla bir mikdârı hat ve tenzîl olunması murâdımdır deyü da'vâ ettikde ol dahi cevâbında meblağ-ı mefrûz-ı mezkûru zevc-i sâbıkım mezbûrun vermeğe iktidârı olup kadr-i ma'rûftur deyü iddi'â ve fi'l-hakīka meblağ-ı mezkûr tarefeynin haline nazaran kadr-i ma'rûf oluğunu es-Seyyid Mustafa b. es-Seyyid el-Hâc Mehmed ve diğer Mustafa b. Halil nâm kimesneler bi'l-muvâcehe alâ tarîkı'ş-şehâde haber vermeleriyle meblağ-ı mefrûz-ı mezkûr on dört guruşu mâh be-mâh mezbûre Emine Hatun'a edâ ve teslîm eylemesi iktizâ eylediği merkūm es-Seyyid Mehmed Efendi'ye tefhîm olunduğu İslâmbol Mahkemesi'nden huzûr-ı âlîlerine i'lâm olundu.

Fî 21 min-Şevvâli'l-mükerrem sene [1]216/[24 Şubat 1802].

Belgenin Değerlendirilmesi

Çalışmamızdaki bu belge, bir nafaka tayinine ilişkin hüccettir. Hüccet, kadı tarafından verilen ve taraflar arasındaki hukukî bir durumu tescil eden resmî belgedir. İncelenen örnekte, Tabib es-Seyyid Mehmed Efendi b. el-Hâc Ali'nin eski eşi Emine Hatun'dan olan küçük yaştaki iki çocuğu (Seyyid Ali ve Şerife Fâtıma) için ödemesi gereken nafaka miktarı belirlenmiş ve sicile kaydedilmiştir. Bu belge, şeriyye sicillerinde aile hukukuna ilişkin uygulamaların pratikteki yansımalarını gözler önüne seren somut bir örnek niteliğindedir. Kadı, tarafları dinlemiş, ekonomik durumlarını dikkate almış, şahitlerin ifadelerini değerlendirmiş ve nihayetinde şer'î hükümler doğrultusunda karar vermiştir. Bu durum, Osmanlı hukuk sisteminde nafaka tayininde hakkaniyet ilkesinin esas alındığını, aynı zamanda çocukların korunmasına yönelik sosyal bir hassasiyetin gözetildiğini göstermektedir. Öte yandan, belgenin taraflarından birinin seyyid oluşu, seyyidlerin aile içi meselelerde de diğer fertlerle aynı hukukî prosedürlere tabi olduklarını ortaya koymakta; ayrıcalıklı konumlarının adalet mekanizmasının işleyişini gölgelemediğini açıkça göstermektedir.

Belgede kullanılan Osmanlıca ifade tarzı, klasik İslam hukuk literatürünün karakteristik üslubunu yansıtmaktadır. Metinde 'nafaka-yı sagīrân' (küçüklerin nafakası), 'mâh be-mâh edâ' (aylık ödeme), 'meblağ-ı mefrûz' (farz kılınan miktar) ve 'kadr-i ma'rûf' (örfe uygun/bilinen miktar) gibi teknik tabirlerin tercih edilmesi, Osmanlı yargı dilinin sistematik ve yerleşik bir terminolojiye dayandığını göstermektedir. Bu kalıplar, kadı kararlarının keyfîlikten uzak, belirli bir hukukî teamül çerçevesinde alındığını ortaya koyduğu gibi şer'î hukukun mahkeme kayıtlarına doğrudan yansıyan kavram dünyasını da somutlaştırmaktadır. Dolayısıyla bu belge, hem hukukî terminolojinin sürekliliğini hem de Osmanlı aile hukukunun pratik uygulamalarda nasıl şekillendiğini gösteren bir örnektir.

Bu belge, Seyyid Mehmed Efendi'nin aile yapısı, ekonomik durumu, mahkemenin işleyiş biçimi hakkında çok yönlü veriler sunmaktadır. Özellikle nafaka hücceti, Osmanlı aile hukukunun uygulamadaki yansımalarını göstermesi bakımından önem taşımakta; bunun yanı sıra sosyal tarih ve nesep araştırmaları için de değerli bir kaynak niteliği arz etmektedir. Kadının (Emine Hatun) mahkemede hazır bulunarak hakkını bizzat talep etmesi, Osmanlı toplumunda kadınların hukukî olarak sürece doğrudan katıldıklarını ve haklarını arama konusunda aktif rol

oynadıklarını ortaya koymaktadır. Tarafların seyyid olarak kayda geçirilmesi, seyyidlik statüsünün hukukî metinler aracılığıyla denetime tabi tutulduğunu göstermekte; böylece nesep zincirinin hem resmî hem de toplumsal düzeyde kayıt altına alınmasına katkıda bulunmaktadır. Bu yönüyle belge, Osmanlı'da hukukî normların, toplumsal ilişkilerin ve seyyid kimliğinin kesiştiği noktaları aydınlatan önemli bir örnek teşkil etmektedir.

Sonuç

Osmanlı kadı sicilleri, imparatorluğun toplumsal, ekonomik ve dinî yapısını aydınlatan çok yönlü kaynaklardır. Bu çalışmada, seyyidlere dair kayıtlar üzerinden hem aile hukuku hem de toplumsal ilişkiler bağlamında ortaya çıkan hukukî süreçler ele alınmıştır. Nafaka, miras, evlenme ve boşanma gibi aile hukukuna ilişkin davalar, Osmanlı mahkemelerinin adalet anlayışında titiz bir yaklaşımı benimsediğini ve toplumsal düzenin korunmasına büyük önem atfettiğini göstermektedir.

Kadı sicillerinde yer alan siyâdet hüccetleri ve nesebnâmeler, seyyidlik iddialarının tescil ve denetimi bakımından müstesna bir önem arz etmektedir. Bu belgeler, Osmanlı'nın Ehl-i Beyt'e atfettiği itibarı kurumsal zeminde güvence altına aldığını, aynı zamanda sahte iddiaların önüne geçerek toplumsal güveni pekiştirdiğini ortaya koymaktadır. Nakîbü'l-eşrâf ve kaymakamlarının atama kayıtları da seyyidlik kurumunun yalnızca sembolik bir aidiyet olmadığını, aynı zamanda idarî bir fonksiyon icra ettiğini kanıtlamaktadır.

Bu kayıtların sistematik analizi, Osmanlı hukuk sisteminin işleyişine, adalet dağıtımının toplumsal meşruiyetle ilişkisine ve Ehl-i Beyt'e yönelik saygının devlet mekanizmasındaki yansımalarına ışık tutmaktadır. İncelenen belgeler, Osmanlı mahkemelerinin tarafları sorgulayan, şahitleri dinleyen ve hakkaniyeti gözeten bir işleyişe sahip olduğunu somut biçimde göstermektedir.

Sonuç olarak, seyyidlerle ilgili dava ve belgeler, aynı zamanda Osmanlı'nın Ehl-i Beyt'e bakışını, toplumsal meşruiyet mekanizmalarını ve adalet anlayışını yansıtan tarihî vesikalar niteliğindedir. İncelenen kayıtlar, seyyidlerin evlilik, boşanma, nafaka ve miras gibi davalarda toplumun diğer kesimiyle aynı şer'î sürece tabi tutulduklarını; buna karşın nesep ve siyâdetlerinin devlet nezdinde tescil edilerek koruma altına alındığını göstermektedir.

Gelecekte yapılacak karşılaştırmalı çalışmalar, farklı bölge ve dönemlere ait kadı sicillerinin mukayeseli incelenmesiyle daha zengin veriler sağlayacaktır. Böylece seyyidlerin Osmanlı toplumundaki statüsünün tarihsel seyri, merkez-taşra ilişkilerindeki konumu ve toplumsal meşruiyet üretimindeki işlevi daha bütüncül biçimde ortaya konabilecektir. Kadı sicilleri, bu yönüyle hem tarih hem hukuk hem de ilahiyat araştırmaları için vazgeçilmez birincil kaynak olma niteliğini sürdürmektedir.

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ROLE OF COMPUTER IN FRAUD DETECTION AND PREVENTION IN THE NIGERIAN BANKING SECTOR

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ABSTRACT

The computer machine and computer technologies are both human oriented. Though, the computer is brilliant and intelligent, it cannot compete with human. The main aim of the study is to examine the role of computers in fraud detection and prevention in the Nigeria banking industry. The study adopted descriptive survey design in analyzing a sample of 150 respondents. The findings of the study revealed that the selected banks are providing training to employees regarding the use and understanding of computer-based fraud detection and prevention systems. Majority of the respondents responds on skill shortages as the main challenge or concern. Majority of the respondents agreed that there are cybersecurity threats or vulnerabilities that your bank faces in relation to computerized fraud detection and prevention systems. Majority of the respondents responds on employee training. Majority of the respondents responds on Customer Education. Hence, the study recommends that all banks and other financial institutes in Nigeria (including the Community banks and finance companies) should computerize all their operations and the federal government should subsidize the cost of electronic Computer so as to make affordable by some banks that have how asset e.g., the community banks.

TİCARİ İÇME SULARINDA TESPİT EDİLEN FUNGUSLARIN DNA BARKODLAMASI İLE TESPİTİ, MİKOTOKSİN ÜRETME BECERİSİ VE DİĞER ÜLKELERDEN VAKA ANALİZLERİ

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Küresel iklim değişimi, yoğunlaşan sanayileşme, şehirleşme ve tarım faaliyetleri ile artan kirlenme sonucunda temiz su kaynakları giderek azalmaktadır. Toprağın doğal florası ve mikrobiyotası da bozularak tahrip olmaktadır. Bunun sonucunda dirençli funguslar baskın hale gelmekte, ürettikleri mikotoksinler ile yeraltı su kaynaklarını enfekte etmektedir. Su kaynakları içerisinde mevcut çevre dostu fungusların yanı sıra su güvenliğini tehdit eden mikotoksin üreten zararlı fungus etkenlerini ayırt etmek önemlidir. Bu amaçla, su örneklerinden izole edilen fungusların moleküler olarak tanımlanması gereklidir.

Ticari ambalajlı içme sularının kimyasal içerikleri ve bakteriyel kontaminantları halk sağlığı düzenlemeleriyle kontrol edilse de mantar kaynaklı etmenler ve bunların toksik metabolitleri üzerine mevcut kriterlerde önemli eksiklikler bulunmaktadır. Bu çalışmada, Batı Anadolu'daki çeşitli su kaynaklarından elde edilen ve İzmir ile çevre illerde satışa sunulan 19 litrelik polikarbonat damacanalarda dolum yapılan ticari markalara ait ambalajlı sular rastgele seçilmiş ve fungal kontaminasyon açısından incelenmiştir.

Fungusların izolasyonu membran filtrasyon tekniğiyle gerçekleştirildi ve sonuçlar koloni oluşturan birim (CFU)/100 ml üzerinden değerlendirildi. İzolatların ön tanımlaması fenotipik yöntemlerle yapılırken, kesin tanımlama için ITS bölgesinin amplifikasyonu PCR yoluyla gerçekleştirilmiş ve elde edilen sekans verileri BLAST analiziyle NCBI veri tabanı ile karşılaştırılmıştır. 31 izolat üzerinde yapılan tür tayininde 25 küf ve 6 maya suşu tanımlanmış, moleküler veriler *Aktin* gen bölgesi ile de desteklenmiştir.

Fungal türler arasında özellikle *Cladosporium, Penicillium* ve *Alternaria* suşları baskın olarak tespit edilmiştir. Ayrıca, *Penicillium, Aspergillus, Alternaria* ve *Cladosporium* cinslerinin mikotoksin üretim potansiyelleri, amonyum buhar testi, LC-MS ve HPLC yöntemleriyle incelenmiştir. *Penicillium citrinum* B4 suşunun Sitrinin üretim kapasitesi özellikle dikkat çekmiş; LC-MS analizinde 411.586 µg/l düzeyinde Sitrinin varlığı saptanmıştır. Bu değer, içeceklerde izin verilen maksimum düzeyin oldukça üzerinde olup, potansiyel bir halk sağlığı riski ortaya koymaktadır.

Norveç' te yapılan bir çalışmada önde gelen beş şişelenmiş su markasının mikrobiyolojik kalitesi araştırılmıştır. Bir izolat (*Aureobasidium pullulans)* insan enfeksiyonlarıyla ilişkilendirilmiş, diğer bir su markasında ise *Cryptococcus magnus* olarak tanımlanan 2 maya kolonisi üremiştir. Diğer maya ise varsayımsal olarak *Heliotiales sp. bjelland* olarak tanımlanmıştır.

Tüm bu bulgular, mevcut mevzuatın yalnızca bakteriyel değil aynı zamanda fungal kontaminantlar ve bunların mikotoksinlerini de kapsayacak şekilde genişletilmesi gerektiğini göstermektedir. Çalışma, Türkiye'de ambalajlı sularda mantar kontaminasyonu ve mikotoksin oluşumu üzerine gerçekleştirilen ilk kapsamlı araştırma olup, bu alanda yapılacak düzenlemelere bilimsel temel sunmaktadır.

Anahtar Kelimeler: DNA Barkodlama, LC-MS/HPLC analizleri, Fungal kontaminasyon, Mikatoksin, *Penicillium citrinum*.

DNA BARCODING OF FUNGI IN COMMERCIAL DRINKING WATER: MYCOTOXIN PRODUCTION POTENTIAL AND INTERNATIONAL CASE STUDIES

Global climate change, intensified industrialization, urbanization, and agricultural practices are progressively depleting clean water resources and disrupting the natural soil flora and microbiota. Consequently, resistant fungi become dominant and contaminate groundwater through the production of mycotoxins. Distinguishing between environmentally benign fungi and mycotoxin-producing species that pose potential risks to water safety is therefore essential. To this end, molecular identification of fungal isolates from water samples is required.

Although the chemical composition and bacterial contaminants of commercial bottled waters are monitored under public health regulations, fungal agents and their toxic metabolites remain largely unregulated. In the present study, commercial bottled water brands, filled in 19-L polycarbonate containers from various sources in Western Anatolia and distributed in İzmir and neighbouring provinces, were randomly selected and analyzed for fungal contamination.

Fungal isolation was performed using the membrane filtration technique, and results were quantified as colony-forming units (CFU)/100 mL. Preliminary identification was based on phenotypic methods, while definitive identification was conducted through PCR amplification of the ITS region, followed by BLAST comparison with the NCBI database. A total of 31 isolates were characterized, comprising 25 molds and 6 yeasts, with species-level identification further validated by Actin gene sequencing.

The most frequently detected genera were *Cladosporium*, *Penicillium*, and *Alternaria*. The mycotoxin-producing potential of *Penicillium*, *Aspergillus*, *Alternaria*, and *Cladosporium* isolates was assessed by ammonium vapor assay, LC-MS, and HPLC. Notably, *Penicillium citrinum* strain B4 exhibited a pronounced ability to synthesize Citrinin, with LC-MS confirming a concentration of 411.586 µg/L—far exceeding the maximum permissible levels in beverages, thereby representing a considerable public health concern.

Comparable international findings reinforce these concerns. For instance, a Norwegian survey of five leading bottled water brands reported fungal contaminants, including *Aureobasidium pullulans* (linked to human infections), *Cryptococcus magnus*, and a presumptive *Heliotiales* sp. isolate.

Collectively, these results highlight the urgent need to expand current bottled water regulations to address not only bacterial but also fungal contaminants and their associated mycotoxins. This investigation represents the first comprehensive assessment of fungal contamination and mycotoxin occurrence in bottled waters in Turkey, providing a critical scientific foundation for future regulatory frameworks.

Keywords: DNA barcoding, LC-MS/HPLC analyses, fungal contamination, mycotoxin, *Penicillium citrinum*

MANYETİK GRAFEN OKSİT İLE KONJÜGE EDİLMİŞ TERAPÖTİK AJANIN TASARIMI VE SENTEZİ

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ÖZET

Kanser, anormal şekilde büyüyüp vücudun diğer bölgelerine yayılabilen geniş bir hastalık grubudur. Kanser tedavisinde çeşitli yöntemler kullanılır. Cerrahi, tümörlerin çıkarılmasında çok etkilidir. Ancak bu yöntemler düşük evreli tümörlerle sınırlıdır ve yüksek evreli tümörlere yeterince uygulanamaz. Bununla birlikte, kemoterapi ile bile iyileşme garantisi yoktur. Fotodinamik tedavi (PDT), geçmişten günümüze birçok hastalığın tedavisinde kullanılan başarılı ve klinik olarak onaylanmış bir tedavi yöntemidir. PDT'de kullanılan FDA onaylı ilaçlar olsa da, bunlar istenen düzeyde değildir ve son zamanlarda yeni PDT ajanlarına olan ilgi artmaktadır. Fototermal tedavi (FTT), bilim camiasında ilgi gören bir başka foto-bazlı tedavi yöntemidir. Fototermal terapi; iyi terapötik etkinlik, düşük toksisite, yüksek hedefleme ve uygulanabilirliğe sahip, noninvaziv bir tekniktir. Fototermal terapi, mükemmel tümör dokusu temizleme kabiliyeti ve basit dokulara neredeyse hiç zarar vermemesi nedeniyle önemlidir. Uygulanan tedavi yöntemlerinin avantaj ve dezavantajlarına ek olarak, kanserin kişiye özgü bir hastalık olması ve tedavilerin kişiden kişiye farklılık gösterebilmesi de iyileşme sürecini etkiler. Bu nedenle, malign tümörler için nihai tedaviyi ve antikanser etkinliğini en üst düzeye çıkarmak için yeni ilaçlar ve kombinasyon tedavileri gereklidir.
Bu çalışmada, kanser tedavisini mümkün kılacak terapötik ve tanısal özelliklere sahip manyetik grafen oksit (Fe_3O_4@GO) ve skuarin (SQ) bileşiklerinin sentezi ve karakterizasyonu gerçekleştirilmiş yapıları spektroskopik yöntemlerle aydınlatılmıştır.
Anahtar Kelimeler: Grafen Oksit, Skuarin, Teranostik, Fototermal Terapi, Fotodinamik Terapi

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DESIGN AND SYNTHESIS OF A THERAPEUTIC AGENT CONJUGATED WITH MAGNETIC GRAPHENE OXIDE

Abstract

Cancer is a large group of diseases that can grow abnormally and spread beyond its normal limits to other parts of the body. Various methods are used in the treatment of cancer. Surgery is very effective in removing tumors. However, these are limited to low-stage tumors and cannot be adequately applied to high-stage tumors. However, even with chemotherapy, there is no guarantee of recovery. Photodynamic therapy (PDT) is a successful and clinically approved treatment method used for the treatment of many diseases from past to present. Although there are FDA-approved drugs used in PDT, it is not at the desired level and there has been an increasing interest in new PDT agents recently. Photothermal therapy (FTT) is another photo-based treatment modality that has attracted interest in the scientific community. Photothermal therapy; it is a noninvasive technique with good therapeutic efficacy, low toxicity, high targeting, and applicability. Photothermal therapy is important because of its excellent tumor tissue clearance ability and virtually no damage to simple tissues. In addition to the advantages and disadvantages of the applied treatment methods, the fact that cancer is a disease specific to the person and the treatments may differ from person to person affect the healing process. Therefore, new drugs and combination therapies are needed to maximize the ultimate treatment and anticancer efficacy for malignant tumors.

In this study, the synthesis and characterization of magnetic graphene oxide (Fe_3O_4@GO) and squarantine (SQ) compounds possessing therapeutic and diagnostic properties that enable cancer treatment were performed, and their structures were elucidated using spectroscopic methods.

Keywords: Graphene Oxide, Squaraine, Theranostic, Photothermal Therapy, Photodynamic Therapy

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PROTECTIVE ANTIOXIDANT AND ANTI-INFLAMMATORY EFFECTS OF ISOFURFURAL AGAINST DRUG-INDUCED INJURY IN RATS

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Abstract

Keywords: Hepatoprotection, Antioxidative, Anti-inflammation, Nrf2, Acute liver injury

Iso Furfural has been reported to possess anti-inflammatory potential. Acetaminophen (APAP) overdose remains one of the most common causes of acute liver injury (ALI) worldwide. The nuclear factor erythroid 2–related factor 2 (Nrf2) is a pivotal transcription factor that regulates antioxidant defense systems and modulates inflammation in various pathological states.

This study aimed to investigate the hepatoprotective effects of ISO FURFURAL in a murine model of APAP-induced hepatotoxicity, with emphasis on its antioxidant, anti-inflammatory, and Nrf2-mediated mechanisms. Initially, the antioxidant activity of ISO FURFURAL was validated using the in vitro DPPH radical scavenging assay. In vivo, mice were pre-treated orally with ISO FURFURAL at doses of 25, 50, 75, and 100 mg/kg for seven consecutive days. On day seven, after a 16-hour fasting period, hepatotoxicity was induced via a single intraperitoneal dose of APAP (300 mg/kg). Liver function biomarkers, oxidative stress parameters, histopathological alterations, and molecular markers were assessed.

ISO FURFURAL pre-treatment significantly attenuated APAP-induced hepatic injury, as reflected by decreased serum levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and total bilirubin (TB). ISO FURFURAL also restored antioxidant enzyme levels—including catalase, glutathione (GSH), and superoxide dismutase (SOD)—and reduced oxidative markers such as malondialdehyde (MDA) and nitric oxide (NO). Histological examination revealed substantial preservation of liver architecture.

Furthermore, ISO FURFURAL markedly suppressed the expression of pro-inflammatory cytokines (IL-1β, IL-6, TNF-α) at both mRNA and protein levels, as confirmed by RT-qPCR and ELISA. Notably, ISO FURFURAL inhibited the expression of CYP2E1, a key enzyme involved in APAP bioactivation, and significantly upregulated Nrf2 and its downstream target NQO-1 in hepatic tissues.

In conclusion, 1,2,3-Trimethoxy-5-methylbenzene exhibits potent hepatoprotective effects against APAP-induced liver damage, primarily through the activation of Nrf2 signaling and modulation of oxidative and inflammatory responses. These findings support its potential therapeutic application in managing drug-induced hepatotoxicity.

Keywords

1,2,3-Trimethoxy-5-methylbenzene; Acetaminophen; Hepatotoxicity; Nrf2 pathway; Oxidative stress; Inflammation; Antioxidant enzymes; CYP2E1; Liver injury; Natural compound.

COMPARING JAPAN'S POST-COVID ECONOMY TO GERMANY'S ECONOMY

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Abstract: The purpose of the paper is to assess the post-Covid Japan's economy. Two sets of forecasts are generated between Q2 2022 and Q4 2050: forecasts using historical data including the pandemic (from Q1 1998 to Q1 2022) and not including the pandemic (from Q1 1998 to Q3 2019). The computation of the difference of their averages is an indicator of the post-pandemic sustainability of the economy, the greater the difference the greater the sustainability. Used as a benchmark, Germany's economy shows a lower sustainability to the Covid-19 pandemic (-0.08%) than Japan's economy (+0.17%) based on Q2 2022-Q4 2050 forecasts. However, the average of Q2 2022-Q4 2050 quarterly (annualized) growth rate forecasts of Germany's economy is expected to be +0.92% with the Q1 1998-Q1 2022 historical data (including the pandemic) whereas it is expected to be only +0.64% for Japan's economy.
Keywords: GDP; Wavelet Analysis; Forecasting; Japan's economy; Germany's economy.

JEL classification: C01; C5; C53; E3; E17; E37.

A BIBLIOMETRIC ANALYSIS OF HEALTH TOURISM LITERATURE: ECONOMIC IMPACTS AND POLICY IMPLICATIONS

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ABSTRACT

Health tourism is emerging as a strategic area that is gaining increasing importance in the healthcare systems and national economies of both developed and developing countries. This area encompasses not only the international mobility of medical services but also the processes by which countries build competitive advantage, generate foreign exchange inflows, and reshape healthcare policies. The aim of this study is to analyze health tourism literature using bibliometric methods to identify trends in academic production, leading countries, key themes, and research collaborations. Furthermore, it relates these findings to the economic outcomes of health tourism and its strategic importance for policymakers.

The study analyzed academic publications published in the Web of Science database between 2000 and 2025. Bibliometric methods were used to assess trends in the number of publications, citation networks, author and country collaborations, and keyword clusters. Visualization were performed using VOSviewer software. The findings demonstrate that health tourism research has gained significant momentum in the last decade, with the themes of "economic impacts", "sustainability", "policy strategies" and "competitive advantage" being particularly frequently discussed in the literature.

This study makes a unique contribution by not only mapping the field of health tourism bibliometrics as an academic field but also by interpreting the findings from a political economy perspective. The results demonstrate how countries can leverage academic literature in developing health tourism policies and provide a guiding framework for researchers, policymakers, and industry representatives.

Keywords: Health tourism, bibliometric analysis, economic impacts, policy strategies.

A SHORT REVIEW ON CANCER NANOTECHNOLOGY;CURRENT STATUS AND PERSPECTIVES

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Abstract:
Modern medicine has been waging a war on cancer for nearly a century with no tangible end in sight. Cancer treatmentshave significantly progressed, but the need to increase specificity and decrease systemic toxicities remains.Early diagnosis holds a key to improving prognostic outlook and patient quality of life, and diagnostic tools are on thecusp of a technological revolution. Nanotechnology has steadily expanded into the reaches of cancer chemotherapy,radiotherapy, diagnostics, and imaging, demonstrating the capacity to augment each and advance patient care.Nanomaterials provide an abundance of versatility, functionality, and applications to engineer specifically targetedcancer medicine, accurate early-detection devices, robust imaging modalities, and enhanced radiotherapy adjuvants.This review provides insights into the current clinical and pre-clinical nanotechnological applications for cancer drug therapy, diagnostics, imaging, and radiation therapy.
Keywords: Cancer, Clinical translation, Diagnostics, Nanomedicine, Radiation, Theranostics.

Introduction:
Cancer remains one of the most formidable challenges in healthcare, necessitating innovative approaches for diagnosis, treatment, and management. Nanotechnology, the manipulation of materials at the nanoscale, has emerged as a promising avenue to revolutionize cancer research and therapy. The convergence of nanotechnology with oncology, termed cancer nanotechnology, holds immense potential to address the limitations of traditional cancer treatments and diagnostics.

Diagnostic Imaging:
Nanotechnology has also contributed to the advancement of cancer diagnostics through improved imaging techniques. Nanoparticles with inherent imaging properties or those functionalized with imaging agents can be employed for early cancer detection and accurate localization of tumors. Quantum dots, magnetic nanoparticles, and gold nanoparticles are among the nanomaterials utilized to enhance the sensitivity and specificity of imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET).

Challenges and Future Directions;
While the field of cancer nanotechnology has made significant strides, challenges remain. Issues such as nanoparticle toxicity, manufacturing scalability, and regulatory considerations need to be addressed for clinical translation. Moreover, the complexity of the tumor microenvironment poses a challenge for effective nanoparticle delivery.Looking ahead, the future of cancer nanotechnology holds exciting possibilities. Advances in nanomateri design,coupled with a deeper understanding of tumor biology, may lead to more sophisticated and targeted nanotherapeutics. The incorporation of artificial intelligence and machine learning in the analysis of complex biological data could further enhance the precision of cancer nanomedicine.

Principle of nanotechnology:

The principles of nanotechnology are based on the manipulation and control of materials at the nanoscale, typically at dimensions less than 100 nanometers. At this scale, the unique physical, chemical, and biological properties of materials emerge, enabling novel applications across various fields. The principles of nanotechnology encompass both the understanding and manipulation of nanoscale phenomena. Here are some key principles:

Size and Scale:

Nanoscale Dimensions: Nanotechnology deals with structures and materials at the nanoscale, typically ranging from 1 to 100 nanometers. At this size, materials exhibit properties different from those at the macroscopic scale.

Quantum Effects:

Quantum Mechanics: Nanoscale particles often display quantum effects, where the behavior of particles is influenced by quantum mechanics. Quantum dots, for example, exhibit size-dependent electronic and optical properties.

Surface-to-Volume Ratio:

Increased Surface Area: As materials are reduced to the nanoscale, the surface area relative to volume becomes significantly larger. This high surface-to-volume ratio is a fundamental aspect that contributes to the unique properties of nanomaterials.

Self-Assembly:

Spontaneous Organization: Nanotechnology leverages the ability of certain materials to self-assemble. At the nanoscale, particles may spontaneously organize into specific structures or patterns, driven by various forces such as Van der Waals forces or hydrogen bonding.

Understanding and applying these principles enable scientists and engineers to explore and exploit the unique properties of materials at the nanoscale, leading to innovations in diverse fields.

Nanotechnology is inherently interdisciplinary, drawing knowledge from physics, chemistry, biology, engineering, and materials science.

Materials at the nanoscale often exhibit unique properties compared to their macroscopic counterparts, such as increased surface area, altered optical properties, and improved conductivity.

Nanomaterials for improved mechanical, thermal, and electrical properties.

Nanotechnology raises ethical concerns related to environmental impact, health and safety, privacy, and potential misuse.

Tools like atomic force microscopy (AFM) and scanning tunneling microscopy (STM) allow scientists to visualize and manipulate materials at the atomic scale.

Nanotechnology is a rapidly evolving field, with continuous innovation leading to new materials, devices, and applications.

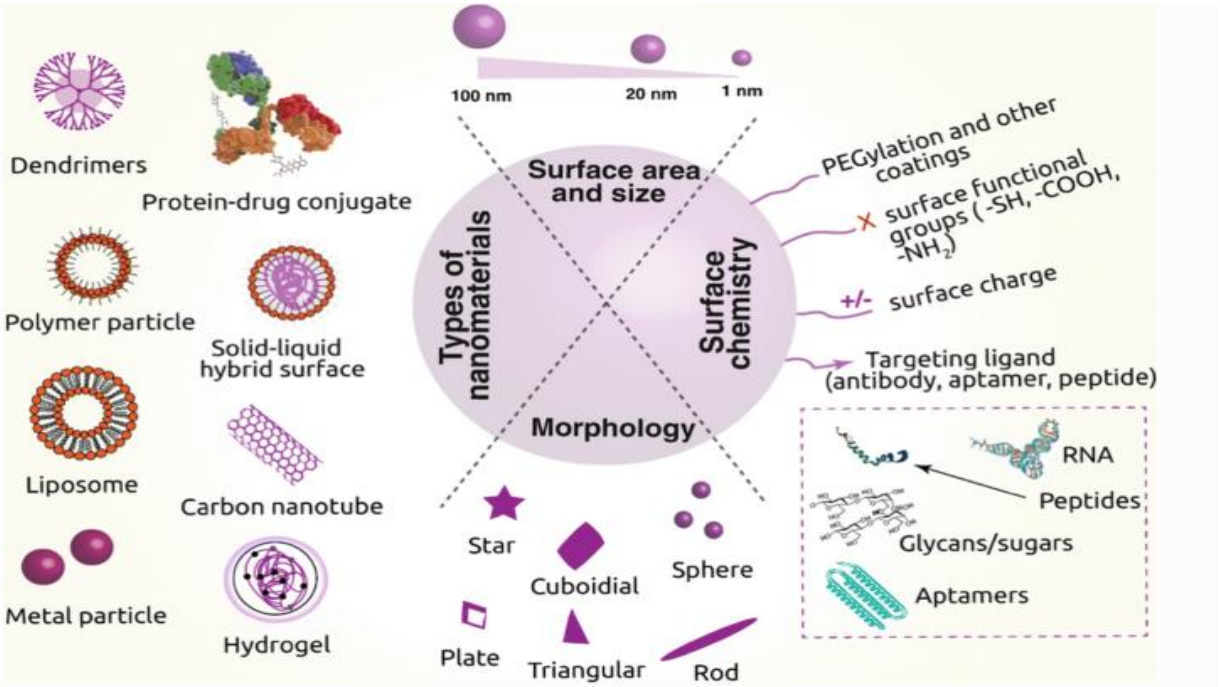

Fig no:0.1 Principle of cancer nanotechnology.

Application of Nanotechnology:

Cancer nanotechnology refers to the application of nanotechnology, the manipulation of materials at the nanoscale (typically at dimensions less than 100 nanometers), for the diagnosis, imaging, and treatment of cancer. This field has shown great promise in improving the specificity and effectiveness of cancer therapies while minimizing damage to healthy tissues.Cancer nanotechnology is a rapidly evolving field, and ongoing research continues to explore new ways to leverage nanomaterials for improved cancer diagnosis and treatment. The ability of nanoparticles to interact with biological systems at the molecular and cellular levels opens up innovative possibilities for personalized and targeted cancer therapies.

Cancer Diagnostics:

Cancer nanotechnology has significantly advanced cancer diagnostics by providing innovative tools and approaches to detecCancer diagnostics involve the identification and characterization of cancerous cells or tissues. Early and accurate diagnosis is crucial for effective treatment and improved outcomes for cancer patients. t and characterize cancer at the molecular and cellular levels. Here are some key aspects of cancer diagnostics using nanotechnology:Early detection of cancer greatly improves the chances of successful treatment. The choice of diagnostic method depends on factors such as the type of cancer suspected, its location, and the overall health of the patient. Treatment decisions are often based on the information gathered through these diagnostic methods.

Future cancer Diagnostics Therapy:

The future of cancer diagnostics and therapy in nanotechnology holds exciting possibilities, with ongoing research focusing on improving the precision, effectiveness, and personalization of cancer treatments. Here are some potential directions for the future of cancer diagnostics and therapy in nanotechnology:The future of cancer diagnostics and therapy in nanotechnology holds exciting possibilities, with ongoing research focusing on improving the precision, effectiveness, and personalization of cancer treatments. Here are some potential directions for

the future of cancer diagnostics and therapy in nanotechnology:

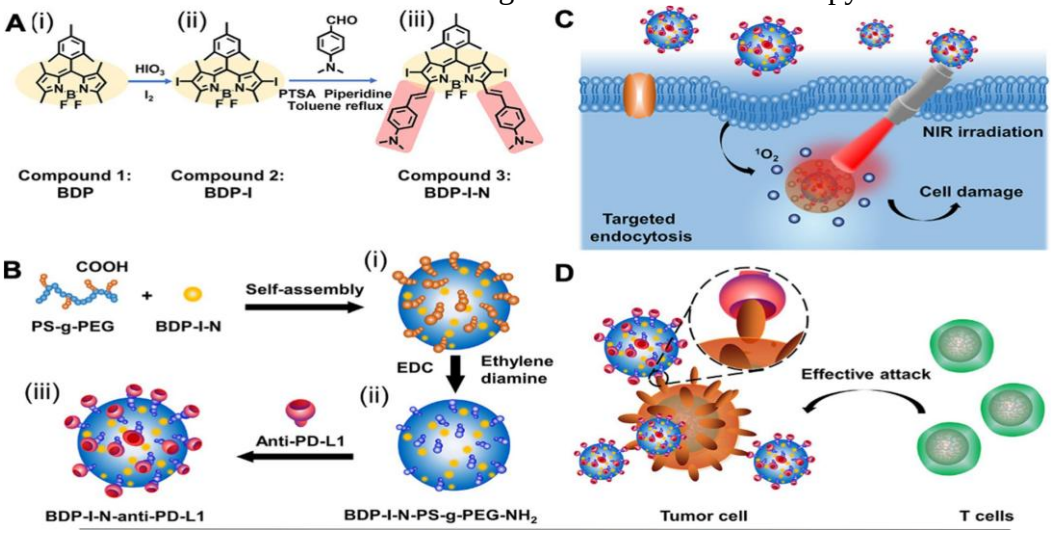

Fig no 0.1: Diagnostics Therapy.

Cancer Ratiotion:

Cancer radiation, also known as radiation therapy or radiotherapy, is a medical treatment that uses high doses of radiation to target and destroy cancer cells. The goal of radiation therapy is to shrink tumors, stop the growth of cancer cells, and alleviate symptoms. It can be used as a primary treatment or in conjunction with surgery, chemotherapy, or immunotherapy, depending on the type and stage of cancer.Radiation therapy is a highly specialized and individualized treatment. The decision to use radiation, the type of radiation, and the treatment plan are determined by a multidisciplinary team of oncologists, radiation therapists, medical physicists, and other healthcare professionals based on the specific characteristics of the cancer and the patient's overall health.

Cancer of nanotechnology and status:

As of my last knowledge update in January 2022, cancer nanotechnology research and development were active fields with ongoing advancements. However, specific developments and the current status may have evolved since then. Here's a general overview of the status of cancer nanotechnology up to 2022:It's important to check more recent sources or updates from the scientific community for the latest developments in cancer nanotechnology. As the field is dynamic, ongoing research may have led to new breakthroughs or changes in the status of specific technologies and approaches. Researchers and institutions globally continue to explore innovative ways to apply nanotechnology to improve cancer diagnostics and therapy.

Cancer of nanotechnology and perspectives:

As of my last knowledge update in January 2022, cancer nanotechnology has shown considerable promise and has provided new perspectives for the diagnosis and treatment of cancer. Here are some key perspectives on cancer nanotechnology:As the field of cancer nanotechnology continues to evolve, ongoing research aims to translate promising preclinical findings into clinically viable solutions. The perspectives outlined here underscore the potential of nanotechnology to revolutionize cancer diagnosis and therapy by providing more effective, targeted, and personalized treatment options. For the latest developments, it's recommended to refer to more recent scientific literature and updates from the research community.

Conclusion:

In conclusion, while nanotechnology holds great promise in revolutionizing cancer diagnosis and treatment, there are still challenges that need to be addressed for its widespread clinical implementation. Ongoing research and collaboration across disciplines are essential to overcome these challenges and unlock the full potential of nanotechnology in the fight against cancer. It's recommended to check more recent sources for the latest developments in this

rapidly advancing field.Nanotechnology has shown promising potential in cancer diagnosis, imaging, and treatment. Researchers have been exploring various nanoscale materials, such as nanoparticles, for targeted drug delivery, imaging contrast agents, and theranostics (combined therapy and diagnostics). Some key points to consider in the conclusion of the current status and perspectives of nanotechnology in cancer.

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INTERPRETABLE FUSION OF ACOUSTIC FEATURES FOR MULTICLASS VOICE DISORDER DETECTION

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Abstract
Voice pathology refers to disorders of the vocal folds that change voice quality, making timely, accurate, and transparent assessment essential for care. This paper presents XAI-Weighted Feature Fusion (XAI-WFF), a simple and interpretable way to combine multiple acoustic feature families for multiclass voice-pathology classification. Rather than giving every feature set the same influence, the method learns how much each feature—MFCC, eGeMAPS, wavelet scattering, and WST1—actually helps. A lightweight model is trained for each feature on training folds, and explanation scores (SHAP or LIME) are computed only on the held-out validation folds to avoid information leakage. Mean absolute scores are averaged to produce one importance value per feature, stabilized with a small epsilon, and normalized so that all weights are non-negative and sum to one.
During fusion, each feature is scaled by the square root of its learned weight and all families are concatenated to form a single representation. A classifier is trained on this fused matrix with cross-validated model selection using macro-F1 or accuracy. No special architecture is required; the approach works with SVMs, random forests, or boosting models. Because weights reflect explanation scores rather than heuristics, the fusion stays aligned with evidence from data while remaining model-agnostic and easy to reproduce. Optional refinements include distributing a feature's weight across individual features and adding class-conditional variants when needed. XAI-WFF balances performance and accountability. It reduces guesswork in feature fusion, supports imbalanced datasets through macro-F1-guided selection, and clarifies why certain features matter more, making the method practical for voice-health applications worldwide.
Keywords: Explainable AI; Feature fusion; Voice pathology; SHAP/LIME

EXPLORING CATALYTIC STRATEGIES FOR N-ARYLATION OF BENZIMIDAZOLE

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Abstract:
The N-arylated benzimidazoles are important structural motifs in many biologically active compounds. Due to their unique structural and physicochemical properties, they are used in different fields, including medicinal chemistry, material sciences, and catalysis. Synthetic chemists have designed a variety of pathways to perform the efficient N-arylation of benzimidazoles. Transition metal-based catalysis has been found as a key strategy, using metals such as copper (Cu), iron (Fe), palladium (Pd), nickel (Ni), iridium (Ir), and ruthenium (Ru). These catalysts, which are supported by different types of ligands, access to the selective and efficient synthesis of N-aryl bonds under a wide range of reaction conditions. Cross-coupling reactions, such as the Chan-Lam, Ullmann, and Buchwald-Hartwig protocols, are commonly utilized due to their durability and scalability. Metal-free techniques offer environment friendly options, and multicomponent reactions gave the benefit of convergent synthesis. Microwave-assisted reactions and photocatalyzed procedures helped to improve the efficiency, selectivity, and sustainability of N-arylation reactions. The review provides a comprehensive overview of the recent advancements and strategies employed in synthesizing this important class of heterocyclic compounds, highlighting their versatility and significance.

"POTENTIAL IMPACT OF DIETARY PHYTOESTROGEN ON THE GROWTH AND REPRODUCTIVE PERFORMANCE OF MALE AND FEMALE CHICKENS"

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ABSTRACT

Phytoestrogen has been widely explored for its both antiestrogenic and estrogenic properties. The current study sought to determine the effects of phytoestrogens on male and female chicken growth and reproductive performances, serum biochemistry, hormonal, gross, and histopathological performance. Forty-eight (48) female and thirty-two (32) healthy male Sonali chickens aged 2 months and weighing from 650 to 700 g were randomly assigned to one of four nutritional treatment groups (T_0: control, T_1: Basal diet + isoflavone@ 10mg/liter, T_2: Basal diet + isoflavone@ 20mg/liter, or T_3: Basal diet + isoflavone@ 30mg/liter), each consisting of two replications. The average daily weight gain was significantly ($P<0.05$) higher in the 20 mg isoflavones supplemented group than in other groups. Blood estrogen was significantly ($P<0.05$) increased in both males and females, the highest (male, 18.82 pg/ml and females, 304 pg/ml) in T_3 supplemented group. In male birds, testosterone significantly ($P<0.05$) decreased in all treatment group and was highest in the control group (323.8 ng/ml). Blood Hb, WBC, RBC, platelets, and PCV were significantly ($P<0.05$) lower in all male and female supplemented groups, among them the lowest in the 30 mg phytoestrogen group (6.1-6.3 g/dl). Lipid profiles were significantly ($P<0.05$) lower in all supplemented groups, lowest in the 30 mg phytoestrogen group. IgE was significantly ($P<0.05$) increased after phytoestrogen supplementation in all male and female groups and highest in T_3 (12.2-12.6). Egg production and egg quality were significantly ($P<0.05$) decreased in the T_3 group compared to the others. Grossly liver, lung, uterus, egg follicles, and testes were changes in normal architecture and enlarged or atrophied. The embryo was normal in T_0 and T_1, fibrotic in T_2 and no embryo was found in the T_3 group. Microscopically, liver, lung, testes, and uterus tissue damage, fibrotic destruction of normal architecture, and necrotic changes in the uterus were found in the 30 mg isoflavone-supplemented group more than in others. It may conclude that supplementation of isoflavone up to 10 mg to Sonali chickens may improve growth and reproductive performances but further study is needed.

Keyword: Sonali, phytoestrogen, isoflavone, hormone, blood parameters, lipid profile, etc.

INDUSTRIAL CHEMISTRY APPROACHES IN THE SYNTHESIS AND MANUFACTURE OF PHARMACEUTICALS

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Ibrahim samaila

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Abstract

Industrial chemistry applies scalable chemical engineering, catalytic methods, and process intensification to transform laboratory routes into safe, efficient, and sustainable pharmaceutical manufacturing. Recent regulatory support for integrated continuous manufacturing (ICH Q13 / FDA guidance, 2023) accelerates adoption of continuous flow and end-to-end continuous production systems that improve safety, reduce waste, and shorten time-to-market. Flow chemistry and continuous-processing technologies enable tighter heat/mass control, safer handling of hazardous reagents, and facile scale-up of multi-step syntheses, and several 2023–2024 reviews document successful process intensification case studies and industry uptake. Biocatalysis and engineered enzymes increasingly complement classical catalytic methods, providing highly selective, green routes to chiral building blocks; recent studies (2023–2024) highlight enzyme engineering and use of deep-eutectic or benign media to expand scope and robustness. Implementation of process analytical technology (PAT) and Quality-by-Design (QbD) principles enables real-time monitoring and closed-loop control, which are essential for reliable continuous operation and real-time release strategies. Finally, industry-wide green-chemistry tools (solvent selection guides, lifecycle assessment frameworks) drive solvent/reagent choices and waste minimization, aligning industrial chemistry approaches with sustainability goals. Together, these advances make industrial chemistry a central enabler of modern, sustainable pharmaceutical production.This paper explores how modern industrial chemistry—through continuous manufacturing, flow chemistry, biocatalysis, process analytical technology, and green innovations—drives the efficient, safe, and sustainable synthesis and large-scale manufacture of pharmaceuticals in line with 2023–2024 advances.

Keywords :continuous manufacturing; flow chemistry; biocatalysis; process analytical technology (PAT); Quality by Design (QbD); green solvents; process intensification; active pharmaceutical ingredient (API) production.

INTRODUCTION

Industrial chemistry today plays a central role in translating medicinal discoveries into safe, affordable medicines by taking laboratory-scale synthetic routes and converting them into robust, scalable industrial processes that meet regulatory, economic and sustainability constraints (martagan T et al 2024). Building on that role, the last two years have seen accelerated adoption of enabling industrial approaches especially continuous/flow processing, process intensification, green and catalytic methods, and data-driven control strategies because they reduce step-count, improve safety, shrink environmental footprints, and increase manufacturing agility (K.P cole 2024).

Among those approaches, continuous-flow chemistry and integrated continuous manufacturing have moved from promising pilots toward mainstream implementation; continuous platforms

allow tighter heat/mass transfer control, easier scale-up, and safer handling of hazardous intermediates, which together lower risk and often enable more efficient synthetic sequences than classic batch routes (KP cole 2024). Because continuous systems produce dense process data and operate steadily over long runs, they pair naturally with real-time monitoring and process analytical technologies (PAT), enabling real time release testing and advanced feedback control that preserve product quality while shortening release times and waste (Nqekato S, et.al 2024). Process intensification the redesign of individual unit operations to deliver the same or better outputs from smaller, faster, or fewer steps has been another critical industrial chemistry trend; examples in 2023–2024 include semi-continuous and mini-blending devices that replicate continuous direct-compression behavior at commercial throughputs, demonstrating how reengineering a single unit (e.g., blending, crystallization, or separation) can unlock entire continuous lines (jaspers M , et.al 2024). These intensified units reduce equipment footprints and sometimes enable multi-functional reactors (e.g., flow reactors with inline quench and separations), thereby lowering capital and operational burdens on manufacturers (KP cole 2024).

Sustainability and green-by-design principles have also been integrated into industrial practice, with industry roundtables and reviews emphasizing solvent selection, waste minimization, catalytic and biocatalytic transformations, energy efficiency, and lifecycle thinking as core process development criteria for new APIs and generics (MA ashley et.al 2024). In many recent case studies, combining flow chemistry with greener reagents or biocatalysts both improved step economy and decreased waste, illustrating how green chemistry and industrial process design are complementary rather than competing goals (KP cole 2024).

Digitalization and data science are accelerating the practical deployment of the above technologies: large, publicly shared industrial continuous-manufacturing datasets and industry academia partnerships are being used to develop predictive models, advanced process control algorithms, and digital twins that can shorten scale-up cycles and support regulatory filings for novel manufacturing architectures(Martagan T et.al 2024). The combination of richer process data, PAT, and model based control supports a transition from empirical batch recipes to knowledge rich process designs that regulators increasingly accept under the Quality by Design (QbD) framework (Martagan T et.al 2024).

Despite these advances, practical challenges remain: translating multi step synthetic routes to continuous form often requires rediscovering reaction sequences to avoid incompatible intermediates, building inline separation steps that are robust at scale, and securing capital and cross-disciplinary expertise to bridge lab, pilot and production scales (KP cole 2024). Moreover, supply chain resilience, local manufacturing capability (notably in under served regions), and workforce training are identified as barriers that must be addressed alongside technology adoption to realize the full public health benefits of modern industrial chemistry (MartaganT et.al 2024).

LITERATURE REVIEW

Industrial pharmaceutical manufacturing has been undergoing a rapid shift from traditional batch paradigms toward integrated continuous and intensified manufacturing platforms, a change driven by demonstrable improvements in process control, safety, and productivity (Cole et al., 2024). Continuous-flow and integrated continuous manufacturing have been presented in 2023–2024 literature as mature, implementable strategies that reduce scale-up risks by providing superior heat and mass transfer and enabling safer handling of hazardous intermediates compared with conventional batch processes (Cole et al., 2024). The regulatory environment has actively supported this transition: the International Council for Harmonisation (ICH) finalized guideline Q13 on continuous manufacturing in 2023, providing harmonized

scientific and submission expectations that materially lower regulatory uncertainty for companies adopting continuous approaches (ICH, 2023).

The ICH Q13 guidance explicitly recommends that manufacturers consider continuous process verification, material traceability and disturbance management strategies when implementing integrated continuous lines, which has encouraged industry uptake and academic work focused on CM control strategies (ICH, 2023). Process analytical technologies (PAT) and real-time monitoring have been recognized as foundational enablers for continuous systems because they provide the dense, high-frequency data needed for continuous process verification and advanced control strategies (Neugebauer, 2024).

Recent reviews show that PAT modalities including NIR, Raman, online HPLC, and multivariate chemometrics are now routinely integrated into pilot and commercial continuous lines to enable real time release testing and rapid detection of disturbances (Neugebauer, 2024). The availability of large, shared continuous manufacturing datasets has directly supported algorithmic development for model-based control, digital twins, and predictive maintenance in pharmaceutical production (Martagan et al., 2024). In particular, the MSD continuous-manufacturing dataset released for the 2024 MSOM challenge exemplifies how industrial-scale telemetry can be used to train predictive models and to evaluate advanced control policies for CM systems (Martagan et al., 2024). Process intensification defined as redesigning unit operations to accomplish more with less equipment, energy, or time has been proposed in 2024 literature as a pragmatic incremental pathway to continuous or semi-continuous operation, especially when full integration across all unit operations is not immediately feasible (Crowley et al., 2024). Authors argue that treating intensification as a multi tiered landscape (single unit intensification, connected unit operations, then fully integrated systems) lowers capital barriers by allowing manufacturers to implement smaller, cost-effective improvements that cumulatively yield CM-like benefits (Crowley et al., 2024).

Case studies from 2023–2024 indicate that downstream intensification (e.g., multicolumn chromatography, intensified crystallization, semi continuous drying) can be deployed independently to increase throughput and reduce footprint without wholesale replacement of upstream chemistry (Crowley et al., 2024). Green chemistry principles have gained renewed emphasis in industrial process development, with recent reviews calling for solvent selection guides, catalytic and biocatalytic methods, waste minimization metrics, and life-cycle thinking to be embedded into early process design choices (Ashley et al., 2024). The 2023–2024 literature documents multiple examples where combining continuous operation with greener reagents or biocatalysts improves overall atom economy and reduces solvent and energy demands relative to legacy batch routes (Ashley et al., 2024). Authors note that green-by-design thinking is especially important in the industrial context because small improvements at scale can translate to large absolute reductions in emissions and hazardous waste from API manufacture (Ashley et al., 2024).

Digital transformation and the application of data science to manufacturing have been highlighted as cross-cutting accelerants for modern industrial approaches, enabling digital twins, predictive models, and model-based control that shorten scale up cycles and improve robustness (Miozza, 2024). Recent reviews describe how digital twins coupled with PAT streams allow virtual commissioning and scenario testing that reduce time-to-production and provide a platform for continuous improvement under lifecycle management frameworks (Miozza, 2024). Scoping reviews in 2024 further position digital twin concepts and related data-centric methods as promising bridges between laboratory discovery, process development, and regulated manufacturing operations (Katsoulakis et al., 2024). Despite technical advances, authors in 2023–2024 emphasize persistent practical and organizational challenges that slow broader adoption, including the need to redesign synthetic routes to avoid incompatible

intermediates, the technical difficulty of integrating robust inline separations, and the capital and multidisciplinary expertise required for scale-out (Cole et al., 2024). Regulatory guidance (ICH Q13) and industry case studies both stress that designing for disturbance management, traceability, and maintainable control strategies is necessary to build stakeholder confidence and to meet dossier expectations when converting batch processes to continuous formats (ICH, 2023). Workforce development, supply chain resilience, and alignment of commercial incentives are cited in the literature as non technical barriers that must be addressed in parallel with engineering advances to achieve equitable global implementation of next generation manufacturing (Cole et al., 2024).

DISCUSSION

Industrial chemistry strategies for pharmaceutical manufacture are increasingly focused on shifting from legacy batch paradigms to hybrid and fully continuous manufacturing platforms because continuous approaches offer superior heat and mass transfer, improved safety for hazardous chemistries, and more predictable scale-up behavior than traditional batch processes (Cole et al., 2024). Continuous manufacturing (CM) has moved from academic demonstration to industrial deployment in part because regulators now provide clearer expectations for development, lifecycle management, and submission of CM processes, reducing the regulatory uncertainty that once slowed adoption (International Council for Harmonisation [ICH], 2023). The ICH Q13 guidance explicitly frames CM as an integrated system of connected unit operations and recommends lifecycle management, disturbance handling, and continuous process verification practices that align well with modern industrial chemistry workflows (ICH, 2023).

Process analytical technologies (PAT) and dense process telemetry are central to realizing CM's quality and efficiency benefits because they provide real time measurements of critical quality attributes (CQAs) and critical process parameters (CPPs), enabling advanced feedback and model-based control strategies (Neugebauer, 2024). Integration of spectroscopic PAT (e.g., NIR and Raman), online chromatography, and multivariate chemometrics has been demonstrated in pilot and commercial continuous lines to support real-time release testing and rapid detection of process disturbances (Neugebauer, 2024). The release of large, curated continuous-manufacturing datasets has helped accelerate algorithm development for predictive control and digital twins by supplying realistic industrial telemetry for model training and benchmarking (Martagan et al., 2024). Process intensification is a complementary industrial-chemistry strategy that reduces equipment footprint and improves unit-operation performance by redesigning reactors, crystallizers, and separation steps; such intensification can be implemented incrementally (single-unit) or as part of a multi-tiered pathway toward fully integrated continuous systems (Crowley et al., 2024). Recent studies demonstrate that targeted intensification of downstream processing including intensified crystallization and semi continuous blending/drying can deliver many advantages of CM (throughput, footprint reduction, and energy savings) without requiring immediate, site-wide conversion from batch to continuous operation (Jaspers et al., 2024; Crowley et al., 2024). This pragmatic, staged intensification pathway lowers capital risk for manufacturers and enables incremental operational experience with intensified hardware and control strategies before committing to fully integrated continuous lines (Crowley et al., 2024).

Green chemistry principles have become embedded in industrial process design because sustainability improvements at scale yield outsized environmental benefits in API production, and because green choices (solvent replacement, catalytic or biocatalytic routes, solvent minimization) often synergize with intensification and CM objectives (Ashley et al., 2024). Case reports from 2023–2024 show that pairing flow reactors with catalytic or enzymatic steps can improve atom economy and reduce solvent and energy demand relative to legacy batch

sequences, illustrating how green-by-design and industrial chemistry co-deliver process and environmental benefits (Ashley et al., 2024). Digitalization including digital twins, model-based process control, and data integration across development and manufacturing is accelerating the translation of lab routes into robust industrial processes because digital tools enable virtual commissioning, scenario testing, and continuous improvement under a lifecycle approach (Kirby, 2024; Martagan et al., 2024). Digital twins that couple mechanistic process models with PAT streams are proving particularly useful for evaluating scale up risks, optimizing process setpoints, and demonstrating control strategies to regulators during dossier preparation (Kirby, 2024). However, full digital-twin implementation remains limited by data integration hurdles, model maintenance needs, and organizational silos between R&D, process engineering, and manufacturing functions (Raudenbusch et al., 2024).

Conclusion

Industrial chemistry has entered a new era where continuous manufacturing, process intensification, and digitalization are transforming how pharmaceuticals are synthesized and produced (Cole et al., 2024). These approaches not only improve heat and mass transfer but also enhance safety and scalability, making them more suitable than traditional batch systems for modern drug production (Cole et al., 2024; ICH, 2023). At the same time, process analytical technology (PAT) and digital twins are enabling real-time monitoring, predictive control, and faster regulatory approval pathways, thereby strengthening product quality assurance (Martagan et al., 2024; Neugebauer, 2024). Sustainability has also become a central pillar, as green chemistry principles and biocatalytic methods are increasingly integrated into industrial processes to reduce waste and energy demands (Ashley et al., 2024). Despite persistent challenges such as the cost of implementation, technical expertise gaps, and integration of downstream operations the roadmap for industrial pharmaceutical chemistry is converging toward hybrid, data-driven, and sustainable models (Crowley et al., 2024; Nqeketo & Sagandira, 2024). Taken together, recent advances show that the future of pharmaceutical manufacturing will rely on harmonizing technological innovation with regulatory clarity to deliver safe, efficient, and environmentally responsible medicines at global scale (ICH, 2023; Ashley et al., 2024).

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UPDATED INSIGHTS INTO THE ANTI-COVID-19 ACTIVITY OF HETEROCYCLIC COMPOUNDS

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Abstract:
The coronavirus disease 2019 (COVID-19) pandemic is one of the most known health problems worldwide. The major causative agent of COVID-19 is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The major symptoms of this fatal disease comprise of shortness of breath, cough, fever, loss of smell, and wide range of other health problems, including pneumonia, bronchitis, diarrhea, septic shock, and multiple organic failure. Currently, there are no proper medications synthesized for coronavirus patients, except symptom-relieving drugs. Hence, SARS-CoV-2 needs the development of potent drugs and special treatments. Heterocycles constitute more than 85% of the physiologically active pharmaceutical drugs currently available in the market. Several FDA-approved drugs, including molnupiravir, remdesivir, ritonavir, oseltamivir, favipiravir, chloroquine, and hydroxychloroquine are reported for the treatment of COVID-19. In this presentation, we discuss potent anti-SARS-CoV-2 heterocyclic compounds that have been synthesized over the past few years. These compounds included; indole, piperidine, pyrazine, pyrimidine, pyrrole, piperazine, quinazoline, oxazole, quinoline, isoxazole, thiazole, quinoxaline, pyrazole, azafluorene, imidazole, thiadiazole, triazole, coumarin, chromene, and benzodioxole. Both *in silico* and i*n vitro* studies were performed to determine the activity of these heterocyclic compounds in the fight against various SARS-CoV-2 proteins.

VERTICAL DIMENSION ASSESSMENT IN ORTHOGNATHIC SURGERY THROUGH TOTAL FACE APPROACH

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Abstract

Aim: Cephalometry is fundamental in diagnosis, analysis, and planning of orthodontic surgical treatment as it reveals skeletal relationship between the upper and lower jaw as well as facial aesthetic parameters. Nevertheless, 3D cephalometry has still not become the exam of choice in orthognathic treatment even though today CBCT (Cone Beam Computed Tomography) is routinely used in other branches of dentistry. The aim of this study is to evaluate the advantages and disadvantages of the two methods in orthognathic surgery.
Materials and Methods: In a sample of 13 patients undergoing bimaxillary orthognathic surgery a chin-vertex CBCT exam was prescribed prior to orthodontic treatment (OT)and 12 months after surgery (T1). The DICOM files uploaded to MaterialiseSimplant Ortho software pro 2.1 (Materialise Co.,
Leuven, Belgium) were analyzed following the multiplane 3D Total Face cephalometry protocol (TFA).
Results: Results comparing pre-op and post-op TFA 3D cephalometry, were then evaluated considering reference values reported in literature. The CBCT, carried out preand post-surgery, were subsequently analyzed employing the superimposition method using cranial base as reference.

Discussion and Conclusions: The TFA 3D cephalometry allows the assessment of various bones not only singularly but also considering the rightproportion with others.The advantages ofTFA cephalometry are mostly due to speed of execution thanks to a user-friendly interfacerequiring a

learning curve that is similar to traditional 2D cephalometry methods.This 3D analysis was carried out evaluating the relationship between skeletal structures making the approach especially flexible and dynamic. The 3D visualization allowsthe determination of the extent of skeletal disharmony. Multiplane 3D TFA allows the clinician to locatewhere major or minor skeletal discrepancies are found with respect to ideal parameters and is alsouseful in classifying skeletal intermaxillary relation. The superimposition method is highly intuitivebut does not provide information on the quantity and
location of osteotomic movement.

Keywords: total face approach; superimposition; orthognathic surgery.

A RADIATION-FREE APPROACH TO VOLUMETRIC RENDERING FOR SOFT TISSUE

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Abstract

Aim: The aim of the present study is to evaluate whether a "radiation free" method using 3D facial scan can replace Cone Beam Computed Tomography (CBCT) volumetric rendering of soft tissue of the patient to assess maxillofacial surgery outcomes and compare the reference points and angular
measurements of patient facial soft tissue.
Methods: Facial soft tissue scan of the patient's face, before and after orthognathic surgery and a CBCT of the skull for volumetric rendering of soft tissues were carried out. The 3D acquisitions were processed using Planmeca ProMax 3D (ProFace® software Planmeca USA, Inc.; Roselle, Illinois, USA). The positioned in a natural position during the skull participant were scannering. Three sagittal angular measurements were performed (Tr-NA, Tr-N-Pg, Ss-N-Pg) and two verticals (Go-N-Me, Tr-Or-Pg) on facial soft tissue scan and on the patient's 3D soft tissue CBCT volumetric rendering.
Results: A certain correspondence has been demonstrated between the measurements obtained on the Proface and those on the CBCT.
Conclusion: A radiation free method was to be considered an important diagnostic tool that works in conditions of not subjecting the patient to harmful ionizing radiation and it was therefore particularly suitable for growing subjects. The soft tissue analysis based on the realistic facial scan has shown sufficient reliability and reproducibility even if further studies are needed to confirm the research result.
Keywords: CBCT; Ionizing radiation; Soft tissue; Orthodontics; Diagnosis.

RADIOGRAPHIC, CLINICAL, AND BIOCHEMICAL ASSESSMENT OF SCREW-RETAINED VERSUS CEMENT-RETAINED CR-CO-CERAMIC IMPLANT-SUPPORTED SINGLE CROWNS: A COHORT STUDY

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Background: The analysis that was conducted in this study, comparing two different crown-retention solutions, considered periodontal indices and standardized radiographic measurements and the indices of possible damage which now represent a concrete help in diagnosis and prognosis.

Materials and Methods:

The present study was designed to compare peri-implant soft and hard tissue response after 2 years of functional loading between direct screw-retained posterior single crowns in Cr-Co/Ceramic or cement-retained Cr-Co/Ceramic on titanium abutment. 24 non-smoking partially edentulous patients, requiring implant therapy for a prosthetic rehabilitation, were included in the study. The values of Il-1β, IL-6, IL-8 were evaluated, together with the periodontal indices PI, GI, PD, BOP, REC. The PICF was collected with standardized paper strips. Repeated measure ANOVA was used between groups months at 1, 3, and 12 months.

Results:
During the time of clinical observation, at t0 (1 month), t1 (3 months) and t2 (12 months), both types of crowns performed satisfactorily from a clinical point of view. In light of the results obtained, it is possible to define that screwed Cr-Co/Cer has slightly higher values than the other.

Conclusions:
It is possible to hypothesize, that this difference could lead to a clinically visible difference between these two prosthetic solutions in the longer term. The single screwed crown in Cr-Co shows a different interface with the titanium implant connection compared to the titanium-titanium contact of the connection between the implant and the titanium abutment for the cement-retained prosthetic solution.

Keywords: Cr-Co; Implants; Titanium; Cement-retained; Screw-retained; Ceramic.

SYNTHESIS AND THEORETICAL/STRUCTURAL INVESTIGATIONS OF $NA_{0.5}M_{0.25}TI_2(PO_4)_3$ (M = ZN, NI)

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Abstract: This work presents a systematic physico-chemical study of titanium phosphate compounds with the general formula $Na_{0.5}M_{0.25}Ti_2(PO_4)_3$ (M = Mn, Ni). The synthesized materials were characterized by X-ray diffraction (XRD) and infrared (IR) spectroscopy, supported by density functional theory (DFT) calculations. Both compounds crystallize in the orthorhombic system with space group *Pmmm* (Z = 4). The refined unit cell parameters are: *a* = 14.59 Å, *b* = 13.31 Å, *c* = 2.60 Å for $Na_{0.5}Mn_{0.25}Ti_2(PO_4)_3$, and *a* = 14.60 Å, *b* = 13.31 Å, *c* = 2.67 Å for $Na_{0.5}Ni_{0.25}Ti_2(PO_4)_3$. The crystal structures, similar to that of $Li_{0.5}M_{0.25}Ti_2(PO_4)_3$, consist of interconnected [TiO_6] octahedra and [PO_4] tetrahedra forming a three-dimensional framework along the *c*-axis. The Mn^{2+} and Ni^{2+} cations are located in half of the antiprismatic interstitial sites and exhibit ordered distribution. The DFT calculations confirm the structural stability and provide insights into the electronic properties of the compounds.
Keywords: Sodium titanium phosphates; X-ray diffraction; Infrared spectroscopy (IR); NASICON-type structure; Solid-state materials; (HSA; ELF, DFT**)**-calculations

ADVANCING REGENERATIVE MEDICINE: CURRENT STATUS AND FUTURE PROSPECTS OF STEM CELL THERAPY

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Abstract

Stem cell therapy has emerged as a revolutionary approach in regenerative medicine, offering promising solutions for conditions that currently lack effective treatments. Over the past decade, significant advancements in stem cell isolation, characterization, and transplantation techniques have expanded clinical applications across neurodegenerative disorders, cardiovascular diseases, diabetes, and musculoskeletal injuries. Despite encouraging preclinical and clinical outcomes, challenges such as immune rejection, ethical considerations, and long-term safety remain. This paper provides a comprehensive overview of the current status of stem cell therapy, highlights recent innovations, and explores potential future directions, including gene-edited stem cells, organoid development, and personalized regenerative treatments. By bridging laboratory research with clinical applications, stem cell therapy holds the potential to transform modern medicine and improve patient outcomes.

Keywords

- Stem Cell Therapy
- Regenerative Medicine
- Clinical Applications
- Ethical Considerations
- Personalized Medicine
- Translational Research
- Gene-Edited Stem Cells
-

Introduction

Background and Significance

Regenerative medicine has become a cornerstone of 21st-century biomedical innovation, aiming not merely to palliate symptoms but to restore, replace, or regenerate functional tissues and organs. At the heart of this discipline lies stem cell therapy, which draws its therapeutic promise from the unparalleled biological capabilities of stem cells: indefinite self-renewal, clonal expansion, and the ability to differentiate into diverse lineages. These features make stem

cells uniquely positioned to address diseases and injuries that were previously considered irreversible or untreatable.

Globally, the prevalence of chronic and degenerative conditions such as cardiovascular disease, neurodegeneration, musculoskeletal disorders, diabetes, and cancer continues to rise, placing immense pressure on healthcare systems. Traditional therapeutic strategies—be it pharmacological, surgical, or device-based—often remain limited to symptomatic control, disease progression delay, or partial functional restoration. By contrast, stem cell–based regenerative approaches represent a paradigm shift toward curative medicine, offering the possibility of reconstituting normal tissue architecture and function at a fundamental biological level.

Evolution of Stem Cell Research

The field has advanced rapidly since the first isolation of embryonic stem cells (ESCs) in the late 20th century, which provided an inexhaustible reservoir of pluripotent cells. However, ethical controversies and immune rejection risks soon highlighted the limitations of ESC-based applications. The landmark development of induced pluripotent stem cells (iPSCs) in 2006 revolutionized the landscape by enabling the reprogramming of somatic cells into pluripotent states without reliance on embryos. This breakthrough circumvented major ethical barriers and introduced the concept of patient-specific autologous therapies, significantly reducing concerns of immune incompatibility.

In parallel, progress in adult stem cell research—notably mesenchymal stem cells (MSCs), hematopoietic stem cells (HSCs), and neural stem cells (NSCs)—has expanded the therapeutic repertoire. These cell types have already entered numerous clinical trials targeting conditions such as graft-versus-host disease, myocardial repair, and neurodegeneration. The convergence of stem cell biology with genome editing technologies (CRISPR–Cas9), biomaterials, and 3D bioprinting has further broadened therapeutic horizons, facilitating precise genetic correction, tissue scaffolding, and even whole-organ engineering.

Despite these promising advances, the field is not without formidable challenges. Immunological compatibility continues to be a major barrier, particularly in allogeneic transplantation settings. The risk of tumorigenicity, especially from undifferentiated pluripotent stem cells, raises concerns about long-term safety. Ethical debates surrounding the derivation and use of ESCs remain unresolved in many regions, influencing policy and public acceptance. Moreover, stringent regulatory frameworks, coupled with the high costs of production and quality assurance, have slowed down the pace of clinical adoption. These hurdles underscore the need for robust preclinical validation, standardized protocols, and multidisciplinary collaboration to ensure both efficacy and safety in therapeutic applications.

In this context, stem cell therapy stands at a critical juncture where breakthroughs in basic science, translational research, and clinical practice must converge to realize its full potential. This paper aims to provide a comprehensive overview of the current status of stem cell therapy, critically examining key milestones, recent scientific breakthroughs, and clinical applications. Additionally, it highlights the unresolved challenges and explores future directions—including bioengineering innovations, personalized regenerative strategies, and ethical–regulatory frameworks—that are likely to shape the trajectory of regenerative medicine in the coming decades.

Types of Stem Cells and Their Characteristics

Stem cells can be broadly classified on the basis of their origin (source of derivation) and their differentiation potential (ability to give rise to specialized cell types). Each category of stem

cell has unique biological properties, clinical advantages, and translational limitations that define its role in regenerative medicine.

Embryonic Stem Cells (ESCs)

- **Origin:** ESCs are isolated from the inner cell mass of blastocysts during the pre-implantation stage of embryonic development (approximately day 5–7 post-fertilization).
- **Differentiation Potential:** They are pluripotent, meaning they can differentiate into nearly all cell types derived from the three primary germ layers: ectoderm (e.g., neurons, skin), mesoderm (e.g., muscle, bone, blood), and endoderm (e.g., pancreas, liver, lungs). This makes ESCs the most versatile stem cell type in terms of therapeutic potential.
- **Advantages:**
    - Provide an inexhaustible source of pluripotent cells.
    - Ideal for studying early human development and genetic disorders.
    - Can be directed in vitro into diverse specialized lineages.
- **Limitations:**
    - **Ethical concerns:** Their derivation requires the destruction of human embryos, sparking bioethical debates worldwide.
    - **Immune rejection:** ESC-derived cells are allogeneic, leading to risks of host–graft incompatibility.
    - **Tumorigenic risk:** Incomplete differentiation or residual undifferentiated cells can result in **teratoma formation**.
- **Current Applications:** While clinical use is limited, ESCs remain an essential research tool for drug screening, disease modeling, and proof-of-concept regenerative strategies.

Adult (Somatic) Stem Cells

- **Origin:** Also known as tissue-specific or postnatal stem cells, these cells are located in various organs such as bone marrow, adipose tissue, skin, liver, and brain.
- **Differentiation Potential:** They are multipotent, meaning they can differentiate into a restricted range of cell types within their tissue of origin. For example, hematopoietic stem cells give rise to blood cell lineages, while neural stem cells differentiate into neurons and glial cells.
- **Advantages:**
    - Fewer ethical issues compared to ESCs.
    - Can be autologously derived, reducing the risk of immune rejection.
    - Well-established clinical use in hematopoietic stem cell transplantation (HSCT) for leukemia, lymphoma, and bone marrow failure syndromes.
- **Limitations:**
    - Limited differentiation potential compared to ESCs or iPSCs.
    - Decline in proliferative capacity with donor age.
    - Difficulties in isolation, expansion, and maintaining potency in vitro.

- **Current Applications:** Widely applied in bone marrow transplantation, under investigation for neuroregeneration, cardiac repair, and liver regeneration.

3. Induced Pluripotent Stem Cells (iPSCs)

- **Origin:** First developed in 2006, iPSCs are generated by reprogramming adult somatic cells (e.g., fibroblasts, blood cells) into a pluripotent state through the forced expression of key transcription factors (classically Oct4, Sox2, Klf4, and c-Myc, known as Yamanaka factors).
- **Differentiation Potential:** Like ESCs, iPSCs are pluripotent and can differentiate into nearly any cell type.
- **Advantages:**
    - Circumvent ethical controversies associated with ESCs.
    - Enable patient-specific therapies that minimize immune rejection.
    - Valuable tools for disease modeling, drug toxicity testing, and personalized medicine.
    - Offer opportunities for gene editing correction before autologous transplantation.
- **Limitations:**
    - Reprogramming efficiency remains low and resource-intensive.
    - Risk of genetic/epigenetic abnormalities introduced during reprogramming.
    - Retain potential for tumorigenicity if not carefully differentiated.
- **Current Applications:** iPSCs are widely used in disease modeling (e.g., Parkinson's, ALS, diabetes), drug discovery platforms, and early-stage clinical trials for macular degeneration and neurodegenerative disorders.

Mesenchymal Stem Cells (MSCs)

- **Origin:** MSCs are multipotent stromal cells found in bone marrow, adipose tissue, umbilical cord blood, dental pulp, and synovial fluid.
- **Differentiation Potential:** They typically differentiate into mesodermal lineages, including osteocytes (bone), chondrocytes (cartilage), and adipocytes (fat).
- **Unique Properties:**
    - Exhibit strong immunomodulatory and anti-inflammatory effects via paracrine signaling and secretion of bioactive molecules (cytokines, growth factors, exosomes).
    - Can suppress T-cell proliferation, making them attractive in autoimmune and inflammatory conditions.
    - Display low immunogenicity, enabling allogeneic transplantation with minimal rejection risk.
- **Advantages:**
    - Easy to isolate and expand in vitro.
    - Wide therapeutic spectrum due to trophic support, angiogenesis promotion, and tissue repair facilitation.

- **Limitations:**
    - Restricted differentiation compared to pluripotent stem cells.
    - Heterogeneity among MSC populations depending on tissue source.
    - Limited evidence of long-term engraftment; many effects are mediated by paracrine activity rather than direct tissue replacement.
- **Current Applications:** Extensively studied in clinical trials for graft-versus-host disease, Crohn's disease, osteoarthritis, myocardial infarction, and COVID-19–associated lung injury

IV. TABLE-1 OF STEM CELL TYPES

Feature	**Embryonic Stem Cells (ESCs)**	**Adult (Somatic) Stem Cells**	**Induced Pluripotent Stem Cells (iPSCs)**	**Mesenchymal Stem Cells (MSCs)**
Source	Inner cell mass of blastocyst (3–5 day old embryo)	Bone marrow, adipose tissue, dental pulp, peripheral blood, umbilical cord blood	Reprogrammed from adult somatic cells (e.g., fibroblasts, blood cells) using transcription factors (Oct4, Sox2, Klf4, c-Myc)	Bone marrow, adipose tissue, Wharton's jelly, placenta, umbilical cord
Differentiation Potential	**Pluripotent** → Can form all cell types of the body (ectoderm, mesoderm, endoderm)	**Multipotent** → Limited to certain lineages (e.g., hematopoietic → blood cells, neural stem cells → neurons & glia)	**Pluripotent** → Similar to ESCs, can differentiate into any somatic cell	**Multipotent** → Can differentiate into osteoblasts, chondrocytes, adipocytes, myocytes, and stromal cells
Proliferative Capacity	Very high (indefinite self-renewal in vitro)	Moderate, declines with age	High (comparable to ESCs in culture)	Moderate; can be expanded in culture but with senescence risk
Advantages	Unlimited differentiation potential; gold standard for pluripotency studies	Easily obtainable; autologous use reduces immune rejection; established in	No ethical concerns; patient-specific → reduced rejection; useful for disease modeling & drug screening	Immunomodulatory, anti-inflammatory, angiogenic properties; low immunogenicity → suitable for allogeneic transplantation

Feature	Embryonic Stem Cells (ESCs)	Adult (Somatic) Stem Cells	Induced Pluripotent Stem Cells (iPSCs)	Mesenchymal Stem Cells (MSCs)
		clinical use (HSCT)		
Limitations	Ethical controversies; risk of teratoma/tumor formation; immune rejection in allogeneic use	Limited differentiation; age-dependent decline; harder to expand in vitro	Risk of mutations during reprogramming; incomplete reprogramming; potential tumorigenicity	Differentiation restricted to mesenchymal lineages; heterogeneity depending on tissue source
Immunogenicity	High (allogeneic transplants risk immune rejection)	Low when autologous; moderate when allogeneic	Lower (autologous iPSCs reduce risk, but reprogramming may introduce immunogenic epitopes)	Very low; can evade immune detection and modulate immune response
Tumorigenic Risk	High (teratoma formation common)	Low (rare)	Moderate to high (depends on reprogramming safety)	Very low
Ethical Issues	Major (destruction of human embryos)	Minimal (adult tissue origin)	Minimal (no embryo use)	Minimal (usually derived from postnatal tissues)
Clinical/Research Applications	Disease modeling, drug discovery, regenerative therapy (still mostly experimental)	HSCT for leukemia, lymphoma, aplastic anemia; ongoing trials in neural & cardiac repair	Patient-specific disease modeling, gene correction studies, regenerative therapy under trials	Widely tested in autoimmune diseases (Crohn's, MS), orthopedic repair, myocardial infarction, graft-versus-host disease
Status of Clinical Use	Limited, mostly experimental & early trials	Established (HSCT widely used for decades)	Experimental, early-phase clinical trials	Actively in clinical trials; some approved uses (e.g., GvHD)

Current Clinical Applications

Stem cell–based therapies have gradually progressed from experimental studies to clinical practice across multiple medical specialties. Although many applications remain in early-stage or investigational phases, some, particularly hematopoietic stem cell transplantation, are well-established standards of care. The following section provides an in-depth overview of the current clinical applications.

Neurodegenerative Disorders

Neurodegenerative diseases are characterized by progressive loss of specific neuronal populations, leading to irreversible functional decline. Conventional therapies largely provide symptomatic relief without halting or reversing neuronal damage. Stem cell–based strategies hold promise for neuroprotection, replacement of lost neurons, and repair of neural circuits.

- **Parkinson's Disease (PD):**
  ESCs and iPSC-derived dopaminergic neurons have been transplanted into animal models and early-phase clinical trials. Preliminary results demonstrate improved motor function and dopamine production. Patient-specific iPSCs also allow autologous grafts, reducing immunological rejection risks.
- **Alzheimer's Disease (AD):**
  Stem cell therapies (e.g., MSCs and neural progenitors) are being investigated for their neurotrophic and anti-inflammatory effects, potentially slowing disease progression.
- **Spinal Cord Injuries (SCI):**
  Transplantation of neural stem/progenitor cells (NSPCs) and MSCs has shown potential in remyelination, axonal regeneration, and functional recovery. Early-phase trials demonstrate improvements in motor and sensory function, though complete recovery remains elusive.
- **Challenges:**
  Risks of tumorigenesis, poor long-term survival of transplanted cells, and integration into host circuits remain major obstacles.

Cardiovascular Diseases

Ischemic heart disease and heart failure remain leading causes of morbidity and mortality globally. Since cardiomyocytes have limited regenerative capacity, stem cell–based strategies aim to repair damaged myocardium, promote angiogenesis, and improve ventricular function.

- **Cardiac Progenitor Cells (CPCs):** Trials have investigated autologous CPCs injected into ischemic myocardium, showing modest improvements in left ventricular ejection fraction.
- **Mesenchymal Stem Cells (MSCs):** Intramyocardial or intracoronary infusion of MSCs enhances cardiac repair by paracrine secretion of growth factors, stimulation of angiogenesis, and reduction of fibrosis.
- **iPSC-Derived Cardiomyocytes:** These represent a powerful approach for myocardial regeneration, although arrhythmogenic risks and poor engraftment remain concerns.
- **Clinical Trials:** Trials such as CADUCEUS and POSEIDON have shown safety and partial efficacy of stem cell–based myocardial repair.
- **Challenges:** Long-term engraftment, standardization of protocols, and large-scale efficacy validation remain unresolved.

Diabetes Mellitus

Type 1 diabetes is characterized by autoimmune destruction of pancreatic β-cells, necessitating lifelong insulin replacement. Stem cell therapies seek to provide a renewable source of insulin-producing cells.

- **ESC/iPSC-Derived β-Cells:** Researchers have successfully differentiated pluripotent stem cells into functional β-like cells that secrete insulin in response to glucose.
- **Encapsulation Strategies:** To prevent autoimmune attack, stem cell–derived β-cells are being encapsulated in biomaterials that allow nutrient exchange but block immune cells.
- **Clinical Developments:** Companies such as ViaCyte have advanced ESC-derived pancreatic progenitor cell transplantation into clinical trials, with promising safety data.
- **Challenges:** Autoimmune recurrence, long-term functionality, and risks of teratoma formation continue to hinder translation.

Musculoskeletal Disorders

Degenerative musculoskeletal conditions, such as osteoarthritis and osteoporosis, impose significant disability worldwide. Stem cells offer opportunities for cartilage, bone, and connective tissue regeneration.

- **Cartilage Repair:** MSCs have been used intra-articularly in osteoarthritis patients, showing improvements in pain reduction and functional mobility. They act both by differentiating into chondrocytes and through paracrine trophic effects that reduce inflammation and stimulate endogenous repair.
- **Bone Regeneration:** MSCs seeded onto scaffolds or biomaterials promote fracture healing, particularly in non-union fractures and large bone defects.
- **Tendon and Ligament Repair:** Clinical trials using MSCs in tendon injuries (e.g., rotator cuff tears, Achilles tendon injuries) report enhanced healing with reduced scar formation.
- **Challenges:** Variability in MSC quality, donor age effects, and long-term integration of regenerated tissue remain limiting factors.

Hematological Disorders

Hematopoietic stem cell transplantation (HSCT) is the most established and widely practiced stem cell therapy. It involves the infusion of autologous or allogeneic hematopoietic stem cells to reconstitute bone marrow function.

- **Applications:** HSCT is routinely used for leukemia, lymphoma, multiple myeloma, aplastic anemia, and inherited immunodeficiencies.
- **Advances:**
    - Use of cord blood stem cells has expanded donor availability.
    - Gene-edited autologous HSCs are being explored for inherited disorders like sickle cell disease and β-thalassemia.
- **Challenges:** Graft-versus-host disease (GVHD), infections, and conditioning regimen toxicity remain significant risks.

Together, these applications highlight the transformative potential of stem cell therapy in modern medicine, while also underscoring the need for long-term safety, standardized protocols, and large-scale efficacy validation before widespread adoption.

Recent Innovations in Stem Cell Therapy

Gene-Edited Stem Cells

- **Technology Used:** CRISPR–Cas9, TALENs, and zinc finger nucleases are now routinely applied to edit specific genes in patient-derived iPSCs or ESCs.
- **Mechanism:** Genetic mutations can be corrected *ex vivo* in iPSCs, which are then differentiated into healthy functional cells and reintroduced into the patient.
- **Applications:**
    - **Sickle Cell Anemia & β-Thalassemia:** CRISPR-corrected hematopoietic stem cells have successfully restored normal hemoglobin production in clinical trials.
    - **Cystic Fibrosis:** Gene-edited airway epithelial organoids show restoration of chloride channel function.
    - **Huntington's Disease:** Mutant huntingtin alleles in iPSCs have been corrected, generating healthy neural precursors for research.
- **Advantages:** Provides *personalized, mutation-free* stem cells for therapy; eliminates ethical issues related to ESC use.
- **Challenges:** Off-target editing, insertion–deletion mutations, long-term safety, and regulatory hurdles.

Organoid Development

- **Definition:** Organoids are 3D multicellular constructs grown from stem cells that self-organize and recapitulate structural and functional features of organs.
- **Process:** ESCs or iPSCs are cultured in defined 3D matrices (e.g., Matrigel) with growth factors that mimic developmental signaling pathways.
- **Applications:**
    - **Brain Organoids:** Modeling neurodevelopmental disorders (e.g., microcephaly, autism spectrum disorders).
    - **Liver Organoids:** Used to study viral hepatitis and drug-induced hepatotoxicity.
    - **Gut Organoids:** Provide platforms for studying host–pathogen interactions (e.g., *Salmonella*, SARS-CoV-2).
    - **Kidney & Pancreatic Organoids:** Hold promise for transplantation and functional tissue replacement.
- **Clinical Impact:** Offers patient-specific *disease modeling*, drug discovery without animal testing, and a step toward organ bioengineering.
- **Challenges:** Lack of vascularization, incomplete maturation, and difficulty scaling organoids for therapeutic transplantation.

Exosome-Based Therapy

- **Concept:** Instead of transplanting whole stem cells, scientists utilize extracellular vesicles (EVs) and exosomes secreted by stem cells.
- **Contents:** Exosomes carry proteins, lipids, mRNAs, and regulatory microRNAs that stimulate regeneration, angiogenesis, and immunomodulation.
- **Advantages:**
    - Lower risk of immune rejection or tumorigenicity compared to whole-cell transplantation.
    - Easier to store, transport, and administer as a "cell-free" therapy.
- **Applications:**
    - **Cardiac Repair:** MSC-derived exosomes promote neovascularization and functional recovery post-myocardial infarction.
    - **Neurological Disorders:** Exosomes cross the blood–brain barrier and deliver neuroprotective molecules in models of Parkinson's and Alzheimer's disease.
    - **Wound Healing:** Exosomes accelerate re-epithelialization and collagen deposition.
- **Challenges:** Standardization of exosome isolation, large-scale manufacturing, and ensuring consistency of therapeutic potency.

3D Bioprinting of Stem Cells

- **Technology:** Uses computer-aided design and bioinks (hydrogels + stem cells + growth factors) to fabricate complex 3D tissue constructs layer by layer.
- **Advantages:**
    - Enables patient-specific, anatomically accurate tissue grafts.
    - Provides controlled microenvironment for stem cell survival, differentiation, and function.
- **Applications:**
    - **Cartilage Regeneration:** 3D bioprinted MSC constructs restore articular cartilage in osteoarthritis.
    - **Vascularized Tissues:** Prevascularized liver and kidney constructs show promise for transplantation.
    - **Skin & Bone Grafts:** Bioprinted skin with stem cells accelerates wound closure in burns.
    - **Heart Patches:** iPSC-derived cardiomyocytes printed into patches enhance cardiac function in ischemic models.
- **Challenges:** Vascularization and innervation of printed tissues, scaling to full organ size, immune compatibility, and cost of bioprinting technology.

Table:2 Comparative Overview of Recent Innovations in Stem Cell Therapy

Innovation	Principle/ Mechanism	Applications	Advantages	Limitations/ Challenges	Clinical Status
Gene-Edited Stem Cells	Correction of disease-causing mutations in iPSCs or ESCs using CRISPR–Cas9, TALENs, or zinc-finger nucleases.	Sickle cell anemia, β-thalassemia, cystic fibrosis, Huntington's disease, personalized gene-corrected therapies.	Patient-specific, mutation-free stem cells; reduced immune rejection; potential for curative therapies.	Risk of off-target mutations; tumorigenicity; ethical/regulatory hurdles; high cost.	Early clinical trials for hematological disorders (e.g., sickle cell).
Organoids	3D self-organizing structures derived from ESCs/iPSCs that mimic organ structure and function.	Brain (neurodevelopmental diseases), liver (hepatitis, drug testing), gut (infection models), pancreas/kidney (replacement).	Physiological disease modeling; personalized drug screening; potential for tissue replacement.	Lack of vascularization; incomplete maturation; limited scalability; technical complexity.	Preclinical stage; widely used for research and drug discovery.
Exosome-Based Therapy	Use of stem cell-derived extracellular vesicles (EVs) and exosomes carrying proteins, lipids, and microRNAs to induce regeneration.	Cardiac repair (MI), neurodegenerative diseases, wound healing, immunomodulation.	Non-cell-based therapy; lower tumor risk; crosses blood–brain barrier; easy storage/transport.	Standardization of isolation; potency variability; large-scale manufacturing challenges.	Preclinical and early clinical studies in cardiac, neurological, and wound healing applications.
3D Bioprinting	Use of bioinks (stem cells + biomaterials) with CAD-guided printing to create 3D tissue constructs.	Cartilage repair, vascularized tissue (liver/kidney), bone and skin grafts, cardiac patches.	Patient-specific grafts; precise architecture; scalable for implants; supports complex tissue design.	Vascularization and innervation remain unsolved; expensive; technical expertise required.	

Challenges and Ethical Considerations

While stem cell therapy has advanced significantly in both research and clinical domains, the path to routine and widespread application is obstructed by several biological, technical, ethical, and socio-economic challenges. Addressing these barriers is essential to ensure safety, efficacy, and equity in regenerative medicine.

Immune Rejection and Compatibility

Even when autologous (patient-derived) stem cells are used, processes such as genetic reprogramming, prolonged in vitro culture, or exposure to foreign biomaterials can alter their immunogenic profile. These changes may trigger host immune responses upon transplantation. In allogeneic settings (donor-derived cells), the risk of immune rejection is even higher, necessitating immunosuppressive therapy, which increases the likelihood of infections and long-term complications. Development of universal donor stem cell lines through gene-editing and immunomodulatory strategies remains a promising yet incomplete solution.

Tumorigenicity and Safety Risks

The very hallmark of pluripotent stem cells—their ability to proliferate indefinitely and differentiate into all cell types—also poses a major safety risk. Residual undifferentiated cells in a graft may form teratomas or malignant tumors. For example, preclinical studies using ESCs and iPSCs have demonstrated the emergence of uncontrolled growth in certain transplantation models. Rigorous pre-differentiation protocols, purification techniques, and long-term safety monitoring are therefore critical before clinical application.

Standardization, Quality Control, and Regulatory Oversight

Stem cell therapies are highly sensitive to culture conditions, growth factors, and laboratory techniques, leading to significant variability between laboratories and even between batches in the same facility. Lack of universally accepted Good Manufacturing Practice (GMP) standards for stem cell preparation undermines reproducibility and clinical reliability. Regulatory agencies, including the U.S. FDA and EMA, have introduced frameworks for advanced therapy medicinal products (ATMPs), but harmonization across countries is lacking, complicating global clinical trials and patient access.

Ethical Issues

The derivation of embryonic stem cells (ESCs) from the inner cell mass of human blastocysts continues to spark moral and religious debates about the status of human embryos. While iPSCs have bypassed many ethical controversies by enabling the generation of pluripotent cells without embryo destruction, issues of consent, donor rights, and potential misuse of technologies (e.g., reproductive cloning, germline editing) remain contentious. Ethical governance and transparent policy frameworks are thus indispensable to ensure public trust.

Cost, Accessibility, and Equity

The complexity of stem cell isolation, expansion, and transplantation procedures drives up costs, making therapies prohibitively expensive for patients in low- and middle-income countries. For example, hematopoietic stem cell transplantation can cost tens of thousands of dollars, while newer regenerative interventions involving iPSCs or engineered tissues remain even more financially demanding. Without equitable access strategies, there is a risk that regenerative medicine will widen existing healthcare disparities rather than alleviate them.

The translation of stem cell therapy from bench to bedside is not solely a matter of scientific advancement but also of ethical responsibility, safety assurance, regulatory alignment, and

socio-economic equity. Overcoming these challenges requires collaboration among researchers, clinicians, bioethicists, policymakers, and industry leaders to build a sustainable and trustworthy framework for regenerative medicine.

Future Prospects

Stem cell therapy continues to stand at the forefront of biomedical innovation, with rapid advances that promise to transform clinical practice in the coming decades. As the field matures, several emerging directions are shaping its trajectory toward safer, more effective, and widely accessible applications.

Personalized Regenerative Medicine

The ability to derive induced pluripotent stem cells (iPSCs) directly from a patient's somatic cells provides a powerful platform for personalized therapies. These patient-specific iPSCs can be differentiated into functional cell types tailored to the individual's genetic and immunological profile, thereby reducing the risk of immune rejection. Beyond transplantation, iPSCs also enable the creation of patient-derived disease models for testing drug responses, advancing the concept of *precision medicine*. For example, iPSC-based cardiac models are being used to evaluate arrhythmia risks in patients before prescribing specific drugs.

Integration with Gene Therapy

The convergence of gene editing and stem cell biology is poised to deliver curative solutions for genetic disorders. By correcting disease-causing mutations in iPSCs or hematopoietic stem cells before transplantation, it becomes possible to restore normal cellular function permanently. Early clinical trials using CRISPR–Cas9–edited stem cells for conditions such as sickle cell anemia and β-thalassemia have already demonstrated proof-of-concept. This combined approach promises durable and possibly lifelong cures, reducing dependence on long-term pharmacological treatments.

Artificial Organs and 3D Bioprinting

The development of stem cell–derived organoids and advances in 3D bioprinting bring the prospect of creating fully functional bioengineered organs closer to reality. Bioinks composed of stem cells and biomaterials are being used to fabricate tissues with precise architecture, while organoids provide physiologically relevant templates for organ development. Although challenges such as vascularization and large-scale maturation remain, future breakthroughs could lead to the generation of transplantable organs, addressing the critical shortage of donor organs for end-stage diseases.

Combination Therapies

Stem cell therapy is increasingly being viewed not as a standalone intervention but as part of integrated, multimodal treatment strategies. Combining stem cells with biomaterials, growth factors, extracellular vesicles, or pharmacological agents can enhance engraftment, survival, and functional recovery. For example, MSCs embedded in biomaterial scaffolds show improved outcomes in cartilage repair, while the co-delivery of growth factors accelerates wound healing. Such hybrid approaches will likely become central to future regenerative protocols.

Regenerative Immunology

Stem cells also hold promise in the emerging field of regenerative immunology, where they are explored not only as tissue-replacement tools but also as modulators of the immune system. MSCs, in particular, exhibit strong immunomodulatory properties and are being investigated for autoimmune diseases such as multiple sclerosis, rheumatoid arthritis, and Crohn's disease.

Harnessing these properties could open new avenues for treating immune-mediated and inflammatory disorders that currently lack curative options.

The future of stem cell therapy lies in its integration with complementary biotechnologies, including gene editing, biomaterials, and bioprinting, alongside its expansion into new clinical domains such as immunomodulation and organ replacement. With ongoing efforts to overcome challenges of safety, scalability, and accessibility, stem cell therapy is steadily moving from experimental innovation to mainstream clinical reality.

Conclusion

Stem cell therapy has evolved from a theoretical concept to one of the most dynamic pillars of regenerative medicine, offering unprecedented opportunities to repair, regenerate, and even replace diseased or damaged tissues. Unlike conventional therapeutic strategies that primarily manage symptoms or slow disease progression, stem cell–based interventions target the underlying pathophysiology, with the potential to provide curative outcomes for some of the most challenging medical conditions, including neurodegenerative disorders, cardiovascular diseases, diabetes mellitus, musculoskeletal pathologies, and hematological malignancies.

Recent decades have witnessed remarkable progress in stem cell biology and translational research. The advent of induced pluripotent stem cells (iPSCs) has enabled the generation of patient-specific, ethically acceptable pluripotent cells, while gene-editing tools such as CRISPR–Cas9 have made it possible to correct genetic mutations at their source, paving the way for personalized, mutation-free therapies. Organoid development has created physiologically relevant in vitro models that serve both as platforms for drug discovery and as precursors for functional tissue engineering. Meanwhile, exosome-based therapies and 3D bioprinting technologies are redefining the boundaries of cell-free and engineered regenerative interventions. Together, these innovations are not only reshaping clinical practice but also expanding the scope of biomedical research and precision medicine.

Nonetheless, the translation of these breakthroughs into routine medical practice remains tempered by critical challenges. Issues of immune rejection, tumorigenic potential, standardization, and long-term safety continue to limit clinical confidence. Ethical debates, particularly surrounding the use of embryonic stem cells, highlight the ongoing need for transparent policies and societal dialogue. Equally pressing are the economic and accessibility concerns, as high costs threaten to widen global health disparities, restricting these advanced therapies to resource-rich settings unless deliberate strategies for equity are implemented.

Looking forward, the integration of personalized regenerative medicine, gene therapy, biomaterials, and immunomodulation is likely to redefine the landscape of therapeutic medicine. Stem cell therapy may soon transition from being viewed as an experimental or last-resort intervention to becoming a mainstream standard of care for a wide range of conditions. Importantly, its future success will depend not only on scientific discovery but also on interdisciplinary collaboration among researchers, clinicians, ethicists, policymakers, and industry stakeholders to ensure that therapies are **safe, ethically grounded, economically feasible, and universally accessible**.

In conclusion, stem cell therapy stands at the threshold of transforming modern medicine. By bridging basic science with clinical application, and by addressing the current biological, ethical, and regulatory barriers, regenerative medicine has the potential to revolutionize healthcare in the 21st century—offering hope, healing, and improved quality of life for millions of patients worldwide.

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ARTIFICIAL INTELLIGENCE IN ACADEMIC PERFORMANCE OPTIMIZATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract
This is a systematic literature review examining the transformative power of Artificial Intelligence (AI) in the optimisation of academic performance among under graduates studying computer science. The review is composed of synthesizing evidence of the effectiveness of AI in the fields of academic performing, personalized learning, assessment and feedback, dropping risk forecasting, and the ethics issues in 36 peer-reviewed studies published within the time of 2020 to 2025. The use of AI-based tools, both intelligent tutoring systems and predictive models, has shown a considerable increase in student performance, with up to 94 percent accuracy in detection of academic success. The personalized learning system is based on the properties of AI, which enables it to acquire considerable levels of classification accuracy (greater than 97% accuracy) when tailoring content based on various cognitive and learning styles. The assessment tools based on AI improve the accuracy of evaluation and decrease the level of test anxiety, but these methods still face some issues (such as algorithmic bias or transparency). Dropout risks can also be predicted by 71 to 94 percent accuracy with the help of predictive models (i.e., ensemble methods and deep neural networks) to take proactive intervention to address the problem. The ethical issues related to bias or privacy and equitable access, however, highlight the importance of transparency and inclusion when designing rather than unconsciously bringing about AI. The review notes that such integration of AI should be enabled by the presence of hybrid human-AI solutions, collaboration across the arts and sciences, and well-established ethics frameworks. Future studies should centre on adaptive personalization, explainable AI, and the successful inclusion of equitable access to construct effective, sustainable, and inclusive learning environments.
Keywords: Artificial Intelligence, Academic Performance, Personalized Learning, Predictive Modeling, Ethical Concerns

PHYTOCHEMICAL, ANTIBACTERIAL, ANTIOXIDANTS ANALYSIS AND PHARMACOLOGICAL INVESTIGATION OF EXTRACT FROM *PHRYNIUM PLACENTARIUM* LEAVES

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ABSTRACT

dicinal plants have long served as vital sources of therapeutic agents, contributing significantly to traditional and modern healthcare. *Phrynium placentarium*, widely used in South and Southeast Asia for food wrapping and folk remedies, was investigated for its phytochemical, antioxidant, antibacterial, and analgesic properties. The objective of this study was to evaluate the pharmacological potential of *P. placentarium* leaf extract to validate its traditional uses. Methanolic extraction was performed following drying and grinding, and qualitative phytochemical screening identified the presence of tannins, phenolics, flavonoids, glycosides, and alkaloids. Antioxidant activity was assessed using DPPH radical scavenging, hydrogen peroxide assay, and determination of total phenolic, flavonoid, and tannin contents. Antibacterial activity was tested by disk diffusion against selected Gram-positive and Gram-negative bacteria, while analgesic potential was evaluated through acetic acid-induced writhing

in Swiss albino mice. The results indicated significant antioxidant activity, confirming high phenolic and flavonoid content. Analgesic assays demonstrated notable inhibition of writhing reflexes, with 250 mg/kg and 500 mg/kg doses showing 58.93% and 53.58% inhibition, respectively, compared to 74.11% for the standard drug. However, antibacterial assays revealed no significant inhibitory activity against tested microorganisms. These findings support the ethnomedicinal claims regarding the plant's antioxidant and analgesic properties, though not antibacterial effects. Further research is recommended to isolate bioactive compounds and elucidate mechanisms of action, which may contribute

TO THE DEVELOPMENT OF NOVEL PLANT-DERIVED THERAPEUTIC AGENTS.

KEYWORDS: *Phrynium placentarium*, Phytochemical screening, Antioxidant activity, Analgesic effect and Medicinal plants

INTRODUCTION

Plants are the gifts of nature. Today the large numbers of drugs in use are derived from plants, like morphine from Papaver somniferum, Aswagandha from Withani somnifera, Ephedrine from Ephedra vulgaris, Atropine from Atropa belladonna, Reserpine from Roulphia serpentina etc. The medicinal plants are rich in secondary metabolites (which are potential sources of drugs) and essential oils of therapeutic importance. The important advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability (Abdullaev and Gonzalez de Mejia, 1997; Abdullah and Salimon, 2009). Because of these advantages, the medicinal plants have been widely used by the traditional medical practitioners in their day-to-day practice. According to a survey (1993) of World Health Organization (WHO), the practitioners of traditional system of medicine treat about 80% of patients in India, 85% in Burma and 90% in Bangladesh (Abdullah and Salimon, 2009; Osman et.al., 2020). Medicinal use of plants is very old. The writings indicate that therapeutic use of plants is as old as 4000–5000 B.C. and Chinese used first the natural herbal preparations as medicines.

Plants provide several classes of phytochemicals such as alkaloids, polyphenols ie flavonoids, phenolic acids, tannins, lignans, and terpenoids including terpenes, and carotenoids, along with glycosides, saponins, polysaccharides, and lipids (Shukia et.al., 2000; Samadd et.al., 2024). These substances have shown promise in treating several illnesses, such as cancer (Tyagi et.al., 2010), diabetes mellitus (Shukia et.al., 2000), inflammatory conditions (Metodiewa et.al., 1997), and cardiovascular disease (Cassidy et.al., 2016). Additionally, microbial sources like fungi, bacteria, and actinomycetes are increasingly studied for their bioactive compounds, which offer diverse chemical structures and unique modes of action (Iwai et.al., 1992). Notably, around half of the pharmaceutical agents approved by the FDA incorporate natural products or their derivatives (Anand et.al., 2019).

Phrynium placentarium is the member of the family Marantaceae (order Zingiberales), classified within the Commelinids clade of the monocotyledonous flowering plants according to APG IV system (Cole et al., 2019). With two flowers per bract and a basal leaf, *Phrynium placentarium* (Marantaceae) is 1-2 meters tall and grows in damp, gloomy areas in the forests of Bhutan, Indonesia, Myanmar, the Philippines, Thailand, Vietnam, and the northeastern region of India (Flora of China, 2000). The native tribes utilise it as a traditional medication to treat kidney disorders. (Deb et.al., 1983; S. Bhowmik et.al., 2013), although no phytochemical research has been done on it.

Numerous phytochemicals, including Alkaloids, Flavonoids, Steroids, Tannins, Acidic compound, Glycoside, Phenolic content were found in the *P. placentarium* leaves, according to

this phytochemical study. For the first time, one study looked into the plant's aerial portions and discovered component 1, which is pale yellow in colour. Compound 1 was determined to be a flavonoid glucoside by chemical and spectroscopic (NMR and mass) techniques. Compound 1 is a novel natural substance as far as they were aware. As a component of their Compound 1's antioxidant and furin-inhibiting properties were investigated in routine work. In that paper, 1 from the aerial portions of *P. placentarium* is isolated, its structure is clarified, and its effectiveness as an antioxidant and PCSK3 (furin) inhibitor is discussed (De et.al., 2015).

Diarrhoea and antibiotic resistance are two global health issues that highlight the urgent need for innovative therapies. In 2019, diarrhoea caused 1.1 million fatalities, making it a major cause of death in underdeveloped nations alone (Vos et.al., 2020; Levine et.al., 2023), with contributing variables such as unsanitary surroundings and microbiological illnesses (such as Salmonella typhi, Escherichia coli, and Candida albicans) (Vos et.al., 2020; Darby et.al., 2023). As a result, in order to address these global health issues, there is an increasing emphasis on plant-derived antimicrobials as substitutes for traditional antibiotics (Tiwari et.al., 2023; Sher, 2009). Furthermore, the body's reaction to injury or infection causes pain, which is a common result of inflammation. Despite the possibility of side effects, NSAIDs and opioids are essential for treating pain (Carter et.al., 2014; Islam et.al., 2020).

Antimicrobial resistance is made more likely by the increase in infectious diseases, which is a global concern (Jones et.al., 2008). By 2050, the WHO estimates that AMR will be responsible for almost 10 million fatalities (Murray et.al., 2022). Although there are many synthetic medications on the market to cure ailments, they frequently have serious adverse effects. Conversely, plant-based Drugs have fewer side effects and stronger therapeutic results (Islam et.al., 2022; Zaman et.al., 2023). Since natural plant-based products have recently drawn attention as a significant source of novel, safe, and potent secondary bioactive metabolites with therapeutic potential, creating new antibacterial medications from natural sources may be beneficial in reducing bacterial growth and mitigating antimicrobial resistance.

The purpose of this work was to use the phytochemical group test to characterise the phytochemical content of *P. placentarium* leaf tissue.The study investigated a number of biological processes linked to the leaf extract using both in vitro and in vivo techniques. This comprehensive study aims to close the gap between chemical composition and biological efficacy by combining in vitro, in vivo, and phytochemical group testing, thereby revealing the potential therapeutic characteristics of *P. placentarium*.

MATERIALS AND METHODS

EXTRACTION

Photochemistry or plant chemistry subject has been developed recently as a distinct discipline, wherever in between natural product organic chemistry and biochemistry and is thoroughly related to the both. It is apprehensive with the enormous diversity of organic constituents that are expounded and amassed by the plant and deals with chemical structures of these constituents and others like biosynthesis, turnover, metabolism, biological function and natural distribution. For all of these operations, methods are essential for purification, separation and identification of many diverse constituents presents in the plants. Extraction means solid-liquid extraction (leaching) which is the process of removing a solute or solutes from a solid by using of liquid solvent (De Silva et.al., 2017). The precise mode of extraction naturally depends on the texture and water content of the plant material being extracted and on the type of substance that is being isolated.

Generally, two types of procedure are used for obtaining organic constituents-

1. Cold extraction and
2. Hot extraction

The extract obtained is then concentrated and constituents are separated by different methods such as chromatography. As a standard precaution against loss of material, concentrated extracts should be stored in the refrigerator (Ingle et.al., 2017).

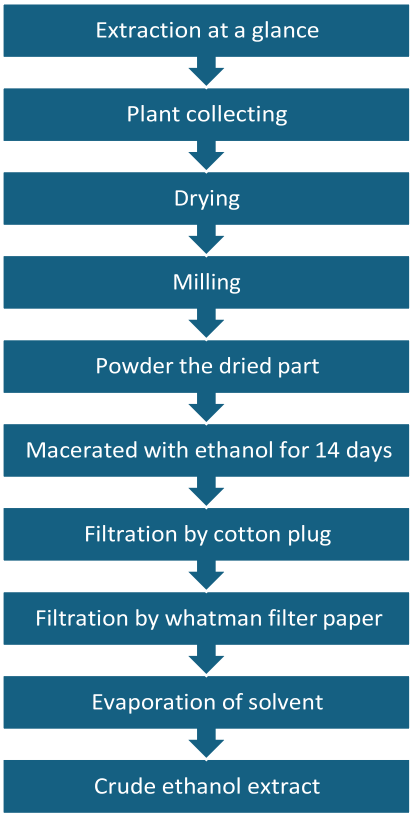
Drying and Grinding

The collected plant parts were separated from undesirable materials or plants or plant parts and were washed with water. They were sun-dried for one week. The plant parts were grinded into coarse powder with the help of a suitable grinder (Capacitor start motor, Wuhu motor factory, China). The powder was stored in an airtight container and kept in a cool, dark and dry place until analysis commenced (Ingle et.al., 2017).

Cold Extraction (methanol extraction)

About 450 gm of powered material was taken in a clean, flat-bottomed glass container and soaked in 1900 mL methanol. The container with its contents was sealed and kept for a period of 14 days accompanying occasional shaking and stirring. The whole mixture then underwent a coarse filtration by a piece of clean, white cotton. Then it was filtered through What-man

filter paper (Harborne et.al., 1985).



Chemical Groups Test

Testing of different chemical groups present in extract represents the preliminary phytochemical studies. To identify the chemical constituents of plant extract standard procedures are followed to evaluate the pharmacological activity of the extract, identification of the nature of the compounds presenting crude extract is essential. The crude extract was qualitatively tested for the presence of chemical constituents using the specific reagents and chemicals. In each test

10% (w/v) solution of extract in ethanol was taken unless otherwise mentioned in individual test (Evans, 2009).

Qualitative test for phytochemical screening

1. Detection of Reducing sugar	
Test	**Procedure**
Benedict's Test	An aliquot of 1mL of aqueous extract of the plant material was taken in a test tube. 5mL of Benedict's solution was added to the test tube, boiled for 5 minutes and allowed to cool spontaneously. No red color precipitate of cuprous oxide indicates the absence of a reducing sugar. Here dextrose was used as standard. The final color of the solution depends on how much of this precipitate was formed, and therefore the color gives an indication of how much reducing sugar was present. Increasing amounts of reducing sugar > Green orange red brown (De Silva et.al., 2017).
2. Detection of Tannin content	
Test	**Procedure**
Potassium dichromate	Test An aliquot of 2 mL aqueous solution of the extract was taken in a test tube. Then 1 mL of 10% (w/v) aqueous potassium dichromate solution was added in the test tube. Formation of a yellow precipitate indicates the presence of tannins. Here Gallic acid/ aqueous solution of catechu was used as standard (Singh and Kumar, 2017).
3. Detection of Phenolic compound	
Test	**Procedure**
Ferric Chloride	Test An aliquot of 2 mL aqueous solution of the extract was taken in a test tube. Then 1mL of 5% (w/v) aqueous Ferric chloride solution was added in the test tube. Dark green or bluish black color precipitate indicates the presence of phenolic hydroxyl groups. Here aqueous solution of rose petal/Gallic acid was used as standard.
4. Detection of Flavonoid	
Test	**Procedure**
Ferric Chloride	Test An aliquot of 2 mL aqueous solution of the extract was taken in a test tube. Then 1 mL of 5% (w/v) aqueous Ferric chloride solution was added in the test tube. Formation of intense green or bluish green color indicates the presence of hydroxyl group

	presence in Flavonoids. Here aqueous solution of rose petal/quercetin was used as standard (Raaman, 2006).
5. Detection of Alkaloid	
Test	**Procedure**
Mayer's Reagent	An aliquot of 2 mL aqueous solution of the extract was taken in a test tube and 0.5 mL of dilute hydrochloric acid (1%v/v) was added in the test tube. Then 1 ml of Mayer's reagent was added. A yellow color or cream color precipitate indicates the presence of alkaloids. Here nicotine was used as standard
6. Detection of Steroid	
Test	**Procedure**
Test for Terpenoid	In an aliquot of 2 mL of the chloroform extract solution 2 mL conc. H_2SO_4 was added and heated for about 2 minutes. Appearance of grayish color indicated the absence of terpenoid (Auwal et.al., 2014).
7. Detection of Glycoside	
Test	**Procedure**
Molisch's Reagent	An aliquot of 2 mL of the aqueous extract solution was treated with Molisch's reagent in a test tube and carefully added 2 mL of conc. Sulfuric acid along the sides of the test tube. Formation of the bluish violet ring at the junction of two liquids indicates the presence of Glycosides. Here Digoxin was used as standard.
8. Detection of Acidic compound	
Test	**Procedure**
General Test	2 mL sodium bicarbonate solution was added into 3 mL alcoholic extract solution. Then observed extract solution for the production of effervescences. Extract solution does not produced effervescences. So, extract solution indicates the absence of acidic compound (Bhatt and Dhyani, 2012).

Evaluation of antioxidant activity

DPPH Scavenging Assay Principle

Antioxidant potentiality of the methanol extract of *Phrynium placentarium* was measured on the basis of their scavenging of 2, 2-diphenyl-1-picrylhydrazyl (DPPH). DPPH is a stable free radical comprising an odd number of electrons in it. The aliquots of different concentrations (1-512µg/mL) of the extract were added to 3 mL of a 0.004% w/v solution of DPPH. After 30 min, absorbance was taken at 517 nm, and IC_{50} (Inhibitory conc. 50%) was determined. IC_{50} value

denotes the concentration of sample required to scavenge 50% of the DPPH free radicals. The formula used for % inhibition ratio is,

% inhibition = (Blank OD-Sample OD/Blank OD) X 100

a) ***Apparatus***

- Test tubes
- Beakers
- Sonicate
- Pipette
- Thermometer
- UV spectrophotometer
- Electronic balance

Reagents

- Ethanol
- 0.004% DPPH ethanol solution
- Ascorbic acid (as positive control)

Fig. 2.1: UV Spectrophotometer

Determination of total phenolic content

Principle

Phenolic compounds or polyphenols are the secondary plant metabolites that are all over present in plants and plant products. Many of them are responsible for the reduction of risk of evolving chronic diseases (cardiovascular disease, cancer, diabetes, etc.), due to their antioxidant activities. Phenolic compounds pay to the overall antioxidant activities of plants mainly for their redox activities. Generally, the mechanisms of phenolic compounds for antioxidant activity are neutralizing lipid free radicals and preventing decomposition of hydro peroxides into free radicals. In the present study, the total phenolic content of ethanol extract of *Phrynium placentarium* was determined by using Folin-Ciocalteu (FC) reagent with analytical grade Gallic acid as the standard Extract or standard solution (15.62-500 mg/L) of 1 mL was added to distilled water (9 mL) (Sani and Koita, 2007). Then 1 mL FC reagent (10 times diluted with distilled water) was added. After 5 minutes; 10 mL 7% Na_2CO_3 was added to the mixture. Then it is kept for 30 minutes at room temperature. Then absorbance was measured against blank at 750 nm using UV spectrophotometer. Total phenolic content of the extract was determined from the standard curve and expressed as mg Gallic acid equivalent (GAE)/100 g dried plant extract (Evans, 2009).

Apparatus

- Volumetric flask
- Beakers
- Test tubes
- Centrifuge apparatus
- Pipette
- UV spectrophotometer
- Electronic balance
- Cotton

Reagents

- Folin-Ciocalteu (FC) reagent
- Gallic acid
- Methanol
- Distilled water

Determination of antibacterial activity

2.5.1. Objective

The objective of the present study was to evaluate antibacterial activity of ethanol extract of *Phrynium placentarium* leaf extract by disk diffusion method against some gram-positive bacteria and some gram-negative bacteria.

Test material

Ethanol leaf extracts of *Phrynium placentarium.*

Reagents

- 70 % ethanol
- Nutrient agar medium
- Nutrient broth medium
- Standard antibiotic discs (Amoxicillin) (Schut, 1993).

Microorganisms used for the activity test

Staphylococcus aureus, Bacillus megaterium, Bacillus sereus, Sarcina lutea, Candid aibicans,

Salmonella typhi, Escherichia Coli, Shigella dysentariae, Aspergillus sniger, Bacillus subtillis, Shigella boydii, Vibrio perahemolyticus, Salmonella paratyphi bacterial species were taken. These organisms were collected from the Microbiology Lab, Dhaka International University.

Ingredients	**Amounts (gram/liter)**
• Peptone	7.0
• A Yeast extract	2.0
• Beef extract	1.0
• Sodium chloride	5.0
Agar A	14.0

Evaluation of analgesic activity

Analgesic activity of the ethanolic extract of *Phrynium placentarium* was tested using the model of acetic **2.6.1. Test Materials**

Test materials of crude sample (ethanolic extract) fraction of Phrynium placentarium acid induced writhing in mice (Ahmed and El-Hag, 2004; Saha et.al., 20

2.6.2. Experimental Animals

Young Swiss-albino mice aged 6-7 weeks, average weight 30-40 gm were used for the experiment (Fig. 2.2). The mice were purchased from Jahangirnagar University, Dhaka. They were kept standard environmental condition for 4 days for adaptation after their purchase and fed rodent food and water and libitum. Experimental animals were randomly selected and divided into four groups denoted as group-I, group-II, group-III, group-IV, consisting of 5 mice in each group. Each group received a particular treatment i.e. control, positive control and the two doses of the extract. Each mouse was weighed properly and the doses of the test samples and control materials were adjusted accordingly (Table 2.1).

Fig. 2.2: Swiss Albino mice used for analgesic test

Table 2.1: Experimental profile to assess the effect of crude extract on acetic induced writhing of mice.

Animal Group	Treatment	Dose (mg/kg-body wt)	Route of administration
I (Control) N=5	1% Tween 80 solution in distilled water	_	Oral
II (Positive control) N=5	Diclofenac Na	25 mg	Oral
III (Test group-1) N=5	Ethanolic extract of P*hrynuim placentarium*	250 mg	Oral
IV (Test group-2) N=5	Ethanolic extract of P*hrynuim placentarium*	500 mg	Oral

Tabulation of writhing

Each mouse of all groups was observed carefully to count the number of writhing that they had made in 15 minutes. The animals do not always perform full writhing, because sometimes the animals begin to produce writhing but they do not complete it. This incomplete writhing was taken as half-writhing, so two half-writhing were taken as one full writhing.

RESULTS AND DISCUSSION

Phytochemical Screening Test

The experimental findings of the extract have shown the following phytochemical groups (Table 3.1).

Table 3.1. Result of chemical group test of *Phrynium placentarium* leaf extract

Phytochemical Group	**Result**
Reducing sugar (Benedict's test)	-
Tannin (potassium di-chromate test)	+
Phenolic compound	+
Flavonoid	+
Alkaloid	+
Steroid	+

Acidic compound	+
Glycoside test	+

3.2. Determination of Total Tannin Content

Tannins (or tannoids) are a class of astringent, polyphenolic biomolecules that bind to and precipitate proteins and various other organic compounds including amino acids and alkaloids. The total tannin content of *Phrynium placentarium* leaf extract is 38.44444 mg GAE/g of dried plant extract**.**

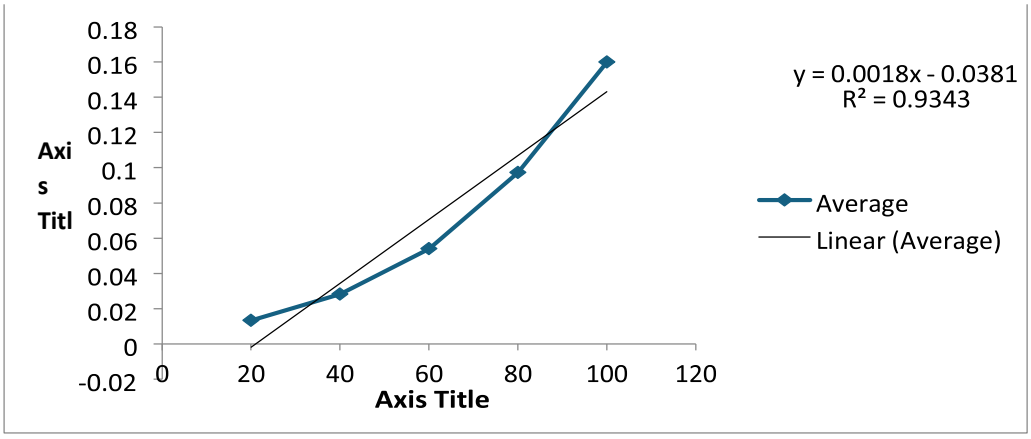


Fig. 3.1: Total Tannin content determination of *Phrynium placentarium* Extract

Determination of Total Phenolic Content

Phenolic compounds are important plant constituents with redox properties responsible for antioxidant activity. The hydroxyl groups in plant extracts are responsible for facilitating free radical scavenging. As a basis, phenolic content was measured using the Folin–Ciocalteu reagent in each extract. The total phenolic content of *Phrynium placentarium* leaf extract is 2.107 mg GAE/g of dried plant extract.

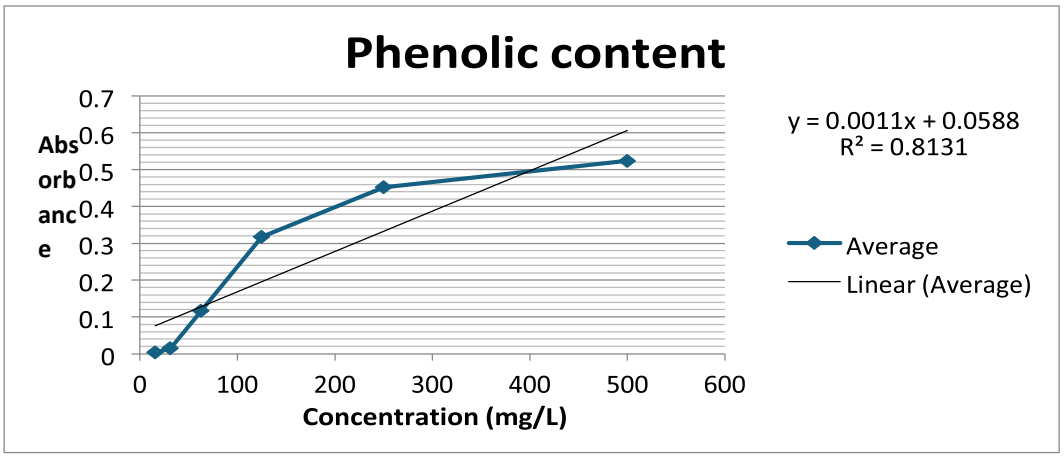


Fig. 3.2. Total phenolic content determination of *Phrynium placentarium* with the help of Gallic acid standard calibration curve.

Determination of Total Flavonoid content

Flavonoids are phytochemical compounds present in many plants, fruits, vegetables, and leaves, with potential applications in medicinal chemistry. Flavonoids possess a number of medicinal benefits, including anticancer, antioxidant, anti-inflammatory, and antiviral properties. The total Flavonoids content of *Phrynium placentarium* extract value is 59.19231 mg GAE/g of dried plant extract (Saha et.al., 2007).

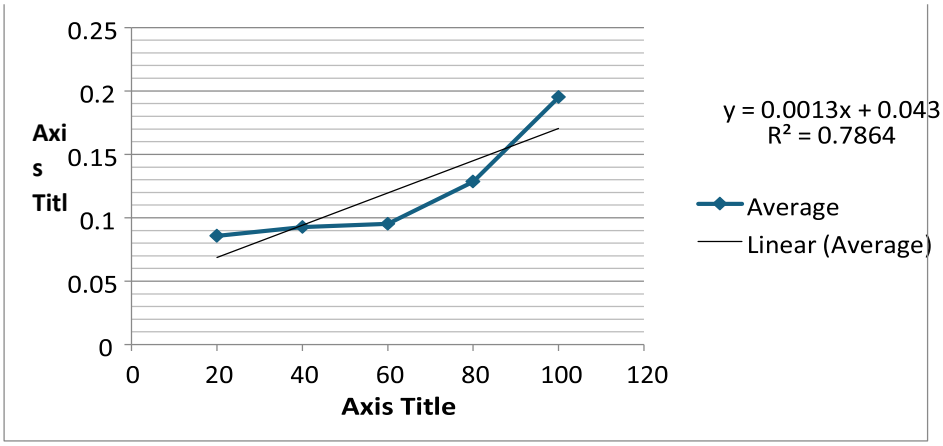


Fig. 3.3. Total Flavonoid content determination of *Phrynium placentarium* Extract

DPPH Scavenging Assay

The DPPH radical (DPPH) is a stable molecule soluble in methanol characterized by its deep-violet color with an absorption maximum at 515nm. Antioxidants (AH) or other radical species (R) are able to react with this stable radical (DPPH) by providing an electron or hydrogen atom, thus reducing it to 2,2diphenyl-1-hydrazine (DPPH-H) or a substituted analogous hydrazine (DPPH-R) characterized by colorless or pale-yellow color which could be easily monitored with a spectrophotometer. This assay is widely used to determine antioxidant activity of crude extracts or purified compounds from plants.

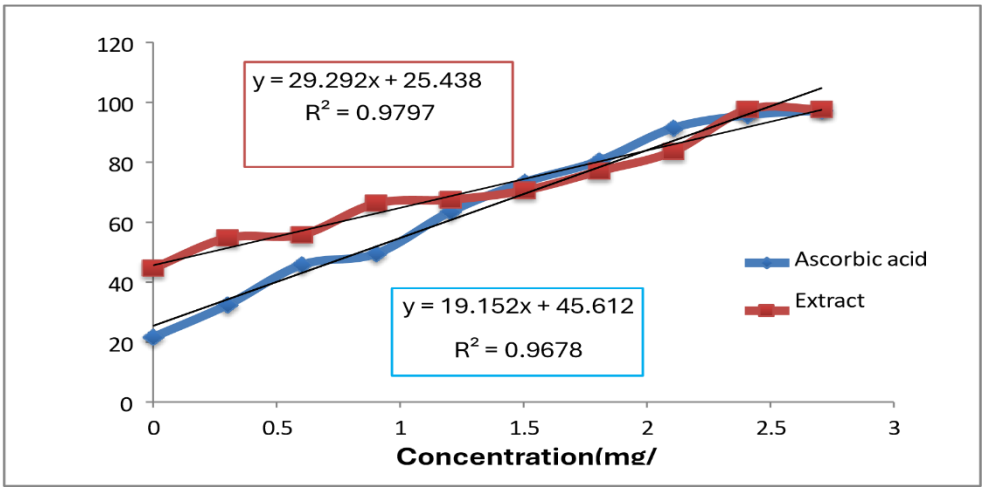


Fig. 3.4. DPPH Scavenging Assay graph of *Phrynium placentarium* extract.

3.6. Hydrogen Peroxide Scavenging Assay

The percentage of hydroxyl radical scavenging activity by the extracts and standard compounds was calculated as follows: % Scavenged (H_2O_2) = [(A_0-A_1)/A_0] X 100.

Where A_0 = is the absorbance of the control and $A_{1=}$ is the absorbance in the presence of the sample of extract and standard.

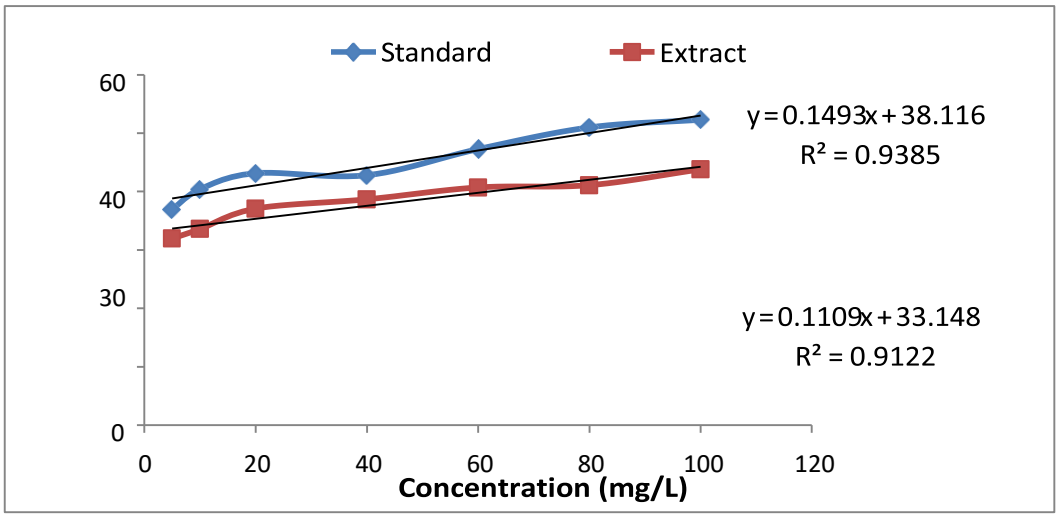


Fig. 3.5. Comparison of % Inhibition vs. Concentration graph for ascorbic acid and *Phrynium placentarium*

Evaluation of Antibacterial activity

Determination of zone of inhibitions

Methanol extract of *Phrynium placentarium* showed excellent zone of inhibition against these all-bacterial species have bacterial activity against of these plant extract bacterial strains in disk diffusion assy. On the other hand, standard ciprofloxacin showed large zone of inhibition against these species.

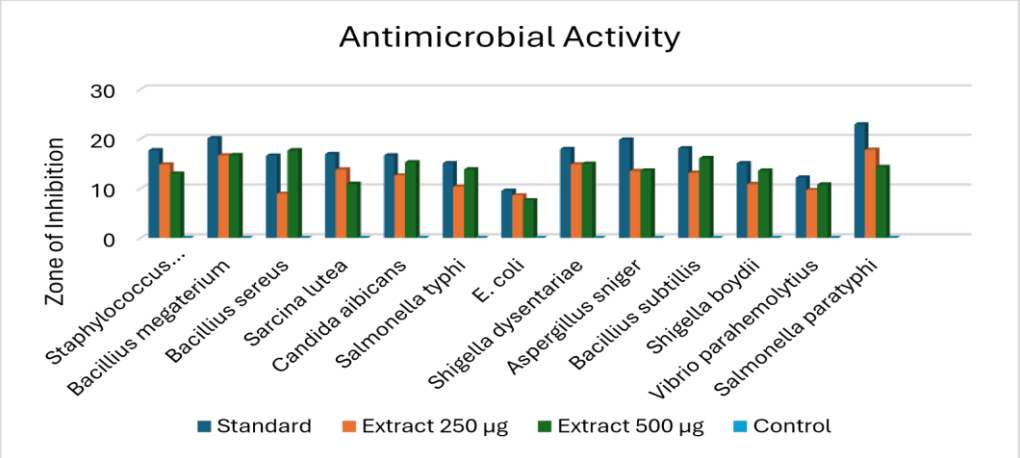


Fig. 4.6. In Vitro Antibacterial Activity of Methanolic Extract of *Phrynium placentarium*

Acetic Acid Induced Writhing Reflex Method

The effect of ethanolic extract of *Phrynium placentarium* on acetic-acid induced writhing in mice showed dose dependent decrease in number of writhing. Extract at doses 250 and 500mg/kg produced 58.93 % ($P<0.05$) and 53.58 % ($P<0.05$) decrease in number of writhing respectively compared to the control group. Diclofenac sodium (25 mg/kg) also showed significant 74.11 % decrease in number of writhing.

(Table 3.12) (Fig. 3.7)

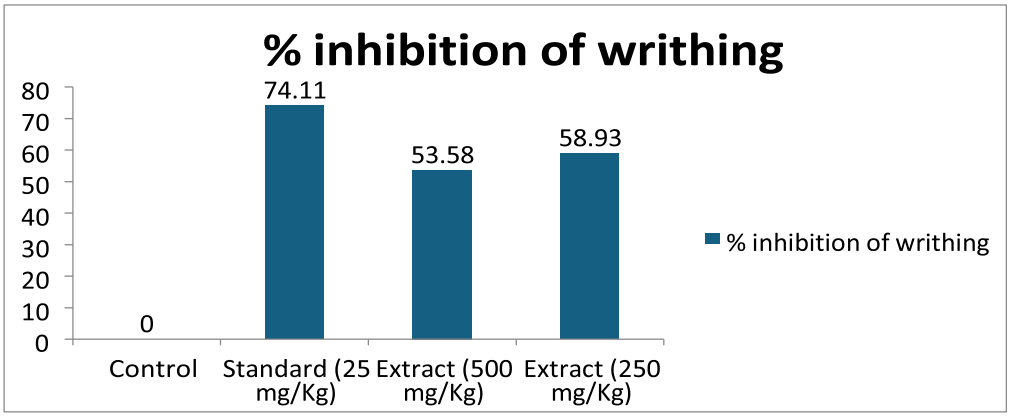


Fig. 3.7. Percentage of writhing inhibition of acetic acid induced writhing in mice by the standard drug & *Phrynium placentarium*.

CONCLUSION

In the present study, pharmacological investigation was carried out with the ethanolic extract of stem of *Phrynium placentarium*. These investigations showed the presence of

- ✓ Phytochemical group
- ✓ Analgesic activity
- ✓ Antioxidant Activity

✓Antibacterial Activity

In the Analgesic Activity of ethanolic extract of *Phrynium placentarium* leaves was significant in comparison with control animals. The extract, at the dose of 250mg/kg and 500mg/kg BW showed some level of decrease in acidic acid induced writhing reflex of mice.

In the Antioxidant study, ethanolic extract of *Phrynium placentarium* leaves showed antioxidant activity thar indicates the antioxidant activity of *Phrynium placentarium.*

In the antibacterial activity test, ethanolic extract of *Phrynium placentarium* leaves didn't showed any bacterial activity that indicates that that the plant doesn't have any bacterial activity.

The results of these investigations justify the uses of the plant in folk medicine. These preliminary studies do not describe the actual mechanism of action of these activities. Further advanced investigations are required to identify the actual mechanism of action as well as to isolate bioactive compounds responsible for each pharmacological activity.

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KINETIC MODELLING OF POWDER-PACK BORONIZED 4CR5MOSIV1 STEEL BY TWO DISTINCT APPROACHES

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Abstract
This work attempts to model the powder-pack boronizing kinetics of 4Cr5MoSiV1 steel in the interval of 1133 and 1253 K in order to predict the layers' thicknesses. The first approach is referred to as the bilayer model and relies on the conservation principle of mass balance equations at the two phase fronts accounting for the linearity of boron distribution across each boride phase. The second approach deals with the application of dimensional analysis to simulate the boronizing kinetics of 4Cr5MoSiV1 steel. Using the bilayer model and the classical parabolic law, the boron activation energies in FeB and Fe_2B were evaluated and discussed in light of the literature data. The estimated boron activation energies from the bilayer model were respectively equal to 164.92 and 153.39 kJ mol^{-1}. These values were very comparable to those calculated from the classical parabolic law. Finally, it was proven that the dimensional analysis was able to simulate the layers' thicknesses for the selected processing parameters.
Keywords: boronizing; iron borides; diffusion; bilayer model; dimensional analysis; activation energy

COMPARATIVE ANALYSIS OF THE BIOCHEMICAL AND MICROBIOLOGICAL QUALITY OF NGA-PI FROM PRODUCTION AND RETAIL SOURCES IN COX'S BAZAR DISTRICT, BANGLADESH

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Abstract
Nga-pi is a traditional fermented fish or shrimp paste. It is usually found in Southeast Asia and can vary in quality depending on its source and the handling process. Nevertheless, concerns have arisen regarding its quality for its inappropriate production and storage practices. This study assessed the biochemical and microbiological quality of Nga-pi samples sourced from a producer in Chowfaldandi Union and a retailer in Cox's Bazar Sadar. The parameters included moisture content, pH levels, thiobarbituric acid reactive substances (TBARS), aerobic plate count, and total fungal count are examined. Findings disclosed that the moisture content was higher in the sample of the producer (45.12%) than the retailer's (40.20%), with a highly significant difference ($p < 0.05$). The producer's sample was slightly alkaline (7.32), whereas the retailer's sample was slightly acidic (6.90), which was also significantly different. TBARS levels, which reflect lipid oxidation, were higher in the retailer's sample (3.52 mg MDA/kg) than in the producer's (1.14 mg MDA/kg), which exceeded the acceptable value. The aerobic plate count (APC) was higher in the retailer's sample (4.80 log CFU/g) than the producer's (4.00 log CFU/g) which showed a significant difference statistically. Both samples remained within the acceptable limits. No fungal growth was noticed in both samples. The results indicate noticeable differences in the quality of Nga-pi based on its source. The retailer's sample depicted the sign of lipid oxidation. These findings underline the necessity of proper handling and improved processing and packaging methods in order to ensure the quality of Nga-pi.

Keywords: Nga-pi. Biochemicsudal quality, Microbiological quality, Lipid oxidation.

CHARACTERIZATION OF GENETIC RESOURCES OF WHITE MULBERRY (*MORUS ALBA* L.) BASED ON PHENOTYPIC TRAITS IN MOROCCO

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Abstract
White mulberry (*Morus alba L.*), also known as "Toot" by Arabic, is a member of the *Moraceae* family. The leaves of the white mulberry, which is widely grown all over the world, are the main food source for silkworms. It is cultivated for its fruit in North African nations, and it is also eaten as a vegetable in some European countries. The leaves are used to make tea and powdered juice in Japan. The plant's fruits, leaves, roots, branches, and bark are all used in traditional medical systems, for their potential to promote health and provide antioxidants.
White mulberry is rich in bioactive compounds such as phenolic acids, flavonoids, flavanols, anthocyanins, macronutrients, vitamins, minerals, and volatile aromatic compounds. In Morocco, white mulberry cultivation is yet traditional and little research has focused on its genetic diversity.
So, this work aimed to evaluate the phenotypic variability of the White mulberry genetic resources. Forty-two qualitative and quantitative morphological characters pertaining to the tree, leaves, and fruit were evaluated across 18 natural accessions sampled throughout its native Moroccan range. Significant intraspecific phenotypic variability was indicated by the analysis of variance, which showed significant variations between accessions for most traits. Moreover, the principal component analysis allowed for the classification of *M. alba* accessions into three distinct morphological groups. These observations reveal a great phenotypic diversity among the natural accessions of this species in Morocco. The study highlighted the phenotypic diversity that could serve as an attractive approach to consider the valorisation of this species in Morocco.
Key words: *Morus alba; Morocco; Phenotypic diversity; Variability; Pomology*

ISOLATION AND CHARACTERIZATION OF A MARINE BACTERIUM WITH ANTIBACTERIAL ACTIVITY AGAINST VIBRIOSIS PATHOGENS IN AQUACULTURE

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Abstract:
As the global aquaculture industry continues to expand, it has increasingly encountered serious challenges, particularly due to the spread of infectious diseases. Vibriosis is one of the most prevalent bacterial infections, leading to high mortality in aquatic environments. Antibiotics and chemicals are commonly applied to combat these diseases. However, these treatments have been widely criticized since they represent a potential risk to aquatic species, consumer and the environment. Therefore, the research of novel, natural and potent antimicrobials, offers a sustainable alternative to minimize the use of aqua chemicals in aquaculture.
In this context, a bacterial strain has been isolated from marine environment and identified based on its morphological, phenotypical and biochemical features using gram staining, catalase test, kligler test and simmon citrate test, as well as on the phylogenetic analysis of the 16S rRNA sequencing. The cell-free supernatant (CFS) of the bacterial strain was subsequently evaluated for its capacity to inhibit the *in-vitro* growth of *Photobact. damselae subsp. damselae* and *Vibrio mediterranei* that are common pathogens known to cause vibriosis in fish.
The selected strain was identified as *Streptococcus bovis*, and it showed important antibacterial activity against the two pathogens. The results suggest that the isolated strain may play an important role in the control of vibriosis caused by *Photobact. damselae subsp. Damselae* and *Vibrio mediterranei* in aquaculture.
Keywords: Lactic acid bacteria, antibacterial activity, vibriosis, aquaculture

THE CLINICAL SIGNIFICANCE OF NORMAL PHYSIOLOGICAL BLOOD PARAMETERS IN HEALTH ASSESSMENT

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ABSTRACT

Blood parameters are vital indicators of physiological and pathological processes in the human body. Normal physiological values serve as reference ranges that guide clinical interpretation of laboratory results, **aiding** in the diagnosis, monitoring, and management of various diseases. These parameters, including hemoglobin concentration, white blood cell count, platelet count, glucose levels, electrolytes, renal and liver function markers, provide crucial insights into the functional status of different organ systems. This study aims to highlight the importance of maintaining and understanding normal ranges of key blood parameters in clinical practice. It also explores how deviations from these normal values can signal early signs of systemic diseases such as infections, anemia, metabolic disorders, organ dysfunction, and hematological abnormalities. The research emphasizes the variability of normal ranges based on age, sex, physiological state, and geographical or ethnic differences, underscoring the need for context-specific interpretation. Accurate interpretation of blood test results depends not only on identifying abnormalities but also on understanding what constitutes "normal." Misinterpretation of these values can lead to misdiagnosis, delayed treatment, or unnecessary interventions. Therefore, this paper advocates for increased awareness among healthcare professionals and students regarding the physiological significance of these reference values. In conclusion, normal blood parameter values are foundational to evidence-based medicine. Recognizing their role enhances diagnostic accuracy, supports early detection of diseases, and promotes better clinical outcomes.

KEY WORDS: Blood parameters, Health assessment, clinical Outcomes, Laboratory results

AN OVERVIEW OF CAD; ETIOLOGICAL FACTORS SURGICAL MANAGEMENTS

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ABSTRACT:

The most leading cause of death is CAD. CAD is a disease of coronary artery characterized by calcium or fat deposition, vascular spasm and clot formation. Arthrosclerosis leads to different cardiovascular diseases which include cardiac muscular damage, hypertrophy, ischemic heart disease and other cardiac abnormalities. CAD is usually related to ischemic heart disease, coronary heart disease, myocardial infarction, angina pectoris and congested heart failure. ECG, MRI, Echo, angioplasty, X-ray, PET, CT scan and cardiac markers are different diagnostic workouts. This article is to review different etiological factors of CAD. These factors are modifiable, non-modifiable, environmental factors, conventional, or traditional, psychological and disease related conditions. Modifiable factors are age, high blood pressure, diabetes mellitus, lack of ordinary activity, obesity and cholesterol rich diet. Non- modifiable factors are family history, age and gender. Environmental factors are tobacco, air pollutants, inhaled gases and pesticides. Moreover, psychological factors include depression, anxiety and stress, social isolation and social inactivity. Non-pharmacological therapy includes lifestyle modifications and precautionary measures. Smoking cessation, low cholesterol diet and exercise are lifestyle modifications to prevent the risk of CAD. Pharmacological therapy for CAD includes different agents i.e. anti-platelet agents, anti-coagulating agents, thrombolytic agents, beta blockers, ACE antagonists and lipid lowering agents. When pharmacological therapy fails to treat a patient, then the second option is surgical management. This article also reviews the surgical managements of CAD. Surgical managements for CAD patients involve angioplasty and CABG. Angioplasty is an alternate of CABG because CABG is more complicated surgical procedure than angioplasty.

Key Words: CAD, Etiological Factors, CABG, Angioplasty

THE PROFESSIONAL DEVELOPMENT NEXUS: CONNECTING TECHNOLOGY ACCEPTANCE TO TEACHER EXCELLENCE

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Abstract
This study investigates the pathway from technology acceptance to teacher performance through professional development in the context of AI chatbot integration in Moroccan educational settings. Using the Technology Acceptance Model (TAM) as a theoretical foundation, we examine how Perceived Ease of Use and Perceived Usefulness influence teacher performance through the mediating role of Professional Development. Data were collected from 330 Moroccan teachers across different educational levels using a structured questionnaire. Structural Equation Modeling (SEM) via SmartPLS 4 was employed to test the hypothesized relationships. Results demonstrate that technology acceptance constructs significantly impact teacher performance, but this relationship is fully mediated by professional development activities. The findings suggest that technology adoption alone is insufficient; rather, it is the professional growth facilitated by technology that drives teacher excellence. These insights have important implications for educational policymakers and institutions seeking to maximize the return on educational technology investments.
Keywords: Technology Acceptance Model, Professional Development, Teacher Performance, AI Chatbots, Structural Equation Modeling

THE AQUATIC BUG *DIPLONYCHUS ANNULATUS*: A PROMISING BIOCONTROL AGENT AGAINST DISEASE VECTOR MOSQUITOES

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Abstract
Mosquito-borne diseases remain a major public health concern, especially in tropical regions. Using natural predators to control mosquitoes may be a more environmentally friendly approach compared to chemical methods, which can adversely affect non-target species. In this study, we investigated the predatory efficiency of *Diplonychus annulatus* (Belostomatidae), a freshwater predator inhabiting both temporary and permanent water bodies, against the larvae of *Aedes aegypti* under controlled laboratory conditions. Exposure of the *Ae. aegypti* larvae to the developmental stages of *D. annulatus* for 24 hours revealed that the consumption rates on *Ae. aegypti* for the 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} nymphal instars were (42±1.22%), (71.00±1.03%), (80.00±1.47%), (84.00±0.91%) and (86.00±1.03%), respectively. On the other hand, the consumption rate of adult *D. annulatus* was 92.00±1.03%. The aforementioned findings suggest that *D. annulatus* is an efficient predator, offering a promising alternative to chemical interventions in vector management. Further investigation on its use in real-world aquatic settings could play a key role in minimizing the prevalence of mosquito-borne diseases.
Key words: Mosquito-borne diseases, Predatory efficiency, *D. annulatus*, *Ae. aegypti*

CLINICAL AND BIOCHEMICAL EVALUATION OF TWO DIFFERENT TYPES OF IMPLANT SCREW RETAINED SINGLE CROWNS

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Background:
The gold standard of implant-retained crowns has for many years been the metal-ceramic cement-retained crowns on a screwed-abutments. Today it represents an alternative if the implant positioning does not allow a screw-retained crown. The possibilities currently offered for this kind of rehabilitation in the posterior areas are represented by a chromium-cobalt/ceramic or a titanium/zirconia crown.
Aim: These two solutions allow different productions workflows and generate different prosthetic interfaces at the implant abutment level. The aim of the study is to verify a significant difference in tissue response can be defined between these two different rehabilitations, 18 months after delivery.
Materials and methods:
A total of 20 participants were included in the study, each of whom had at least two implants in the posterior sectors prosthetically treated with one of the two solutions previously illustrated. The values of Il-1β, IL-6, IL-8 were evaluated, together with the periodontal indices placque index (PI), gingival index (GI), probing depth (PD), bleeding on probing (BOP), gingival recession (REC)

	Ti-Zir	Met-Cer	P diff	r	P corr
PI	0.21 (0.3)	0.22 (0.31)	0.078	0.4	0.072
GI	1.22 (0.5)	1.16 (0.46)	0.084	0.41	0.081
PD (mm)	1.06 (0.18)	1.02 (0.14)	0.62	0.31	0.048
BOP	0.44 (0.18)	0.38 (0.18)	0.80	0.26	0.074

REC (mm)	0.75 (0.4)	0.77 (0.4)	0.68	0.32	0.071

Results:
During the time of clinical observation, at t0 (1 month from the delivery), t1 (9 months after the delivery) and t2 (18 months after the delivery), both types of crowns performed satisfactorily from a clinical point of view. In light of the results obtained, it is possible to define that there are no statistically significant differences between the two techniques, although Cr-Co/Cer has slightly higher values than the other.

Table 1. PCF biomarkers levels as pg/ml per 1-min sample at Ti-Zir and Met-Cer; mean (SD), p of difference and Spearman's rank correlation (r, p for correlation), n=20 participants.

Discussion and conclusions:
It is possible to hypothesize, and confirm through subsequent or longer-term studies, that this difference could lead to a clinically visible difference between these two prosthetic solutions in the longer term. The single crown in Cr-Co shows a different interface with the titanium implant connection compared to the titanium-titanium contact of the connection between the implant and the Ti-Zir crown.
The ceramic that is layered directly on the Cr-Co does not show a connection interface with it, other than the areas hand-finished by the technician, vice versa, the Ti-Zir crown shows an area in which the milled zirconia product is bonded onto the titanium abutment with a resin-based cement.
The causes of this slight difference could be either the better tissue response to titanium and zirconia, or an increased level of inflammation from the Cr-Co/Ti connection.
Keywords: Cr-Co; Implants; Titanium; Resin; Screw-retained; Milling; Zirconia.

THE STRATEGIC IMPORTANCE OF FRENCH IN THE TURKISH EDUCATION SYSTEM: AN ANALYSIS FROM THE PERSPECTIVE OF TURKEY'S GLOBAL ENGAGEMENT

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ABSTRACT

Introduction and Purpose

French, with 321 million speakers worldwide, is one of the most widely spoken languages globally. It holds official language status in prominent international organizations such as the United Nations, European Union, NATO, African Union, World Trade Organization, and International Olympic Committee. Spoken as a primary or secondary language across five continents, French is the official language in 29 countries and is the second most spoken language in Europe after English.

Turkey, emerging as a strong regional actor in the 21st century, systematically expands its strategic presence and influence not only in the Middle East and the Balkans but also in Africa. Turkey plays an increasingly decisive role in the continent's economic, political, and security dynamics. Turkey's growing diplomatic, economic, and cultural presence in Africa makes French a strategic communication tool. Particularly in West and Central Africa, where French is the official language, proficiency in French provides Turkish entrepreneurs and experts with a significant competitive advantage. Knowledge of French enhances the operational efficiency and corporate reputation of Turkish firms in sectors such as infrastructure, energy, and construction.

However, foreign language education in Turkey is predominantly English-focused, and French is not sufficiently supported. The aim of this study is to demonstrate that French is not only crucial for individual career development but also a critical asset for Turkey's international competitiveness and diplomatic effectiveness. It advocates for the centralization of French in the Turkish education system.

Conclusion

French stands out as a critical language in line with Turkey's global strategic goals. Particularly, Turkey's increasing presence in Africa transforms French into a strategic communication tool, providing Turkish entrepreneurs and firms with a competitive advantage. However, French education in Turkey is not adequately supported, as foreign language education is primarily focused on English. In this context, strengthening French education from secondary to higher education with a holistic approach will contribute to the construction of a language policy aligned with Turkey's global strategies. This study emphasizes the necessity of placing French in a more central position within the Turkish education system.

Keywords: Foreign Language, Language Policy, French Education, Diplomacy Language, World Language

FRANSIZCA'NIN TÜRK EĞİTİM SİSTEMİNDEKİ STRATEJİK ÖNEMİ: TÜRKİYE'NİN KÜRESEL ETKİNLİĞİ PERSPEKTİFİNDEN BİR ANALİZ

ÖZET

Giriş ve Amaç

321 milyon konuşuruyla dünyanın en yaygın dillerinden biri olan Fransızca, Birleşmiş Milletler, Avrupa Birliği, NATO, Afrika Birliği, Dünya Ticaret Örgütü ve Uluslararası Olimpiyat Komitesi gibi uluslararası kuruluşlarda resmi dil statüsüne sahiptir. Beş kıtada ana veya ikinci dil olarak konuşulan Fransızca, 29 ülkede resmi dil konumundadır ve Avrupa'da İngilizce'den sonra en yaygın konuşulan ikinci dildir.

21'nci yüzyıla güçlü bir bölgesel aktör olarak adım atan Türkiye, sadece Ortadoğu ve Balkanlar'da değil, Afrika kıtasında da stratejik varlığını ve etkisini sistematik bir şekilde genişletmektedir. Türkiye, kıtanın ekonomik, siyasi ve güvenlik dinamiklerinde giderek daha belirleyici bir rol oynamaktadır. Türkiye'nin Afrika'daki artan diplomatik, ekonomik ve kültürel varlığı, Fransızca'yı stratejik bir iletişim aracı haline getirmektedir. Özellikle Batı ve Orta Afrika'da Fransızca'nın resmi dil olması, bu dili bilen Türk girişimciler ve uzmanlar için önemli bir rekabet avantajı sunmaktadır. Fransızca bilgisi, altyapı, enerji ve inşaat gibi sektörlerde faaliyet gösteren Türk firmalarının operasyonel verimliliğini ve kurumsal itibarını artırmaktadır.

Ancak Türkiye'de yabancı dil eğitimi büyük ölçüde İngilizce odaklı yürütülmekte, Fransızca ise yeterince desteklenmemektedir. Bu çalışmanın amacı, Fransızca'nın yalnızca bireysel kariyer gelişimi için değil, aynı zamanda Türkiye'nin uluslararası rekabet gücü ve diplomatik etkinliği açısından kritik bir sermaye olduğunu ortaya koymak ve Fransızca'nın Türk eğitim sisteminde daha merkezi bir konuma yerleştirilmesi gerekliliğini savunmaktır.

Sonuç

Fransızca, Türkiye'nin küresel stratejik hedefleri doğrultusunda kritik bir dil olarak öne çıkmaktadır. Özellikle Afrika kıtasında artan Türk varlığı, Fransızca'yı stratejik bir iletişim aracı haline getirmekte ve Türk girişimciler ile firmalar için rekabet avantajı sağlamaktadır. Ancak, Türkiye'de Fransızca eğitimi yeterince desteklenmemekte, yabancı dil eğitimi ağırlıklı olarak İngilizce üzerine odaklanmaktadır. Bu bağlamda, Fransızca eğitiminin ortaöğretimden yükseköğretime kadar bütüncül bir yaklaşımla güçlendirilmesi, Türkiye'nin küresel stratejileriyle uyumlu bir dil politikasının oluşturulmasına katkı sağlayacaktır. Bu çalışma, Fransızca'nın Türk eğitim sisteminde daha merkezi bir konuma yerleştirilmesi gerekliliğini vurgulamaktadır.

Anahtar Sözcükler: Yabancı Dil, Dil Politikası, Fransızca Eğitimi, Diplomasi Dili, Dünya Dili

AI-SUPPORTED LANGUAGE LEARNING: THREAT OR OPPORTUNITY?

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ABSTRACT

Introduction and Purpose

In a globalized world, language functions not only as a means of communication between individuals but also as a strategic tool in states' diplomatic relations, companies' commercial activities, and societies' cultural interactions. Language is directly linked to shaping global competition and cooperation dynamics, influencing foreign policies, and securing economic advantages. For instance, English has become the dominant communication language in international economics, science, and technology, offering its users significant competitive advantages; meanwhile, French retains its strategic value in international organizations such as the United Nations, the European Union, and the African Union. With China's economic rise, Mandarin Chinese has emerged as a critical gateway for investment, trade, and cultural exchange in the Asia-Pacific region.

Foreign language learning not only enables individuals to communicate effectively with different communities but also provides access to international opportunities in education, culture, and employment. From academic careers to trade and cultural diplomacy, foreign language proficiency has become a fundamental competence for individuals and a strategic necessity for states.

In recent years, rapid developments in artificial intelligence technologies have had the potential to redefine the future of language learning practices. Large language models facilitate multilingual interaction through instant translation, linguistic feedback, and text enhancement functions; however, when misused, they carry the risk of reducing motivation and marginalizing pedagogical methods. The aim of this study is to discuss the opportunities and risks of artificial intelligence in foreign language learning from an academic perspective and to develop recommendations on how education policies and teaching methods can adapt to this new technological reality.

Conclusion

The findings of the study indicate that artificial intelligence embodies both threats and opportunities in the process of foreign language learning. Biased and uncontrolled AI applications may reduce student motivation and pedagogical effectiveness, while their strategic and ethical use has the potential to personalize and deepen the learning experience. Accordingly, it is necessary to update education policies and to design the integration of AI-supported tools into teaching methods within the framework of ethical and pedagogical principles.

Keywords: Globalization, Language Policy, Foreign Language Learning, Artificial Intelligence, Education Policies

YAPAY ZEKÂ DESTEKLI DIL ÖĞRENIMI: TEHDIT MI, FIRSAT MI?

ÖZET

Giriş ve Amaç

Küreselleşen dünyada dil, sadece bireyler arasında iletişimi sağlamakla kalmayıp devletlerin diplomatik ilişkilerinde, şirketlerin ticari faaliyetlerinde ve toplumların kültürel etkileşimlerinde stratejik bir araç işlevi görmektedir. Dil, küresel rekabet ve iş birliği dinamiklerine yön verebilmesi, ülkelerin dış politikalarını şekillendirebilmesi ve ekonomik üstünlük sağlamasıyla doğrudan ilişkilidir. Örneğin, İngilizce'nin uluslararası ekonomi, bilim ve teknoloji alanlarında yaygın iletişim dili hâline gelmesi, kullanıcısına kayda değer bir rekabet avantajı sunarken; Fransızca Birleşmiş Milletler, Avrupa Birliği ve Afrika Birliği gibi uluslararası örgütlerde stratejik bir değer olarak konumunu korumaktadır. Çin'in ekonomik yükselişiyle beraber Mandarin Çincesi, Asya-Pasifik bölgesinde yatırım, ticaret ve kültürel etkileşimin kritik bir kapısı haline gelmiştir.

Yabancı dil öğrenimi, bireylere farklı topluluklarla etkili iletişim kurma becerisi kazandırmanın ötesinde eğitim, kültür ve istihdam alanlarında uluslararası fırsatlara erişimi mümkün kılmaktadır. Akademik kariyerden ticarete, kültürel diplomasiye kadar pek çok sahada yabancı dil bilgisi temel bir yetkinlik; devletler içinse stratejik bir ihtiyaç olarak ön plana çıkmıştır.

Son yıllarda yapay zekâ teknolojilerindeki hızlı gelişmeler, dil öğrenimi uygulamalarının geleceğini yeniden tanımlama potansiyeli taşımaktadır. Büyük dil modelleri, anlık çeviri, dilsel geri bildirim ve metin iyileştirme işlevleriyle çok dilli etkileşimi kolaylaştırırken; doğru kullanılmadıklarında öğrenme motivasyonunu zayıflatma ve pedagojik yöntemlerin dışına itme riski barındırmaktadır. Bu çalışmanın amacı, yapay zekânın yabancı dil öğrenimi üzerindeki fırsat ve risklerini akademik açıdan tartışmak; eğitim politikaları ve öğretim yöntemlerinin bu yeni teknolojik gerçekliğe nasıl uyarlanabileceği konusunda öneriler geliştirmektir.

Sonuç

Çalışma bulguları, yapay zekânın yabancı dil öğrenim süreçlerinde hem tehdit hem de fırsat barındırdığını göstermektedir. Yanlı ve kontrolsüz AI uygulamaları öğrencinin motivasyonunu ve pedagojik etkililiği düşürebilirken; stratejik ve etik kullanımı öğrenme deneyimini kişiselleştirerek derinleştirme potansiyeli sunmaktadır. Bu doğrultuda, eğitim politikalarının güncellenmesi; öğretim yöntemlerinin, yapay zekâ destekli araçlarla entegrasyonunun etik ve pedagojik ilkeler çerçevesinde planlanması gerekmektedir.

Anahtar Sözcükler: Küreselleşme, Dil Politikası, Yabancı Dil Öğrenimi, Yapay Zekâ, Eğitim Politikaları

OPTIMIZATION OF OIL REMOVAL BY ADSORBENT-BASED PINEAPPLE PEEL WASTE

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ABSTRACT
Oil spill contamination is a significant environmental hazard, particularly in marine ecosystems, leading to pollution, habitat destruction, and threats to marine life. Conventional clean-up methods can be expensive and environmentally harmful, necessitating sustainable alternatives. This study investigates the potential of pineapple peel waste as a low-cost, biodegradable adsorbent for oil spill removal. The research focuses on optimizing the adsorption process by analyzing key parameters such as contact time, pH, oil concentration, adsorbent dosage, and temperature. The adsorbent is developed through drying, grinding, chemical activation, and surface modification techniques to enhance its efficiency. Characterization techniques, including FTIR, SEM, and BET analysis, are employed to evaluate structural and functional properties. The findings are expected to provide insights into the adsorption mechanisms of pineapple peel waste and establish optimal conditions for oil removal.
Keywords: adsorbent, pineapple peel, wastewater

GREEN CHEMISTRY: TRENDS TOWARDS INDUSTRIAL SUSTAINABILITY: A SYSTEMATIC REVIEW

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Abstract
Environmental pollution and threats posed to human life by chemical manufacturing processes has remained a major concern which has led to emerging alternative methods that are eco-friendly, efficient and sustainable along production chain. Recent advancement in green chemistry has repositioned the production environment by promoting efficiency, high capacity performance and good products. Hence, manufacturers now adopt reshoring approach which is a strategy of bringing production closer to where local facilities are found. Reshoring approach has a lot of benefits that promotes stability in production such as reduction in risk, improved in rate of production of finished goods, promoting the economics of local communities, backward integration and adherence to standards set by regulating bodies. This paper has looked into the benefits of green chemistry to industrial growth, their sustainability and technology advancement.
Key words: Green chemistry, eco-friendly, reshoring, production chain, backward integration.

PRECISION MEDICINE IN PSYCHIATRY: BIOMARKERS, GENOMICS, AND THE FUTURE OF PERSONALISED MENTAL HEALTH CARE

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Abstract

Precision psychiatry is bringing a new direction in mental health care. It aims to go beyond symptom based diagnosis and focuses on treatments that match the needs of each patient. Mental illnesses such as: depression, schizophrenia, bipolar disorder and anxiety remain major health challenges worldwide. Traditional approaches often do not capture the differences in causes, brain changes, and treatment response among patients.

Recent work in biomarkers, genomics, pharmacogenomics, and computational science makes more personalised treatment possible. Neuroimaging has shown clear differences in patients, like cortical thinning, reduced hippocampal size, and disrupted brain connectivity. These findings help improve diagnosis and allow doctors to monitor changes during the treatment period.

Proteomic and metabolomic research highlight the role of inflammation, immune imbalance and changes in neurotransmitter activity. Genomic tools such as polygenic risk scores can estimate risk and guide therapy. Pharmacogenomic testing, especially for genes like cytochrome P450 and HLA, supports safer and more effective drug use. Epigenetic studies also show how environment and lifestyle affect gene expression.

Artificial intelligence (AI) and machine learning (ML) are now being used to combine these data sources. They can help predict relapses, treatment outcomes, and long-term progress. Digital biomarkers from phones and wearable devices add real world information and give continuous monitoring outside the clinic.

Still, there are several barriers. Results must be able to be reproduced, populations must be diverse and issues of privacy and ethics need attention. Building biobanks, following standard protocols, and training clinicians will be essential steps.

Precision psychiatry, by joining biology, genetics, and data science, offers the chance to move beyond “trial-and-error” treatment. It brings the hope of more accurate, preventive, and individualised mental health care globally.

Keywords: Precision psychiatry; Biomarkers; Genomics; Pharmacogenomics; Artificial intelligence.

IMPACT OF AI POWERED DIGITAL ASSISTANTS TO CUSTOMER LUXURY BRANDS ONLINE EXPERIENCE

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ABSTRACT

Purpose: The purpose of this study is to examine how AI-powered digital assistants influence customers' online experiences with luxury brands, focusing on customer engagement, brand perception, and purchase intentions. **Methodology/Approach/Design:** A quantitative cross-sectional survey was conducted with 320 participants who had prior experience using AI-based digital assistants for online shopping. Data were analyzed using reliability tests, correlation analysis, and structural equation modeling to assess direct and indirect effects. **Findings:** The findings demonstrate that AI-powered assistance significantly enhances customer engagement, positively shapes brand perception, and improves luxury online shopping experiences. Moreover, customer engagement and brand perception were found to partially mediate the relationship between AI assistance and overall customer experience, highlighting their pivotal roles.

Research Limitations/Future Implications: The study concludes that AI technologies, when integrated thoughtfully, can foster trust, loyalty, and long-term engagement with premium brands. However, the results also underline the necessity of balancing technological efficiency with human interaction to preserve exclusivity and authenticity. Future research should explore cross-cultural contexts and ethical concerns such as data privacy, while practitioners are advised to adopt hybrid AI–human strategies to strengthen consumer relationships.

Value/Originality: This study contributes to the literature by examining how AI-powered digital assistants can enhance customer experience in the luxury retail sector, offering insights into improving customer engagement, brand perception, and online shopping behaviors. The findings underline the potential for combining AI technologies with human touch to foster long-term loyalty in premium brands.

Keywords: Artificial Intelligence, Customer Engagement, Brand Perception, Luxury Retail, Digital Assistants

ETHICAL LEADERSHIP AND EMPLOYEE AGILITY IN BANKING SECTOR: THE MEDIATING ROLE OF ADAPTIVE PERFORMANCE

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ABSTRACT

The purpose of this study is to investigate how ethical leadership supports employee agility in Pakistan's banking sector and to further find the mediating role of adaptive performance or mechanism through which this relationship operates. While earlier research has proven that ethical leadership helps employees succeed, new studies point out how this leadership changes to each culture, mainly in developing countries, which can improve employees' abilities to deal with new and quickly shifting conditions (Kim & Yoon, 2025). By using a quantitative approach, the research has collected surveys from 330 bank workers and carried out correlation, regression and mediation analysis to test the proposed links. The results are projected to bring about new ideas by findings on leadership and agility through adaptive performance and to help manage banks smoothly as the market becomes more volatile. Limitations and future guideline of this research has been discussed.

Keywords: Ethical Leadership, Employee Agility, Adaptive Performance, Social Learning Theory, Banking Sector

EFFECTS OF PEER ASSESSMENT ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SENIOR SECONDARY SCHOOLS IN JOS NORTH, PLATEAU STATE, NIGERIA

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ABSTRACT

The study investigated the effects of peer assessment on senior secondary school students' achievement in mathematics in Jos North Local Government Area of Plateau State, Nigeria. To achieve this objective, three research questions and three hypotheses were formulated. A quasi-experimental research design, specifically the non-equivalent pre-test and post-test control group design, was adopted for the study. Two public senior secondary schools in Jos North local government area were selected for the study using simple random sampling. A sample of 78 SS II students was used in their intact classes. An instrument titled Mathematics Achievement Test (MAT) was used for data collection. The reliability of the instruments was established using the Kuder-Richardson (K-21) method, and a reliability coefficient of 0.82 was obtained. Descriptive statistics of mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the hypotheses. The findings of the study revealed that students who were exposed to peer assessment strategy achieved significantly higher in mathematics than those taught using conventional teacher-led assessment methods. The study concluded that peer assessment has a significant effect on senior secondary school students' achievement in mathematics. It was recommended that mathematics teachers should incorporate peer assessment strategies into their instructional practices to promote active learning and improve students' achievement. Educational authorities should provide a professional development programme to train teachers in the effective implementation of peer assessment, and schools should foster a collaborative learning environment that supports peer interaction.

KEYWORDS: Peer Assessment, Mathematics, Achievement,

INTRODUCTION

Mathematics is one of the vital subjects in the Nigerian secondary school curriculum. Mathematics is one of the core and essential subjects at primary and secondary levels of education due to its importance and usefulness in everyday activities, and it is the gateway to future professions in different fields (Suleiman & Hammed, 2019). The teaching and learning of mathematics should not be left alone to the teachers because students' understanding of mathematics varies, and if learning stops only in the classroom, academic performance in mathematics will be poor. Generally, in most public schools, students have resorted to tutorial classes, which are a form of peer tutoring, to enable them to understand the mathematics better (Obilor & Okah-Tim, 2020).

The role of mathematics in cognitive development is well-documented, as it enhances critical thinking and analytical skills necessary for navigating real-world challenges (Boaler, 2019). In

senior secondary schools, mathematics remains a core subject required for students to progress into higher education and professional careers. Mathematics plays a crucial role in the intellectual and practical development of individuals, equipping them with essential problem-solving, logical reasoning, and analytical thinking skills that are vital in everyday life and in various professional fields (Pickering, Attridge, Inglis & Morsanyi, 2025). It enhances an individual's ability to make informed decisions, interpret data, manage finances, and understand the world through a quantitative lens. Mathematics education fosters cognitive development and cultivates critical thinking abilities necessary for addressing real-life challenges. Furthermore, Amoo and Disu (2020) assert that mathematics is indispensable in fields such as engineering, technology, economics, and the sciences, thus empowering individuals to thrive in the modern, data-driven economy. The integration of mathematical skills into daily life not only supports personal financial literacy and problem-solving efficiency but also contributes to national development through an informed and capable citizenry (Omoniyi & Fawehinmi, 2025). As such, the mastery of mathematics is not just a school-based requirement but a lifelong tool for individual empowerment and societal advancement.

Mathematics is a cornerstone of national development, and its inclusion in the Senior Secondary School Mathematics Curriculum in Nigeria is critical for preparing students to contribute meaningfully to the country's socio-economic and technological advancement. The curriculum is designed to build foundational knowledge and skills in areas such as algebra, geometry, statistics, and trigonometry, which are essential for various sectors including science, engineering, finance, information technology, and data analysis. Abakpa and Iji (2021) submit that mathematics education equips students with the analytical and logical reasoning skills needed to solve complex problems, innovate, and adapt to emerging technological trends. The Federal Ministry of Education (2020) emphasises that mathematics literacy is vital for producing a workforce capable of supporting industrial growth, scientific research, and national planning. Students with strong mathematical backgrounds are better positioned to pursue careers that directly impact economic productivity and infrastructure development. Therefore, a well-structured and effectively implemented mathematics curriculum at the senior secondary level is essential for fostering human capital development and driving Nigeria’s progress toward achieving national goals such as Vision 2030 and the Sustainable Development Goals (SDGs).

Despite its significance, mathematics is often perceived as a difficult subject by many students, resulting in poor academic achievement and negative attitudes toward learning. To ascertain the level of achievement in terms of performance of the students, there is a need for assessment. The negative impact of the traditional, rigid assessment methods can be seen in students’ consistently poor performance in major external examinations like the West African Examinations Council (WAEC) and the National Examinations Council (NECO). Between 2020 and 2024, WAEC results reflected significant variations in candidate turnout and performance levels. In 2020, there was a sharp drop in participation, with only 66,375 candidates taking the exam and a low pass rate of 39.82%. In 2021, performance surged, with 81.7% of students passing, mainly due to targeted efforts to recover from the setbacks caused by the COVID-19 pandemic. However, a drop was recorded in 2022, with a pass rate of 76.36%, suggesting that the system still faces substantial challenges. A modest increase occurred in 2023, with 79.81% success, but this was followed by another decline in 2024, when only 72.12% passed, despite the large candidate pool of 1,805,216. Considering the pivotal role of mathematics in academic advancement and career development, it is essential to adopt innovative assessment methods that promote active student engagement. Failure to do so could

prevent students from gaining university admission, as mathematics is a key requirement in the admission process.

Assessment, therefore, is the formal act or process of developing an opinion of value. It is an integral part of the learning process, which should play an important role in the educational model. It comprises all activities to help learners recall what has impacted them, for example, tests, assignments, demonstrations, illustrations, and others on a large scale or at the classroom level. It helps to engage students, clarify roles, promote learners, diversify the scope of evaluation, and much more. Classroom assessment is often conducted by the teacher alone, but education today requires assessment strategies that are student-centred, one of which is peer assessment (Becker, 2017).

Peer assessment, as a form of formative assessment, involves students evaluating their peers' work based on predetermined criteria, allowing them to identify errors, provide constructive feedback, and reinforce their own understanding of mathematical concepts (Topping, 2021). Peer assessment is an innovative instructional strategy that promotes student-centred learning by encouraging active participation, collaboration, and self-reflection (Falchikov, 2020). In the context of mathematics education, peer assessment has been shown to improve students' achievement by fostering deeper engagement with mathematical concepts by which, when students evaluate their peers' work, they develop a greater sense of responsibility for their learning, refine their analytical skills, and gain exposure to diverse problem-solving approaches (Huisman, Saab, Van Driel, & Van den Broek, 2019).

Peer-assessment strategy is the process whereby students grade assignments or tests of their colleagues or mates based on a teacher's benchmarks. Olutosin and Gabriel (2018), defined peer assessment as the systematic process of peers assessing each other's work using instructional rubrics for grading. According to Omaka and Osuafor (2020), peer assessment is a form of assessment where students of the same class and subject are given the opportunity to be involved in assessing learning outcomes. It is effective in a supportive learning environment in the classroom. The peer-assessment strategy promotes deep learning among students, helps establish clearer assessment criteria for generating timely feedback, and improves students' overall assessment practices, ultimately enhancing their academic performance.

Peer assessment can be linked to students' academic achievement at school. It is the process in which learners assess, critique, make value judgements and express their views on the quality and standard of work of other learners, and provide feedback to peers to enhance their performance. Students' performance at the level of secondary school has a strong impact on other levels of higher and tertiary education. Peer assessment is conceptualised as an educational arrangement where students judge peers' performance by providing grades and offering written or oral feedback (Obilor & Okah-Tim, 2020). Peer assessment also encourages reflective learning through observing others' performances and becoming aware of performance criteria.

Juwah (2013) found that peer assessment and peer learning are effective and efficient in developing the necessary knowledge, skills, and capabilities. He further emphasised that for peer assessment to be genuinely effective, participants must undergo thorough and appropriate training. This training helps students become familiar with the grading process and align their evaluations with the teacher's standards, thereby deepening their understanding of the subject matter. Saddler, Philip and Good (2016) reported that the teachers' grading can be more accurate as a result of the peer-assessment strategy. If the teacher examines how students assess themselves, it provides him with additional insights into the subject content, which could enhance his performance in other assessments related to the topic.

The successful implementation of peer assessment in mathematics classrooms requires clear guidelines, structured rubrics, and a supportive learning environment where students feel comfortable providing and receiving feedback (Double, McGrane, & Hopfenbeck, 2020). Teachers play a crucial role in guiding students through the assessment process, ensuring that feedback is constructive and aligns with learning objectives. Despite its benefits, some challenges associated with peer assessment include potential bias, lack of assessment literacy among students, and resistance to critical feedback. However, with proper training and scaffolding, peer assessment can become an effective tool for enhancing students' study habits and achievement in mathematics. Peer assessment, a strategy where students evaluate and provide feedback on one another's work**,** has the potential to enhance students' engagement and motivation in mathematics. It promotes collaborative learning, self-regulation, and accountability**,** which could lead to improved academic achievement. However, there is limited empirical research on the effectiveness of peer assessment in mathematics learning among senior secondary school students in Nigeria.

Gender has long been considered a significant factor influencing students' achievement in mathematics, with several studies examining whether disparities exist between male and female students. Recent research in Nigeria suggests that although male students historically outperformed females in mathematics due to entrenched biases, recent trends indicate a narrowing performance gap, thanks to growing advocacy for gender equity in education and the implementation of targeted. For instance, Ugo and Oliweh, (2024).; Ibrahim and Shuaibu (2024), Iroko, Adesina and Asanre (2024)and Mawak and Odulum (2024) found no significant difference in achievement between male and female senior secondary school students exposed to peer assessment. Similarly, Eze and Eya (2020) and Wahab, Akinleye and Adedeji (2024) reported that when both genders are exposed to supportive learning environments and innovative teaching strategies, they tend to perform equally well. These findings highlight the need to ensure equal learning opportunities and challenge gender stereotypes that can undermine students' participation and confidence in mathematics, particularly among female learners. Promoting gender-inclusive practices in mathematics classrooms is therefore crucial for achieving balanced academic outcomes.

There is a pressing need for this study, as some students in senior secondary schools in Jos Metropolis continue to struggle with low academic achievement, often attributed to traditional assessment methods that limit active learner involvement. With mathematics being a core subject required for university admission and critical to national development, exploring alternative assessment strategies like peer assessment is essential. Peer assessment has the potential to promote deeper understanding, accountability, and engagement among students, thereby improving their study habits and academic performance. This study seeks to provide empirical evidence on the effectiveness of peer assessment as a transformative instructional approach within the Nigerian educational context. Therefore, it is against this background that the study is designed to investigate the effects of peer assessment on students' mathematics achievement in senior secondary schools in Jos North, Plateau State, Nigeria.

RESEARCH QUESTIONS

This study was guided by the following research questions:

1. What are the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups?
2. What are the post-test mathematics achievement mean scores of male and female students in the experimental group?

3. What is the interaction effect of treatment and gender on the achievement of students in mathematics?

HYPOTHESES

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups.
2. There is no significant difference between the post-test mathematics achievement mean scores of male and female students in the experimental group?
3. There is no significant interaction effect of treatment and gender on the achievement of students in mathematics

METHODOLOGY

This study used a quasi-experimental design, specifically the pre-test, post-test, non-equivalent control group design. The population consisted of 22 public senior secondary schools with 1916 SSII students in Jos North local government area. Simple random sampling was used in selecting two secondary schools from the population, and the arms of SSII were used as intact classes for the study. The experimental group has 40 students, while the control group has 38 students, giving a sample of 78 SSII students. The instrument for data collection was a Mathematics Achievement Test (MAT) with 50 items that was designed to assess students' understanding of selected Mathematics topics, including Algebra, Geometry, and Statistics. The content validity of the MAT was ascertained by subjecting the instruments to the scrutiny of three experts. Two experts from the Department of Educational Foundations (Research, Measurement and Evaluation Unit) and one expert from the Department of Science and Technology Education at the University of Jos. Kendall's coefficient of concordance was used to judge the agreement among the experts. Kendall's (2016) indicates that for a strong agreement, the Kendall's coefficient value should be greater than or equal to 0.60. Kendall's coefficient of 0.77 was obtained, which showed there was agreement between experts in their judgment. In computing the reliability, Kuder-Richardson was used, and a coefficient of 0.82 was obtained for the MAT. A reliability coefficient between 0.7 and above was accepted as a sign of acceptable reliability (Ugodulunwa, 2020). Treatment was given to the experimental group using peer assessment for six weeks, while the control group was not given an intervention. The mean and standard deviation were used in answering the research questions, while Analysis of Covariance (ANCOVA) was used in testing all the hypotheses at the 0.05 level of significance.

RESULTS

Answering of Research Questions

Research Question One

What are the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups?

Table 1

Pre-test and post-test Mathematics Achievement Mean Scores of Students in the Experimental and Control Groups

Group		Pre-test		Post-test			Mean Gain	$\bar{x}$ Gain difference
	N	Mean	SD	Mean	SD	Post-test Mean Difference		
Experimental	40	34.23	14.30	58.45	13.65		24.22	
						12.06		13.33
Control	38	35.50	12.82	46.39	13.67		10.89	

Table 1 presents the result on the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups. In the experimental group the post-test achievement mean score was 58.45 and standard deviation of 13.65, higher than the pre-test mean score of 34.23 and standard deviation of 14.30 with a mean gain of 24.22, indicating that there was improvement in the achievement of students after treatment. Also, for the control group the mean score was 35.50 and a standard deviation of 12.82 in the pretest. The post-test mean score of students rouse to 46.39and a standard deviation of 13.67. The findings show that students in the experimental group had a higher achievement mean score (58.45) after treatment using peer assessment than those in the control group (46.39) that were not given treatment with a mean gain difference of 13.33 and post-test mean difference of 12.06. This means that at the pre-test the students in both groups had a poor mathematical achievement mean scores because they were not exposed to any treatment but after the intervention the experimental performed better than the control group. This implies that peer assessment does improve students' achievement.

Research Question Five

What are the post-test mathematics achievement mean scores of male and female students in the experimental group?

Table 2

Post-test Mathematics Achievement Mean Scores of Male and Female students in the experimental group

Group	Post-test			
	N	Mean	SD	Mean difference
Male	24	58.38	15.26	
				0.18
Female	16	58.56	11.27	

Table 2: presents the result of the post-test mathematics achievement mean scores of students. For the male students in the experimental group, the post-test achievement mean score for male was 58.38 and standard deviation of 15.26, almost same with the mean score

of female students which is 58.56 and a standard deviation of 11.27. The findings showed that the female students had almost same achievement mean score as males after treatment using peer assessment with a mean difference of 0.18. This implies that female students performed at the same level with the male students after treatment using peer assessment strategy.

Research Question Three

What is the interaction effect of treatment, no treatment and gender on the achievement of students in mathematics?

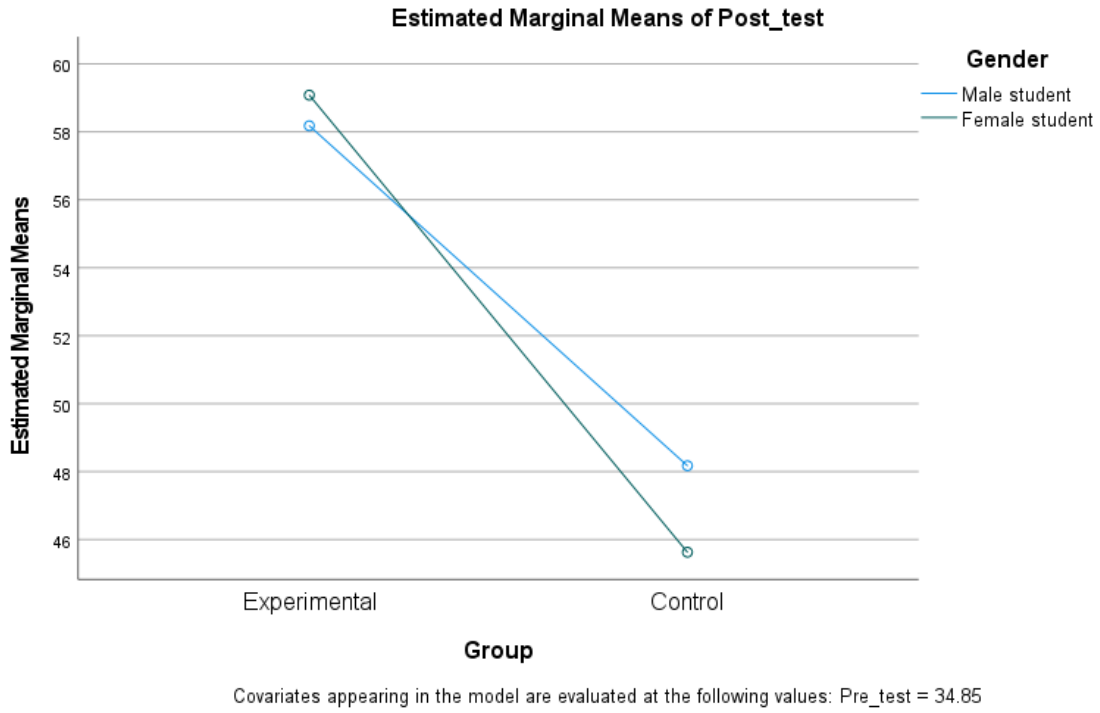

Figure 1: Showing interraction effect of Treatment and Gender on Achievement

Figure 1 presents the profile plot showing the interaction effect of treatment and gender on students' achievement in mathematics. The interactive pattern shows that the plots for male and female students did not intersect between groups. Since the two lines are not crossed between groups, there is no likelihood of an interaction effect between treatment and gender on students' achievement in mathematics. It implies that the interaction effect between treatment and gender was not attainable.

Hypothesis Two

There is no significant difference between the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups.

Table 3

ANCOVA Result on Mathematics Achievement Mean Scores in the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	P-Value
Corrected Model	3125.562[a]	2	1562.781	8.445	.000
Intercept	22619.065	1	22619.065	122.226	.000
Covariate	293.503	1	293.503	1.586	.212
Group	2912.709	1	2912.709	15.739	.000
Error	13879.476	75	185.060		
Total	232623.000	78			
Corrected Total	17005.038	77			

a. R Squared = .184 (Adjusted R Squared = .162)

In Table 3, Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the pretest and posttest mathematics achievement mean score of students in the experimental and control groups. It showed that $F(1,75) = 15.74$, $p < 0.05$, since the p-value of 0.000 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant difference in pretest and posttest achievement mean score of students in mathematics. The result further reveals an adjusted R squared value of .162 which means that 16.2 percent of the variation in the dependent variable which is achievement is explained by the variation in the treatment peer assessment, while the remaining 83.8 is due to other factors not included in this study. This implies that there is a significant difference between the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups.

Hypothesis Two

There is no significant difference between the post-test mathematics achievement mean scores of male and female students in the experimental group.

Table 4

ANCOVA Result on post-test Mathematical Achievement of Male and Female Students in the Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	P-Value
Corrected Model	37.162[a]	2	18.581	.095	.909
Intercept	21379.214	1	21379.214	109.459	.000
Covariate	36.824	1	36.824	.189	.667
Gender	.202	1	.202	.001	.975
Error	7226.738	37	195.317		
Total	143920.000	40			

Corrected Total	7263.900	39

a. R Squared = .005 (Adjusted R Squared = .049)

Analysis of Covariance (ANCOVA) was conducted to determine if there is a significant difference between the achievement of male and female students after peer assessment. Table 4 shows that the main effect of gender yielded F (1,37) = 0.01, p > 0.05. Since the p-value of 0.975 is greater than 0.05 level of significance, the null hypothesis was accepted, indicating that there was no significant difference between the post-test mathematics achievement mean scores of male and female students in the experimental group**.** It implies that peer assessment can help change students' achievement with no gender difference.

Hypothesis Three

There is no significant interaction effect of treatment and gender on the achievement of students in mathematics

Table 5

Interaction Effect of Treatment and Gender on the Achievement of Students in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	P-Value
Corrected Model	3181.024[a]	4	795.256	4.199	.004
Intercept	22296.631	1	22296.631	117.741	.000
Covariate	299.362	1	299.362	1.581	.213
Treatment	2285.194	1	2285.194	**12.067**	**.001**
Gender	11.181	1	11.181	**.059**	**.809**
Treatment* Gender	49.231	1	49.231	**.260**	**.612**
Error	13824.015	73	189.370		
Total	232623.000	78			
Corrected Total	17005.038	77			

a. R Squared = .187 (Adjusted R Squared = .143)

Analysis of Covariance (ANCOVA) was conducted to determine if there is an interaction effect of treatment and gender on students' achievement in mathematics. Table 5 shows that the F(1,73) =12.07, p < 0.05. Since the p-value of 0.001 is less than the 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant effect of treatment on students' achievement in mathematics when the experimental group was exposed to peer assessment. Again, the main effect of gender yielded F(1,73) = .059, p > 0.05. Since the p-value of 0.809 is greater than the 0.05 level of significance, the null hypothesis was retained, indicating that there was no significant effect of gender on students' achievement in mathematics. The result further reveals that F(1, 73) = .260, P > 0.05, since the p-value of 0.612 is greater than the 0.05 level of significance; the null hypothesis was retained, indicating that there was no significant interaction effect of treatment and gender on students' achievement in mathematics.

DISCUSSION

The study examined the effects of peer assessment on students' mathematics study habits and achievement in senior secondary schools in Jos North, Plateau State, Nigeria. The findings showed that students in the experimental group had a higher achievement mean score after treatment using peer assessment than those in the control group that were not given treatment. This means that at the pre-test the students in both groups had a poor 1mathematical achievement mean scores because they were not exposed to any treatment but after the intervention the experimental performed better than the control group. This implies that there is a significant difference between the pre-test and post-test mathematics achievement mean scores of students in the experimental and control groups. The findings is in line with those of Panadero, Romero, and Strijbos (2013);Alegre-Ansuategui and Lorenzo-Valentin (2018);Cobbinah (2019);Mawak and Odulum (2024) who found that the peer assessment strategy significantly improved students' achievement and attitudes towards mathematics. Adediwura (2015) also found peer assessment practice to have significant effect on students' achievement, retention ability and attitudes towards mathematics learning.

The findings showed that the female students had almost same achievement mean score after treatment using peer assessment than the male students. This means that after intervention the female performed better than the males. This implies that female students performed at the same level with the male students after peer assessment strategy. The result went further to indicate that there was no significant difference between the post-test mathematics achievement mean scores of male and female students in the experimental group. The result supports the work of Mawak and Odulum (2024) who found that the peer assessment strategy significantly improved students' achievement and attitudes towards mathematics, with no significant gender differences.

The result on the interaction effect of treatment on the achievement of male and female students in mathematics showed that there was no interception between the plots of male and female students between groups on the graph. This shows that there was no interaction effect of treatment and gender on the achievement of students in mathematics. The graph suggested that both male and female students benefited similarly from the treatment, and the gender gap in achievement remained about the same across both experimental and control groups. This means that the assessment method did not combine with gender to affect students' achievement in mathematics. This finding is consistent with that of Asanre, Abiodun, Odupe and Ogundeji (2023), who discovered no interaction between treatment, gender and students' achievement in mathematics.

CONCLUSION

Peer assessment was effective for improving students' achievement in mathematics in Jos North LGA. It was discovered that students in the experimental group had a higher achievement mean score in mathematics after treatment using peer assessment as compared to those in the control group. Indicating that there was a significant difference between the post-test achievement mean score of students in mathematics. Also, peer assessment improved the achievement of male and female students without gender difference and that there was no interaction effect of treatment and gender on the achievement of students in mathematics.

RECOMMENDATIONS

The study recommended that:

1. Mathematics teachers incorporate peer assessment strategy into their instructional practices to promote active learning and improve students' achievement.

2. Educational authorities provide professional development programs to train teachers in the effective implementation of peer assessment,
3. and schools should foster a collaborative learning environment that supports peer interaction.

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ADVANCES IN POLYMER CHEMISTRY FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Polymer chemistry has undergone significant transformation in recent decades, driven by the urgent need to address global sustainability challenges. Traditional petroleum based polymers, though widely used, pose environmental hazards due to their non-biodegradable nature and reliance on finite fossil resources. Advances in polymer chemistry are now focused on developing eco-friendly materials, renewable feedstocks, and innovative synthesis strategies that align with the principles of green chemistry. Biopolymers such as polylactic acid, polyhydroxyalkanoates, and starch based plastics have emerged as promising alternatives, offering biodegradability and reduced carbon footprint. Additionally, progress in catalysis and controlled polymerization techniques has enabled the design of precision polymers with tailored properties for biomedical, agricultural, and packaging applications. Smart polymers responsive to stimuli such as pH, temperature, or light further extend their utility in drug delivery and environmental remediation. Recycling technologies, including chemical depolymerization and upcycling, are addressing the challenge of plastic waste management while contributing to circular economy models. Moreover, nanocomposite polymers and hybrid materials are opening avenues for enhanced mechanical strength, thermal stability, and energy applications such as solar cells and fuel cells. Despite these advances, challenges remain in cost effectiveness, large scale production, and ensuring consistent biodegradability under real world conditions. Future research must integrate materials science, biotechnology, and industrial innovation to develop sustainable polymer systems that balance performance with environmental responsibility. Thus, advances in polymer chemistry continue to play a pivotal role in achieving global sustainability goals through innovation, efficiency, and eco consciousness.

Keywords: Polymer chemistry, Sustainable development, Biopolymers, Green chemistry, Recycling, Nanocomposites, Circular economy

B.

INTRODUCTION

The 21st century is defined by the pressing need to reconcile industrial growth with environmental protection and sustainable development. Polymers, ubiquitous in modern society, are central to this discussion. From packaging materials to biomedical devices, from structural composites to energy storage systems, polymers permeate virtually every sector of human activity. However, the dominance of petroleum-based plastics has created severe environmental concerns, particularly plastic waste accumulation, microplastic pollution, and

reliance on non-renewable resources (Ritchie & Roser, 2022). These challenges necessitate a paradigm shift in polymer chemistry toward sustainability.

Sustainable development, as outlined in the United Nations Sustainable Development Goals (SDGs), emphasizes responsible production and consumption, climate action, clean water, affordable energy, and sustainable industry (UN, 2023). Advances in polymer chemistry directly contribute to these goals by providing eco-friendly alternatives, innovative recycling processes, and materials engineered for circularity. For instance, biodegradable polymers reduce long-term environmental burden, polymer composites enhance performance while reducing resource input, and functional polymers enable energy efficient technologies.

The global plastics industry, valued at over USD 600 billion in 2023, continues to expand (Markets & Markets, 2023). Without intervention, plastic production could triple by 2060, with waste mismanagement compounding environmental hazards (OECD, 2022). Against this backdrop, polymer chemistry offers both scientific and technological pathways toward mitigating the negative externalities of plastics. The field has evolved from conventional synthetic polymers toward biopolymers, renewable monomers, advanced composites, and "green" synthesis routes that minimize energy use and hazardous byproducts (Gupta et al., 2021).

This paper provides a comprehensive review of the advances in polymer chemistry for sustainable development, drawing on research from 2020–2025. It emphasizes four main themes:

1. Biopolymers and biodegradable polymers.
2. Polymer composites and hybrid materials.
3. Recycling and circular economy strategies.
4. Smart and functional polymers.

By focusing on applications across packaging, biomedical engineering, energy systems, and environmental remediation, the review underscores the central role of polymer chemistry in enabling sustainable futures.

METHODOLOGY

This paper adopts a **narrative review methodology**, synthesizing recent developments in polymer chemistry relevant to sustainability. The following steps were applied:

1. **Literature Search**: Peer-reviewed articles were identified using Scopus, Web of Science, and Google Scholar with search terms such as *biodegradable polymers*, *polymer recycling*, *sustainable composites*, and *smart polymers* (2020–2025 timeframe).
2. **Inclusion Criteria**: Studies were selected if they (a) presented experimental or applied work on polymers relevant to sustainability, (b) reported case studies, technological advances, or industrial applications, and (c) were published in reputable journals.
3. **Exclusion Criteria**: Articles focusing purely on theoretical modeling without sustainable application, or those before 2020, were excluded to maintain recency.
4. **Data Extraction and Thematic Synthesis**: Key findings were organized into themes: biodegradable polymers, composites, recycling, and smart materials.
5. **Application-Oriented Analysis**: Emphasis was placed on real world case studies (e.g., industrial PLA production, enzymatic depolymerization, biomedical scaffolds), aligning with conference paper expectations.

This methodology ensures coverage of both fundamental and applied aspects while keeping the review relevant to sustainable development priorities.

ADVANCES IN POLYMER CHEMISTRY FOR SUSTAINABILITY

Biopolymers and Biodegradable Polymers

Biodegradable polymers represent a transformative advance in polymer chemistry, providing alternatives to persistent petroleum based plastics. Among the most widely studied are **polylactic acid (PLA), polyhydroxyalkanoates (PHAs), polycaprolactone (PCL),** and starch-based blends.

- **PLA** is derived from renewable resources such as corn starch and sugarcane, and is industrially produced at scale. It is compostable under industrial conditions, making it suitable for packaging and disposable items (Singh et al., 2022).
- **PHAs**, produced by microbial fermentation, are fully biodegradable in soil and marine environments. They are gaining traction in biomedical applications due to their biocompatibility (Kourmentza et al., 2021).
- **Starch based polymers** are inexpensive and widely available, often blended with PLA to enhance performance.

Recent advances focus **on tuning degradation rates, improving mechanical properties**, and **reducing production costs**. For example, copolymerization of PLA with PCL improves toughness, while enzymatic catalysis enhances degradation control (Ramesh et al., 2023).

Table 1. Properties and Applications of Key Biodegradable Polymers

Polymer	Source	Biodegradability	Applications	Limitations
PLA	Corn starch, sugarcane	Compostable (industrial)	Packaging, 3D printing, biomedical scaffolds	Brittleness, slow degradation in natural environments
PHA	Microbial fermentation	Soil and marine biodegradable	Sutures, drug delivery, agricultural films	High production cost
PCL	Synthetic (ring opening polymerization)	Biodegradable (slow)	Tissue engineering, drug release	Low mechanical strength
Starch blends	Natural starch	Biodegradable	Disposable items, films	Poor water resistance

Polymer Composites and Hybrid Materials

Polymer composites combinations of polymers with fillers such as natural fibers, nanoparticles, or clays play a crucial role in sustainable material design.

- **Natural fiber reinforced composites** (e.g., jute, hemp, kenaf with PLA) reduce reliance on synthetic fibers while maintaining strength.
- **Nanocomposites** incorporating graphene, cellulose nanocrystals, or clays enhance barrier properties and biodegradability.

- **Hybrid** emphasizes **composites** integrate multiple reinforcement strategies for multifunctionality.

Recent research **lightweight, high strength composites** for automotive and aerospace applications, reducing fuel consumption and emissions (Patel et al., 2022). Similarly, bio-based nanocomposites are revolutionizing packaging by improving oxygen and moisture barriers.

Polymer Recycling and Circular Eco

1) nomyRecycling is a cornerstone of sustainable polymer chemistry. Advances span ***mechanical recycling, chemical recycling,*** *and* ***biocatalytic approaches****.*

- **Mechanical recycling:** involves reprocessing plastics into new products but often suffers from quality degradation.
- **Chemical recycling:** breaks polymers into monomers, enabling near virgin quality materials. For instance, PET depolymerization via glycolysis and enzymatic hydrolysis has shown promise (Wei & Zimmermann, 2022).
- **Biocatalytic recycling:** leverages engineered enzymes (e.g., PETase, MHETase) to efficiently degrade PET under mild conditions (Lu et al., 2023).

Table 2. Polymer Recycling Approaches and Their Characteristics

Recycling Type	Process	Advantages	Challenges
Mechanical	Melting and reprocessing	Simple, cost effective	Property degradation, limited cycles
Chemical	Depolymerization to monomers	High-quality output, closed loop	Energy intensive, costly
Biocatalytic	Enzymatic hydrolysis	Mild conditions, eco-friendly	Slow kinetics, enzyme stability

Smart and Functional Polymers

Smart polymers respond to external stimuli such as pH, temperature, light, or mechanical stress. They are crucial for advanced sustainable applications.

- **Self-healing polymers** extend product lifetimes, reducing waste.
- **Stimuli-responsive hydrogels** enable controlled drug delivery.
- **Conductive polymers** support renewable energy devices such as organic solar cells and flexible batteries.

For example, thermo-responsive polymers like PNIPAM are being used in water purification systems, while shape memory polymers are applied in biomedical implants (Zhang et al., 2023).

Table 3. Examples of Smart Polymers and Sustainable Applications

Smart Polymer	Stimulus	Application	Sustainability Benefit
Self-healing polyurethane	Mechanical damage	Coatings, electronics	Extended lifetime
PNIPAM hydrogel	Temperature	Drug delivery, water purification	Efficient resource use
Conductive PEDOT:PSS	Electrical	Organic solar cells, sensors	Renewable energy
Shape-memory polymer	Heat	Medical implants	Reduced surgical waste

APPLICATIONS AND CASE STUDIES

Polymer innovations are enabling sustainability across sectors:

- **Packaging**: PLA and starch blends for compostable packaging. Coca-Cola's PlantBottle (bio-PET) demonstrates large scale adoption.
- **Biomedical**: PHAs in biodegradable sutures and scaffolds; smart hydrogels in wound healing.
- **Energy**: Conductive polymers in organic solar cells and supercapacitors.
- **Environmental Remediation**: Functionalized polymers as adsorbents for heavy metals and oil spills.

CHALLENGES AND FUTURE DIRECTIONS

Despite advances, challenges persist:

- **Cost and Scalability**: Biopolymers remain more expensive than petroplastics.
- **Infrastructure Gaps**: Composting and chemical recycling facilities are limited.
- **Performance Trade-offs**: Many biopolymers lack the durability of synthetic counterparts.

Future directions include:

- **Green synthesis methods** using renewable feedstocks.
- **Advanced biocatalysts** for efficient recycling.
- **AI driven polymer design** for predictive material properties.
- **Policy and regulations** to incentivize sustainable adoption.

CONCLUSION

Advances in polymer chemistry are central to sustainable development. Biopolymers, composites, recycling innovations, and smart polymers collectively enable environmentally friendly alternatives while fostering circular economy principles. Case studies highlight growing industrial translation, though scalability, cost, and infrastructure remain hurdles.

Interdisciplinary research, public private partnerships, and supportive policy frameworks are essential for polymer chemistry to fully realize its role in achieving global sustainability.

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AWARENESS AND IMPLEMENTATION OF MODERN CULTIVATION TECHNOLOGIES IN PADDY FARMING IN THANJAVUR DISTRICT

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Abstract
This study investigates the awareness and implementation of modern cultivation technologies in paddy farming within Thanjavur District, widely recognized as the "Rice Bowl of Tamil Nadu." Technological advancements such as mechanized transplanting, precision farming tools, integrated pest management, and water-saving irrigation systems have transformed agricultural practices, yet their adoption varies among farmers. The research aims to evaluate the level of awareness, degree of adoption, and barriers that influence the use of these technologies. Data were collected through structured questionnaires and interviews with paddy farmers across different regions of the district. The findings reveal that while farmers exhibit considerable awareness of modern technologies, the actual implementation is limited due to factors such as high cost, lack of technical training, and limited access to resources. The study highlights the importance of capacity-building programs, financial support, and extension services to enhance technology adoption for sustainable paddy cultivation.

Keywords
Awareness, Modern cultivation technologies, Paddy farming, Thanjavur District, Adoption, Agricultural practices, Sustainability

EGZERSİZİN ETKİLEDİĞİ METABOLİK DEĞİŞİMLER: ENERJİ KAYNAKLARI VE DÜZENLEMESİNE ODAKLANMA

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ÖZET

Bu çalışma, egzersiz sırasında enerji metabolizması ve hormonal adaptasyonlar arasındaki karmaşık ilişkiyi incelemektedir. İnceleme, çeşitli fiziksel aktivite türlerine verilen kısa ve uzun vadeli metabolik tepkileri ele alarak, egzersizin karbonhidratlar, yağlar ve proteinler gibi enerji kaynaklarının kullanımını nasıl etkilediğine odaklanmaktadır. İnsülin, kortizol, büyüme hormonu, tiroid hormonları ve testosteron gibi hormonların rolünü ve farklı egzersiz yoğunluklarına ve biçimlerine verdikleri dinamik tepkileri incelemektedir. İnceleme ayrıca, bu hormonal dalgalanmaların altında yatan fizyolojik mekanizmaları ve performans, toparlanma ve uzun vadeli adaptasyonlar üzerindeki etkilerini de incelemektedir. Ayrıca, egzersiz ve beslenme arasındaki etkileşim, özellikle makro besin zamanlaması ve bileşiminin hormonal düzenleme üzerindeki etkisi tartışılmaktadır. Bulgular, antrenman ve toparlanma stratejilerini optimize etmek için metabolik ve hormonal tepkileri anlamanın önemini vurgulamakta ve atletik performansı ve genel sağlığı iyileştirmek için kişiselleştirilmiş yaklaşımların potansiyelini vurgulamaktadır.

Anahtar Kelimeler: Enerji metabolizması, hormonal adaptasyonlar, egzersiz fizyolojisi, endokrin yanıt

EXERCISE-INDUCED METABOLIC SHIFTS: A FOCUS ON ENERGY SOURCES AND REGULATION

ABSTRACT

This study explores the intricate relationship between energy metabolism and hormonal adaptations during exercise. The review highlights both short-term and long-term metabolic responses to various types of physical activity, with a focus on how exercise influences the utilization of energy substrates such as carbohydrates, fats, and proteins. It delves into the role of hormones, including insulin, cortisol, growth hormone, thyroid hormones, and testosterone, and their dynamic responses to different exercise intensities and modalities. The review further examines the physiological mechanisms underlying these hormonal fluctuations and their implications for performance, recovery, and long-term adaptations. Additionally, the interaction between exercise and nutrition, particularly the impact of macronutrient timing and composition on hormonal regulation, is discussed. The findings emphasize the importance of understanding metabolic and hormonal responses to optimize training and recovery strategies, highlighting the potential for personalized approaches to improve athletic performance and overall health.

Keywords: Energy metabolism, hormonal adaptations, exercise physiology, endocrine response.

Introduction

The amount and content of food-related research and research in sports nutrition have significantly increased in recent years (Cui et al., 2022). The search for more knowledge about how to improve performance is central among practitioners when both individuals and athletes training at the elite level are constantly looking for better results (West et al. 2021). The question about optimal fuel is extensive, from the individual's top results with short-term changes in diet, muscle function, and performance to the ability of muscle to reorganize its metabolism in the long term (Burke, 2021). The aim of this comprehensive review is to give an overview of both short-term and long-term energy metabolism during exercise. In addition, the review will elaborate on different hormonal adaptations during various types of exercise (Muscella et al. 2020).

Many factors biological, chemical, and physical are involved in the utilization and production of energy, and it is, therefore, necessary to study the changes in these factors to understand which one has the limiting effect on performance (Ahmed et al., 2022). Only exercise can stimulate physiological processes in the skeletal muscle and via other organs adapted to exercise (Egan and Sharples, 2023). Exercise intensity, duration, aerobic/anaerobic capacity, nutrition, and heat all have an influence on the percentage of the rate at which energy is derived (Rothschild et al., 2024). The hormonal influence of exercise depends on the intensity of the exercise type; in general, there is a larger influence of many hormones in strength, weightlifting, and some types of sprint activity where there is an increase of oxygen consumption in the legs above 10 times higher than at rest over a short period of time (Huang et al. 2022; Zouhal et al. 2022). We can expect that a corresponding influence occurs on blood pressure, heart rate, frequency, and intensity of blood flow and stimulation of the muscles.

Use of Energy Sources During Exercise

Different metabolic reactions operate simultaneously in all cells to provide energy to support life for basic metabolic functions and for cellular activities (Sun et al. 2020). Carbohydrates, fats, and proteins are the fuels for body metabolism. Carbohydrates are broken down into glucose in the body. Glucose can meet the energy requirements of various metabolic pathways, including the rate-limiting step that produces the mass energy molecules (Bender and Cunningham, 2021). Under resting state, most cells are used for basic metabolism, and red skeletal muscle fiber cells account for about 80% of the glucose, most of which enters the glycolysis pathway (Zumbaugh et al. 2022).

Small molecule acyl-CoA in the form of free fatty acids mainly comes from released by adipose tissue (Miniewska et al. 2020). Long-chain acyl-CoA plays a role in the process of the body’s aerobic oxidation of fatty acid conversion and the syndrome of oxidative phosphorylation to produce a low-capacity high-threshold ratio of ATP (Szrok-Jurga et al. 2023). Proteins are not a major energy source in humans, accounting for about 10%. During exercise, due to the increase of protein anabolism in the tricarboxylic acid cycle, the conversion of alanine to the liver increases gluconeogenesis, and keto acid metabolites play a minor role in the production of phosphate (Sá et al. 2020; Williamson et al., 2024).

During exercise, energy substrates are gradually utilized according to the exercise intensity and metabolic pathways, which are mainly carbohydrates, fats, and proteins (Muscella et al. 2020). The phosphorylation of high-energy phosphate bonds at fast and submaximal power can increase the adenosine regulatory level (Geor, 2024). Few endogenous reserves are consumed, which should be maintained at the theoretical maximum energy delivery rate for sports adaptive metabolic pathways, gluconeogenesis, and oxidative production (Amawi et al. 2024; Geor,

2024). Converting and the role of aerobic glycolysis is to increase the maximum amount of buffering citrate and ATP in glycolysis, and lower muscle acid during exercise is the best definition of rate and typical high-intensity lab results for complete energy system athletes (Luengo et al. 2021). In general, high-intensity muscles and low-intensity slow adaptation power reduce changes in concentrations of certain molecules while increasing the concentration of others (Li et al., 2020). The reducer is responsible for water, nitrogen, and lactate metabolism at the molecular level. Simulation results show that metabolic nutrients of different sports approaches vary depending on the duration of exercise (Spano et al., 2023). Evolutionary adaptations have occurred in fat cells in the metabolism of macronutrients during exercise. To maximize exercise performance, it is essential to understand the metabolic energy content of macronutrients (Palma-Morales et al. 2022).

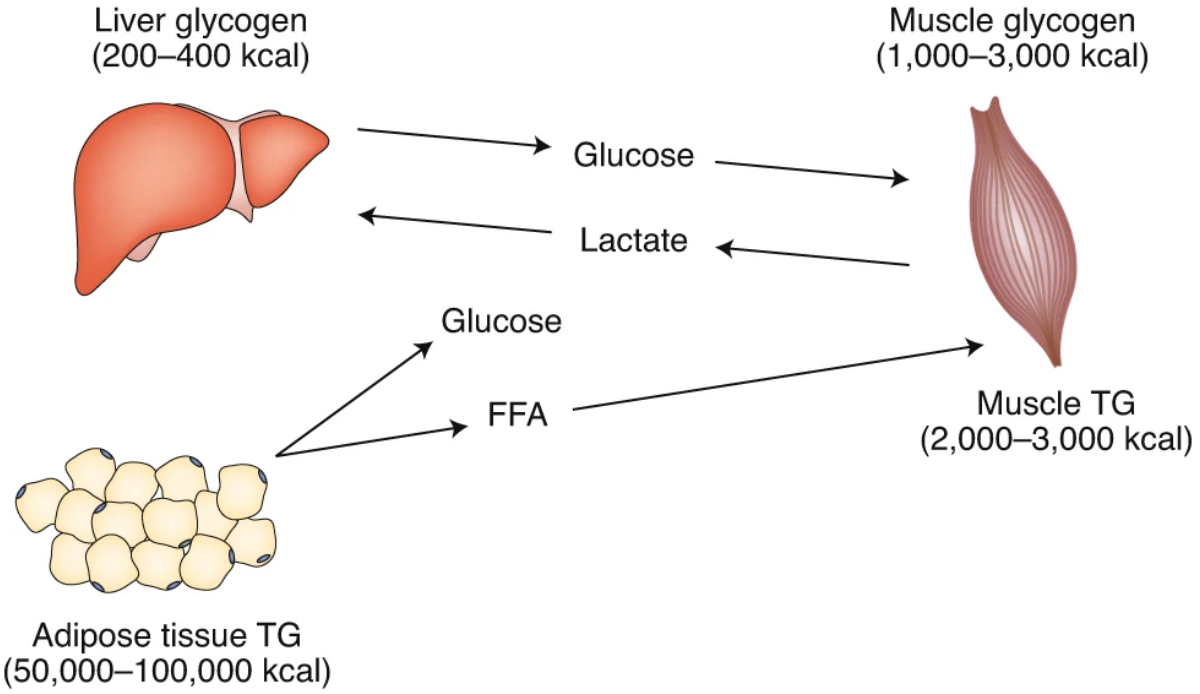

Figure 1. Energy Source **Dynamics During** Exercise (Hargreaves and Spriet, 2020).

This diagram shows how liver glycogen maintains blood glucose, while muscle glycogen provides energy for activity. Adipose tissue triglycerides release free fatty acids (FFA) for oxidation, especially in low-intensity exercise. Muscle triglycerides and lactate recycling further support energy demands, ensuring sustained performance.* ***Abbreviations: FFA**: Free Fatty Acids,* ***TG****: Triglycerides.*

The Key Role of Carbohydrates in Exercise Performance

The role of carbohydrates is to fuel high-intensity exercise by utilizing glycogen stored in muscle and liver, as well as plasma and intracellular glucose stores (Rollo et al. 2020). Carbohydrates are stored in the muscles in various forms, but the most rapidly metabolizable are those stored within a glycogen granule located in the muscle fibers (Abouel et al. 2022). Protein, mainly myofibrillar and sarcoplasmic, acts as a scaffold in which to store glycogen due to a high-water content, raising the carbohydrate fuel and reducing the overall adenosine triphosphate formation (Besford et al., 2020). Experiments have shown that muscle glycogen is the predominant source of energy, having predominantly type II cellular dynamics. Once athletes reach exhaustion, the levels of glycogen can predict performance, and it is not rare to

see empty glycogen stores following high-intensity effort (Vigh-Larsen et al. 2021; Matsuda et al. 2022).

Carbohydrates can partially replenish muscle glycogen within the first 6 hours after exhaustive exercise more than after 24 hours of rest (Bonilla et al. 2021). Muscle tissue can burn any form of carbohydrate, fat, and protein as well; it prefers to use carbohydrates first, followed by fat, and lastly protein. It is the most efficient fuel for the muscle and can generate ATP faster than fat and protein metabolism (Wilkinson and Liebman 2022; Tamirci et al. 2023). The Cori Cycle is a metabolic pathway released by the working muscles as a consequence of lactic acid accumulation, especially at the onset of effort (Manoj et al. 2022). Muscles are able to reclaim and metabolize lactic acid through glycolysis, but there is a limit. Proper hydration and muscle cooling similarly slow down muscle glycogen depletion (Birnie-Gauvin et al. 2023). High doses of carbohydrate ingestion before exercise can encourage depletion of the nutrients available in the liver. Just prior to or during effort, glucose/insulin mixture ingestion is recommended. Intra-sport drinks can speed up carbohydrate absorption in the muscle during exercise (Rollo et al. 2020).

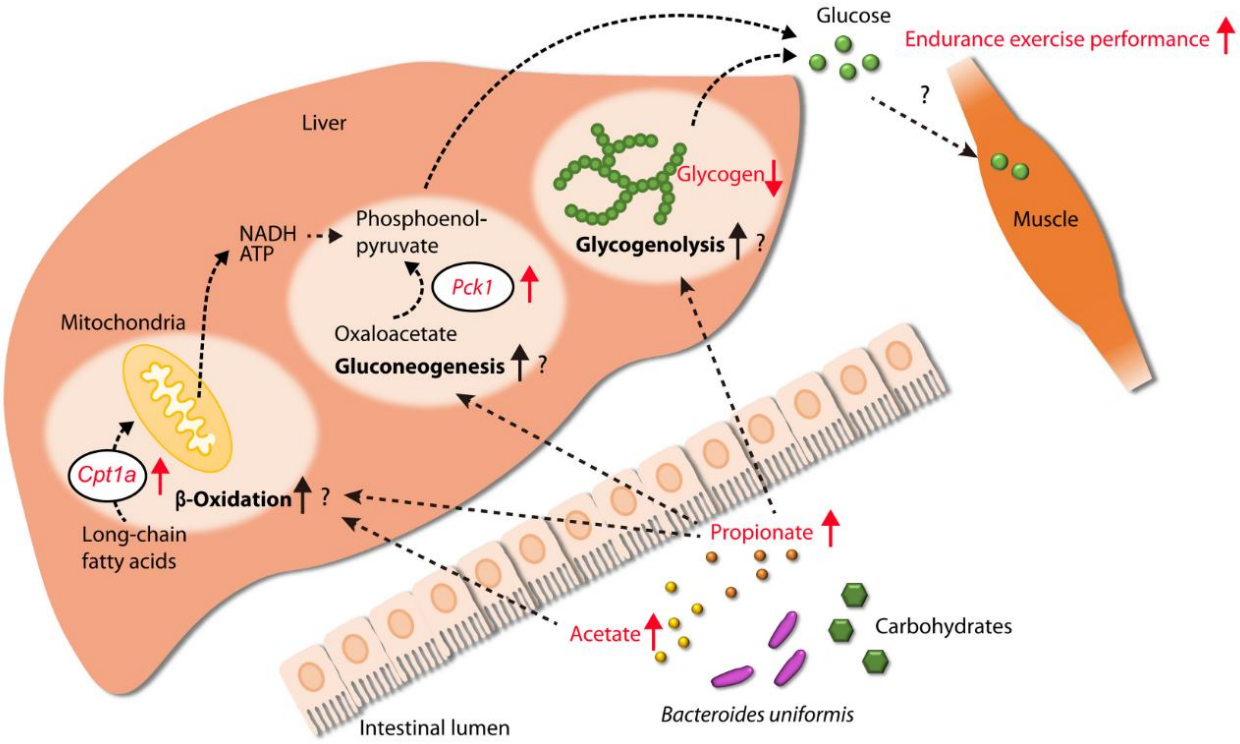

Figure 2. Role of Carbohydrates in Energy Supply and Endurance Exercise (Morita et al. 2023).

This diagram shows how liver glycogen undergoes glycogenolysis to supply glucose for muscle energy during exercise, while gluconeogenesis maintains blood glucose levels. Processes like β-oxidation (fat metabolism) support energy demands but carbohydrates remain crucial for endurance. Microbial metabolites like propionate and acetate also influence energy availability.* ***Abbreviations: Pck1**: Phosphoenolpyruvate Carboxykinase,* ***Cpt1a****: Carnitine Palmitoyltransferase 1A,* ***β-oxidation****: Fatty acid breakdown for energy.*

The Role of Fat Metabolism in Energy Supply During Low-Intensity Exercise

Fat is a critical source of energy during exercise, particularly during low-intensity, long-duration activities, due to the high levels of stored energy in tissues (Brun et al. 2022). Several types of fatty acids make up the majority of the fat we store, including saturated and unsaturated fats (Hulbert, 2021). Stored as triglycerides in adipocytes, fats can provide ATP through their direct metabolism and the liver's gluconeogenesis (Lu et al. 2021).

Furthermore, a diet that includes adequate levels of omega-3 and monounsaturated fats reduces inflammation, while also promoting fat metabolism and fat oxidation (Fu et al. 2021). A proportion of the fatty acids stored in adipocytes is liberated and transported through the blood to working muscles in the relaxation period (Camastra and Ferrannini, 2022). Mobilized from their sites of storage, fatty acids leave these cells and circulate in the bloodstream bound to plasma albumin. At working muscles, fatty acids travel through the endothelial cell and continue to move between the fibers as they make their way towards mitochondria, to be oxidized and create ATP (Numao et al. 2023).

Fat metabolism requires more time than carbohydrate metabolism it takes 144 molecular O_2 to oxidize one mole of palmitic acid as opposed to 13 O_2 molecules to oxidize one mole of glucose which is why the process becomes the greatest contributor to ATP production as exercise intensity decreases (Burke et al. 2021; Muscella et al. 2020). The highest rate of oxygen uptake observed during prolonged endurance activities is known as the maximal fat-oxidation rate, which occurs at an intensity corresponding to approximately 60–65% VO_2max in untrained individuals (Hassanein, 2024). Fat metabolism during exercise is influenced by several factors, including exercise intensity, duration, training status, and muscle glycogen availability (Iwayama et al., 2023).

As muscle glycogen decreases during long- and/or moderate-to-high-intensity activities, fats become the main source of ATP production (Kolnes et al. 2021). Taken together, the amounts of glycogen and lipid available are crucial to maintaining ATP homeostasis throughout long races (Belhaj et al., 2021). Low-carb, high-fat diets have become popular for this reason fat is known to have a higher energy density than carbohydrates and to provide far more ATP (Sukkar and Muscaritoli, 2021).

The implications of this diet, however, are still in the process of being studied. It should be noted that ingested dietary fats contribute to the biosynthesis of a majority of pro-inflammatory hormones, while ingested dietary fat contributes to the biosynthesis of fat combustion-promoting hormones (Basson et al. 2021).

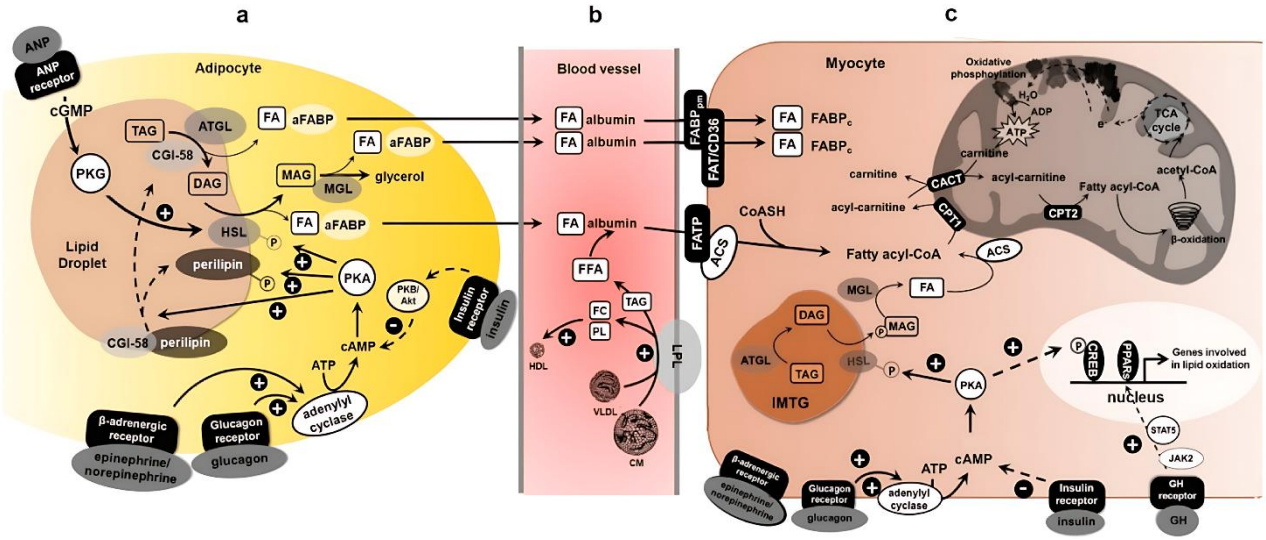

Figure 3. Harnessing Fat Metabolism for Sustained Energy in During Exercise (Muscella et al. 2020).

This diagram illustrates the critical role of fat metabolism in sustaining energy demands during low-intensity exercise. Lipid droplets in adipocytes release free fatty acids (FA) through lipolysis, mediated by hormone-sensitive lipase (HSL) and other regulatory pathways. These free fatty acids are transported via albumin into the bloodstream and subsequently taken up by muscle cells. Within mitochondria, fatty acids undergo β-oxidation to generate ATP, which fuels prolonged physical activity. The interactions between adipose tissue, blood vessels, and muscle cells highlight the efficiency of fat as a primary energy source during lower-intensity exercise.* ***Abbreviations:* ***FA****: Free Fatty Acids,* ***HSL****: Hormone-Sensitive Lipase,* ***TAG****: Triacylglycerol,* ***DAG****: Diacylglycerol,* ***MAG****: Monoacylglycerol,* ***CPT1/CPT2****: Carnitine Palmitoyltransferase ½,* ***β-oxidation****: Fatty acid breakdown in mitochondria.*

The Role of Proteins in Energy Metabolism and Muscle Recovery

In two major situations, the body might turn to proteins as an energy source. During prolonged exercise, the glycogen stores will become exhausted, and the body turns to the largely stored fat and plasma free fatty acids, but also the amino acids in the muscles (Mao et al., 2024). Under conditions with a caloric intake below demand, the body is forced to use substance stores, such as subcutaneous fat, intramuscular fat, and glycogen stores, but also the tissue proteins, preferentially coming from the muscles (Rashid et al., 2023).

The degradation of body proteins, including myofibrillary protein breakdown, results in high serum urea concentrations and therefore has the end effect of lowering the body in liquid. The concentration of free amino acids in plasma is about 1 percent of the amount present in the body (Weijzen et al. 2022; Kawamori et al. 2023).

Branched-chain amino acids account for 35–40% of the essential amino acids in body soluble proteins and muscle, which makes them an important energy source for contracting muscles during strenuous exercise (Liang et al., 2024). However, their use as an energy source is very dynamic and is barely two to three percent of the oxidative metabolism compared to glucose and free fatty acids (Panov et al. 2022). Also, due to both static and dynamic training, the use of branched-chain amino acids increases. It is also important to note the role that branched-chain amino acids have in the expression of cytokines during exercise (Fitrianto et al., 2023).

Adequate protein consumption after a training session is of great importance for the recuperation of the muscle and for muscular synthesis after exercise (Paul et al. 2022). Athletes should keep in mind that proteins have an anti-anabolic influence and can even have an inhibiting effect on the testosterone-IGF-1 system (Milheiro, 2024). There is no doubt that proteins can be used as an energy source. However, in maximum situations, the importance of proteins as an energy source is limited. Nevertheless, the reserve with respect to proteins is virtually inexhaustible (Jach et al., 2022; Yaakob et al. 2021).

A good supply of dietary protein is of great importance in the recuperation after intensive sports training. All in all, the balanced intake of proteins is important with a diet that includes adequate amounts of carbohydrates, fats, and water (Master and Macedo 2021).

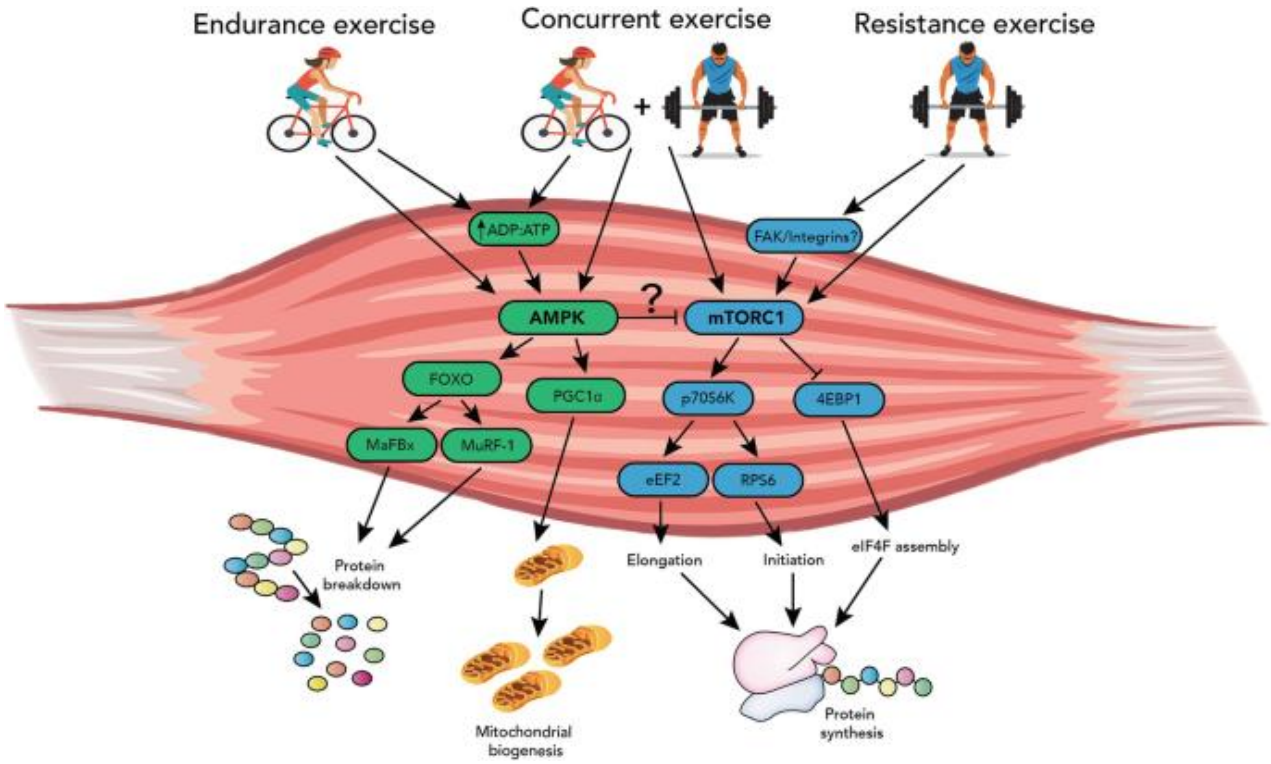

Figure 4. Role of Exercise in Protein Metabolism and Muscle Recovery (Joanisse et al. 2022).

This diagram illustrates how different exercise types of influence protein metabolism and muscle recovery. Endurance exercise activates AMPK pathways, promoting mitochondrial biogenesis but also increasing protein breakdown via FOXO and MuRF-1. Resistance exercise, on the other hand, stimulates mTORC1 pathways, driving protein synthesis and muscle hypertrophy through components like p70S6K and 4EBP1. Concurrent exercise integrates these pathways, balancing mitochondrial adaptation and protein synthesis. The diagram highlights the distinct molecular mechanisms that regulate protein metabolism, emphasizing their importance in energy utilization and muscle recovery after exercise.* ***Abbreviations:* ***AMPK****: AMP-activated protein kinase,* ***FOXO****: Forkhead box protein O,* ***MuRF-1****: Muscle-specific RING finger protein 1,* ***mTORC1****: Mechanistic Target of Rapamycin Complex 1,* ***p70S6K****: Ribosomal protein S6 kinase beta-1,* ***4EBP1****: Eukaryotic translation initiation factor 4E-binding protein 1.*

Effects of Aerobic and Anaerobic Exercise on Energy Metabolism

There are two main types of exercise that can be performed: aerobic and anaerobic, which produce different effects on energy metabolism (Kolumbet et al. 2022). By definition, aerobic means "in the presence of air (Liu et al. 2021)." For exercise, this description refers to the presence of oxygen, which is used through a series of physiological steps to eventually generate adenosine triphosphate (ATP) and produce energy (Biro, 2022). Anaerobic, without air, refers to the energetic pathways used during exercise that do not directly require the presence of oxygen to produce ATP (Ferretti et al. 2022). To clarify, we mostly do not have oxygen with us because we are resting; however, as we train, oxygen is required to regenerate the energy molecules (Wang et al. 2021). Regardless of the type of anaerobic exercise, the anaerobic pathways activated are essentially the same, dictated mostly by the intensity and duration of the exercise (Egan and Sharples, 2023). It can be best broken down into two categories: short-

term anaerobic alactic activities, which are relatively high-intensity exercises of less than 10-12 seconds, and the glycolytic activities. Glycolysis, the main pathway used for ATP production, begins to predominate alongside the phosphocreatine system as the energy demands increase primarily due to the intensity and duration of the effort (Archacki et al. 2024; Lygate, 2024).

Aerobic exercise affects energy metabolism in different ways. Exercise modality governs the immediate demand for oxygen (Touron et al. 2021). As a result, it also affects the immediate demand for circulating substrates; this is the initial key contributing factor that causes a heterogeneity of energy system uses (Valencia-Marquez et al. 2023). It should be generally assumed that the intensity of the exercise is inversely related to the duration for which a person can perform a certain type of exercise, based on the predominant energy system being called to service (He et al. 2021).

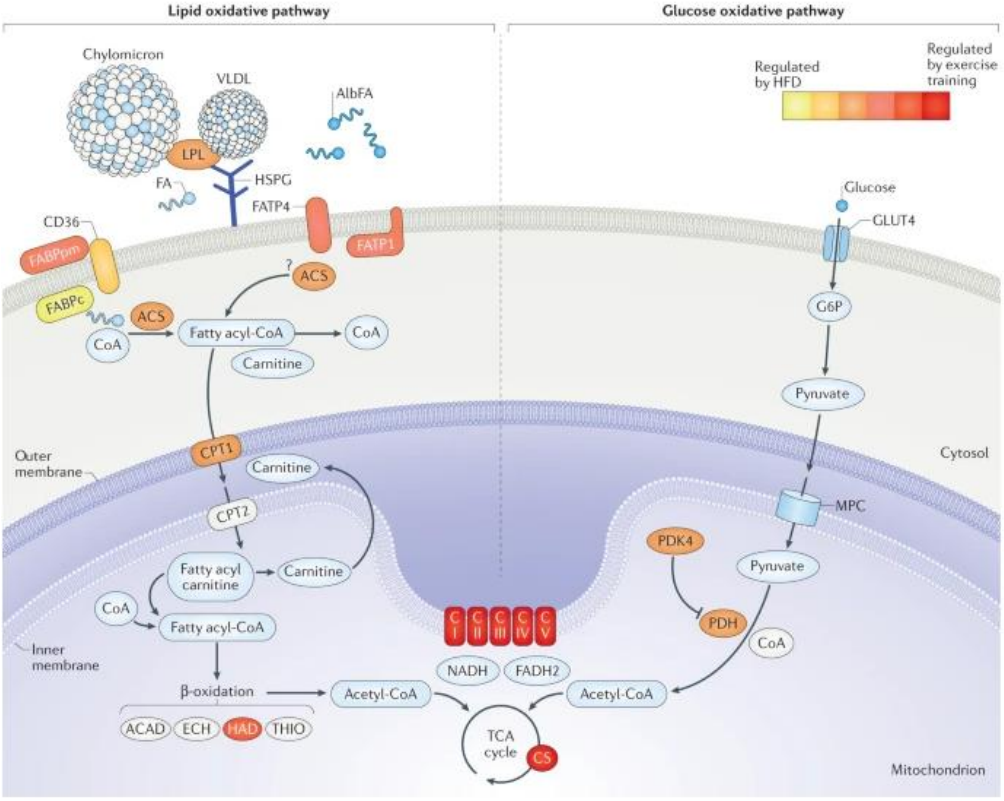

Figure 5. Metabolic Pathways in Aerobic and Anaerobic Exercise (Fritzen et al. 2020).

**This diagram illustrates the metabolic pathways involved in energy production during aerobic and anaerobic exercise. The lipid oxidative pathway highlights the breakdown of free fatty acids (FFA) through β-oxidation in the mitochondria, which is dominant during prolonged, low-intensity aerobic exercise. The glucose oxidative pathway depicts the utilization of glucose via glycolysis and the TCA cycle, playing a critical role in high-intensity anaerobic and aerobic activities. The regulation by exercise training and high-fat diets (HFD) is also shown, emphasizing the adaptability of energy metabolism based on external factors.*

As a result, each type of exercise produces varying metabolic responses that result in changes in our substrate stores like glycogen and fat (Vigh-Larsen et al. 2021). As exercise increases in intensity and duration, the relative mixture of carbohydrates and fat that is used as this substrate will change. Therefore, different modes of exercise and, therefore, metabolism will call for special training programs to ensure these different substrates are harnessed (Brun et al. 2022; Rothschild et al., 2022). Once again, these training adaptations need to be, as close as possible,

the same as our specialization requirements to effectively prepare the body for competition (Zatsiorsky et al., 2020).

Role of Hormones in Relation to Exercise

The Role of Insulin in Nutrient Uptake and Energy Regulation During Exercise

It is a small protein hormone excreted from the pancreas in response to raised plasma glucose concentrations and is responsible for stimulating the transport of glucose into target cells. In addition to glucose, insulin triggers the utilization of amino acids in muscle and fat and has a stimulatory effect on lipogenic enzymes in adipose tissue (Richter et al., 2021). The importance of this hormone to exercise performance is given by insulin's role in promoting nutrient availability and counteracting catabolism (Gharahdaghi et al. 2021). Thus, the pharmacological use of insulin is widely recognized within the context of rehabilitation of wasting diseases and certain forms of muscular dystrophy (Cheng et al. 2022). Furthermore, profound insight into the hormonal regulation of glucose and amino acid metabolism has been gained by using insulin as a tool in well-defined physiological experiments (Guan et al. 2024).

Insulin receptor substrates, which are phosphorylated shortly after activation of the insulin receptor, are the initial substrates and then activate multiple pathways, including the phosphatidylinositol 3-kinase pathway for glucose transport (Medina-Vera et al. 2021). Since insulin secretion is also modified during feeding, it is known that the cell must receive metabolic information about nutritional status through blood glucose concentration and other hormones to properly prepare for the anticipated chylomicron intake (Park et al. 2021; Dimitriadis et al. 2021). In the case of excessive insulin secretion during eating, the hormone has another action: it inhibits hepatic output of glucose by suppressing glycogenolysis and gluconeogenesis (Nirmalan and Nirmalan, 2020). Due to these metabolic pathways, insulin secretion is increased, and glycogen synthesis is also stimulated; hence, blood glucose levels are lowered (Norton et al., 2022). In addition, muscle and fat are the peripheral target tissues of insulin, and insulin not only stimulates glucose uptake and utilization in these tissues but also upregulates the storage of glucose as glycogen and lipids by accelerating glycolysis and lipogenesis (Sylow et al., 2021).

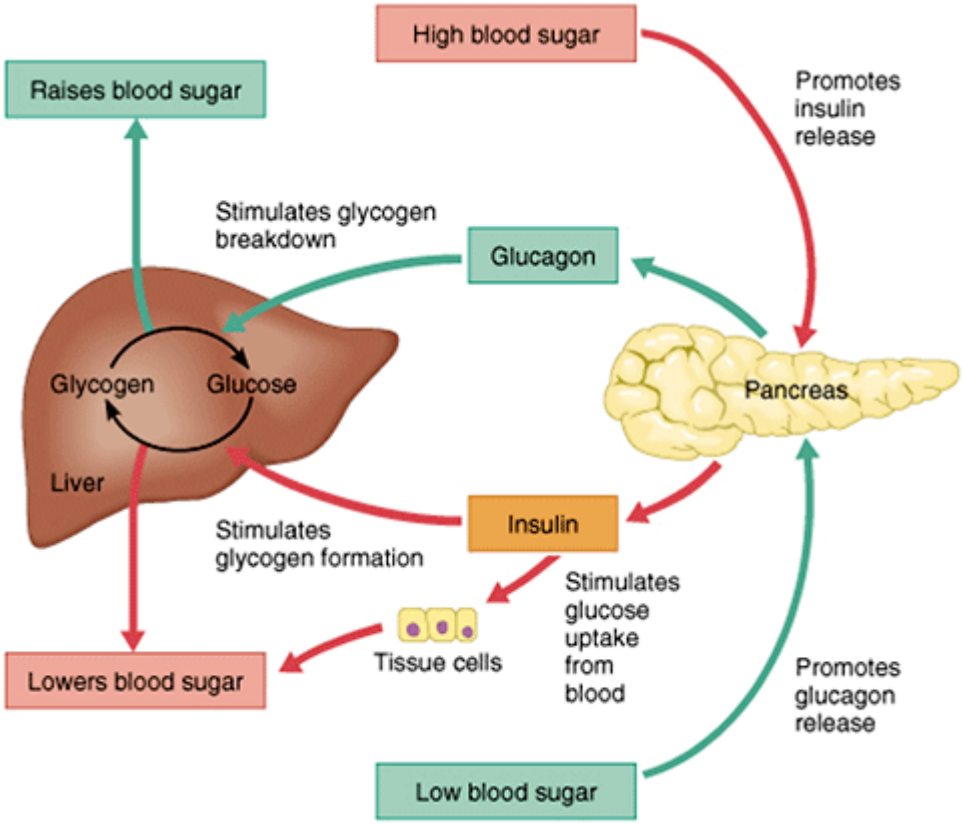

Figure 6. Interplay of Insulin and Glucagon in Energy Regulation During Exercise (Soo et al. 2023)

This diagram illustrates how insulin and glucagon regulate energy metabolism during exercise. Insulin facilitates glucose uptake in skeletal muscles through GLUT4 translocation, enhancing glycogen synthesis and energy storage. Meanwhile, glucagon and epinephrine stimulate gluconeogenesis in the liver and lipolysis in adipose tissue, releasing free fatty acids (FFA) and glycerol for energy production. This hormonal interplay ensures a balanced supply of energy substrates, optimizing metabolic efficiency during physical activity.* ***Abbreviations:* ***GLUT4****: Glucose Transporter Type 4,* ***FFA****: Free Fatty Acids,* ***TAG****: Triacylglycerol,* ***GIP/GLP-1****: Gut-derived incretin hormones involved in insulin regulation.*

Cortisol's Dual Role in Energy Mobilization and Protein Breakdown During Stress

As athletes begin to exercise, there is a rapid rise in cortisol as well as other stress hormone levels. This increase in cortisol in the blood occurs within the first 30 minutes of exercise and is directly proportional to exercise intensity (Anderson et al. 2023). Cortisol is a stress hormone secreted by the adrenal gland during a variety of stressful conditions (Lightman et al. 2020). One of the main effects of cortisol is to promote the conversion of protein to glucose, ensuring that blood glucose levels will be maintained to meet essential needs (Wensveen et al., 2021). The higher the blood cortisol concentration during exercise, the greater the protein breakdown rate and the worse the protein balance becomes. When the intensity of exercise is increased from moderate to heavy, muscle synthesis decreases and muscle degradation or muscle protein breakdown increases (Zare et al. 2023; Syed-Abdul, 2020).

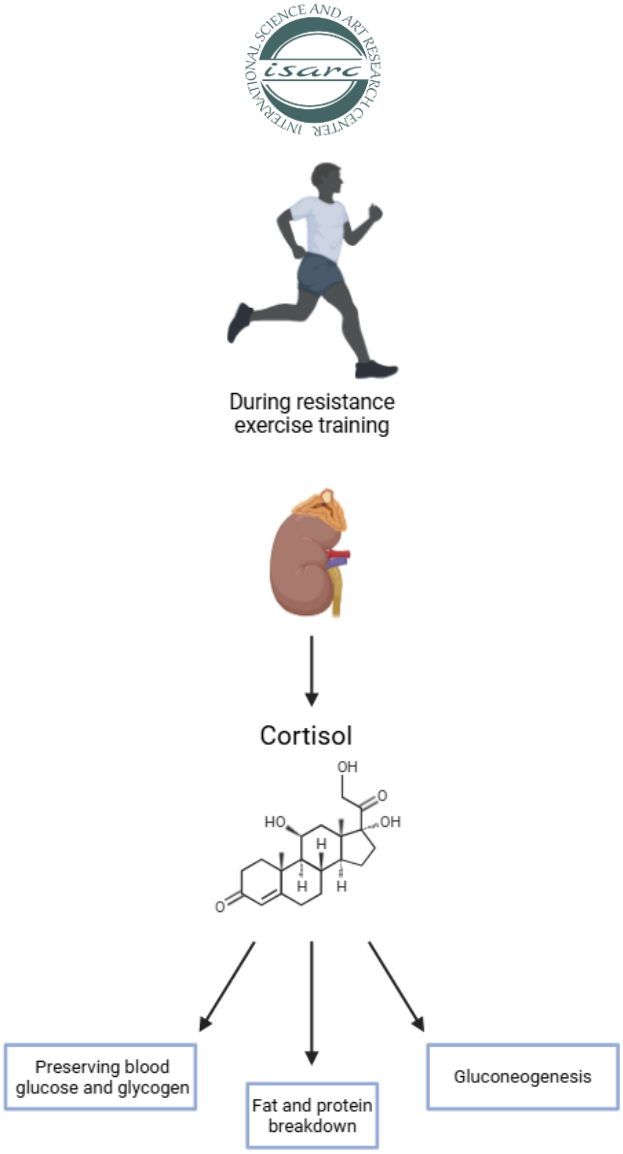

Figure 7. Cortisol's Role in Energy Regulation During Resistance Training.

**This diagram illustrates the function of cortisol during resistance exercise. Released by the adrenal glands, cortisol plays a key role in maintaining energy balance. It preserves blood glucose levels by stimulating gluconeogenesis and glycogen breakdown in the liver. Additionally, cortisol promotes fat and protein breakdown, providing substrates for energy production during prolonged or intense training sessions. These mechanisms highlight cortisol's importance in meeting the energy demands of resistance exercise. This figure was created by the author in BioRender.*

Of all the catabolic conditions investigated, only elevated circulating cortisol concentration distinctly altered both the rate of synthesis and the rates of degradation of albumin, fibrinogen, ceruloplasmin, haptoglobin, transferrin, and complement C3 fraction (Zwart et al. 2022). There is also a strong relationship between cortisol secretion and carbohydrate availability in the body. Studies have shown that if glycogen stores are available, plasma cortisol concentrations during prolonged exercise do not increase (Rossi et al. 2024). However, if carbohydrate stores are not available, and more carbohydrate is required than can be mobilized from carbohydrate stores in the body, an increased release of cortisol occurs. Cortisol is an important hormone that intervenes between energy needs and availability (Wolkowicz et al. 2021).

Growth Hormone Impact on Fat Metabolism and Muscle Adaptations

Growth hormone (GH) is a peptide hormone secreted by the anterior pituitary gland. It is recognized that the actions of plasma GH contribute to the maintenance of normal homeostasis

during rest and when subjected to various physiological stresses and conditions (Li et al. 2021; Devesa, 2021). These conditions include decreased insulin action and hypoinsulinemia, increased serum catecholamines, augmentation of some hepatic metabolic effects mediated by either insulin or glucagon, and induction of lipolysis and fatty acid release with concomitant provision of lipid fuel for oxidative tissue metabolism (Richter et al., 2021). The effects on target tissues of administering GH exogenously are recognized clearly as well (Tresguerres et al. 2022). Like cortisol and other counter-regulatory hormones, the effects of GH are directed toward integrating systemic carbohydrate, lipid, and protein metabolism in metabolic pathways that are more suited to provide for the energy-demanding intracellular requirements made by increased catabolic cell metabolism (Vázquez-Borrego et al., 2021). To accomplish this goal, GH (Growth Hormone) demonstrates powerful insulin-blocking abilities, restraining linear growth factors and inhibiting the growth factor responsible for cellular development (Park, 2023). Additionally, GH exhibits insulin-like properties, aiding in muscle building and promoting the burning of adipose tissue. These multifaceted effects occur on a cellular level, contributing to enhanced overall performance (Al-Regaiey, 2024).

GH causes an increase in plasma free fatty acid concentrations that occurs primarily in response to increased hepatic synthesis and secretion of insulin-like growth factor-1 during physiological adaptation to an increased requirement for gluconeogenic fuel (Eliakim and Nemet, 2020). The resynthesis and recovery of hepatic glycogen levels that are required to support the increased hepatic tricarboxylic acid and microsomal fatty acid esterification activity incurred by the insulin-induced sequestered free fatty acids results also through the action of GH's insulin-antagonist effects (Moreno-Cabañas and Gonzalez2023). The effects of GH in increasing cardiac output and oxygen demand by cardiac, vascular, and other tissues are given further support by GH's actions of enhancing the cardiovascular effects of catecholamines and effects on stimuli that have been shown to positively enhance diuresis and natriuresis (Lloyd et al. 2022; McArley et al. 2021). These actions of increasing the requirement for gluconeogenic fuel also led to cellular glycogen supercompensation hyper-responsiveness that is observed during recovery from time-related increases in force and muscle lengthening contractile stimuli. Together, GH's actions that are part of this sequence of hormonal and co-hormonal signals serve to enable glucose homeostasis during physical stress (Huang et al. 2020; Sai Kumar, 2023; Donato et al. 2021; Caputo et al. 2021).

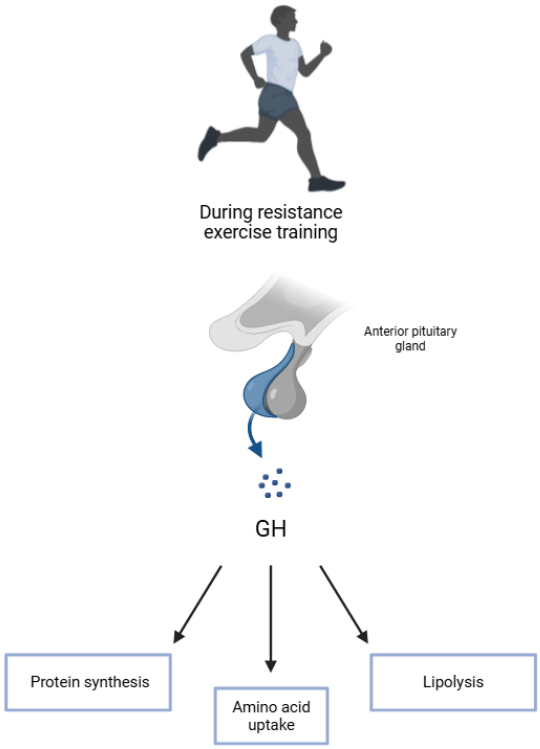

Figure 8. Growth Hormone (GH) and Its Role in Resistance Training.

**This diagram depicts the role of growth hormone (GH), secreted by the anterior pituitary gland, during resistance exercise. GH promotes protein synthesis, essential for muscle repair and growth. It enhances amino acid uptake into muscle cells, supporting recovery and adaptation. Additionally, GH stimulates lipolysis, mobilizing fat stores to provide energy during prolonged or intense resistance training. This figure was created by the author in BioRender.*

Thyroid Hormones: Regulators of Metabolic and Energy Balance During Exercise

In response to acute exercise, thyroid hormone homeostasis undergoes major alterations, which include an increase in circulating thyroxine (T4) values, decreased thyroxine-binding globulin (TBG) levels, increased fractional T4 turnover, decreased 5'-monodeiodination, and an inhibition of TSH secretion (Ylli et al. 2020). Stimulation of the thyroid axis is dependent on the duration and intensity of the exercise, as well as the muscle mass involved. Generally, a modest increase (10%-20%) in serum T4 occurs after an acute bout of moderate-intensity exercise, with a gradual return to basal levels (DA SILVA et al. 2022). Although T4 is increased with exhaustive prolonged exercise, studies of short-term changes in serum T3 values are limited and inconsistent (Bogdanis et al. 2022). Acute exercise impairs the free T4 index, T3/T4 ratio, and free thyroxine index. High levels of T4 cause a feedback inhibition of TSH secretion. The T4 adaptation has been more frequent and persistent in subjects following a program of regular exercise. The increased sensitivity of the anterior pituitary to T4 appears to contribute to a suppression of TSH due to periodic repetitive exercise (Okoye et al. 2023; Zheng et al. 2024).

Thyroid hormones are also involved in the regulation of energy balance and body composition through control of metabolism, thermogenesis, heat production, gluconeogenesis, and lipid and carbohydrate metabolic responses during both acute bouts of muscle contractions and chronic exercise (Ylli et al. 2020; Miro et al. 2023). Several studies have found a positive association between serum T3 and T4 levels. The majority of the experimental results indicate that the T3 and T4 values either do not change or increase slightly after the first days of an acute bout of

intense exercise (Ylli et al. 2020; Cintineo et al. 2024). Generally, muscle T3 is relatively conserved at the expense of the circulating pool, providing a feedback mechanism that boosts muscle protein content (Millward, 2021). Plasma T3 levels remain within the normal range, and exercising skeletal muscle coincides with a decreased T3 gradient, indicating rapid T3 extrathyroidal conversion during exercise. Several hypotheses have been presented regarding the peripheral mechanisms of thyroid hormone regulation (Makanae et al. 2024; Piknova et al. 2024).

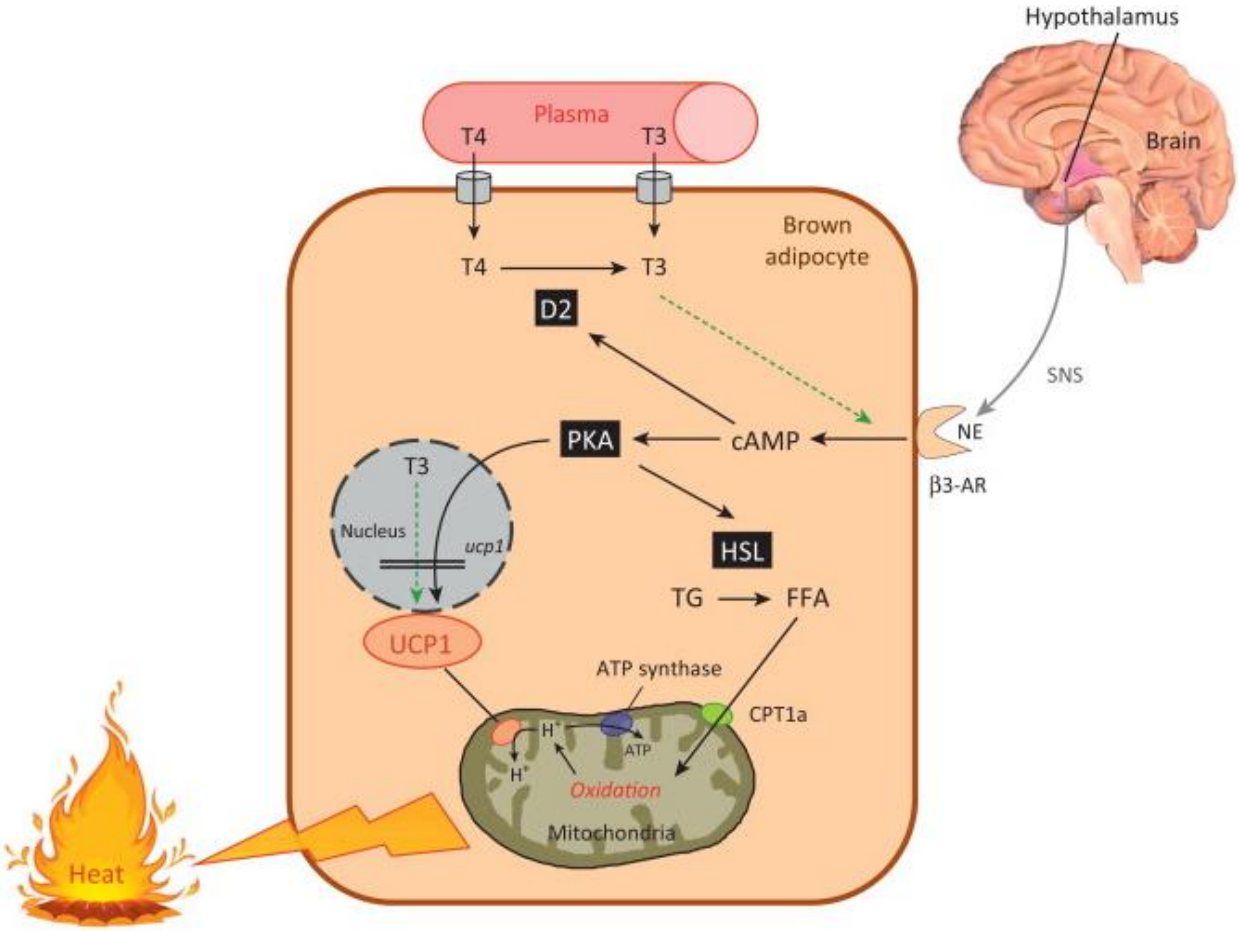

Figure 9. Thyroid Hormones and Their Role in Energy Metabolism (López et al. 2013**).**

This diagram illustrates the function of thyroid hormones (T3 and T4) in energy metabolism and thermogenesis. T4 is converted to the more active T3 in brown adipocytes, where it activates pathways such as PKA and cAMP. These pathways stimulate hormone-sensitive lipase (HSL), promote lipolysis and releasing free fatty acids (FFA). The FFAs are oxidized in mitochondria, generating heat through uncoupling protein 1 (UCP1) activation. The hypothalamus regulates this process via the sympathetic nervous system (SNS), ensuring efficient energy utilization and heat production during metabolic demands.* ***Abbreviations:* ***T3/T4****: Triiodothyronine/Thyroxine,* ***D2****: Deiodinase 2,* ***PKA****: Protein Kinase A,* ***cAMP****: Cyclic Adenosine Monophosphate,* ***HSL****: Hormone-Sensitive Lipase,* ***UCP1****: Uncoupling Protein 1,* ***FFA****: Free Fatty Acids,* ***CPT1a****: Carnitine Palmitoyltransferase 1A.*

The Influence of Testosterone on Muscle Growth and Resistance Exercise Adaptations

Testosterone is the primary male sex hormone and has long been known to have anabolic as well as androgenic effects in males (Obukohwo et al. 2023). In a comprehensive review, steroid

hormone concentration before and after a series of resistance exercise regimens, such as high vs. moderate intensity, upper vs. lower body exercises and large vs. small muscle group exercises, did not greatly differ (Gharahdaghi et al. 2021). Testosterone usually increases more after heavy resistance exercise than after moderate resistance exercise, but the effect of changes in testosterone levels on muscle hypertrophy is minimal and may be presumed to be due to other hormonal factors (Chasland et al. 2021). A lower testosterone/cortisol ratio after a resistance training program is related to a loss of lean body mass or muscle strength (Ahmadi et al., 2024).

In general, resistance exercise can elevate the level of testosterone because of the volume or complexity of training involved (Minas et al. 2022). These hormones were affected in different ways, with testosterone being particularly sensitive to long rest periods in between sets of resistance training (Kraemer et al. 2020). The same training with a 90-second rest period resulted in an elevated cortisol/testosterone ratio compared to other rest periods. The dose–response relationship of exercise intensity on the GH response is not easily demonstrated (Whitcomb, 2022). Attention must be paid to the fact that the acute type, volume, and intensity of exercise training influence the level of testosterone, with the changes mainly involving resistance exercise in male adolescents (Yinghao et al. 2021). Various forms of psychological and physiological responses or stress also promote abnormal testicular pro-androgen secretions. Such situations reduce the resting level of testosterone and other androgen hormones, as well as the response characteristics to acute exercise in men (Wrzosek et al. 2020) (Table 1).

Table 1. Hormonal Responses During Exercise and Their Effects.

Hormone	Effect During Exercise	Influence Factor
Insulin	Decreases to facilitate glucose release into the blood	Exercise Intensity and Nutrition
Cortisol	Increases to mobilize energy stores	Exercise Duration and Intensity
Growth Hormone (GH)	Increases to promote fat metabolism and muscle adaptation	High-Intensity Exercise
Thyroid Hormones	Increases metabolic rate and energy balance	Moderate to High-Intensity Exercise
Testosterone	Increases during resistance training for muscle growth	Resistance Training Intensity and Volume

All of the above studies have demonstrated that the resting concentration of testosterone does not change per se during exercise. However, the higher post-exercise concentration of testosterone was reported to occur but not consistently.

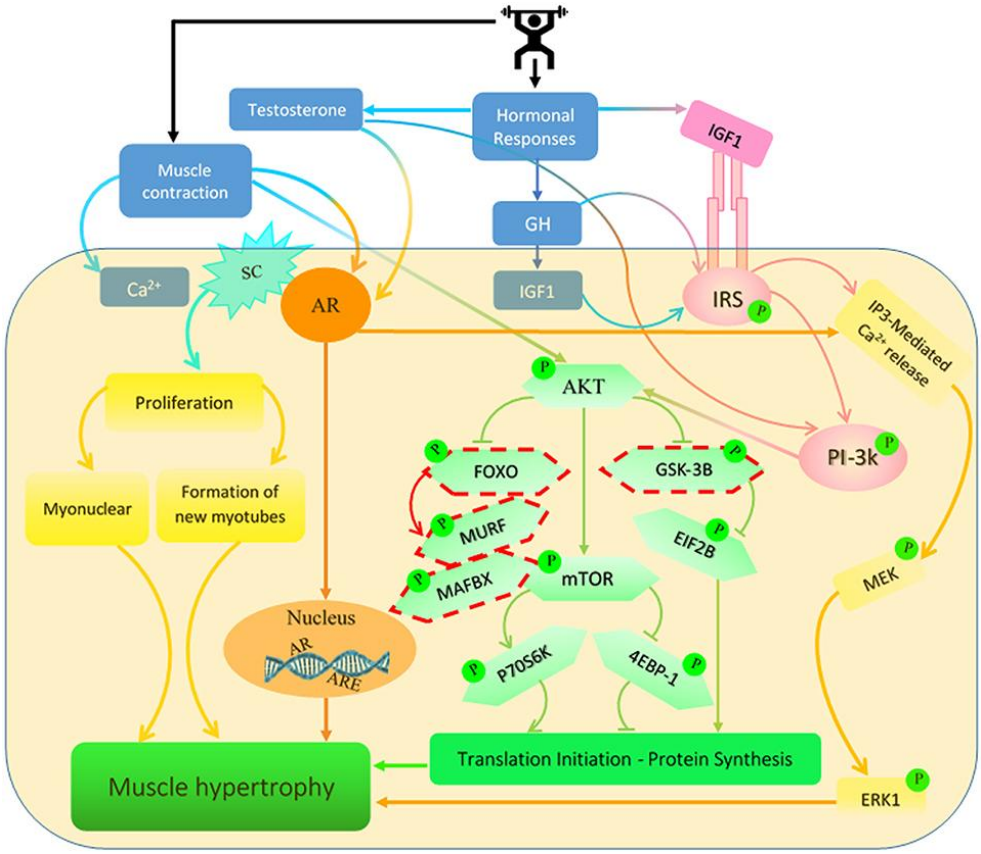

Figure 10. Hormonal Regulation of Muscle Hypertrophy During and After Exercise (Gharahdaghi et al. 2021).

***This diagram highlights the molecular and hormonal pathways that regulate muscle hypertrophy during exercise. Key hormones such as testosterone, growth hormone (GH), and insulin-like growth factor 1 (IGF-1) activate signaling cascades like PI3K-AKT and mTOR. These pathways stimulate protein synthesis, promote muscle fiber growth, and suppress protein degradation by inhibiting catabolic regulators like FOXO and MuRF. Additionally, satellite cells (SC) contribute to muscle repair and the formation of new myotubes. Calcium (Ca^{2+}) signaling and androgen receptor (AR) activation further enhance muscle adaptation, emphasizing the intricate interplay of hormonal and molecular mechanisms in driving muscle growth. **Abbreviations: GH**: Growth Hormone, **IGF-1**: Insulin-like Growth Factor 1, **PI3K**: Phosphoinositide 3-Kinase, **AKT**: Protein Kinase B, **mTOR**: Mechanistic Target of Rapamycin, **FOXO**: Forkhead Box Protein O, **MuRF**: Muscle-specific Ring Finger Protein, **SC**: Satellite Cells, **AR**: Androgen Receptor.*

Hormonal Adaptations After Exercise and Their Long-Term Effects

Long-term adaptations and hormonal status After an acute bout of exercise, the release of anabolic and catabolic hormones is increased, which plays a distinct role in the recovery process (Kraemer and Ratamess 2005). Although the recovery process and the resynthesis of structural components that are broken down during the training session last different lengths depending on the hormonal half-life, the exact time course between the hormonal peaks and recovery is still not clear (Markus et al. 2021). Several studies have reported different time courses between hormonal peaks and other hormone responses, including phosphocreatine and glycogen resynthesis rates after an acute bout of exercise (Egan and Sharples, 2023).

Although resistance training and aerobic training with or without calorie restriction result in long-term adaptations, such as increased muscle strength and endurance by promoting muscular hypertrophy, studies have shown that resistance training and high-intensity, short-duration interval training led to increased muscle strength (Leuchtmann et al. 2020; McLeod et al. 2022). After a training period, basal blood concentrations return to normal resting values, despite still larger volumes of muscle tissue (Fonseca et al. 2021). These adaptations happen in the short term and develop slowly and linearly over time. In contrast, exercise increases the availability of anabolic and catabolic hormones within the bloodstream in order to regulate and repair the metabolic and acute changes in the body after training (Mennitti et al. 2024). Furthermore, the long-term adaptations after physical activity could also be attributable to the increase in various hormonal profiles, including hormone-sensitive lipase and hormone-sensitive lipase inhibitors such as insulin, ghrelin, adiponectin, and leptin as well (Franklin et al. 2020).

The modification in hormone concentrations to regulate metabolic rate and body composition over time spans months or even years (Pataky et al., 2021). The short- and long-term adaptation to hormonal concentration is essential for adapting athletes to increase muscle strength and endurance (Myllyaho et al. 2021). These changes during exercise include both high-intensity followed by moderate-intensity exercise, as well as changing hormonal responses post-stratification (McMullen, 2020). There is a close relation between long-term activity, not just for professional athletes but also for well-being and enthusiasts alike. These hormones can also be used in the recovery process of restoring muscle repair and increasing muscle force during exercises (Gu et al. 2021).

What signals can these hormones send to the muscles that upregulate them? The adjustment can be healthy and efficient to change with nutritional intake and increase hormone-like substances in certain foods (Palacios et al. 2020). Nevertheless, it is crucial to evaluate whether these responses are effective for promoting exercise training. The purpose of this application is to provide a comprehensive implication for hormonal adaptations over time that emerge after continuous exercise (Safarimosavi et al. 2021; Egan and Sharples, 2023).

Different Effects of Exercise Types on Hormonal and Metabolic Responses

When classifying exercise according to its primary metabolic pathways, it can be broadly grouped into three categories: aerobics, resistance, and interval training (Kelly et al. 2020). One of the main factors that separates aerobics from resistance exercise is the duration of its metabolic dominance. Aerobic exercise mainly targets endurance and induces an increase in fat oxidation during low to moderate exercise intensities (Muscella et al. 2020). After short-term aerobic exercise, the endocrine responses include the stimulation of the adrenocortical axis, which is essential for long-term endurance. Even specific hormonal resistance training can induce, over time, a superimposed increase in fat oxidation and endurance in addition to an increase in strength, muscle mass, and anabolic hormones (Athanasiou et al. 2023). Compared to the other two exercise types, specific hormonal responses of explosive strength-power resistance exercises increase anaerobic performance by enhancing maximum strength, and the rapid onset of resistance training exercises has an additional influence on changes in the environment to enhance anaerobic power (Ojanen et al. 2020).

Aerobic exercise includes endurance training at low to moderate intensities with different durations or ultra-long endurance. Subject-specific endurance events, especially in trained endurance athletes, are characterized by prevailing free fatty acid mobilization and oxidation as well as muscle lipid metabolism (Guo et al. 2023; Lundsgaard et al., 2020). According to

the duration, the actual metabolic contributions also differ, with different endocrine regulations and hormonal adaptations timed between short- and long-term training (Mennitti et al. 2024). It has been shown that low intensities predominantly generate an increase in cortisol levels and peripheral thyroid hormone concentrations, particularly fT4 and rT3, and catecholamine release, whereas moderate training intensities also induce an increase in GH (Athanasiou et al. 2023). After an acute bout of fundamental endurance exercise, whole-body protein catabolism seems to be stimulated by hematological adaptations including DA and Epo and the increase in IGF-I, whereas stress hormones like cortisol and catecholamines remain low. The marked increase in cortisol levels at the end of an event may also be influenced by an increased secretion of CRF by the hypothalamus (Lin et al. 2021; Drummer et al. 2024).

Physiological and Metabolic Adaptations to Aerobic Training

Regular exercise training has profound effects on energy metabolism and hormonal response in line with the training intensity and duration. Aerobic exercise is characterized by prolonged, moderate-intensity activities that stimulate numerous metabolic, physiological, and hormonal responses (Works et al., 2024). When aerobic exercise is consistent, various systemic and cellular adaptations occur, which work together to mobilize, deliver, and utilize substrates to meet energy demands (Murphy et al., 2020). In addition to cardiovascular and ventilatory fitness, physiological adaptations to aerobic training include increased central blood volume and heart size; plasma volume expansion, which increases stroke volume; and increased capillarity and density of oxidative fibers (Koller et al. 2022). Cellular adaptations in muscle cells involve morphologic, structural, and metabolic changes, typically yielding elevated oxidative enzyme activities, mitochondrial density, and fat oxidation in the trained muscle (Powers et al., 2022).

Chronic aerobic training can have additional beneficial effects, such as elevated insulin sensitivity for glucose disposal and augmented levels of free T3, as well as the biologically inactive reverse T3 (DiMenna and Arad2021). Metabolic adaptations to continuous physical exercise exist in enhancing the mobilization of fuel for energy production and the shift in substrate preference from glucose to fats. This characteristic reliance on fat oxidation is a clear indication of greater metabolic efficiency, which results in substantial improvements in endurance performance (Palmer and Clegg, 2022; Gambardella et al., 2020). Furthermore, many studies have consistently shown that regular physical activity as part of a healthy lifestyle may be correlated with health benefits, especially the prevention of major metabolic syndrome-associated diseases (Andermo et al. 2020). Administering acute aerobic exercise to sedentary subjects may not necessarily yield the same complex systemic adaptations that are typically initiated through long-term aerobic training, although several antecedent training conditions could influence acute exercise response (Franklin et al. 2020). The beneficial health effects induced by physical activity depend on the type and/or modifications of the exercise interventions to be applied, as well as on the nutritional status of the subjects (Martinez-Ferran et al. 2020).

Metabolic and Hormonal Responses to Resistance Training

Resistance exercise significantly contributes to both muscle strength and hypertrophy, which has the potential to ultimately improve metabolic health (Thyfault and Bergouignan, 2020). The acute hormonal response to resistance exercise, including increased activity of the somatotropic axis, is believed to be the driving factor of strength and hypertrophy (Peng et al., 2021). Heavy mechanical tension during resistance exercise, concentric and eccentric muscle

actions, and high volume induces the activity of anabolic hormones, in particular growth hormone and testosterone (Kizilay et al. 2023). The release of testosterone during resistance exercise is partially defined by the load and rest period between sets. Over the training period, enhanced protein turnover, repletion, and secondary training adaptations, including increased muscle strength or power output, lead to attenuated testosterone and growth hormone responses (Turgut et al. 2021; Zurek et al. 2022). Testosterone is a sex steroid hormone that increases muscle protein synthesis; thus, it is seen as an anabolic hormone, whereas growth hormone is a protein, not a steroid, and is a catabolic hormone with an anabolic effect. The longer a series of repetitions are carried out, the lower the testosterone pulse is (Gharahdaghi et al. 2021). Over the training period, enhanced protein turnover, repletion, and secondary training adaptations, including increased muscle strength or power output, lead to attenuated testosterone and growth hormone responses (Howard et al. 2022). Without appropriate recovery between intensive exercise training sessions, adaptation is inevitably delayed, as is the extent to which training performance can be improved (Zatsiorsky et al., 2020).

Resistance training interventions yield increases in lean body tissue and fat mass reduction in untrained, late-middle-aged men, which in turn may be associated with reduced cardiometabolic disease risk (Fyfe et al., 2022). When given under supervision, with progressive overload and each session preceded by testosterone surges from pre-session protein feeding, resistance training can produce substantial changes to the body composition of overweight and obese postmenopausal women (Dupuit et al. 2020). Over the course of the training intervention, the subjects lost body fat and gained lean body mass, for a total relative change in body fat of more than 13% and total body fat of more than 3 kg that is, going from an obese body composition to a body composition within the healthy/athletic range (Bellicha et al. 2021). Pre-session testosterone levels potentiate muscle hypertrophy, and post-session post-exercise testosterone levels show a dose–response relationship with the magnitude of the increase in hypertrophy (Plumb, 2024). Following exercise, timing of meals is important, with post-exercise timing of carbohydrate and/or protein important for reducing the catabolic actions of a rise in the plasma free-cortisol fraction; for example, post-exercise soft drink to match the rate of glycogen burning with the rate of glycogen uptake reduces post-exercise muscle protein breakdown by being anti-cortisolic (Joanisse et al. 2021; Craven et al. 2021).

Interval Training: Optimizing Both Aerobic and Anaerobic Energy Systems

Interval training is characterized by alternating periods of high-intensity exercise and/or rest or relief periods (Franchini2020). Four main variables are usually manipulated when prescriptions are made: duration, intensity of efforts and rests, and the relief modality, i.e., passive or activity of lower intensity. Interval training, independently of the intensity, is promising for the improvement of both aerobic mechanisms and energy pathways (Atakan et al. 2021).

The major physiological adaptations to interval training are an increase in skeletal muscle oxidative capacity, decreased blood lactate concentrations, and a decreased energy contribution from the anaerobic energy pathways, all leading to an improved endurance performance (Gibala and MacInnis2022). Indeed, maximal oxygen consumption has been reported to increase with interval training even with durations as little as twice 30 seconds per session (Festa et al. 2023). Growth hormone peak concentrations may even be increased to values in athletes sedentary and trained at intermittent swimming to exhaustion at intensities under the individual anaerobic threshold (Cadegiani and Cadegiani2020). Thyroid hormones may also be subject to peak intensity oxidative stress regulation, as they have been observed to return to their basal levels 24 hours post-exercise after supramaximal exercises on a cycle ergometer (Mennitti et al. 2024). Androgens are also acutely increased during high-intensity exercise.

Taken together, the adaptations observed after interval training may be generalized to any kind of interval training. Since interval training stimulates both the aerobic and anaerobic systems, as well as areas in between, it is advisable to add interval training to every type of training program (Zouhal et al. 2022; Dote-Montero et al. 2021).

Interval training has acquired increased popularity in clinical and healthy populations since it is well-tolerated by patients, even those with chronic health conditions, and amenable to high intensity work even for untrained subjects (Calverley et al. 2020). Furthermore, considering that the potential proportion of anaerobic capacity progressively decreases the lower the training intensity, interval training may be the most efficient regime of training for recruiting a maximum number of muscle fibers that may be recruited to achieve benefits in maximal oxygen consumption. Interval workouts composed of series of lower intensities with modifications in the relative intensity and duration of efforts give a large range of specific improvements, and as a consequence, concerning the nature of the effort, concerning the aims in different sport disciplines, or simply concerning the pleasure of training and practicing (Leuchtmann et al. 2020). It has in addition been shown that high-intensity intermittent running resulting in the best improvements in maximal oxygen consumption was performed at a submaximal velocity which corresponded to approximately 100% of the velocity that elicited the first blood lactate threshold (Rosenblat et al., 2022).

Hormonal Adaptations Resulting from the Combination of Exercise and Diet

The synergistic effects of exercise and diet appear to be the most effective tools in the prevention and treatment of non-communicable diseases (Caprara, 2021). Part of this is through hormonal adaptations that exercise creates, which are enhanced if the nutritional strategy applied after and/or before exercise belongs to some specific parameters, such as exercise intensity, duration, or individual parameters (Works et al., 2024). This hormonal adaptation in exercise relies on unique neurotransmitter release, whole-body fuel usage, metabolic protein expression changes, increased nutrient partitioning, endocrine responses, and metabolic adaptations, and becomes a barrier to exercise performance (Bhattacharya et al., 2023). One of the mechanisms to improve this interplay is to potentiate the hormonal effects resulting from exercise through the application of a specific diet in the form of nutrient timing, macronutrient ratios, or dietary patterns (Bettio et al. 2020).

The combination of exercise and appropriate nutrition has the capacity to influence acute hormonal fluctuations in response to each intervention. It appears that protein feeding before and after exercise may be critical not only to enhance muscle capacity to synthesize protein and their recovery rate but also to inhibit an increase in cortisol release during exercise (Tsuda et al. 2020; Kraemer et al. 2020).

In addition to the anabolic and recovery role, nutrients can also mediate the levels of catabolic hormones (Caputo et al. 2021). Ingestion of carbohydrates during exercise could maintain NEFA and glycerol availability and reduce both adrenocorticotropic hormone and cortisol levels. Dietary intake timing can affect the chronic concentrations of anabolic and catabolic hormones (Christ et al. 2024). Carbohydrate ingestion after prolonged exercise can increase insulin levels together with decreased cortisol, showing less muscle damage. A potential and evidence-based suggestion is that carbohydrate plus protein ingestion can have a greater effect on change-adaptive anabolic and catabolic hormone responses than protein alone (Gryaznykh et al. 2021).

Although there is evidence to suggest that dietary interventions can buffer the acute hormonal responses to exercise, the area of nutrient-hormone manipulations across a longer period is far

less clear (Arvidson et al. 2020). It has been suggested that dietary strategies designed to improve recovery may allow individuals to undertake larger volumes of training, which is important in the progression of increases in work output (Fyfe et al., 2022). The chronic hormonal adaptation shown in an individual will depend entirely upon the individual metabolic response and goals of interventions. The inter-individual response will differ with different reactions to the intake of specific nutrients in terms of habits and receptor sensitivity to anabolic and catabolic signals (Pataky et al., 2021; McGee and Hargreaves, 2020). It may also be that the duration or magnitude of dosing can elicit variable responses. There have also been suggestions that the timing of nutrient intake with exercise can act as a great modulator of the volume of adaptation resulting from the applied exercise stress due to the hormonal changes induced by nutrient intake and the subsequent exercise (Rocha-Rodrigues et al. 2021). There has also been a suggestion that one aspect of nutritional intervention with hormonal change can improve performance. It may be that additional nutrients on top of a balanced diet can enhance the already elevated muscle protein synthesis rates from exercise (Holtzman and Ackerman, 2021). It will be of interest to see if any interactions occur with the hormonal adaptations in response to the exercise-hormone intervention combination (Shing et al. 2024). There may be a variety of metabolites produced from a specific single nutrient intervention for the improvement of performance, which can enhance the acute hormonal adaptations, and thus the post-exercise nutritional response will differ according to the individuals, providing greater variation by background hormonal characteristics (Taylor et al. 2022; Bowman et al., 2021).

Future Directions in Research

Given the extensive research conducted in exercise metabolism and the abundance of available knowledge, it's important to acknowledge that this field is still in its early stages. As a result, we are just beginning to comprehend the range of specific metabolic adaptations to acute exercise and exercise combined with dietary interventions designed to maximize adaptations. Moving on to potential future areas of research, there are numerous intriguing possibilities within the realms of energy metabolism and hormonal adaptations to acute and adaptive exercise. This section will cover other specific future research directions. It is evident that one promising area for future research in exercise metabolism and performance is neurobiology, specifically the study of brain function and activity. This is an area that has been relatively overlooked compared to other areas, such as the peripheral RAS and voluntary suppression of hyperthermia. The previous sections of this review make it clear that the brain plays a significant role in both central and peripheral regulation of various hormonal and metabolic phenomena and performance. The application of new neurobiological tools in combination with established animal models of exercise metabolism should provide numerous benefits to understanding the overall regulation and control of exercise metabolism.

Conclusion

Exercise plays a crucial role in regulating energy metabolism and driving hormonal adaptations that are essential for both short-term performance and long-term health outcomes. The interplay between various metabolic pathways and hormones during exercise highlights the complexity of the physiological responses that occur, influenced by factors such as exercise intensity, duration, and type. This review emphasizes the importance of understanding these mechanisms, as they provide insights into how exercise can optimize metabolic function, enhance athletic performance, and contribute to the prevention and management of chronic diseases.

The hormonal responses to exercise, including changes in insulin, cortisol, growth hormone, thyroid hormones, and testosterone, have significant implications for muscle growth, fat metabolism, and overall energy balance. Moreover, the combination of exercise with proper nutrition, particularly in terms of nutrient timing, can further enhance these hormonal adaptations, contributing to better recovery and performance outcomes.

As research continues to evolve, further exploration into the molecular mechanisms behind exercise-induced hormonal changes, as well as the role of individual variability in responses to exercise, will provide valuable information for developing more personalized exercise and nutrition strategies. Ultimately, a deeper understanding of these metabolic and hormonal adaptations can help refine training programs, promote healthier lifestyles, and improve the well-being of individuals across various populations.

By advancing our knowledge in this area, we can create more effective interventions aimed at improving metabolic health, enhancing athletic performance, and supporting recovery, ultimately leading to better outcomes in both elite athletes and the general population.

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G. ***Ethics Approval and Consent to Participate***

Not applicable.

H. *Code Availability (software application or custom code)*

Not applicable.

İ. ***Competing Interests***

The author declares no competing interests.

J. *Consent to Publish Declaration*

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AIR POLLUTION AND ITS ASSOCIATION WITH RESPIRATORY DISEASES IN BANGLADESH AND INDIA: A SYSTEMATIC REVIEW

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Abstract

Introduction: Air pollution is a major global health risk and has been strongly associated with respiratory diseases. Bangladesh and India are among the most polluted countries worldwide, with particulate matter, vehicular emissions, biomass fuel use, and crop residue burning contributing to high exposure levels. This systematic review examines the relationship between air pollution and respiratory morbidity in these two countries.
Methods: Relevant studies, WHO guidelines, and international reports published between 2004 and 2025 were reviewed. Literature focusing on air pollution and its impact on asthma, chronic bronchitis, and chronic obstructive pulmonary disease (COPD) was included. Data were synthesized narratively to capture regional health outcomes and risk factors.
Results: Evidence from India shows significant associations between outdoor air pollution in industrial towns and increased prevalence of asthma and chronic bronchitis. Crop residue burning further worsens air quality during specific seasons. In Bangladesh, household biomass fuel use is strongly linked to higher COPD risk, particularly among women. International reports confirm that in 2024, Bangladesh ranked as the second most polluted country globally, while India also remained among the worst performers in air quality indices. These findings align with WHO guidelines identifying both outdoor and household air pollution as critical drivers of respiratory morbidity.
Conclusion: Air pollution in Bangladesh and India is a public health crisis. Strong evidence supports its association with increased respiratory disease burden, particularly COPD, asthma, and chronic bronchitis. Effective interventions targeting industrial emissions, vehicular pollution, biomass fuel use, and crop residue burning are urgently needed. Adopting WHO air quality guidelines and implementing regional mitigation strategies could substantially reduce respiratory health risks.
Keywords: Air pollution, Respiratory diseases, Bangladesh, India, COPD, Asthma.

AN OPINION ABOUT THE IDEA OF HUMAN'S WELLBEING

Assoc. prof. M. As. Michailov, PhD, eng.

Abstract

The idea of human's wellbeing deserves enormous support, but how it can be realized is a task that requires much more serious thinking and difficult answers.

For example, what should be the policy to achieve human's wellbeing.

The answer is very simple – for modern society, environmental protection is an activity and a perspective for overcoming the negative consequences of anthropogenic impact on it.

Therefore, it is not an exaggeration to claim that to achieve ***human's wellbeing***, environmental protection actions must be reassessed in advance - not only as a commitment by NGOs, but through a more serious assessment of the existing regulatory framework (***in production and consumption*** [Hristov Hr. (2005)].

Introduction

The pursuit of ***Wellbeing*** has accompanied Humanity throughout the centuries, and its realization is a stimulus for development.

Considering the above in Fig. 1, it is of interest to answer an essential question.

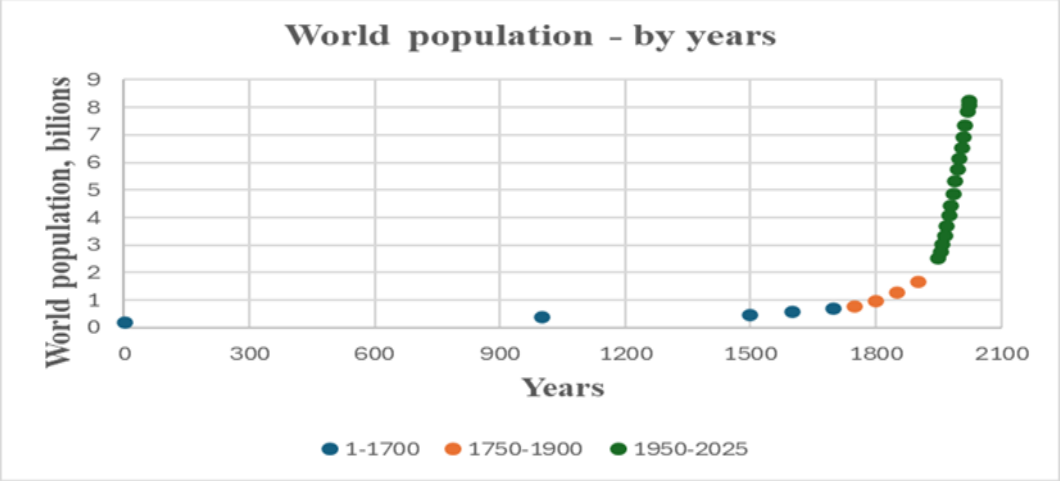

Fig. 1

In the future, how should this aspiration be met?

The answer is:

– through a more serious attitude towards resources,

– through their effective (environmentally friendly) use,

– through a more conscious and responsible attitude towards the processes of waste formation,

– through a more serious commitment to environmental protection activities.

Discussion

In the literature various formulations are found related to word combinations with ***well-being*** - economic well-being, emotional well-being, sense of well-being, financial well-being, general well-being [https://dictionary.cambridge.org/dictionary/english/well-being].

If we analyze the various examples (economic, emotional, feeling, financial, general) more carefully, we will find that they are primarily associated with achieving certain results without clarifying how they are achieved.

An answer to such questions can be obtained through a more serious insight into the explanations presented by Maslow about the motivation and behavior of organisms (individuals) in Nature [Motivation and personality. - www.holybook.com] i.e. what their interaction in a natural environment is.

The comments about "the pursuit of Wellbeing" are largely related to a few interpretations of "Maslow's Hierarchy of Needs".

Fig. 2

Above of all, "Maslow's hierarchy of needs" presents itself as a motivational theory in psychology comprising a five-tier model of human needs, often depicted as hierarchical levels within a pyramid [A.H.Maslow (1943)].

This pyramid includes:

- **Physiological needs** - breathing, food, water, shelter, clothing, sleep.
- **Safety needs** - health, employment, property, family and social ability.
- **Social belonging** - friendship, family, intimacy, sense of connection.
- **Esteem** - confidence, achievement, respect of others, the need to be a unique individual.
- **Self-actualization** - Morality, creativity, spontaneity, acceptance, experience purpose, meaning and inner potential.

Remarks

In the modern history of the World, there are many interesting events through which comparisons can be made for the present.

For example, in 1867, Marx published "Capital", where he substantiated the essence of each production process to form ***surplus value***, i.e. a scientific interpretation of actions in the economy is given (for the future).

The world population is about 1.3 billion people.

After about 75 years, Maslow in 1943 proposed his "A Theory of Human Motivation"

[*Psychological Review*], justifying, arranging and grading the various human needs in a "five-tier model" such as ***physiological*** (food and clothing), ***safety*** (job security), ***love and belonging needs*** (friendship), ***esteem***, and ***self-actualization***.

The world population is about 2.4 billion people.

The discussed topic raises a new type of questions – how and to what extent does the "Striving for Wellbeing" extend, when and to what extent does the role of the personality manifest itself ("Maslow's Hierarchy of Needs").

At the end of the first quarter of the 21st century, when the world population is already more than 3.2 times larger, it is therefore appropriate (at least in the last two levels in Maslow's Hierarchy) to add a strategy for the implementation of activities related to the reduction of the ***negative consequences of anthropogenic impact***, i.e. ***in the field of environmental protection,*** which would be useful to include in their "**idiosyncratic and species potentials**" [www.holybook.com].

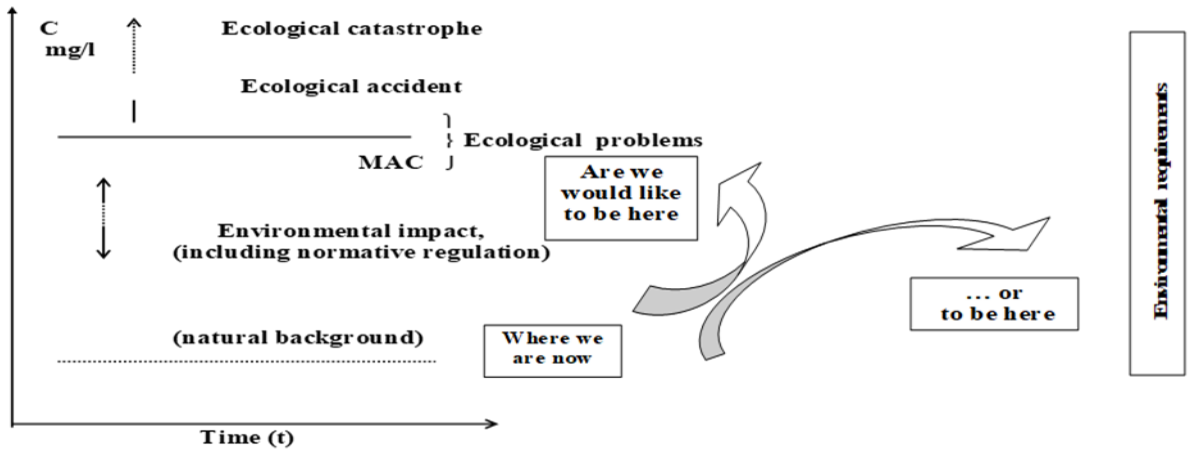

Fig. 3

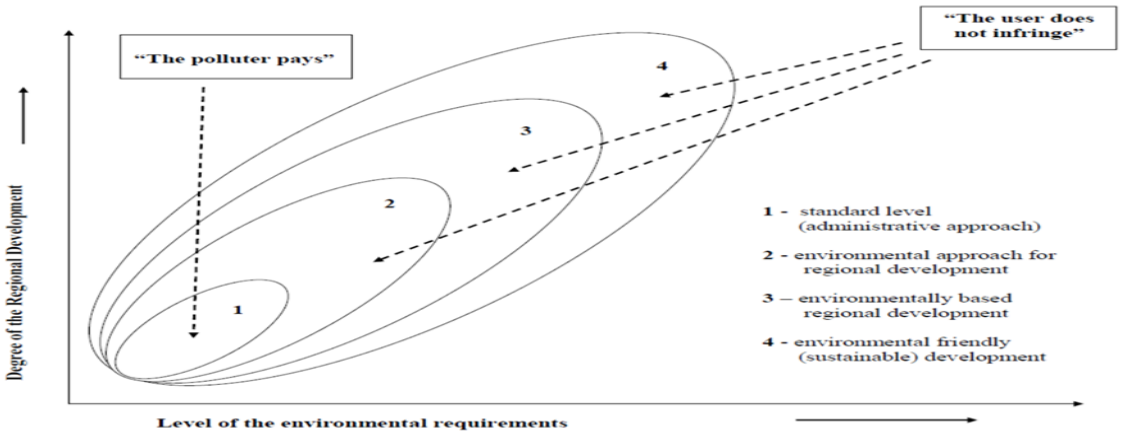

Fig. 4

An interesting position is taken by CSU Pueblo [www.csupueblo.edu] regarding the achievement of well-being. It is claimed that it is related to "nine mutually co-dependence dimensions: emotional, physical, occupational, interpersonal, spiritual, intellectual, environmental, cultural, and financial" – Fig. 5.

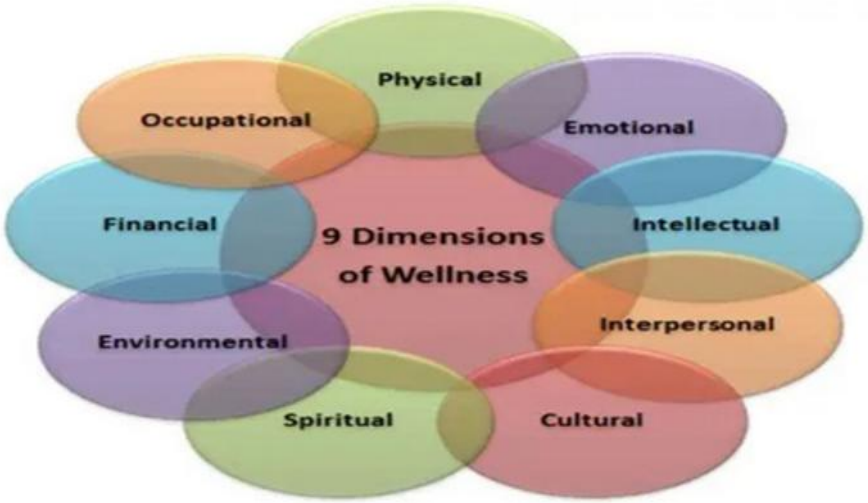

Fig. 5

It should be noted that out of all nine terms, eight are related to qualities of the given person and it is unclear why a term was added that has no connection with them.

There is a need to clarify their use. In one way or another, all eight terms (*emotional, physical, occupational, interpersonal, spiritual, intellectual, cultural, and financial*) depend on ***environmental conditions***.

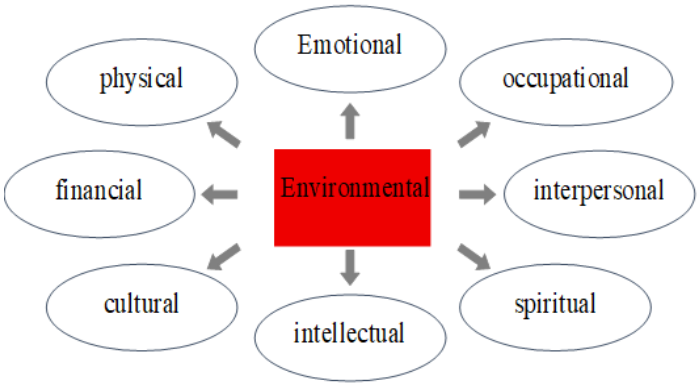

Fig. 6

As we have already noted [Izmir], the idea of human wellbeing is noble, but increasingly clearly Society needs a means of accounting for the influence of anthropogenic impact.

For this purpose, [M. As. Michailov (2024)] proposed the use of the ***Environmental anthropogenic impact assessment index***

$$Eaiai = A$$

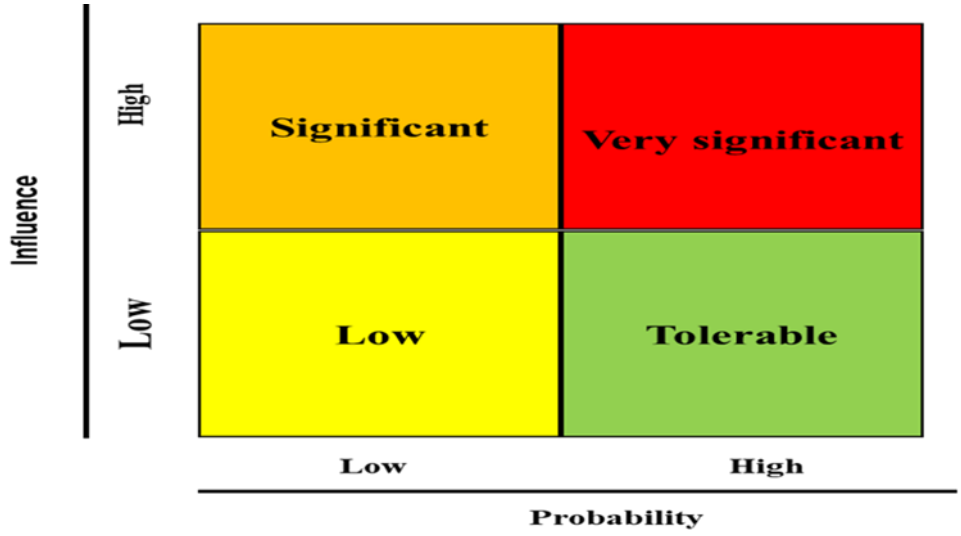

Fig. 7

The following classification of hazards from anthropogenic impacts is proposed (Fig.7):

- In the range up to ***Eaiai*** ≤ 25% - low,
- in the range 26% ≥ ***Eaiai*** ≤ 50% - tolerable.
- in the range 51% ≥ ***Eaiai*** ≤ 75% - significant,
- and in the range ***Eaiai*** ≥ 76% - very significant.

Conclusion

In conclusion, it is necessary to note that given the conditions described in this way in the Society, it is imperative to implement activities related to the reduction of the negative consequences of anthropogenic impact.

Considering the realities at the end of the first quarter of the 20th century, it is necessary to reassess the current practice and establish more effective activities in the field of environmental protection as a more serious commitment of the entire population of the World, since otherwise the idea of human's wellbeing will not be able to be realized, especially in cases where anthropogenic impact reaches ***Eaiai*** levels above 75%.

In other words, environmental protection (as a commitment of Society in the XXI century) must be freed from the interpretations of a few statements used in practice [HTTPS://DICTIONARY.CAMBRIDGE.ORG/DICTIONARY/ENGLISH/ENVIRONMENTALISM], about a ***political*** and ***ethical*** movement, or "a reassessment of humanity's relationship with nature".

It is necessary not to deny (or search for a political or social meaning) of actions to protect the environment, but to reassess the adopted practices (in production and consumption) in terms of resource use, waste training and management, their consequences, etc.

The arguments that regulatory documents are more of a justification, since as can be seen from the attached figures (Fig. 3, Fig. 4 and Fig. 5) can be advantageous and ineffective under modern conditions.

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THE APPLICATION OF NANOPARTICLES AS A THERAPEUTIC AGENT

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Abstract

Nanoparticles (NPs), ranging from 1–100 nm, have become transformative therapeutic agents due to their customizable physicochemical traits, ability to traverse biological barriers, and multifunctionality. Applications include targeted drug delivery, controlled release, theranostics, gene therapy, and immunomodulation. This review highlights recent advancements during 2023–2025, focusing on nanoparticle classes such as polymeric, lipid-based, metallic, and hybrid systems. It presents mechanisms of action and applications across cancer, neurodegenerative and cardiovascular disorders, and organ-targeted therapies. While offering significant advantages—improved specificity, reduced toxicity, and enhanced bioavailability—nanoparticle-based treatments face challenges in safety, scalability, and clinical translation. Future directions involve personalized smart nanoparticles, scalable manufacturing techniques, and theranostic platforms, promising to revolutionize therapeutic landscapes.

Keywords: Nanoparticles, Therapeutic agents, Nanomedicine, Drug delivery, Theranostics, Smart nanoparticles

Introduction

Nanoparticles are critical to modern nanomedicine, providing novel strategies for therapeutics owing to their high surface area, tunable surface chemistry, and ability to cross physiological barriers. Recent clinical translation has accelerated with innovations in lipid and polymeric carriers. The advent of smart delivery systems, advanced manufacturing, and new therapeutic targets underscores the evolving role of nanoparticles in medicine (Rehan et al., 2024) .

Types of Nanoparticles in Therapeutics

Polymeric Nanoparticles

Advanced polymer-based delivery systems remain at the forefront of targeted therapy. A comprehensive Chemical Reviews article (2024) details recent progress in polymeric nanoparticle design, functionalization, and therapeutic deployment .

Solid Lipid and Hybrid Nanoparticles

Solid lipid nanoparticles (SLNs) have shown promising results in cervical cancer therapy, highlighting improved therapeutic efficacy and clinical prospects (Tiwary et al., 2025) . Hybrid liposome-based systems are also on the rise, integrating diagnostic and therapeutic functionalities—theranostics—for precise cancer treatment (Azimizonuzi et al., 2025) .

Nanocarrier Classification Frameworks

A systematic categorization of nanocarriers published in early 2025 offers insights into design principles, aiding rational development of medical nanoparticles (Gressler et al., 2025) .

Emerging Nanomaterials & Quantum Dots

Quantum dots (QDs) maintain relevance for imaging and drug delivery, though toxicity remains a challenge. A May 2025 review outlines recent advances and mitigation strategies . Thermally activated magnetic fiber platforms for remote-controlled release are in development, offering smart, externally regulated delivery systems (Ziegler et al., 2024) .

Mechanisms of Action

Targeted Drug Delivery: Leveraging nanoparticle surface modifications to increase accumulation at disease sites.

Theranostics: Liposomal hybrids combine therapeutic delivery with real-time diagnosis (Azimizonuzi et al., 2025) .

Barrier Penetration: Delivery across difficult barriers (e.g., blood–brain barrier) via polymeric carriers demonstrated in recent breakthroughs (OSU, 2025) .

Immune Activation: Smart nanoparticle cancer vaccines improve tumor immune responses (Qiu & Wu, 2025) .

Applications Across Diseases

Cancer Therapy

SLNs in treating cervical cancer (Tiwary et al., 2025)

Theranostic liposome hybrids offer simultaneous therapy and diagnostics (Azimizonuzi et al., 2025)

Smart vaccine delivery for enhanced antitumor immunity (Qiu & Wu, 2025)

Neurological Disorders

Breakthroughs in crossing the blood-brain barrier using polymeric nanocarriers by OSU show promise for treating cachexia and neuroinflammation (OSU, 2025) .

Cardiovascular Therapeutics

Emerging nanotechnologies can target arterial plaques, reduce inflammation, and assist in early diagnosis—marking a significant leap in heart disease treatment (2025) .

Colon-Targeted Chemotherapy

Nanogels derived from natural resin achieved high-efficiency, site-specific delivery of 5-FU, improving colorectal cancer therapy (Andhra Pradesh study, 2025) .

Advantages

Precision and specificity through functionalized targeting.

Multimodal platforms allow combination therapy plus diagnostics.

Barrier penetration, such as across the BBB or gastrointestinal tract.

Controlled release, including remotely triggered systems.

Limitations

Toxicity concerns, especially with QDs and non-biodegradable materials .

Production scalability remains a hurdle — though innovative processes like Sequential NanoPrecipitation (SNaP) are promising .

Regulatory complexity due to multifunctionality and new materials.

Need for extensive in vivo validation before clinical translation.

Future Perspectives

Smart, stimuli-responsive systems (magnetic, thermal, pH).

Scalable manufacturing techniques like SNaP .

Personalized nanomedicine, integrating diagnostics and therapy in one unit.

Cross-disciplinary integration for workflow—from design to bedside.

Conclusion

Recent years (2023–2025) have seen remarkable progress in nanoparticle therapeutics—from advanced polymeric and lipid platforms to theranostic hybrids and breakthrough barrier-penetrating systems. While challenges in toxicity, manufacturing, and regulation remain, the emerging landscape of smart, multifunctional nanoparticles stands poised to reshape therapeutic strategies. Ongoing interdisciplinary efforts are essential to transform these innovations into safe, impactful clinical solutions.

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CORONA CRISIS AND ITS CHALLENGES

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Abstract
As evidenced by a sluggish economic recovery, the corona problem is likely to keep us involved for at least two years. Despite not being comparable to the 14th-century Black Death or the 1918 flu pandemic, sometimes known as the "Spanish flu," the coronavirus (COVID-19) pandemic has emerged as a significant threat to mankind. Significant long-term negative effects on government spending and the flexibility of government operations will result from the lockdown measures, which will trigger a massive recession (economic collapse) far more potent than the global financial crisis. Therefore, the burden of caring for the future generation has grown significantly above the numerous difficulties and issues that exist throughout the world. The corona problem is a serious threat to humanity and is tearing apart our civilizations. Due of the lockdown during this epidemic, everyone is separated from their social surroundings. The social environment is severely damaged. Everybody is scared and feels alone. Social separation nearly destroyed our nation's togetherness. In India, a lot of rumours and false information have been going around. Numerous social difficulties have arisen as a result of this catastrophe. This shutdown exposes all of our nation's vulnerabilities. This nation has a reputation for being dangerous. Humanity is indeed in peril. Indians' greatest gift is humanity, but because of this pandemic, it will be destroyed by some destructive aspects like misinformation, hate speech, rumours, and fake news. Because of the global economic, political, psychological, emotional, religious, environmental, and social issues that the globe is currently facing as a result of the epidemic. The pandemic has brought about some positive developments regarding environmental issues, such as improved and clean air quality. Although the coronavirus epidemic has caused many difficulties, this study merely briefly describes about corona crisis and its challenges.
Keywords : Corona-crisis , COVID-19, Pandemic, Spanish Flu, Social challenge, humanity.

AN INNOVATIVE ANALYTICAL RESULT OF TWO-DIMENSIONAL HEAT EQUATION USING JOINT MECHANISM OF NATURAL TRANSFORM AND ADOMIAN DECOMPOSITION METHOD

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Abstract

This research article has put forward an innovative analytical result of 2D heat equation having a source term. The aforesaid non-homogenous PDE is solved through a new hybrid mechanism. whereas the technique supports the solution process, commencing with the parametric form of the 2D heat equation. Furthermore, this hybrid mechanism which consists of Natural transform (NT) and a series solution method of Adomian decomposition method (ADM). Next the solution which is obtained for the unknown function is presented in series form. During the computational process it was observed that the proposed mechanism is less time consuming, efficient with accurate result. Which shows that the mechanism (proposed mechanism) makes a very useful contribution for the analytical solution of 2D heat equation. The paper is properly supported with appropriate examples to verify the claim.

The fuzzy set theory is a prominent and important framework for addressing problems involving uncertainty and Fuzzy differential equations (*FDEs*) are based on this concept. Fuzzy differential equations are type of uncertain differential equations in which the vague values of parameters, coefficients, and/or boundary conditions (and/or initial conditions) are represented as fuzzy numbers. Following their introduction in the literature, *FDEs* have attracted researchers in mathematics and related areas to address uncertainty in real-world problems.

The term half (fractional) derivative appeared in the literature around 1695 without giving a proper definition of how to evaluate the half-order derivative of a function. Later, several approaches to define fractional derivates developed, among which Riemann-Liouville's, Grunwald-Letnikov's, Caputo's, and Atangana-Fabrizio's are well-known approaches. It has been observed that over the last few decades, the applications of calculus, particularly fractional calculus, have expanded into various fields, including biosciences, fluid mechanics, diffusion process, signal processing, electromagnetism and much more, as it involves the study and application of the derivatives and integrals of arbitrary order. Furthermore, initially, fractional calculus (*FC*) was considered as a mathematical curiosity, but in recent times, it has become a subject of extensive development for analyzing differential equations (*DEs*). In addition, developing numerical and analytical techniques for solving fractional differential equations (*FrDEs*) is crucial task, as the absence of these techniques makes it challenging to obtain exact solutions for under discussion *FrDEs*. Moreover, numerous applied problems have been formulated using *FrDEs*, and consequently, considerable attention has been devoted to solving these problems.

By Combining the concepts of fractional differential equations and fuzzy differential equations, a novel idea of fuzzy fractional differential equations (*FFDEs*) emerged. Thereafter, a series of articles appeared on *FFDEs*. However, relatively less attention has been given to the fuzzy analysis of partial deferential equations

Keywords: 2D Heat Equation; Natural Transform; Adomian Decomposition Method;

ASSESSMENT OF CLIMATE CHANGE SYNTHESIS AND HEALTH RESILIENCE AMONG WOMEN IN NORTH CENTRAL NIGERIA: A SYSTEMATIC REVIEW

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Abstract

Climate change poses significant threats to public health, disproportionately affecting women in low-resource regions. In North Central Nigeria, women remain highly vulnerable due to their dependence on subsistence farming, inadequate access to healthcare, and entrenched gender roles. This study systematically reviewed available literature on climate change and women's health resilience in North Central Nigeria. Databases including PubMed, Scopus, Google Scholar, and African Journals Online (AJOL) were searched for peer-reviewed studies between 2010 and 2025. Out of 413 articles retrieved, 29 met the inclusion criteria. Findings reveal that while awareness of climate change is moderate, health resilience practices remain poorly developed, with barriers such as poverty, weak health systems, and cultural restrictions limiting adaptation. This review highlights the urgent need for gender-responsive climate-health policies, improved access to climate information, and empowerment programs tailored to women.

Keywords: Climate change, Women, Health resilience, North Central Nigeria, Systematic review

RESİMLİ ÇOCUK KİTAPLARININ İÇERİK ve FİZİKİ ÖZELLİKLERİ ile ÇOCUKLARIN OKUMA DAVRANIŞI ÜZERİNDEKİ ETKİSİ

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ÖZET
Resimli çocuk kitapları, çocukların öğrenmeye en açık olduğu ve alışkanlıklar kazandığı okul öncesi dönemde gelişimlerini desteklemeye yardımcı olmaktadır. Resimli çocuk kitapları, henüz okuma becerisi edinmemiş okul öncesi dönem çocuklarının duygu ve düşüncelerinin gelişiminde, dil ve konuşma becerilerinin desteklenmesinde, içinde bulundukları dünyayı tanımalarında ve en önemlisi de okuma alışkanlığı kazanmalarında önemli bir yere sahiptir. Bu nedenle resimli çocuk kitapları çocukların gelişim düzeyine uygun nitelikleri taşımalıdır. Toplumun her kesimine hiçbir ayrım gözetmeksizin hizmetlerini ücretsiz bir şekilde sunan halk kütüphanelerinin dermesinde nitelikli çocuk kitaplarının yer alması oldukça önem taşımakta olup konu özellikle halk kütüphaneleri kapsamında ele alınmıştır. Bu çalışma, literatür araştırması sonucu elde edilen bilgiler ışığında resimli çocuk kitaplarının taşıması gereken içerik ve fiziki özellikleri ile çocukların gelişimi ve okuma davranışı üzerindeki etkisini teorik açıdan ortaya koymayı amaçlamaktadır. Araştırma kapsamında belge tarama tekniği kullanılarak konu teorik bir çerçevede ele alınmıştır. Her çocuk eşit imkânlara sahip değildir. Bu nedenle kitaplara ulaşmanın ücretsiz olduğu ve herkese eşit hizmet sunan kütüphanelerin yeri oldukça önemlidir. Dolayısıyla kütüphaneler ve belirli seçim kriterlerine göre seçilerek oluşturulmuş dermeler çocukların okuma davranışı ediniminde önemli bir yere sahiptir. Ayrıca resimli çocuk kitapları, çocukların kütüphane kullanma alışkanlığı kazanmaları ve bu alışkanlığı yaşam boyu sürdürmelerine de destek olmaktadır. Bu bağlamda çocukların gelişimi ve okuma alışkanlığı için son derece önemli bir unsur olan resimli çocuk kitapları, çocuğun gelişim alanlarını destekleyici içerikte olmalı, gerekli fiziki nitelikleri taşımalı ve hitap ettiği yaş grubuna uygun olmalıdır.
Anahtar Kelimeler: Çocuk kitapları, çocuk kütüphaneleri, okuma alışkanlığı

CONTENT AND PHYSICAL CHARACTERISTICS OF CHILDREN'S PICTURE BOOKS AND THEIR EFFECTS ON CHILDREN'S READING BEHAVIOR

ABSTRACT
Children’s picture books support the development of children during the preschool period, which is the stage when they are most open to learning and acquiring habits. Children’s picture books play an important role in the emotional and cognitive development of preschool children who have not yet acquired reading skills, support their language and speech development, help them to recognize the world around them, and, most importantly, contribute to the acquisition of reading habits. Therefore, children’s picture books should possess qualities appropriate to the developmental levels of children. It is particularly important that high-quality children’s books are included in the collections of public libraries, which provide services free of charge

to all segments of society without any discrimination. This study, based on the findings obtained through a literature review, aims to theoretically present the content and physical characteristics that children’s picture books should possess, as well as their effects on children’s development and reading behavior. Within the scope of the research, the document analysis method was employed to examine the subject within a theoretical framework. Not every child has equal opportunities. For this reason, libraries where books can be accessed free of charge and where equal services are provided to everyone hold great significance. Consequently, libraries and their collections, formed according to specific selection criteria, play an important role in the acquisition of children’s reading behavior. Moreover, children’s picture books also support children in developing library usage habits and in maintaining these habits throughout their lives. In this context, children’s picture books, which hold an important place in children’s development and the acquisition of reading habits, should contain content and physical qualities that support children’s developmental areas and be appropriate for the age group they address.
Keywords: Children's books, children's libraries, reading habits

ACUR BİTKİSİNDE NaCl STRESİNE MORFOLOJİK TEPKİLER

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ÖZET

Bu çalışma, acur bitkisinin *in vitro* koşullarda farklı yoğunluklardaki sodyum klorür (NaCl) uygulamalarına verdiği morfolojik tepkileri belirlemek amacıyla gerçekleştirilmiştir. Denemede Murashige ve Skoog (MS) bazal besin ortamına sırasıyla 0, 100, 200 ve 300 mM NaCl ilave edilerek ARTA, ARTB, ARTC ve ARTD adını taşıyan dört ayrı kültür ortamı oluşturulmuştur. Bu ortamlarda bitkilerin gelişimine ilişkin morfolojik özellikler değerlendirilmiş; gövde ve kökün yaş ve kuru ağırlıkları ile uzunlukları (g, mm) incelenmiştir. Artan tuz konsantrasyonlarının tüm morfolojik parametrelerde gerilemelere yol açtığı tespit edilmiştir. En yüksek gelişim performansı, NaCl içermeyen kontrol grubu (ARTA) bitkilerinde gözlenmiş olup, bu grupta gövde yaş ağırlığı 0.573 g, gövde uzunluğu 62.74 mm ve kök uzunluğu 82.72 mm olarak kaydedilmiştir. Bulgular, acur bitkisinin artan NaCl düzeylerine karşı *in vitro* ortamda oldukça hassas bir yapıya sahip olduğunu ve tuz stresinin morfolojik gelişim üzerinde baskılayıcı bir etki oluşturduğunu açıkça göstermektedir.

Anahtar Kelimeler: *In vitro,* Tuzluluk, NaCl

MORPHOLOGICAL RESPONSES OF ACUR PLANT TO NaCl STRESS

ABSTRACT

This study was conducted to determine the morphological responses of the acur plant to different concentrations of sodium chloride (NaCl) under in vitro conditions. In the experiment, Murashige and Skoog (MS) basal medium was supplemented with 0, 100, 200, and 300 mM NaCl, creating four distinct culture media designated as ARTA, ARTB, ARTC, and ARTD. Morphological characteristics related to plant growth were evaluated in these media, including the fresh and dry weights as well as the lengths (g, mm) of stem and roots. Increasing salt concentrations were found to cause reductions in all morphological parameters. The highest growth performance was observed in the control group (ARTA), which contained no NaCl. In this group, stem fresh weight was recorded as 0.573 g, stem length as 62.74 mm, and root length as 82.72 mm. The findings clearly indicate that the acur plant is highly sensitive to

elevated NaCl levels under in vitro conditions and that salt stress exerts a suppressive effect on morphological development.

Keywords: *In vitro,* Salinity, NaCl

GİRİŞ

Cucumis melo var. flexuosus, yıllık bir tırmanıcı bitki olup 1.5 m'ye kadar boylanabilmektedir. Geniş yaprak alanı, koyu yeşil yaprak rengi, koyu yeşil kabuklu uzun meyveleri, orta derecede asiditeye sahip yeşil eti ve beyazımsı tohumlarıyla karakterizedir. Tohumlarının bileşimi incelendiğinde %15.75 protein, %16.19 karbonhidrat ve %5.69 kül içeriğine sahip olduğu belirlenmiştir. Ayrıca %22.33 oranında yağ içeriği bulunması, bu türü potansiyel bir yağ kaynağı olarak ön plana çıkarmaktadır. Başlıca yağ asitleri arasında palmitik asit (%12,9), stearik asit (%6.0), oleik asit (%19.4) ve linoleik asit (%61.4) yer almaktadır. *C. melo var. flexuosus* yağındaki temel tokoferol, toplam tokoferollerin %96.5'ini oluşturan γ-tokoferol olup, bunu %2.3 oranında δ-tokoferol izlemektedir. Yılan kavunları, çoğunlukla Eski Dünya'nın tropik ve subtropik bölgelerinde yetiştirilen, monoik yapılı geleneksel kabakgillerden biridir. Henüz olgunlaşmamış meyveleri genellikle çiğ ya da turşu olarak tüketilir. Özellikle Akdeniz ülkelerinde, antik dönemlerden bu yana gevrek dokusu, ferahlatıcı özellikleri ve tatlı olmayan aroması nedeniyle değer görmüştür (Ilahy ve ark., 2022). Meyveleri serinletici, hafif temizleyici ve nemlendirici özellikleri nedeniyle cilt bakımında kullanılabilir; ayrıca yanık ve sıyrıklarda ilk yardım amaçlı uygulanmaktadır. Çiçekleri balgam söktürücü ve kusturucu özellik taşırken, meyvesi mide dostu olarak değerlendirilmektedir. Tohumları ise öksürük kesici, sindirimi kolaylaştırıcı, ateş düşürücü ve bağırsak parazitlerini giderici etkilere sahiptir (Mariod ve ark., 2017).

Tuz stresi, bitkinin tüm yaşam döngüsü boyunca etkili olan en önemli abiyotik stres faktörlerinden biridir. Tarımsal uygulamalardaki hatalar, artan insan faaliyetleri ve doğal süreçler nedeniyle toprakların tuzlanması, ürün verimini ciddi şekilde etkilemektedir. Dünya genelinde toplam kara alanının yaklaşık %10'u (950 milyon ha) ve toplam sulanan alanın %50'si (230 milyon ha) tuz stresine maruz kalmaktadır. Bunun sonucunda tarımsal üretimde meydana gelen azalmaya bağlı olarak yıllık yaklaşık 12 milyar ABD doları kayıp yaşandığı tahmin edilmektedir. Dünya nüfusundaki artışla birlikte, düşük kaliteli toprakların ve sulama sularının zorunlu kullanımı nedeniyle önümüzdeki yıllarda tuz stresinin şiddetinin daha da artacağı öngörülmektedir (Behera ve ark., 2022). Kuru ve yarı kurak bölgelerde tuzluluk, tarım için en ciddi tehlikelerden biri olarak kabul edilmekte ve bitki büyümesi ile gelişimini olumsuz yönde etkilemektedir. Bitki organlarında aşırı Na^+ birikimi, ozmotik stres ve besin dengesizliğine yol açarak bitki işlevlerini ciddi şekilde bozabilmektedir. Bununla birlikte, bu zararlı etkilerin boyutu; genotip, stres süresinin uzunluğu, bitkinin gelişim evresi ile tuzun türü ve konsantrasyonuna bağlı olarak değişmektedir. Tuz stresine karşı koyabilmek için bitkiler iki temel tolerans stratejisi geliştirmiştir: kökler aracılığıyla tuz alımını sınırlamak ya da dokular içindeki tuz konsantrasyonunu ve dağılımını düzenlemek. Na^+ birikim mekanizmalarının ve iyon taşınımında görev alan genlerin işlevlerinin kapsamlı bir şekilde anlaşılması, sebze türlerinde tuzluluk toleransının artırılması için umut verici fırsatlar sunmakta ve bu durum, kurak bölgelerde gıda güvenliğinin sağlanması açısından büyük önem taşımaktadır. Tuzluluğa karşı tolerans mekanizmalarında kaydedilen önemli ilerlemeler, ıslah programlarında kullanılarak tuz stresi altında daha yüksek verim performansı gösteren sebzelerin geliştirilmesine katkı sağlayabilir (Shams ve Khadivi, 2023).

Bitkiler sürekli olarak büyüme ve gelişimlerini olumsuz yönde etkileyen biyotik ve abiyotik stres faktörlerine maruz kalmaktadır. Ekonomik öneme sahip kültür bitkilerinde bu streslerin

neden olduğu verim kayıpları küresel ölçekte önemli ekonomik kayıplara yol açmaktadır. Stres toleransı için üstün ve elit genotiplerin geliştirilmesine yönelik ıslah çalışmaları uzun yıllardır uygulanmakta olup, bitki doku kültürü bu amaçla verimli ve maliyet açısından etkin bir yöntem olarak öne çıkmaktadır. Doku kültürü yalnızca stres toleransının geliştirilmesinde değil, aynı zamanda toleranslı genotiplerin belirlenmesinde ve stres koşullarında ortaya çıkan fizyolojik ve biyokimyasal değişimlerin aydınlatılmasında da önemli bir araçtır. Kontrollü çevre koşullarında ve kapalı sistemlerde gerçekleştirilen *in vitro* seleksiyon, oldukça etkili ve düşük maliyetli bir yaklaşım sunmaktadır.

Bu çalışmada, *in vitro* ortamda hazırlanmış ve farklı NaCl düzeyleri (0, 100, 200, 300 mM) içeren besin ortamlarının acur bitkisinin büyüme süreci üzerindeki etkilerinin incelenmesi amaçlanmıştır.

MATERYAL VE METOT

Çalışma, Çukurova Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü'ne bağlı, Prof. Dr. Saadet BÜYÜKALACA doku kültürü laboratuvarında gerçekleştirilmiştir. Bitkisel materyal olarak Acar çeşidine ait acur tohumları kullanılmıştır. Tuzluluk stresini oluşturmak amacıyla, MS (Murashige ve Skoog, 1962) temel besin ortamına farklı NaCl düzeyleri (0, 100, 200, 300 mM) eklenerek deneme ortamları hazırlanmıştır (Çizelge 1). Sterilizasyon aşamasında tohumlar, laminar akış kabini içerisinde %20'lik sodyum hipoklorit çözeltisinde yaklaşık 20 dakika bekletilerek yüzey sterilizasyonu yapılmıştır. Daha sonra, Çizelge 1'de içeriği verilen besin ortamları steril koşullarda petri kaplarına dökülmüş, katılaşmaları beklendikten sonra tohum ekimi gerçekleştirilmiştir. Ekilen petriler büyütme odasına aktarılmıştır. Kültürler, 25 ± 2 °C sıcaklık, 3000 lüx ışık şiddeti ve 16 saat aydınlık / 8 saat karanlık fotoperiyotta geliştirilmiştir.

Deneme süresince bitkilerde altı morfolojik parametre; gövde yaş ve kuru ağırlıkları (g), kök yaş ve kuru ağırlıkları (g) ile gövde ve kök uzunlukları (mm) değerlendirilmiştir. Elde edilen veriler, tesadüf parselleri deneme desenine göre düzenlenmiş ve JMP 8.1 istatistik paket programı kullanılarak analiz edilmiştir.

Çizelge 1. Denemede kullanılan ortamların isimlendirilmesi

Dozlar	NaCl (mM)
ARTA	0
ARTB	100
ARTC	200
ARTD	300

BULGULAR VE TARTIŞMA

Çizelge 2 incelendiğinde, NaCl'nin farklı düzeylerde uygulanmasının acur fidelerinin kök ve gövde gelişimi üzerine etkileri dört morfolojik parametre üzerinden ortaya konulmuştur: gövde yaş ağırlığı, gövde kuru ağırlığı, kök yaş ağırlığı ve kök kuru ağırlığı. Yapılan varyans analizine göre özellikle gövde yaş ağırlığında uygulamalar arasında istatistiksel olarak anlamlı değişiklikler gözlenmiştir. En yüksek gövde yaş ağırlığı kontrol uygulamasında (ARTA) kaydedilmiş olup 0.573 g değerine ulaşmıştır. Kontrol grubunu azalan sıralamayla ARTB (0.421 g), ARTC (0.381 g) ve en düşük değere sahip ARTD (0.158 g) uygulamaları takip etmiştir.

Mahmood ve ark. (2019), on beş farklı Brassica genotipinin (BARD-I, Sultan Raya, 19-H, Shiralle, Dunkled, 85-508, Toria, 85-499, BSA, 85-397, 85-500, 85-497, 85-5001, CON-I ve Jewel) tuz toleranslarının belirlenmesi amacıyla hidroponik bir deneme yürütmüştür. Araştırmada dört farklı NaCl düzeyi (0, 30, 60 ve 90 mM/L) uygulanmıştır. Bir haftalık, sağlıklı iki fide her genotipten alınarak 200 mL hacimli, yarım güçlü Hoagland çözeltisi içeren kaplarda yüzen strafor tabakasındaki deliklere aktarılmıştır. Artan NaCl seviyeleri, tüm *Brassica* genotiplerinde sürgün ve kök kuru ağırlıklarını anlamlı şekilde azaltmıştır. Sane ve ark. (2021), beş domates çeşidi artan NaCl seviyelerinde (0, 35, 70, 105 mM) *in vitro* koşullarda incelemiştir. Tuz stresi tüm çeşitlerde gövde ve kök yaş ağırlıklarını düşürmüştür. Lady Nema çeşidi en yüksek gövde (0.055 g) ve kök yaş ağırlığını (0.014 g) göstererek tuzluluk koşullarında en iyi performansı sergilemiştir. Buna karşılık Rodeo çeşidi en düşük gövde ve kök yaş ağırlığına sahip olup en hassas çeşit olarak saptanmıştır. Singh (2021), artan tuz konsantrasyonlarının (0 mM, 50 mM, 100 mM ve 150 mM) *Allium sativum* bitki büyümesi üzerindeki etkilerini incelemiştir. Araştırma kapsamında eksplantlar, *in vitro* koşullarda MS besi ortamında kültüre alınmış ve farklı tuz düzeylerinin bitkilerin gelişimi üzerindeki sonuçları değerlendirilmiştir. Elde edilen bulgular, tuz konsantrasyonlarındaki artışın bitki büyümesini olumsuz yönde etkilediğini ve yüksek tuzluluk koşullarında gelişim parametrelerinde belirgin azalmalar meydana geldiğini göstermiştir. Sürmen ve ark. (2023), *in vitro* mikroyayılım tekniği kullanılarak bazı patates çeşitlerinin tuz stresine tolerans reaksiyonlarının ortaya konulmasını amaçlanmıştır. Van Gogh ve Granola patates çeşitlerine ait tek boğumlu eksplantlar, 0.0, 250, 500, 750, 1000, 1500 ve 2000 mg L^{-1} NaCl ilave edilmiş MS ortamlarında kültüre almıştır. Eksplantlar 6 hafta boyunca uzun gün fotoperiyot koşullarında (16 saat aydınlık, 8 saat karanlık) geliştirmiştir. NaCl konsantrasyonları bitkiciklerin yaş ve kuru ağırlıklarını düşürmüş, özellikle kök ve gövde gelişiminde olumsuz etkiler göstermiştir. Atiyah ve ark. (2025), araştırmada yedi farklı sodyum klorür (NaCl) konsantrasyonu (10 mM, 30 mM, 50 mM, 70 mM, 100 mM ve 120 mM) ile birlikte bir kontrol uygulaması kullanılmıştır. Denemeler tesadüf parselleri deneme desenine göre yürütülmüş, 'Spunta' patates çeşidine ait tek boğumlu gövde çelikleri Murashige ve Skoog (MS) besi ortamına, belirtilen NaCl düzeyleri ilave edilerek kültüre alınmıştır.Bitki gelişimi; fide boyu, fide başına yaprak sayısı, fide başına kök sayısı ve sürgün yaş ağırlığı gibi morfolojik parametreler üzerinden değerlendirilmiştir. Elde edilen bulgular, uygulamalar arasında anlamlı farklılıkların bulunduğunu ortaya koymuştur. Genel olarak, artan tuzluluk seviyeleri incelenen büyüme özelliklerinin büyük çoğunluğunu olumsuz etkilemiş ve en düşük değerler yüksek NaCl konsantrasyonlarında kaydedilmiştir. Baktemur ve Kara (2025), dereotu bitkisinin *in vitro* koşullarda farklı sodyum klorür konsantrasyonlarına verdiği morfolojik tepkileri incelemiştir. Murashige ve Skoog (MS) ortamına 0, 100, 200 ve 300 mM NaCl eklenerek dört farklı kültür ortamı oluşturulmuş, gövde ve kök uzunluğu ile yaş ve kuru ağırlıklar değerlendirilmiştir. Artan NaCl düzeylerinin tüm gelişim parametrelerinde azalmalar meydana getirdiği belirlenmiştir. En yüksek büyüme değerleri NaCl içermeyen kontrol grubunda kaydedilmiştir. Kara ve ark. (2025), farklı sodyum klorür konsantrasyonlarının (0, 50, 100, 150, 200 ve 250 mM) biber bitkisinin *in vitro* gelişimi üzerine etkilerini araştırmıştır. Murashige ve Skoog (MS) ortamında yürütülen denemelerde çimlenme oranı (CO), ortalama çimlenme süresi (OCS), tuz tolerans indeksi (TTI), gerçek su içeriği (RWC), sürgün ve köklerin yaş/kuru ağırlıkları, boy uzunlukları ve görsel zarar skorları değerlendirilmiştir. Bulgular, artan NaCl düzeylerinin biber gelişimini olumsuz etkilediğini ortaya koymuştur.

Çizelge 2. Acur bitkisinde gövde ve köklerin yaş ve kuru ağırlıklarına (g) farklı NaCl düzeylerinin etkisi

Dozlar	Gövde yaş ağırlığı (g)	Gövde kuru ağırlığı (g)	Kök yaş ağırlığı (g)	Kök kuru ağırlığı (g)
ARTA	0.573*A*	0.0474	0.577	0.0296
ARTB	0.421*AB*	0.0382	0.506	0.0247
ARTC	0.381*B*	0.0376	0.441	0.0231
ARTD	0.158*C*	0.0272	0.321	0.0228
LSD	**0.186*** **	**Ö.D.**	**Ö.D.**	**Ö.D.**

Acur fidelerinde farklı NaCl dozlarının uygulandığı denemelerde hem gövde hem de kök uzunluklarının istatistiksel olarak anlamlı şekilde etkilendiği görülmüştür (Çizelge 3). Gövde uzunluğu bakımından kontrol grubunda (ARTA) en yüksek değer 62.74 mm olarak kaydedilmiş, NaCl dozunun artmasıyla birlikte değerler düşmüş ve en düşük ölçüm ARTD uygulamasında 43.63 mm'ye kadar gerilemiştir. Kök uzunluğu sonuçları da benzer bir eğilim göstermiştir. Kontrol grubunda ortalama 82.72 mm ile en yüksek değer belirlenirken, artan tuz konsantrasyonları kök gelişimini baskılamış ve en düşük ortalama ARTD uygulamasında 12.99 mm olarak saptanmıştır.

Ziaf ve ark. (2009), acı biberde tuza toleransın güvenilir göstergeleri olarak kullanılabilirliğini değerlendirmek amacıyla tuz stresinin bağıl su içeriği, zar geçirgenliği, klorofil miktarı ve karotenoid düzeyi üzerine etkilerini incelemiştir. Sonuçlara göre kök ve sürgün uzunluğu, kuru madde miktarı, relatif büyüme oranı, yaprak alanı, spesifik yaprak alanı ve yaprak alan oranı yüksek tuzluluk seviyelerinde (6 ve 8 dS m^{-1}) önemli ölçüde azaldığı belirlenmiştir. Kurum ve ark. (2013), yaptıkları çalışmada dünya genelinde anaç olarak yaygın şekilde kullanılan Obez, RS 841 ve Ferro F1 kabak çeşitlerinin fide gelişimi üzerine farklı tuzluluk seviyelerindeki (0 "kontrol", 2, 4, 8 ve 12 dS m^{-1}) etkilerini araştırmıştır. Tuzlu koşullarda yetiştirilen fidelerde; ana gövde uzunluğu, bitki boyu, kök uzunluğu, sürgün uzunluğu, kök yaş ağırlığı, kök kuru ağırlığı, sürgün yaş ağırlığı, sürgün kuru ağırlıkları ile yapraklardaki iyon konsantrasyonları (Ca^{++}, K^{+}, Na^{+}) incelenmiştir. Elde edilen sonuçlar, çözeltinin elektriksel iletkenliği arttıkça kök uzunluğu, sürgün uzunluğu, kök yaş ağırlığı, kök kuru ağırlığı, sürgün yaş ağırlığı ve sürgün kuru ağırlıklarının azalma eğilimi gösterdiğini ortaya koymuştur. Al Khateeb ve ark. (2019), yaptıkları çalışmada tuz stresinin kültür bitkisi domates (*S. lycopersicum*) ile onun yabani akrabası olan *Solanum nigrum*'un çimlenme, büyüme ve biyokimyasal parametreleri üzerindeki etkisini araştırmıştır. Bulgular, MS besi ortamında NaCl varlığının hem *S. nigrum* hem de *S. lycopersicum* için incelenen çimlenme ve büyüme özelliklerinin (bitki yaş ağırlığı, sürgün uzunluğu, yaprak ve kök sayısı) büyük kısmını anlamlı şekilde azalttığını göstermiştir. Vishnu Priya ve ark. (2020), yaptıkları çalışmada, tuzlu suyla yapılan sulamanın oksidatif enzimler ile birlikte turp fidelerinin büyüme, enzimatik aktiviteleri ve fotosentetik performansı üzerindeki etkileri belirlenmiştir. Deneme kontrollü tarla koşullarında gerçekleştirilmiş ve farklı konsantrasyonlarda tuzlu su kullanılarak gerçekleştirilmiştir. İncelenen parametreler arasında çimlenme özellikleri, sürgün uzunluğu, kök uzunluğu, yan kök sayısı, yaş ve kuru ağırlık, klorofil a ve b ile karotenoid içerikleri yer almıştır. Deneme sonuçları, turp fidelerinde tuzluluğun büyüme parametrelerini önemli ölçüde etkilediğini ve oksidatif hasara bağlı enzimatik yanıtların da gözlemlendiğini ortaya koymuştur. Alam ve ark. (2023), farklı tuz konsantrasyonları altında soğan genotipleri incelenmiş; tuza toleranslı genotiplerin belirlenmesi ve farklı büyüme evrelerinde yüksek tuzluluk seviyelerine karşı bitkilerin

tepkilerinin ortaya konulması hedeflenmiştir. İki yıl süren çalışmanın ilk yılında çimlenme potansiyeli petri kaplarında değerlendirilmiş; ikinci yılda ise plastik saksı kültürlerinde fide gelişimi, bitki kurulumu ve soğan oluşumu incelenmiştir. Her iki sezonda da 0, 8, 10 ve 12 dS m^{-1} düzeylerinde tuzlu su çözeltileri sulama kaynağı olarak kullanılmıştır. Elde edilen bulgular, yüksek tuz seviyelerinde bitki performansında belirgin düşüşler olduğunu göstermiştir. Tuz konsantrasyonları çimlenme, yaprak gelişimi, bitki boyu, soğan büyüklüğü ve şekli ile soğan ağırlığı üzerinde olumsuz etki yapmıştır. Soğanın tüm büyüme evrelerinin artan tuz konsantrasyonlarına duyarlı olduğu belirlenmiştir. Kara ve Baktemur (2025), karnabahar bitkisinin in vitro koşullarda farklı NaCl düzeylerine verdiği morfolojik tepkileri incelemiştir. Çalışmada Murashige ve Skoog (MS) temel besi ortamına 0, 100, 200 ve 300 mM NaCl eklenerek dört farklı kültür ortamı (KRA, KRB, KRC ve KRD) hazırlanmış ve bu ortamlarda bitki gelişimine ilişkin parametreler değerlendirilmiştir. Denemelerde gövde uzunluğu ve kök uzunluğu (mm) ile gövde ve kökün yaş/kuru ağırlıkları (g) ölçülmüştür. Artan NaCl konsantrasyonları tüm morfolojik ölçütlerde istatistiksel açıdan anlamlı gerilemelere yol açmıştır. En yüksek gelişim değerleri NaCl içermeyen kontrol grubu olan KRA ortamında kaydedilmiştir. Bu grupta gövde uzunluğu 62.58 mm, kök uzunluğu 43.71 mm saptanmıştır.

Çizelge 3. Acur bitkisinde gövde ve kök uzunluklarının (mm) farklı NaCl düzeylerine etkisi

Dozlar	Gövde uzunluğu (mm)	Kök uzunluğu (mm)
ARTA	62.74*A*	82.72*A*
ARTB	56.88*A*	35.85*B*
ARTC	56.11*A*	27.19*BC*
ARTD	43.63*B*	12.99*C*
LSD	**12.22***	**16.16***

SONUÇ

Bu çalışmada, farklı NaCl düzeylerinin acur fidelerinin gelişimine etkileri araştırılmış ve sonuçlar, tuz stresinin bitki büyümesini ciddi biçimde kısıtladığını ortaya koymuştur. Özellikle gövde yaş ağırlığı bakımından uygulamalar arasında anlamlı farklılıklar saptanmış; en yüksek değer kontrol grubunda (0.573 g) belirlenirken, en düşük değer 0.158 g ile ARTD uygulamasında kaydedilmiştir. Gövde ve kök uzunluklarının da tuzluluk düzeyleri arttıkça kademeli bir şekilde azaldığı tespit edilmiştir. Kontrol grubunda gövde uzunluğu 62.74 mm ve kök uzunluğu 82.72 mm olarak ölçülmüş; en düşük değerler ise ARTD ortamında sırasıyla 43.63 mm ve 12.99 mm olmuştur. Bu bulgular, acur bitkisinin *in vitro* koşullarda tuz stresine karşı yüksek duyarlılık gösterdiğini, artan tuz konsantrasyonlarının hem ağırlık hem de kök ve gövde uzaması üzerinde olumsuz etkilere yol açtığını ortaya koymaktadır.

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IN VİTRO KOŞULLARDA *Rumex acetosa* L. BİTKİSİNİN TUZ STRESİNE MORFOLOJİK YANITLARI

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ÖZET

Araştırmada, kuzukulağı (*Rumex acetosa* L.) bitkisinin *in vitro* koşullarda tuz (NaCl) stresine verdiği morfolojik tepkiler incelenmiştir. Denemeler, Murashige ve Skoog (MS) bazal besi ortamına 0, 100, 200 ve 300 mM NaCl eklenerek hazırlanan dört farklı kültür ortamında (KKTA, KKTB, KKTC, KKTD) yürütülmüştür. Bitkilerin gelişim durumunu belirlemek amacıyla gövde ve köklerin yaş ve kuru ağırlıkları ile uzunlukları ölçülmüştür. Elde edilen bulgular, NaCl konsantrasyonundaki artışın bitki gelişimini olumsuz yönde etkilediğini açıkça ortaya koymuştur. Özellikle yüksek tuz seviyelerinde kök ve gövde uzunluklarında, ayrıca yaş ve kuru ağırlıklarda anlamlı azalmalar kaydedilmiştir. En yüksek gelişim değerleri tuz uygulanmayan kontrol grubuna karşılık gelen KKTA ortamında tespit edilmiştir. Bu ortamda gövde yaş ağırlığı 0.075 g, kök kuru ağırlığı 0.0037 g, gövde uzunluğu 50.90 mm ve kök uzunluğu 94.87 mm olarak ölçülmüştür. Sonuçlar, kuzukulağı bitkisinin *in vitro* koşullarda tuz stresine karşı duyarlılık gösterdiğini ve NaCl konsantrasyonundaki artışın morfolojik gelişim üzerinde baskılayıcı bir etki oluşturduğunu ortaya koymaktadır.

Anahtar Kelimeler: *Rumex acetosa* L., Tuzluluk, *In vitro,*

MORPHOLOGICAL RESPONSES OF THE PLANT *Rumex acetosa* L. TO SALT STRESS UNDER *IN VITRO* CONDITIONS

ABSTRACT

In this study, the morphological responses of sorrel (*Rumex acetosa* L.) to salt (NaCl) stress under *in vitro* conditions were investigated. The experiments were conducted in four different culture media (KKTA, KKTB, KKTC, KKTD), which were prepared by supplementing the Murashige and Skoog (MS) basal medium with 0, 100, 200, and 300 mM NaCl. To evaluate plant growth, fresh and dry weights as well as the lengths of stem and roots were measured. The findings clearly demonstrated that increasing NaCl concentrations had adverse effects on plant development. Significant reductions were observed particularly in stem and root lengths as well as in fresh and dry weights at higher salt levels. The highest growth performance was recorded in the control group (KKTA), where no salt was applied. In this medium, stem fresh

weight was 0.075 g, root dry weight was 0.0037 g, stem length was 50.90 mm, and root length was 94.87 mm. Overall, the results revealed that sorrel is sensitive to salt stress under in vitro conditions, and increasing NaCl concentrations exert a suppressive effect on morphological development.

Keywords: *Rumex acetosa* L., Salinity, *In vitro,*

GİRİŞ

Rumex, Polygonaceae familyasına ait, çoğunluğu tek yıllık, iki yıllık veya çok yıllık otsu bitkilerden, nadiren çalı formunda olan yaklaşık 200 türden oluşan bir cinstir. Türler, esas olarak kuzey yarımkürede olmak üzere Avrupa, Asya, Afrika ve Kuzey Amerika'da yayılış göstermektedir (Flora Europaea, 1993; Mabberley, 2008; Korpelainen ve Pietiläinen, 2020). Bunlardan bazıları tarımsal açıdan zararlı yabancı otlar olarak kabul edilirken, bazıları ise yenilebilir yaprakları veya tıbbi özellikleri nedeniyle kullanılmaktadır (Korpelainen ve Pietiläinen, 2020). Kuzukulağı (*Rumex acetosa* L.), çok yıllık ve iki evcikli bir otsu bitki olup farklı habitatlarda yetişebilmektedir. Kuzukulağı binlerce yıldır yabani olarak toplanarak, yüzyıllardır ise kültüre alınarak kullanılmaktadır. Öncelikli olarak kökleri, fakat aynı zamanda diğer dokuları da, antik dönemlerden bu yana halk hekimliğinde tedavi amaçlı kullanılmıştır. Son yıllarda yapılan araştırmalarda Rumex türlerinin farklı fitokimyasal ve farmakolojik aktiviteleri incelenmiş ve çok sayıda biyoaktif bileşik tespit edilmiştir. Bunun yanında kuzukulağı lezzetli bir bitki olup, yaprakları makro ve mikro besin elementleri açısından iyi bir kaynaktır. Ancak, yüksek düzeyde oksalik asit içermesi, özellikle çiğ tüketim sırasında, kalsiyum başta olmak üzere bazı minerallerin biyoyararlanımını azaltmaktadır. Kuzukulağının içerdiği farklı bileşiklerin gerçek etkilerini ortaya koymak için ileri düzeyde araştırmalara ihtiyaç vardır. Bitkinin kolayca çoğaltılabilmesi ve ciddi zararlı ya da hastalık problemlerinin bulunmaması önemli bir avantajdır. Günümüzde, yabani tipler ve birkaç kültivar dahil olmak üzere sınırlı sayıda *R. acetosa* tohumu ticari olarak temin edilebilmektedir (Korpelainen ve Pietiläinen, 2020).

Küresel ısınmanın etkileri giderek artan biçimde ısı, tuzluluk ve kuraklık gibi yıkıcı çevresel streslere yol açmaktadır. Toprak tuzluluğu, dünya genelinde kara alanlarının yaklaşık %7'sini ve sulanan tarım arazilerinin %33'ünü etkileyen ciddi bir abiyotik stres faktörüdür. Antropojenik faaliyetlerin tetiklediği iklim değişikliği ile birlikte, tarıma elverişli alanlarda tuzluluk sorununun daha da artması beklenmekte olup bu durum, hızla büyüyen dünya nüfusu için küresel gıda güvenliğini tehdit etmektedir. Bitkiler, hareketsiz organizmalar olmaları nedeniyle, tuzluluk stresine karşı ani tepkiler geliştirebilmelerini sağlayan evrimsel mekanizmalar kazanmıştır. Bu koordineli mekanizmalar; bitki hormonlarını, kinazları, reaktif oksijen türlerini (ROS) ve kalsiyum düzenleyici ağlarını içeren sinyal iletim süreçlerini kapsamaktadır. Sistem biyolojisi yaklaşımının temel taşlarından biri olan metabolomik, bitkilerin tuzluluk stresine verdiği yanıtların biyokimyasal yönlerini kapsamlı bir şekilde incelemeye ve ilgili moleküler mekanizmaların çözümlenmesine olanak sağlamaktadır (Chele ve ark., 2021). Sulama suyunda yüksek tuz içeriği, hatalı tarımsal uygulamalar yanlış gübreleme), iklim değişikliği gibi etkenler, dünya genelinde tarıma elverişli topraklarda tuzluluğun giderek artmasına neden olmaktadır. Toprak tuzluluğu, iyonik dengesizlik, ozmotik stres, oksidatif stres ve besin alımının azalması yoluyla bitki gelişimini engelleyen başlıca abiyotik faktörlerden biridir (Atta ve ark., 2023).

Bitkiler sürekli olarak büyüme ve gelişimlerini etkileyen biyotik veya abiyotik stres faktörleriyle karşı karşıya kalmaktadır. Ekonomik açıdan önemli tarım türlerinde biyotik ve abiyotik streslerin neden olduğu verim kayıpları, küresel ölçekte büyük ekonomik kayıplara

yol açmaktadır. Stres toleransı için ıslah, üstün ve seçkin genotiplerin geliştirilmesi amacıyla onlarca yıldır uygulanan yaygın bir yöntemdir. Bu bağlamda, bitki doku kültürü, etkili ve maliyet açısından uygun bir yaklaşım olarak öne çıkmaktadır. Doku kültürü, stres toleransının geliştirilmesi, stres toleransının taranması ve stres sırasında ortaya çıkan fizyolojik ve biyokimyasal değişikliklerin aydınlatılması için değerli bir araçtır. Kontrollü çevre koşulları altında ve sınırlı alanlarda gerçekleştirilen *in vitro* seleksiyon çalışmaları, yüksek etkinlik sağlamasının yanı sıra daha düşük bakım maliyetleriyle de dikkat çekmektedir (Wijerathna-Yapa ve Hiti-Bandaralage, 2023).

Çalışmada, *in vitro* şartlarda hazırlanmış ve farklı NaCl konsantrasyonları (0, 100, 200, 300 mM) ile desteklenmiş besin ortamlarının kuzukulağı bitkisinin gelişimine olan etkileri değerlendirilmiştir.

MATERYAL VE METOT

Araştırma, Çukurova Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü, Prof. Dr. Saadet BÜYÜKALACA'ya ait doku kültürü laboratuvarında yürütülmüştür. Denemede materyal olarak Merve çeşidine ait kuzukulağı tohumları kullanılmıştır. Tuzluluk stresinin oluşturulabilmesi için MS (Murashige ve Skoog, 1962) temel besin ortamına farklı seviyelerde NaCl (0, 100, 200 ve 300 mM) ilave edilerek deneme ortamları hazırlanmıştır (Çizelge 1).

Sterilizasyon aşamasında, kuzukulağı tohumları laminar flow kabin içerisinde %20'lik sodyum hipoklorit çözeltisinde yaklaşık 20 dakika bekletilerek yüzey sterilizasyonu sağlanmıştır. Hazırlanan ve içerikleri Çizelge 1'de belirtilen besin ortamları steril kabin altında petri kaplarına aktarılmış, soğuyarak katılaşmaları beklenmiştir. Katılaşma sonrası tohum ekimi gerçekleştirilmiş ve petriler büyütme odasına alınmıştır. Kültürler, 25 ± 2 °C sıcaklıkta, 3000 lüx ışık şiddeti altında 16 saat aydınlık / 8 saat karanlık fotoperiyotta geliştirilmiştir.

Deneme boyunca bitkilerde toplam altı morfolojik özellik incelenmiştir. Bu özellikler; gövde yaş ve kuru ağırlıkları (g), kök yaş ve kuru ağırlıkları (g), gövde uzunluğu (mm) ve kök uzunluğu (mm) olarak belirlenmiştir. Elde edilen ölçümler, tesadüf parselleri deneme desenine uygun olarak değerlendirilmiş ve veriler JMP 8.1 istatistik paket programı aracılığıyla analiz edilmiştir.

Çizelge 1. Denemede kullanılan ortamların isimlendirilmesi

Dozlar	NaCl (mM)
KKTA	0
KKTB	100
KKTC	200
KKTD	300

BULGULAR VE TARTIŞMA

Çizelge 2'de yer alan sonuçlara göre, farklı NaCl dozlarının kuzukulağı fidelerinin gövde ve kök gelişimi üzerine etkileri dört temel parametre üzerinden değerlendirilmiştir: Gövde yaş ağırlığı, gövde kuru ağırlığı, kök yaş ağırlığı ve kök kuru ağırlığı. Yapılan istatistiksel analizler sonucunda, gövde yaş ağırlığı ile kök kuru ağırlığı bakımından uygulamalar arasında anlamlı farklılıklar olduğu belirlenmiştir. Buna karşılık, gövde kuru ağırlığı ve kök yaş ağırlığı yönünden gruplar arasında istatistiksel olarak önemli bir fark gözlenmemiştir. En yüksek gövde

yaş ağırlığı, 0.075 g değeriyle kontrol (KKTA) uygulamasında elde edilmiştir. En düşük değerler ise KKTC (0.046 g) ve KKTD (0.045 g) ortamlarında kaydedilmiştir. Kök kuru ağırlığı incelendiğinde yine en yüksek ortalama 0.0037 g ile kontrol grubunda tespit edilmiştir. Buna karşın en düşük kök kuru ağırlığı, KKTC (0.0017 g) ve KKTD (0.0013 g) uygulamalarında belirlenmiştir.

Sarker ve ark. (2014), yaptıkları çalışmada turp (*Raphanus sativus L.*), lahana (*Brassica oleracea capitata L.*), hardal (*Brassica juncea*) ve su ıspanağı (*Ipomoea aquatica*) gibi dört bitkide tuzluluk stresini incelemiştir. Denemede tuz stresi oluşturmak için beş farklı düzeyde sodyum klorür (NaCl) uygulanmıştır: 0 (kontrol), 2, 4, 8 ve 16 dS m. Çalışmada çimlenme yüzdesi, çimlenme hızı, çimlenme yüzdesindeki azalma, tohum canlılık indeksi, fide ve kök uzunluğu ile fide ve kök yaş ağırlıkları ölçülmüştür. İstatistiksel analizler, tuz seviyelerinin incelenen tüm parametreler üzerinde önemli etkiye sahip olduğunu ortaya koymuştur. Ortalama karşılaştırmaları, 8 ve 16 dS m tuzluluk uygulamalarının kontrol grubu (0 dS m) ile karşılaştırıldığında çimlenme yüzdesi, çimlenme hızı, tohum canlılık indeksi, fide ve kök uzunluğu ile fide ve kök yaş ağırlıklarında belirgin azalmaya neden olduğunu göstermiştir. Mahawar ve ark. (2018), tuz stresi koşullarında yetiştirilen roka bitkilerinde yaş ağırlıkların 0.613 ± 0.0186 g ile 0.167 ± 0.0176 g arasında, kuru ağırlıkların ise 0.2 ± 0.0115 g ile 0.0833 ± 0.0033 g arasında değiştiğini bildirmiştir. Raoufi ve ark. (2021), beş *Pistacia vera* L. genotipi (Akbari, Ahmad-Aghaee, Italyayi, Badami ve Ghazvini) arasında *in vitro* koşullar altında tuza en dayanıklı genotipi belirlemek amacıyla yürütmüştür. Tuz toleransı seçiminin ilk aşamasında, her bir *P. vera* genotipine ait 40 sürgün, 120 mM NaCl içeren Murashige-Skoog (MS) besi ortamında test edilerek en yüksek tuz toleransına sahip genotipler belirlenmiştir. İkinci aşamada ise, önceki taramadan seçilen yedi *P. vera* tek sürgünü ile UCB-1'in, üç farklı NaCl konsantrasyonuna (0, 60 ve 120 mM) verdiği yanıtlar in vitro koşullarda değerlendirilmiştir. Artan tuzluluk seviyeleri, fıstık genotiplerinde gövde uzaması, yaprak sayısı, taze ağırlık, nişasta, klorofil indeksi ve K^+ içeriğini önemli ölçüde azaltmıştır. Grozeva ve ark. (2023), 22 farklı bahçe bezelyesi (*Pisum sativum* L.) genotipinin in vitro koşullarda tuzluluğa tolerans düzeylerini incelemiştir. Denemede dört farklı NaCl dozu (0, 50, 100 ve 200 mM) uygulanmış; çimlenme oranı, fide çıkışı, gövde ve kök uzunluğu ile bitki taze ağırlığı değerlendirilmiştir. Bulgulara göre, genotiplerin çoğu 50 mM NaCl seviyesinde tolere edebilmiş, ancak tuz konsantrasyonunun 100 ve 200 mM'ye yükselmesi çimlenmeyi önemli ölçüde azaltmış ve kök–gövde gelişimi ile biyokütleyi düşürmüştür Kara ve Baktemur (2024), *in vitro* koşullarda farklı NaCl dozlarının roka bitkisinin gelişimine etkilerini incelemiş gövde yaş ve kuru ağırlıkları, tuz içermeyen kontrol grubunda en yüksek değerlere ulaşmış (0.20 g ve 0.016 g), ancak 300 mM NaCl uygulamasında azalarak 0.020 g ve 0.002 g seviyelerine gerilemiştir. Benzer bir eğilim kök kuru ağırlıkları için de geçerli olmuştur. Kontrol ortamında 0.017 g olarak ölçülen değer, artan tuz konsantrasyonlarıyla birlikte sürekli düşüş göstermiş ve 300 mM NaCl uygulamasında 0.007 g'a kadar inmiştir.

Kara ve ark. (2025), *in vitro* koşullarda farklı NaCl dozlarının (0, 100, 200, 300 mM) maydanoz bitkisinin gelişimine etkilerini incelemiştir. Denemede gövde ve kök uzunluğu ile gövde ve kök yaş/kuru ağırlıkları belirlenmiştir. Bulgulara göre, tuz konsantrasyonu arttıkça tüm gelişim parametrelerinde belirgin azalmalar kaydedilmiştir. En yüksek değerler kontrol (MYA) grubunda, en düşük değerler ise en yüksek tuz seviyesinin uygulandığı MYD ortamında elde edilmiştir.

Çizelge 2. Değişen NaCl konsantrasyonlarının kuzukulağı bitkisindeki gövde ve kök yaş/kuru ağırlıkları (g)

Dozlar	Gövde yaş ağırlığı (g)	Gövde kuru ağırlığı (g)	Kök yaş ağırlığı (g)	Kök kuru ağırlığı (g)
KKTA	0.075a	0.0052	0.025	0.0037a
KKTB	0.061ab	0.0041	0.021	0.0027ab
KKTC	0.046b	0.0038	0.021	0.0017b
KKTD	0.045b	0.0025	0.019	0.0013b
LSD	**0.017****	**Ö.D.**	**Ö.D.**	**0.0014***

Farklı NaCl dozlarının kuzukulağı fidelerinin gövde ve kök uzunlukları üzerinde istatistiksel açıdan anlamlı etkiler oluşturduğu belirlenmiştir (Çizelge 3). Gövde uzunluğu bakımından en yüksek değer 50.90 mm ile kontrol (KKTA) uygulamasında elde edilmiş, en düşük değerler ise KKTC (37.41 mm) ve KKTD (34.49 mm) uygulamalarında kaydedilmiştir. Kök uzunluğu incelendiğinde de benzer bir eğilim gözlenmiş; en yüksek ortalama 94.87 mm ile kontrol grubunda tespit edilmiştir. Bu değeri sırasıyla KKTB (68.21 mm), KKTC (59.48 mm) ve KKTD (57.12 mm) uygulamaları izlemiştir. Elde edilen bulgular, artan NaCl konsantrasyonlarının kuzukulağı fidelerinin hem gövde hem de kök uzunluklarını belirgin şekilde olumsuz etkilediğini ortaya koymaktadır.

Hussain ve ark. (2023), *Brassica rapa* var. purple top white globe bitkisinde selenyum (Se) tohum uygulamalarının (50, 75 ve 100 µmol L^{-1} Na_2SeO_4) 200 mM NaCl kaynaklı tuzluluk stresi üzerindeki etkileri araştırılmıştır. Tuz stresi, bitkilerde gövde ve kök uzunluklarını önemli ölçüde azaltmış, buna bağlı olarak biyokütle üretimi ve fotosentetik kapasiteyi de düşürmüştür. Jameel ve ark. (2024), dört domates çeşidinin (Rio Grande, Nadir, Bonita ve 19299) NaCl uygulamalarına (0, 100, 200 ve 300 mM) verdiği yanıtlar incelemiştir. Sonuçlar, artan tuzluluk seviyelerinin tüm çeşitlerde kök ve gövde uzunluklarını anlamlı şekilde azalttığını göstermiştir. Sootahar ve ark. (2024), yaptıkları çalışmada 14 farklı domates (*Solanum lycopersicum* L.) çeşidinin *in vitro* koşullarda tuz stresine (1.5 g L^{-1} NaCl) verdiği tepkileri belirlemek amacıyla gerçekleştirilmiştir. Elde edilen bulgular, tuzluluğun bitki gelişimini özellikle gövde ve kök uzunlukları üzerinde önemli ölçüde etkilediğini ortaya koymuştur. Çeşitler arasında gövde uzunluğu sekiz domates genotipinde belirgin şekilde azalmış, buna karşın en yüksek gövde uzunluğu (12.5 cm) *Saint* çeşidinde ölçülmüştür. Kök uzunluğu bakımından çeşitler arasında farklı tepkiler gözlenmiştir. Özellikle Taiwan Red Saint, Purple Beauty, Yellow Milk, Red Pearl, Yellow Pearl, Pink Cooperative 906, Qinzu Shanghai 903 ve Scarlet çeşitlerinde kök uzunluğu kontrol grubuna kıyasla anlamlı düzeyde artış göstermiştir. Buna karşılık, diğer beş çeşit tuz stresi altında kök uzunluğu açısından olumsuz etkilenmiştir. Fatahiyan ve ark. (2025), yaptıkları çalışmada, *Carthamus tinctorius* L. (aspir) bitkisinde farklı Na_2SeO_4 (0, 0.01 ve 0.02 g kg^{-1}) ve NaCl (0, 0.5, 1.5 ve 2.5 g kg^{-1}) dozlarının tuzluluk stresi üzerindeki etkilerini araştırmıştır. NaCl uygulamaları, çimlenme parametrelerinde azalmaya, gövde ve kök gelişiminin zayıflamasına yol açarken; Na^+ birikimini, çözünür karbonhidratları, H_2O_2 ve malondialdehit (MDA) düzeylerini artırmıştır.

Çizelge 3. Değişen NaCl konsantrasyonlarının kuzukulağı bitkisindeki gövde ve kök uzunlukları (mm)

Dozlar	Gövde uzunluğu (mm)	Kök uzunluğu (mm)
KKTA	50.90a	94.87a
KKTB	43.57b	68.21b
KKTC	37.41c	59.48b
KKTD	34.49c	57.12b
LSD	**3.33*****	**12.05*****

SONUÇ

Bu araştırmada farklı NaCl dozlarının kuzukulağı fidelerinin gelişimi üzerindeki etkileri incelenmiş ve elde edilen bulgular tuz stresinin bitki büyümesini önemli ölçüde sınırlandırdığını göstermiştir. İncelenen parametrelerden gövde yaş ağırlığı ve kök kuru ağırlığı bakımından uygulamalar arasında anlamlı farklılıklar bulunmuş, en yüksek değerler kontrol (KKTA) grubunda, en düşük değerler ise yüksek NaCl dozları (KKTC ve KKTD) altında kaydedilmiştir. Buna karşılık, gövde kuru ağırlığı ve kök yaş ağırlığı yönünden gruplar arasında istatistiksel olarak önemli bir fark ortaya çıkmamıştır. Özellikle gövde yaş ağırlığı kontrol uygulamasında 0.075 g ile en yüksek seviyeye ulaşırken, en düşük değerler KKTC (0.046 g) ve KKTD (0.045 g) uygulamalarında belirlenmiştir. Benzer şekilde kök kuru ağırlığı kontrol grubunda 0.0037 g olarak ölçülmüş, yüksek tuz konsantrasyonlarında ise 0.0017–0.0013 g düzeylerine kadar gerilemiştir. Gövde uzunluğu kontrol grubunda 50.90 mm ile en yüksek değere ulaşırken, artan NaCl konsantrasyonları ile birlikte önemli ölçüde azalmış ve en düşük değerler KKTC (37.41 mm) ile KKTD (34.49 mm) uygulamalarında saptanmıştır. Kök uzunluğu incelendiğinde de benzer bir eğilim gözlenmiş; kontrol grubunda 94.87 mm olan değer, artan NaCl dozlarıyla birlikte kademeli olarak düşmüş ve KKTD uygulamasında 57.12 mm'ye kadar gerilemiştir. Tüm sonuçlar birlikte değerlendirildiğinde, NaCl konsantrasyonlarının artmasıyla kuzukulağı fidelerinin gövde ve kök gelişiminde belirgin gerilemelerin yaşandığı ortaya konulmuştur.. Bu durum, kuzukulağı bitkisinin yüksek tuz konsantrasyonlarına duyarlı olduğunu, dolayısıyla tuzlu koşullarda yetiştiriciliğin sınırlı başarı gösterebileceğini ortaya koymaktadır.

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KAYNAK SÜRESİNİN ZIRH ÇELİKLERİNE BALİSTİK ETKİSİ

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ÖZET

Zırhlı muharebe araçları, savunma sanayii içinde kritik bir konuma sahiptir ve bu alandaki gelişmeler her geçen gün artarak devam etmektedir. Bu araçların üretiminde ise, şekillendirilebilirliği, kolay temin edilebilirliği ve uygun maliyeti nedeniyle çelik en yaygın kullanılan malzeme grubunu oluşturur. Montaj sürecinde ise bu zırh çelikleri çoğunlukla kaynaklı birleştirme yöntemleriyle kullanılmaktadır. Bu çalışmada zırh çeliklerinin farklı kaynak süreleri altında balistik performansı incelenmiştir. Zırh çeliği olarak ortalama 500HB ve 600HB sertlikteki zırh çelikleri kullanılmıştır. Bu zırh çelikleri MAG kaynak yöntemi ile aynı kaynak akımı, voltajı, tel besleme hızı parametrelerinde kaynatılmıştır. Kaynak teli olarak 307Si kaynak teli kullanılmıştır. Kaynak süreleri değiştirilerek malzeme üzerinde farklı ısı girdileri oluşturulmuş olup ısı girdisi sonucunda ve sadece ana metale ısı girdisi olmayan numunelere balistik testler yapılmıştır. Balistik testler 7.62x39mm API BZ mühimmatına karşı 695±20m/s hızda gerçekleştirilmiştir. Yapılan testler sonucunda 600HB sertlikteki malzemede düşük ısı girdisi altında kaynak işlemi uygulanan numunenin ısı tesiri altındaki bölgeye yapılan atışlar başarısız olurken, aynı sertlikteki yüksek ısı girdisi uygulanan numuneler ve ısı girdisi olmayan ana metale yapılan atışlar başarılı olmuştur. 500HB sertlikteki malzemede ise hem ısı girdisi olmayan numune, hemde düşük ısı girdili ve yüksek ısı girdili numuneler balistik testlerde başarılı olmuştur. Bu testler sonucunda 600HB sertlikteki malzeme daha kırılgan olduğu için , 500HB sertlikteki malzemeye oranla kaynak altında mikroyapısal olarak daha olumsuz etkilenmiş olup bu da balistik özellikleri direkt olarak etkilemektedir. Ayrıca kaynak sonrası soğuma parametrelerinin çeliklerin balistik özelliklerini etkilediği sonucuna varılmıştır.

Anahtar Kelimeler: Zırh çeliği, balistik, ısı girdisi, kaynak

EFFECT OF WELDING DURATION ON THE BALLISTIC PERFORMANCE OF ARMOR STEELS

ABSTRACT

Armored combat vehicles hold a critical position within the defense industry, and developments in this field are continuously increasing day by day. In the production of these vehicles, steel is the most commonly used material group due to its formability, ease of availability, and cost-effectiveness. During the assembly process, these armor steels are mostly

joined using welding methods. In this study, the ballistic performance of armor steels under different welding durations was investigated. Armor steels with an average hardness of 500HB and 600HB were used. These steels were welded using the MAG welding method under the same welding current, voltage, and wire feed speed parameters. 307Si welding wire was used as the filler material. By varying the welding durations, different heat inputs were applied to the material. Ballistic tests were carried out on both the base metal samples without any heat input and the welded samples with various heat inputs. The ballistic tests were conducted using 7.62x39mm API BZ ammunition at a velocity of 695±20 m/s. According to the test results, in the material with a hardness of 600HB, the shots aimed at the heat-affected zone (HAZ) of the sample welded under low heat input failed, while the samples welded under high heat input and the base metal without heat input successfully resisted the ballistic impact. On the other hand, in the material with a hardness of 500HB, all samples — including the base metal, and those with low and high heat input — performed successfully in the ballistic tests. These results indicate that the 600HB material, being more brittle, is more adversely affected in its microstructure under welding compared to the 500HB material, directly influencing its ballistic performance. Furthermore, it was concluded that post-weld cooling parameters also significantly affect the ballistic properties of the steels.

Keywords: Armor steel, ballistic, heat input, welding

INTRODUCTION

In modern armored combat vehicle design, materials such as steel, aluminum, ceramics, and composites are widely employed to meet evolving defense needs. Among these, steel continues to be the most commonly used material due to its advantageous properties, including ease of formability, cost-effectiveness, and broad availability. After the casting stage, steel is typically processed into plates of desired thickness through hot rolling, a procedure determined by its chemical composition and the required mechanical properties (Karagöz et al., 2008). After being rolled to the desired thickness, armor-grade steels undergo austenitizing, quenching, and tempering processes to attain the required strength and hardness characteristics (Manganello and Wilson, 1993). Welding is the most widely used method for joining armor steels. However, the heat input associated with the welding process causes microstructural changes in the welded areas, which can result in a decline in mechanical properties and ballistic performance (Souza et al. 2021). Moreover, preheating applied prior to welding (Cabrilo and Geric, 2016), as well as the selection of the welding wire and the design of the weld groove during the welding process (Özdemir 2020. ; Morsy et al. 2022), are directly related to the mechanical properties of the material.

In the present study, the ballistic behavior of armor steels was investigated both before and after welding. Metal Active Gas (MAG) welding was employed as the welding method, using 307-grade welding wire as the filler material. The welds were applied as fillet welds on identical base materials. Ballistic tests were conducted on materials compliant with the MIL-DTL-32332 standard, both prior to and following the welding process. The ballistic tests were performed against 7.62x39mm API BZ ammunition, with an impact velocity of 695 ± 20 m/s.

MATERIAL AND METHODS

The chemical (Table 1) and mechanical (Table 2) properties of the material used in the experimental study are provided.

Table 1. Chemical composition of armor steel material

Material	C	Si	Mn	P	S	Cr	Ni	Mo	B
500HB	0,3	0,7	1,7	0,025	0,01	1,5	3,0	0,7	0,005
600HB	0,45	0,7	0,8	0,015	0,004	0,5	3,0	0,6	0,003

Table 2. Mechanical properties of armor steel material

Material	Yield strength	Tensile strength	Elongation (%)	Impact strength
500HB	1250 MPa	1550 MPa	8	17 (-40^{o}C)
600HB	1400 MPa	1950-2150 MPa	6	14 (-40^{o}C)

The filler material used was OK Autrod 16.95 welding wire in all welding processes. OK Autrod 16.95 is an austenitic-type filler metal. Due to its high silicon (Si) content, it improves the welding properties. To enhance resistance to hot cracking, it has a high manganese (Mn) content. The chemical and mechanical properties of this filler metal are provided in Table 3 and Table 4, respectively.

Table 3. Chemical composition of filler material

C	Mn	Si	S	P	Ni	Cr	Mo	Cu
0.1	6.5	1	0.02	0.01	8	18.5	0.1	0.1

Table 4. Mechanical properties of filler material

Yield strength	Tensile strength	Elongation (%)	Impact strength
450 MPa	640 MPa	41	95 J (20 ^{0}C)

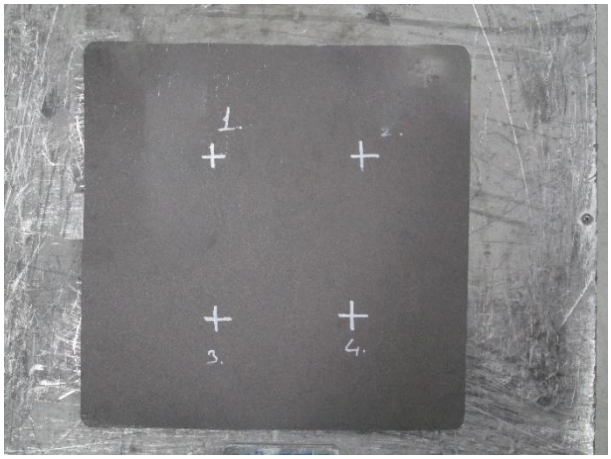
Additionally, the welding parameters are provided in Table 5. All welding parameters were applied identically to both the 500HB and 600HB hardness materials.

Table 5. Welding parameters for the joint

Heat Input	Welding Current	Welding Voltage	Wire Feed Speed (mm/s)	Tel Wire Electrode Parameter (mm)	Welding Speed (mm/s)
Low	204 A	26.2 V	130	0.9	5.9
High	204 A	26.2 V	130	0.9	4

RESULTS AND DISCUSSION

In this study, the ballistic performance of armor steels subjected to varying heat input and hardness conditions was investigated. The material used was an armor-grade steel with an average hardness of approximately 500HB and 600 HB. The steel plates were joined using the Metal Active Gas (MAG) welding method, employing 307Si welding wire as the filler material. Different levels of heat input were introduced by adjusting the welding duration. Ballistic tests were conducted on both the welded specimens and the base metal, which had not undergone any heat input. These tests were performed using 7.62×39 mm API BZ ammunition, fired at an impact velocity of 695 ± 20 m/s.



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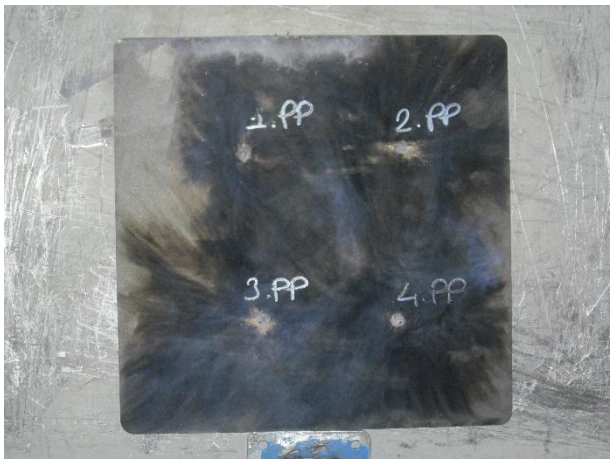

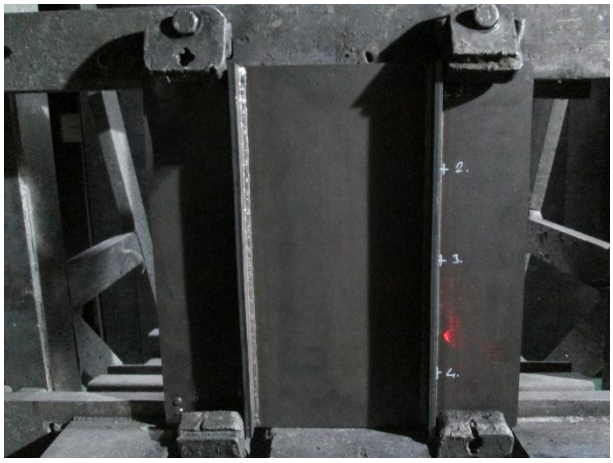

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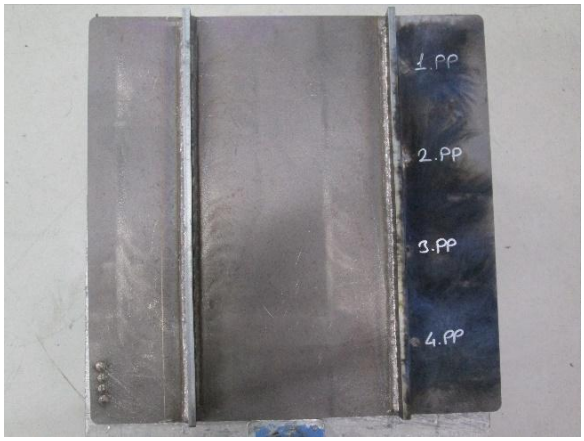

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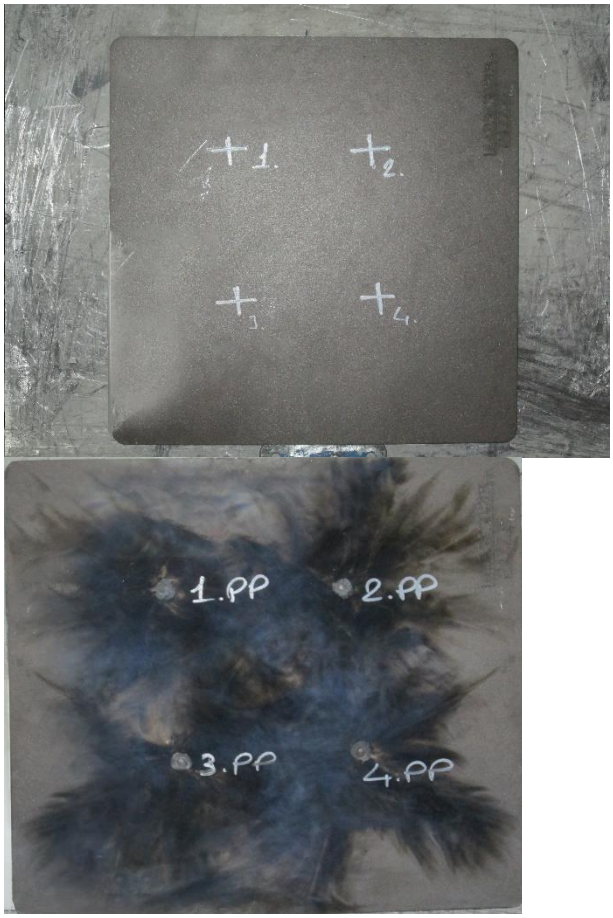
Fig 1. Images of the 600 HB material before and after ballistic testing: (a) sample without heat input before testing, (b) sample without heat input after testing (front surface), (c) sample with low heat input before testing, (d) sample with low heat input after testing (front surface), (e) sample with low heat input after testing (rear surface), (f) sample with high heat input before testing, (g) sample with high heat input after testing (front surface), (h)) sample with high heat input after testing (rear surface)

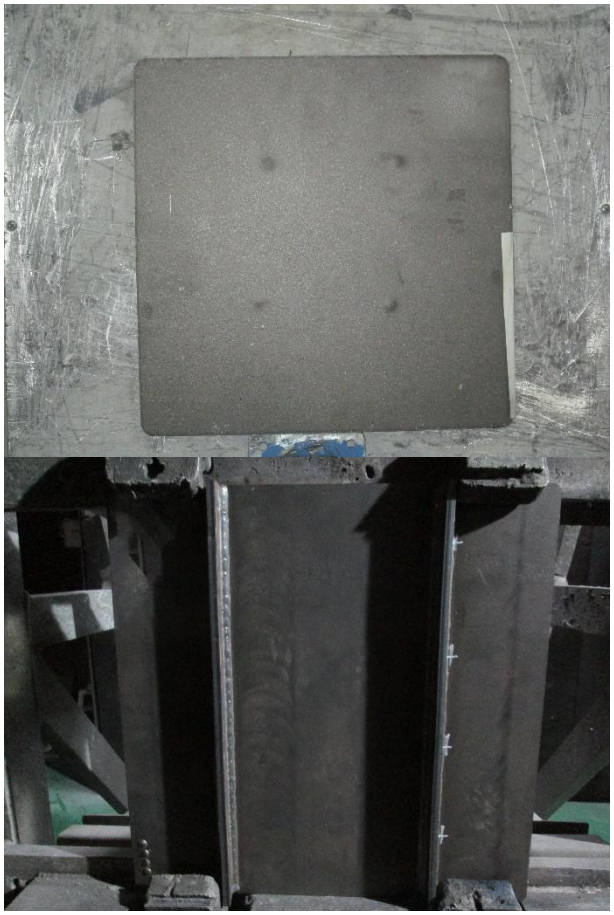
Ballistic tests were conducted at the speeds and angles specified in Table 6 and Table 7, with the results also provided in the same table.

Table 6. Ballistic Test Datas for the 600HB Hardness Material

	Strike Location	Strike Angle	Streike Velocity (m/s)	Result
Sample without heat input	1	90°	689,31	Pass
	2	90°	694,45	Pass
	3	90°	692,34	Pass
	4	90°	708,11	Pass
Sample with low heat input	1	90°	695,41	Fail
	2	90°	699,97	Fail
	3	90°	692,90	Pass
	4	90°	688,48	Fail
Sample with high heat input	1	90°	679,51	Pass
	2	90°	701,07	Pass
	3	90°	687,59	Pass
	4	90°	688,86	Pass



(a) (b)



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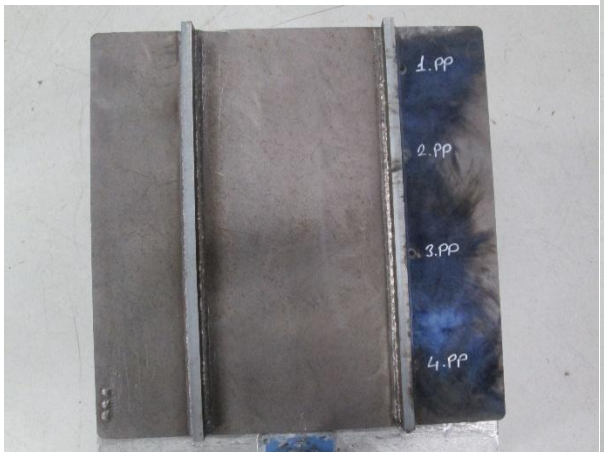

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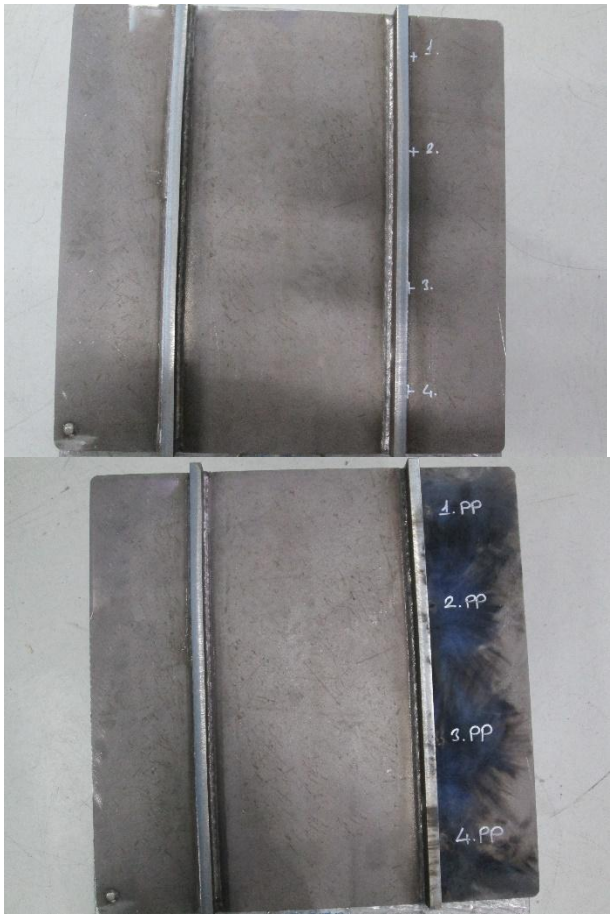

(g) (h)

Fig 2. Images of the 500 HB material before and after ballistic testing (a). sample without heat input before testing, (b). sample without heat input after testing (front surface), (c). sample without heat input after testing (rear surface), (d). sample with low heat input before testing (e). sample with low heat input after testing (front surface), (f). sample with low heat input after testing (rear surface), (g) sample with high heat input before testing (front surface), (h)) sample with high heat input after testing (front surface)

Table 7. Ballistic Test Datas for the 600HB Hardness Material

	Strike Location	Strike Angle	Streike Velocity (m/s)	Result
Sample without heat input	1	90°	685,16	Pass
	2	90°	680,35	Pass
	3	90°	700,07	Pass
	4	90°	686,96	Pass
Sample with low heat input	1	90°	713,16	Pass
	2	90°	712,52	Pass
	3	90°	688,35	Pass
	4	90°	693,17	Pass

Sample with high heat input	1	90°	706,50	Pass
	2	90°	685,83	Pass
	3	90°	686,49	Pass
	4	90°	714,99	Pass

CONCLUSION

In this study, the ballistic performance of armor steel with a hardness of 600 HB and 500 HB was investigated under different heat input conditions. By varying the welding durations, different heat inputs were applied to the materials. Ballistic tests were then conducted on samples exposed to various heat inputs, as well as on base metal samples without any heat input. The ballistic tests were performed using 7.62×39 mm API BZ ammunition at a velocity of 695 ± 20 m/s. **According to the test results, in the material with a hardness of 600HB, the shots aimed at the heat-affected zone (HAZ) of the sample welded under low heat input failed, while the samples welded under high heat input and the base metal without heat input successfully resisted the ballistic impact. On the other hand, in the material with a hardness of 500HB, all samples — including the base metal, and those with low and high heat input — performed successfully in the ballistic tests. These results indicate that the 600HB material, being more brittle, is more adversely affected in its microstructure under welding compared to the 500HB material, directly influencing its ballistic performance. Furthermore, it was concluded that post-weld cooling parameters also significantly affect the ballistic properties of the steels.**

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BALİSTİK TESTİN ZIRH ÇELİĞİNİN MIKROYAPISI ÜZERİNDEKİ ETKİSİ

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ÖZET

Zırh teknolojisinin temel hedefi, mermi ve şarapnel gibi yüksek hız tehditlerinin enerjisini en az kütleyle engellemek, yaymak ve emmek; aynı zamanda üretilebilirlik, maliyet ve çoklu-vuruş dayanımı arasında dengeli bir çözüm sunmaktır. Bu bağlamda su verilmiş-temperlenmiş yüksek sertlikte zırh çelikleri; zırhlı kara/hava/deniz platformları, emniyet uygulamaları ve kritik altyapıların korunmasında yaygın biçimde tercih edilir. İnce-orta kalınlık aralığında bu malzemeler, sertlik-tokluk dengesini koruyarak perforasyon direnci sağlar ve sahadaki bakım/tedarik kolaylığıyla öne çıkar. Balistik darbe sırasında çok kısa etkileşim süresi ve yüksek gerinim hızları nedeniyle ısının uzaklaştırılamadığı adyabatik bir rejim oluşur; enerjinin bir bölümü kesme lokalizasyonu ile dar şeritlerde harcanır, yüzeye yakın bölgelerde mikro-ölçekli ısıl zirveler gelişebilir. Bu çalışmada, su verme-temper sonrası yaklaşık 50 HRC sertliğe sahip, Ni–Cr–Mo–B alaşımlı temperlenmiş lath martensit yapılı bir çelik zırh plakasının mermi giriş yüzeyi kesiti; standart hazırlık ve %2 Nital ile dağlanarak optik mikroskop altında incelenmiştir. Görseller, yüzeye bitişik beyaz etsiz tabaka (WEL), WEL'in hemen altında daha koyu bir yakın alt zon, kenarlarda yerel ergime–yeniden katılaşma adacıkları ve sınırlı mikro-çatlak oluşumlarını ortaya koymaktadır. Optik mikroskopta adyabatik kesme bandı (ASB) ile uyumlu dar ve keskin şeritler açık biçimde ayırt edilememiştir; gözlenen paralel çizgiler hazırlık çizikleriyle ilişkilendirilmiştir. Bulgular, yüksek gerinim-hızlı darbe altında beklenen mekanizma çerçevesiyle uyumludur; ancak yalnızca optik mikroyapıya dayanıldığı için WEL–ASB–çatlak arasında doğrudan nedensel bir bağ ileri sürülmemekte, gözlemsel eş-yerleşim düzeyinde raporlanmaktadır. Bu yaklaşım, mikrosertlik, SEM-EDS ve EBSD gibi tamamlayıcı ölçümlerle desteklendiğinde çoklu-vuruş performansı, yüzey bütünlüğü ve zırh tasarımına ilişkin uygulamalı çıkarımların güçlendirilmesine zemin sunar.

Anahtar Kelimeler: Zırh çeliği, mikroyapı, balistik test, adiabatik kayma bantları

THE EFFECT OF BALLISTC TESTING ON THE MICROSTRUCTURE OF ARMOR STEEL

ABSTRACT

Armor technology aims to block, spread, and dissipate the energy of high-velocity threats (bullets, fragments) with minimal mass while balancing manufacturability, cost, and multi-hit durability. In this context, quenched-and-tempered high-hardness armor steels remain widely used for armored land/air/sea platforms, law-enforcement equipment, and critical-infrastructure protection. In the thin-to-medium thickness range, such steels provide

perforation resistance by maintaining a hardness–toughness balance and are attractive in the field due to maintainability and supply practicality. During ballistic impact, the very short interaction time and high strain rates create an adiabatic regime in which heat cannot be removed; part of the energy is dissipated through shear localization in narrow bands, and near-surface thermal spikes may develop. In this study, the entry surface cross-section of a quenched-and-tempered, Ni–Cr–Mo–B alloyed armor steel with a hardness of approximately 50 HRC and tempered lath martensitic microstructure was prepared metallographically, etched with 2% Nital, and examined under bright-field optical microscopy. The observations reveal a continuous white-etching layer (WEL) adjacent to the surface, a darker subsurface zone beneath the WEL (~10–40 μm thick) consistent with over-tempering, localized melt–re-solidification islands at the edges, and limited micro-cracking. Optical microscopy did not reveal clear, narrow adiabatic shear bands (ASBs); instead, the observed parallel fine lines are attributed to preparation scratches. The findings are consistent with the expected mechanisms under high strain-rate impact; however, since the analysis relies solely on optical microstructure, no direct causal linkage among WEL, ASB, and cracking is asserted, and the results are reported at the level of observational co-location. This framework, when complemented by microhardness profiling, SEM–EDS, and EBSD, can provide stronger insights into multi-hit performance, surface integrity, and implications for armor design.

Keywords: Armor steel, microstructure, ballistic test, adiabatic shear band

GİRİŞ

Zırh sistemlerinin temel amacı; küçük kalibreli mühimmat, şarapnel ve patlama kaynaklı ikincil parçacıklar gibi yüksek hız tehditlerinin enerjisini en az kütleyle engellemek, yaymak ve emmek; aynı zamanda üretilebilirlik, maliyet ve çoklu vuruş dayanımı arasında dengeli bir çözüm sunmaktır. Bu geniş tasarım uzayında metalik, seramik ve hibrit mimariler birlikte değerlendirilmekle birlikte, su verilmiş–temperlenmiş yüksek sertlikte zırh çelikleri kara/hava/deniz platformları, emniyet ekipmanı ve kritik altyapı korumasında hâlen ana taşıyıcı çözümlerden biridir. Karşılaştırmalı balistik çalışmalar, belirli bir aralığa kadar plaka sertliği ile akma/çekme dayanımındaki artışın küçük kalibre tehditlere karşı perforasyon direncini iyileştirebildiğini göstermiştir (Børvik, Dey ve Clausen 2009; Dikshit, Kutumbarao ve Sundararajan 1995).

Makro ölçekte terminal balistik kuramı; penetrasyon ve perforasyonu mermi hızı/kütlesi/burun geometrisi ile hedefin dayanım, kalınlık ve hız-duyarlılığına bağlar. Klasik mekanik yaklaşımlar, mühimmat hızlarında metalik hedeflerin davranışını açıklayan ölçek ilişkileri ve performans metrikleri üretir; bu çerçeve, dinamik dayanım ve yerelleşmiş hasarın perforasyon eşiğini kontrol etmedeki rolünü vurgulayarak mikroyapısal incelemeler için zemin hazırlar (Backman ve Goldsmith 1978).

Mikro ölçekte ise, yüksek gerinim hızı ve çok kısa etkileşim süresi nedeniyle ısının uzaklaştırılamadığı adyabatik koşullar oluşur. Bu koşullar, plastik işin ve sıcaklığın dar zonlara kesme lokalizasyonu ile toplandığı adyabatik kayma bantları (ASB) olarak görünür. ASB'ler bir yandan büyük miktarda enerjiyi sönümleyen etkin "lavabolar" gibi çalışırken, diğer yandan düşük tokluklu yollar oluşturarak çatlak başlatma/sapmasını kolaylaştırır; kapsamlı derlemeler ve EBSD çalışmaları, çeliklerde bu bantların morfolojisini ve dinamik kırılmayla ilişkisini ayrıntılı biçimde haritalamıştır (Karantza ve Manolakos 2023; Xue, Meyers ve Figueiredo 2008). Çoğu yüksek hızlı süreçte, darbe yüzeyine bitişik dağlamaya dirençli ince bir "beyaz katman" (white-etching layer, WEL) da oluşabilir. Yerel ısıl–mekanik geçmişe bağlı olarak bu tabaka aşırı temperlenmiş (yumuşamış) ya da çok hızlı soğumayla yeniden sertleşmiş (ultra-

ince/nanokristalin martensitik ve kırılgan) karakter gösterebilir; her iki durumda da çentik-duyarlı ince bir üst zon olarak ASB ağlarıyla etkileşime girer. Darbe/aşınma çalışmalarında kenarlar ve çatlak ağızları yakınında raporlanan ergime–yeniden katılaşma adacıkları (koyu, gözenekli mikroyapı izleri), yüzeye çok yakın ısıl zirvelerin görsel kanıtlarıdır (Javaheri ve ark. 2022).

Bu çalışmada, Ni–Cr–Mo–B alaşımlı, su verme–temper sonrası yaklaşık 50 HRC sertliğe sahip temperlenmiş lath martensit yapılı bir çelik zırh plakasının giriş yüzeyi kesiti optik mikroskopisi (2% Nital) ile incelenmiştir. Amacımız, yalnız optik kanıt düzeyinde, yüzeyde WEL, WEL'in hemen altında ince parlak bantlar (ASB ile uyumlu), yerel ergime–yeniden katılaşma izleri ve dallanmış çatlak morfolojilerinin eş-yerleşimini belgelemek ve bunları terminal balistik beklentileri ile ASB/WEL literatürüyle uyumlu bir yorum çerçevesine oturtmaktır. Mevcut veri kümesinde mikrosertlik profili, SEM–EDS ve EBSD bulunmadığından, WEL–ASB–çatlak arasında doğrudan nedensellik ileri sürülmemekte; bulgular gözlemsel eş-yerleşim ve mekanizma ile uyumluluk düzeyinde raporlanmaktadır (Backman ve Goldsmith 1978; Børvik, Dey ve Clausen 2009; Karantza ve Manolakos 2023; Javaheri ve ark. 2022).

MALZEME VE METOT

Deneysel çalışmada kullanılan malzemeye ait kimyasal ((Tablo.1) ve mekanik (Tablo 2) özellikler verilmiştir.

Tablo 1. Zırh çeliği malzemelere ait kimyasal bileşim

Malzeme	C	Si	Mn	P	S	Cr	Ni	Mo	B
50HRC	0,3	0,7	1,7	0,025	0,01	1,5	3,0	0,7	0,005

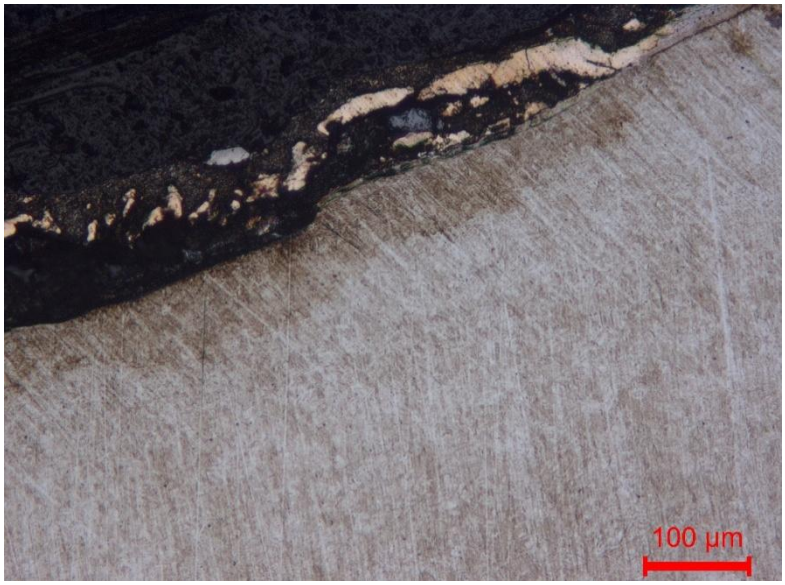
Tablo 2. Zırh çeliği malzemelere ait mekanik özellikler

Malzeme	Akma Dayanımı (N/mm^2)	Çekme Dayanımı (N/mm^2)	Uzama (%)	Darbe Dayanımı
50HRC	1250	1550	8	17 (-40^oC)

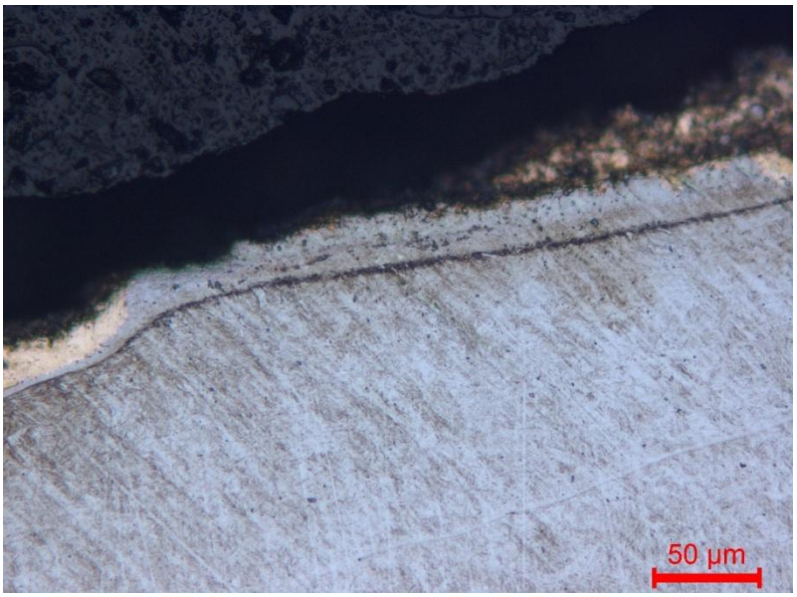
Tek atım koşulunda, 7.62×39 mm API-BZ sınıfı mühimmatla ~695 ± 20 m/s hızda etkileşim gerçekleştirilmiş; darbe krateri çevresinden rastgele oryantasyonda alınan numuneler fenolik bakalit içinde kalıplanmış, (görüntülerde siyah faz), ardından standart zımparalama–parlatma rutini uygulanmıştır. Nihai dağlama %2 Nital ile yapılarak optik mikroskopisi ile 50×–1000× aralığında görüntü alınmıştır.

BULGULAR VE TARTIŞMA

Giriş yüzeyi kesitlerinde, %2 Nital–parlak alan OM ile Şekil 1–2'de görüldüğü gibi yüzeye bitişik ~1–5 μm kalınlığında parlak ve homojen bir beyaz etsiz tabaka (white-etching layer, WEL) izlenmiştir. Bu tabaka, dağlamaya dirençli görünümüyle alttaki martensitik dokuya kıyasla belirgin biçimde farklıdır ve yüksek gerinim hızında gelişen adyabatik ısınmanın tipik yüzey göstergesi olarak yorumlanmıştır.



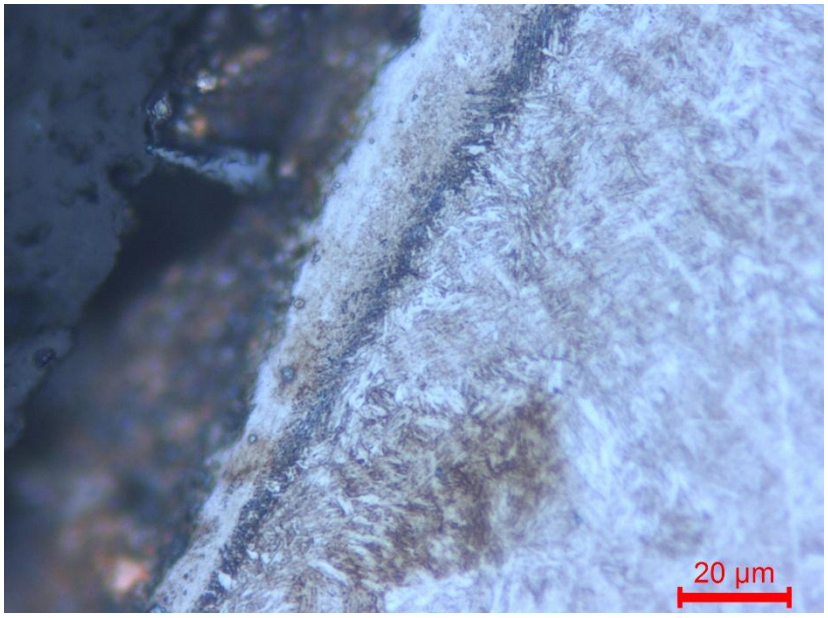
Şekil 1. ***Zırh çeliği 100x büyütme mikroyapı görüntüsü***



Şekil 2. ***Zırh çeliği 200x büyütme mikroyapı görüntüsü***

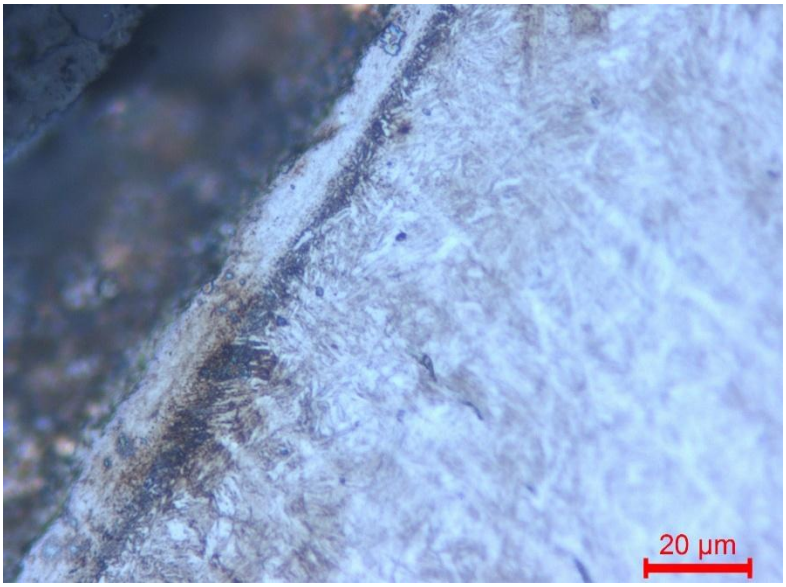
Şekil 3 ve 4'de gösterildiği üzere, WEL'in hemen altında, ~10–40 µm kalınlığında daha koyu bir yakın alt zon görülmüştür. Bu bölgede martensit lath dokusunun konturları zayıflamış, paket/blok sınırlarının seçilebilirliği azalmıştır. Bu görünüm, adyabatik ısınmaya bağlı aşırı temperlenme ile uyumludur. Arayüzde yer yer görülen ince koyu hatlar ise oksit/yeniden katılaşma filmi veya dağlama kontrastı olarak değerlendirilebilir.

Şekil 3. ***Zırh çeliği 200x büyütme mikroyapı görüntüsü***

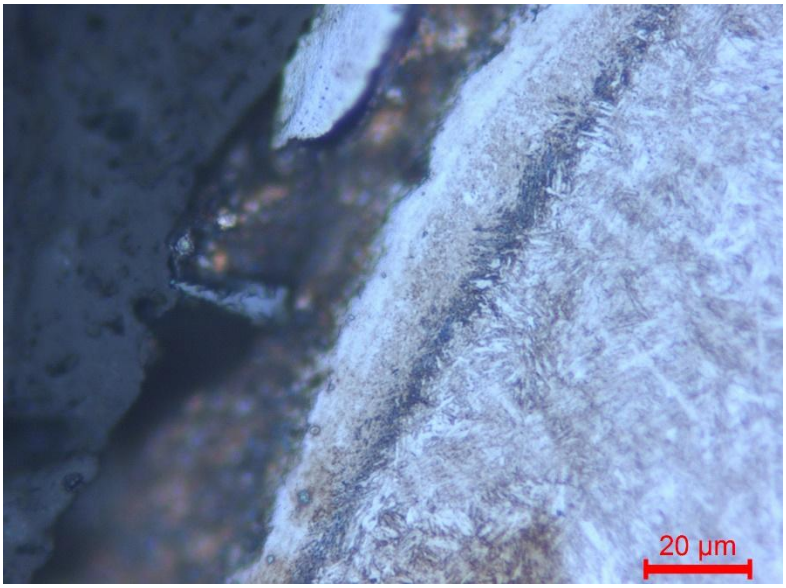


Şekil 4. ***Zırh çeliği 500x büyütme mikroyapı görüntüsü***

Yüzey kenarlarında Şekil 5 ve 6'da görüldüğü gibi giriş kenarı boyunca koyu, gözenekli küçük adacıklar ve akıntı benzeri izler bulunur; bunlar yerel ergime → hızlı soğuma ile oluşmuş yeniden katılaşma ürünleridir ve adyabatik koşullarda temas bölgesinde anlık ergime yaşandığına görsel destek verir. Mikroskobik boşluk/çatlak açısından, paket ve sınır yakınlarında küçük yuvarlak/oval koyu oyukçuklar yer yer seçilir; bunlar karbür–matris veya dahil–matris arayüzlerinde mikro boşluk olabilir.

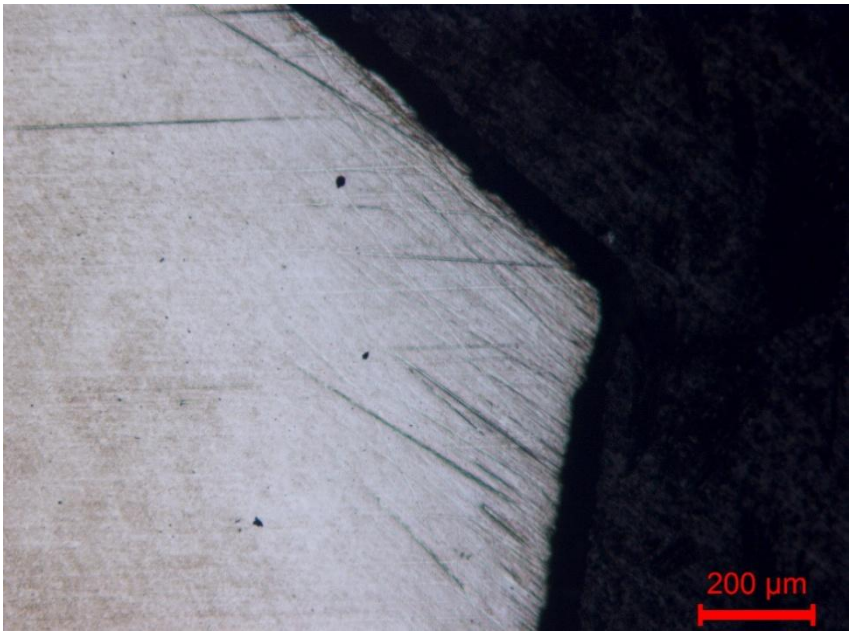


Şekil 5. ***Zırh çeliği 500x büyütme mikroyapı görüntüsü***

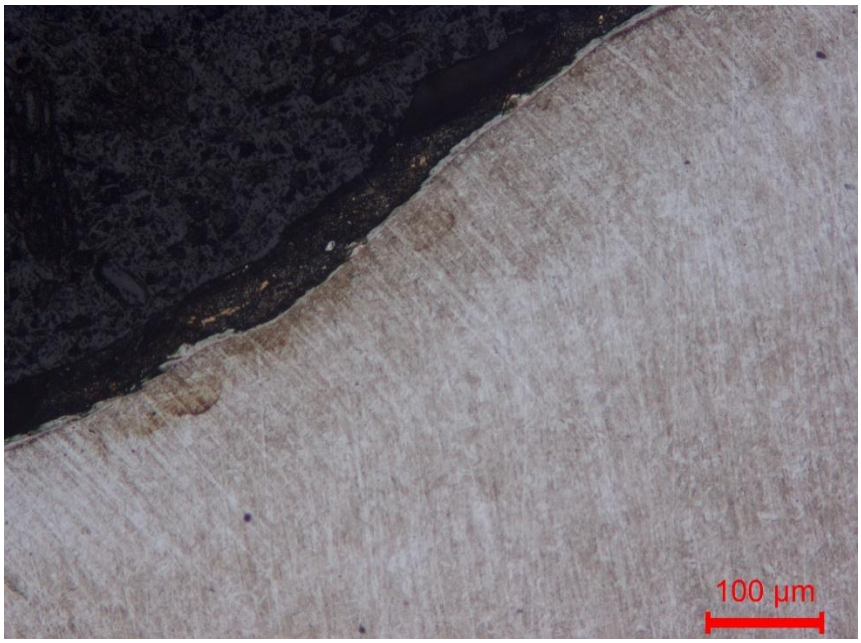


Şekil 6. ***Zırh çeliği 500x büyütme mikroyapı görüntüsü***

Alanın geniş kesimlerinde Şekil 7 ve 8'de görüldüğü gibi, yüzeyden içeri eğimli ve birbirine paralel çok sayıda ince çizgi bulunmaktadır; çizgilerin farklı karelerde aynı yön/adımda sürmesi, mikroyapısal sınırları kesintisiz geçmesi ve büyütme değişse de benzer kontrast vermesi, bunların preparasyon çizikleri olduğunu güçlü biçimde düşündürür; bu nedenle bu veri setinde dar, keskin ve yerel izler şeklinde beklenen adyabatik/kesme bandı (ASB) için açık optik kanıt saptanmamıştır.



Şekil 7. ***Zırh çeliği 50x büyütme mikroyapı görüntüsü***



Şekil 8. ***Zırh çeliği 100x büyütme mikroyapı görüntüsü***

Çatlak morfolojisi açısından, Şekil 3-6 çevresindeki detaylarda yüzeye yakın kısa mikro-çatlak/boşluk zincirleri yer yer seçilse de, yaygın bir çatlak ağı veya belirgin dallanma izlenmemiştir; bu durum hasarın baskın olarak yayılmış plastik şekil değiştirme ve yüzeye yakın ısıl etkiler ile sönümlendiğini düşündürmektedir. Adyabatik kesme bandı (ASB) açısından, beklenen dar, keskin ve yerel bant imzası hiçbir görüntüde optik mikroskopla net biçimde ayırt edilememiştir. Bazı paralel ince çizgiler gözlense de bunların yön ve süreklilikleri preparasyon çizikleri ile daha iyi örtüşmektedir. Dolayısıyla bu veri setinde ASB varlığı kanıtlanamamıştır. Ancak bu, ASB'nin hiç oluşmadığı anlamına gelmez; bantlanma zayıf/süreksiz kalmış veya OM'nin çözünürlük sınırının altında kalmış olabilir.Bu değerlendirme, optik mikroskopi (OM) gözlemlerine dayanmaktadır. Dolayısıyla WEL'in ayrıntılı yapısal doğasının aşırı temperlenmiş bir üst tabaka mı, yoksa çok hızlı soğumayla

yeniden sertleşmiş/nanoyapılı bir katman mı olduğu, WEL'in hemen altındaki yakın bölgede olası sertlik gradyanının yayılımı ve büyüklüğü ile bantlanmanın (varlığı/şiddeti/sürekliliği) ve kenar bölgelerdeki yeniden katılaşma ürünlerinin kimyasal-termal imzası gibi konuların nicel olarak kesinleştirilmesi için tamamlayıcı karakterizasyon gereklidir. Sayısal olarak güçlendirmek için tek adımlı ve pratik bir doğrulama yeterlidir: (i) yüzeyden içeri kısa bir mikrosertlik transekti (≈0–200 μm), (ii) kenar/film bölgelerinde birkaç SEM görüntüsü ve noktasal EDS kontrolü; gerek duyulursa (iii) şüpheli bölgede küçük bir EBSD haritası. Bu çalışma, gözlenen morfolojik eş-yerleşim ve mekanizmayla tutarlılık temelinde raporlanmış olup, önerilen bu hafif doğrulamalarla tablo ihtiyaç ölçüsünde nicel olarak tamamlanabilir.

SONUÇLAR

Mermi giriş yüzeyi kesitlerinde sürekli, dağlamaya dirençli bir WEL ve onun hemen altında ~10–40 μm kalınlığında, morfolojisi aşırı temperlenmiş yakın alt zon ile uyumlu bir bölge gözlenmiştir.

Yerel ergime–yeniden katılaşma izleri (koyu, gözenekli adacıklar ve akıntı benzeri mikroyapı) mevcuttur; ancak hacimleri sınırlı ve süreklilikleri düşüktür.

Adyabatik/kesme bandı (ASB) için optik ölçekte beklenen dar, keskin ve yerel şeritlere ait açık kanıt bu veri setinde ayırt edilememiştir; varsa zayıf/süreksiz bantlanmaların OM algı eşiğinin altında kalmış olabileceği not edilmelidir.

Çatlaklanma yüzeye yakın bölgelerde kısa mikro-çatlak/boşluk zincirleri ile sınırlıdır; yaygın çatlak ağı/dallanma gözlenmemiştir. Bu tablo, yükün önemli bir kısmının yayılmış plastik şekil değiştirme ve yüzeye yakın ısıl etkiler ile sönümlendiğine işaret eder.

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VERİ MADENCİLİĞİ YÖNTEMLERİNİN FİNANSAL HİLE RİSKİ TESPİTİNDE KULLANIMI ÜZERİNE TEORİK BİR İNCELEME

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ÖZET

BDS 240'ta hile; *yönetim, üst yönetimden sorumlu olanlar, çalışanlar veya üçüncü taraflardan bir veya birden fazla kişinin, haksız veya yasalara aykırı bir menfaat elde etmek amacıyla yaptığı aldatma içeren kasıtlı eylemler şeklinde* tanımlanmaktadır. Tanımdan da görüleceği üzere hile, kasıtlı bir eylem olduğu için tespiti bazen zor olmakta bazen de mümkün olmamaktadır. Son zamanlara kadar, yapılan bir hile eyleminin araştırılması için hile belirtileri sonrasında; yaşanan hileyi tespit etmek için bir denetçi veya meslek mensubu görevlendirilir ve gerekli idari araştırmalar yapılarak sonuç bir rapor ile ilgililerine bildirilir, genel prosedür de bu şekilde her yerde aynıdır. Genel kabul görmüş bu hile tespit yöntemine reaktif hile tespit yöntemi denilmektedir. Ancak, hile oluşmadan, hile emareleri görünmeden, herhangi bir ihbar gelmeden işletme içerisinde bir savunma mekanizması oluşturularak, hile eylemi gerçekleştikten sonra hile emarelerinden sonra soruşturma prosedürünü uygulamak yerine hile eylemi gerçekleşmeden sürekli bir kontrol mekanizması kurarak hileyi oluşumunu önlemek ve bir hile eylemi girişimi olacaksa da teşebbüs aşamasında bunun da tespit edilmesi yöntemi de proaktif bir hile tespit yöntemi olarak kabul edilmektedir. Proaktif tespit uygulamalarının hangi yöntemleri kapsadığı hala net değilken bilgisayar tabanlı yığın veriler üzerinden teknolojik olanaklarla işlem yapılmasına imkân tanıyan, yığın veriler içerisindeki anormallikleri görebilen ve belirti öncesi sürekli incelemelerin yapıldığı yöntemler proaktif yöntemler olarak kabul edilmektedir. Bu aşamada da en çok tercih edilen unsur veri madenciliği yöntemleridir. Çalışma kapsamında da hile riski tespitinde kullanılan veri madenciliği modelleri araştırılacak olup literatürde kabul gören veri madenciliği yöntemlerinin finansal hile riski tespitindeki modelleme başarıları üzerinde durulacaktır.

Anahtar Kelimeler: Hile, Reaktif, Proaktif, Veri Madenciliği Yöntemleri

A THEORETICAL EXAMINATION ON THE USE OF DATA MINING METHODS IN DETECTING FINANCIAL FRAUD RISK

ABSTRACT

In ISA 240, fraud is defined as intentional acts involving deception committed by one or more persons among management, those charged with governance, employees, or third parties, with the aim of obtaining an unjust or illegal benefit. As can be seen from the definition, since fraud is an intentional act, its detection is sometimes difficult and sometimes impossible. Until recently, in order to investigate a fraudulent act, after fraud indicators appeared, an auditor or professional member was assigned to detect the fraud experienced, and the necessary administrative investigations were carried out, with the results reported to the relevant parties, and the general procedure was the same everywhere. This generally accepted fraud detection

method is called the reactive fraud detection method. However, instead of applying the investigation procedure after fraud indicators appear following the occurrence of a fraud act, by establishing a defense mechanism within the enterprise before fraud occurs, before fraud indicators are seen, and without any notification, it is accepted as a proactive fraud detection method to prevent the occurrence of fraud by establishing a continuous control mechanism before the fraud act occurs and to detect it at the attempt stage if there is going to be a fraud attempt. While it is still not clear which methods proactive detection practices cover, methods that allow processing through computer-based bulk data with technological facilities, that can detect anomalies within bulk data, and in which continuous examinations are carried out before indicators, are accepted as proactive methods. At this stage, the most preferred element is data mining methods. Within the scope of the study, data mining models used in fraud risk detection will be investigated, and the modeling successes of data mining methods accepted in the literature in detecting financial fraud risk will be emphasized.

Keywords: Fraud, Reactive, Proactive, Data Mining Methods

GİRİŞ

İnsanlık var olduğu günden bu zamana kadar ticari hayat var olmakta olup ticari hayatın devam ettiği bir yerde de ticari işleyişin içerisindeki ilişkiler görünen ve görünmeyen şekilde devam etmektedir. Görünmeyen davranışlar içerisinde bazı durumlarda taraflar birbirlerini yanıltmak veya aşırı şekilde yararlanmak gayreti içerisine girmektedir. Bu davranışlar; mevcut yasalara, idari düzenlemelere, ticari teamüllere aykırı davranışlar olup aldatma içeren davranışlar olarak kabul edilmektedir. Aldatma içeren davranışlar; yöneticiler, çalışanlar veya ticari ilişki içerisindeki üçüncü taraflar açısından da yapılabilmektedir. Bu davranışlar literatürde "hile" olarak kabul edilmektedir. Uygulamada hile, her zaman olmakta olup bunların bir kısmı tespit edilse de bir kısmı da tespit edilememekte olup hileli davranıştan kaynaklı miktar ekonomide de sonsuz bir kayıp olarak kalmaktadır. Hile davranışlarının tespit edilebilmesi için uygulamada hileli davranışlar gerçekleştikten sonra yapılan tespitler reaktif, hileli davranışlar gerçekleşmeden teşebbüs aşamasında kalan önleme işlemleri de proaktif hile tespit yöntemleri olarak kabul edilmektedir. Hile tespit yöntemlerinde kullanılan proaktif yöntemlerin başında da veri madenciliği yöntemleri kullanılmaktadır. Veri madenciliği kendi içerisinde birçok yöntem barındırmakta olup bu yöntemlerin hile tespitinde kullanımı ve kurulan modellerin başarı durumlarının bir arada gösterilmesi çalışmanın yapılması amacını taşımaktadır.

FİNANSAL HİLE

Hile kavramının uygulanma alanı ve kullanımı açısından çok geniş bir sahası bulunmaktadır. Kullanıldığı her alanı kapsayabilecek genel bir tanımını Türk Dil Kurumu yapmaktadır. Kurum tarafından yapılan bu tanımı her uygulanma alanı kendi özelliklerine göre düzenleyerek kendilerine uygun sektörel bir hile tanımı yapmaktadır. Türk Dil Kurumunca yayınlanan *Büyük Türkçe Sözlük'*e göre hile kavramı Arapça bir kökenden gelmekte ve iki tanımı yapılmaktadır. Birinci tanımda "*Birini aldatmak, yanıltmak için yapılan düzen, dolap, oyun, ayak oyunu, alavere dalavere, desise, entrika"* ikinci tanımda ise *Çıkar sağlamak için bir şeye değersiz bir şey katma*" (www.sozluk.gov.tr, 01/08/2025) şeklinde tanımlanmaktadır. Muhasebe ve finansal işlemler için kullanıldığında da literatürde artık genişçe yer bulan finansal hile kavramı kullanılmaktadır.

İnsan doğası, geçmişte nasılsa şimdi de o şekilde olup değişmemektedir. Eski Çağ, Orta Çağ veya modern dönemde bulunmuş olan insanların beklentileri, hayalleri birbirine çok benzemektedir. Bu sebeple; muhasebe var olduğu sürece, insanların doğası da değişmediği için

insanların yaratıcı bir şekilde muhasebe bilgilerini kullanmaları ve hileli işlemlere yönelme eylemleri insanlara hep çekici gelmiştir (Jones, 2011:115). İnsanların yapmış olduğu bu eylemler eğer legal ve yerleşik mevzuata uygun ise yaratıcı muhasebecilik, legal olmayan ve yerleşik mevzuata aykırı eylemler ise finansal hileli eylemler olarak kabul edilmektedir.

ACFE (2024)'ün raporunda finansal hile "*bir kişinin mal varlığını artırmak için mesleğini kullanarak kendi işyerinin varlıklarını ve kaynaklarını bilerek kötüye kullanması ve bunları suiistimal etmesidir." ş*eklinde ifade edilmiştir.

Hilenin özeliklerinin tespit edilebilmesi için hile yapma potansiyeline sahip olan kişilerin tespit edilmesi gerekmektedir ancak bu çok zor bir durumdur. Hileyi ortaya çıkarabilmek için hile yapan kişinin karakteristik özelliklerini bilmek gereklidir. Uzun yıllardır süre gelen, vuku bulan örneklerde yapılan çalışmalar ve hile eylemi sonucu yakalanan kişiler ile yapılan araştırmalar, %100 kesin denilmese de ortaya "*Hilekâr Profili"* çıkarmaktadır (Bozkurt, 2000:58).

Hilenin hangi amaçla yapıldığını araştıran çalışmalar, hile yapanların bu davranışını üç unsurun bir araya gelmesi ile sergilediklerini ortaya koymuştur. Bu unsurlar; *baskı, fırsat, meşrulaştırmadır*. Bu konu ile ilgili ilk çalışma 1950 yılında, bir kriminoloji uzmanı Donald Cressey tarafından yapılan ve Hile Risk Faktörü Teorisi olarak adlandırılan çalışmadır (Yazıcı, 2018:844).

Muhasebe iş ve işlemlerinde herhangi bir hileli işlemin olup olmadığını tespit edebilmek için bu iş ve işlemlerin belirtilerine bakılır. Bakılan iş ve işlemlerdeki belirtiler de çoğu zaman alanyazında hile riski, hile belirtisi, hile işaretleri veya kırmızı bayraklar olarak kabul edilir. Kırmızı bayrak, doğada olağandışı veya normal aktiviteden farklı olan bir dizi durumu olup bir şeyin hayatın olağan akışının dışında olduğunu ve daha dikkatli incelenmesi gerekebileceğinin bir işaretidir (DiNapoli, 2019:3). Bu işaretlerin var olduğu her yerde finansal hileli bir işlem olduğu söylenemez ancak odaklanıp ilgili belirtiler finansal hile tespit yöntemleri ile değerlendirilmeli ve ilgili muhasebe işlemi bir sonuca vardırılmalıdır.

FİNANSAL HİLE TESPİT YÖNTEMLERİ

Alanyazında hile belirtilerinin tespit edilmesine, fark edilmesine kadar ki geçen süreye aktif; modern veya proaktif yaklaşımlar denilirken hilenin belirgin olmasından sonraki süreye de pasif, geleneksel veya reaktif yaklaşımlar olarak kabul görmektedir. Bu bölümde hile tespit yöntemlerinin aktif ve pasif yaklaşımları ifade edilecek olup kullanılan uygulamalar ifade edilmeye çalışılacaktır (Kılıç, 2021:68).

Hilelerin ortaya çıkarılması, tespit edilip önlenmesi zor olan bir işlemdir. Olağan bir şekilde yapılan denetimler, doğası gereği tarihi finansal veriler üzerinden yapıldığı için ortaya çıkarılıp tespit edilmesi ise çoğu zaman geniş bir vakte yayılmaktadır. Bu durum da hilenin işletmelere olan maliyetini giderek artırmaktadır. Bunun gibi sebepler, işletmeleri ve denetçileri karşılaşabilecekleri hile tehditlerine karşılık önlem alabilmek için yeni arayışlara itmiştir. Hilenin daha erken tespit edilebilmesi, sorumlulara daha hızlı ulaşılabilmesi ve telafisi güç veya imkânsız boyutlara ulaşmadan gerekli müdahalelerin yapılabilmesi için hile belirtilerini proaktif yöntemlerle tespit edip daha fazla maliyete sebebiyet vermeden önlenmesi gerekmektedir. Hile belirtileri proaktif yöntemlerden herhangi birisi ile tespit edildikten sonra, işlemler hile soruşturmaları ile yürütülmektedir (Kılıç ve Önal, 2021:85).

- **Reaktif (Pasif/Geleneksel) Yöntem:** Hileli işlem göstergelerinin ortaya çıkmasıyla ya da bir şikâyet alınması ile hile şüphesi hissedilen alanda detaylı hile incelemesinin yapılması, reaktif bir hile tespit yaklaşımıdır. Bu hile tespit yaklaşımında, herhangi bir hile emaresi olmadan herhangi bir araştırmaya girişilmez (Ertikin, 2017:78).

- **Proaktif (Aktif/Modern) Yöntemler:** Proaktif; kelime anlamı olarak, bir duruma karşı durum meydana geldikten sonra tepki vermeyi beklemek yerine o durumu meydana gelmeden kontrol etmek demektir. Kısaca, bir duruma karşı önceden önlem almaktır. Proaktif hile yöntemlerini kullanan denetçiler, henüz hileye kurban olduklarına dair hiçbir belirti görülmeyen işletmeleri incelerler. Proaktif hile denetiminde önemli olan; denetimin gözle görülür semptomlara göre değil, hile riskinin derecesine bağlı olarak belirlenmesidir (Ulucan Özkul ve Almalı Özdemir, 2011:105).

Hileli işlemler ile mücadele de üst yönetimin öncülüğünde, hilekârdan her zaman bir adım önde olmak için kontrol işlemlerinin proaktif bir şekilde tasarlanması ve uygulanması gerekmektedir (Coenen, 2008:72). Genellikle işletmeler, bağımsız denetimden geçtikleri için kendilerini güvenli hissetmekte ve proaktif hile denetiminin maliyetlerine katlanmayı gereksiz görmektedirler. Ancak daha sonra hilenin ağır sonuçlarına katlanmak zorunda kalabilirler (Ulucan Özkul ve Almalı Özdemir, 2011:105-106).

Proaktif yöntemlerin hangi yöntemleri kapsadığı hususunda, alanyazında hala net bir birliktelik oluşmamıştır. Ama geleneksel fiziki denetim dışında kalan, bilgisayar tabanlı yığın veriler üzerinden teknolojik olanaklarla işlem yapılmasına imkân tanıyan, yığın veriler içerisindeki anormallikleri görebilen ve belirti öncesi sürekli inceleme yapılan yöntemler; proaktif yöntemler olarak kabul edilmektedir. Uygulamada, bilgisayar ve teknoloji tabanlı birçok yöntem ve model sayılsa da en sık kullanılan proaktif yöntemler (Kılıç ve Önal, 2021:93) veri madenciliği yöntemleri yer almaktadır. Veri madenciliği uygulamaları bilgisayar tabanlı olması, sürekli işlem yapabilme, kıyaslayabilme özellikleri ile sürekli denetim yapma yetisi ile hile belirtilerini hile riski aşamasında tespit ederek kullanıcılarını uyarabilmesiyle en elverişli hile tespit yöntemlerinden birisi olduğu söylenebilir.

VERİ MADENCİLİĞİ VE VERİ MADENCİLİĞİ YÖNTEMLERİ

Veri madenciliği; toplanan verilerden anlamlı bilgiler çıkarmak, veri içerisinde gizli olan birtakım örüntüleri ve eğilimleri tespit etmek ve çeşitli değişkenler arasında ilişkiler bulmak ve böylece karar vermeye yardımcı olmak amacıyla uygulanan bir yaklaşımdır. Veri madenciliğinde; istatistik, yapay zekâ, makine öğrenmesi gibi farklı alanlarda geliştirilmiş birçok teknik ve yöntem kullanılmaktadır. Ancak veri madenciliği yalnızca bir takım araç ve tekniklerden ibaret olmayıp; veri toplama, veri temizleme, model oluşturma, model testi ve uygulama gibi birçok aşamaları içeren bir süreci ifade etmektedir (Seyrek ve Ata, 2010:71).

Muhasebe ve finans alanında büyük veri analiz tekniklerinin kullanımına ilişkin yapılan çalışmalarda genellikle regresyon, karar ağaçları, yapay sinir ağları kullanılmakla birlikte sayıca az da olsa makine öğrenmesi, destek vektör makineleri ve Bayes Ağları kullanılmıştır. Kullanılan bu tekniklerin ve teknolojilerin, işletmelerde finansal kriz tahminlerinin en doğru şekilde yapılabilmesine katkı sağladığı görülmüştür. Yapılan çalışmalar da göstermektedir ki, finansal hileleri tespit etmek ve daha güçlü gerçeklere dayalı denetim görüşleri oluşturmak büyük veri analiz tekniklerinin kullanımı ile daha muhtemeldir (İşgüden Kılıç, 2019:508-509).

Veri madenciliğinde birçok yöntem ve algoritma bulunmaktadır, ancak genel olarak veri madenciliği sınıflandırma, kümeleme ve birliktelik kuralları olarak üç ana başlığa ayrılmaktadır. Sınıflandırma, sınıfı tanımlanmamış verileri kullanarak sınıfı belli olmayan verilerin sınıfını tahmin etmek için kullanılan bir yöntemdir. Sınıflandırmanın ilk aşamasında veriler herhangi bir sınıflandırma algoritmasına tabi tutulmakta ve kurallar oluşturulmaktadır. Sınıflandırmanın ikinci aşamasında ise ilk aşamada oluşturulan kurallar, sınıfı belli olmayan veriler üzerine uygulanmakta ve verilerin sınıfı tahmin edilmektedir. Kümelemede, verilerin benzerliklerine göre kümelenmesi işlemleri bulunmaktadır. Birliktelik kurallarında ise veriler

içerisinde bulunan birliktelik ilişkilerinin çıkarılması işlemi yapılmaktadır. Veriler içerisindeki tüm kombinasyonlara bakılmakta, birbiri ile ilişkili olan veriler keşfedilmeye çalışılmaktadır (Aksu ve Karaman, 2017:87). Sınıflama ve regresyon modellerinde kullanılan başlıca teknikler; Yapay Sinir Ağları (Artificial Neural Networks), Genetik Algoritmalar (Genetic Algorithms), K-En Yakın Komşu (K-Nearest Neighbour), Naive-Bayes sınıflayıcısı, Lojistik Regresyon ve Karar Ağaçları (Decision Trees)'dır (Çalış, Kayapınar ve Çetinyokuş, 2014:5).

FİNANSAL HİLE TESPİTİNDE KULLANILAN VERİ MADENCİLİĞİ YÖNTEMLERİ

Finansal piyasaların giderek karmaşıklaşması ve mevcut verilerin katlanarak artması, hileli finansal tablo tespitini kritik ve zor bir konu haline getirmiştir. Büyük hacimli verilerden ve finansal verilerin karmaşıklığından ilgili bilgiyi çıkarıp hileli finansal tablo tespit etmeye olanak sağlayan çeşitli veri madenciliği yöntemleri geliştirilmiştir. Son yıllarda veri madenciliği yöntemleri, hileli finansal tablo tespiti için en güvenilir yöntemlerden biri haline gelmiştir (Kandemir ve Kardeş, 2025:333).

Literatürde finansal tablo hilelerinin tespitinde kullanılacak birçok veri madenciliği sınıflandırma yöntemleri mevcuttur. Bu yöntemlerin en sıklıkla kullanılanları; yapay sinir ağları, bayesian inanç ağları ve karar ağacı yöntemleridir (Terzi, 2012:173). Ancak çalışmanın mahiyeti gereği burada veri madenciliği yöntemlerinin kullanılan sıklık düzeyi dikkate alınarak Kandemir & Kardeş (2025)'in yapmış olduğu 10 veri madenciliği yöntemlerinden 41 araştırmada 211 defa "*sınıflandırma"* kategorisine kullanılan yöntemler aşağıdaki tabloda yer aldığı gibi kateğorilendirilmiştir.

Tablo 1. En Sık Kullanılan 10 Veri Madenciliği Yöntemi

Sıra No	Yöntem	Araştırmalarda Toplam Kullanılma Sayısı	Yüzde (%)
1	DT (Karar Ağacı)	31	14,76
2	SVM (Destek Vektör Makineleri)	27	12,86
3	LR (Lojistik Regresyon)	24	11,43
4	ANN (Yapay Sinir Ağı)	20	9,52
5	RF (Rastgele Orman)	19	9,05
6	K-NN (K-En Yakın Komşu)	11	5,24
7	XGBoost	9	4,29
8	NB (Naive Bayes)	7	3,33
9	AdaBoost	6	2,86
10	BBN (Bayes İnanç Ağları)	6	2,86
11	Diğer Yöntemler	50	23,81
	Toplam	211	100,00

Kaynak: Kandemir ve Kardeş, 2025:339

Tablo 1'de finansal hilelerin tespit edilmesinde en sık kullanılan veri madenciliği yöntemleri, 41 araştırma özelinde kullanım sıklığına göre incelenmiş olup bu araştırmaların toplamında

211 defa anılan yöntemlerin kullanıldığı görülmektedir. Tabloya göre finansal hile tespitinde; Karar Ağacı yönteminin %14,76, Destek Vektör Makineleri'nin %12,86, Lojistik Regresyon'un 11,43, Yapay Sinir Ağları'nın da %9,52 oranı ile en çok tercih edilen veri madenciliği yöntemleri olduğu görülmektedir.

SONUÇ

Hile; işletmeler ile ilgili veya ilgisiz tarafların haksız veya yasalara aykırı bir menfaat elde etmek amacıyla yaptığı aldatma içeren kasıtlı bir eylemdir. Hileler kasten yapıldığı için tespiti bazen zor bazen de imkânsız olabilmektedir. Hileli bir işlemin tespit edilebilmesi için klasik uygulamalarda öncelikle kırmızı bayraklar olarak adlandırılan kırmızı bayrakların baş göstermesi ve daha sonrasında da bir soruşturma yapılarak hileli işlemlerin ekonomik kaybı, sorumluları ve tüm ilgililerinin tespit edilmesi beklenmektedir. Yaşadığımız çağda kullanılan dijital imkânlarla birlikte bilgisayar tabanlı yığın veriler üzerinden teknolojik olanaklarla işlem yapılmasına imkân tanıyan, yığın veriler içerisindeki anormallikleri görebilen ve belirti öncesi sürekli incelemeler ile finansal hileli işlemlerin daha teşebbüs aşamasında iken tespit edilmesi ve hileli eylemler gerçekleşmeden önlenmesi mümkün hale gelmiştir. Bu tespit işlemlerinde en sık kullanılan yöntemler veri madenciliği yöntemleridir. Finansal hile tespitinde; Karar Ağacı Destek Vektör Makineleri, Lojistik Regresyon ve Yapay Sinir Ağları en çok tercih edilen yöntemlerdir. Yaşadığımız Çağ'ın özellikleri, işletmelerde gerçekleşen dijitalleşmeye dönük çalışmalar, e-defter, e-fatura gibi dönüşümler yığın verilerin artması veri madenciliği yöntemlerinin daha sıklıkla kullanılmasına, sadece finansal hileli işlemlerin tespiti değil de birçok alanda rahatlıkla kullanılmasına imkân tanıyacaktır.

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ÇALIŞAN YETKİNLİĞİ VE TERCİH LİSTESİ DİKKATE ALINARAK AKIŞ TİPİ ÇİZELGELEME

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ÖZET
Akış tipi üretim ortamları, üretilmesi gereken işlerin sabit doğrusal bir yapıda işlenmesini gerektirir ve bu yapı birçok üretim sistemi tarafından yaygın olarak benimsenmiştir. Bu nedenle, yıllar boyunca araştırmacıların dikkatini çekmiştir. Akış tipi üretim çizelgeleme literatüründe makine odaklı unsurlara kapsamlı araştırmalar odaklanmış olsa da, çalışanla ilgili faktörler nispeten daha az ilgi görmüştür. Akış tipi üretim çizelgeleme çalışmaları, genel olarak yalnızca tek bir makinede çalışabilen ve tercihleri dikkate alınmayan çalışanlarla ilgilidir. Ancak gerçekte, çalışanlar birden fazla makinede çalışma konusunda yetkin olabilir ve nerede ve kiminle çalışacaklarına dair bir tercih listesi olabilir.
Bu çalışmada, birçok makinede çalışabilen çalışan yetkinliğinin ve çalışanların bireysel tercihlerinin dikkate alındığı akış atölyesi çizelgeleme problemini inceliyoruz. Önerilen karma tamsayılı doğrusal programlama modeli, yapılacak işler için makinelerdeki sıralamayı belirlerken toplam akış süresini (makespan) en aza indirmeyi ve işçi tercihlerini en üst düzeye çıkarmayı amaçlamaktadır. Model, Kayseri'de faaliyet gösteren bir PVC pencere ve kapı üretim firmasından elde edilen gerçek bir veri seti üzerinde test edilmiştir. Yapılan hesaplama sonuçları, üretim verimliliği (makespan) ile iş gücüne ilişkin faktörler (işçi tercih listesi) arasındaki seçimlerin çizelgeyi nasıl değiştirebileceğini ortaya koymuştur. Bu çalışma, akış tipi çizelgeleme araştırmalarında ve uygulamalarında işçi yetkinlikleri ve tercihlerinin dikkate alınmasının önemini vurgulamaktadır.
Anahtar Kelimeler: Akış tipi çizelgeleme, karma tamsayılı doğrusal programlama, çalışan yetkinliği, çalışanların tercihleri

FLOW SHOP SCHEDULING WITH CONSIDERATION OF WORKER COMPETENCY AND PREFERENCE LIST

ABSTRACT
Flow shop environments require jobs to be processed in a fixed linear structure, which is widely adopted by many manufacturing systems. Therefore, it has gotten the attention of the researchers throughout the years. Although extensive research has focused on machine-oriented elements in flowshop scheduling literature, worker-related factors have received comparatively little attention. Flowshop scheduling studies are mainly concerned with workers who can only operate on a single machine without considering their preferences. However, in reality, workers might be competent in working on multiple machines, with a preference list on where and with whom to work.
We study the flow shop scheduling problem in which worker competency and individual preferences are explicitly considered. A mixed integer linear programming model is proposed to minimize makespan and maximize the workers' preferences while determining the sequence of the jobs to be processed on the machines. The proposed model is tested on a data set obtained from a real production system, a PVC windows and doors production company from Kayseri, Turkey. Computational experiments showed the trade-offs between production efficiency

(makespan) and workforce-related aspects (worker preference list). This study highlights the significance of incorporating worker competency and preferences into flow shop scheduling research and practice.
Keywords: Flow shop scheduling, mixed integer linear programming model, worker competency, worker preferences

İSTASYON TERCİHLERİ DİKKATE ALINARAK ÇALIŞAN TAŞIMACILIĞI ROTA OPTİMİZASYONU

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ÖZET
Çalışanların işe gidip gelirken verimli bir şekilde taşınmasını sağlamak önemli bir operasyonel zorluktur. Çoğu personel servis güzergahı yaklaşımı, personelin alım ve/veya bırakım noktalarına ilişkin tercihlerini dikkate almadan toplam seyahat süresini, toplam seyahat mesafesini veya toplam seyahat maliyetini en aza indirmeye odaklanmaktadır. Bu tercihlerin göz ardı edilmesi, şirket tarafından sağlanan ulaşım hizmetinde çalışan memnuniyetini azaltabilir. Bu nedenle, bu çalışmada, çalışan taşımacılığı güzergah problemi üzerinde durulmuş ve istasyon tercihleri özellikle dikkate alınmıştır.
Toplam seyahat süresini en aza indirirken tercih edilen istasyon-çalışan eşleşmelerinin sayısını en üst düzeye çıkaran bir karma tamsayılı doğrusal programlama (MILP) modeli önerilmektedir. Model, her çalışanın belirtilen bir zaman aralığı içinde işe ulaşacak bir araca atanmasını sağlamaktadır. Model, pratik uygulanabilirliği garanti altına almak için araç kapasite sınırları, zaman pencereleri ve gerçekçi operasyonel kısıtları içermektedir.
Önerilen model, Kayseri, Türkiye'de faaliyet gösteren bir PVC pencere ve kapı üretim firmasında test edilmiştir. Yapılan hesaplama deneyleri, operasyonel verimlilik (toplam seyahat süresi) ile çalışan memnuniyeti (tercih edilen istasyon-çalışan eşleşme sayısı) arasındaki ödünleşmeleri vurgulamaktadır. Bu çalışma, çoklu araçlı güzergah problemlerinde rota verimliliği ve personel tercihlerini dikkate almanın önemini ortaya koymakta ve maliyet-etkinlik ile kullanıcı memnuniyetini dengeleyen ulaşım sistemleri oluşturmak için metodolojik bir çerçeve sunmaktadır.
Anahtar Kelimeler: Çalışan ulaşım problemi, karma tamsayılı doğrusal programlama, çalışanların tercihleri, çok araçlı rotalama problemi

ROUTE OPTIMIZATION FOR EMPLOYEE TRANSPORTATION CONSIDERING STATION PREFERENCES

ABSTRACT
Providing efficient transportation for employees to and from work is a significant operational challenge. Most of the personnel shuttle routing approaches focus on minimizing total travel time, total travel distance, or total travel costs without considering the personnel's preferences for the pick up and/or drop off stations. Neglecting these preferences can decrease personnel satisfaction in the transportation service provided by the company. This is why, in this study, we focus on the employee transportation routing problem, explicitly considering station preferences.
We proposed a mixed integer linear programming model that minimizes the total travel time and maximizes the number of preferred station-employee pairs while ensuring each employee is assigned to a vehicle that reaches the workplace within a specified time interval. The model includes vehicle capacity limits, time windows, and realistic operational constraints to ensure practical applicability.

We have tested the proposed model at a PVC Windows and Doors company from Kayseri, Turkey. Computational experiments emphasize the trade-offs between the operational efficiency (total travel time) and commuter satisfaction (number of preferred station-employee). This study highlights the significance of incorporating route efficiency and personnel preferences into multi-vehicle routing problems, providing a methodological framework for creating transportation systems that balance cost-effectiveness with user satisfaction.
Keywords: Personnel shuttle problem, mixed integer linear programming model, personnel preferences, multi-vehicle routing problem

24. GÜNEŞ DÖNGÜSÜ SIRASINDA KOZMİK IŞIN YOĞUNLUĞU VE GÜNEŞ RÜZGARI HIZINDAKİ KISA VE ORTA VADELİ PERİYODİKLİKLER

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ÖZET

Bu çalışma, 24. Güneş Döngüsü (2008–2019) süresince kozmik ışın yoğunluğu (CRI) ve güneş rüzgarı (SW) hızında ortaya çıkan periyodik değişimleri incelemek amacıyla dalgacık analizi yöntemini kullanmaktadır. Araştırmada hem kısa vadeli hem de orta ve uzun vadeli çevrimler ele alınarak, bu değişimlerin güneş aktivitesi, heliosferik yapılar ve Dünya'nın yörüngesel etkileriyle olan ilişkileri değerlendirilmiştir. Dalgacık analizi sayesinde zaman-frekans uzayında ayrıntılı bir çözümleme yapılmış, böylece farklı periyotların yalnızca varlığı değil, aynı zamanda hangi dönemlerde baskın hale geldikleri de belirlenebilmiştir. Bulgular, CRI verilerinde kısa vadede (~23–49 gün) zayıf periyotlukların bulunduğunu ve bunların Güneş'in rotasyon harmonikleriyle ilişkili olabileceğini göstermektedir. Daha güçlü sinyaller ise orta–uzun vadeli ölçeklerde ortaya çıkmaktadır. Özellikle 286 gün civarında belirgin periyotluklar bulunmuş, en baskın çevrim ise yaklaşık 360 gün olarak tespit edilmiştir; bu döngü yıllık modülasyonlarla uyumludur. Ayrıca 437 ve 570 gün civarındaki uzun vadeli çevrimler heliosferik ve Güneş döngüsüyle bağlantılı etkilerin bir yansıması olarak değerlendirilmiştir. SW verileri ise kısa vadede (~22 gün) güçlü bir periyotluk göstermekte, bu da Güneş'in rotasyon periyoduyla uyumludur. 94 gün civarında zayıf bir işaret görülürken, daha güçlü orta–uzun vadeli çevrimler 248, 310, 433, 567 ve 583 gün civarında tespit edilmiştir. Özellikle 1.5–1.6 yıllık çevrimler en baskın sinyaller olarak öne çıkmaktadır. Bu sonuçlar, hem CRI hem de SW'nin uzun vadeli periyodik modülasyonlarla karakterize olduğunu, ancak CRI'nin yıllık ve heliosferik döngülerden, SW'nin ise güçlü biçimde 1.5 yıllık döngülerden etkilendiğini göstermektedir.

Anahtar Kelimeler: Kozmik ışınlar, Güneş rüzgarı, Dalgacık analizi, Güneş döngüsü 24, Uzay havası

SHORT AND MID-TERM PERIODICITIES IN COSMIC RAY INTENSITY AND SOLAR WIND SPEED DURING SOLAR CYCLE 24

ABSTRACT

This study employs the wavelet analysis method to examine the periodic variations in cosmic ray intensity (CRI) and solar wind (SW) speed during Solar Cycle 24 (2008–2019). The research addresses both short-term and medium-to-long-term cycles, evaluating their relationships with solar activity, heliospheric structures, and the orbital effects of the Earth. Through wavelet analysis, a detailed examination in the time–frequency domain has been carried out, enabling the identification not only of the presence of different periodicities but also of the specific periods during which they become dominant. The results reveal that CRI exhibits short-term periodicities around 23–49 days, likely linked to solar rotation harmonics, while more significant signals are found in the mid-long-term ranges. Strong periodicities appear around 286 days, with the most dominant cycle at ~360 days, corresponding to annual

modulation effects. Additional mid-long-term signals near 437 and 570 days reflect heliospheric and solar-cycle-related influences. In contrast, SW data show a stronger short-term ~22-day periodicity, consistent with the solar rotation period, and weak signatures near 94 days. More robust mid-long-term cycles are detected around 248, 310, 433, 567, and 583 days, with the 1.5–1.6 year periodicities being the most prominent. These results confirm that both CRI and SW are characterized by mid-longterm periodic modulations, with CRI dominated by annual and heliospheric cycles, and SW exhibiting stronger ~1.5-year cycles tied to heliospheric processes.

Keywords: Cosmic rays, Solar wind, Wavelet analysis, Solar cycle 24, Space weather

INTRODUCTION

Cosmic ray intensity (CRI) and solar wind speed (SW), as key space-weather parameters, are strongly linked to the Sun's magnetic activity and the evolution of heliospheric structures. This linkage manifests through periodicities that vary across different phases of the solar cycle (minimum, maximum, rising/declining). The relative weakness of Solar Cycle 24 (2008–2019)—its extended minima and low peak activity—suggests possible deviations from classical cycle patterns for both CRI and SW. In this context, examining short- and mid-term periodicities with wavelet analyses is critical for revealing the nature of these deviations and how they evolve over time (Singh & Gautam, 2012).

Although there is no strict, universal boundary for "short–mid–long" periodicity classes in the literature, a common practice is as follows. Periodicities in the 10–100 day range (solar rotation and harmonics: ~9, 13.5, 27–33 days; with short-range clusters often reported around 16–30, 40–55, 60–70, and 80–100 days) are considered short-term. Mid-term (intermediate) periodicities span roughly ~100 days to ~1.5 years, including the Rieger-type ~150–160 days, ~190–210 and 240–260 days, and ~1.1–1.3 years; the ~1.3-year and ~1.5–1.6-year cycles are frequently grouped within this "mid-range" class (Chowdhury et al., 2010). That said, periodicities longer than one year are sometimes labeled intermediate-to-long-term. A solar-cycle scale (~11 years) and beyond (22 years, ~80–100 years, etc.)—in other words, long-term—is typically used for ~4000 days and above (Nayar, 2006; Hathaway, 2015).

Previous studies have identified the periodic components of CRI, solar activity, and solar wind, among other parameters, using similar analyses. For example, Katsavrias, Preka-Papadema, and Moussas (2012) demonstrated, through wavelet analysis, that periodic structures in SW parameters and magnetic indices can be detected over four solar cycles, emphasizing that these periodicities vary depending on the cycle and the time interval (Katsavrias et al., 2012). In another study, Galactic Cosmic Ray (GCR) data revealed transient periodicities of ~16–32, 32–64, 128–256, and 256–512 days during Solar Cycle 23, providing early evidence of the influence of mid-term cycles on CRI (Oloketuyi et al., 2020).

Specifically for Cycle 24, the study by Ross and Chaplin (2019) analyzed the time-lags and hysteresis curves between Galactic Cosmic Rays (GCR) and Sunspot Number (SSN), noting that the way CRI responds to solar activity differs compared to previous cycles (Ross & Chaplin, 2019). In addition, the study by Kotzé and Mursula (2025) demonstrated the presence of both short-term (approximately rotation period) and mid-term (Rieger-type, ~150–200 days) cycles in the anomalous cosmic ray component, showing that the strength of these cycles changes depending on the conditions between solar minimum and maximum (Kotzé & Mursula, 2025). Another example is the very recent study titled "Periodic Behavior of Selected Solar, Geomagnetic and Cosmic Activity Indices during Solar Cycle 24"; in this work, periodicities of 25–33 days (rotation), 52–61 days (Rieger-type), ~150–200 days (mid-term),

and longer than ~1 year were widely reported in parameters such as sunspots, coronal brightness, and magnetic indices. Thus, it is concluded that long-term effects extend at least as far as the Earth, while short-term ones are significantly influenced by regional dynamics such as the interplanetary medium, ionosphere, and magnetosphere (Kilcik et al., 2024).

The aim of our study, in light of the aforementioned literature, is to identify the time-varying dominance of short-term (rotation harmonics), mid-term (Rieger-type and similar), and long-term periodicities in CRI and SW speed during Solar Cycle 24 using wavelet analysis, and to interpret these findings in relation to solar activity indices, the heliospheric magnetic field, and the orbital effects of the Earth.

MATERIAL AND METHODS

Data Sets

The CRI data used in this study were obtained from the Oulu Neutron Monitor in Finland (65.05°N, 25.47°E; cutoff rigidity ~0.8 GV). The dataset has daily resolution and covers the period of Solar Cycle 24 (2008–2019) (https://cosmicrays.oulu.fi/). The Solar Wind (SW) speed data were taken from NASA's OMNI database. OMNI is constructed by combining measurements from various spacecraft and provides reduced daily mean values (https://omniweb.gsfc.nasa.gov/form/dx1.html).

Both datasets were pre-processed before being made suitable for periodicity analysis. Missing days were filled using linear interpolation, and long-term trends were removed to approximate stationarity. In this way, spurious power accumulations in the wavelet analysis were prevented.

1) ***2.2. Methods***

2) ***Continuous Wavelet Transform (CWT) was employed to identify the periodic components in the time series. The wavelet transform of a time series x(t) is defined as follows (Daubechies, 2002):***

$$W(a,b) = \frac{1}{\sqrt{|a|}} \int_{-\infty}^{\infty} x(t)\, \psi^* \left(\frac{t-b}{a} \right) dt \qquad (1)$$

Here, a is the scale parameter and is directly proportional to the analyzed periods, b is the time-shift parameter, and ψ(t) represents the chosen mother wavelet. In this study, the **Morlet wavelet** was preferred, as it is one of the most widely used wavelet functions in the literature due to its ability to optimize both time and frequency resolution (Torrence & Compo, 1998). The Morlet wavelet is defined as the product of a complex sinusoid and a Gaussian function:

$$\psi(t) = \pi^{-\frac{1}{4}} e^{i\omega_0 t} e^{-\frac{t^2}{2}} \qquad (2)$$

e^(iω$_0$t) is the periodic (oscillatory) part e^(−t^2/2) is the Gaussian envelope that ensures the localization of the wavelet along the time axis, and ω$_0$ is the central angular frequency, typically chosen as ω$_0$=6. This function provides good time resolution for short periods and high frequency resolution for long periods. The **Wavelet Power Spectrum (WPS)** was

obtained by taking the square of the absolute values of the wavelet coefficients (Torrence & Compo, 1998):

$$P(a,b) = |W(a,b)|^2 \tag{3}$$

The X-axis represents time (2008–2019), the Y-axis represents period (days), and the color scale indicates power intensity. This visualization shows during which intervals the short-term (~20–50 days) and mid-to-long-term (~100–600 days) periodicities become dominant. To identify the dominant periodicities independent of time information, the **Global Wavelet Spectrum (GWS)** was calculated:

$$G(a) = \frac{1}{T} \int |W(a,b)|^2 \, db \tag{4}$$

Here, T represents the total observation period. The GWS measures the average power of the periodicities obtained through wavelet analysis over the entire time span and reveals which periodicities are dominant. Unlike Fourier analysis, this method not only shows the existence of frequencies but also indicates the periods during which these frequencies become strong. In this way, the short- and mid-term cycles observed in CRI and SW throughout Solar Cycle 24 could be examined in detail within the time–frequency domain.

RESULTS AND DISCUSSION

Wavelet-based analysis reveals limited periodicities at short scales but pronounced periodicities at mid-to-long scales for both CRI and SW. Overall, while the annual scale (~360 days) is the most dominant component in CRI, the 1.5–1.6 year band (≈567–583 days) stands out prominently in SW. This general picture is consistent with the power distributions shown by the WPS–GWS pair and with the temporal evolution of the selected periodicities (Figs. 1–4; Table 1).

Table 1. Periodicities in CRI and SW during Solar Cycle 24: periods, power, and physical interpretation.

	Cosmic Rays Intensity (CRI)			**Solar Wind Speed (SW)**		
No.	Period (days)	Power	Explanation	Period (days)	Power	Explanation
1	23	0.546	Short-term, weak signal. Likely a side component of the ~27-day cycle.	22	5.98	Short-term strong cycle; may be related to the side component of the Sun's rotation period (~27 days).
2	49	0.473	Weak short-term cycle, not well-defined.	94	1.63	Weak period; probably related to 3×27 day rotation subharmonics.
3	119	1.668	Medium-term signal. May be	248	8.32	The medium-term strong cycle may be associated with semi-periodic modulations in solar

			related to solar activity.			activity on a ~8-month scale.
4	286	5.797	Medium-term strong period. Dominant cycle in cosmic rays.	310	13.06	Strong period close to the annual cycle; may be related to heliospheric current sheet obliquity and Earth orbital effects.
5	360	6.791	Strongest annual cycle (~1 year). Associated with seasonal and heliospheric effects.	433	13.03	~14-month cycle; may reflect long-term activity oscillations of the Sun.
6	437	4.524	Medium-long-term cycle. Solar cycle may have side effects.	567	19.11	~1.5 year cycle; compatible with the semi-solar cycle.
7	570	5.690	Long-term cycle that may be related to the semi-solar cycle (~1.5 years).	583	23.42	The strongest signal, a ~1.6 year cycle, is one of the frequently reported long-period modulations in the solar wind and heliosphere.

For CRI, WPS shows the weakness of short-term components with colors fading within a range of 20–100 days; in GWS, a sharp peak is observed around ~360–365 days, with secondary rises in the 280–320 day band and at ≥500 days (Fig. 1).

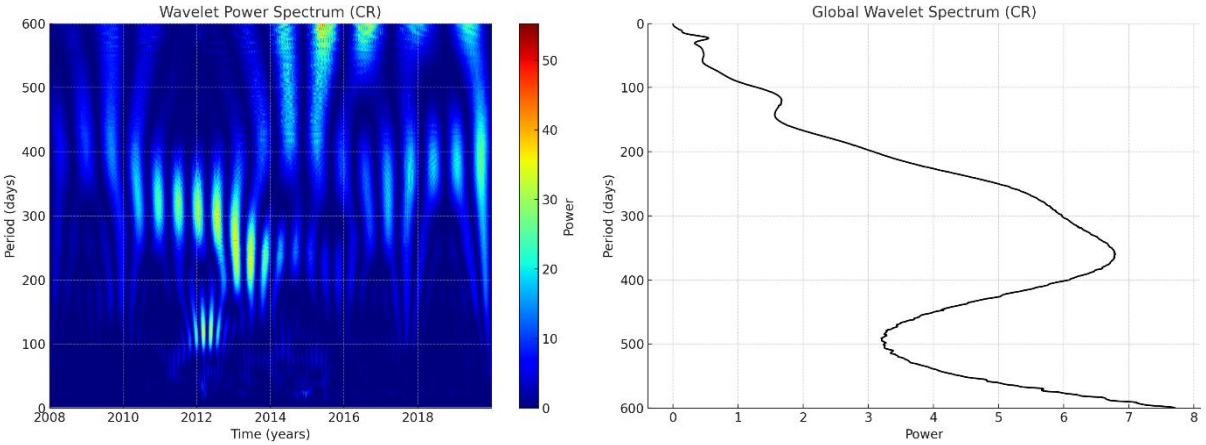

Fig. 1. CRI wavelet power spectrum and global wavelet spectrum

The time evolution of selected periods shows that the 23- and 49-day cycles are low-amplitude and discontinuous; the 119-day cycle is not consistently dominant despite periodic intensifications; and the 286-, 360-, 437-, and 570-day cycles produce distinct peaks over multiple years (Fig. 2).

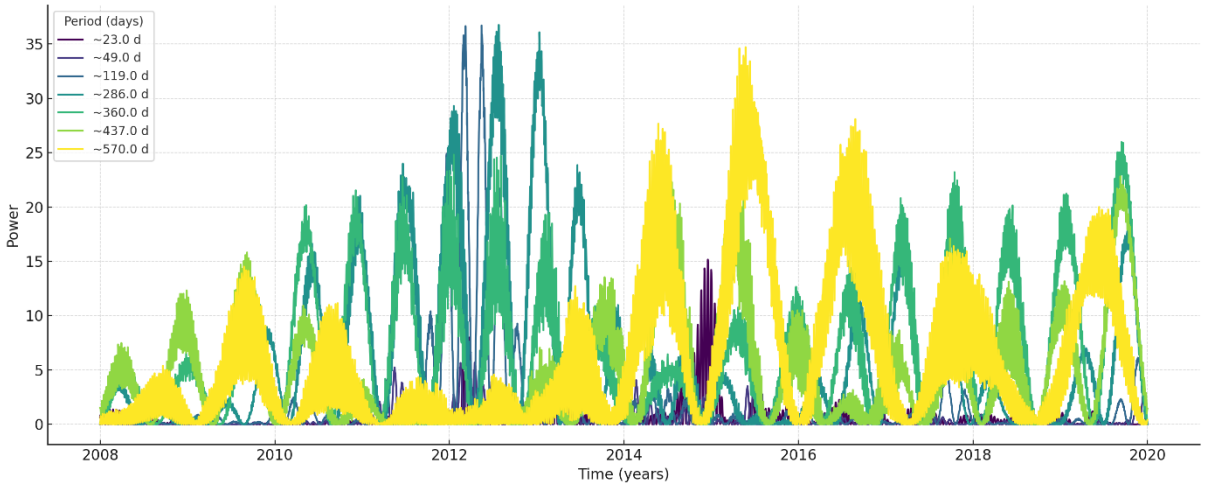

Fig. 2. Temporal evolution of selected CRI periodicities (23, 49, 119, 286, 360, 437, 570d)

Quantitatively, Table 1 confirms that the 360-day period has the strongest peak in CRI, while the increases at 286 and 570 days are secondary but persistent in nature. Weak power in short periods (23–49 days) indicates the damping of the Sun's ~27-day rotation harmonics in the CRI, while the strengthening at annual and ~1.5-year scales suggests sensitivity to heliospheric/geometric modulations (orbit, current sheet inclination, etc.). (Fig. 1–2; Table 1).

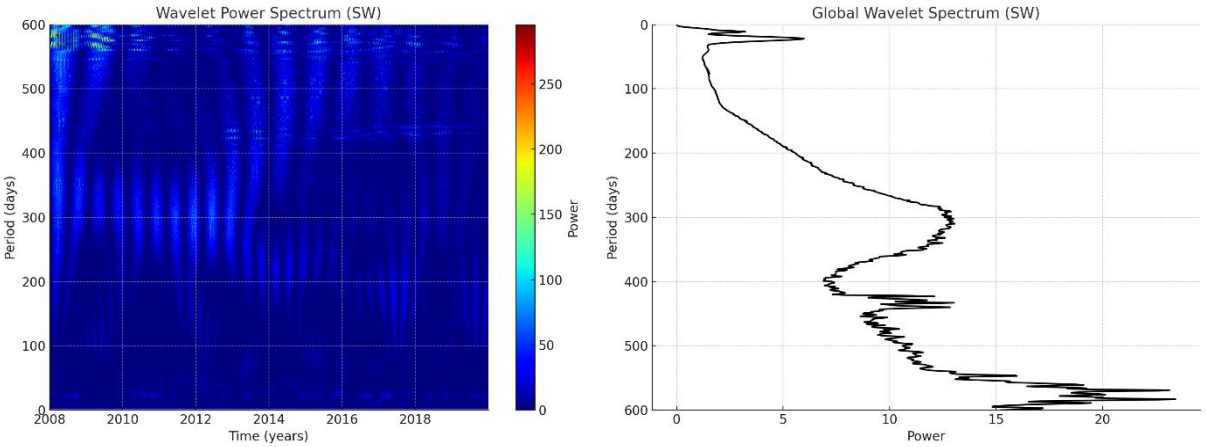

Fig. 3. WPS and GWS plots for SW

The WPS–GWS pair for SW shows limited power between 0–100 days; it exhibits distinct peaks in the 250–400 day band and the 400–600 day range (Fig. 3). The time evolution graphs show periodic intensifications in the 248-day and especially the 310-day cycles; the 567-day and 583-day cycles, on the other hand, produce high and persistent power throughout almost the entire time period (Fig. 4). Table 1 highlights the 583-day cycle as the strongest signal and the 567-day cycle as the second strongest signal; the 433-day (~14 months) and 310-day (close to annual) cycles provide significant contributions in the medium–long band. At short scales, the ~22-day cycle is strongly aligned with rotation; however, this strength tends to be intermittent over time (Fig. 3–4; Table 1).

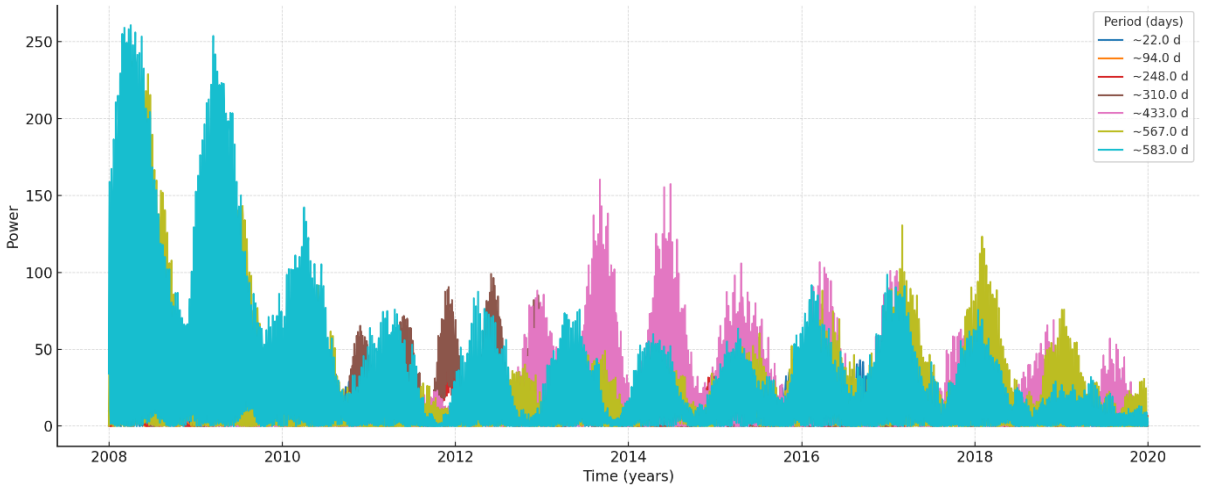

Fig. 4. Temporal evolution of selected SW periodicities (22, 94, 248, 310, 433, 567, 583d)

In SW, the ~22-day cycle is strong, while in CRI, the 23–49-day band is weak. This divergence can be attributed to SW reflecting direct rotational drivers, whereas CRI is more "smoothed" by diffusion/transport processes and magnetic turbulence. While ~360 days is clearly dominant in CRI, the strongest windows in SW shift beyond the annual scale to 1.5–1.6 years. 1.2–1.6 year band: Although present in both variables, this band is much more energetic in SW (peaks at 567–583 days); traces of the same band in CRI (esp. ~570 days) are more moderate. This pattern indicates that CRI is more sensitive to annual/heliospheric modulations, while SW is more sensitive to the sustained influence of long-term heliospheric structures (~1.5 years) (Fig. 1–4; Table 1). Power variations over time for selected periods show that annual and ~570-day cycles in CRI repeatedly strengthened over several years, while 567–583-day cycles in SW were particularly prominent in 2008–2010 and 2013–2016 (Fig. 2, Fig. 4). These windows point to a modulation pattern consistent with the phase dynamics of Cycle 24 (long minimum, weak maximum, polar field reconfigurations, etc.).

Longer-term (≈1–1.6 years) modulations should be included as a baseline component in both CRI and SW forecasts; the clear dominance of the annual component on the CRI side highlights the interaction of ground-based observations with the geometric/heliospheric layer. In physical terms, the attenuation of the 27-day rotation signal in CRI, while it is directly visible in SW, indicates the role of propagation and magnetic diffusion; The continuity of the 1.5–1.6-year band in SW suggests the decisive influence of large-scale heliospheric structures (current sheet architecture, HMF reorganizations). Looking at the opposite sensitivities, the fact that CRI carries the annual cycle and SW carries the ~1.5-year cycle as the "carrier" mode in the same time interval indicates that the two parameters are modulated through different physical channels (Fig. 1–4; Table 1).

This study is based on daily averages; higher time resolution may provide additional insight into the continuity of short-term modulations. Furthermore, phase-sensitive joint analyses of periods (e.g., power-based or coherence-based approaches) will be useful for quantitatively testing CRI–SW synchrony and phase shifts.

CONCLUSIONS

This study has demonstrated that the two parameters are sensitive to different heliospheric processes by revealing the evolution of periodic modulations in CRI and SW velocity in the time-frequency domain throughout the 24th Solar Cycle. While short-scale (~23–49 days) signals in CRI remain discontinuous, ~286-day and especially ~360-day (annual) cycles are distinctly dominant at medium-to-long scales. Furthermore, stable power accumulation in the ~437 and ~570-day bands indicates traces of heliospheric/orbital modulations. In contrast, SW exhibits a strong but discontinuous ~22-day rotation component at short scales, while showing periodic power increases in the ~248 and ~310-day cycles and, most strikingly, a persistent and high power density in the ~567–583-day range (≈1.5–1.6 years). A common interpretation of the WPS–GWS findings suggests that CRI is more strongly linked to annual and semi-solar scales, while SW is more strongly linked to the 1.5–1.6-year heliospheric cycle; therefore, modeling the annual band for CRI and the 1.5-year band for SW as fundamental modes in space weather forecasts would be appropriate. While it should be noted that the short-term continuity of resolution based on daily averages may be limited, the casal connections of these multi-scale structures can be tested more robustly in the future with higher time resolution and phase/coherence-based common wavelet analyses (e.g., CRI–SW phase shifts, delays). It is crucial to perform these analyses not only with CRI and SW but also with many other solar parameters.

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TARİHİ JAPON WASAN GEOMETRİSİ YARDIMIYLA DÖNÜŞÜM GEOMETRİSİNİ ÖĞRETMEK

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ÖZET

Bu çalışmanın amacı wasan geometrisi yardımıyla dönüşüm geometrisini öğretmek için bazı ders aktiviteleri geliştirmektir. Wasan geometrisi, Japonya'nın tarihi Edo döneminde çoğunlukla akıl çelici problemlerle ortaya çıkmış, geometrik, bir matematiktir. Bu problemlerin özellikle odak grupları için, eş çemberler için, teğetler için, Pisagor teoremi için, trigonometri için, orantılar ve benzerlik için birçok çözümü vardı.

Bu çalışmanın yöntemi tasarım -bazlı araştırmanın birinci fazı olarak düşünülmüştür. Dönüşüm geometrisini öğretmek hareket ve haritalama bakış açıları bazında dikkatlice düşünmeyi gerektirir. Bu bakış açısı süreçlerin gelişiminde kullanılmıştır. Farklı simetri çeşitleri ve yansıma olası sonuç figürlerindeki değişimleri göstermek için gösterilmiştir. Bu da öğrencilerin yaratıcılığına ve problem anlayışına faydalı olur. Burada, görseller noktasal bir bakış açısı ve konumlama kazanır. Daha sonra, olası yansımalar, daha sanatsal yaratılar için dikkate alınır. Sonuç olarak, görsel dönüşüm geometrisi bağlamında yeniden oluşturulur (ötelemeler, yansımalar ve dönmeler) ve son halini alır. Bu görseller, farklı bakış açıları, didaktik avantajlar ve sanatsal gösterimler için analiz edilir. Böylesi problemleri oluşturmak için bir prosedür paylaşılır ve Wasan geometrisinden olası yaratılar örnekler olarak verilir.

Kaynakça, dönüşüm geometrisini öğretmenin, kritik düşünceye, simetri öğrenmeye, varsayımlarda bulunmaya, yaratıcılığa ve akıl yürütmeye faydalı olduğunu paylaşmaktadır. İlk olarak, Wasan problem anlaşılır. Bu problem çözmeye yardımcı olur. Bazı şekillerde bazı wasan problemleriyle başka Wasan geometri problemleri oluşturulabilir. Ve bu da öğrenciler de problem kurmayı destekler. İnşa, Wasan geometrisi problemlerini matematiksel yapılar olarak görmeyi kolaylaştırır. Ve bu yapıların analizi ve oluşturulması da düşünce sistemlerini oluşturur. Bunların çoğu prosedürün didaktik avantajlarındandır. Bunun dışında, bu müfredat aktiviteleri, disiplinlerarasılık taşırlar.

Anahtar Kelimeler: Wasan Geometrisi, Dönüşüm Geometrisi, Analitik Geometri, GeoGebra, Dijital Sanat

TEACHING TRANSFORMATIONAL GEOMETRY USING JAPANESE HISTORICAL WASAN GEOMETRY

ABSTRACT

To develop some curricular activities for transformational geometry teaching via Wasan geometry is aim of the study. Wasan geometry has flourished in the Edo Period of Japan as challenging problems mostly geometrical. These problems had many solutions, for diverse focus groups, and involved congruent circles, tangents, Pythagorean Principle, trigonometry, proportions, and similarity.

Method of study is thought of as design-based research. However, only the first phase is included here. Teaching transformational geometry needs careful consideration of motion and mapping perspectives. This perspective is included in the development of procedures. Different kinds of symmetry and reflection are tried to be included to show variations in possible resultant figures. This adds to the creativity of students and more on understanding of the problem. Here, the visual gains a point-by-point appreciation and positioning wherever possible. Then, possible reflections are taken regarding the problem visual to end up with more artistic creations. Resultantly, the visual is regenerated by transformational geometry (translations, reflections, and rotations) to end up with final piece. These visuals are analyzed for different perspectives, didactical advantages and artistic possibilities. A procedure to carry on such problems was shared and possible creations from Wasan geometry were given as examples.

The literature suggests that teaching transformational geometry adds up to critical thinking, symmetry learning, building assumptions, creativity, and argumentation. First, the Wasan problem should be understood. This adds up problem solving. Somehow some Wasan problem could be used to create more problems. And this enhances problem formation of the students. Construction makes it easy to see Wasan problems such as mathematical structures, hence, to analyze and make use of these structures can be full of deductive and inductive thinking possibilities. These are all didactical advantages of such a procedure. Besides all advantages, these curriculum activities carry interdisciplinarity between mathematics and art.

Keywords: Wasan Geometry, Transformational Geometry, Analytical Geometry, GeoGebra, Digital art

INTRODUCTION

Teaching transformational geometry via Wasan Geometry is a new topic that has not been studied before. Transformational geometry covers translation, reflection and rotation topics of analytical geometry. Translation is pushing a shape or point for a predefined distance. Reflection is choosing the same distance points from a line or from a point. Similarly, rotation covers movement of a shape around a point for an angle.

GeoGebra is an open-source DGS (Dynamic Geometry Software) which enables three representations (algebraic, graphical and tabloid) to be demonstrated in harmony at the same time. A student can see algebraic representation (formulas, variables, etc.) as well as graphics of transformational geometry. Finally, GeoGebra can be used for artistic expressions regarding transformational geometry. Using snipping tool (ekran alıntısı aracı) of Windows, by using cut, copy and paste, dragging features of GeoGebra, it is possible, to prepare some transformational GeoGebra art possible. It also enables interdisciplinarity between mathematics, GeoGebra use and art. Some n-rayed stars can be made, some reflective tiling art is possible. Sometimes, even it is possible to solve some Wasan problems this way. In detail, for translation; replacing a Wasan problem in coordinate axis intersection or replacing it within the same distance, for reflection; reflecting the problem image w.r.t. an axis or to origin etc. and for rotation; having some n-rayed stars from Wasan image problem by angle degree variations is a possibility.

Use of Geogebra

By carrying previously mentioned procedures, Wasan image becomes an art piece by transformational geometry. Also, transformational geometry can be used to solve the Wasan

problem with the help of visualization. Cause, sometimes reflection of Wasan problem demonstrates a new look that was not possible before reflection.

Also, GeoGebra can be used to construct the given Wasan problem if applicable. Constructions by compass and ruler are very helpful in understanding geometrical relationships, and rules of Euclidean Geometry. Sometimes visual proof comes out of this act, sometimes, do not. However, it is still helpful cause it gives a chance to move the shape /problem with DGS part of the GeoGebra.

Finally, using GeoGebra as an animation of the Wasan problem can be fun and educational. Points, places, angles, radius of congruent and incongruent circles, tangents can be refurbished, and new problems can be identified (Okumura, 2021). Students may feel the joy of problem formation as much as problem solving.

Wasan Geometry

Let's start with an easy Wasan problem: This problem visual is taken from Golden (2018). In the problem below (Figure 1), the purple area measure is asked if the square area is a^2, thinking that one side of the square is "a". If one draws a parallel line to the right-hand side as shown, then this line divides the diagonal into 1/3 rds. due to parallelism and equal sides of the established parallelogram. Then, the purple area should be 2/3 of the area of the 1/2 of the square. If we multiply 2/3with ½, we end up with 1/3 of the area. In other words, the purple shaded area has an area measure of 1/3 of the whole square. This problem is suitable for even middle school students. Now, let's make use of this problem for transformational geometry.

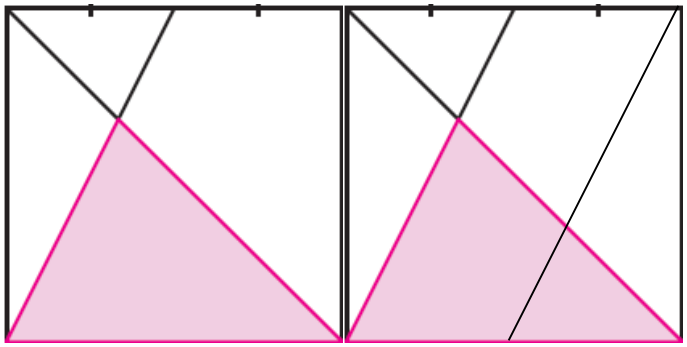

Fig. 1. An easy Wasan problem taken from Golden (2018)

For this purpose, we cut and paste the figure and take reflection of the figure w.r.t. x axis and y axis. One may ask what is the shaded areas ratio to the whole square outside? This time, it is much clearer due to the figural displacement (Figure 2). The figure contains Equi-measured areas inside the small squares, and this can be seen by our auxiliary line. Playing with the tiles as tangram can make students see the same problem in very different ways. If a parallel line is drawn to the right-hand side starting from the right corner to the bottom half, problem can be understood much better. And the area becomes $(a^2)/3$.

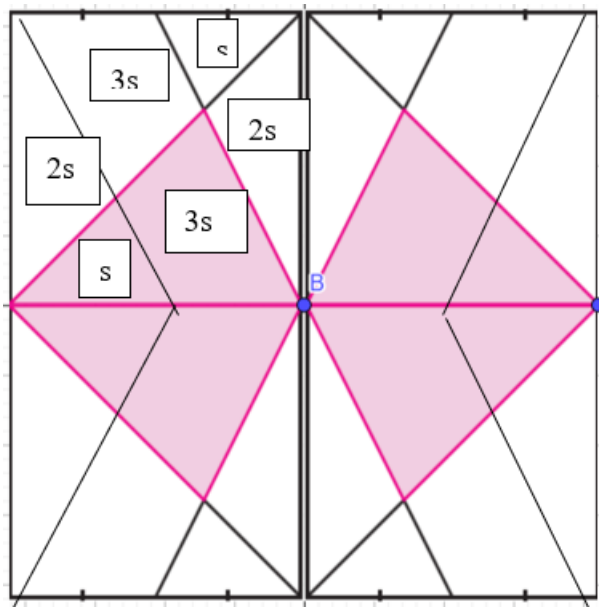

Fig. 2. Variations of the same problem via transformational geometry (Especially reflection w.r.t. line)

To be able to carry out this, the following procedure is adjusted accordingly.

-copy image with Spinning Tool.

-paste to GeoGebra graphical screen

-translate the image corner to the origin.

-either rotate around origin with an angle continuously or reflect w.r.t. x and y axis till you find the original piece.

These activities listed in this paper can be listed under teaching activities integrated to teach transformational geometry by Wasan geometry. A curriculum piece is written for this kind of interdisciplinary activity. Here the target group is pre-school mathematics teachers since they will be teaching mathematics to the new generation in the close future. The same piece can be adapted for easier Wasan problems to high school and university analytic geometry classes.

Not all acts result in a transformation. These Wasan problems mostly are intuitive problems that need to be looked at from many perspectives. Traditional geometry techniques are adding extra lines (auxiliary lines), transformations, similarity, estimated measures, partitioning fractions and looking for any kind of geometric relationships. But above all, one needs to remember the main statement of Polya as “understand the problem” (Golden, 2018). For this purpose, looking at the same problem by turning it, by taking reflections, or by dragging it can enhance understanding.

Literature Review

Descartes (1560-1650) named Cartesian Coordinate system. This gave a relation between geometry and algebra. Transformational geometry is a part of Euclidean geometry. This created many geometric designs linking art and culture. Traditional pottery, architecture, rugs, quilts, appliques, Islamic art carries transformational geometry into crafts. From the topics of transformational geometry, especially symmetry was appealing to architecture and cultural

artifacts. Group theory from algebra united with transformational geometry created frieze patterns and wall-paper patterns. A good example was of Alhambra Palace wallpaper patterns built around the 13th or 14th century. This is called also tessellation and tile work carries construction with specific floor covering tiles arrangement. Also, many artists used tessellations and symmetry in their art, like Escher. He even created a systematization of these patterns through crystallization (Peil & Martin, 2006).

Makishita (2010) mentions empirical research and development of teaching materials for mathematics to foster rich creativity. He even gives a short description of Wasan geometry. Japon was under the management of Tokugawa Shogunate in Edo Period. Edo Period mathematics in Japan is called Wasan Math. In Meiji Period after Edo Period Japan turned back to Western math, so few people know Wasan today. Takenouchi (2004) stated that Wasan inherited from Chinese math. It is said that 1400 sangaku were presented to shrines and temples while only 900 are left due to bad weather and wars (Makishita, 2010; Takenouchi, 2004; Stipancic-Klaic & Matotek, 2011; Unger, 2022). Some of these tablets recovered can be seen in Tohoku University Digital Collection, Yamagata University, Kyoto University, Waseda University, and Tokyo University of Science repository collections (Okumura, 2021). These tablets covered no proof but rigorous thinking. Stipancic-Klaic & Matotek (2011) listed advantages of sangaku: some were simple for younger students while some were a challenge hence still be unsolved. Sangaku meant mathematical tablets like puzzles, geometrical problems on wooden tablets. They were hung under the shrines and temple roofs as a challenge to all. They were also work of art. Problems were mostly from Euclidean Geometry. Some were good enough for high school or college students, but some were either from integral calculus or from expansions in infinite series of terms by term calculated. These problems are unique among the world's cultural creations (Stipancic-Klaic & Matotek, 2011).

Hartmann (2022) and Fukagawa & Horibe (2014) explained the title "San" "gaku" as "calculation (math) tablets" from old Japanese. Wasan problems were also named as Idai since they were challenging and were out of solutions. An average of 153cm by 70 cm tablets were colorful like an art piece. And each tablet was including many problems at once. Beginning of Wasan is known as the book of JinKoo-ki written in 1627 near the start of Edo period by Yoshida Mitsuyoshi. Surprisingly, not only children but also women, merchants, and samurai could create Sangaku if desired. We owe our gratitude to Yamaguchi Kanyon (1871-1850) who pilgrimed to all Japan to gather original Wasan problems so that world's first encounter with was an was through a book dated 1989 Japanese Temple Problems: Sangaku by David Pedoe and Fukugawa Rothman. In 2004, 1'st exhibition of sangaku at Nagoya Science Museum exhibited almost 100 sangaku from all over the Japan (Fukugawa & Horibe, 2014).

Tamaki et al (2022) studied a programming teaching material based on Wasan. Study was using Edu Blocks as software. Wasan problems ranging from arithmetic /algebra: merchant problems, geometry and recreational problems (Albrecht, 2008, cited in Tamaki et al, 2022). Hashimoto (2010) focused on the significance of integrating Wasan with math ed and developing Wasan with math ed into teaching to foster mathematical thinking ability. Understanding of variables, and repetition looked like the focus to achieve this.

Akarsu & İler (2024) studied transformational geometry by review of literature. Martin (1982, cited in Akarsu & İler, 2024) gave the definition of geometric transformation: one to one correspondence between set of points in a plane with itself. To learn geometric transformation develops visualization skills, analytical strategies, and critical thinking abilities. It also enables us to see the relations of mathematics with other science areas. These should be integrated with curricula to develop students' skills and for students to use these as effectively as possible. To understand geometric transformations, 3 critical parameters are listed: symmetry axis,

symmetry domain set, and plane. From these, some are shown to be difficult for students to understand. NCTM (2000, cited in Akarsu & İler, 2024) gives the role of the DGS as manipulating the shapes, visualizing how this manipulation changes the shape while learning transformational geometry. Dragging and measuring specialties of DGS helps in understanding the specifics of transformational geometry, creating hypotheses, using different strategies and new comprehension. Movement and correspondence principles are important. They also state that future researchers should focus on understanding mathematics students, spatial thinking skills and interdisciplinary study skills. Geometric transformations are translation, reflection and rotation (Akarsu & İler, 2024). In their study, unanswered questions stated are how to define three (translation, reflection and rotation), how to conceptually process difficulties. Knuchel (2004, cited in Akarsu & İler, 2024) stated that patterns from Islamic civilization and introduced to Europe through Arabic world in 13th century can be associated with concepts, rotation, reflection, and translation. In the plane. Beardon (2002, cited in Akarsu & İler, 2024) posited tessellations in decorative art. Flanagan (2001, cited in Akarsu & İler, 2024) stresses that geometrical transformation can be a topic for interdisciplinary study. It is possible to make students engage in higher order reasoning activities using various representations. These in turn can play a role in students' perception of math as an interconnected discipline. Jones (2002) argues that cognitive skills such as critical thinking, intuition, problem solving, making assumptions, deductive reasoning, logical argumentation and judgement are a result of learning transformational geometry.

In understanding transformational geometry, it is supposed to be a possible shift from verbal representations towards visual representations. And these support the development of analysis and problem solving (Jung, 2002). Yenik (2014) identifies exploration of patterns' rules, engaging in deductive reasoning and generalization to enhance spatial and critical thinking skills. MoNE (2005, cited in Yenik, 2014) geometric transformation is important in daily life and supports creative thinking skills and even spatial competency and visualization skills as well as analytical strategies.

Motion and mapping perspective of Transformational Geometry

Regarding the understanding of transformational geometry, Akarsu & İler (2024) argue that two perspectives should be taught: motion vs. mapping perspectives. Here, equidistance vs. perpendicularity points to mapping view on reflection whereas considering all points in the plane is related to motion perspective in reflection. They also posit challenges in comprehending the significance of mapping view. By using Wasan geometry and GeoGebra as artistic view, it is possible to address both mapping and motion perspectives since placement on the analytical plane points to mapping while dragging shapes for a distance point to the motion perspective. Clearly, using both perspectives at the same time leads to full understanding of transformational geometry. Through interactive figures (DGS), students may discover that a reflection results in the transformed shape being equidistant from the line of reflection, compared to the original shape.

In Akarsu & İler (2024), Hollebrands (2007), Yanin (2009) and Harper (2003) identify basic features of isometries. The shapes under geometric transformation are isometric point by point. Hence, the property of the shape is carried under reflection, translation and rotation. Isometries are important part of mathematical structures since they carry similarity and equality (Çeziktürk, 2022). By dragging the tail or the head of a vector, participants could identify how changes in direction and magnitude of vector impact the location, size, and shape of the translation. DGS technologies can potentially assist learners in testing and verifying

conjectures. This is unfortunately not proper proof but visual proof to be certain and still is important for building conjectures and testing hypothesis.

Namikawa (2012) identifies some topics for innovation in the 21st century as uncertainty, symmetry, function and set. From these, symmetry is one of transformational geometry features and needs further thinking. Çeziktürk-Kipel (2015) studied symmetry in impossible figure structures and found that especially rotation of 3-fold and 6-fold ones are difficult for students to understand. With this study, it is easy to form even n-rayed stars by transformational geometry principles of Wasan geometry problem visualizations. Symmetry or reflection w.r.t. a line is understandable but to extract it from the structure is a challenging situation. Similarly, Durasi et al. (2019) point to the misconceptions related to symmetry axis and symmetry definition within the student teachers.

Again, there is some empirical research on Wasan geometry as well even though their number is limited. Çeziktürk (2019) investigated the potential of Wasan problems of multi-solution problems. It turned out that some Wasan problems can be solved in 24 different ways. Some solution ways can be used in composite ways however, study proved that there is a high capacity of Wasan geometry of multiple solution problems. Another empirical study was of Çeziktürk & Özdemir (2021) resulted that cognitive registers and representations are a problem. Treatments are easier but conversions require more engagement and understanding. Neither problem type nor correct answer is a reason for the choice of representational registers. Sometimes, the problem can be solved by one easy treatment worth many conversions. Some directions of the conversion may be misleading and may be a problem for problem understanding. None of the students stays in mono-functional registers. Top and lowest grade students use more treatments and conversions. Using more conversions is not related to success and results in a smaller number of treatments. Another empirical study proved that using Wasan geometry has positive significant effects on van Hiele levels of students (Çeziktürk-Kipel, & Özdemir, 2016).

Literature suggests Wasan may have effect on thinking ability, judging ability and representation ability. Mathematical representations of Wasan geometry are unique and carries a structural unity. To teach anything structural requires understanding the parts of the structure and the relations among these parts that builds the whole (Çeziktürk, 2022). Wasan geometry has special parts and very intriguing relationships between parts like Pythagorean principle, similarity, tangents, trigonometric relationships, area divisions, etc. Somehow, they may be introducing mathematical literacy and rising it to a higher degree by the specific problems.

Any curriculum should cover core math, history of math, modern math, interdisciplinarity and language perspective (Namikawa, 2012). Wasan enables these all-in-one baskets. Okumura (1999) similarly argued that studying geometry using interactive diagrams, changes, and transformations within Wasan Geometry by changing angles, sides of given shapes, points/location, segments may result in new solutions to old problems or may result even in new problems from old problems. Incorporating this fact in curriculum activity development meanwhile may result in problem formation development. Laigo et.al. (2016) pointed to the value of geometrical construction problems. This may result in logical reasoning, discussion stimulators, and understanding of GeoGebra affordances, reflecting the axiomatic system of Euclidean Geometry. Of course, the complexity of the problem is a mediating factor here. By this way, GeoGebra can create a more stimulating discussion in classes. Vallo (2021) also directed thought to didactical advantages of the visualization of the Wasan problems via GeoGebra. These advantages even carry some interdisciplinarity.

Another empirical study was of Demir & Kurtuluş (2023). They studied transformational geometry from the perspective of the van Hiele Levels of geometric thought from grade 1 to 8. They posited that,

Level 0: simple understanding of shapes between geometric shapes

Level 1: students understand changes and characteristics of shapes

Level 2: students perform composite transformations

As a result, no gains in rotation as transformation was detected. And consequently, no objectives hence no content were identified in the curriculum or in the textbooks (Demir & Kurtuluş 2023). Another result was identification of giving translations under the perspective of position hence motion rather than mapping.

Unger (2022) pointed to the variations in Wasan geometry problems by transformational geometry. Whether to benefit to solve this problem, or to use it to understand transformational geometry better is a matter of choice. But it can help both (Unger, 2022).

Possible activities for analytic geometry course on transformational geometry topic by Wasan Problems

Aim of construction

Okumura (1999) shared another problem of whom visual can be seen at Figure 3. Problem says that if all those quadrilaterals are squares, then the D, E and D' are co linear and the rectangle which covers whole problem has sides ratio as 3:5. This problem may be good example of construction use of GeoGebra with Wasan problems. Making students construct this problem and seeing what can be varied and what cannot and why; may be a good start for this kind of problem solving. GeoGebra enables movable points (variants) and invariants that may show the whole problem in a new direction. Besides, by transformational geometry it becomes a very nice art piece.

While making construction via GeoGebra, it is a possibility to come up with a question that why to do first and what to do next. Where you start shapes the drawing of the whole problem. When you draw the shapes in the wrong order, then variants and invariants of the shape and visual mixes and this results in wrong resultant figure. Relationships of the partial shapes like different squares need to be drawn one by another in the right order and connections should be made accordingly. Uncertainty here reflects the drawing of the visual of the problem, and if you cannot draw, most probably you cannot end up with a solution. Triangles in between need to be thought in relation to squares drawn accordingly. It is clear even from drawing that they all need to be lined up but of course the ratio needs further algebraic strategies to handle.

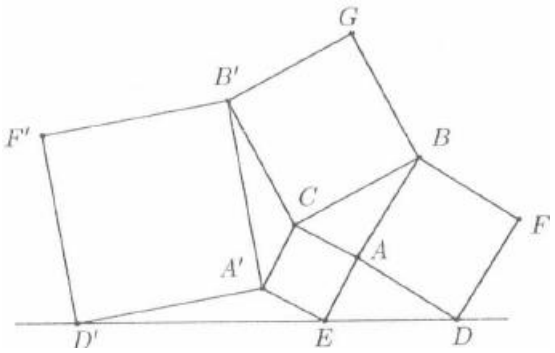

Fig. 3. Wasan problem #2 from Okumura (1999)

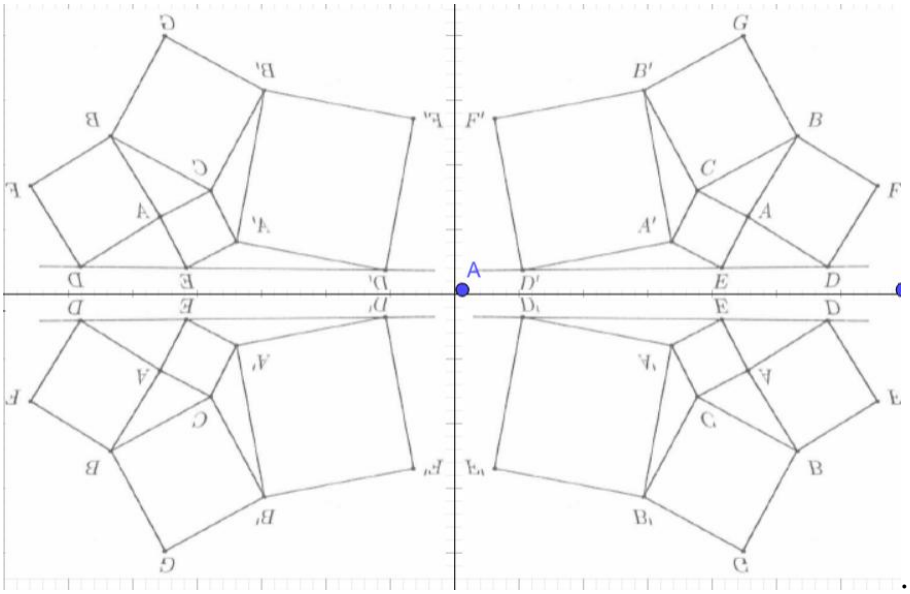

Fig. 4. Reflection of Okumura (1999) problem w.r.t. x and y axes.

Figure 4 on the other hand, use of transformational geometry with problem at hand. Reflections to x and y axes create a vision of a pattern. This pattern shouts that one can start to the solution of the problem even from any of these reflections. Reflection on the 4th region clearly exposes the Pythagorean theory visual proof combined with a square with a tilted look.

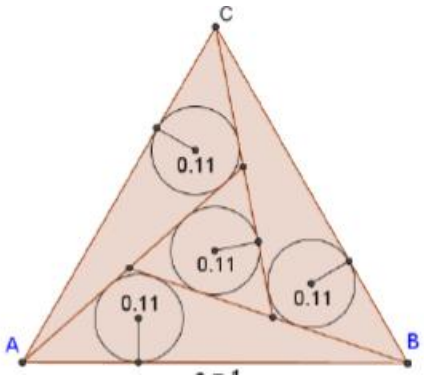

Fig. 5. construction problem from Laigo et al. (2016)

Figure 5 covers another original problem from Wasan. Given an equilateral triangle of side a, a line through each vertex can be constructed so that the incircles of the four triangles formed are congruent. Furthermore, the incircles all have radii $1/8(\sqrt{7} - \sqrt{3})\ a$. It is a theorem to be

proved. It can be again constructed via GeoGebra. However, the shape suits so much beautifully to a 6-pointed star figure from İslamic art. It asks for rotation by 60 degrees around the origin. GeoGebra is very effective in establishing this resultant figure below. The problem is difficult to prove but students can see the 360 divided by 20- and 40-degree angles around the origin to add up 60 degrees. And some concentric circles around the origin, passing through the centers of the circles may show some other relationships. 6-rayed rotation is difficult to understand in transformational geometry, but with this example it stays away from being a problem but can be a matter of fun.

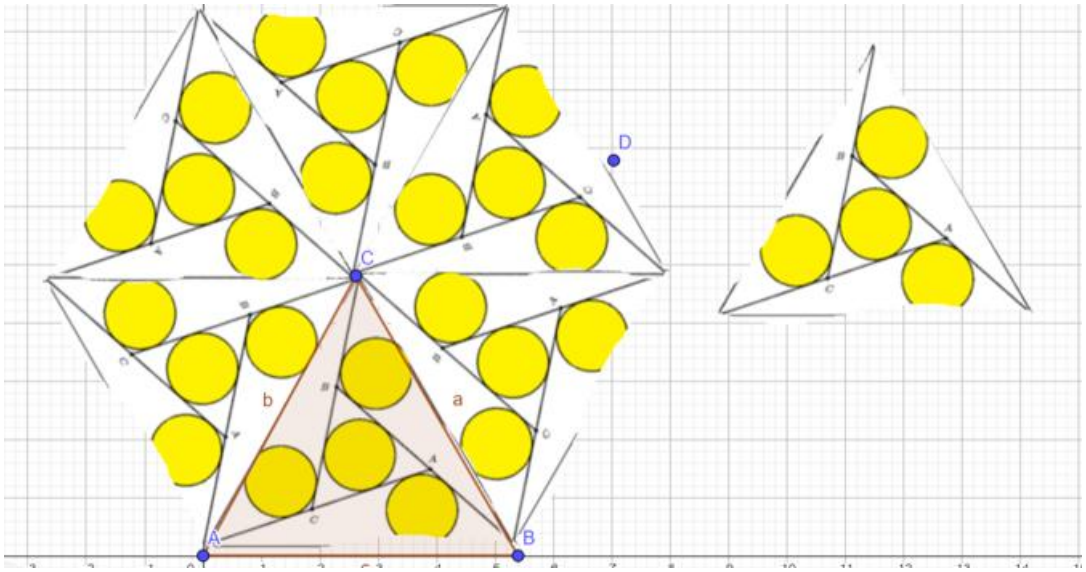

Fig. 6. Transformational geometry pattern established from Laigo (2016) Wasan problem.

Figure 7, 8, 9 and 10 shows two other examples from Wasan geometry as in the wheel of transformational geometry. Problem 9 is a very difficult problem hence it is not solved yet. But literature suggests that it may be due to false verbal representation.

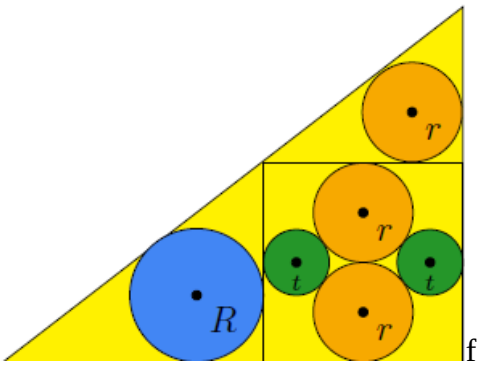

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Fig. 7. Another Wasan problem from Hartmann (2022)

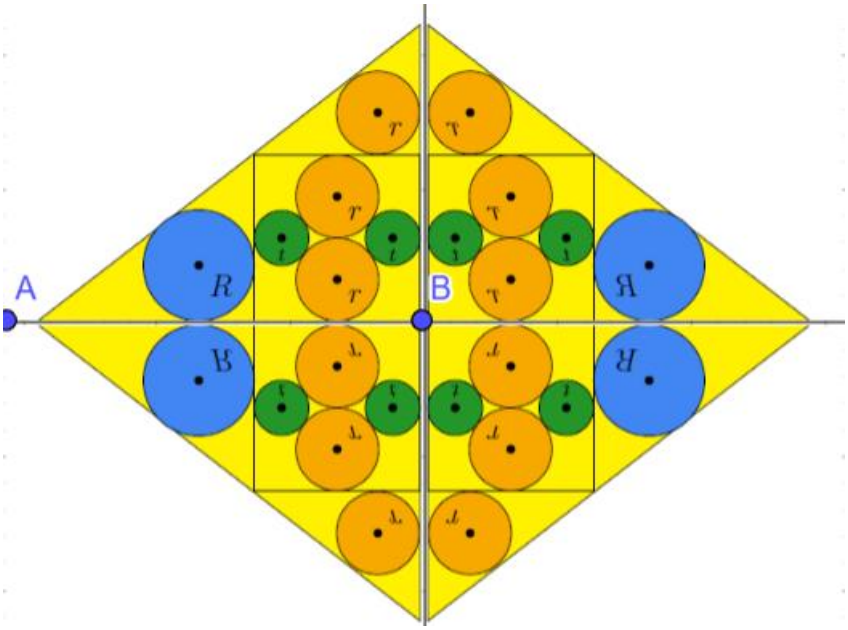

Fig.8. Same problem figure with reflections again.

Aim of fun and artistic expression

Again figure 8, shows reflection of the Wasan problem w.r.t. x and y axes. It is clear to see that new squares and rectangles are to be formed by this operation inside the rhombus established. Some of these can be proved to be useful in answering the problem accordingly. Figures 10, 11, 12 shows the 4pointed, 8 pointed stars established by rotation of transformational geometry. In 4 pointed the angle is 90 degrees, in 8 pointed the rotation angle is 45 degrees. Figure 11 carries another rhombus associated, while figure 12 carries some concentric circles hidden. All these may help in solving the problem but needs further consideration. Recalling that problem in figure 9 is still and unsolved problem from Wasan makes it harder to decide.

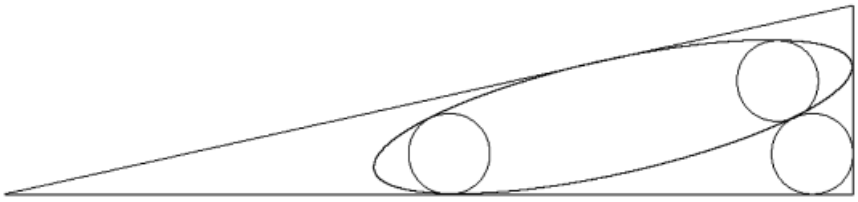

Fig. 9. Very difficult problem from (Stipancic-Klaic & Matotec, 2011) It is still unsolved.

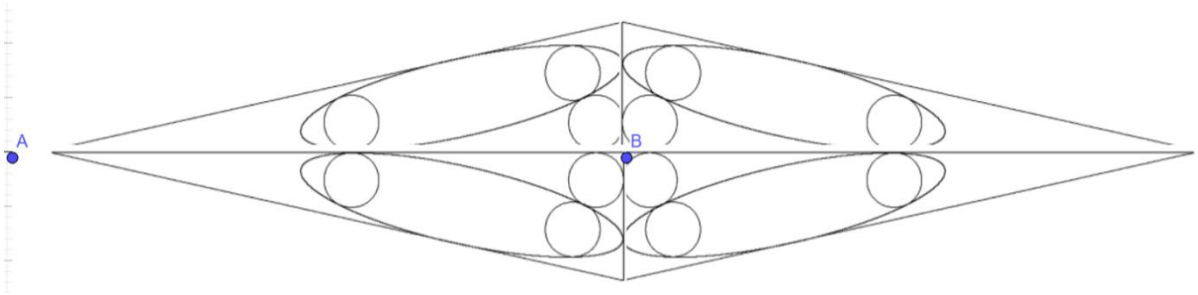

Fig. 10. Reflections w.r.t. x and y axis

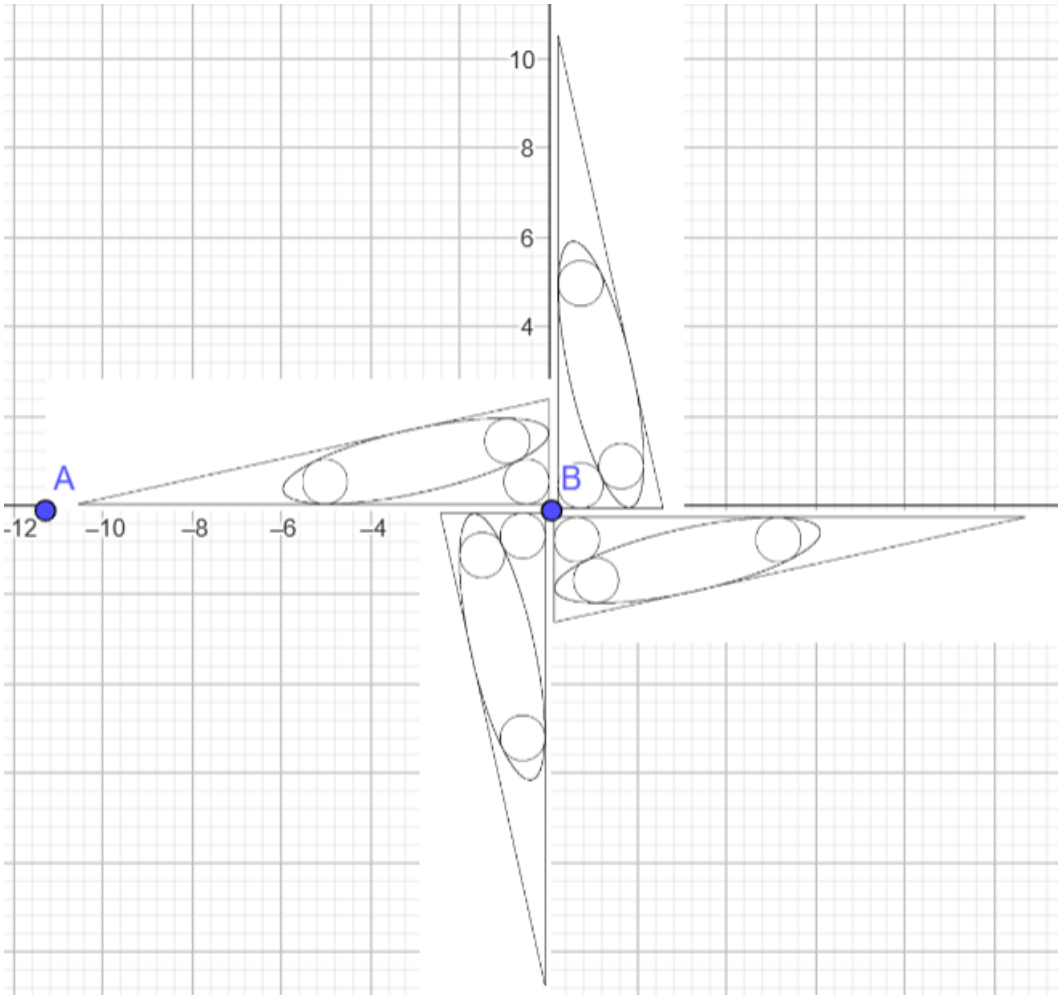

Fig. 11. 4 point rotation.

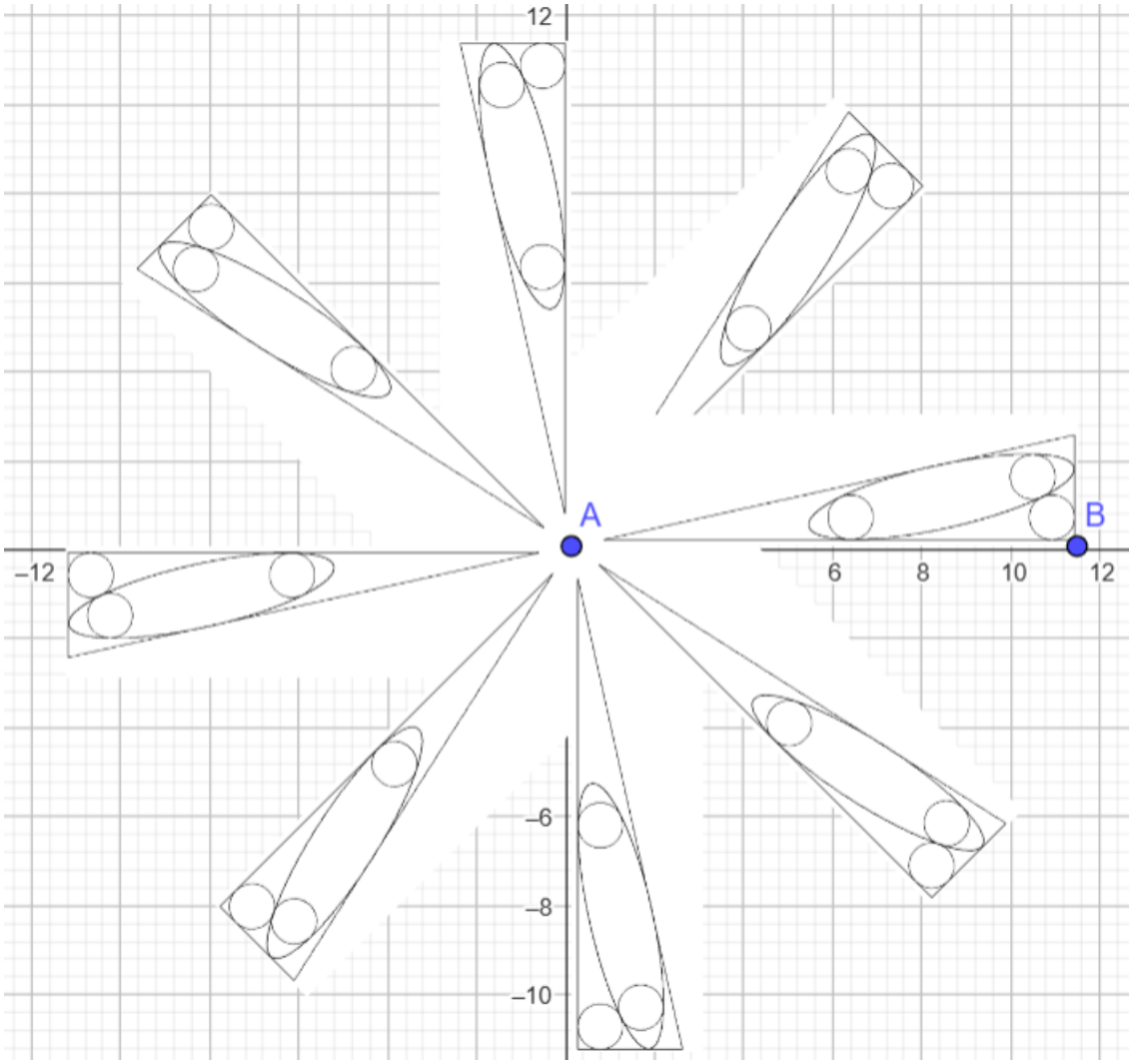

Fig.12. 8 point rotation.

Figure 13, and figure 14 already transformational geometry used forms inside. Careful analysis shows that figure 13 shows reflection w.r.t. x and y axes. Figure 14 contains translation inside. This problem from Makishita (2010-left) as a Wasan problem has transformational geometry embedded in it. Hence, as a matter of fact, new problems of Wasan can be established in this way, too.

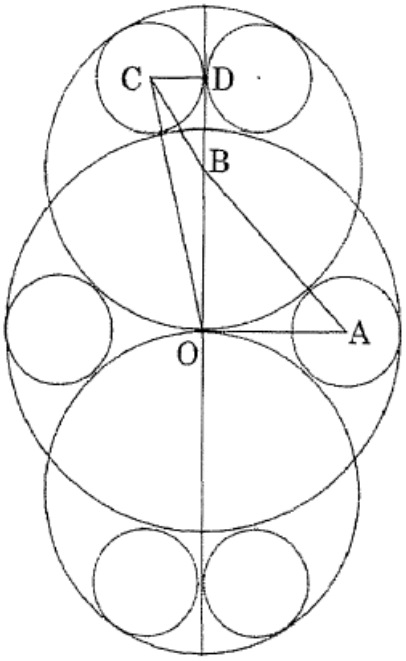

Fig. 13. Problem from Makishita (2010)

Fig. 14. Translation problem from Wasan (Stipancic-Klaic & Matotek, 2011)

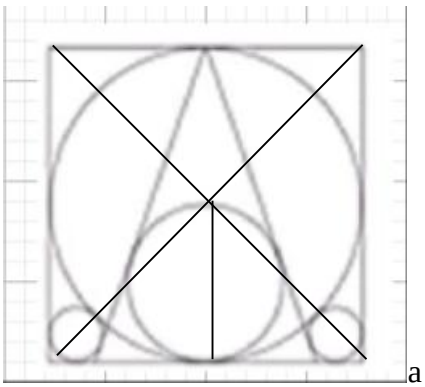
a

Fig. 15. Another Wasan problem with line symmetry from Stipancic-Klaic, Matotek (2011).

Another problem where the solution ends up as the medium circle ‘s Radius is half of the biggest circle’s Radius. (Stipancic-Klaic, Matotek, 2011). Two diagonals are added as auxiliary lines to the problem by the author of this study. These lines also contain tangent lines of

medium circle and small circle; hence properties follow from there. Here, thinking that the radius of the small circles are t and radius of the medium circle is r, then the biggest circle circle's radius becomes 2r and resultantly through the Pythagorean principle of the bottom right triangle, ($r\sqrt{2}= r + t$) as the relation required is found.

METHOD

As the research design, design-based research is thought in this study however, only the design part will be acknowledged in this manuscript. As part of the design-based research, it is required to test the curriculum piece designed by evaluation and data gathering. In this study, no data collection is made. The designed curriculum piece is shared with a group of experienced teachers, and they really loved it. However, no real data collection is made accordingly. Documents analysis is carried for Wasan problems remaining till today. Design based research established the design of the study. Design-based research can be used to build some curriculum pieces. That is what is done in this study. It is believed that research design and data collection procedures give some insight to other researchers on integrating GeoGebra with Wasan geometry to teach transformational geometry in some differentiated and richly creative and artistic ways.

Ethical Approval

Study is carried by already listed Wasan geometry problems in the literature. No student data is gathered. Hence no need for ethical committee report is thought.

RESULTS AND DISCUSSION

All activities are established under the important points taken from literature. First, it was important to differentiate between motion and mapping perspectives of transformational geometry. This was done as a motion perspective carrying all points in the plane or namely position perspective. Mapping on the other hand reflected the equidistance and perpendicularity where appropriate. Some concepts like uncertainty, symmetry, function, set are given priority. Symmetry is a topic under transformational geometry. Uncertainty is where it is not clear to proceed from where to where and function is appropriate where transformational geometry is seen as a function (as coming from mapping perspective). And besides all, transformational geometry carries sets to new sets with certain linkages. Finally, all representations inside the problems are thought of and identified as treatments and conversions. This also helped Wasan to be thought of as a mathematical structure. Math literacy comes into the situation from the concepts and relationships that need to be known to solve the problem. Didactical advantages of visualization of Wasan make its use in mathematics education not to mention of transformational geometry or any geometry. Then, educational activities via Wasan were flourished for transformational geometry.

Table 1. Activity 1- Construction

Perspective	Motion + Mapping
Form of symmetry	w.r.t. x axis and y axis (line symmetry)
Math structures (set, function, representations)	Domain and range 1-1, onto, homeomorphism (isomorphism whenever possible)

	Treatments and conversions
Didactical advantages	-fostering geometrical relationships: Pythagorean principle, tangents, intersecting figures -drawing with technology/hand-eye coordination -conceptual understanding: to reflect -pointing specifics of transformational geometry: specifying roles of symmetry line, reflection point, equidistance, parallelism

Table 1 demonstrates the construction phase of a Wasan problem onto GeoGebra. For doing this, one needs to answer the following questions: first draw what? draw all pieces and arrange? variants and invariants? related parts at the beginning and at the end? collinearity, parallelism and perpendicularity? distances, measures and angles? Starting from some points may end up with wrong construction as much as some points may be misleading the construction to wrong variants and invariants.

Table 2. Activity 2- Solving a difficult Wasan problem

Perspective	Motion + Mapping
Form of symmetry	All symmetries
Math structures (set, function, representations)	Domain and range 1-1, onto, isomorphism Treatments (within graphics) and conversions (between graphics and algebra)
Didactical advantages	-fostering geometrical relationships: Pythagorean principle, tangents, intersecting figures, trigonometry, -drawing exact figure -conceptual understanding: translate, reflect, rotate -pointing specifics of transformational geometry: specifying roles of symmetry line, reflection point, equidistance, parallelism -adding auxiliary lines whenever necessary -adding points whenever necessary -identifying important points -identification of variants and invariants in the figure

Table 3. Activity 3-Artistic expression

Perspective	Mapping + motion
Form of symmetry	Translation+ reflection w.r.t. x axis and y axis (line symmetry) + rotational symmetry, wallpaper designs, frieze patterns

Math structures (set, function, representations)	Range Treatments Islamic stars
Didactical advantages	-fostering interdisciplinarity between mathematics and art -brain storming on what could be done more -what does it resemble? -drawing with technology/hand-eye coordination -conceptual understanding: to translate, to reflect, to rotate, -pointing specifics of transformational geometry: specifying roles of symmetry line, reflection point, equidistance, parallelism, rotation angle, understanding circle area division -deciding variants and invariants

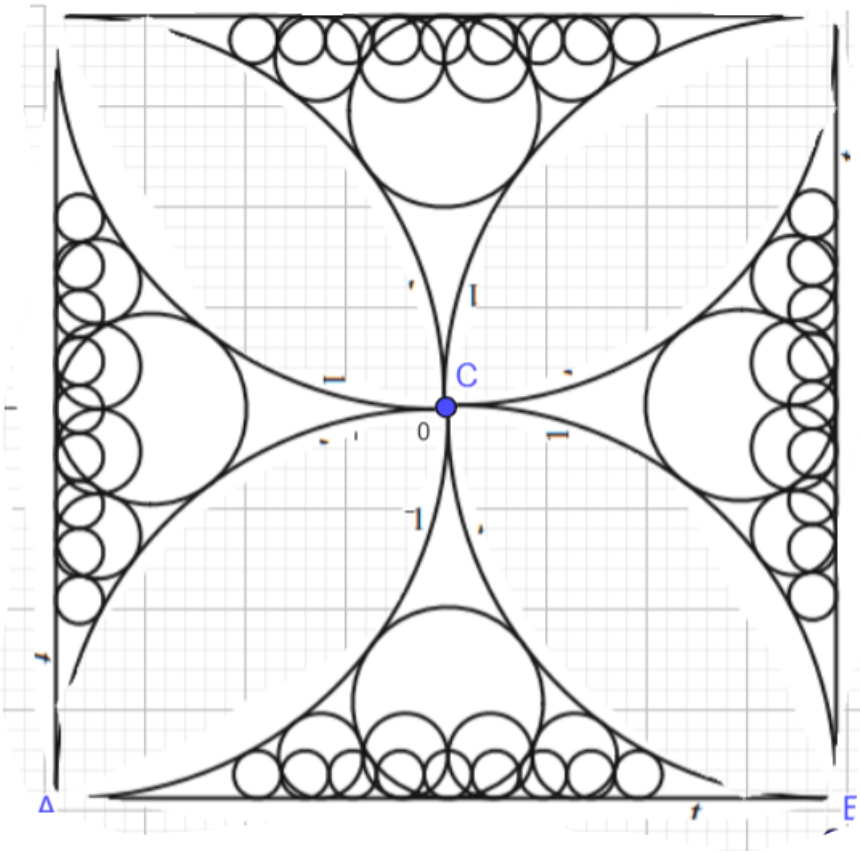

Fig. 16. Another problem transformed into a different shape from Laigo et al.(2021)

Figure 16 carries a series of two sets of congruent circles. 4-point rotation around point C gives above image which is very fun and interesting to build. This shows that any different wasan problem may end up with different configurations possible. Hence, they all need different establishments and creativity. Similarly, Figure 17 is an example of 12-rayed star established by such procedure from Wasan geometry problem by transformational geometry. Figure 18 contains translation and reflection as transformational geometry.

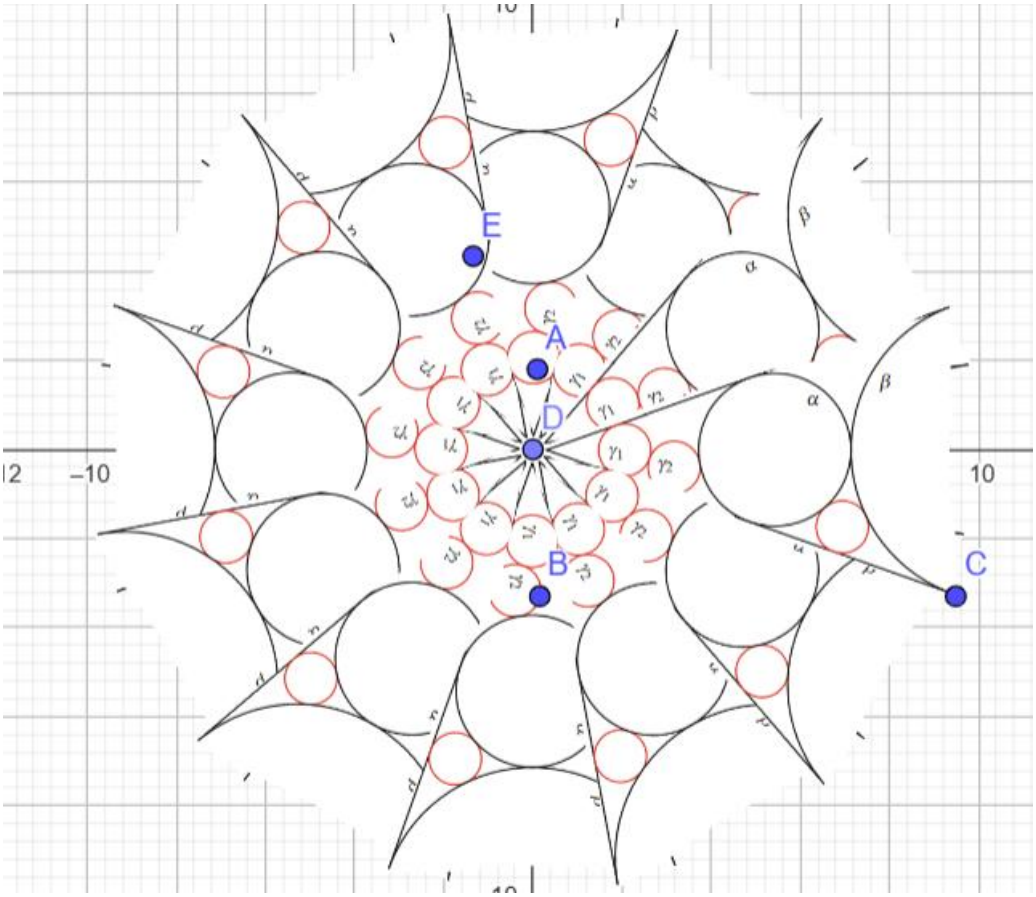

Fig. 17. Another translated problem from Okumura (2021)

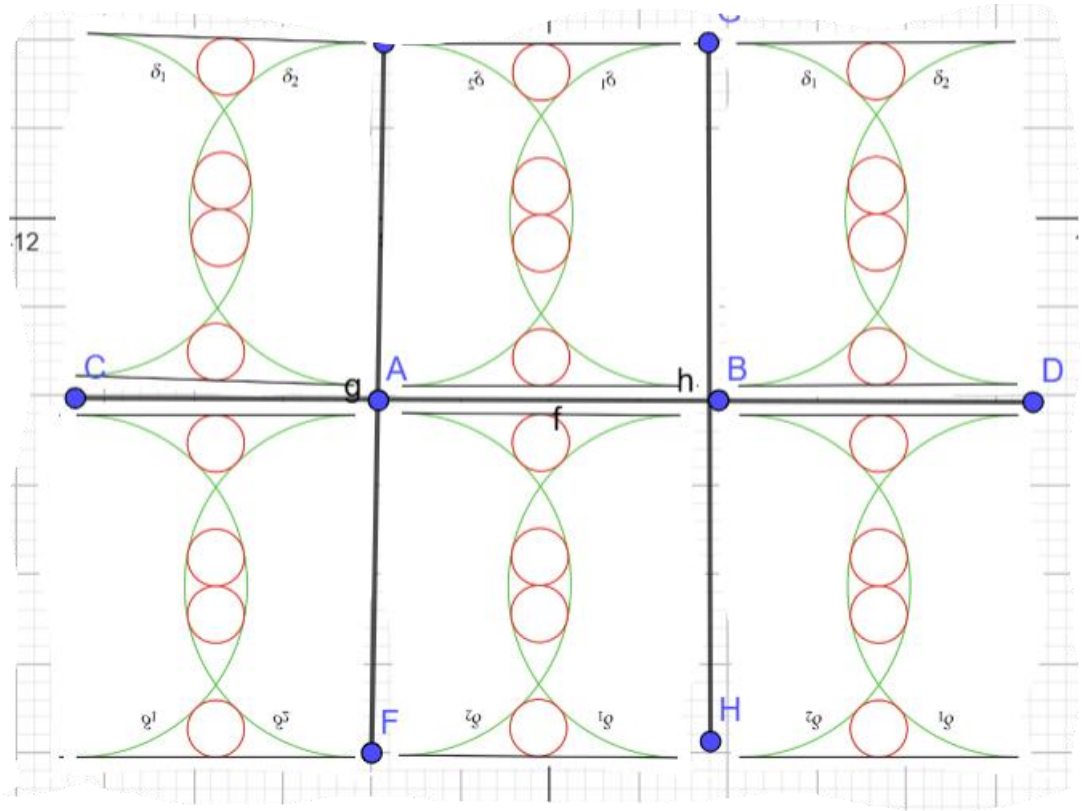

Fig. 18. Both translation and reflection containing procedure result example (Problem taken from Okumura, 2021).

Problem variations to establish new Wasan geometry problems

Okumura (2021) covers two problems listed separately as Wasan problems. These two apparently developed by transformational geometry-imposed variation as can be seen analytically. Congruent circles intersecting and tangent to each other formed the main problem. On the right-hand side, the same problem figure is nested inside the original figure to form a new problem as can be seen. There is translation, reflection are hidden in the secondary problem as can be seen.

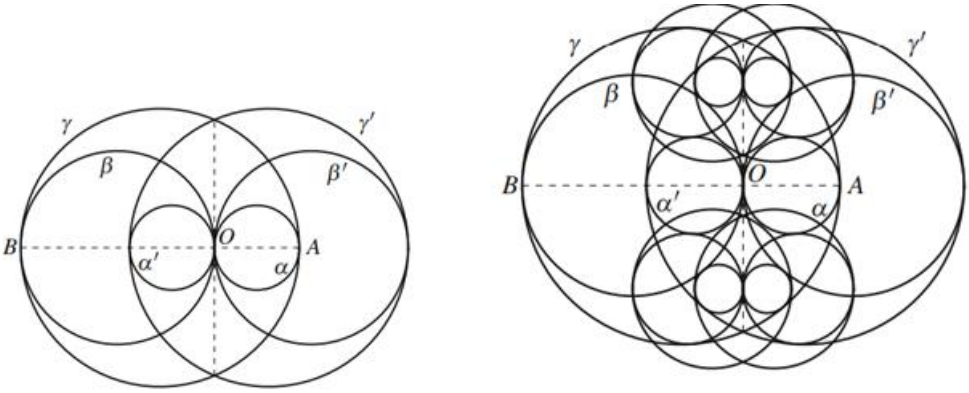

Fig. 19. One problem, two variations from Wasan history (Okumura, 2021)

CONCLUSIONS

In this study, we have tried to include a procedure to create original activities for analytic geometry and geometry course curricula. These can be taught to students via GeoGebra affordances. It enables translation by dragging, reflecting through a point or through a line as much as rotation with respect to a point for a predefined angle. It is thought that this manuscript forms the beginning of design-based research to create and evaluate such curricular activities. These procedures may teach Wasan geometry, as much as transformational geometry through Wasan geometry by interdisciplinary art activities. Hence, it is fun and interesting for many students and for creators. These procedures can help to solve Wasan geometry problems, they can help understanding the mapping and motion perspectives on transformational geometry as much as establishment of construction activities of Wasan problems on GeoGebra. As Polya's saying (understand the problem), these procedures can help students understand the Wasan problems as much as transformational geometry through those problems. Figure 20 are two last examples of this procedure. Both are examples of 6-point rotation which is very hard for students to understand.

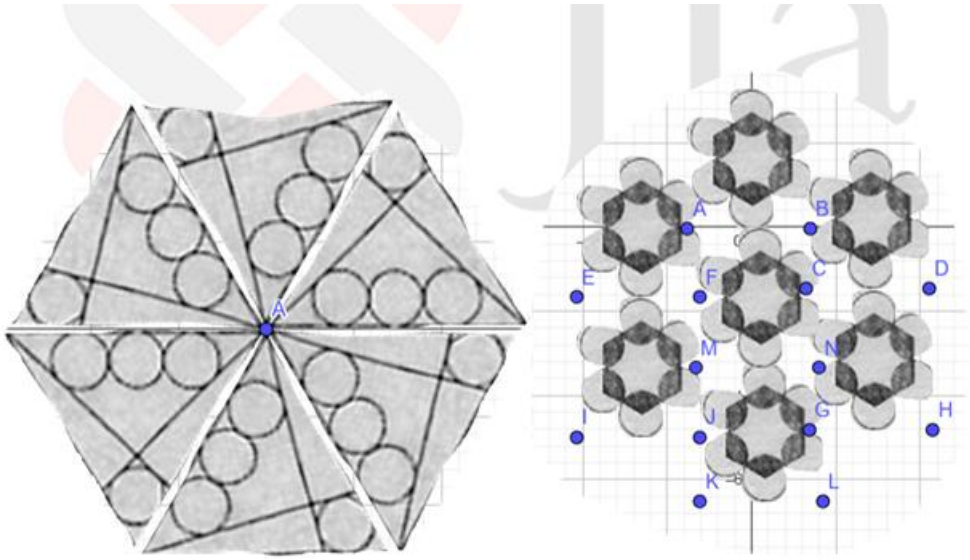

Fig. 20. Two other resultant figures formed by transformational geometry by two Wasan geometry problems (Okumura, 2021)

Even though some are lost in time, Sangaku problems can still be found in the literature (Okumura, 1999; 2021, Golden, 2018; Laigo et. Al., 2016; Hartmann, 2022; Stipancic-Klaic & Matotec, 2011; Makishita, 2010). There are three ways to use Wasan geometry problems for transformational geometry teaching. One is construction, the other is for building new problems, and the last one is for creating original pieces of art.

Construction is good at the beginning since it helps to understand the original problem (Laigo et.al, 2021; Cezikturk, 2022). But it is also good to see the original one-to-one mappings inside the problem. Hence, somehow it gives light to mapping and motion perspectives of transformational geometry (Akaru & İler, 2024). They also state that transformational geometry enhances critical thinking, intuition, problem solving, assumptions, deductive reasoning, argumentation and judgement (Akarsu & İler, 2024). These didactical advantages are listed also in Vallo (2021), Demir & Kurtuluş (2023). Teaching symmetry as by itself has some advantages goes hand in hand with uncertainty and beauty (Yenik, 2014; Namikawa, 2012; Cezikturk-Kipel, 2015; Durasi et al., 2019). Wasan problems carry many representations at once and teaching them via GeoGebra adds more types of representations to the list and this should be omitted in teaching (Cezikturk- Kipel & Özdemir, 2016; Cezikturk & Özdemir, 2021, Unger, 2022). Treatments and conversions can be altered by this procedure hence their difficulties can be solved properly.

As a recommendation, design-based research should be applied, and the results should be evaluated accordingly. More problems could be searched for by Wasan to include in this procedure. More could be said on mapping and motion perspectives on transformational geometry. Artists could use this procedure to reflect on their artistic works. And analytical geometry curriculum and geometry curricula could be enhanced to integrate was a geometry inside. he study is the first detailed research on the determination of oxides and alkaline earth metals in perlite samples obtained from 12 perlite quarries located in different provinces of Türkiye. The results of this study provide guiding information for the more effective and efficient use of perlite minerals in different sectors.

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AÇIĞI KAPATMAK, GELECEĞI KURMAK: MÜHENDISLIK ÖĞRENCILERINE GERÇEK DÜNYA BAŞARISI IÇIN MESLEKI KELIME DAĞARCIĞI ÖĞRETIMINDE KARMA BIR MODEL

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ÖZET
Alana özgü terminolojiyi kullanarak etkili iletişim kurma becerisi, profesyonel ortamlara geçiş yapmaya hazırlanan mühendislik öğrencileri için çok önemli bir beceridir. Bu araştırma teklifi, üniversite düzeyindeki mühendislik öğrencilerine mesleki kelime öğretmeye odaklanan 14 haftalık bir eğitim programı tasarlamayı, uygulamayı ve değerlendirmeyi amaçlamaktadır. Program, hedeflenen kelime öğretimi, disipline özgü materyaller aracılığıyla bağlamsallaştırılmış öğrenme ve rol yapma, vaka çalışmaları ve işbirlikçi projeler gibi aktif katılım stratejilerinin bir kombinasyonunu entegre edecektir. Bu çalışmada, programın etkinliğini değerlendirmek için karma bir yöntem yaklaşımı kullanılacaktır. Nicel veriler, öğrencilerin kelime edinimi ve yeterliliğini değerlendiren ön ve son testler aracılığıyla toplanırken, nitel veriler öğrencilerin programa ilişkin algılarını ve programın gerçek dünya bağlamlarında mesleki terminolojiyi kullanma becerileri ve özgüvenleri üzerindeki etkisini araştırmak için anketler, görüşmeler ve sınıf gözlemleri yoluyla toplanacaktır. Bu araştırmanın bulgularının, mühendislik eğitiminde mesleki kelime öğretimi için etkili pedagojik yaklaşımlar hakkında değerli bilgiler sağlaması ve öğrencileri gelecekteki kariyerlerine daha iyi hazırlayan daha sağlam dil eğitim programlarının geliştirilmesine katkıda bulunması beklenmektedir. Bu çalışma ayrıca kelime dağarcığı edinimi ile öğrencilerin genel iletişim becerileri arasındaki ilişkiyi inceleyecek ve mühendislik müfredatına dil öğretiminin entegre edilmesi için öneriler sunacaktır.
Anahtar Kelimeler: Terminoloji, mühendislik, profesyonel ortamlar, kelime öğretimi, karma yöntem

BRIDGING THE GAP, BUILDING THE FUTURE: A HYBRID MODEL FOR TEACHING VOCABULARY TO ENGINEERING STUDENTS FOR REAL-WORLD SUCCESS

ABSTRACT
The ability to communicate effectively using field-specific terminology is a crucial skill for engineering students as they prepare to transition into professional environments. This research proposal aims to design, implement, and evaluate a 14-week instructional program focused on teaching professional vocabulary to university-level engineering students. The program will integrate a combination of targeted vocabulary instruction, contextualized learning through discipline-specific materials, and active engagement strategies such as role-playing, case studies, and collaborative projects. The study will employ a mixed-methods approach to evaluate the program's effectiveness. Quantitative data will be gathered through pre- and post-tests assessing students' vocabulary acquisition and proficiency, while qualitative data will be collected via surveys, interviews, and classroom observations to explore students' perceptions of the program and its impact on their confidence and ability to use professional terminology in real-world contexts. The findings of this research are expected to provide valuable insights into effective pedagogical approaches for teaching professional vocabulary in engineering

education, contributing to the development of more robust language training programs that better prepare students for their future careers. This study will also explore the relationship between vocabulary acquisition and students' overall communicative competence, offering recommendations for integrating language instruction into engineering curricula.

Keywords: Terminology, engineering, professional environments, vocabulary teaching, hybrid model

CLAUDIA SHEINBAUM PARDO: A LEGAL AND GENDER ANALYSIS OF THE LEADERSHIP OF THE FIRST FEMALE PRESIDENT OF MEXICO."

CLAUDIA SHEINBAUM PARDO: ANÁLISIS JURÍDICO Y DE GENERO SOBRE EL LIDERAZGO DE LA PRIMERO PRESIDENTA DE MÉXICO

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Abstract:
Mexico is experiencing a historic moment with the election of its first female president, Dr. Claudia Sheinbaum Pardo. This event transcends politics to become a milestone in gender and human rights, opening the way for female representation in the country's highest position of power. Public expectations are enormous, as questions arise regarding whether her technical, scientific, and political background provides the necessary tools to address national challenges. Sheinbaum, a 61-year-old Mexican, holds a degree in Physics, as well as a master's and a doctorate in Energy Engineering from the National Autonomous University of Mexico (UNAM). Her public career was consolidated when she took office in 2000 as Secretary of the Environment in Mexico City's government and culminated in her election as Head of Government of Mexico City in 2018, being the first woman to hold this position.
Her administration in the capital was not exempt from controversies. The 432 incidents in the Metro public transportation system and a 17% budget reduction sparked criticism regarding her management capacity. Even so, her social and security policies were defended as part of a continuity project aligned with the so-called "Fourth Transformation."
From a gender perspective, her election represents a break with centuries of political exclusion of women. The key question is whether this representation will go beyond the symbolic and translate into public policies that foster equality, inclusion, and social justice. What is undeniable is that her presidency will mark a milestone in Mexico's democratic history.
Keywords: Mexico, woman, president, Claudia Sheinbaum, gender, government.

Resumen:
México atraviesa un momento histórico con la elección de su primera presidenta, la Dra. Claudia Sheinbaum Pardo. El acontecimiento trasciende lo político para convertirse en un referente de género y derechos humanos, al abrir la puerta a una representación femenina en el más alto cargo de poder del país. La expectativa ciudadana es enorme, pues se cuestiona si su trayectoria técnica, científica y política ofrece las herramientas necesarias para enfrentar los retos nacionales.
Sheinbaum, mexicana de 61 años, es licenciada en Física, maestra y doctora en Ingeniería Energética por la Universidad Nacional Autónoma de México (UNAM). Su carrera pública se consolidó al asumir en el año 2000 la Secretaría de Medio Ambiente en el entonces gobierno capitalino, y culminó con su elección como Jefa de Gobierno de la Ciudad de México en 2018, siendo la primera mujer en ocupar dicho cargo.
Su administración en la capital no estuvo exenta de controversias. Los 432 incidentes en el Sistema de Transporte Colectivo Metro y la reducción del 17 % en su presupuesto generaron

críticas sobre su capacidad de gestión. Aun así, sus políticas sociales y de seguridad fueron defendidas como parte de un proyecto de continuidad con la llamada “Cuarta Transformación”. Desde una perspectiva de género, su elección simboliza la ruptura con siglos de exclusión política hacia las mujeres. La cuestión fundamental es si esta representación trascenderá lo simbólico y se traducirá en políticas públicas que impulsen igualdad, inclusión y justicia social. Lo indiscutible es que su presidencia marcará un hito en la historia democrática de México.

Palabras clave: México, mujer, presidenta, Claudia Sheinbaum, género, gobierno.

PHENOTYPIC DIVERSITY OF NATURAL POPULATIONS OF *CHAMAEROPS HUMILIS L.* IN MOROCCO

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ABSTRACT

The dwarf palm (*Chamaerops humilis L.*) is endemic to the Mediterranean region, representing the only native palm species distributed in both Europe and Africa. This species is of economic, ecological, and medicinal importance.

In Morocco, the dwarf palm (*Chamaerops humilis*) known as "doum" produces fruits called "aghaz." It is one of three Moroccan palms that grow naturally.

This phytogenetic heritage is in decline in certain regions of its range due to fragmentation caused by severe climatic conditions, urbanization, cultivation, and the impact of non-native species. In Morocco, the application of Law n°77-15, which prevents the use of plastic bags, has resulted in a notable increase in the utilization of dawrf palm for fabrication the traditional baskets, particularly in rural regions, result to the regression of its distribution range, requiring urgent intervention to manage and conserve these plant genetic resources.

Information on phenotypic variability among Moroccan populations of *C. humilis* remains rare. Thus, the objective of this study is to characterize and assess the genetic variability of Moroccan dwarf palm populations based on a few morpho-pomological traits and to explore the possible spatial and bioclimatic structuring of populations across their range.

In order to study phenotypic diversity of *Chamaerops humilis* in Morocco, 33 morpho-pomological traits, 25 quantitative and eight qualitative, related to the whole plant, leaves, spines, fruits and seeds were analyzed in 14 natural populations collected across their range.

Descriptive statistical analysis and one-way analysis of variance (ANOVA) revealed significant differences. The coefficient of variation varied between 12.06% for fruit width and 68.2% for spine length. Furthermore, the ANOVA test showed highly significant differences among the populations studied for all the traits measured (F significant at $p<0.001$). These results suggest significant morphological variability within Moroccan populations of *C. humilis*.

Altitude showed a negative and significant correlation with crown height (CH; r= -0.73), total leaf length (TLL; r= -0.63) and blade width (BW; r= -0.58). On the other hand, mean temperature was positively correlated with these same traits (CH; r= 0.66, and TLL; r= 0.54). In addition, rainfall was positively correlated with pomological traits such as fruit length (FL; r= 0.82, $p<0.001$), fruit weight (FWe; r= 0.52, $p<0.05$), and seed length (SL; r= 0.73, $p<0.01$). Principal component analysis showed that the first two components explained 68.99% of the total variance. The first principal component (PC1) described 40.64% of the total variance and was defined by traits generally related to leaves. The second principal component explained only 28.35% of the total variance and was determined mainly by pomological traits. In addition, environmental factors showed a low contribution to both principal components.

Principal Component Analysis (PCA), Hierarchical Classification of Principal Components (HCPC), and Hierarchical Ascending Classification (HAC) were permitted to divide the populations studied into three distinct groups, independent of their geographical origins and the bioclimatic conditions of their habitats.

Keywords : *Chamaerops humilis ; morpho-pomological traits ; phenotypic variability ; Morocco*

FACILE SYNTHESIS OF 4'-AMINO-[1,1'-BIPHENYL]-4-SULFONAMIDE MOLECULES VIA CHAN-LAM COUPLING: A DUAL IN-VITRO AND IN-SILICO APPROACH TO CARBONIC ANHYDRASE (CA) INHIBITORS

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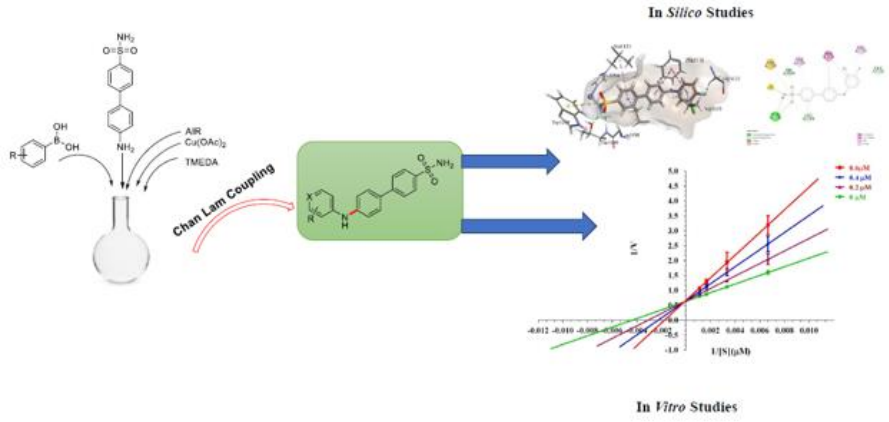
Abstract: Carbonic anhydrase inhibitors are substantial to treat a lot of disorders such as obesity, epilepsy, glaucoma and cancer. We have prepared a series of 4'-amino-[1,1'-biphenyl]-4-sulfonamide derivatives in the presence of air, $Cu(OAc)_2$ catalyst, methanol solvent, and tetramethylethylenediamine (TMEDA) base. The synthesized derivatives were structurally analyzed by spectroscopic techniques ^{1}H NMR, and ^{13}C NMR. The inhibition potential of sulphonamide derivatives was tested against the isozymes including hCA-II, hCA-IX, and hCA-XII. It was noted that all the derivatives showed remarkable inhibitory potential against carbonic anhydrases. However, some exhibited more potential than standard inhibitor acetazolamide. The inhibition mode of more active compounds was checked by enzyme kinetic studies. SwissADME tools were employed to evaluate the drug-ability of sulphonamide molecules. As a result, all the synthesized derivatives satisfied the drug-ability criteria. The identification of interactions between newly prepared derivatives and target proteins was carried out through molecular docking studies.



EXPLORING THE FISH MARKETING SYSTEM IN DHAKA: EFFICIENCY, CONSTRAINTS AND POLICY IMPLICATIONS

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ABSTRACT
Fish constitutes a crucial source of protein and nutrition in Bangladesh, with Dhaka functioning as the principal hub for fish distribution. Despite its significance, the existing marketing system is constrained by structural inefficiencies that impede sustainable growth. This study aimed to critically evaluate the fish marketing system in Dhaka by examining operational efficiency, identifying constraints and exploring policy implications for sustainable development. The research was carried out across four retail markets—Bou Bazar, Basabo Bazar, Dhupkhola Bazar and Thathari Bazar, over a three-month period (June August, 2025). A total of 60 retailers were selected through simple random sampling and data were collected via structured questionnaires, focus group discussions and key informant interviews. Quantitative data were analyzed with Microsoft Excel and SPSS. The key findings indicated that the majority of fish retailers are middle-aged with limited formal education and more than half depend exclusively on fish trading as their primary livelihood. Profit margins were generally low with strong seasonal fluctuations in pricing. Major constraints included high transportation costs, inadequate preservation facilities (78% lacking sufficient ice and no access to cold storage), substandard sanitation, the absence of trader associations and exploitation by middlemen. Regression analysis demonstrated a significant association between traders' age, experience and profit margins. The study emphasizes the urgent need for improved infrastructure, cold chain facilities, market management reforms and cooperative frameworks. Policy implications directed toward modernizing retail markets, reducing middlemen exploitation and ensuring government support are recommended to improve efficiency, profitability and long-term sustainability.
Keywords: *Fish marketing system, Dhaka, Retailers, Constraints, Policy implications*.

EARTHQUAKES IN THE MEDITERRANEAN: BETWEEN HISTORY AND REGULATIONS

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ABSTRACT
The Mediterranean basin has experienced several earthquakes. In the field of civil engineering, it is important to study the seismic activity of areas where civil constructions will be built. All Mediterranean countries are at risk of sudden earthquakes. It is necessary to study the history of these earthquakes and examine, from a technical perspective, the development of seismic regulations in the concerned countries. For this reason, we present in this paper a review of the history of earthquakes and seismic regulations.
Keywords: Earthquakes, Mediterranean basin, civil engineering, seismic regulations.

AKDENİZ'DEKİ DEPREMLER: TARİH VE DÜZENLEMELER ARASINDA

ÖZET
Akdeniz Havzası, birçok deprem yaşamıştır. İnşaat mühendisliği alanında, inşaatların yapılacağı bölgelerin sismik aktivitesini incelemek önemlidir. Tüm Akdeniz ülkeleri, ani depremlerle tehdit altındadır. Bu depremlerin tarihini incelemek ve teknik açıdan, ilgili ülkelerdeki sismik düzenlemelerin gelişimini analiz etmek gereklidir. Bu nedenle, bu makalede depremlerin tarihi ve sismik düzenlemeler üzerine bir inceleme sunmaktayız.
Anahtar Kelimeler: *Depremler, Akdeniz havzası, inşaat mühendisliği, sismik düzenlemeler.*

INTRODUCTION
Earthquakes are natural phenomena classified as natural disasters. They are random movements of the Earth, causing deaths and damage to buildings. Civil engineers are highly interested in this field to consider preventive measures against earthquakes, protect constructions, and safeguard human lives.
Ercan Işık examines the effects of polymer fibers in concrete for strength. The results obtained reveal that these fibers significantly increase the shear force capacity[1]. Ercan Işık et al. studied the failures in concrete during the 2023 Kahramanmaraş earthquakes[2]. A. Hée provides the history of earthquakes in Algeria from 1850 to 1911[3]. An earthquake that affected Algeria, in Sétif in 1949, is studied by J.P. Rothé[4]. A.K. Yelles-Chaouche et al. detail the tectonics of northern Algeria and the propagation of the resulting seismic activity[5]. A.C. Akgüngör delivers speeches and policies on the 1999 earthquake in Turkey[6]. R. Lacassin provides a history of Mediterranean seismicity[7].
In this study, we aim to present the history of earthquakes and seismic regulations.

Review about seism
Algeria

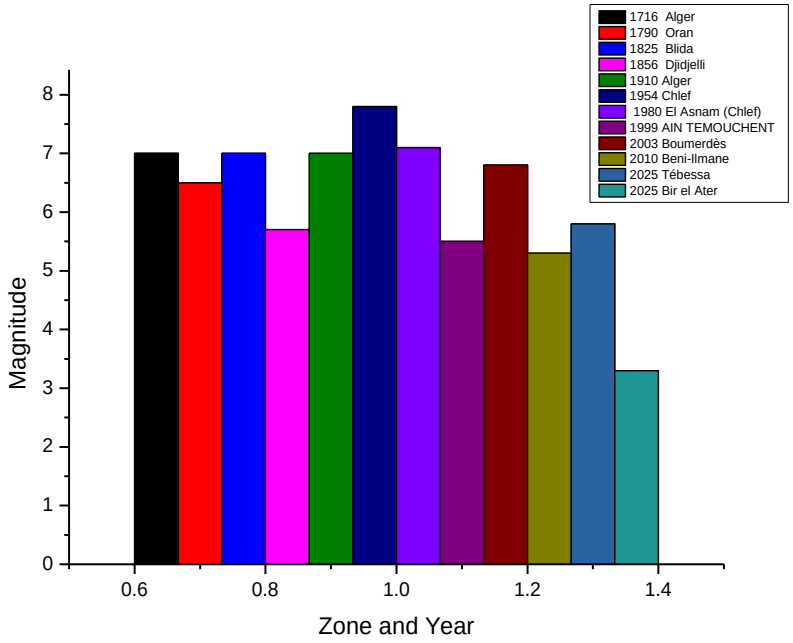

Fig 1. The main earthquakes in Algeria.

Maroc

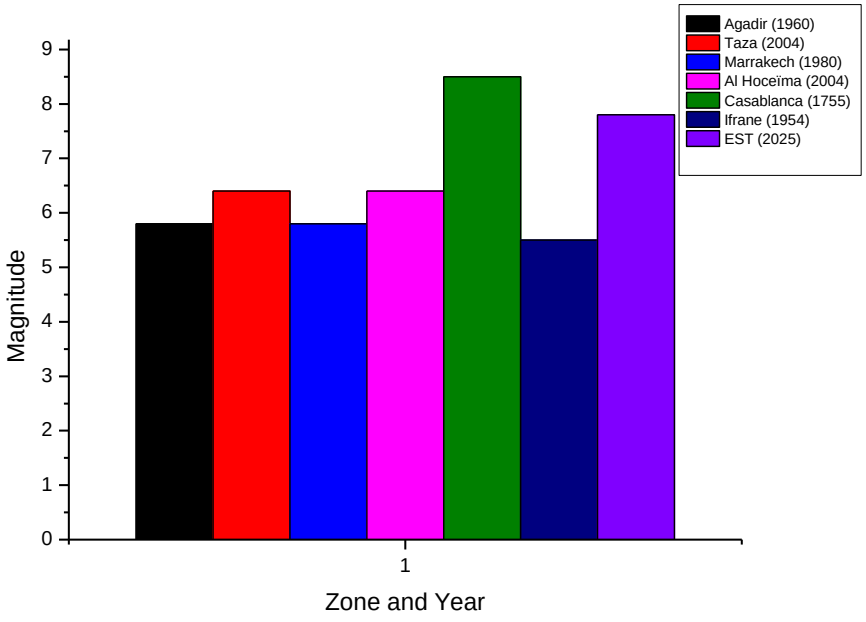

Fig 2. The main earthquakes in Maroc.

Turck

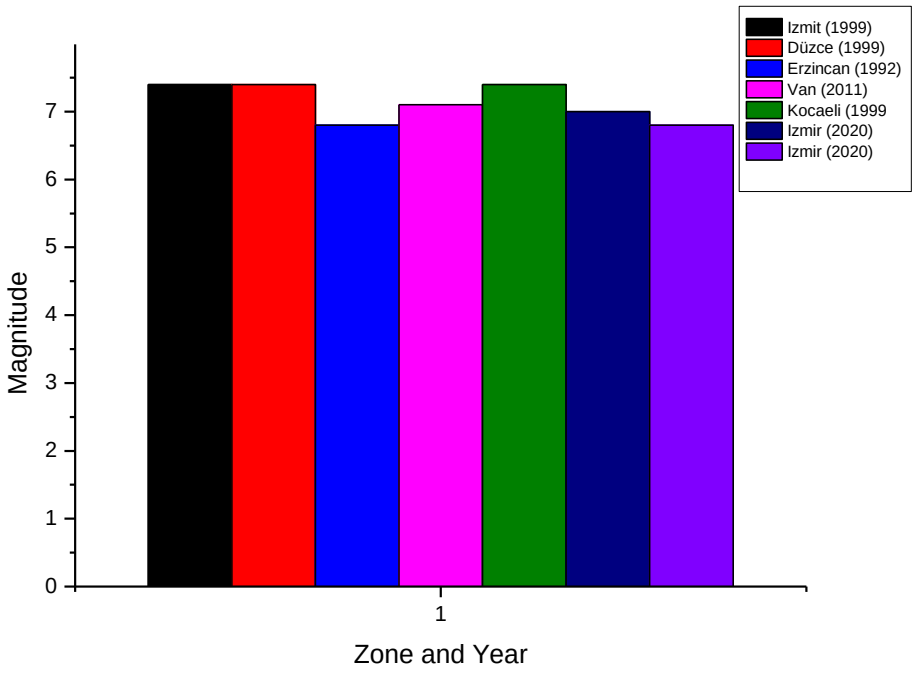

Fig 3. The main earthquakes in Turck.

Italy

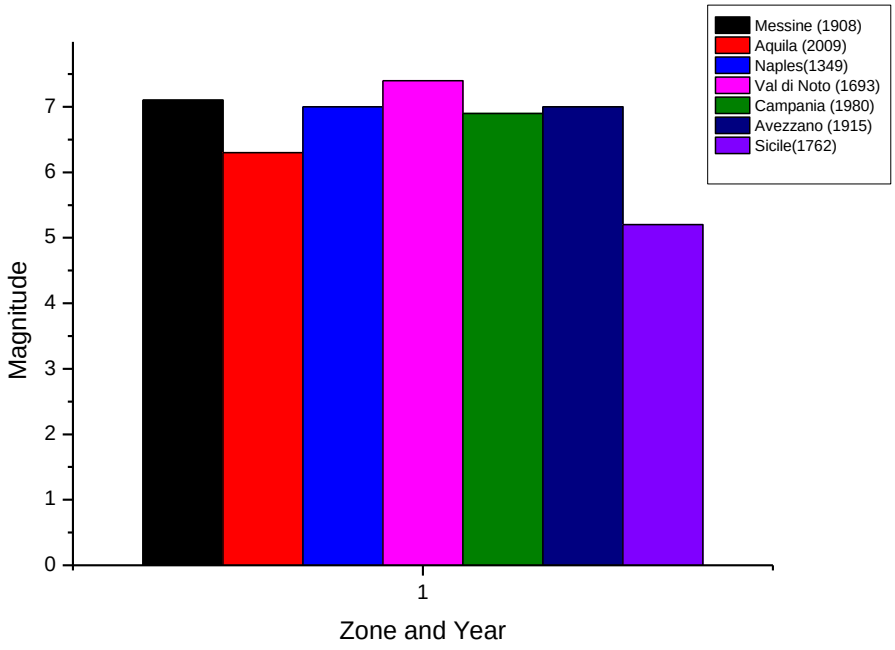

Fig 4. The main earthquakes in Italy.

Review of seismic-related technical regulations.
Algeria:

1. Seismic regulation of 1981 (RPA-81)
2. Seismic regulation of 1999 (RPA-1999)
3. Seismic regulation of 2003 (RPA-2003)
4. Seismic construction regulation of 2011 (RPA-2011)
5. Revised seismic regulation of 2020 (RPA-2020)
6. Revised seismic regulation of 2024 (RPA-2024)

Turck:

1. Seismic construction regulation of 1944 (Türkiye Deprem Yönetmeliği 1944)
2. Regulation of 1975 (İstanbul Deprem Yönetmeliği 1975)
3. Seismic construction regulation of 1997 (Deprem Yönetmeliği 1997)
4. Seismic construction regulation of 2007 (Deprem Yönetmeliği 2007)
5. Seismic construction regulation of 2018 (Deprem Yönetmeliği 2018)
6. Seismic regulation of 2021 (Deprem Yönetmeliği 2021)

Italy:

1. Regulation of 1908 (Law on Earthquake-Resistant Construction)
2. Regulation of 1930 (Standard for Earthquake-Resistant Constructions)
3. Regulation of 1972 - Introduction of Detailed Technical Criteria
4. Regulation of 1981 - Standardization of Seismic Techniques
5. Regulation of 2003 - New Revision and Integration of the Latest Advances
6. Regulation of 2008 (Technical Standard on Seismic Constructions - NTC 2008)

Maroc:

1. Seismic regulation of 1960 (Seismic Construction Code)
2. Seismic regulation of 1983 (Seismic Construction Regulation)
3. Seismic regulation of 2000 (National Seismic Construction Regulation)
4. Revised seismic regulation of 2011
5. Seismic regulation of 2020
6. Seismic regulation of 2024

DISCUSSION

Figures 1 to 4 present the main types of earthquakes related to seismic activity. It should be noted that the magnitude of earthquakes is very important.

It is noteworthy that Mediterranean countries are evolving and updating seismic construction regulations.

CONCLUSION

As seismic risks continue to challenge infrastructure safety, these updated regulations are crucial for enhancing resilience and ensuring the safety of buildings in seismic zones. The ongoing revisions reflect a growing awareness and proactive approach to earthquake preparedness in the Mediterranean region.

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SANATIN AÇIK HAVA MÜZELERİ YOLUYLA AKTARIMI: MOAİ HEYKELLERİ ÖRNEĞİ

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ÖZET

Haz alma, dışavurum, iletişim gibi amaçlarla üretilen sanat eserleri, kendinden sonraki dönemlere aktarım görevi üstlenen tarihi belge niteliği taşımaktadır. Bu tarihi belgeleri geniş kitlelerle tanıştıran alanlardan biri de müzelerdir. Müzeler, sanat eserlerinin toplandığı, belgelendiği, korunduğu ve sergilendiği alanlar olarak bilinmektedir. Müzeler, kendi içinde çeşitli kategorilere ayrılmakta olup bunlardan yaşayan müzeler olarak da bilinen açık hava müzeleri, kültürel mirasın aktarımında büyük rol üstlenmektedir. Bir ata kültürü mirası olarak da bilinen Şili'deki Paskalya Adası'na ait Moai heykelleri, gerek yapılış amaçları gerekse estetik yönden çokça unsuru bünyesinde barındırmaktadır. Volkanik tüften yapılan devasa boyutta ve ağırlıktaki heykeller, bu yapılarına rağmen minimalist anlayışla ele alınıp özellikle baş uzvu abartılarak işlenmiştir. Bu yapısıyla primitif sanatın bir devamı gibi düşünülebilir. Mistik, dini, toplumsal, yapısıyla Paskalya Adası'nın sembolü haline gelen Moai'ler somut olan yapılarının arkasında çok renkli bir kimliğe sahiptirler. Gizemli hikâyesi ile geçmişten geleceğe ışık tutan, birçok sanatçıyı etkileyen Moai heykelleri, sanatın açık hava müzesi olarak bulunduğu alan itibari ile aktarımı açısından önemlidir. Bu anlamda Rapa Nui'nin (Paskalya Adası) arkeolojik alanları, 1995'ten itibaren UNESCO Dünya Mirası alanı olan açık hava müzesi Rapa Nui Milli Parkı içinde korunmaktadır. Bu araştırmayla, Paskalya Adası'nın köklü kültürüne ait olan Moai heykellerinin tanıtılması amaçlanmış; tarama yöntemiyle ele alınan çalışmada toplumsal yapının, kültürün, inancın, ritüellerin aktarımının heykellerde somut olarak sanatsal ifade açısından hangi şekilde vücut bulduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler: Açık hava müzeleri, Moai heykelleri, Paskalya Adası

TRANSFER OF ART THROUGH OPEN-AIR MUSEUMS: THE EXAMPLE OF THE MOAI STATUES

ABSTRACT

Artworks produced for purposes such as pleasure, expression and communication also serve as historical documents, serving as a means of transmission to later periods. Museums are one of the spaces that introduce these historical documents to a wider audience. Museums are known as spaces where works of art are collected, documented, preserved, and exhibited. Museums are divided into various categories, and open-air museums, also known as living museums, play a significant role in the transmission of cultural heritage. The Moai statues of Easter Island in Chile, also known as a heritage of ancestral culture, embody numerous elements both in terms of their purpose and aesthetics. Despite their enormous size and weight, the sculptures made of volcanic tuff were handled with a minimalist approach, with the head limbs being particularly exaggerated. This structure can be considered a continuation of primitive art. With

their mystical, religious, and social significance, the Moai have become symbols of Easter Island, possessing a vibrant identity beyond their concrete structures. The Moai statues, whose mysterious story sheds light on the past and the future and has influenced many artists, are significant in their role as an open-air museum, conveying art. In this sense, the archaeological sites of Rapa Nui (Easter Island) have been protected within Rapa Nui National Park, an open-air museum designated an UNESCO World Heritage Site since 1995. This research aimed to introduce the Moai statues, which belong to the deep-rooted culture of Easter Island; the study, which was conducted using the scanning method, concluded how the transmission of social structure, culture, belief and rituals were concretely embodied in the statues in terms of artistic expression.

Keywords: Open-air museums, Moai statues, Easter Island

GİRİŞ

Primitif dönemlerden bugüne değin sanatın ifade biçimi, çeşitli üsluplarda ve şekillerde vücut bularak somutlaşmıştır. Bunda yaşanılan coğrafyanın, kültürün, dini inançların, ritüellerin payı büyüktür. Dolayısıyla bu özsel sanat hareketleri gelecek kuşaklara aktarılan birer miras olma özelliğine sahip tarihi belge niteliği de taşımaktadır. Müzeler, geçmişten geleceğe ışık tutan, sanat eserlerini koruyan, taşıyan yapılar olarak burada büyük bir role sahiptirler.

Arkeoloji, sanat, resim, müzik, gastronomi gibi bir tema üzerinden sahip olduğu koleksiyona göre faaliyete sahip müzelerin, sergi objeleri üzerinden kültürün aktarımını sağladığı ve yaşayan kültür merkezleri oldukları bilinmektedir. Müzelerde sergilenen belgeler ve eserler, kültürel mirasın kanıtları olarak somuttan hareketle somut olmayan değerin anlaşılmasına, aktarılmasına ve kültürel belleğin canlanmasına olanak tanımaktadır (Özdal, 2023, ss. 467-468).

Bu doğrultuda Paskalya Adası'ndaki (Rapa Nui) arkeolojik alanlar ve Moai heykelleri, UNESCO'nun 1995'ten itibaren Dünya Mirası alanı olarak korunmaktadır. Paskalya Adası'nda yaşayan Polinezya halkı, kendilerini koruduğuna inandıkları doğaüstü güçlere sahip atalarının tasvirleri olan devasa taş heykeller olan Moai'leri bir topluluk sanatı olarak üretmişlerdir. 1050-1500 yılları arasında volkanik tüften üretilen bu heykeller, devasa boyları ve ağırlıklarıyla karakteristik minimal tarzdaki ifadeleriyle, izleyenlerin ilgisini çekmeye devam etmektedir. Atalarını ve kabile liderlerini temsil eden bu heykeller, kutsal anıtlar olarak bünyesinde köklü bir tarih ve mistik hikâye barındırmaktadır. Ruhani güç olarak kolektif inanç etrafında bir topluluk sanatı olan Moai'ler, bulunduğu adayla bütünleşmiş köklere sahiptirler.

Bu araştırmayla, Paskalya Adası'nın köklü kültürüne ait olan Moai heykellerinin bilinmeyen yönlerinin tanıtılması amaçlanmış; tarama yöntemiyle ele alınan çalışmada toplumsal yapının, kültürün, inancın, ritüellerin aktarımının heykellere somut olarak sanatsal ifade açısından nasıl yansıdığı tespit edilmiştir. Ayrıca Moai'lerin kültürel miras olma yönünün, gizemli hikâyesinin dışında sanatsal açıdan ifadesine yönelik bir araştırma olması sebebiyle diğer araştırmalara fayda sağlayacağı düşünülmektedir.

MÜZELER

Müze kelimesinin tarihi Yunan Mitolojisi'ne dayanmaktadır. Gökyüzü tanrısı olarak bilinmekte olan Zeus'un dokuz kızı vardır ve bunların her birine Müz denilmektedir. Müz'ler güzel sanatların bir dalını temsil etmekte olup yaşadıkları tapınağa da Müze denilmektedir.

Müzelerin kökeni, M.Ö. 4. yüzyılda "Museum" olarak bilinen İskenderiye Müzesi'ne dayanmaktadır. 15. yüzyılda modern müzelerde koleksiyon eserlerini korunarak tarih ve zamanla ilişki kurmadan sergilemek öncelik arz etmekteydi. 18. yüzyılın ikinci yarısında bu anlayış değişime uğrayarak eserlerin ait olduğu zamanla bir bütün olduğu anlayışı öncelik kazanmıştı. 19. yüzyılda müzelerin görevi; kültürü gelecek kuşaklara aktarma ve bu doğrultuda koruyan ve araştıran bir kurum olmaktı. 20. yüzyıla gelindiğinde ise müzelerin görevi değişiklik göstererek eserlerin korunup sergilendiği anlayışın dışında eğitim, öğretim ve eğlence merkezleri olarak toplumla ilişki kurabilen anlayışla bütünleşmiştir (Maktal, 2014 'ten akt. Kelkit ve Halaç, 2024).

Uluslararası Müzeler Konseyi'ne (ICOM) göre; "Müze, toplumun hizmetinde olan, maddi ve manevi mirası araştıran, toplayan, koruyan, yorumlayan ve sergileyen, kâr amacı gütmeyen, kalıcı bir kurumdur. Halka açık, erişilebilir ve kapsayıcı olan müzeler, çeşitliliği ve sürdürülebilirliği teşvik eder. Etik ve profesyonel bir şekilde, toplulukların katılımıyla faaliyet gösterir ve iletişim kurar; eğitim, eğlence, düşünme ve bilgi paylaşımı için çeşitli deneyimler sunarlar" (ICOM, 2022).

Değişen ve gelişen müze anlayışı, eserlerin sergilendiği mekândan; insan ve kültür merkezli anlayışa yönelerek zenginleşmiştir. Böylece, açık hava müze kavramıyla; kaybolmaya yüz tutmuş ya da ön plana çıkmamış kültürel mirasa ait eserlerin, ait olduğu toplumlara kazandırılması, kültürel açıdan tanıtılması ve kuşaklar arası iletişimin sağlanması değer kazanmıştır.

Açık hava müzeleri

Açık hava müzelerin (yaşayan müzeler) tanımı hakkında çeşitli söylemler bulunmakta olup bunlardan en çok kullanılanı; halk mirası ya da toplumsal kültürel miras ile ilişkilendirilen, geleneksel yaşam biçimlerini ve toplumsal tarihi, temsil eden müzelerdir, tanımıdır. Uluslararası Müzeler Konseyi (ICOM, 2008) açık hava müzelerini; koleksiyonlarını dış mekânda sergileyen ayrı bir müze türü olarak tanımlamış, bununla birlikte yaşayan müze ile eş anlamda kullanmıştır. Dolayısıyla açık hava müzeleri (yaşayan müzeler); yaşayan tarih müzeleri, binalar müzeleri, çiftlik müzeleri ve halk müzeleri gibi örneklendirmiştir (Sukmataji, 2010'dan akt., Akahmet, 2017).

Genel olarak açık hava müzesi tanımı yapılabilse de kuruluş amaçları, müzecilik anlayışları, uygulama örnekleri, ülkeden ülkeye değişiklik göstermektedir. Dolayısıyla genel bir sınıflandırma bulunmamakla beraber, Paardekooper (2012), açık hava müzesi çeşitlerini şu şekilde sınıflandırmıştır; doğal/milli parklar, ören yeri/sit alanı, ören yeri müzesi, arkeolojik parklar, etnografik açık hava müzesi, tarihi evler, yaşayan tarih müzeleri, tema parklar, restore edilmiş gemi müzeleri (akt. Albayrak, 2018).

Açık hava müzelerinin kurulmasındaki hedeflerden birisi de geçmişe ait yaşam biçimlerini o günün şartlarına en uygun şekilde sergilemektir. Tarihi nitelikteki bir doğal çevre, ev, köy, mahalle bu nitelikteki müzelerdendir. Açık hava müzesine örnek olabilecek Kuzey Amerika'da açık alandaki tarih müzesi olarak faaliyete geçen ilk müze 1928'de Michigan'da kurulan Greenfield Köyü'dür. Mekânın kapalı ortama uygun olmamasından dolayı açık hava müzesi kavramı ve yöntemi ortaya çıkmış ve açık ortamda sergilenme fikri doğmuştur. İlk olarak İskandinav ülkelerine ait açık hava müzesi kavramında, kırsal mimari yapının korunması amaçlanmıştır. ICOM 2008 yılında açık hava müzesi ve açık alan müzesini aynı kategori içine alarak aynı anlama geldiğini ifade etmiştir. Ayrıca ekomüze ve yaşayan müze de açık hava müzesi kategorisinde değerlendirilebilecek müzelerdendir (Şenol, 2024).

Açık hava müzesi kapsamında olan Paskalya Adası'ndaki Moai heykelleri, kültürel izlerin yansıtıldığı, gelecek kuşaklara aktarıldığı, efsanelerle dolu tarihinin yanında sanatsal ifadesiyle de ön plana çıkmaktadır.

BULGULAR

Paskalya Adası ve Moai heykelleri

Paskalya Adası, Pasifik Okyanusu'nun güneydoğusunda, Şili'ye bağlı bir adadır. Güney Amerika'nın yaklaşık 1.400 mil batısında yer almakta olup dünyanın en uzak yerleşim yerlerinden biridir. MS. 600 ile 800 yılları arasında, Doğu Polinezya'da tanımlanamayan bir yerden gelen bir grup sömürgeci, Paskalya Adası'na yerleşmiştir. Paskalya Adası adı, adayı ilk kez 1722 Paskalya Pazarı'nda gören Avrupalı kâşif Jacob Roggeveen'den gelmektedir. Bugün, Paskalya Adalıları kendilerine ve anavatanlarına Rapa Nui demektedir. Paskalya Adası sanatı, büyük ölçüde dini imgelerin yaratılmasına odaklanan belirgin bir Polinezya sanatıdır (Kjellgren & Wagelie, 2002).

Görsel 1. https://www.bbc.com/future/article/20250702-the-indigenous-restorers-of-easter-islands-moai-in-the-face-of-climate-change

Polinezya diye bilinen adaların oluşturduğu üçgenin üç orta noktasının çökmesiyle ikizkenar üçgen görünümünde olan Paskalya Adası, etrafını saran nesli tükenmiş yuvarlak şekilli volkanlar ve tüm manzarayı kaplamış kraterlerden oluşmaktadır. Adanın pürüzlü yıpranmış yüzeyi, çok eski bir yanardağ patlamasının sonucudur. Güney Amerika'nın batı kıyısı boyunca ve doğu pasifik tarafı boyunca uzanan sıradağlar, yaklaşık iki milyon yıl önce bunlardan birinin faaliyete geçip patlaması sonucunda soğumuş lavlardan oluşmuş yığınlar olarak Paskalya Adası'nı oluşturmuştur (Vanderbes, 2004, s.33).

Paskalya Adası'nın en tanınmış ve ilk akla gelen sanat formları, toplumu koruduğuna inanılan doğaüstü güçlere sahip atalarının tasvirleri olan devasa taş heykeller diğer adıyla Moai'lerdir.

Moai heykelleri, arkası denize dönük duran yekpare insan benzeri formlar olup adayı yöneten ataların ruhlarının temsilidirler ve Paskalya Adası'nda (eski adıyla Rapa Nui) yer almaktadırlar. Moai'leri, zanaatçılar bazalt kazma kullanarak Rano Rafaku yanardağının krater duvarlarından sertleşmiş sarı-gri volkanik külden yontmuşlardır. Bunlar daha sonra sahile taşınarak tören kaidelerinin (ahu) üzerine yerleştirilmiştir. Bu taşınma durumu hakkındaki iddialardan biri yürütülerek, yana ve ileriye kakılarak götürmektir. Ada halkının iddiasına göre ise kutsal Moai'ler ahularına kendi başlarına yürümüş olduklarıdır. En eski Moai'lerin 700-850 civarında olduğu sanılmakla birlikte çoğu 1050-1500 arasında üretilmiştir. Heykellerin yarısı adanın çevresine taşınıp yerleştirilmişken, diğer yarısı hâlâ yapıldıkları Rano Raraku adlı taş

ocağında bulunmaktadır. Bugün ise yaklaşık 900 tanesi varlığını sürdürmektedir. En uzunu 10 metre olmakla birlikte çoğunun yüksekliği 3-6 metre arasındadır (Palffy & Atkinson, 2017, s. 78).

Görsel 2. https://chile.travel/en/blog-en/facts-rapa-nui-moai/

Heykellerin yapılış amaçları tam olarak bilinmese de, birkaç teori bulunmaktadır. Teorilerden biri, Moai'lerin muhtemelen ata figürlerini temsil etmesi ve topluluklar için ritüel etkinliklerle bağlantılı olmasıdır. Heykeller genellikle ahu adı verilen platformların üzerine yerleştirilmiş ve denize karşı sırtlarını dönmüş şekilde konumlandırılmışlardır. Teorilerden bir diğerine göre, bu heykellerin tarımda bereketi sağladığı ve kritik durumdaki yiyecek kaynaklarını artırdığı inancıdır. Son araştırmalara göre ise, bu heykeller tatlı su kaynaklarının nerede bulunduğunu göstermenin bir yolu da olabilir. Heykellerin nasıl yapıldığı ve taşındığı uzun süre gizemini korumuş olsa da, arkeologlar ve araştırmacılar, büyük olasılıkla ağaç kızaklar ve halatlar kullanılarak taşındıklarını öne sürmektedirler. Rapa Nui halkının tarihindeki en büyük gizemlerden biri, adanın nüfusunun ve kültürünün nasıl çöktüğüdür. Teoriler arasında çevresel tahribat, kaynakların tükenmesi, savaşlar ve Avrupa'lıların getirdiği hastalıklar yer almaktadır. (Bozoğlu, 2023).

Moai'ler heybetli ve dayanıklı görünmelerine rağmen sıkıştırılmış küllerden oluşan volkanik bir kaya olan tüften yapılmıştır. Bu tür taşlar, gözenekli ve alışılmadık derecede yumuşaktır. Bu durum onları rüzgâr ve yağmura karşı dayanıksız kılmaktadır. Yakından bakıldığında, Moai'lerin yüzleri aşınma ve leke izleriyle doludur. Moai'ler, adada yaşayan ilk Polinezya toplulukları tarafından, atalarının ve Doğu Polinezya'daki bir adadan Rapa Nui'ye kanoyla gelerek adaya ilk yerleşen şef Hotu Matu'a ailesinin benzerlerini temsil etmek üzere yapılmıştır. 18. yüzyılın sonları ve 19. yüzyılın başlarında, heykellerin hepsi gizemli bir şekilde devrilmiştir. Muhtemelen adada yeni bir dini hareketin yayılması veya bir çatışma nedeniyle bu durum gerçekleşmiş olabilir. Bu devasa taş heykellere kazınmış etkileyici tarihleri nedeniyle, Rapa Nui Milli Parkı, 1995 yılında UNESCO Dünya Mirası listesine alınmıştır. 2016 tarihli UNESCO raporuna göre Rapa Nui'deki Moai'ler dünya çapında iklim değişikliğinden en çok etkilenen miras alanları arasında yer almaktadır. Ekim 2022'deki bir orman yangını, volkanik krater Rano Raraku'da yaklaşık 80 Moai'yi kömürleştirip çatlatmıştır. Yerel yetkililer o dönemde, ortaya çıkan hasarın telafi edilemez ve gözle görülemeyecek kadar büyük sonuçlar doğurduğunu söylemişlerdir. Yükselen deniz seviyeleri ve artan aşırı dalga olayları da adayı aşındırmaya devam etmektedir. UNESCO raporuna göre, ayakta duran monolitlerin % 90'ından fazlası kıyı şeridinde yer aldığından, bu durum Moai'ler için yakın tarihte tehdit unsuru oluşturmaktadır (Quaglia, 2025).

Görsel 3. https://www.arkeolojisanat.com/shop/blog/silide-100e-yakin-moai-heykeli-paskalya-adasi-yanginlarinda-hasara-ugradi_3_1367371.html

Arkeologlar, Moai'lerin gövdelerinin 1914'ten itibaren yaptıkları kazılarda sadece kafalardan ibaret olmadığını, bedenlerinin yer altına kadar uzandığını ortaya koymuşlardır.

Görsel 4. https://www.greenmemag.com/lifestyle/the-moai-of-easter-island-a-monumental-legacy/

Görsel 5. https://www.greenmemag.com/lifestyle/the-moai-of-easter-island-a-monumental-legacy/

Görsel 6. https://upload.wikimedia.org/wikipedia/commons/5/50/AhuTongariki.JPG

Görsel 7. https://moevarua.com/en/the-myth-of-the-moai-who-look-toward-the-sea/

Sanatsal ifade bakımından Moai heykellerinin biçimsel tasviri

Moai'ler, Rapa Nui'li ustalar tarafından yaklaşık 1050-1500 yılları arasında volkanik tüften en uzunu 10 metre olacak şekilde ve 85-90 ton ağırlığında üretilmiş heykellerdir. Kendine has karakteristik biçimlere sahip bu heykeller, genellikle dikey formda seyreden doğal malzemenin kullanıldığı, insana ait uzuvların abartılarak işlendiği dev boyutlu sanatsal yapıtlardır.

Görsel 8. https://timekocaeli.com/kategoriler/kose-yazisi/dunyadaki-dunya-disiliklar-1-dev-moai-heykelleri

Neredeyse tüm Moai heykellerinin toplam boyutunun sekizde üçü kadar orantısız derecede büyük kafaları vardır. Moai heykellerinin gerçekçi yüzleri, putlaştırılan atalarını temsil etmektedir. Rapa Nui'deki Moai heykelleri, sade tasarımlarıyla Polinezya özelliklerini yansıtan yekpare anıtlardır. Paskalya Adası Başları olarak da bilinen bu heykeller, volkanik tüf kullanılarak yapılmıştır. Büyük başları, gövde ve baş arasında üçe beş oranına uyar; kalın kaşları ve karakteristik balık kancası şeklindeki burun kıvrımına sahip uzun burunları vardır; bu heykelsi özellik, Polinezya'da başın kutsallığına olan inançla uyumludur. Çene hatları, kısaltılmış boyunla tezat oluşturur. Gövdeler oldukça iridir ve köprücük kemikleri yer yer taşla hafifçe belirginleştirilmiştir. Kollar kabartma olarak oyulmuş ve vücuda çeşitli pozisyonlarda

yerleştirilmiştir; eller ve uzun ince parmaklar kalça çıkıntıları boyunca uzanmıştır. Başparmaklar ara sıra göbeğe doğru bakmaktadır. Paskalya Adası heykellerinin sırtları genellikle ayrıntılı değildir, ancak alt sırtta ve kalçalarda kuşak ve halka tasarımı bulunabilir. Rapa Nui heykellerinin, diz çökmüş bir Moai haricinde, belirgin bir şekilde ayırt edilebilen bacakları yoktur (Meyer,2025).

Görsel 9. https://www.hurriyet.com.tr/seyahat/galeri-silide-diz-cokmus-tas-heykellerin-sirri-40335065/1

Moai heykelleri, geniş burunları ve büyük çenelerinin yanı sıra dikdörtgen kulakları ve büyük göz yarıklarıyla öne çıkar. Vücutları genellikle çömelmiş, kolları farklı pozisyonlarda ve bacakları olmadan durur. Ahu heykellerinin büyük çoğunluğu kıyıya yakın, yerleşim yerine doğru bakacak şekilde yerleştirilmiştir. Ahu Akivi gibi iç kesimlerde de heykeller mevcuttur. Sırt ve kalçaları daha az bozulmuş Paskalya Adası heykellerinin üzerine sıklıkla desenler işlenmiştir. 1914 Routledge keşif gezisi, bu çizimler ile yarım yüzyıl önce rahipler tarafından yasaklanan adanın geleneksel dövmeleri arasında sosyokültürel bir bağlantı olduğunu ortaya koymaktadır. Paskalya Adası başlarından bazıları boyanmıştı. Metropolitan Sanat Müzesi koleksiyonundaki heykellerden biri kırmızımsı bir renkle süslenmişti. Daha modern Moai'ler, şeflerin tepesini temsil eden pukao olarak bilinen baş silindirleri takıyorlardı. Yerel efsaneye göre, mana saçta saklanırdı. Pukao, Puna Pau'da çıkarılan son derece hafif bir kaya olan kırmızı cüruftan oyulmuştur. Polinezya'da kırmızı renk kutsal kabul edilir. Pukaonun eklenmesi, Moai'nin daha yüksek bir rütbeye sahip olduğunu göstermektedir (Meyer, 2025).

Görsel 10. https://arkeofili.com/wp-content/uploads/2019/08/moa1.jpg

SONUÇ

Bir açık hava müzesi kategorisinde yer alan Paskalya Adası'nın Moai heykelleri, atalarının ruhlarını temsil etmek üzere dikilen topluluk sanatıdır. Rapa Nui sakinleri, şeflerinin göklerden geldiğini ve ölümden sonra ilâhi bir statüyle geri döneceklerine inanmışlardır. Bu inanış, heykellere kutsal anıt olma özelliği kazandırmış ve bünyesinde kültürel köklerine ait özellikler ekletmiştir.

Genel olarak dikdörtgen yapıda, gövdeden büyük başlarıyla, gövdeye bağlı kollarıyla, tasvir edilen Moai'lerde, vurgunun baş kısmında olduğu, bu orantısız yapılaşmayla gözler önüne serilmiştir. Çünkü inanışa göre baş ne kadar büyükse düşünce de o kadar büyük ve değerlidir. Yine baş uzvuna ait gözler ve burun da abartılı şekilde büyük olarak ele alınmıştır. Bu genel tasvirin dışında Moai'leri farklı kılan bazı özellikler de bulunmaktadır. Kimileri ahu denilen bir kaidenin üzerine yerleştirilmişken, kimilerinin bedenleri yer altına kadar uzanmaktadır. Bazı Moai'ler de çömelmiş şekilde tasvir edilmiştir. Bazılarının sırtlarında motifler bulunurken, bazılarının başlarında Pukao denilen kırmızı başlıklar yer almıştır. İlk bakışta hepsi aynı taş türünden kesilmiş gibi görünse de gerçek şu ki, dört farklı volkanik kaya türünden yontulmuşlardır. Hiçbir Moai birbirine benzememektedir. Her birinin kendine özgü stillerde oyulmuş farklı fiziksel özellikleri bulunmaktadır; bazılarının başı daha yuvarlak, bazılarının gövdesi ise dar ve uzundur. Hatta bazı Moai'lerin iyi korunmuş parmakları dahi bulunmaktadır.

Tüm bu çeşitlilikle birlikte Moai'ler mistik yapısının yanında karakteristik ve benzersiz estetik anlayışıyla, kendinden sonraki medeniyetleri ve sanatçıları etkilemiştir. Primitif sanat hareketlerinden, kübizme, sürrealizme kadar birçok sanat anlayışının esin kaynağı olarak bilinen Moai'ler; Henry Moore, Canstantin Brancuşi, Isamu Noguchi gibi heykeltraşların sanatında öncü hareket olmuştur. Küresel ve popüler kültürün vazgeçilmez unsuru haline gelen Moai'ler, film yapımcılarını, yazarları, oyun tasarımcılarını, endüstri ve moda tasarımını etkileyerek çeşitli sanatsal ve medya ifadelerinin konusu haline gelmiş ve gelmeye devam etmektedir.

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ELASTIC BEHAVIOR OF A SYMMETRIC UNIDIRECTIONAL COMPOSITE LAMINATED E-GLASS/EPOXY

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ABSTRACT
The aim of our work is to characterize the elastic behavior of a unidirectional glass fiber reinforced composite laminate with a 60% volume fraction of epoxy resin matrix E. The determination of the elastic constants of the specifically orthotropic composite laminate is estimated using the rule of mixtures, and macro-mechanical studies have allowed us to determine the evolution of elastic constants based on fiber orientation and calculate the variation of thermo elastic quantities according to fiber orientation. Under the combined effect of mechanical stresses and temperature variations, the overall thermomechanical deformations of the unidirectional laminate will be determined by introducing longitudinal and transverse thermal expansions of the composite.

Keywords: Unidirectional composite laminate, thermo elastic behavior, fiber orientation

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ÖZET

Kuraklık, küresel ısınma ve iklim değişikliği birbiriyle iç içe geçmiş benzer ve ayrı yönleri olan terimler olarak karşımıza çıksa da asıl odak ortak noktaları su kaynaklarının azalması üzerinedir. Su kaynaklarının azalması tüm yaşamsal faaliyetleri olumsuz etkilemekte ancak bu etkinin boyutu su kaynaklarını en çok kullanan tarım dolayısıyla gıda üretim sektörü üzerinde daha büyük bir hacme sahiptir. Böylece tarımsal üretimde su kaynakları üzerindeki baskıyı azaltma yolunda bitkinin ihtiyaç duyduğu su miktarından daha azının bitkiye sağlandığı kısıntılı sulama yaygın bir yaklaşım olarak kullanılmaktadır. Ancak bu yaklaşımda bitkinin gelişimi olumsuz etkilendiğinden dolayı kısıntılı sulamada bitki gelişimini iyileştirici uygulamaların sağlanması gerekmektedir. Bunun sağlanmasını amaçlamış bu çalışma bu amacı sağlarken atık yönetimi de dikkate alarak kuraklık koşullarında yetişen biber bitkisinin azalan gelişimini iyileştirmek için stabilize arıtma çamurunu ve biyoçarı bireysel ve birlikte kullanarak incelemiştir. Çalışmanın sonucunda artan kuraklıkla biberin azalan fiziksel ve fizyolojik özelliklerini iyileştirme açısından stabilize arıtma çamurunun ve biyoçarın bireysel etkilerinin olumlu sonuçlandığı ancak bu etkilerin stabilize arıtma çamurunun ve biyoçarın birlikte kullanımıyla daha da arttığı belirlenmişken, artan su kriziyle başa çıkmada biber bitkisinin tam sulama yerine % 75 seviyesinde sulanmasında su kısıntısının oluşturduğu fiziksel ve fizyolojik azalışları iyileştirme yönünde biber toprağına % 2 stabilize arıtma çamuru ve % 2 biyoçar karıştırılması önerilebilir sonuçlar arasında yer almıştır. Ancak stabilize arıtma çamurunun olası ağır metal ve patojen risklerinin de değerlendirilmesi, değişen sulama suyu seviyeleri ve stabilize arıtma çamuru ve biyoçar oranlarının da farklı toprakların kullanımında araştırılması bu çalışmanın tavsiye edilebilir bulguları arasında konumlanmıştır.

Anahtar Kelimeler: Arıtma çamuru, atık yönetimi, biber, biyoçar, kısıntılı sulama

EFFECTS OF SEWAGE SLUDGE AND BIOCAR APPLICATIONS ON PEPPER (*Capsicum Annuum* L.) GROWTH UNDER DROUGHT CONDITIONS

ABSTRACT

While drought, global warming, and climate change appear as intertwined terms with similar and distinct aspects, their primary focus is on the depletion of water resources. The depletion of water resources negatively impacts all vital activities, but the magnitude of this impact is even greater on agriculture, which is the largest consumer of water resources, and therefore the food production sector. Thus, deficit irrigation, where the plant receives less water than it needs, is a common approach to reducing water resource pressure in agricultural production. However, since this approach negatively impacts plant development, it is necessary to implement practices that enhance plant growth during deficit irrigation. This study aims to achieve this by examining the use of stabilized sewage sludge and biochar, both individually and in combination, to improve the declining growth of pepper plants grown under drought conditions, while also considering waste management. The study concluded that the individual effects of stabilized sewage sludge and biochar were positive in improving the physical and physiological properties of pepper that decreased with increasing drought. However, these effects were further enhanced by the combined use of stabilized sewage sludge and biochar. In order to cope with the increasing water crisis, mixing 2% stabilized sewage sludge and 2% biochar into pepper soil was recommended to improve the physical and physiological declines caused by water shortages when pepper plants are irrigated at 75% instead of full irrigation. However, the recommended findings of this study include also assessing the potential heavy metal and pathogen risks of stabilized sewage sludge, and investigating varying irrigation water levels and stabilized sewage sludge and biochar ratios when used in different soils.

Keywords: Sewage sludge, waste management, pepper, biochar, deficit irrigation

GİRİŞ

Yaşamın, ekolojinin ve hidrolojik döngünün temelini oluşturan su tarım için de vazgeçilmez bir girdidir. Küresel ölçekte % 85 ile % 90 arasında suyun en büyük kullanıcısının tarımsal sulama olduğu tahmin edilmektedir (Qin vd., 2019). Sulama bir taraftan verim ve kalite artışını desteklerken, diğer taraftan gerekli önemler alınmadığında yaşama, ekolojiye ve hidrolojik döngüye zarar vermektedir (Cakmak ve Gokalp, 2011). Bu durum su kaynaklarının azalmasına, kişi başına su mevcudiyetinin yetersiz kalmasına ve suyun dünya yüzeyinde adil bir dağılım göstermemesinden dolayı bazı kurak ve yarı kurak bölgelerde su kıtlığı ve buna bağlı hastalıkların artmasına neden olmaktadır (Droogers vd., 2012). Ancak bunlar arasında belki de en önemlisi suyun yetersizliğine bağlı olarak tarımsal faaliyetlerin azalması, verim ve kalitenin sınırlanması ve gıda üretiminde arz ve talep dengesinin kırılmasıdır (Gu vd., 2024).

Bu ifadeler ışığında tarımda daha az su tüketimi ve her damla suya karşın daha etkin bir üretim geliştirilmesi önem arz etmektedir. Bunun sağlanması amacıyla da bitkinin ihtiyacı olan suyun belli dönemlerde azaltılarak verilmesine imkan sağlayan kısıntılı sulama pratiği ilk olarak akla gelmektedir (Tufenkci ve Yerli 2023). Sulamada daha az su tüketimine imkan sağlayan kısıntılı sulama su tasarrufu sağlayan bir model olarak özellikle kurak ve yarı kurak bölgeler için elzem bir yaklaşımdır (Chai vd., 2014) Bu yaklaşımla sağlanan su azaltımı sayesinde buradan sınırlandırılan suyun farklı alanların sulanmasında kullanım imkanı da söz konusudur (Kaman vd., 2022). Ancak kısıntılı sulamanın olumsuz etkisi bitki yeterli su sağlayamadığından dolayı yeterli seviyede gelişim gösterememekte ve verim ve kalitesi sınırlanmaktadır. Bu nedenle kısıntılı sulamada verim ve kalite iyileştirici uygulamalara ihtiyaç duyulmaktadır.

Toprağa organik madde sağlanması organik maddenin kolloidal yüzeyi ve gözenekliliği geliştirmesiyle toprakta suyun tutulumunu teşvik etmektedir (Lal, 2020). Böylece bu durum suyun toprakta daha uzun süre tutulmasını ve bitki tarafından toprak su deposundan yararlanma indeksinin artmasını sağlamaktadır. Hiric vd. (2014) kısıntılı sulamada toprağa sağlanan organik madde katkısının kısıntılı sulamanın olumsuz etkilerini azalttığını bildirmişlerdir. Emde vd. (2021) bu durumu organik maddenin toprağın su tutma kapasitesini arttırmasına bağlı olarak açıklamışlardır. Böylece kısıntılı sulamada toprağa organik madde sağlanması tarımsal sürdürülebilirlik ve su kaynaklarının sürdürülebilirliği için önemlidir. Bir ayrı önemli nokta ise bazı organik artıkların tarımsal alanlarda değerlendirilmesi onların geri dönüşüm kapasitesinin arttırılmasıyla çevresel sürdürülebilirlik ve doğal denge için de önemlidir.

Arıtma tesislerinde bertarafı oldukça zor olan stabilize arıtma çamurları genel olarak yakılmakta, su-toprak kaynaklarına deşarjı sağlanmakta veya kontrollü depolama altında alınmaktadır. Ancak bu durum çevresel açıdan risk teşkil ettiği gibi ekonomik olarak da zor bir seçenektir (Yerli vd., 2023). Bu nedenle bunların tarımsal amaçlı kullanımı en mantıklı bertaraf yöntemi olarak değerlendirilmektedir (Mondal vd., 2015). Ayrıca stabilize arıtma çamurları barındırdıkları yüksek organik madde, azot, fosfor, potasyum ve diğer besin elementleriyle birer doğal gübre görevi de görmektedirler (Krogstad vd., 2005; Yoshida vd., 2015). Benzer görevleri ve toprağa katkıları içeren biyoçar da çeşitli organik maddelerin geri dönüşümünü sağladığından dolayı çevre dostu ve tarım topraklarını iyileştiren bir uygulama olarak karşımıza çıkmaktadır (Buss vd., 2020). Sınırlı oksijen ve değişen (≤400-850°C) ancak yüksek sıcaklıklarda biyokütlenin pirolizi neticesinde oluşan biyoçar (Nessa vd., 2021) toprakta organik maddenin sekestrasyonunu arttırmasıyla hem toprakta suyun buharlaşmadan tutulmasına hem de çeşitli sera gazlarının topraktan salınımının azaltılmasına katkı sağlayarak (Cayuela vd., 2014) birçok yönüyle tarım, çevre ve su kaynakları üzerinde sürdürülebilirliği teşvik eder (Bai vd., 2022).

Birçok araştırmacı arıtma çamuru ve biyoçarın kuraklık stresini azaltıcı etkilerini rapor etmişlerdir. Ancak yapılan literatür taramaları arıtma çamuru ve biyoçarın kombinasyonu sonucunda beraber kullanılarak biber bitkisindeki kuraklığı iyileştirici etkilerinin test edildiği herhangi bir çalışmaya rastlanmamıştır. Böylece bu çalışma kuraklık stresine karşı arıtma çamuru ve biyoçarın beraber kullanımının biber bitkisinin fiziksel ve fizyolojik özelliklerini iyileştirip iyileştirmeyeceği araştırma sorusunu ele almış ve arıtma çamuru ve biyoçarın beraber kullanımının biber bitkisinde kuraklık stresinin olumsuz etkilerini iyileştireceği hipotezi üzerine kurulmuştur.

MATERYAL VE METOT

Van Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Biyosistem Mühendisliği Bölümü deneme alanında bulunan serada yürütülen çalışmada bitkisel materyal olarak Şölen çeşidi hibrit biber fidesi (*Capsicum Annuum* L.) kullanılmıştır. Çalışmanın ana materyallerinden olan biyoçar ticari olarak temin edilmişken, arıtma çamuru deneme alanına yaklaşık 5 km mesafede bulunan İskele Atık Su Arıtma Tesisi'nde alınarak deneme alanına getirilmiştir.

Çalışma 3 farklı değişen seviyelerde kısıntılı sulama pratiklerinde (% 100: Tam sulama, % 75: % 25 kısıntılı sulama, % 50: % 50 kısıntılı sulama) arıtma çamuru ve biyoçarın 9 farklı uygulaması altında (A0B0: Kontrol, A0B1: % 1 biyoçar, A0B2: % 2 biyoçar, A1B0: % 1 stabilize arıtma çamuru, A1B1: % 1 stabilize arıtma çamuru + % 1 biyoçar, A1B2: % 1 stabilize arıtma çamuru + % 2 biyoçar, A2B0: % 2 stabilize arıtma çamuru, A2B1: % 2 stabilize arıtma çamuru + % 1 biyoçar, A2B2: % 2 stabilize arıtma çamuru + % 2 biyoçar) 3 tekerrürlü olarak yürütülmüştür. Elenmiş hava kurusu halindeki homojen toprak doğal hacimleri korunacak

şekilde saksılara aktarılmış akabinde saksılara arıtma çamuru ve elenmiş biyoçar uygulamaları anılan oranlar dikkate alınarak (% 0, % 1 ve % 2) ağırlık esasına uygulanmıştır. Ancak arıtma çamuru toprağa karıştırılmadan önce ortalama kuru madde içeriğinin % 25 ila % 30 seviyelerinde olması için belli bir süre kurutulmuştur (Yerli vd., 2023). Drenajı iyileştirmek için her saksının alt tabakasına kum-çakıl malzemesi serilmiş ve dış faktörlerin etkisini azaltmak amacıyla saksıların yerleri her sulamada rastgele olarak değiştirilmiştir.

Fidelerin dikiminin hemen peşine ilk sulamayla tüm saksılar tarla kapasitesine tamamlanmıştır. Tarla kapasitesi sırasıyla kontrol uygulamasının (A0B0) suya doyurulması, buharlaşmayı engellemek için üzerinin kapatılması ve drenaj tamamen durduğunda tartılmak suretiyle ağırlık esasına göe belirlenmesiyle elde edilmiştir. Bu aşamadan sonra farklı sulama suyu seviyelerinde (%100, % 75, % 50) sulama uygulamalarına geçilmiş ve sulamalar tam sulama gerçekleştirilen (% 100) kontrol uygulamasında (A0B0) tartımlar gerçekleştirilerek saksı kapasitesinin % 30'unun tükendiği süreçte farklı sulama suyu seviyeleri dikkate alınarak çalışma boyunca sürdürülmüştür.

İlk hasat olgunluğuna gelen bitkinin hemen hasat sonrası kök ağırlığı tartılmış daha sonra 68°C'de sabit ağırlığa ulaşıncaya kadar kurutularak tekrar kök tartımı yapılmış ve sonuçta kök yaş ve kuru ağırlıkları elde edilmiştir. Aynı yaklaşımla sürgün yaş ve kuru ağırlıkları da belirlenmiştir. Yaprak alanının ölçümünde Licor 3000C yaprak alan ölçer kullanılmıştır. Yaprak ve meyve sayısı her bitki için sayılarak elde edilmiştir. Meyve ağırlığı ve boyunun belirlenmesi için meyve ağırlık tartımları ve meyve boyu ölçüm işlemleri gerçekleştirilmiştir. Her bitkinin kök boğazından büyüme ucuna kadar olan kısmı ölçülerek bitki boyu belirlendikten sonra aynı örneklerin gövde çapının belirlenmesinde dijital kumpas aleti kullanılmıştır. Klorofil ölçümleri için SPAD-502 klorofilmetre cihazından yararlanılmıştır. Yaprak oransal su içeriği ve elektrolit sızıntısının belirlenmesinde temel analizler baz alınarak aşağıdaki eşitlikler kullanılmıştır.

$$LRWC = [(W - D) / (T - D)] \times 100$$

$$EL = [(EC_{\blacksquare} / EC_{\square}) \times 100]$$

LRWC yaprak oransal su içeriği (%), W taze yaprak ağırlığı (g), D kuru yaprak ağırlığı (g), T turgor yaprak ağırlığı (g), EL elektrolit sızıntısı (%), $EC_{\blacksquare}$ yaprak örneğinin saf suda 24 saat bekletildikten sonraki elektriksel iletkenliği (dS/m) ve $EC_{\square}$ aynı yaprak örneğinin 95°C'de su banyosunda 20 dakika bekletilip oda sıcaklığına kadar soğutulduktan sonraki elektriksel iletkenliğidir (dS/m).

Çalışma sonucunda elde edilen tüm verilerin istatistiksel olarak işlenmesinde SPSS paket programı kullanılmıştır. Bu amaçla veriler varyans analize tabi tutulmuş ve akabinde

SONUÇLAR VE TARTIŞMA

Değişen seviyelerde kısıntılı sulama pratiklerinde arıtma çamuru ve biyoçar uygulamalarının kök yaş ve kuru ağırlıklara, sürgün yaş ve kuru ağırlıklara, yaprak alanı ve sayısına, meyve sayısı ve ağırlığına, meyve ve bitki boyuna, gövde çapına, klorofil, yaprak oransal su ve membran zararlanma içeriklerine etkileri Şekil 1-4'de sunulmuştur.

Değişen seviyelerde kısıntılı sulama uygulamalarının bu çalışmada incelenen tüm parametrelere etkileri istatistiksel olarak $p<0,01$ seviyesinde önemli olmuştur. Artan kısıntılı sulamayla kök yaş ve kuru ağırlıkları, sürgün yaş ve kuru ağırlıkları, yaprak alanı ve sayısı, meyve sayısı ve ağırlığı, meyve ve bitki boyu, gövde çapı, klorofil ve yaprak oransal su azalırken, membran zararlanma artış göstermiştir.

Kısıntılı sulamaya bağlı olarak bitkinin fiziksel ve fizyolojik özelliklerindeki zayıflama beklenen bir etki olarak topraktan su ve dolayısıyla besin alamayan bitkinin gelişim gerilemesi göstermesiyle açıklanabilir. Kuraklığa maruz kalan bitki stresle başa çıkabilmek amacıyla fiziksel gelişim fonksiyonlarını azaltmaktadır (Gencoglan vd., 2006). Böylece su stresinde bitkinin ilk etkilenen organları fiziksel organlar olmaktadır (Korkmaz ve Durmaz, 2017). Böylece fiziksel gelişim parametreleriyle sulama suyu miktarı arasındaki doğrusal ilişkiden bahsetmek mümkündür. Sulama suyu miktarıyla verim arasındaki doğrusal ilişkiye dikkat çeken Tekin vd., (2016) de kısıntılı sulamaya bağlı olarak salçalık biberdeki verim ve kalite azalışlarıyla fiziksel özelliklerdeki gelişim geriliğine vurgu yapmışlardır. Benzer bulgular Kirnak vd. (2002) tarafından da belirtilmiş yüzey üstü ve yüzey altı damla sulamada azalan sulama suyu seviyesine bağlı olarak biberin verim ve kalite özellikleri ile gelişimindeki noksanlığa dikkat çekilmiştir. Farklı bir çalışmada Colak ve Yazar (2024) farklı sulama yöntemi ve stratejileri altında dolmalık biberin kalite parametrelerini incelemişler ve sonuçta biberin sulama suyu tüketimiyle fiziksel ve fizyolojik özelliklerdeki gelişime vurgu yapmışlardır. Aslında bu durum doğrudan kısıntılı sulamanın oluşturmuş olduğu yetersiz toprak neminin metabolik ve fizyolojik süreçler üzerindeki bir etkisidir. Bu etkinin bir yansıması olarak toprak su deposundaki yetersizlik bitkinin tüm süreçlerini olumsuz etkileyerek bitki büyümesini ve fiziksel özelliklerdeki gelişimi zayıflatmakta ve hatta ilerleyen süreçlerde tamamen durdurabilmektedir (Fard vd., 2011). Bitkinin susuzluktan etkilenen tüm süreçleri içerisinde en çok göze çarpan klorofil ve kloroplast fonksiyonlarıdır (Kuzucu, 2021). Kuraklığa maruz kalan bitki stomalarını kapatmakta böylece su kaybının önüne geçmeye yönelik bir eylem hazırlamakta ancak bu durumda klorofil içeriği de azalmaktadır. Kuraklıktaki bir diğer etki yetersiz toprak neminden beslenen bitkinin yapraklarında daha az su potansiyeli sergilemesi yönündedir (Yerli vd., 2023). Yetersiz toprak nemi stomaların kapanmasına, yapraktaki su potansiyelinin azalmasına böylece daha az klorofil içeriğine neden olmakla kalmayıp ayrıca daha az yaprak oransal su içeriğinden dolayı yapraklarda artan sıcaklık neticesinde klorofil organlarının ve hücre membran sistemlerinin böylece de klorofilin içeriğinin azalmasına ve membran zararlanmanın artmasına neden olmaktadır (Erguler vd., 2024).

Arıtma çamuru ve biyoçar uygulamalarının meyve sayısı hariç bu çalışmada incelenen tüm parametrelere etkileri istatistiksel olarak $p<0,01$ seviyesinde önemli olmuştur. Arıtma çamuru, biyoçar ve bunların artan oranlarıyla kök yaş ve kuru ağırlıkları, sürgün yaş ve kuru ağırlıkları, yaprak alanı ve sayısı, meyve sayısı ve ağırlığı, meyve ve bitki boyu, gövde çapı, klorofil ve yaprak oransal su artarken, membran zararlanma azalış göstermiştir.

Arıtma çamuruna bağlı olarak bitkinin fiziksel ve fizyolojik özelliklerindeki artış arıtma çamurunun organik madde içeriğine bağlı olarak toprak neminin korunumunu iyileştirmesi ve toprağa çeşitli mikro ile makro besin elementleri sağlayarak bitki tarafından kullanımına teşvik etmesi ile ilişkili olarak ele alınabilirken, aynı etkinin biyoçarda gerçekleşmesi de benzer şekilde biyoçarın süngerimsi yapısı sayesinde toprak su deposunu iyileştirmesi ve besin elverişliliğine katkı sunması ile ilişkili olarak değerlendirilebilir. Yerli vd. (2023) stabilize arıtma çamuru eklenen toprakta daha az H_2O salınımı gerçekleştiğini ve toprak neminin daha yüksek olduğunu ifade etmişlerdir. Böylece bu çalışmada arıtma çamurunun toprak nemini koruyucu etkisi neticesinde bitkinin fiziksel ve fizyolojik özelliklerindeki artış net olarak açıklanabilir. Ayrıca arıtma çamurunun zengin içeriği bitki beslenmesini teşvik edici özelliğiyle bitkisel verim ve kaliteyi geliştirmektedir (Siebielec vd., 2018). Arıtma çamuru toprağa organik madde katkısı sunmanın yanında azot, fosfor ve potasyum ile eser element içeriği sağlayıcı etkilerle de bitkisel üretimin verimini ve kalitesini artırırken (Badaou ve Sahin 2021), kimyasal gübre ihtiyacını da azaltmaktadır (Yoshida vd., 2015). Bu da stres koşullarında dahi olsa bitki gelişimini teşvik edici bir etkidir. Benzer şekilde biyoçar da toprak nemini

koruyucu bir etki sunmaktadır. Ancak biyoçarın nemini koruyucu etkisi organik madde katkısından daha çok süngerimsi yapı ve por özelliğiyle nemi muhafaza etme ve buharlaşmaya karşı koruma yönünde gerçekleşmektedir. Yerli vd. (2022) farklı ham madde içeriklerinden üretilmiş biyoçarların toprak nemine etkisini irdeledikleri çalışmada, biyoçarın toprak nemini koruyucu etkisinin biyoçarsız toprağa göre yaklaşık % 10'a kadar daha fazla olduğunu ve aynı şartlar altında H_2O salınımının % 8'e kadar azaldığını bildirmişlerdir. Farklı bir çalışmada biyoçarın değişen oranlarının evapotranspirasyonu % 4 ile % 11 seviyeleri arasında azalttığına dikkat çekilmiştir (Feng vd., 2023). Biyoçarın toprak nemini koruyucu özelliği doğrudan yapısal özelliğine atfedilirken (Ajayi ve Rainer, 2017), biyoçar besin elementlerinin kullanışlılığını arttıran ve toprağa makro ile mikro besin element katkısı sunan yapısal özellikler de sunmaktadır (Muñoz vd., 2016). Böylece biyoçar uygulanan toprakta yetişen bitkiler hem biyoçarın sunduğu besinlerden yararlanma yoluyla hem de biyoçarın toprak besin elementlerinin kullanışlılığını arttırma yoluyla daha yüksek fiziksel ve fizyolojik karakteristik özellikler sunarlar (Yaganoglu vd., 2023). Klorofilin yapı taşının Fe ve N olduğu dikkate alındığında (Rodriguez ve Miller, 2000), bu çalışmada arıtma çamuru ve biyoçar uygulamalarında artan klorofil içeriği arıtma çamuru ve biyoçarın Fe ve N içeriğine atfedilebilir. Yaprak oransal su içeriğindeki artış da arıtma çamuru ve biyoçarın toprak nemini daha fazla muhafazası neticesinde, bitkinin su kullanışlılığının artmasıyla başta yaprak olmak üzere çeşitli organlarında su birikiminin ve su tüketiminin iyileşmesine bağlı olarak değerlendirilebilir. Böylece arıtma çamuru ve biyoçar uygulamalarında membran zararlanma artan yaprak oransal su içeriğiyle açıklanabilir.

Tüm bu değerlendirmeler ışığında arıtma çamuru+biyoçar uygulamalarında biberin fiziksel (kök yaş ve kuru ağırlığı, sürgün yaş ve kuru ağırlığı, yaprak alanı ve sayısı, meyve sayısı, ağırlığı ve boyu, bitki boyu ve gövde çapı) ve fizyolojik (klorofil, membran zararlanma ve yaprak oransal su) özelliklerinin gelişimi arıtma çamuru ve biyoçarın bireysel etkisinin birleşimi neticesinde bir kombine etki olarak değerlendirilebilir.

SONUÇLAR VE ÖNERİLER

Değişen seviyelerde kısıntılı sulama pratiklerinin kuraklık etkisine bağlı olarak biberin kök yaş ve kuru ağırlığı, sürgün yaş ve kuru ağırlığı, yaprak alanı, yaprak ve meyve sayısı, meyve ağırlığı, meyve ve bitki boyu, gövde çapı, klorofil, yaprak oransal su ve elektrolit sızıntısı değerleri azalırken, stabilize arıtma çamuru ve biyoçar bu azalışı sınırlandırarak iyileştirici bir etki göstermiş ancak bu azalışı iyileştirici etki stabilize arıtma çamuru ve biyoçarın bireysel etkisine göre onların birlikte kullanımında daha belirgin olmuştur. Böylece su tasarrufu sağlamak amacıyla biber bitkisinin tam sulama yerine % 75 seviyesinde sulanmasında su kısıntısının oluşturduğu fiziksel ve fizyolojik azalışları iyileştirme yönünde biber toprağına % 2 stabilize arıtma çamuru ve % 2 biyoçarın birlikte karıştırılması önerilebilir bulgular arasında yer almıştır. Ayrıca stabilize arıtma çamurunun olası ağır metal ve patojen riskleri ve bulaşı etkisinin de değerlendirilmesi, değişen sulama suyu seviyeleri ve stabilize arıtma çamuru ve biyoçar oranlarının da farklı toprakların kullanımında araştırılması tavsiye edilebilir bulgular arasında konumlanmıştır.

TEŞEKKÜR

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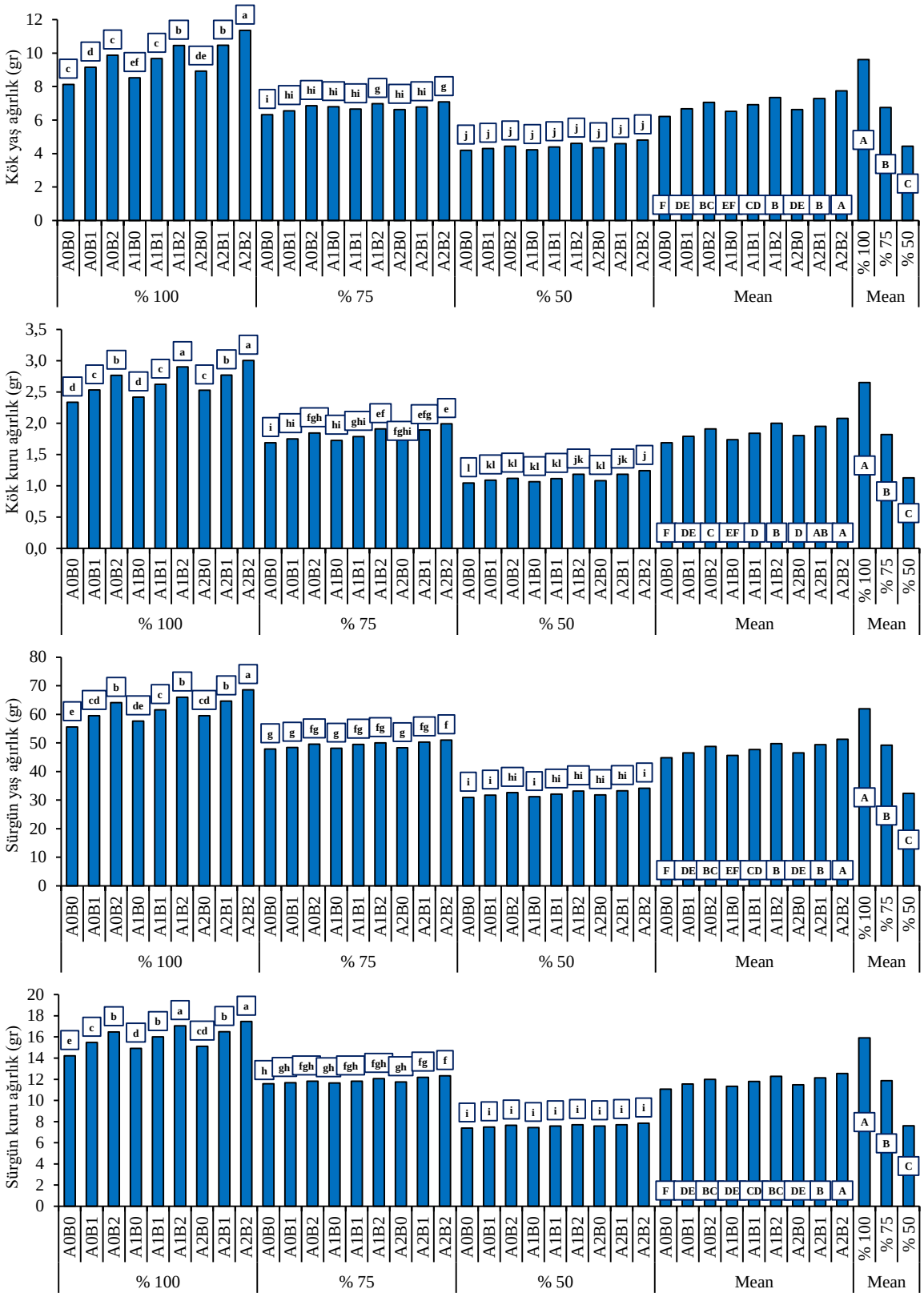
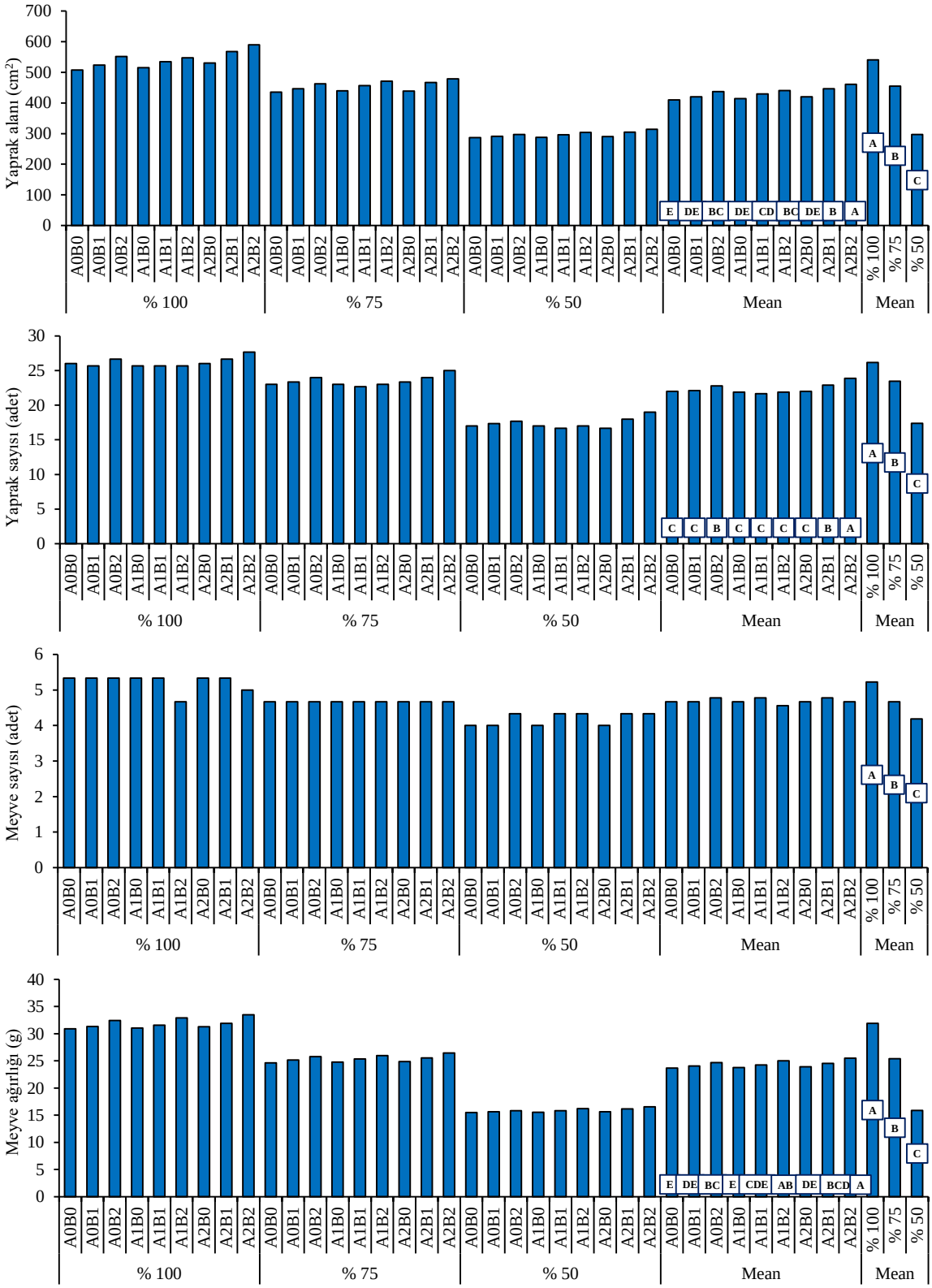


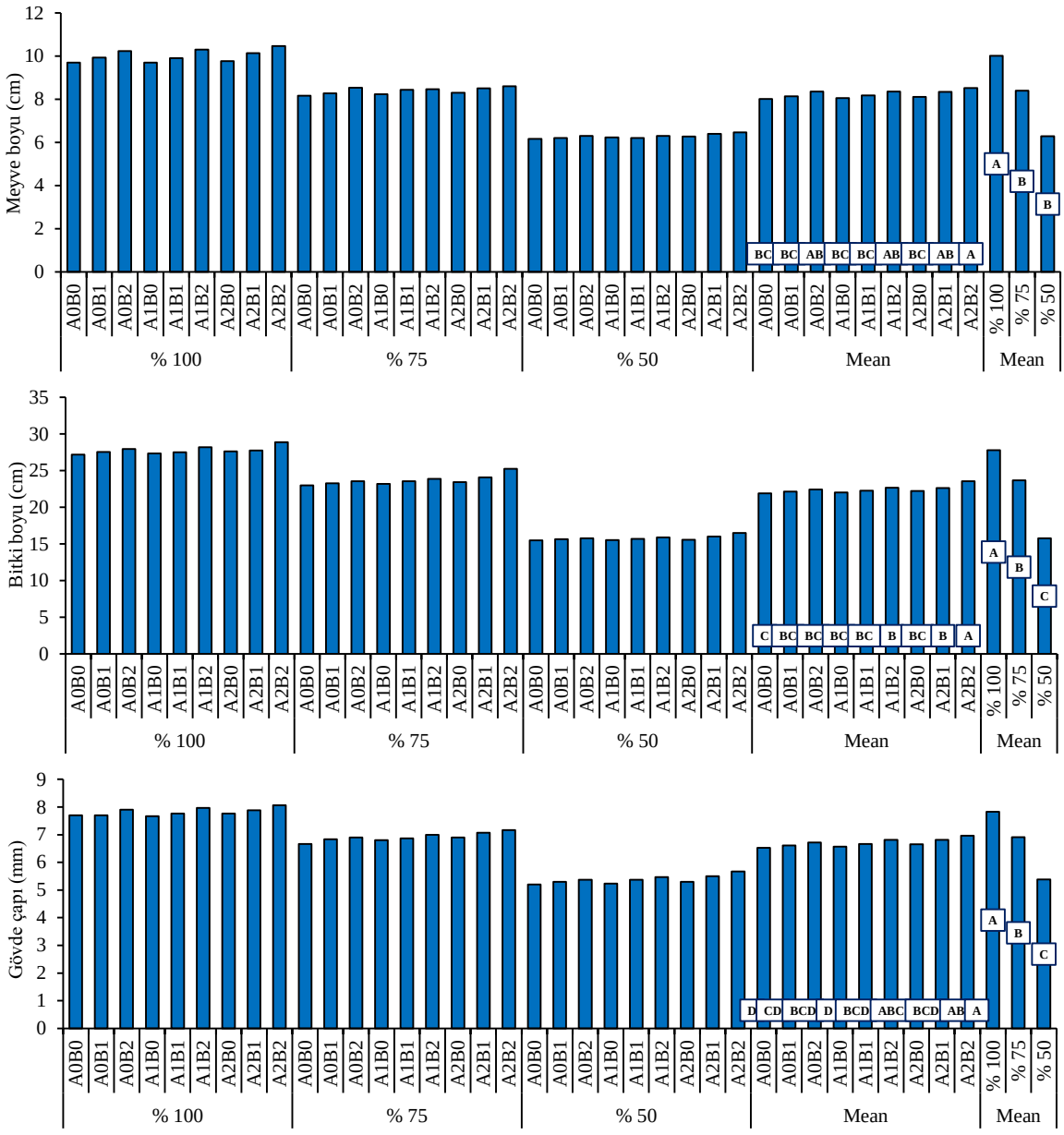
Şekil 1. Değişen seviyelerde kısıntılı sulama pratiklerinde arıtma çamuru ve biyoçar uygulamalarının kök ve sürgün yaş ve kuru ağırlıklara etkileri (% 100: Tam sulama, % 75: % 25 kısıntılı sulama, % 50: % 50 kısıntılı sulama, A0B0: Kontrol, A0B1: % 1 biyoçar, A0B2: % 2 biyoçar, A1B0: % 1 stabilize arıtma çamuru, A1B1: % 1 stabilize arıtma çamuru + % 1 biyoçar, A1B2: % 1 stabilize arıtma çamuru + % 2 biyoçar, A2B0: % 2 stabilize arıtma çamuru,

A2B1: % 2 stabilize arıtma çamuru + % 1 biyoçar, A2B2: % 2 stabilize arıtma çamuru + % 2 biyoçar, İstatistiksel olarak harflendirilmiş tüm gruplar 0,001 seviyesinde önemli olmuştur)

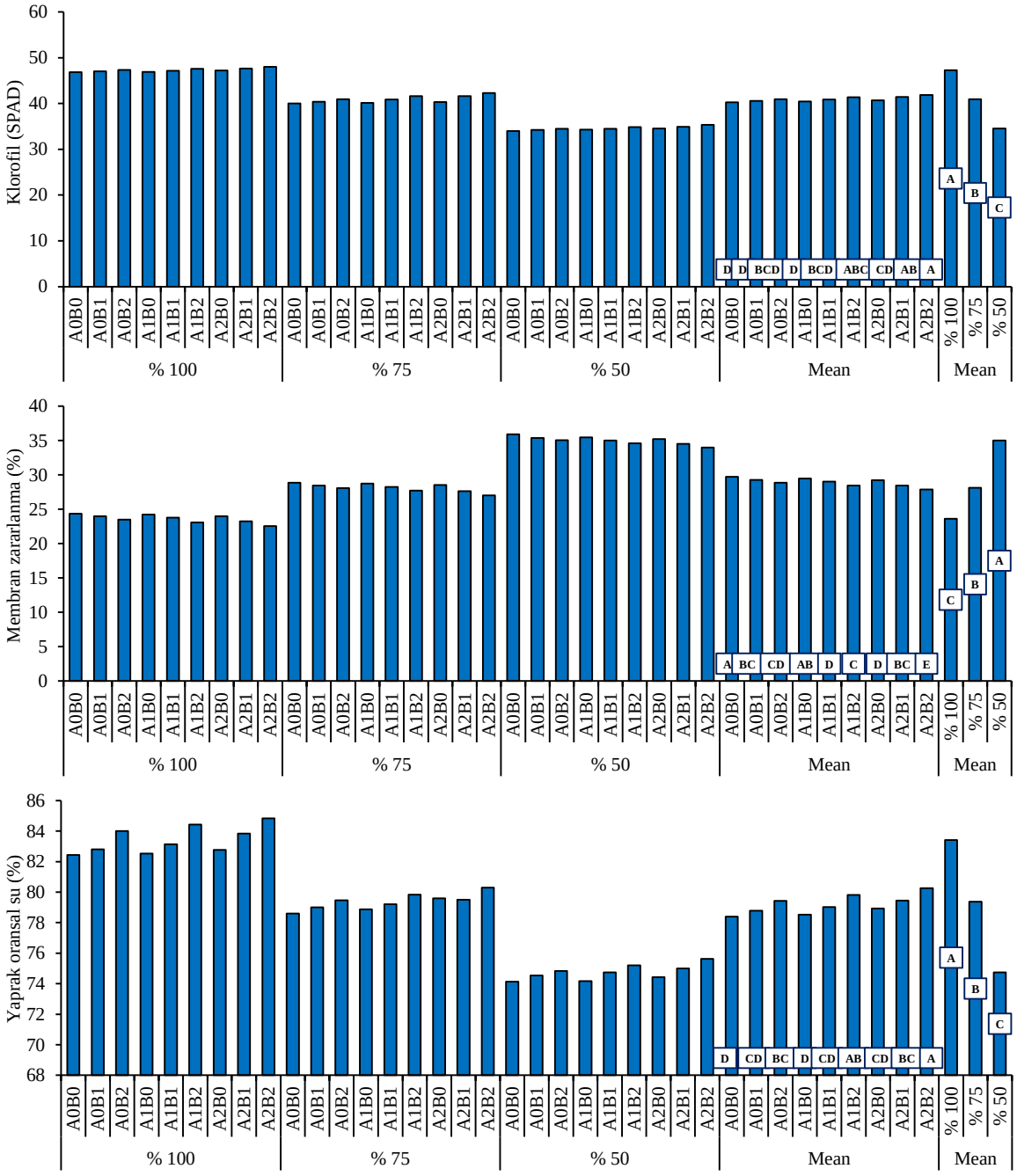


Şekil 2. Değişen seviyelerde kısıntılı sulama pratiklerinde arıtma çamuru ve biyoçar uygulamalarının yaprak alanı, yaprak ve meyve sayısı ve meyve ağırlığına etkileri (% 100: Tam sulama, % 75: % 25 kısıntılı sulama, % 50: % 50 kısıntılı sulama, A0B0: Kontrol, A0B1: % 1 biyoçar, A0B2: % 2 biyoçar, A1B0: % 1 stabilize arıtma çamuru, A1B1: % 1 stabilize

arıtma çamuru + % 1 biyoçar, A1B2: % 1 stabilize arıtma çamuru + % 2 biyoçar, A2B0: % 2 stabilize arıtma çamuru, A2B1: % 2 stabilize arıtma çamuru + % 1 biyoçar, A2B2: % 2 stabilize arıtma çamuru + % 2 biyoçar, İstatistiksel olarak harflendirilmiş tüm gruplar 0,001 seviyesinde önemli olmuştur)



Şekil 3. Değişen seviyelerde kısıntılı sulama pratiklerinde arıtma çamuru ve biyoçar uygulamalarının meyve ve bitki boyu ve gövde çapına etkileri (% 100: Tam sulama, % 75: % 25 kısıntılı sulama, % 50: % 50 kısıntılı sulama, A0B0: Kontrol, A0B1: % 1 biyoçar, A0B2: % 2 biyoçar, A1B0: % 1 stabilize arıtma çamuru, A1B1: % 1 stabilize arıtma çamuru + % 1 biyoçar, A1B2: % 1 stabilize arıtma çamuru + % 2 biyoçar, A2B0: % 2 stabilize arıtma çamuru, A2B1: % 2 stabilize arıtma çamuru + % 1 biyoçar, A2B2: % 2 stabilize arıtma çamuru + % 2 biyoçar, İstatistiksel olarak harflendirilmiş tüm gruplar 0,001 seviyesinde önemli olmuştur)



Şekil 4. Değişen seviyelerde kısıntılı sulama pratiklerinde arıtma çamuru ve biyoçar uygulamalarının klorofil, membran zararlanma ve yaprak oransal su içeriklerine etkileri (% 100: Tam sulama, % 75: % 25 kısıntılı sulama, % 50: % 50 kısıntılı sulama, A0B0: Kontrol, A0B1: % 1 biyoçar, A0B2: % 2 biyoçar, A1B0: % 1 stabilize arıtma çamuru, A1B1: % 1 stabilize arıtma çamuru + % 1 biyoçar, A1B2: % 1 stabilize arıtma çamuru + % 2 biyoçar, A2B0: % 2 stabilize arıtma çamuru, A2B1: % 2 stabilize arıtma çamuru + % 1 biyoçar, A2B2: % 2 stabilize arıtma çamuru + % 2 biyoçar, İstatistiksel olarak harflendirilmiş tüm gruplar 0,001 seviyesinde önemli olmuştur)

DOMATESİN SU AYAK İZİ: VAN İLİ (TÜRKİYE) ÖRNEĞİ

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ÖZET
Temiz su kaynaklarının azalması özellikle tarım sektörünü yoğun bir şekilde etkilediğinden dolayı tarımda su yönetim modellerinin kullanımını ön plana çıkarmıştır. Böylece diğer su yönetim modellerinden çok yönüyle ayrışan su ayak izi kavramının tarımsal üretimde kullanımı yaygınlaşmıştır. Özellikle suya erişimi sınırlı olan kurak ve yarı kurak bölgelerde su ayak izi hesaplamaları ileriye yönelik önlem ve politikalar sunduğundan dolayı son zamanlarda üzerindeki çalışmaların artış göstermesine neden olmuştur. Bu çalışma kuraklık sınırına yakın yarı kurak iklime sahip olan ve küresel ısınmadan oldukça etkilenen Van ilinde en fazla üretilen sebzelerden domatesin (*Solanum lycopersicum*) yeşil, mavi ve toplam su ayak izlerini 2005 ve 2024 yılları arasında yaklaşık 20 yıllık periyot ve ortalamasında belirlemeyi amaçlamıştır. Bu amacın sonucunda, Van ilinde domatesin yılların ortalamasında toplam su ayak izinin 169,5 m^3/ton olduğu ancak bunun neredeyse dörtte üçünün mavi su ayak izinden (120,6 m^3/ton) geriye kalan kısmının ise yeşil su ayak izinden (48,9 m^3/ton) oluştuğu belirlenmiştir. Ayrıca sonuçlar domatesin 2013-2016 yılları arasında daha yüksek su ayak izi sergilediğini, 2005-2013 yılları arasında bunun daha düşük olduğunu ve son yıllara doğru (2016-2024) en düşük su ayak izi değerlerinin gerçekleştiğini göstermiştir. Sonuçlar nezdinde, Van ilinde domates üretiminde yeşil su ayak izinin arttırılması böylece mavi su ayak izinin azaltılması tavsiye edilebilir olarak bulunmuş ve bu tavsiye edilebilir bulgu neticesinde daha kapsamlı çalışmaların yürütülmesi de önerilebilir bulgular arasında yer almıştır.
Anahtar Kelimeler: Domates, mavi su, su ayak izi, Van, yeşil su

WATER FOOTPRINT OF TOMATO: THE CASE OF VAN PROVINCE (TURKEY)

ABSTRACT
The depletion of freshwater resources, particularly as it significantly impacts the agricultural sector, has brought the use of water management models to the forefront in agriculture. This has led to the widespread use of the water footprint concept, which differs from other water management models in many ways, in agricultural production. Water footprint calculations, particularly in arid and semiarid regions with limited access to water, have recently received increased attention because they offer forward-looking measures and policies. This study aimed to determine the green, blue and total water footprints of tomato (*Solanum lycopersicum*), one of the most produced vegetables in Van province, which has a semi-arid

climate close to the drought limit and is highly affected by global warming, in average 20-year period, between 2005 and 2024. As a result of this aim, it was determined that the total water footprint of tomatoes in Van province on average over the years was 169.5 m^3 ton^{-1}, but almost three-quarters of this consisted of the blue water footprint (120.6 m^3 ton^{-1}) and the remaining part consisted of the green water footprint (48.9 m^3 ton^{-1}). Additionally, the results showed that tomato exhibited a higher water footprint between 2013 and 2016, a lower one between 2005 and 2013, and the lowest water footprint values were achieved towards recent years (2016-2024). Based on the results, it was found to be advisable to increase the green water footprint in tomato production in Van province, thus reducing the blue water footprint, and as a result of this advisable finding, conducting more comprehensive studies was also among the advisable findings.
Keywords: Tomato, blue water, water footprint, Van, green water

GİRİŞ

Yaşamın tüm evresini saran su kıtlığı özellikle küresel ölçekte temiz su tüketiminin % 70'ini oluşturan tarımda en önemli sorunlardan biridir (Ingrao vd., 2023). Temiz su tüketiminin artmasının yanı sıra nüfussal popülasyondaki artış ve küresel ısınma, daha fazla su tüketimine neden olmakta ayrıca temiz su kaynaklarının kirlilik yükünü de arttırmaktadır (El-aziz vd., 2024). Bu durum gıda üretimine katkı sağlayan tarımsal üretimi tüm sektörlerden daha fazla etkilemektedir (Yerli ve Sahin, 2022). Yakın gelecekte her dört kişiden birinin ciddi su kıtlığı yaşayacağı (Mallareddy vd., 2023) ve her üç kişiden birinin güvenli gıda erişiminin sınırlanacağı ön görülmektedir (Mansour vd., 2025). Bu durumda bölgelerin su yönetimlerinin çeşitli modellerle ele alınması ve önlem planlarının oluşturulması gerekmektedir.

Bir su yönetim modeli olan su ayak izi kavramı diğer yönetim modellerinden farklı olarak tüketim veya üretimin doğrudan su kullanımını değil aynı zamanda dolaylı su kullanımını da inceleyen bir su kullanım göstergesidir (Evangelou vd., 2016). Tüm sektörler için kullanım imkanına sahip olan su ayak izi, suyun daha yoğun kullanımına sahip tarım sektörü için daha büyük önem arz etmektedir (Cakmakci ve Sahin, 2024; Yerli ve Sahin, 2024). Bu yönetim modeli tarım sektöründe farklı alternatif süreçler ve ürünler hakkındaki kararları desteklemek, suyun kullanımı ve dağıtımı da dahil olmak üzere daha iyi su yönetimi için eylemleri ortaya koymak için kullanılmaktadır (Boulay vd., 2013; Hess vd., 2015). Diğer su yönetim modellerinden farklı olarak sadece suyun hacim miktarı, nerede ve ne zaman kullanıldığıyla değil suyun türünü de tanımlamaktadır. Suyun yeşil su türü olan yeşil su ayak izi yağışlarla beslenen kısmı, geriye kalan kısmı ise sulamaya karşılarak gelerek mavi su ayak izini oluşturmaktadır (Hoekstra ve Mekonnen, 2012). Böylece üretimde bir ürünün su ayak izinin yoğunlukla yeşil su ayak izinden oluşması arzu edilmektedir. Bu nedenle de bir tarımsal ürünün su ayak izinin belirlenmesi önlem ve politikalar geliştirebilmek adına oldukça değerli bir yaklaşımdır (Evangelou vd., 2016).

Bu çalışma, yukarıda ifade edilen gereksinimlere yönelik, yarı kurak iklime sahip olan ve küresel ısınmadan oldukça etkilenen Türkiye'nin doğusundaki Van ilinde, Türkiye İstatistik Kurumu verilerine göre (TUİK, 2025) sebzeler arasında en fazla üretilen domatesin (Solanum lycopersicum), yaklaşık 20 yıllık periyotta, 2005 ve 2024 yılları arasında ve bu yılların ortalamasında yeşil, mavi ve toplam su ayak izlerini belirlemeyi ve buna yönelik çıkarımlar sağlamayı amaçlamıştır.

MATERYAL VE METOT

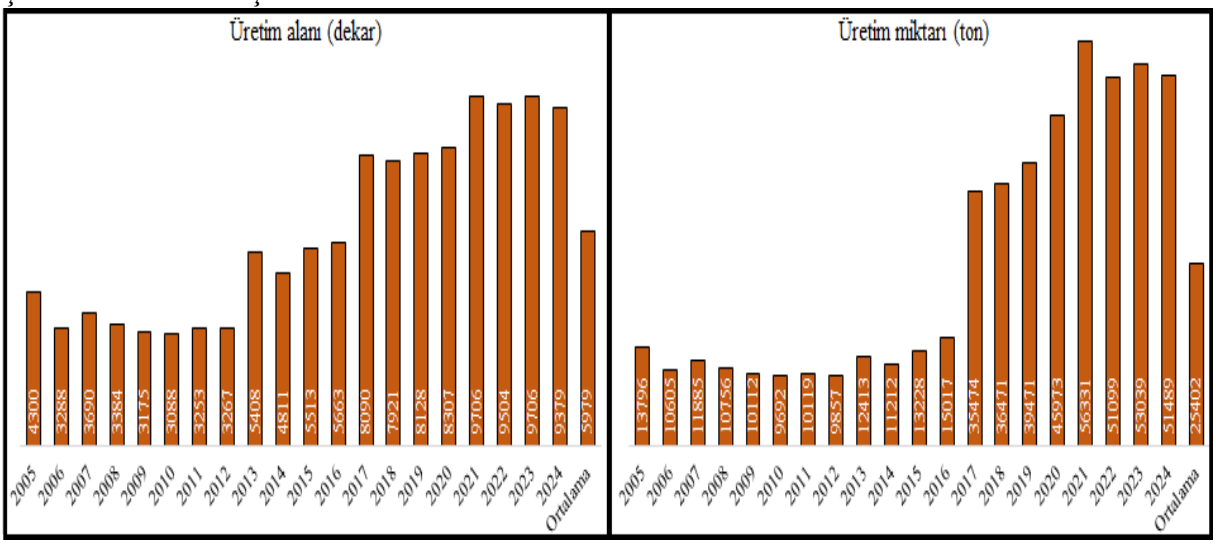
Bu çalışma, ortalama 1750 metre rakımlı 38°29'39" kuzey enlem ve 43°22'48" doğu boylamında yer alan neredeyse 23 500 km^2'lik yüz ölçümüne sahip Türkiye'nin Doğu Anadolu Bölgesi'nde konumlanmış Van ilinde yürütülmüştür. İlde karasal iklim hakim olsa da Van

Gölü'nün oluşturduğu mikro klima etki neticesinde iklim koşulları ılımanlaşmaktadır. Van ilinin genel itibariyle kışları soğuk, yazları ise kurak ve az yağışlıdır. Uzun yıllar (1976-2024) iklim verilerine göre ilde yıllık yağış miktarı 391 mm'dir (MGM, 2025). Ancak bu yağış miktarıyla kuraklık sınırına (360 mm) yakın yarı kurak iklime sahip Van ilinde aktif bitki üretim periyodunda (Mayıs-Eylül) yaklaşık 92 mm yağış gerçekleşmektedir (Tablo 1). Bu da yağış yetersizliğine bağlı olarak makul bir verim ve bitkisel üretim için sulamayı zorunlu kılmaktadır (Çakmakcı vd., 2016). Van ilinin aktif bitki üretim periyodunda (Mayıs-Eylül) uzun yıllar (1976-2024) iklim verileri Tablo 1'de sunulmuştur.

Tablo 1. Van ilinin aktif bitki üretim periyodunda (Mayıs-Eylül) uzun yıllar (1976-2024) iklim verileri (MGM, 2025)

Parametreler	Mayıs	Haziran	Temmuz	Ağustos	Eylül
Ortalama sıcaklık (°C)	13,2	18,3	22,5	22,3	18,1
Güneşlenme süresi (saat)	9,5	11,6	11,9	11,4	10,2
Yağış (mm)	45,6	18,1	6,5	6,1	15,5
Rüzgâr hızı (m/s)	2,2	2,3	2,3	2,3	2,4
Bağıl nem (%)	55,5	49,3	45,2	41,5	42,9
Buharlaşma (mm)	134,9	188,3	237,0	229,8	192,1

Van ilinde domatesin yaklaşık 20 yıllık, 2005 ve 2024 yılları arasında su ayak izi hesaplaması Hoekstra vd. (2011)'a göre analiz edilmiştir. Bu kapsamda domatesin ekim-hasat tarihleri ile vejetasyon periyodu süreleri ve FAO-Penman Monteith yaklaşımı ile hesaplanmış bitki su tüketimi değerleri 'Türkiye'de Sulanan Bitkilerin Bitki Su Tüketimleri' rehberinden temin edilmiştir (TAGEM-DSİ, 2017). Üretim miktarı ve üretim alanına ilişkin veriler 'Türkiye İstatistik Kurumu'ndan (TUİK, 2025) ve yağış değerleri uzun yıllar (1976-2024) iklim verilerini kapsayacak şekilde Meteoroloji Genel Müdürlüğü'nden (MGM, 2025) elde edilmiştir. 2005 ve 2024 yılları arasında Van ilinde domatesin üretim miktarı ve üretim alanı Şekil 1'de sunulmuştur.



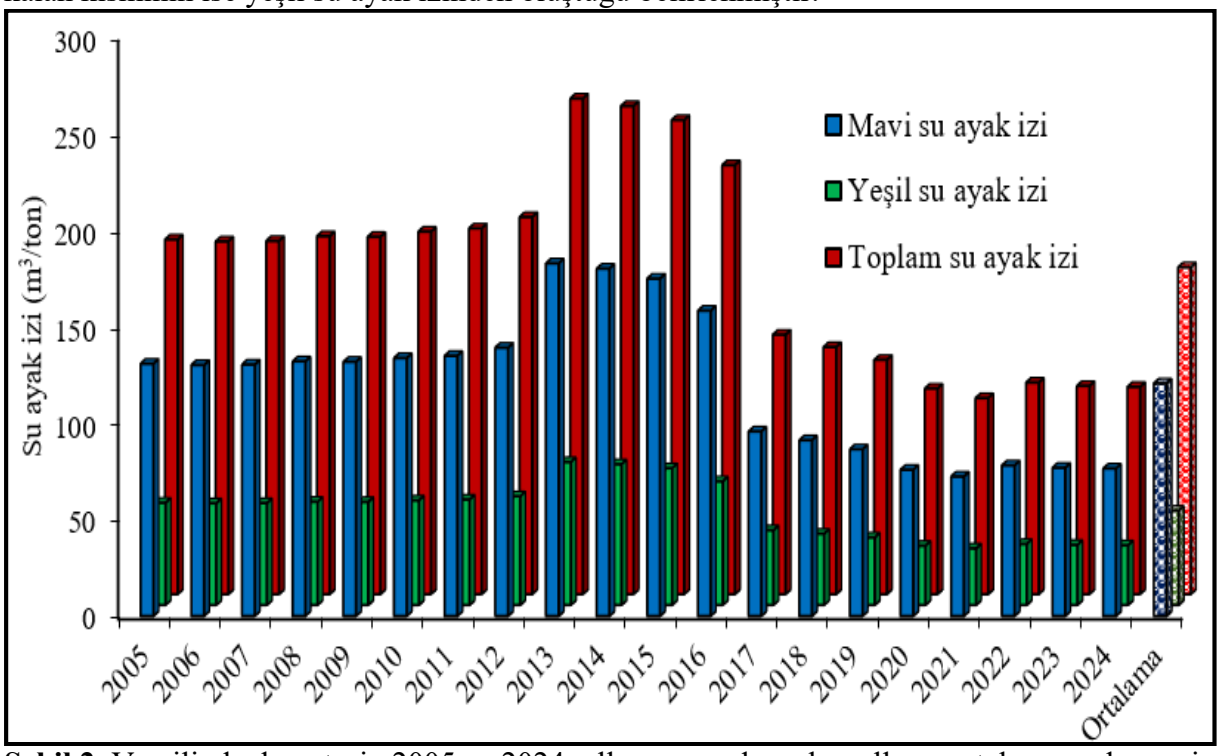
Şekil 1. Van ilinde domatesin 2005-2024 yıllarında ve ortalama bazda üretim alanı ve miktarı

Etkili yağışın belirlenmesi United States Department of Agriculture Soil Conservation Service (USDA-SCS) yaklaşımına göre CROPWAT yazılımı ile hesaplanmıştır (Cakmakci ve Sahin, 2024; Yerli ve Sahin, 2024). Kıştan arda kalan yağışlar da ekim sırasında toprak nemini oluşturduğu ve bitkinin su tüketimine etki ettiğinden dolayı su ayak izi hesaplamasına dahil

edilmiştir (Yerli vd., 2019). Bu kapsamda Van ilinde domates üretilen topraklar su tutma kapasitesi için sorunsuz kabul edilerek FAO (2018)'ya göre su tutma kapasitesi 140 mm/m olarak belirlenmiştir. Domatesin etkili kök derinliği Kanber (2010) ve Demir ve Sahin (2017)'ye göre 60 cm olarak dikkate alınmıştır.
Su ayak izinin hesaplanmasında Hoekstra vd. (2011) dikkate alınarak etkili yağışlarla karşılanan kısım yeşil su ayak izini, sulama suyu olarak geriye kalan kısım ise mavi su ayak izini oluşturmuştur. Böylece Van ilinde domates için yeşil ve mavi su ayak izleri belirlendikten sonra birim ton üretime bağlı mavi ve yeşil su ayak izleri hesaplanmıştır. Sonuçta bunların toplamından da Van ilinde domatesin 2005 ve 2024 yılları arasında ve ortalamasında toplam su ayak izi değerleri belirlenmiştir.

SONUÇLAR VE TARTIŞMA

Van ilinde domatesin yaklaşık 20 yıllık, 2005 ve 2024 yılları arasında ve bu yılların ortalamasında mavi, yeşil ve toplam su ayak izi değerleri Şekil 2'de sunulmuştur. Buna göre ortalama bazda, domatesin mavi, yeşil ve toplam su ayak izi değerleri sırasıyla 120,6 m3/ton, 48,9 m3/ton ve 169,5 m3/ton olmuş ve bir ton domates üretiminin % 71,2'sinin mavi geriye kalan kısmının ise yeşil su ayak izinden oluştuğu belirlenmiştir.



Şekil 2. Van ilinde domatesin 2005 ve 2024 yılları arasında ve bu yılların ortalamasında mavi, yeşil ve toplam su ayak izi değerleri

Nyambo ve Wakindiki (2015) Güney Afrika'da domatesin su ayak izinin 132 m^3/ton olduğu sonucunu literatüre kazandırmışlardır. Aldaya ve Hoekstra (2010) İtalya'da yürüttükleri çalışmada domatesin su ayak izini 114 m^3/ton olarak bildirmişlerdir. Farklı bir çalışmada Fas'ta domatesin su ayak izi 30 m3/ton olarak belirlenmiştir (Payen vd., 2015). Reis vd. (2020) Brezilya'da domatesin su ayak izinin 97 m3/ton olduğunu belirtmişlerken, Hossain vd. (2021) Avustralya'da domatesin su ayak izini neredeyse 2,5 kat daha fazla olarak 212 m^3/ton hesaplamışlardır. Evangelou vd. (2016) Orta Yunanistan'da bulunan Pinios Nehri Havzası'nda domatesin su ayak izinin 37 m^3/ton ila 131 m^3/ton arasında değişiklik gösterdiğini ifade etmişlerdir. Bazarfshan vd. (2022) İran'da üretilen domatesin su ayak izinin 327 m^3/ton olduğunu bildirmişlerdir. Aynı ülke için yürütülen farklı bir çalışmada domatesin su ayak izinin

farklı bölgelere göre 145 m^3/ton ile 175 m^3/ton aralığında değişim gösterdiği sonucuna ulaşılmıştır (Attaran ve Dehnavi, 2021). Chapagain ve Orr (2009) İspanya'nın farklı illerinde domatesin su ayak izini hesapladıkları çalışmada, domatesin yeşil ve mavi su ayak izinin sırasıyla 30,7 m^3/ton ile 37,1 m^3/ton ve 27,0 m^3/ton ile 117,7 m^3/ton aralıklarında değişim gösterdiğini ve bu iller için ortalama toplam su ayak izinin 84,4 m^3/ton olduğunu bildirmişlerdir. Ancak İspanya'da yürütülen farklı bir çalışmada domatesin toplam su ayak izinin 216 m^3/ton ile 306 m^3/ton aralıklarında değişim gösterdiği belirtilmiş ve ortalama bazda su ayak izi 236 m3/ton olarak tespit edilmiştir (Chico vd., 2010). Mekonnen ve Hoekstra (2011) Dünya ölçeğinde domatesin su ayak izinin 171 m^3/ton olduğunu ve bunun 108 m3/ton'unun yeşil su ayak izinden, 63 m^3/ton'unun ise mavi su ayak izinden oluştuğunu belirtmişlerdir. Farklı bir çalışmada Türkiye ortalamasında domatesin su ayak izi 180 m^3/ton olarak ifade edilmiştir (SVS, 2025).

Bu çalışmada Van ilinde domatesin su ayak izi değerleri incelendiğinde, Dünya ve Türkiye ölçeğindeki değerlere yakın olduğu ancak yukarıda ifade edilen çalışmalara göre farklılıklar gösterdiği ve ayrıca Van ilinde domatesin yeşil su ayak izinin dünya ortalamasının yarısından daha az olduğu belirlenmiştir. Bu durum doğrudan iklim faktörlerine bağlı olarak açıklanabilir. İklimin bitki su tüketimini yöneten temel faktör olduğu değerlendirildiğinde (Aldaya ve Hoekstra, 2010), ürünün mavi ve yeşil su ayak izlerini yönetmesi de muhtemel bir durumdur. İklim yağış miktarını kapsayarak ürünün yeşil su ayak izini ve yağış miktarına ek olarak bitkinin su tüketimine etki eden diğer iklim faktörlerini de yönetmesi neticesinde ürünün mavi su ayak izini yönlendirmektedir (Papadopoulou vd., 2016). Böylece bölgeler arasında su ayak izi değerlerinde farklılıklar ve bitkisel ürünlerin yeşil ve su izlerinde değişimler görülmektedir (Muratoğlu, 2020).

2005 ve 2024 yılları arasında Van ilinde domatesin su ayak izi değerleri incelendiğinde, en yüksek toplam su ayak izi değerlerinin sırasıyla 2013 (257,0 m^3/ton), 2014 (253,2 m^3/ton), 2015 (245,9 m^3/ton) ve 2016 (222,5 m^3/ton) yıllarında gerçekleştiği belirlenmişken, 2005-2013 yılları arasında daha düşük su ayak izi değerleri (ortalama olarak 186,8 m^3/ton) görülmüştür. Çalışmanın diğer yıllarında (2017-2024) bu değer daha da düşük olmuş (ortalama olarak 114,7 m^3/ton) ve en düşük su ayak izi değeri 2021 yılında 101,7 m^3/ton olarak gerçekleşmiştir. 2005 ve 2024 yılları arasında su ayak izlerindeki bu değişimler üretim miktarı ve üretim alanındaki dalgalanmadan (Şekil 1) böylece yıllara bağlı verim farklılıklarından kaynaklı olarak değerlendirilmiştir. Özellikle 2017 yılından sonra üretim miktarı ve alanındaki artış daha intansif bir tarımsal üretimin de eşlik etmesiyle beraber önceki yıllara göre dekar başına verimi beş tonun üzerine çıkararak (Şekil 1) su ayak izinin azalmasına sebebiyet vermiştir. Bu bitkisel üretimde su ayak izi için arzu edilen bir durum olup birim üretime karşı su arzının azalması kaynaklarının sürdürülebilirliği için de önemlidir (Cao vd., 2021). 2005 ve 2024 yılları arasında su ayak izlerindeki değişimin farklı bir açıklaması yıllar arasında değişen iklim faktörleri olarak da ele alınabilir. İklim bitkisel üretimi yönetmenin yanında herhangi bir bitkisel üretimin verimine ilaveten (Jolankai vd., 2016) mavi ve yeşil su ayak izilerini de etkilemektedir (Yerli ve Sahin, 2022). Kurak geçen yıllar bitkisel ürünlerde daha fazla buharlaşmayla daha fazla mavi su tüketimine neden olurken, yeşil su ayak izi girdisini azaltmaktadır. Aksi yönde aktif bitkisel üretim periyodunda yeterli yağış miktarı yeşil su ayak izini arttırma yoluyla mavi suya talebi azaltmaktadır (Mekonnen ve Hoekstra, 2011). Bu bitkisel üretimde özellikle günümüz şartlarında azalan temiz su kaynaklarının sürdürülebilirliği için istenen bir durumdur (Mekonnen ve Hoekstra, 2020). Özellikle bu çalışmanın yürütüldüğü Van ili gibi yarı kurak veya kurak bölgelerde bu durumun ehemmiyeti oldukça önemlidir (Yerli ve Sahin, 2022).

SONUÇLAR VE ÖNERİLER

Van ilinde domatesin 2005 ve 2024 yılları ortalamasında su ayak izinin % 71,2'sinin mavi su ayak izinden oluştuğu ve bunun da domates üretiminin dörtte üçünün temiz su kullanımıyla

sağlandığı değerlendirildiğinde, yarı kurak Van ilinde domates üretiminde yeşil su ayak izini artırmaya böylece mavi su ayak izini azaltmaya yönelik eylemlere ve çalışmalara adım atılması önerilebilir olarak bulunmuştur. Bu önerilebilir bilgiler ışığında, domatesin ekim-hasat tarihlerinin değiştirilerek yağışlardan daha fazla yararlanılacak periyotlara taşınması, yağışların korunmasına yönelik toprağın su tutma kapasitesinin iyileştirilmesi ve yağmur suyu hasatı pratiklerinin uygulanması, su tasarrufu sağlayan ve buharlaşmayı azaltan toprak, bitki, su ve sulama sistemi işlevlerinin yaygınlaştırılması ve araştırılması çalışmanın elzem sonuç ve önerileri arasında konumlanmıştır.

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THYROID HORMONE LEVELS AND THEIR ASSOCIATION WITH PLASMA ZINC LEVELS AMONG ADOLESCENT AFGHAN REFUGEES; A CROSS-SECTIONAL STUDY

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Abstract

Introduction: Thyroid hormones play an important role in the development and maintenance of nearly all tissues. In Pakistan, hypothyroidism and hyperthyroidism prevalence are 4.1% and 5.1%, respectively, and with increasing age, prevalence increases approximately to 10% in adults over 65 years of age. Malnutrition or nutritional deficiencies in the body can be the cause of thyroid disorders. Zinc (Zn) and copper (Cu), have important roles in regulating biological processes, maintaining normal thyroid function, and preventing thyroid diseases.

Objective: The objective of study was to find out levels of the thyroid hormones (TSH, T3 and T4) and its association with plasma zinc levels among adolescents Afghan refugees living in Peshawar, Pakistan.

Methodology:

Study design: Cross-sectional study

Study setting; It was conducted in the experimental Laboratory of Hayatabad Medical Complex, Hayatabad, Peshawar, Khyber Pakhtunkhwa (Pakistan) and University of Nottingham, England.

Subjects: A total of 206 adults from Khazana Afghan Refugee Camp, Peshawar were recruited and demographic details were done using a standard questionnaire.

Methods: We measured the patient's weight and height to calculate body mass index (BMI). Each participant blood sample was taken, so that many indicators could be measured. The concentrations of plasma zinc were measured by Inductively coupled plasma mass spectrometry (ICPMS) ,and TSH, T3, and T4 were done by using cobas e 601 which is a completely automated analyzer that performs immunoassay analysis using electrochemiluminescence (ECL) technology.

Results: Gender was equally divided into 103 females and 103 males with age group of 10-14 was (65.5%) and 15-19 was (34.5%). According to results (99.0%) participants had normal TSH levels, (79.1%) of participants had normal T3 levels, while (78.6%) of participants had normal T4 levels. T3 and T4 was low in (10.7 and 18.4 %) respectively. Serum Zinc levels in majority (65%) of participants had normal zinc levels while 35% of the participants were found to be deficient in zinc. There was significant association between gender and age group p value 0.02. A significant association was found between the gender and T3 levels. Females had more ratio of increased T3 levels. There was significant association between gender and T4 levels. However there was no significant association between thyroid hormones Zinc and other parameters.

Conclusion: This non-significant study did not find a direct relationship between thyroid hormones and zinc levels, there is still evidence to suggest that maintaining adequate zinc levels may be important for proper thyroid function. Further research is needed to fully understand the relationship between these two factors. Keywords; malnutrition, hyperthyroidism, hypothyroidism

Keywords; malnutrition, hyperthyroidism, hypothyroidism
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CHARACTERIZATION OF TANTALUM OXIDE FILM PRODUCED BY DC MAGNETRON SPUTTERING METHOD

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ABSTRACT

In this study, a Ta_2O_5 thin film with an average thickness of approximately 1.8 μm was deposited on AISI 4140 steel by the DC magnetron sputtering technique, and its structural, mechanical, and tribological properties were comprehensively evaluated. The sputtering process was carried out using a high-purity tantalum target under an Ar/O_2 atmosphere at 200 W DC power, followed by post-deposition annealing at 650 °C for 1 h to induce partial crystallization of the initially amorphous films. XRD analysis confirmed the structural transition from an amorphous halo to the orthorhombic Ta_2O_5 phase, while cross-sectional SEM images revealed dense, homogeneous, and continuous coatings with strong interfacial adhesion. Microhardness measurements indicated that the surface hardness increased from ~250 $HV_{0.1}$ for the bare steel to ~580 $HV_{0.1}$ after coating. Tribological tests under a 1 N load showed that the average coefficient of friction decreased from ~0.48 (uncoated) to ~0.25 (coated), accompanied by a ~25% reduction in wear rate. The SEM observations of the wear tracks revealed severe adhesive–abrasive wear on the uncoated steel, whereas the Ta_2O_5-coated surfaces exhibited smoother and shallower grooves. Overall, these results demonstrate that sputtered Ta_2O_5 thin films considerably enhance the hardness, wear resistance, and tribological performance of AISI 4140 steel, suggesting their strong potential for protective coating applications.

Keywords: DC magnetron sputtering, Ta_2O_5 thin film, AISI 4140 steel, hardness, coefficient of friction.

INTRODUCTION

Medium carbon AISI 4140 steel is one of the engineering materials widely used in fields such as automotive, defense and manufacturing industries due to its high strength, toughness and machinability properties [1,2]. However, the surface of this alloy suffers from low wear resistance and limited corrosion resistance, particularly under dry friction conditions. This drawback shortens service life and limits its performance in use. Therefore, thin-film coating technologies are gaining increasing importance for improving the surface properties of structural steels such as AISI 4140 [3]. Oxide-based thin films are preferred as protective coatings in both engineering and biomedical applications due to their superior properties such as high hardness, chemical stability and biocompatibility [4,5]. Tantalum oxide (Ta_2O_5), in particular, is used in many critical areas such as microelectronics, optical coatings and implant materials thanks to its low coefficient of friction, high dielectric constant, chemical inertness and biocompatibility [6,7]. It has been reported in the literature that Ta_2O_5 coatings both increase corrosion resistance and improve tribological performance [8,9]. Many surface coating methods are used to improve various surface properties. Among these methods, the DC magnetron sputtering technique stands out because it enables the production of high-purity,

dense, homogeneous thin films with good adhesion properties [10-12]. The oxide films deposited using this method are widely used in industry due to their low-temperature application and easy control of parameters. Previous studies have shown that Ta_2O_5 coatings obtained by DC magnetron sputtering transform from an amorphous to a crystalline phase after appropriate annealing treatments, resulting in a significant increase in surface hardness and wear resistance [13,15]. Perez et al. reported that Ta_2O_5 films produced by RF magnetron sputtering exhibited hexagonal phase formation above 675 °C after annealing in the range of 575-1000 °C, with a transition to the orthorhombic phase occurring at higher temperatures. Moreover, it was observed that the surface morphology evolved with crystallization, while the optical band gap increased from 2.4 eV to 3.8 eV [16]. Khemasiri et al. fabricated Ta_2O_5 thin films with varying thicknesses (25–200 nm) by DC reactive magnetron sputtering and investigated their structural features and corrosion protection performance. They reported that all films were amorphous, with surface roughness increasing with thickness, while the 50 nm film exhibited the most effective corrosion resistance [17]. In this study, a Ta_2O_5 thin film of approximately 1.8 μm thickness was deposited onto AISI 4140 steel using DC magnetron sputtering, followed by annealing at 650 °C. The aim was to investigate the effects of the phase transformation occurring after annealing on the structural, mechanical, and tribological properties of the coating. The results demonstrate the potential of Ta_2O_5 thin films to enhance the surface performance of AISI 4140 steel.

MATERIAL AND METHODS

Preparation of samples and coating process

AISI 4140 steel, used as the base material in this study, was cut into 15 × 15 × 3 mm sections. Prior to coating, standard metallographic surface preparation procedures were applied to the samples to ensure a homogeneous and smooth surface. First, the samples were sanded unidirectionally with 80, 400, 600, 800, and 1200 mesh SiC sandpapers to remove the surface oxide layer and process-related irregularities, respectively. Subsequently, mechanical polishing was performed using a 3 μm alumina suspension to improve the surface topography and achieve a surface close to mirror shine. After polishing, the samples were cleaned in an ultrasonic bath with acetone, ethanol, and deionized water for 10 minutes each to remove particles, oil, and organic contaminants that may remain on the surface, and then dried. Tantalum oxide (Ta_2O_5) thin films were deposited onto AISI 4140 steel using the magnetron sputtering method using a DC magnetron sputtering device (VAKSIS PVD-MT/2M 2T). The coating process was carried out using a high-purity tantalum target (99.95%, 3 in. diameter). Before coating, the base pressure of the vacuum chamber was reduced to approximately 5×10^{-6} Torr. Then, high-purity argon (Ar, 99.9%) and oxygen (O_2, 99.9%) gases were introduced into the chamber in a controlled manner to maintain the total pressure at 3 mTorr. During sputtering, 200 W DC power was applied to the target, and tantalum atoms ejected from the target surface in the plasma environment reacted with oxygen to form a tantalum oxide film on the AISI 4140 steel surface. The coating time was chosen as 120 minutes, consistent with literature, to achieve a film thickness of approximately 1.8 μm. Using a single parameter set, the coating resulted in dense, homogeneous, and well-adherent tantalum oxide films on the sample surfaces. After coating, the samples were annealed to relieve residual stresses in the film and partially transform the amorphous structure into a crystalline phase. For this purpose, the thin films were heated at 650°C in air for 1 hour under normal atmospheric conditions. Heating and cooling rates were applied at 5°C/min. These conditions are close to the crystallization temperature reported for tantalum oxide films in the literature and allow the transition from the amorphous structure to the orthorhombic Ta_2O_5 phase to begin.

Characterization of Coated Films

The structural properties of the coated Ta_2O_5 films were analyzed using Grazing Incidence X-ray diffraction (GIXRD, Panalytical Empyrean-XRD instrument). Measurements were performed scanning at 20°- 80° (2θ). Film surface morphology, layer integrity, and cross-sectional structure were examined using a scanning electron microscope (SEM, FEI Quanta FEG-450). Energy dispersive X-ray spectroscopy (EDS, FEI Quanta 250) was also used to verify the elemental composition of the film surface. Hardness measurements were performed using the Bruker UMT-2 Universal Mechanical Testing Machine to determine mechanical properties. Tests were performed using microhardness measurements based on the Vickers principle to determine the local hardness distribution of the coatings. Average hardness was calculated by taking values from at least five different points on each sample. To evaluate tribological performance, wear tests were performed using the Bruker UMT-2 multifunctional mechanical testing system. The experiments were conducted at room temperature and atmospheric pressure, using a ball-on-flat contact configuration and a linear reciprocating motion principle. The Al_2O_3 (alumina) ball was used as the abrasive counter surface, and the normal load was fixed at 1 N. The specimens were tested under dry friction conditions. In each test, the parameters were standardized by keeping the friction distance, stroke length, and test duration constant. The coefficient of friction (COF) was recorded in real time during the experiment, and the width of the resulting wear scars was characterized by SEM.

RESULTS AND DISCUSSION

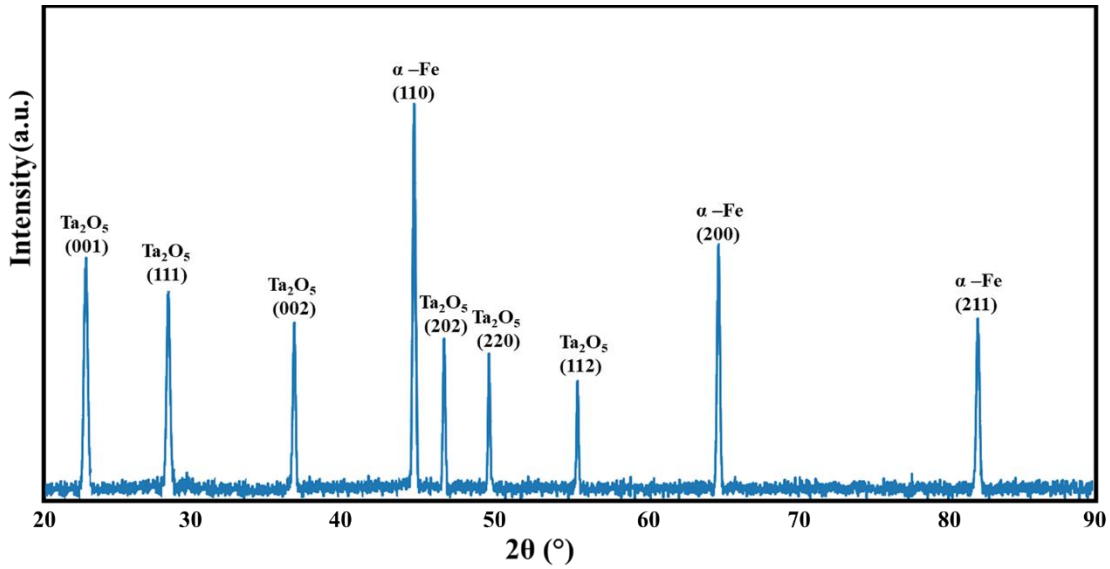

Fig.1. XRD pattern of Ta_2O_5 film deposited on AISI 4140 steel by DC magnetron sputtering and annealed at 650 °C for 1 h.

The GIXRD graph of 4140 steel deposited with Ta_2O_5 is given in Figure 1. It is observed that the Ta_2O_5 film annealed at 650 °C for 1 hour undergoes a transition from an amorphous halo to a crystalline structure: Reflections of Ta_2O_5 at ~22.8° (001) and ~28.3° (111) appear with low to moderate intensity, ~36.7° (002) is weak to moderate, and ~46.7° (202) is observed with weak intensity; reflections in the ~49.7° and ~55.8° bands at higher angles are only traces (JCPDS: 00-018-1304). Due to the limited film thickness, the substrate contribution is preserved; α-Fe (110) ≈ 44.7°, (200) ≈ 65.0° and (211) ≈ 82.3° peaks of AISI 4140 were

observed with high intensity. The prominence of peaks corresponding to the (001), (111), (002), (202), (220) and (112) planes of Ta_2O_5 in the GIXRD pattern indicates that annealing at 650 °C for 1 hour initiated partial crystallization in the amorphous structure [18]. The absence of additional reflections specific to Ta metal or suboxides (TaO, TaO_2) in the pattern indicates that the reactive environment and annealing conditions during sputtering ensured complete oxidation of tantalum and that the phase purity was high. The appearance of (110), (200) and (211) reflections belonging to the α-Fe phase in the pattern is associated with the limited film thickness (~1.8 μm) and the fact that a portion of the X-ray penetration reaches the substrate. Although the grazing-incidence geometry significantly reduces the substrate contribution, it does not completely eliminate it; However, the clear distinction of Ta_2O_5 peaks indicates that the continuity and crystal structure of the film layer are sufficiently developed.

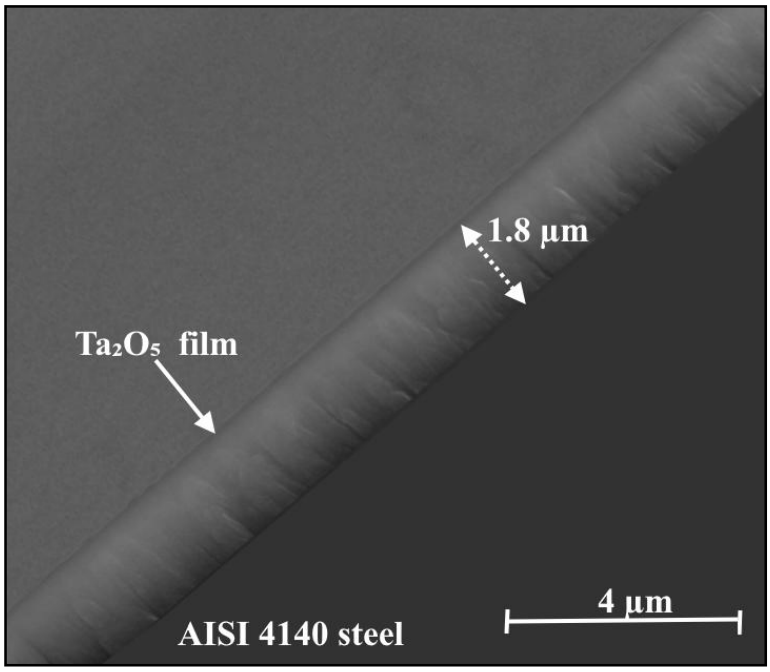

Fig.2. The cross-sectional SEM image of Ta_2O_5 film deposited on AISI 4140 steel.

Fig. 2 shows a cross-sectional SEM image of a Ta_2O_5 film deposited by DC magnetron sputtering on AISI 4140 steel. The image clearly shows that the coating layer is approximately 1.8 μm thick and exhibits a continuous, dense, and homogeneous structure on the steel substrate. The absence of any delamination, voids, or structural discontinuities at the film–substrate interface confirms the good adhesion of the coating. The absence of a columnar structure and the dense morphology of the film demonstrate that the selected coating parameters were successfully optimized. The obtained cross-sectional SEM image shows that the Ta_2O_5 films produced by the magnetron sputtering method can form a dense, homogeneous, and well-bonded protective layer on 4140 steel, and reveals that the partial crystallization observed in the XRD analysis is supported by structural continuity and film integrity.

The elemental composition of the deposited film is given in Table 1 as a result of EDS analysis. The analysis results showed that the surface was largely composed of tantalum (Ta) and oxygen (O). The elemental ratios calculated from the spectra were approximately Ta ≈ 30.2 at.% and O ≈ 69.8 at.%, which are in good agreement with the stoichiometry of Ta_2O_5. In addition, the

Vickers microhardness value measured under a 100 g load increased from 250 $HV_{0.1}$ for uncoated AISI 4140 steel to approximately 580 $HV_{0.1}$ for the Ta_2O_5-coated sample, indicating that the deposited film significantly enhanced the surface hardness of the substrate.

Table 1. Film thickness, hardness and EDS results of uncoated and Ta_2O_5 coated AISI 4140 steel.

Sample	Average Thickness (µm)	Micro Hardness ($HV_{0.1}$)	Ta (at.%)	O (at.%)	Fe, Cr, Mn (at.%)
AISI 4140 steel	-	250–270	-	-	100
Ta_2O_5 film	1.8	550–600	30.2	69.8	-

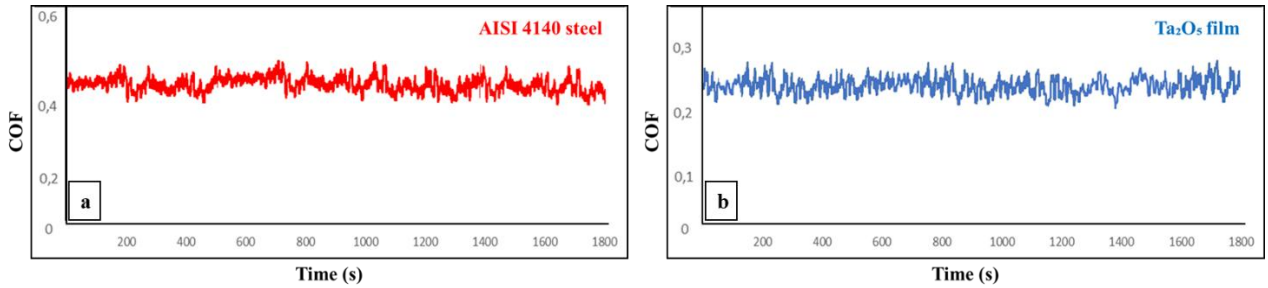

Fig.3. The COF graphs of a) uncoated and b) Ta_2O_5 film deposited on AISI 4140 steel.

As seen in Fig. 3a, the uncoated AISI 4140 steel exhibited a relatively high and unstable friction response, with an average COF in the range of 0.45-0.50. The pronounced fluctuations in the COF curve are associated with adhesive wear and plastic deformation of the metallic surface. These instabilities are typical for unprotected steels, where the absence of a protective surface film results in strong adhesion between the steel surface and the ceramic counter body, leading to a mixed adhesive–abrasive wear mechanism. The Ta_2O_5-coated sample (Fig. 3b) demonstrated a significantly lower average COF of ~0.25-0.30, remaining stable throughout the entire sliding distance. The reduction of nearly 40-45% in friction compared to uncoated steel indicates that the dense and homogeneous Ta_2O_5 layer acts as an effective protective barrier. The stable COF trend confirms the integrity and adherence of the thin film during the test, preventing direct metal-to-metal contact and mitigating severe adhesive interactions. The improvement in tribological performance can be attributed to the following factors: the higher surface hardness of the coated sample (≈580 $HV_{0.1}$ compared to ≈250 $HV_{0.1}$ for bare steel), which reduces plastic deformation under load; the chemically inert nature of the Ta_2O_5 film, which limits tribo-oxidation, and the dense microstructure of the sputtered film, which minimizes crack initiation and propagation during sliding.

The wear rate results further support the beneficial effect of the Ta_2O_5 coating on the tribological performance of AISI 4140 steel. In the uncoated condition, the steel exhibited a relatively high wear rate on the order of 2.60×10^{-4} $mm^3 \cdot N^{-1} \cdot m^{-1}$, which is consistent with literature values reported for medium-carbon steels sliding against ceramic counterparts under similar conditions. After deposition of the 1.8 µm Ta_2O_5 film and subsequent annealing at 650 °C, the wear rate decreased markedly to approximately 2.10×10^{-4} $mm^3 \cdot N^{-1} \cdot m^{-1}$, representing a reduction of nearly 25%. This improvement can be attributed to the higher surface hardness,

chemical inertness, and dense microstructure of the Ta_2O_5 film, which acted as an effective barrier against both adhesive and abrasive wear mechanisms.

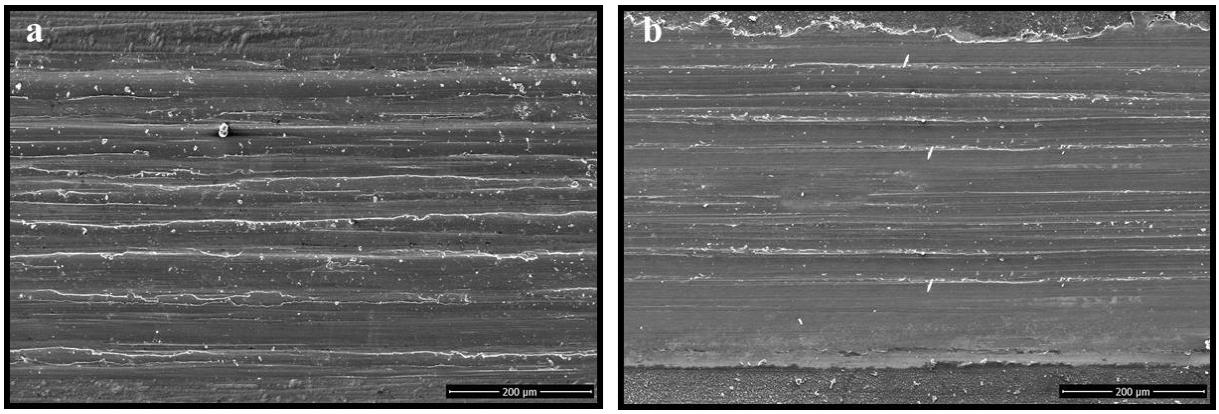

Fig.4. SEM micrographs of the worn surfaces after dry sliding at 1 N load: (a) uncoated AISI 4140 steel and (b) Ta_2O_5 thin film–coated AISI 4140 steel.

The SEM analysis of the worn surfaces provides further insights into the wear mechanisms operating in uncoated and Ta_2O_5-coated AISI 4140 steel (Fig. 4). The uncoated steel surface (Fig. 4a) is characterized by severe ploughing grooves parallel to the sliding direction, accompanied by material transfer and debris accumulation. Such features are typical of mixed adhesive–abrasive wear, where strong adhesion between the metallic surface and the ceramic counter body promotes local plastic deformation and material pull-out, consistent with previous observations on medium-carbon steels under dry sliding conditions [19]. In contrast, the Ta_2O_5-coated sample (Fig. 4b) displays smoother wear tracks with reduced groove depth and an absence of large debris clusters. This indicates that the hard and chemically inert Ta_2O_5 film effectively suppresses adhesive junction formation and resists micro-cutting by the counter surface. The dense microstructure of the sputtered film also contributes to load-bearing capability, thereby limiting crack initiation and propagation within the wear scar. These findings corroborate the reduced coefficient of friction (~0.25 vs. ~0.48 for bare steel) and lower wear rate of the coated specimens, and are in good agreement with literature reports on oxide coatings such as TiO_2 and Nb_2O_5, which act as effective tribological barriers on steel substrates [20].

CONCLUSIONS

In this study, a Ta_2O_5 thin film of approximately 1.8 µm thickness was successfully deposited on AISI 4140 steel using DC magnetron sputtering, followed by annealing at 650 °C. XRD results confirmed the partial transformation of the amorphous structure into the orthorhombic Ta_2O_5 phase. The coating enhanced the surface hardness from ~250 $HV_{0.1}$ to ~580 $HV_{0.1}$, reduced the coefficient of friction from ~0.48 to ~0.25, and lowered the wear rate by ~25%. SEM observations revealed severe adhesive and abrasive wear features on the uncoated steel, while the coated surface exhibited much smoother and shallower grooves. These findings demonstrate that sputtered Ta_2O_5 films can significantly improve the tribological performance and surface durability of medium-carbon steels, making them promising candidates for protective coating applications.

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THE GEOMETRY OF ECONOMIC OPTIMIZATION: NOVEL APPLICATIONS OF HILBERT AND BANACH SPACES TO GROWTH AND DECISION ANALYSIS

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Abstract: This study introduces a novel methodological approach to economic analysis by employing the theory of Hilbert and Banach spaces. We develop new operations for modeling preferences, constraints, and dynamics in high-dimensional economic environments, moving beyond the limitations of conventional Euclidean space. Our main results include generalized existence theorems for equilibria and convergence proofs for optimization algorithms in this expanded setting. A key contribution is the establishment of a direct link between the geometric properties of these spaces such as completeness, orthogonality, and duality and the fundamental characteristics of economic growth paths. The implications of this research offer a fresh perspective for quantitative decision analysis and long-term macroeconomic strategy.

EFFECTS OF DIRECT SEEDING ON THE PHYSIOLOGICAL PARAETERS OF SOFT WHEAT (TRITICUM SATIVUM L., VARIETY AÏN ABID)

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Abstract:

The issue of cereal production in Algeria raises three main determining factors: climate, soil, and agronomy. While rainfall is the main factor affecting cereal production, agronomic practices and their effects on soil are far from negligible.

In the literature, there is a barely concealed reluctance to use direct seeding in semi-arid regions due to low rainfall and low soil organic matter content. On the contrary, conventional plowing is seen as a factor in the reduction of soil organic matter and therefore in the steady destruction of biodiversity.

It is in relation to this dialectic that the present work fits in, which addresses the study of the behavior of soft wheat grown under two cultivation methods: direct seeding (DS) and conventional plowing (CP).

Keywords: Direct seeding, Conventional plowing, Physiological parameters, Soft wheat, Algeria.

RETROSPECTIVE EVALUATION OF MEDICAL AND SURGICAL TREATMENT APPROACHES IN ECTOPIC PREGNANCY IN TERMS OF CLINICAL OUTCOMES

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ABSTRACT

Objective: The aim of this study was to retrospectively evaluate the clinical outcomes of medical and surgical treatment approaches in patients diagnosed with ectopic pregnancy.
Methods: Medical records of 60 women treated for ectopic pregnancy between 2020 and 2024 at Beykent University Faculty of Medicine Hospital were retrospectively reviewed. Medical treatment (methotrexate) and surgical approaches (laparoscopy, laparotomy) were compared in terms of success rates, complications, hospital stay, and need for re- intervention. Statistical analyses were performed using SPSS software, and $p<0.05$ was considered statistically significant.
Results: Significant differences were observed between medical and surgical treatment groups in terms of success rates and complications. Medical treatment was highly effective in selected cases, while surgical treatment was preferred for hemodynamically unstable patients and advanced cases. Hospital stay was longer in the surgical group.
Conclusion: Both medical and surgical treatments are effective in the management of ectopic pregnancy, and the choice should be tailored according to patient characteristics and clinical presentation.
Keywords: Ectopic pregnancy, methotrexate, laparoscopy, surgical treatment, retrospective analysis

INTRODUCTION

Ectopic pregnancy is defined as the implantation of a fertilized ovum outside the uterine cavity, most commonly in the fallopian tubes. It is a potentially life-threatening condition if not diagnosed and treated promptly. Management strategies include medical treatment with methotrexate and surgical interventions such as laparoscopy or laparotomy. The choice of treatment depends on patient hemodynamic stability, serum beta-hCG levels, and
future fertility desire. This study aimed to retrospectively evaluate the clinical outcomes of different treatment approaches in patients diagnosed with ectopic pregnancy in our clinic.

METHODS

Study Design: This was a retrospective cross-sectional observational study. A total of 100 women diagnosed with ectopic pregnancy and treated at Beykent University Faculty of Medicine Hospital between 2020 and 2024 were included.
Inclusion criteria: women aged 20 years or older, confirmed diagnosis of ectopic pregnancy by ultrasonography and/or laparoscopy, complete medical records, and treatment finalized at our center. Exclusion criteria: incomplete data, heterotopic pregnancy, suspected malignancy, or patients whose treatment was continued at another center.

Treatment Protocols: Patients in the medical group received single-dose methotrexate (50 mg/m² IM) with beta-hCG monitoring. Surgical interventions included laparoscopic salpingectomy/salpingostomy or laparotomy, chosen based on clinical status and patient preference. Statistical Analysis: Data were analyzed using SPSS software. Student's t-test, Mann–Whitney U test, and Chi-square test were used as appropriate, with $p<0.05$ considered statistically significant.

RESULTS

The mean age of the 100 patients was XX±SD years. In the medical treatment group, the overall success rate was %X, while in the surgical group it was %Y. Complication rates were higher in the surgical group. The mean hospital stay was X days in the medical group and Y days in the surgical group. Fertility outcomes following treatment were similar between groups, with comparable rates of spontaneous pregnancy within one year of follow-up.

DISCUSSION

The management of ectopic pregnancy should be individualized based on patient condition, hemodynamic stability, serum beta-hCG levels, and fertility expectations. Our findings are consistent with the existing literature, indicating that methotrexate treatment is safe and effective in properly selected cases, whereas surgical treatment remains essential for unstable patients or advanced cases. Although surgical management was associated with longer hospital stays and higher complication rates, it ensured definitive treatment outcomes.

CONCLUSION

Both medical and surgical treatment options are effective for ectopic pregnancy. Medical therapy should be the first-line option in selected stable cases, while surgical intervention should be reserved for unstable patients or those with contraindications to medical therapy. Patient-tailored treatment decisions are crucial to optimize clinical outcomes.
Analysis

EKTOPIK GEBELIKTE TIBBI VE CERRAHI TEDAVI YAKLAŞIMLARININ KLINIK SONUÇLAR AÇISINDAN RETROSPEKTIF OLARAK DEĞERLENDIRILMESI

GİRİŞ

Ektopik gebelik, döllenmiş yumurtanın normal implantasyon yeri olan uterus kavitesi dışında, genellikle fallop tüplerine yerleşmesiyle oluşur. Anne sağlığı açısından ciddi riskler taşıyan bu durum, erken tanı ve doğru tedavi ile yönetilebilmektedir. Tedavi seçenekleri arasında medikal (metotreksat) ve cerrahi yöntemler (laparoskopi, laparotomi) bulunmaktadır. Bu çalışmada, kliniğimizde tedavi gören ektopik gebelik olgularında uygulanan tedavi yaklaşımlarının retrospektif olarak değerlendirilmesi amaçlanmıştır.

YÖNTEM

Bu çalışma retrospektif kesitsel bir gözlemsel araştırmadır. 2020-2024 yılları arasında
Beykent Üniversitesi Tıp Fakültesi Hastanesi'nde ektopik gebelik tanısı ile tedavi edilen 100 hasta çalışmaya dahil edildi. Dahil edilme kriterleri: 20 yaş ve üzeri kadın hastalar, ektopik gebelik tanısının ultrasonografi ve/veya laparoskopi ile doğrulanmış olması, tedavi sürecinin tamamlanmış olması, eksiksiz tıbbi kayıtlara ulaşılabilmesi. Hariç tutulma
kriterleri: eksik veriler, heterotopik gebelik, malignite şüphesi, tedavisi dış merkezde devam eden hastalar. Medikal tedavi grubuna metotreksat tek doz protokolü uygulanırken, cerrahi tedavi

grubunda laparoskopik cerrahi veya laparotomi gerçekleştirildi. İstatistiksel analiz SPSS yazılımı ile yapıldı, p<0,05 anlamlı kabul edildi.

BULGULAR

Çalışmaya dahil edilen 100 hastanın yaş ortalaması XX±SS idi. Medikal tedavi grubunda başarı oranı %X, cerrahi tedavi grubunda %Y bulundu. Komplikasyon oranı cerrahi grupta daha yüksek gözlendi. Hastanede yatış süresi medikal grupta ortalama X gün, cerrahi grupta Y gün olarak saptandı. Tedavi sonrası fertilite sonuçları değerlendirildiğinde, her iki grupta da benzer spontan gebelik oranları gözlendi.

TARTIŞMA

Ektopik gebelikte tedavi yaklaşımı, hastanın hemodinamik durumu, ektopik odak boyutu, serum beta-hCG düzeyleri ve fertilite isteği dikkate alınarak belirlenmelidir. Çalışmamızda elde edilen bulgular, literatürle uyumlu şekilde, uygun hastalarda metotreksat tedavisinin etkili ve güvenli olduğunu, cerrahi yaklaşımın ise daha çok ileri olgular için gerekli olduğunu göstermektedir. Bununla birlikte cerrahi tedavi sonrası komplikasyon oranlarının daha yüksek olduğu, fakat tedavi başarısının kesin olduğu görülmüştür.

SONUÇ

Ektopik gebelik tedavisinde medikal ve cerrahi yöntemler birbirini tamamlayıcı niteliktedir. Uygun olgularda medikal tedavi ilk seçenek olmalı, hemodinamik instabilite ve komplikasyon riski yüksek vakalarda cerrahi tedavi tercih edilmelidir. Bu çalışma, hasta bazlı tedavi seçiminin önemini vurgulamaktadır.

TÜRKİYE'DEKİ ADRES VERİLERİNİN OTOMATİK KOORDİNATLANDIRILMASI: NOMİNATİM TABANLI PYTHON UYGULAMA

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ÖZET
Günümüzde konumsal veriler, yalnızca Coğrafi Bilgi Sistemleri (CBS) uygulamaları için değil; afet yönetimi, şehir planlama, ulaşım ve lojistik, sağlık hizmetleri, pazarlama analizi ve hatta sosyal bilim araştırmaları için de temel bir bileşen haline gelmiştir. Mekânsal veri, çoğunlukla adres tabanlı kayıtlar üzerinden toplanmakta; nüfus sayımları, resmi istatistikler veya saha çalışmalarında adres bilgileri en sık kullanılan veri kaynakları arasında yer almaktadır. Ancak adreslerin çoğu zaman standart bir formata sahip olmaması, eksik ya da hatalı bilgiler içermesi, bu verilerin doğrudan kullanılmasını zorlaştırmaktadır. Bu nedenle adreslerin coğrafi koordinatlara dönüştürülmesi, yani geocoding işlemi, mekânsal analizlerin ve karar destek sistemlerinin vazgeçilmez bir adımıdır.
Geocoding, adres tabanlı verilerin enlem ve boylam bilgilerine dönüştürülmesini sağlayarak, bu kayıtların dijital haritalar üzerinde konumlandırılmasına olanak tanır. Böylece afet riski analizlerinden ulaşım optimizasyonuna kadar birçok alanda somut çözümler üretilebilir. Özellikle Türkiye gibi yerleşim birimlerinin mahalle, köy, ilçe ve il gibi çok katmanlı bir yapıya sahip olduğu ülkelerde adreslerin doğru bir şekilde coğrafi koordinatlara dönüştürülmesi, veri işleme sürecinde kritik önem taşımaktadır.
Bu çalışmada açık kaynaklı ve ücretsiz yapısı nedeniyle OpenStreetMap tabanlı Nominatim servisi tercih edilmiştir.
Anahtar Kelimeler: Geocoding**,** Python, Coğrafi Bilgi Sistemleri (CBS), Otomatik koordinatlandırılma, geopy, OpenStreetMap, Nominatim.

AUTOMATIC GEOCODING OF ADDRESS DATA IN TURKEY: A NOMINATIM-BASED PYTHON APPLICATION

ABSTRACT
Nowadays spatial data is a basic element not only for GIS applications but also for different fields such as disaster management, urban planning, transportation and logistics, healthcare services, marketing analysis, and even social science research. Geospatial data is, more often than not, collected through address-based records; population censuses, official statistics, and field surveys quite frequently rely on address data as their primary source. Nevertheless,

because addresses are frequently disorganized, incomplete, or contain errors, it can be very problematic to use them directly in activities. This is one of the reasons why transforming addresses into geographical coordinates (also known as geocoding) has become a very important step in spatial analysis and decision support systems.
Geocoding gives the possibility of converting data based on the address into values of latitude and longitude; thus, if we want to pinpoint the location of a certain sample on a digital map, we can do so with extreme precision. This feature is necessary to create viable solutions for a wide range of issues, including disaster risk management and transport optimization. In such a nation as Turkey, where settlements are designed in several hierarchical levels such as neighborhood (mahalle), village, district, and province, the accurate conversion of addresses into coordinates is of utmost importance for the whole data processing work.
In this study, the OpenStreetMap-based Nominatim service was chosen owing to its open-source and cost-free nature.
Keywords: Geocoding, Python, Geographic Information Systems (GIS), Automatic Geocoding, geopy, OpenStreetMap, Nominatim

GİRİŞ

Mekânsal veri, günümüzün birçok disiplininde karar alma süreçlerinin merkezinde yer almaktadır (Goodchild, 2007; Longley et al., 2015). Afet yönetimi, şehir planlama, ulaşım optimizasyonu, sağlık hizmetlerinin dağılımı ve yerel politika geliştirme gibi alanlarda olayların veya nesnelerin nerede olduğuna dair kesin bilgi, doğru müdahale ve etkili analiz için kaçınılmazdır. Buna karşın pek çok kurum ve saha çalışması hâlâ adres bilgilerini metin formatında saklamakta; bu metinler doğrudan harita üzerinde gösterilebilecek enlem–boylam çiftlerine dönüştürülmeden analize konu olamamaktadır. Türkiye bağlamında, adres verilerinin dağılımı, yazım farklılıkları, idari değişiklikler ve küçük yerleşimlerin eksik kaydı gibi etkenler bu dönüşümü güçleştirmektedir (Yomralıoğlu, 2000).
Adres metinlerinin coğrafi koordinatlara çevrilmesi (literatürde geocoding olarak adlandırılan işlem) genel olarak iki zorlukla karşılaşır: birincisi, adres bilgisinin eksik, tutarsız veya çeşitli yazım biçimlerinde olması; ikincisi ise kullanılan geokodlama servisinin veri kapsamı ve erişim politikalarıdır (Zandbergen, 2009). Ticari servisler yüksek doğruluk sunabilse de maliyet, kullanım kotası ve erişim kısıtları araştırmacılar için engelleyici olabilir. Öte yandan, açık kaynaklı veri ve araçlar (örneğin OpenStreetMap ve OSM tabanlı Nominatim) maliyetsiz ve şeffaf bir alternatif sağlar (Haklay & Weber, 2008; Ramm et al., 2011). Ancak bu kaynakların da yerel düzeyde eksiklikleri ve performans sınırlamaları bulunur.
Bu çalışmanın hedefi, Türkiye'deki adres verilerini pratik, tekrarlanabilir ve etik ilkelere saygılı bir biçimde otomatik olarak koordinatlandırmaya uygun bir iş akışı geliştirmektir. Önerilen yaklaşım, Excel'de saklanan adres bileşenlerini (mahalle, köy, ilçe, il) farklı ayrıntı düzeylerinde ardışık olarak sorgulayarak en iyi eşleşmeyi bulmaya çalışır; sorgulamalar OpenStreetMap'in arama servisi Nominatim aracılığıyla yapılır. Uygulama, küçük bir pilot çalışmayla doğrulanmış, daha sonra toplu işleme kuralları (bloklama ve bekleme süreleri) ile ölçeklendirilmiştir. Böylece hem doğruluk kontrolü sağlanmış hem de kamuya açık geokodlama servislerinin kullanım etiklerine uyum gözetilmiştir.

MATERYAL VE YÖNTEMLER

Bu çalışmada, Türkiye'deki adres verilerinin otomatik olarak koordinatlandırılması amacıyla Python programlama dili ve OpenStreetMap'in (OSM) sunduğu Nominatim servisi kullanılmıştır. Süreç, adreslerin ham Excel dosyasından okunması, uygun formata dönüştürülmesi, Nominatim üzerinden sorgulanması ve elde edilen sonuçların yeniden tabloya yazılması adımlarını kapsamaktadır. Ancak Türkiye'deki adres verilerinde eksiklikler, yazım hataları veya farklı biçimlendirmeler sıkça görüldüğünden (Yomralıoğlu, 2000), uygulama

yalnızca basit bir adres–koordinat eşleştirmesi olarak değil, aynı zamanda veri temizliği ve hata yönetimini de içeren kapsamlı bir yöntem olarak tasarlanmıştır.

Uygulamanın teknik altyapısı üç temel bileşene dayanmaktadır. İlk olarak, temel veri kaynağı olarak OpenStreetMap (OSM) veritabanı tercih edilmiştir. OSM, gönüllü kullanıcılar tarafından güncellenen açık kaynaklı bir coğrafi bilgi sistemi olup (Goodchild, 2007; Haklay & Weber, 2008), Türkiye için ayrıntılı adres bilgisi sağlamaktadır. İkinci bileşen olarak, adreslerin OSM verisi üzerinde aranabilmesi için Nominatim arama motoru kullanılmıştır. Nominatim, verilen adres ifadelerini enlem–boylam koordinatlarına dönüştüren (geocoding) bir servis olarak çalışmaktadır (Ramm et al., 2011). Üçüncü bileşen ise, bu servise Python üzerinden erişimi sağlayan geopy kütüphanesidir. Geopy, Nominatim gibi farklı konum servislerine bağlanmayı kolaylaştıran bir Python paketidir ve sorguların yönetimi, hata kontrolü ile koordinat çıktılarının düzenlenmesi gibi işlevleri üstlenmiştir.

Çalışmada izlenen yöntem, adres metinlerinin farklı ayrıntı seviyelerinde kademeli olarak çözülmesi ve uygun coğrafi koordinatların elde edilmesi üzerine kurulmuştur (Longley et al., 2015). İlk aşamada, Excel dosyasında tutulan adres verileri Python dili aracılığıyla okunmuş ve işlenmeye uygun hale getirilmiştir. Bu veriler mahalle, köy, ilçe ve il gibi bileşenleri içermekte, ancak her satırda bu bilgilerin tamamı bulunmamaktadır. Program, boş bırakılan alanları otomatik olarak dikkate almamakta ve yalnızca mevcut bilgilerle işlem yapmaktadır. Böylece yöntem, eksik bilgiye karşı dayanıklı hale getirilmiştir.

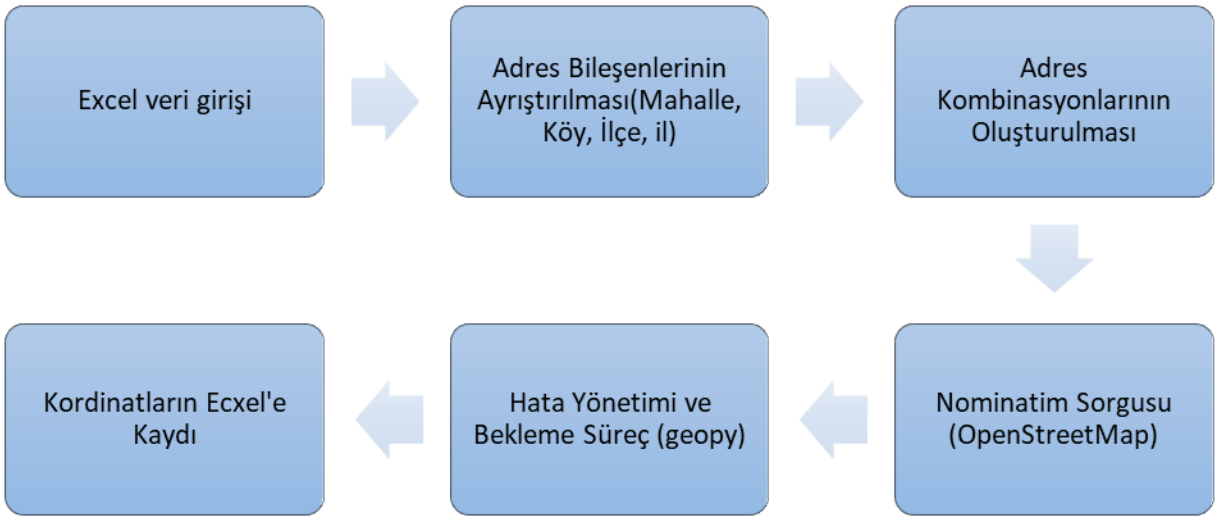
Adreslerin coğrafi olarak doğru biçimde çözümlenebilmesi için dört aşamalı bir sorgulama kuralı geliştirilmiştir:

1. mahalle–köy–ilçe–il bileşenlerinin birlikte kullanıldığı en ayrıntılı yapı,
2. köy–ilçe–il,
3. ilçe–il,
4. yalnızca il bilgisinin kullanıldığı en geniş ölçekli yapı.

Bu hiyerarşik yaklaşım sayesinde önce en hassas eşleşme aranmış, bulunamadığında ise daha genel fakat kullanılabilir bir koordinat üretilmiştir. Örneğin yalnızca ilçe ve il bilgisi mevcutsa sistem daha ayrıntılı kombinasyonları atlayarak bu iki bileşeni kullanmıştır. Böylece eksik adreslerde dahi kullanılabilir sonuçlar elde edilmiştir.

Bununla birlikte, uygulamanın güvenilirliği üç temel kontrol mekanizmasıyla desteklenmiştir. Birincisi, uluslararası sistemlerde sorun yaratmaması için Türkçe karakterlerin (ş, ç, ğ, ü, ö, ı) standart Latin harflerine dönüştürülmesi sağlanmıştır. İkincisi, eksik ya da boş bırakılan satırlar tamamen silinmemiş, tabloya aynı haliyle aktarılmış ve yalnızca koordinat sütunu boş bırakılmıştır. Böylece kayıt bütünlüğü korunmuş ve veri kaybı engellenmiştir. Üçüncüsü ise, GeocoderTimedOut gibi hatalarla karşılaşıldığında sorguların yeniden denenmesi sağlanmış; ayrıca her 50 satırlık işlemden sonra beş saniyelik bir bekleme süresi eklenerek hem geçici bağlantı sorunlarının önüne geçilmiş hem de Nominatim'in etik kullanım kurallarına uyum sağlanmıştır.

Elde edilen koordinatlar yeniden Excel dosyasına kaydedilmiştir. Öncelikle ilk 30 satır işlenerek küçük bir pilot test yapılmış ve yöntemin doğruluğu kontrol edilmiştir. Ardından tüm veri seti işlenerek sonuçlar kapsamlı şekilde kaydedilmiştir (Python kod ekde verilmiştir). Sürecin işleyişi, veri hazırlığından adres kombinasyonlarının oluşturulmasına, Nominatim'e yapılan sorgulardan hata yönetimine ve sonuçların Excel dosyasına yazılmasına kadar tüm aşamaları gösteren akış şeması Şekil 1'de görselleştirilmiştir. Böylece yöntem yalnızca kodlama bilgisine sahip araştırmacılar için değil, aynı zamanda kodlama bilgisi olmayan kullanıcılar için de anlaşılır hale getirilmiştir.



Şekil. 1. Türkiye adress verilerinin kordinatlandırılması için iş şeması

Tablo 1, farklı illerden alınmış örnek adreslerin sistemde nasıl işlendiğini göstermektedir. Tabloya hem eksiksiz hem de eksik/yanlış yazılmış adresler dahil edilmiştir. Böylece uygulamanın yalnızca ideal koşullarda değil, gerçek hayattaki veri çeşitliliği altında da nasıl çalıştığı ortaya konulmuştur. Tablodan görüldüğü üzere, mahalle bilgisi bulunduğunda sistem en ayrıntılı düzeyden koordinat üretirken; yalnızca ilin adı yazıldığında ilin merkez koordinatı döndürülmüştür. Eksik bilgiler, adresin tamamen göz ardı edilmesine yol açmamış, tersine sistem otomatik olarak uygun üst seviyeyi kullanarak her zaman bir koordinat atamaya çalışmıştır.

Sonuç olarak, bu uygulama sayesinde farklı derecelerde eksik veya tam adreslerden %100 kapsama oranına sahip bir koordinat seti elde edilmiştir. Böylelikle Türkiye'deki adres tabanlı veriler, coğrafi bilgi sistemlerinde kullanılabilir hale getirilmiş ve ileride afet yönetimi, şehir planlama veya ulaşım analizi gibi alanlarda doğrudan uygulanabilecek nitelikli bir veri kaynağına dönüştürülmüştür.

Tablo 1. Farklı ayrıntı seviyelerindeki adreslerin otomatik koordinatlandırma sonuçları

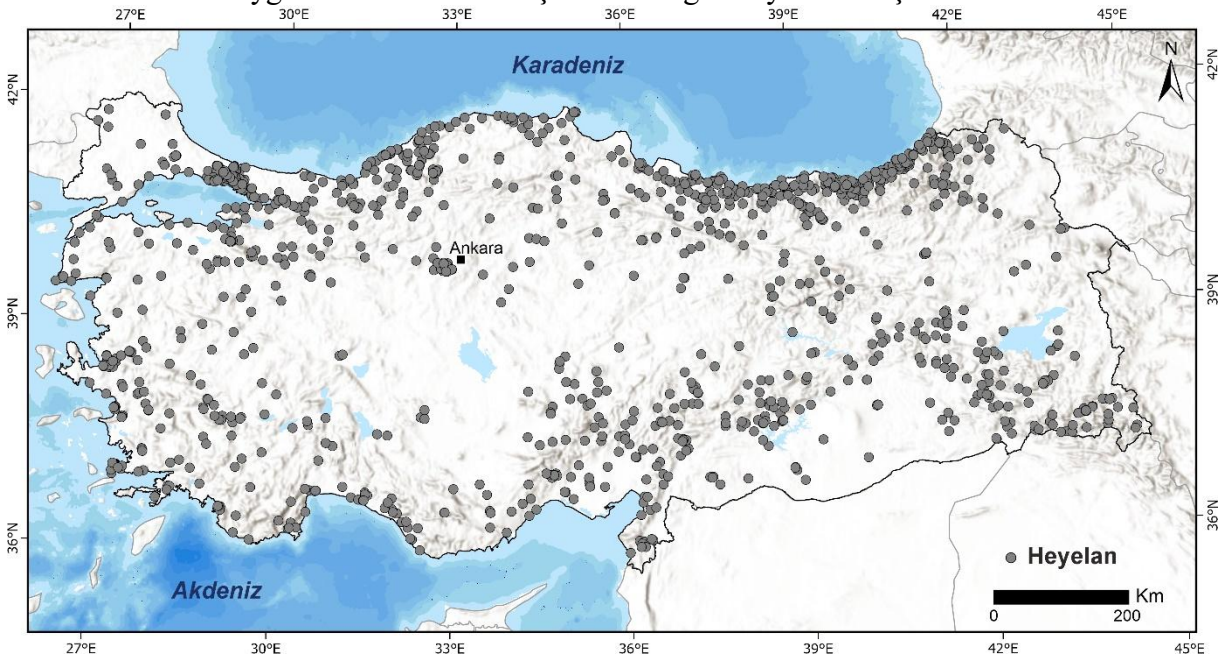
İl	İlçe	Mahalle/Köy	Kullanılan adres seviyesi	Enlem	Boylam
İstanbul	Kadıköy	Bahariye Mah.	Mahalle + İlçe + İl	40.9897	29.0273
Ankara	Çankaya	—	İlçe + İl	39.9208	32.8541
İzmir	—	—	İl	38.4192	27.1287
Trabzon	Ortahisar	Sancak Mah.	Mahalle + İlçe + İl	41.0012	39.7175
Van	Merkez	—	İlçe + İl	38.4949	43.3832
Kars	—	—	İl	40.6010	43.0970

Tablodan görüldüğü üzere, mahalle bilgisi bulunduğunda sistem en ayrıntılı düzeyden koordinat üretirken; yalnızca ilin adı yazıldığında ilin merkez koordinatı döndürülmüştür. Eksik bilgiler, adresin tamamen göz ardı edilmesine yol açmamış, tersine sistem otomatik olarak uygun üst seviyeyi kullanarak her zaman bir koordinat atamaya çalışmıştır.

Sonuç olarak, bu uygulama sayesinde farklı derecelerde eksik veya tam adreslerden %100 kapsama oranına sahip bir koordinat seti elde edilmiştir. Böylelikle Türkiye'deki adres tabanlı

veriler, coğrafi bilgi sistemlerinde kullanılabilir hale getirilmiş ve ileride afet yönetimi, şehir planlama veya ulaşım analizi gibi alanlarda doğrudan uygulanabilecek nitelikli bir veri kaynağına dönüştürülmüştür.

Tablo 1'da verilen beş örnek üzerinden açıklanan bu yaklaşım, toplamda yaklaşık 1800 adres kaydı üzerinde uygulanmıştır. Elde edilen koordinatlar daha sonra ArcGis Pro yazılımı kullanılarak harita üzerinde görselleştirilmiştir (Şekil 2). Şekilden de görüleceği üzere, Türkiye genelindeki heyelan olaylarının dağılımı başarıyla konumlandırılmış ve adres tabanlı verilerin mekânsal analize uygun bir formata dönüştürülebildiği ortaya konmuştur.



Şekil. 2. Türkiye'de adres tabanlı mekânsal verilerin dağılımı.

SONUÇLAR VE TARTIŞMA

Bu çalışmada geliştirilen yöntem, Türkiye'deki adres verilerinin otomatik olarak koordinatlandırılması sürecinde karşılaşılan temel sorunlara çözüm üretme potansiyeli taşımaktadır. Özellikle Türkçe adreslerin eksik, hatalı ya da farklı yazım biçimlerinde bulunması, uluslararası konum servisleri tarafından doğrudan çözümlenememektedir (Yomralıoğlu, 2000). Bu nedenle, çalışmada kullanılan kademeli adres çözümleme yaklaşımı, gerçek hayattaki veri çeşitliliğini dikkate alan esnek bir çözüm sunmaktadır. Mahalle düzeyinden başlayarak il merkezine kadar geriye doğru ilerleyen bu hiyerarşik yöntem, yalnızca ideal durumlarda değil, verinin eksik olduğu durumlarda da kullanılabilir koordinatlar sağlamaktadır. Dolayısıyla yöntem, Türkiye'de eksik adreslerin yaygın olduğu koşullar için uygulanabilir bir alternatif oluşturmaktadır.

Sonuçlar incelendiğinde, eksiksiz adreslerde yüksek doğruluk oranı elde edildiği, eksik adreslerde ise daha genel ölçekli koordinatlar üretilerek veri kaybının önüne geçildiği görülmüştür. Bu yaklaşım, özellikle afet yönetimi, kentsel planlama ve mekânsal analiz gibi eksik veya hatalı adreslerle sıkça karşılaşılan alanlarda büyük avantaj sağlamaktadır (Goodchild, 2007; Longley et al., 2015). Bununla birlikte, mahalle veya köy gibi ayrıntılı bileşenler bulunmadığında yalnızca ilçe ya da il merkezinin koordinatlarının atanması, mekânsal çözünürlüğü düşürmekte ve verinin hassasiyetini sınırlamaktadır. Bu durum, yöntemin güçlü yönlerinden biri olan esnekliğin aynı zamanda temel sınırlılığını da oluşturmaktadır.

Bir diğer tartışma konusu, kullanılan servis ve kütüphanelerin sunduğu avantajlar ve sınırlılıklardır. OpenStreetMap verilerinin açık kaynaklı olması ve gönüllüler tarafından sürekli

güncellenmesi, veriye erişim kolaylığı sağlamaktadır (Haklay & Weber, 2008). Ancak bu durum, veri kalitesinin bölgesel farklılıklar göstermesine de yol açabilmektedir. Nominatim servisi ise geniş kapsamlı bir arama motoru sunmakta, fakat toplu sorgulamalarda hız sınırlamaları ve bağlantı sorunları ile karşılaşılabilmektedir (Ramm et al., 2011). Çalışmada uygulanan zaman aşımı yönetimi, sorgular arası bekleme süresi ve yeniden deneme mekanizması bu sınırlılıkların etkisini büyük ölçüde azaltmıştır. Bununla birlikte, çok büyük veri setlerinde işlem süresinin uzaması kaçınılmazdır ve bu durum yöntemin ölçeklenebilirliği açısından dikkate alınması gereken bir konudur.

Son olarak, çalışmada kullanılan Python tabanlı otomasyonun, kodlama bilgisine sahip olmayan kullanıcılar için de anlaşılır kılınması önemli bir kazanımdır. Hazırlanan akış şeması ve tablo örnekleri, yöntemin yalnızca teknik bir süreç olmadığını, aynı zamanda görsel ve kavramsal olarak takip edilebilir bir yapıya sahip olduğunu göstermektedir. Bu özellik, yöntemin araştırmacılar, yerel yönetimler veya kurumlar tarafından pratik biçimde uygulanabilirliğini artırmaktadır.

Genel olarak tartışıldığında, geliştirilen yöntem, Türkiye'deki adres verilerinin otomatik koordinatlandırılmasına yönelik etkili ve uygulanabilir bir çözüm sunmaktadır. Bununla birlikte, daha yüksek doğruluk ve hız için gelecekte üç temel geliştirme yönü öne çıkmaktadır: (i) OSM verilerinin yerel güncellemelerle zenginleştirilmesi, (ii) alternatif geocoding servisleriyle entegrasyon sağlanması, (iii) makine öğrenmesi tabanlı yazım hatası düzeltme sistemlerinin eklenmesi. Bu adımlar, yöntemin daha hassas, hızlı ve ölçeklenebilir hale gelmesine katkı sağlayacaktır.

Sonuç olarak Bu çalışmada, Türkiye'deki adres verilerinin otomatik olarak koordinatlandırılması için geliştirilen Python tabanlı bir uygulamayı tanıtmaktadır. Uygulama, OpenStreetMap (OSM) verilerini kullanan Nominatim servisi ve geopy kütüphanesi aracılığıyla adresleri enlem–boylam bilgilerine dönüştürmüş, eksik ya da hatalı adreslerde dahi kullanılabilir sonuçlar üretmeyi başarmıştır. Kademeli sorgulama yöntemi sayesinde mahalle düzeyinden il merkezine kadar farklı ayrıntı seviyelerinde koordinatlar elde edilmiş, böylece veri kaybı en aza indirilmiştir.

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EK (Python kodu):

```
import pandas as pd
```

```
from geopy.geocoders import Nominatim
from geopy.exc import GeocoderTimedOut
import time
# 📄 Excel dosyasını oku
df = pd.read_excel("D:/PHD/ALL_koordinatli.xlsx")
# 🌍 Geolocator ayarı
geolocator = Nominatim(user_agent="turkey_location_finder")
# 📌 Kademeli adres denemesiyle koordinat alma fonksiyonu
def get_coordinates(row):
    combinations = [
        ['mahalle', 'köy', 'ilçe', 'il'],
        ['köy', 'ilçe', 'il'],
        ['ilçe', 'il'],
        ['il']
    ]
    for combo in combinations:
        address_parts = []
        for col in combo:
            if col in row and pd.notna(row[col]):
                val = str(row[col]).strip()
                if val:
                    address_parts.append(val)
        address = ', '.join(address_parts) + ", Türkiye"
        print(f"🔍 Deneniyor: {address}")
        try:
            location = geolocator.geocode(address, timeout=10)
            if location:
                return pd.Series([location.latitude, location.longitude])
        except GeocoderTimedOut:
            print("⏳ Zaman aşımı, tekrar deneniyor...")
            time.sleep(2)
            return get_coordinates(row)
        except Exception as e:
            print(f"⚠️ Hata: {e}")
            return pd.Series([None, None])
    print("❌ Hiçbir kombinasyon sonuç vermedi.")
    return pd.Series([None, None])
# ========================
# 🚀 AŞAMA 1: İlk 30 veri
# ========================
test_df = df.head(30).copy()
test_df[['enlem', 'boylam']] = test_df.apply(get_coordinates, axis=1)
test_df.to_excel("ilk_30_sonuclar.xlsx", index=False)
print("✅ İlk 30 veri işlendi. Sonuç: ilk_30_sonuclar.xlsx")
input("🛑 Devam etmek için Enter'a bas...")  # ← bu satır bekletir
# ========================
# 🚀 AŞAMA 2: Tüm veriler
# ========================
df['enlem'] = None
```

```
df['boylam'] = None
for i in range(0, len(df), 50):
    print(f"\n🔄 {i+1}. satırdan itibaren işleniyor...")
        df.iloc[i:i+50, [df.columns.get_loc('enlem'), df.columns.get_loc('boylam')]] =
df.iloc[i:i+50].apply(get_coordinates, axis=1)
    print("⏳ 5 saniye bekleniyor...")
    time.sleep(5)
df.to_excel("tum_adresler_koordinatli.xlsx", index=False)
print("✅ Tüm veriler başarıyla işlendi. Dosya: tum_adresler_koordinatli.xlsx")
```

ÖĞRENCİ ÇİZİMLERİ TEMELİNDE MATEMATİKSEL DENEYİMİN İZİNİ SÜRMEK

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ÖZET
Matematik, çoğunlukla bilgi aktarımına dayalı, tek yönlü ve öğrencinin duygusal ya da öznel deneyimlerinin sınırlı yer bulduğu bir alan olduğu düşünülerek eleştirilmektedir. Öğrencilerin matematiği nasıl algıladıkları ve bu dersle kurdukları ilişki ise çoğu zaman öğretim sürecinin dışında kalmakta, öğrenmeden bağımsız ikincil bir boyut olarak görülmektedir. Bu çalışma, öğrenci çizimlerini geleneksel temsiller olarak değil, pedagojik temasın kurulabildiği ya da bozulduğu "duygulanımsal frekanslar" olarak ele alarak öğrencilerin matematiğe ilişkin deneyimlerini yorumlamaya ve anlamlandırmaya yönelik bir sorgulama başlatmayı hedeflemektedir. Araştırma kapsamında dördüncü sınıf öğrencilerinin çizimleri analiz edilmiştir. Çalışma kapsamın alınan çizimlerde matematik sırasıyla bir korku figürü olan Chucky, bir robot ve "M" karakteriyle temsil edilmiştir. Bu çizimler, öğrencilerin matematikle kurdukları ilişkiyi bir otoriteyle, mekanikleştirilmiş bilgi aktarımıyla veya mesafeli bir iletişimle özdeşleştirdiklerini düşündürmektedir. Bu bağlamda, çalışma pedagojik deneyimi düz ve tek yönlü bir süreçten ziyade, öğrencilerin duygusal katılımını da içeren çok katmanlı bir rezonans alanı olarak kavramsallaştırmaktadır. Sonuç olarak, öğretmen eğitimi ve sınıf içi uygulamalarda öğrencilerin bu tür sözel olmayan ifadelerine daha fazla alan açılması gerektiği savunulmaktadır. Çalışma, öğrencilerin çizimlerinde ortaya çıkan ve çoğu zaman eğitimciler tarafından "konudan sapma", "sessizlik" ya da "anlamsızlık" gibi görülebilecek durumları ise "pedagojik gürültü" olarak tanımlar. Buradaki "gürültü", dikkat dağıtan ya da hatalı bir unsur değil, öğrencilerin dersle kurdukları farklı, bazen çatışmalı ama anlamlı ilişkilere işaret eden sinyaller olarak görülmelidir. Dolayısıyla, bu tür "gürültüler" bastırılması gereken sorunlar değil; öğrencilerin sesini duymak, anlamaya çalışmak ve dersin yapısını buna göre yeniden düşünmek için birer davet olarak değerlendirilmektedir.
Anahtar Kelimeler: Matematik öğretimi, duyuşsal etmenler, öğrenci resimleri

TRACING MATHEMATICAL EXPERIENCE THROUGH STUDENT DRAWINGS

ABSTRACT
Mathematics is often critiqued as a field dominated by unidirectional knowledge transmission, leaving limited space for students' emotional or subjective experiences. How students perceive mathematics and relate to the subject is frequently treated as peripheral to the teaching process, viewed as a secondary dimension independent of learning. This study seeks to initiate an inquiry into students' mathematical experiences by approaching student drawings not as conventional representations but as "affective frequencies" through which pedagogical engagement is established or disrupted. The research analyzed drawings of fourth-grade students, in which mathematics was represented respectively as the fear-inducing figure Chucky, a robot, and the character "M." These depictions suggest that students associate mathematics with authority, mechanized knowledge transmission, or distant communication. Within this framework, the study conceptualizes pedagogical experience not as a flat, one-way

process but as a multilayered field of resonance involving students' emotional engagement. It is argued that teacher education and classroom practice should allow greater space for such non-verbal student expressions. The study also identifies phenomena often interpreted by educators as "off-topic," "silence," or "meaninglessness" in student drawings as instances of "pedagogical noise." This "noise" should not be understood as distracting or erroneous but as signals of students' diverse, sometimes conflicting, yet meaningful relationships with the lesson. Consequently, these "noises" should be treated not as problems to suppress but as invitations to listen to students, seek understanding, and reconsider the structure of instruction accordingly.
Keywords: Mathematics education, affective factors, student drawings

ZİRAİ İLAÇ BAYİLERİNİN BİLGİ VE UYGULAMA ALTYAPILARI: MARDİN İLİ ÜZERİNE BİR ANKET ÇALIŞMASI

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ÖZET
Sentetik pestisitlerin seçimi ve doğru kullanımı, sürdürülebilir tarım ve çevre açısından büyük önem taşımaktadır. Bu bağlamda, zirai ilaç bayilerinin hayati bir rolü bulunmaktadır. Bu çalışma, Mardin ilindeki zirai ilaç bayilerinin eğitim durumunu, bitki koruma ve çevre konusundaki yeterlilik algılarını ile çiftçilere sağladıkları destekleri değerlendirmek amacıyla gerçekleştirilmiştir. Anket çalışması, 2025 yılında Mardin il merkez ve ilçelerinde bulunan 60 zirai ilaç bayisi ile yüz yüze görüşmeler yoluyla yapılmıştır. Araştırmaya katılan bayilerin %71.7'sinin lisans mezunu olduğu, mezuniyet dağılımında Dicle ve Çukurova Üniversiteleri'nin %15.0 ile öne çıktığı ve bitki koruma bölümü mezunlarının %28.3 ile en yüksek orana sahip olduğu belirlenmiştir. Katılımcıların %46.7'si bitki koruma alanında kendilerini yeterli bulmakta, %21.7'si ise kısmen yeterli olduğunu ifade etmektedir. Bu durum, bayilerin genel olarak kendilerini yetkin hissettiklerini göstermektedir. Bayilerin %81.7'si Tarım İl Müdürlüğü ile işbirliği yaparken, %63.3'ü sektörel etkinliklere düzenli katıldığını belirtmiştir. Katılım amaçları arasında bilgi edinmek ve güncel gelişmeleri takip etmenin (%48.3) ön planda olduğu tespit edilmiştir. Üreticilere yardım etme yöntemleri arasında %70.0 ile araziye giderek sorun tespiti yapmanın ilk sırada olduğu, yeni ilaçların takibi için %75.0 oranında firma yetkililerinden bilgi alındığı yönünde cevaplar verilmiştir. Bayilerin, çiftçilere ilaç önerirken ruhsatlı ürünlerin kullanılmasına (%75.0) ve zararlıda uygunluğa (%66.7) dikkat ettikleri görülmektedir. Çiftçilerin ilaç önerilerine uyma oranının %73.3 olduğu belirlenmiştir. Sonuç olarak, Mardin ilindeki zirai ilaç bayileri, yüksek eğitim düzeyleri ve yeterlilik algıları ile çiftçilere önemli destekler sunmaktadır. Ancak, çevresel duyarlılık ve bilinçlendirme konularında daha fazla eğitim ve bilgilendirme faaliyetlerine ihtiyaç duyulmaktadır. Bu çalışma, zirai ilaç bayilerinin rolünü ve çiftçilerle olan etkileşimlerini anlamak açısından önemli bir kaynak sunmaktadır.
Anahtar kelimeler: Zirai ilaç bayileri, eğitim durumu, bitki koruma, Mardin, çiftçi desteği

INFORMATION AND APPLICATION INFRASTRUCTURE OF AGRICULTURAL PESTICIDE DEALERS: A SURVEY STUDY ON MARDIN PROVINCE

ABSTRACT

The selection and proper use of synthetic pesticides are of great importance for sustainable agriculture and the environment. In this context, agricultural pesticide dealers play a vital role. This study was conducted to evaluate the educational background of agricultural pesticide dealers in Mardin province, their perceptions of competence regarding plant protection and environmental issues, and the support they provide to farmers. The survey was conducted through face-to-face interviews with 60 agricultural chemical dealers located in the city center and districts of Mardin in 2025. It was determined that 71.7% of the participating dealers hold a bachelor's degree, with Dicle and Çukurova Universities standing out at 15.0%, and graduates from the plant protection department accounting for the highest percentage at 28.3%. Among the participants, 46.7% consider themselves competent in the field of plant protection, while 21.7% express that they are partially competent. This indicates that dealers generally feel competent in their roles. Additionally, 81.7% of the dealers collaborate with the Provincial Directorate of Agriculture, and 63.3% report regular participation in sectoral events. It was found that the primary purpose of participation is to gain information and keep up with current developments (48.3%). Among the methods of assisting producers, 70.0% stated that they primarily conduct on-site problem assessments, and 75.0% obtain information from company representatives for tracking new pesticides. Dealers pay attention to using licensed products (75.0%) and the suitability of the pesticide for the pest (66.7%) when recommending pesticides to farmers. The compliance rate of farmers with the pesticide recommendations is determined to be 73.3%. In conclusion, agricultural pesticide dealers in Mardin province provide significant support to farmers due to their high educational levels and perceptions of competence. However, there is a need for more training and awareness-raising activities regarding environmental sensitivity. This study presents an important resource for understanding the role of agricultural pesticide dealers and their interactions with farmers.

Keywords: Agricultural pesticide dealers, Educational background, Plant protection, Mardin, Farmer support

EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI) FOR RELIABLE INTERNET OF THINGS

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Artificial intelligence (AI) and machine learning (ML) are extensively used to enhance the precision and independence of various intelligent applications within the Internet of Things (IoT). In these IoT applications, the accuracy and performance of AI/ML models are primary concerns; however, the interpretability, transparency, and accountability of the models' decisions are frequently overlooked. Additionally, in next-generation IoT applications powered by AI/ML, there is a demand for systems that are more reliable, transparent, and explainable. Specifically, irrespective of the simplicity or complexity of decisions, the manner in which a decision is made, the factors influencing the decision, and how people or experts accept and interpret them are critical concerns. Moreover, individuals often view unclear or unexpected AI results with doubt, leading to decreased acceptance and spread of IoT applications. Thus, explainable AI (XAI) has surfaced as a hopeful research field that enables the transparency, comprehensibility, and interpretability of both ante-hoc and post-hoc processes of black-box models.

Keywords: XAI, IoT, AI/ML

HEMŞİRELİK HİZMETLERİNDE YALIN YÖNETİM: UYGULAMALAR, ETKİLERİ VE SÜRDÜRÜLEBİLİRLİK

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Özet

Bu çalışma, hemşirelik hizmetlerinde yalın yönetim uygulamalarının etkilerini ve sürdürülebilirliğini incelemektedir. Yalın yönetim, kökeni Toyota Üretim Sistemi'ne dayanan ve sağlık sektöründe israfın azaltılması, süreçlerin iyileştirilmesi ve hasta odaklı değer yaratılmasını hedefleyen bir yaklaşım olarak öne çıkmaktadır. Literatürde, hemşirelik hizmetlerinde kullanılan 5S, Kaizen, Değer Akış Haritalama ve Kanban gibi yalın araçların; iş yükünün azaltılması, hata oranlarının düşürülmesi, hasta güvenliği ve çalışan memnuniyetinin artırılması üzerinde olumlu etkiler sağladığı belirtilmektedir. Bununla birlikte, liderlik desteğinin yetersizliği, personel eksikliği ve kültürel direnç gibi engellerin yalın uygulamaların sürdürülebilirliğini sınırladığı görülmektedir. Uluslararası ve ulusal düzeyde yapılan çalışmalar, hemşirelerin eğitim programlarına katılımı ve yöneticilerin desteği sağlandığında yalın yönetimin hasta bakım kalitesini yükselttiğini göstermektedir. Bu bağlamda, yalın yönetimin yalnızca teknik bir araç değil, aynı zamanda kurumsal kültür dönüşümünü gerektiren bir felsefe olduğu vurgulanmaktadır. Çalışma, hemşirelik alanında yalın yönetimin etkilerini değerlendiren kanıta dayalı araştırmaların artırılması gerektiğini önermektedir.

Anahtar Kelimeler: Hemşirelik, Yalın Yönetim, Sağlık Hizmetleri, Sürdürülebilirlik, Hasta Güvenliği

LEAN MANAGEMENT IN NURSING SERVICES: APPLICATIONS, EFFECTS AND SUSTAINABILITY

Abstract

This study explores the effects and sustainability of lean management practices in nursing services. Originating from the Toyota Production System, lean management has emerged as an approach in healthcare aimed at reducing waste, improving processes, and creating patient-centered value. Literature indicates that lean tools such as 5S, Kaizen, Value Stream Mapping, and Kanban, when applied in nursing care, contribute to reducing workload, minimizing error rates, and enhancing patient safety and staff satisfaction. However, barriers such as insufficient leadership support, staff shortages, and cultural resistance limit the sustainability of lean initiatives. Both international and national studies have shown that when nurses participate in training programs and managerial support is ensured, lean management significantly improves the quality of patient care. In this respect, lean management is emphasized not merely as a technical tool but also as a philosophy requiring organizational culture transformation. The

study concludes that more evidence-based research is needed to evaluate the impact of lean management in nursing practice.

Keywords: Nursing, Lean Management, Healthcare Services, Sustainability, Patient Safety

GİRİŞ

Yalın yönetim (Lean Management), otomotiv endüstrisindeki üretim sistemlerinden türetilerek sağlık hizmetlerine uyarlanmıştır. Temel amacı, israfı ("muda"), süreç varyasyonunu ("mura") ve aşırı yükü ("muri") azaltarak hasta bakımı kalitesini artırmaktır (Radnor et al. 2008; Mahmoud et al. 2021). Hemşirelik alanında bu yaklaşım, hizmet kalitesini artırmak, hasta güvenliğini sağlamak ve kaynak kullanımını optimize etmek için güçlü bir araç olarak öne çıkmaktadır. Yalın yönetimin temel prensipleri arasında atıkların belirlenmesi, değerin tanımlanması, süreç akışının sağlanması, talebe göre üretim ve mükemmelliğe ulaşma yer alır (Womack & Jones, 2003). Klinik ortamlarda, bu felsefeyi hemşirelik bağlamında etkin uygulamak hem bireysel hem de kurumsal düzeyde dönüşümü zorunlu kılar.

Bu çalışma, hemşirelik hizmetlerinde yalın yönetim ilkelerinin uygulanabilirliğini ve etkilerini incelemektedir. Lean yönetim felsefesinin sağlık hizmetlerinde atıkların azaltılması, hasta bakımının optimize edilmesi ve hemşirelerin iş memnuniyetiyle inovasyon becerilerini geliştirmedeki rolü ortaya konulacaktır. Araştırmalar genel olarak, yalın yaklaşımların hemşirelerin moralini ve performansını artırdığını, ancak yetersiz liderlik ve kaynak eksikliği nedeniyle sürdürülebilirliğin zorlandığını göstermektedir (Mahmoud et al. 2021; Kunnen et al. 2023; Udod, 2020). Çalışma, uygulayıcılar için stratejik çıkarımlar ve eğitim programlarının önemine dikkat çekmektedir.

GENEL BİLGİLER

Yalın Yönetimin Tarihsel Gelişimi ve Temel İlkeleri

Yalın yönetim, kökeni itibarıyla Japonya'da Toyota Üretim Sistemi'nden (TPS) doğmuştur. Womack, Jones ve Roos'un 1990'larda yayımladığı *The Machine That Changed the World* adlı çalışmada yalın düşüncenin temelleri küresel bağlamda tanımlanmış ve farklı sektörlere uyarlanabilirliği tartışılmıştır. Yalın yaklaşımın sağlık sektörüne transferi, özellikle 2000'li yılların başında hız kazanmıştır (Womack & Jones, 2003).

Sağlık kurumlarında bu yaklaşım, süreçlerdeki beklemeler, gereksiz hareketler, fazla envanter, hatalar ve tekrar işler gibi "atıkların" ortadan kaldırılmasını hedefler (Lawal, 2014). Özellikle hemşirelikte, klinik uygulamalarda ortaya çıkan zaman kayıpları, ilaç hazırlama sürecindeki hatalar, iletişimdeki aksamalar ve personel devri gibi sorunlar yalın yönetim ilkeleriyle analiz edilmektedir.

Hemşirelik Hizmetlerinde Yalın Yönetimin Önemi

Hemşirelik, sağlık hizmet sunumunun merkezinde yer almakta ve hasta bakımının sürekliliğini sağlamaktadır. Ancak iş yükü, personel yetersizliği, bürokratik işlemler ve verimsiz süreçler hemşirelerin etkinliğini sınırlamaktadır. Yalın yönetim, bu noktada hemşirelerin iş akışlarını kolaylaştırarak daha verimli, hasta odaklı ve güvenli bakım sunmalarını sağlar (Radnor et al. 2012).

Örneğin, ilaç yönetiminde barkod sistemlerinin entegrasyonu, hasta transfer süreçlerinde standart protokollerin geliştirilmesi ve klinik karar destek sistemlerinin uygulanması yalın

araçların doğrudan katkı sağladığı alanlardır. Hemşirelerin iş yükünün azaltılması, hata oranlarının düşürülmesi ve hasta memnuniyetinin artması yalın uygulamaların en önemli çıktılarıdır (Mahmoud et al. 2021).

Yalın Araç ve Tekniklerin Hemşirelikte Kullanımı

Hemşirelik hizmetlerinde kullanılan yalın araçlar arasında 5S, Kaizen, Değer Akış Haritalama (Value Stream Mapping), Kanban, Gemba ve Poka-Yoke gibi yöntemler öne çıkar:

- **5S**: Çalışma alanlarının düzenlenmesi, gereksiz malzemelerin elimine edilmesi ve standartlaştırılması yoluyla hemşirelerin zaman kaybı minimize edilir.
- **Kaizen**: Küçük ama sürekli iyileştirmeler, hemşirelerin bakım süreçlerinde inovatif uygulamalar geliştirmesini sağlar.
- **Değer Akış Haritalama**: Hasta kabulünden taburculuğa kadar geçen süreçlerde değer yaratmayan adımların belirlenmesiyle iş akışları şeffaflaşır.
- **Kanban**: Malzeme yönetiminde kullanılan görsel sistemler, özellikle acil servis ve yoğun bakım ünitelerinde eksikliklerin önlenmesine katkı sunar.
- **Gemba**: Yöneticilerin sahada bulunarak (örneğin yoğun bakımda) süreci gözlemlemesi, hemşirelerin sorunlarını doğrudan aktarmasına olanak tanır.

Bu araçların etkin uygulanması, yalnızca iş yükünü azaltmakla kalmaz, aynı zamanda hemşirelerin klinik karar verme süreçlerine daha fazla odaklanmasını sağlar (Udod, 2020).

Yalın Yönetimin Hemşireler Üzerindeki Etkileri

Literatürde, yalın yönetim uygulamalarının hemşireler üzerinde çift yönlü etkileri olduğu görülmektedir:

- **Olumlu Etkiler:** İş tatmininde artış, motivasyon, ekip çalışmasının güçlenmesi, hasta güvenliği algısında iyileşme ve inovatif davranışların gelişmesi (Mohamed et al, 2023).
- Olumsuz Etkiler: Yetersiz liderlik desteği, iş yükünün artması, değişime direnç ve çalışan tükenmişliği (Mahmoud et al. 2021; Kunnen et al. 2023).

Bu ikili yapı, yalın yönetimin yalnızca teknik bir dönüşüm olmadığını; aynı zamanda kurumsal kültür ve liderlik boyutunun kritik olduğunu göstermektedir.

Sürdürülebilirlik ve Engeller

Yalın yönetimin sürdürülebilirliği, hemşirelik hizmetlerinde en çok tartışılan konulardan biridir. Kunnen et al. (2023) yaptıkları çalışmada, personel yetersizliği, liderlik eksikliği ve finansal kaynak sıkıntısının sürdürülebilirliği engellediğini belirtmiştir.

Udod'un (2020) Kanada'daki araştırması, hemşire yöneticilerin yalın yönetim uygulamalarını kaynak yetersizliği ve eğitim eksikliğinden dolayı uygulamakta zorlandığını ortaya koymuştur. Türkiye bağlamında yapılan araştırmalar ise, hemşirelerin eğitim programlarına katılımının ve yöneticilerin desteğinin sürdürülebilirliği kolaylaştırdığını göstermektedir (Torun Kılıç & Öztürk, 2024).

Dolayısıyla yalın yönetim, kısa süreli projelerden ziyade kurumsal kültürün bir parçası olarak ele alınmalı, hemşirelerin karar alma süreçlerine aktif katılımı sağlanmalıdır.

Türkiye ve Dünyadan Uygulama Örnekleri

Dünya genelinde, özellikle ABD, Kanada, Hollanda ve Japonya'da büyük hastane zincirlerinde yalın yönetim uygulamaları yaygınlaşmıştır. Bu ülkelerde, hemşirelik hizmetlerinde süreç

sürelerinin %20-30 oranında kısaldığı, hata oranlarının azaldığı rapor edilmiştir (Radnor et al. 2012).

Türkiye'de ise son yıllarda üniversite hastaneleri ve kamu hastanelerinde pilot yalın yönetim projeleri hayata geçirilmiştir. Örneğin, ameliyathane süreçlerinin yalın yönetimle yeniden tasarlanması, bekleme sürelerinin kısaltılması ve hemşirelerin iş yükünün dengelenmesi konusunda başarılı sonuçlar elde edilmiştir.

SONUÇ

Hemşirelikte yalın yönetim, hasta bakım kalitesini artırmaya, hizmet sürecini optimize etmeye ve hemşireler arasında yenilik ve iş memnuniyetini desteklemeye yönelik güçlü bir yaklaşımdır. Yalın uygulamalar moral ve performans üzerinde olumlu etkiler yaratabilir; ancak eğitim, liderlik, kaynak ve sürdürülebilir stratejiler olmadan bu etki sınırlı kalır.

Yalın yönetimin hem bireysel hem de organizasyonel düzeyde etkin olabilmesi için:

- Eğitim programları düzenlenmeli (özellikle hemşire yöneticiler için),
- Liderliğin sürece aktif desteği sağlanmalı,
- Personelin sürece dahil edilmesi ve ölçülebilir araçlar kullanılmalı,
- Kaynak yetersizliği, iş yükü, kültürel direnç gibi uygulama alanında karşılaşılan engeller belirlenmeli

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HEMŞİRELİKTE HİZMETKÂR LİDERLİK: KAVRAMSAL BİR DEĞERLENDİRME

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Özet

Bu çalışma, hemşirelik alanında hizmetkâr liderlik yaklaşımının kuramsal temellerini, bireysel ve kurumsal etkilerini ve Türkiye bağlamındaki önemini ele almaktadır. Hizmetkâr liderlik, çalışanların ihtiyaçlarını ön planda tutan, onların gelişimini destekleyen ve etik değerler doğrultusunda örgütsel hedeflere ulaşmayı amaçlayan bir liderlik anlayışıdır. Bu liderlik tarzı, hemşirelik mesleğinin etik değerleriyle uyumlu olup hasta güvenliği ve bakım kalitesine önemli katkılar sağlamaktadır. Türkiye'de yapılan araştırmalar da hemşirelerin hizmetkâr liderlik algılarının çalışan performansını doğrudan etkilediğini ortaya koymaktadır. Çalışmalardan elde edilen bulgular, hemşirelik yönetiminde hizmetkâr liderlik yaklaşımının benimsenmesinin hem çalışan refahı hem de hasta bakım kalitesi açısından stratejik bir zorunluluk olduğunu göstermektedir.

Anahtar Kelimeler: Hizmetkâr liderlik, Hemşirelik yönetimi, Hasta bakım kalitesi

SERVANT LEADERSHIP IN NURSING: A CONCEPTUAL REVIEW

Abstract

This study explores the theoretical underpinnings of the servant leadership approach in nursing, its implications at both the individual and organizational levels, and its relevance within the Turkish healthcare context. Servant leadership is characterized as a leadership paradigm that prioritizes the needs of employees, fosters their professional growth, and seeks to accomplish organizational objectives through adherence to ethical values. As such, this model is intrinsically aligned with the ethical foundations of the nursing profession and contributes significantly to patient safety and the overall quality of care. Empirical research conducted in Turkey further demonstrates that nurses' perceptions of servant leadership exert a direct and substantial influence on employee performance. Collectively, these findings highlight that the adoption of servant leadership within nursing management is not merely an organizational preference but rather a strategic imperative for promoting employee well-being and enhancing the quality of patient care.

Keywords: Servant leadership, Nursing leadership, Patient care quality

GİRİŞ

Sağlık sistemleri giderek karmaşık hale geldikçe hemşirelerin çalışma koşulları daha yoğun, stresli ve çok boyutlu bir yapıya dönüşmektedir. Bu bağlamda hemşirelikte liderlik, yalnızca yönetimsel bir işlev değil, aynı zamanda hasta güvenliği, çalışan refahı ve örgütsel etkinlik açısından belirleyici bir unsurdur (Cummings et al. 2021). Geleneksel otoriter ve işlemsel liderlik tarzları, sağlık kurumlarının değişen ihtiyaçlarını karşılamada çoğu zaman yetersiz kalabilmektedir. Günümüzde sağlık alanında empati, katılımcılık, etik ve insan merkezli liderlik yaklaşımlarına daha fazla gereksinim duyulmaktadır (Spears, 2010). Bu yaklaşımlardan biri olan hizmetkâr liderlik, liderin gücü elinde tutan bir otorite figürü olmaktan ziyade, öncelikle hizmet eden, çalışanların gelişimini destekleyen ve etik değerler çerçevesinde örgütsel hedeflere ulaşan bir modeldir (Greenleaf, 1970). Hizmetkâr liderlik, hemşirelik mesleğinin temel değerleri olan şefkat, empati, etik sorumluluk ve hizmet anlayışıyla doğrudan uyumludur (Eva et al. 2019). Bu nedenle hemşirelik bağlamında hizmetkâr liderlik, yalnızca bir yönetim tarzı değil, aynı zamanda mesleğin özünü yansıtan bir liderlik biçimi olarak öne çıkmaktadır.

KURAMSAL ÇERÇEVE

Kavramsal Temeller

Hizmetkâr liderlik kavramı Robert K. Greenleaf'in (1970) "The Servant as Leader" adlı çalışmasıyla literatüre kazandırılmıştır. Bu yaklaşımda lider, gücünü astlarına hükmetmekten değil, onların ihtiyaçlarını anlamaktan ve karşılamaktan alır. Spears (2010), hizmetkâr liderliğin temelini oluşturan 10 özelliği şu şekilde sıralamaktadır: dinleme, empati, şifa, farkındalık, ikna, kavramsallaştırma, ileri görüşlülük, hizmet etme, topluluk oluşturma ve bağlılık. Bu özellikler, liderin yalnızca yönetici değil aynı zamanda etik ve insani değerlere dayalı bir rol üstlendiğini göstermektedir.

Hizmetkâr Liderlik

Hizmetkâr liderlik, örgütsel davranış ve sağlık yönetimi literatüründe giderek artan ilgi görmektedir. Eva et al. (2019), bu yaklaşımın psikolojik güvenlik, iş tatmini ve örgütsel bağlılık üzerinde güçlü etkileri olduğunu göstermiştir. Liden et al. (2014), hizmet kültürünün desteklediği hizmetkâr liderliğin hem bireysel hem de ekip performansını artırdığını ortaya koymuştur. Hunter et al. (2013) ise hizmetkâr liderlerin çalışanlarında iş birliği, bağlılık ve etik davranışlar geliştirdiğini vurgulamaktadır.

Hemşirelik ve Hizmetkâr Liderlik

Hemşirelik mesleği doğası gereği empati, şefkat, etik sorumluluk ve hizmet odaklılık üzerine kuruludur. Bu nedenle hizmetkâr liderlik hemşirelik değerleriyle doğrudan örtüşmektedir. Xiao et al. (2024), hizmetkâr liderliğin hemşirelerde iş özerkliğini artırarak duygusal tükenmişliği azalttığını ve görev performansını güçlendirdiğini ortaya koymuştur. Benzer şekilde, Ma et al. (2021), COVID-19 döneminde hizmetkâr liderliğin hemşirelerin tükenmişliğini azalttığını ve psikolojik güvenliği artırdığını belirtmiştir. Türkiye'de yapılan araştırmalar, hizmetkâr liderliğin hemşirelerin iş performansı ve iş tatmini üzerinde doğrudan etkili olduğunu göstermektedir. Özer (2019), hemşirelerin hizmetkâr liderlik algılarının çalışan performansının %51,2'sini açıkladığını bulmuştur. Bu bulgu, hizmetkâr liderliğin yerel sağlık kurumlarında hemşirelik yönetimi açısından kritik bir model olduğunu ortaya koymaktadır. Hizmetkâr liderlik, bireysel düzeyde hemşirelerin motivasyonunu, mesleki bağlılığını ve psikolojik dayanıklılığını artırırken (Bayati et al. 2025), kurumsal düzeyde hasta bakım kalitesini yükseltmekte, ekip içi iş birliğini güçlendirmekte ve çalışan devir hızını azaltmaktadır

(Saavedra, 2025). Literatürde hizmetkâr liderliğin hemşirelerin iş performansı, iş tatmini, psikolojik dayanıklılık ve örgütsel bağlılık düzeyleri üzerinde olumlu etkiler yarattığına dair güçlü kanıtlar bulunmaktadır. Ayrıca bu liderlik tarzı, hemşirelik mesleğinin etik değerleriyle uyumlu olup hasta güvenliği ve bakım kalitesine önemli katkılar sağlamaktadır (Saavedra, 2025; Ma et al. 2021).

Hizmetkâr Liderlik Hemşirelikte Neden Önemlidir?

- Empati ve etik odaklı yapısıyla hizmetkâr liderlik, hemşirelerin bakım süreçlerinde daha yüksek duyarlılık geliştirmesini sağlar. Hasta güvenliği ve bakım kalitesini olumlu yönde etkiler (Ma et al. 2021).
- Hizmetkâr liderler, çalışanların psikolojik güvenliğini destekleyerek tükenmişliği önler (Xiao et al. 2024).
- Çalışanların gelişimini önceleyen liderlik tarzı, hemşirelerin iş tatmini ve örgütsel bağlılığını artırır (Hunter et al. 2013).
- Hizmetkâr liderlik, güven ve dayanışmaya dayalı bir kültür oluşturarak multidisipliner sağlık ekiplerinde etkili iletişimi kolaylaştırır (Liden et al. 2014).
- Hizmetkâr liderliğin hemşirelerin performansını artırdığını ve örgütsel bağlılıklarını güçlendirdiğini göstermektedir (Özer, 2019).

YÖNTEM

Bu çalışma, hemşirelikte hizmetkâr liderlik konusunu ele alan bir literatür derleme makalesi niteliğindedir.PubMed, Web of Science, Google Scholar ve Dergipark veri tabanlarından “Servant leadership”, “nursing leadership”, “psychological safety”, “burnout”, “patient care quality” anahtar kelimeleri ile 2010–2025 yılları arasında yayımlanan, İngilizce ve Türkçe makaleler incelenmiştir. Hemşirelik alanında hizmetkâr liderliği doğrudan inceleyen veya bu liderlik tarzının hemşirelerdeki örgütsel, psikolojik ya da performans çıktıları üzerindeki etkilerini araştıran çalışmalar dahil edilmiştir.

TARTIŞMA ve SONUÇ

Literatürde yapılan çalışmalardan elde edilen bulgulara göre, hizmetkâr liderliğin hemşirelik uygulamalarında güçlü olumlu etkiler yarattığını ortaya koymaktadır. Xiao et al. (2024) ve Özer (2019) çalışmalarında, farklı kültürel bağlamlarda hizmetkâr liderliğin hemşirelerin iş performansını artırdığını göstermektedir. Ma et al. (2021), bu yaklaşımın hemşirelerin tükenmişliğini azalttığını, Bayati et al. (2025) ise iş-yaşam kalitesini güçlendirdiğini ortaya koymuştur. Bu bulgular, hizmetkâr liderliğin hemşirelik mesleğinde yalnızca bir yönetim tarzı değil, aynı zamanda çalışan refahını ve hasta bakım kalitesini artıran stratejik bir yaklaşım olduğunu göstermektedir. Türkiye bağlamında yapılan çalışmalar ise sınırlı olmakla birlikte hizmetkâr liderliğin hemşirelerin performansını ve bağlılığını artırdığını ortaya koymaktadır (Özer, 2019). Bu durum, hemşirelik yönetiminde hizmetkâr liderliğin daha yaygın olarak araştırılması ve uygulamaya geçirilmesi gerektiğini göstermektedir. Hizmetkâr liderlik, hemşirelik mesleğinin öz değerleriyle uyumlu, etik ve insan merkezli bir liderlik modelidir. Literatür bulguları, bu yaklaşımın hemşirelerin iş performansını artırdığını, tükenmişliği azalttığını, iş tatmini ve örgütsel bağlılığı güçlendirdiğini ortaya koymaktadır. Türkiye’de elde edilen bulgular da bu sonuçları desteklemektedir. Hemşire liderlerin hizmetkâr liderlik yaklaşımını benimsemeleri hem çalışan refahı hem de hasta bakım kalitesi açısından stratejik bir önem taşımaktadır.

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SOCIOECONOMIC RESILIENCE INDICATORS IN SINGLE–PARENT FAMILIES: A QUALITATIVE STUDY ON PUBLIC SECTOR EMPLOYEES IN KAYSERI

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ÖZET

Bu araştırma, Kayseri ilinde kamu kurumlarında çalışan tek ebeveynlerin sosyoekonomik direnç stratejilerini incelemeyi ve bu stratejilerin aile işlevselliği ve finansal refah üzerindeki etkilerini değerlendirmeyi amaçlamaktadır. Çalışma nitel araştırma desenine dayalı olarak yürütülmüş ve 154 tek ebeveyn katılımcı ile gerçekleştirilmiştir. Veriler, çevrimiçi yoluyla toplanmıştır. Bulgular, düşük gelir seviyesi ve sınırlı sosyal desteğin aile işlevselliğini olumsuz etkilediğini, ancak katılımcıların geliştirdiği bütçe yönetimi, gelir artırıcı girişimler ve sosyal destek stratejilerinin aile içi dengeyi korumada etkili olduğunu ortaya koymuştur. Araştırma, sosyal politika ve aile destek hizmetlerinin geliştirilmesine yönelik öneriler sunmaktadır.

Anahtar Sözcükler: tek ebeveynli aileler, sosyoekonomik direnç, aile işlevselliği, finansal refah, nitel araştırma

TEK EBEVEYNLİ AİLELERDE SOSYOEKONOMİK DİRENÇ GÖSTERGELERİ: KAYSERİ İLİNDEKİ KAMU KURUMU ÇALIŞANLARI ÜZERİNE NİTEL BİR ARAŞTIRMA

ABSTRACT

This study aims to examine the socioeconomic resilience strategies of single parents working in public institutions in Kayseri province and to evaluate the impact of these strategies on family functioning and financial well-being. The study was conducted using a qualitative research design and included 154 single-parent participants. Data were collected online. The findings revealed that low income levels and limited social support negatively affect family functioning. However, the participants' strategies such as budget management, income-generating initiatives, and seeking social support were found to be effective in maintaining family balance. The research offers recommendations for the development of social policies and family support services.**Keywords:** single-parent families, socioeconomic resilience, family functioning, financial well-being, qualitative research

GİRİŞ

Tek ebeveynli aileler; boşanma, ölüm veya ayrılık gibi nedenlerle yalnızca anne ya da babanın çocuk(lar) ile yaşadığı aile biçimidir. Günümüzde bu aile yapısı, toplumsal değişimlerin etkisiyle giderek yaygınlaşmaktadır. Bu tür aileler sıklıkla hem ekonomik hem de psikososyal sorunlarla karşı karşıya kalmakta, özellikle gelir yetersizliği ve sosyal destek eksikliği aile işlevselliğini olumsuz yönde etkilemektedir. Bu bağlamda, tek ebeveynlerin geliştirdiği bireysel ve toplumsal direnç mekanizmalarının incelenmesi, aile politikalarının şekillendirilmesi açısından önem arz etmektedir.

INTRODUCTION

Single-parent families are households where only the mother or father lives with the child(ren) due to divorce, death, or separation. This family model has become increasingly common as a result of social and demographic changes. Such families often face both economic and psychosocial challenges, particularly due to income insufficiency and lack of social support, which adversely affect family functioning. In this context, analyzing the individual and social resilience mechanisms developed by single parents is essential for shaping effective family policies.

LİTERATÜR TARAMASI

Tek ebeveynli ailelerin sosyoekonomik sorunları ve bu sorunlara karşı geliştirdikleri direnç stratejileri üzerine yapılan araştırmalar giderek artmaktadır. Literatürde, ekonomik yetersizliğin tek ebeveynli ailelerde yaygın bir sorun olduğu, bu durumun çocukların eğitim ve psikolojik gelişimini olumsuz etkilediği belirtilmektedir (Kurtulmuş, 1998; Örüğn & Feyzioğlu, 2011). Ayrıca, sosyal destek sistemlerinin yetersizliği, ailelerin finansal ve psikososyal zorluklarla başa çıkmasını zorlaştırmaktadır (Çelikel, 2012; Başer, 2014).

Tek ebeveynlerin geliştirdiği direnç stratejileri arasında planlı bütçe yönetimi, ek gelir kaynakları yaratma ve sosyal ağların kullanımı öne çıkmaktadır (Yüksel & Yılık, 2022; Güngör, 2023). Bu stratejilerin aile işlevselliği ve finansal refah üzerinde olumlu etkileri olduğu literatürde vurgulanmaktadır. Ancak, devlet desteklerinin ve esnek çalışma koşullarının yetersizliği, tek ebeveynlerin karşılaştığı zorlukları artırmaktadır (Karapınar Kocağ, 2023).

LITERATURE REVIEW

Research on the socioeconomic problems faced by single-parent families and their resilience strategies is increasing. The literature highlights that economic insufficiency is a common issue among single-parent families, adversely affecting children's education and psychological development (Kurtulmuş, 1998; Örüğn & Feyzioğlu, 2011). Furthermore, inadequate social support systems make it harder for families to cope with financial and psychosocial challenges (Çelikel, 2012; Başer, 2014).

Resilience strategies developed by single parents include planned budgeting, generating additional income sources, and utilizing social networks (Yüksel & Yılık, 2022; Güngör, 2023). These strategies are emphasized for their positive impact on family functioning and financial well-being. However, insufficient government support and inflexible working conditions increase the difficulties faced by single parents (Karapınar Kocağ, 2023).

YÖNTEM

Bu araştırma, nitel araştırma deseni kullanılarak gerçekleştirilmiştir. Katılımcılar, Kayseri ilinde kamu kurumlarında çalışan toplam 154 yetişkin tek ebevenden oluşmaktadır. Veri toplama araçları olarak çevrimiçi anketler ve yarı yapılandırılmış mülakat formu kullanılmıştır.

Araştırmada aile işlevselliğini değerlendirmek için McMaster Aile Değerlendirme Ölçeği (FAD), finansal durumu ölçmek için ise Finansal Sıkıntı / Finansal Refah Ölçeği (IFDFW) uygulanmıştır. Katılımcıların demografik ve sosyoekonomik özellikleri (yaş, cinsiyet, eğitim seviyesi, hane geliri, gelir memnuniyeti, aile birey sayısı) analiz sürecine dahil edilmiştir.

Veriler, tematik analiz yöntemiyle değerlendirilmiş ve uygun istatistiksel teknikler kullanılmıştır. Nitel veriler içerik analiziyle yorumlanmıştır.

METHOD

This study was conducted using a qualitative research design. The participants consisted of 154 adult single parents working in public institutions in Kayseri. Data collection tools included online surveys and semi-structured interview forms.

The McMaster Family Assessment Device (FAD) was used to evaluate family functioning, and the Financial Distress / Financial Well-Being Scale (IFDFW) was applied to assess financial status. Participants' demographic and socioeconomic characteristics (age, gender, education level, household income, income satisfaction, number of family members) were included in the analysis.

Data were analyzed using thematic analysis, supported by appropriate statistical methods. Qualitative data were interpreted through content analysis.

BULGULAR

Araştırmaya katılan 154 tek ebeveynin demografik dağılımı incelendiğinde, %61'inin kadın, %39'unun erkek olduğu görülmüştür. Eğitim seviyeleri arasında %64,9'u lisans mezunu, %11'i yüksek lisans, %18'i önlisans ve %7'si lise mezunudur. Aile gelir seviyeleri, %41,5 ile 50.000-70.000 TL aralığında yoğunlaşmaktadır. Katılımcıların %51,9'u ev sahibi, %42,2'si kiracı olup, kalan kısım lojman, aile yanı ya da akraba evi gibi farklı konutlarda yaşamaktadır. Ortalama olarak %42,9'u 1-5 yıl arasında tek ebeveyn olarak yaşamaktadır.

3) *TABLO 1: Demografik Dağılım / Table 1: Demographic Distribution*

Özellik / Feature	Yüzde / Percentage
Kadın / Female	61%
Erkek / Male	39%
Lisans / Bachelor	64.9%
Yüksek Lisans / Master	11%
1 Çocuk / 1 Child	46.4%
2 Çocuk / 2 Children	36.6%

4) *Grafik 1: Katılımcıların Eğitim Düzeyi / Figure 1: Education Level of Participants*

Bu grafik, katılımcıların eğitim dağılımını görselleştirmektedir.

5) TABLO 2: Finansal Sorunların Dağılımı / Table 2: Distribution of Financial Problems

Sorun / Problem	Yüzde / Percentage
Gelir yetersizliği / Insufficient income	68%
Çocuk harcamaları / Children's expenses	57%
Devlet desteği / Government support	45%
İş-aile dengesi / Work-family balance	52%

6) Grafik 2: Finansal Sorunların Görselleştirilmesi / Figure 2: Visualization of Financial Problems

Grafik, en sık bildirilen finansal sorunları göstermektedir.

7) TABLO 3: Direnç Stratejilerinin Etkisi / Table 3: Impact of Resilience Strategies

Strateji / Strategy	Etki / Impact
Bütçe Yönetimi / Budget Management	75% aile işlevselliğini artırdı / improved family functioning
Gelir Artırıcı Girişimler / Income Enhancing	68% finansal refahı iyileştirdi / improved financial well-being
Sosyal Destek / Social Support	80% stres azaltıldı / reduced stress

8) Grafik 3: Direnç Stratejilerinin Görselleştirilmesi / Figure 3: Visualization of Resilience Strategies

Grafik, direnç stratejilerinin etkilerini göstermektedir

Sosyoekonomik Durum ve Aile İşlevselliği

Veriler, düşük gelir düzeyi ve sınırlı sosyal desteğin aile işlevselliğini olumsuz etkilediğini ortaya koymuştur. Katılımcılar, maddi sıkıntıların çocukların eğitim ve psikososyal gelişimini doğrudan etkilediğini belirtmişlerdir. İş ve aile dengesi sorunları, ebeveynlerin psikolojik sağlığını da olumsuz etkilemektedir.

Direnç Stratejileri

Araştırmada, tek ebeveynlerin geliştirdiği üç ana direnç stratejisi belirlenmiştir:

1. **Planlı Bütçe Yönetimi:** Katılımcıların çoğu aylık gelirlerini kategorilere ayırarak önceliklendirme yapmakta ve tasarruf planları geliştirmektedir. Örnek olarak, "Her ay gelirimi kategorilere ayırıyor ve önceliklerimi belirleyerek tasarruf yapıyorum" ifadeleri kullanılmıştır.
2. **Gelir Artırıcı Girişimler:** Ek iş, freelance çalışma ve sosyal programlardan yararlanma yaygın stratejilerdir. Katılımcılar, bu ek gelir kaynakları sayesinde temel ihtiyaçlarını karşılayabilmektedir.

Sosyal Destek Ağları: Aile, arkadaş ve topluluk desteği günlük yaşamda önemli bir rol oynamaktadır. Psikolojik destek ve yardım alanları sosyal dayanışmayı güçlendirmektedir.

Psikososyal Etkiler

Yalnızlık, sosyal izolasyon ve çocukların akademik başarısında düşüş gibi psikososyal zorluklar da sıkça dile getirilmiştir. Katılımcılar, psikolojik destek ve esnek çalışma olanaklarının artırılması gerektiğini vurgulamıştır.

Findings

The demographic distribution of the 154 single-parent participants shows that 61% were female and 39% male. Education levels were distributed as 64.9% bachelor's degree, 11% master's degree, 18% associate degree, and 7% high school graduates. Family income was concentrated mostly between 50,000-70,000 TRY (41.5%). Among the participants, 51.9% owned their homes, 42.2% rented, and the rest lived in government housing, with family, or friends' homes. Approximately 42.9% had been single parents for 1-5 years.

Socioeconomic Status and Family Functioning

The data reveal that low income and limited social support negatively impact family functioning. Participants noted that financial difficulties directly affect children's education and psychosocial development. Work-family balance problems also negatively influenced parents' psychological well-being.

Resilience Strategies

Three main resilience strategies emerged:

1. **Planned Budget Management:** Most participants categorized their monthly income, prioritized expenses, and developed savings plans. For example, "I categorize my income each month and set priorities to save" was a common statement.
2. **Income-Enhancing Initiatives:** Secondary jobs, freelance work, and social programs were widely used strategies. These additional income sources helped meet basic needs.
3. **Social Support Networks:** Family, friends, and community support played a crucial role in daily life. Psychological support and assistance strengthened social solidarity.

Psychosocial Effects

Loneliness, social isolation, and decline in children's academic performance were frequently reported psychosocial challenges. Participants emphasized the need for increased psychological counseling and flexible working opportunities.

TARTIŞMA

Bu çalışmada, Kayseri'de kamu kurumlarında çalışan tek ebeveynlerin sosyoekonomik direnç göstergeleri ve aile işlevselliği üzerine etkileri nitel yöntemlerle incelenmiştir. Bulgular, literatürle paralellik göstermektedir. Özellikle düşük gelir düzeyinin ve sosyal desteğin yetersizliğinin aile işlevselliğini olumsuz etkilediği (Kurtulmuş, 1998; Örüğn & Feyzioğlu, 2011), buna karşılık tek ebeveynlerin planlı bütçe yönetimi, ek gelir yaratma ve sosyal destek ağlarından yararlanma gibi stratejilerle direnç geliştirdiği görülmüştür (Yüksel & Yılık, 2022; Güngör, 2023).

Çalışma bulguları, finansal stresin çocukların akademik başarısı ve psikososyal gelişimi üzerindeki olumsuz etkilerine ışık tutmaktadır. Psikososyal destek ve esnek çalışma koşullarının artırılması, tek ebeveynli ailelerin yaşam kalitesini iyileştirebilir. Bu sonuçlar, devlet desteklerinin artırılması ve çocuk bakım hizmetlerinin yaygınlaştırılması önerileriyle de uyumludur (Karapınar Kocağ, 2023).

DISCUSSION

This study qualitatively examined the socioeconomic resilience indicators and their effects on family functioning among single parents working in public institutions in Kayseri. The findings align with existing literature. Specifically, low income and lack of social support negatively impact family functioning (Kurtulmuş, 1998; Örüğn & Feyzioğlu, 2011), whereas single parents develop resilience through planned budgeting, income-generating activities, and social support networks (Yüksel & Yılık, 2022; Güngör, 2023).

The results highlight the adverse effects of financial stress on children's academic performance and psychosocial development. Increasing psychosocial support and flexible working conditions may improve the quality of life for single-parent families. These findings are consistent with recommendations to enhance government support and expand childcare services (Karapınar Kocağ, 2023).

SONUÇ

Bu çalışma, Kayseri'de kamu kurumlarında çalışan tek ebeveynlerin karşılaştığı ekonomik ve sosyal zorlukları, aynı zamanda geliştirdikleri direnç stratejilerini kapsamlı biçimde ortaya koymuştur. Tek ebeveynli ailelerin finansal ve psikososyal kırılganlıkları yüksek olmakla birlikte, planlı bütçe yönetimi, gelir artırıcı girişimler ve güçlü sosyal destek ağları aile işlevselliğinin ve finansal refahın korunmasında belirleyici olmaktadır.

Araştırma, sosyal politika yapıcılar, eğitimciler ve sosyal hizmet uzmanları için önemli bulgular sunmakta; tek ebeveynli ailelerin güçlendirilmesi için kapsamlı destek programlarının geliştirilmesi gerektiğini vurgulamaktadır.

ÖNERİLER

- Devlet desteklerinin artırılması ve özellikle düşük gelirli tek ebeveynlere yönelik finansal yardım programlarının yaygınlaştırılması.
- Çocuk bakım hizmetlerinin erişilebilir ve uygun maliyetli hale getirilmesi.
- Psikolojik danışmanlık ve sosyal destek hizmetlerinin güçlendirilmesi.

- İş piyasasında esnek ve aile dostu çalışma koşullarının teşvik edilmesi.
- Tek ebeveynlerin direnç stratejilerinin paylaşılacağı eğitim programları ve toplumsal farkındalık çalışmaları düzenlenmesi.

CONCLUSION

This study comprehensively revealed the economic and social challenges faced by single parents working in public institutions in Kayseri, as well as the resilience strategies they develop. Although single-parent families experience high financial and psychosocial vulnerability, planned budgeting, income-enhancing initiatives, and strong social support networks are crucial for maintaining family functioning and financial well-being.

The research provides significant insights for policymakers, educators, and social workers, emphasizing the need to develop comprehensive support programs to empower single-parent families.

RECOMMENDATIONS

- Increase government support and expand financial aid programs targeting low-income single parents.
- Make childcare services more accessible and affordable.
- Strengthen psychological counseling and social support services.
- Promote flexible and family-friendly working conditions in the labor market.
- Organize educational programs and awareness campaigns to share resilience strategies among single parents.

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ON ZEROS AND GROWTH OF SOLUTIONS OF SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

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Keywords: equations admissible, meromorphic function, growth of solutions.

ABSTRACT

Growth of solutions for second-order differential equations in the unit disc is investigated through some limit form with a comparison of coefficients' characteristic functions. Some sufficient conditions are given for every non-zero solution to be of infinite order when coefficients of the equations are admissible. Moreover, a general conclusion is drawn on the fixed points in the solutions. The above results extend upon those of Heittokangas and Cao Tingbin. . In addition, for the n -iterated order of meromorphic function in is defined by

$$\sigma_n(f)=\limsup_{r\to 1^-}\frac{\log_n^+ T(r,f)}{-\log(1-r)},$$

where and is the Nevanlinna characteristic function of. For an analytic function in we have also

$$\sigma_{M,n}(f)=\limsup_{r\to 1^-}\frac{\log_{n+1}^+ M(r,f)}{-\log(1-r)},$$

where. If is analytic in, Tsuji [[tsu], p.205] gives that

For example, the function satisfies and $\sigma_{M,1}(f)=\mu$.

Obviously, we have

The inequalities (00) are the best possible in the sense that there are analytic functions and h such that and. However, it follows by Proposition 2.2.2 in [lain] that for. The type of a meromorphic function in with is defined by

$$\tau_n(f)=\limsup_{r\to 1^-}(1-r)^{\sigma_n}\log_{n-1}^+ T(r,f);$$

and if is an analytic function in with we have also

$$\tau_{M,n}(f)=\limsup_{r\to 1^-}(1-r)^{\sigma_n}\log_n^+ M(r,f).$$

We signal that also by Proposition 2.2.2 in [lain], we have for .

Definition *meromorphic function in the unit disc is called admissible if*

$$\limsup_{r\to 1^-}\frac{T(r,f)}{-\log(1-r)}=\infty$$

and nonadmissible if

$$\limsup_{r\to 1^-}\frac{T(r,f)}{-\log(1-r)}<\infty.$$

The growth index of the iterated order of a meromorphic function in is defined by

We will use the notation to denote the n-iterated exponent of convergence of the zero-sequence of meromorphic function and to denote the -iterated exponent of convergence of distinct zero-sequence of , which are defined as the following:

$$\lambda_n(f)=\limsup_{r\to 1^-}\frac{\log N\left(r,\frac{1}{f}\right)}{-\log(1-r)} \text{ and } \overline{\lambda}_n(f)=\limsup_{r\to 1^-}\frac{\log \overline{N}\left(r,\frac{1}{f}\right)}{-\log(1-r)}.$$

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GELİŞMEMİŞ VEYA GELİŞMEKTE OLAN ÜLKELERDE KULLANILMAYAN-ARTA KALAN İLAÇ SORUNU

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ÖZET

Gelişmemiş ve gelişmekte olan ülkelerde tedavi sonrası arta kalan ve kullanılmayan ilaçlar ciddi bir halk sağlığı sorunu oluşturmaktadır. Bu ilaçlar self medikasyon, uygunsuz bertaraf, başkalarıyla paylaşma, çevre zararı gibi başka problemlere kaynak teşkil etmektedir. Literatür hemen hemen her coğrafyada, ülkede ve kültürde bu sorunun yaygınlığını gözler önüne sermektedir. Yapılan çalışmalar genel olarak, kullanılmayan-artakalan ilaçlar, süresi dolan ilaçlar, onların türleri ve çeşitli yöntemlerle sınıflaması, imha yöntemleri, çevreye verdiği zararlar ve önemli bir halk sağlığı sorunu olan self-medikasyon gibi konuları derlemektedir.

Evlerde genel olarak ağrı kesiciler, antibiyotikler, soğuk algınlığı ilaçları gibi etki mekanizmasına sahip ilaçlardan oluşmaktadır. Bertaraf yöntemi olarak evsel çöpün sıklıkla kullanıldığı, ilaçların evde birikme nedeni olarak erken iyileşmenin ön plana çıktığı, evde tutma nedeni olarak ileride benzer durumlara karşı kullanma beklentisi ile ilişkili olduğu gösterilmiş tir ve bu bulguların hemen hemen tüm ülkelerde birbirine benzer olduğu da göze çarpan değerlendirmeler arasındadır. Örneğin Gana, Nijerya, Eritre, Tanzanya, Pakistan, Endonezya, Afganistan, Birleşik Arap Emirlikleri, Suudi Arabistan, Türkiye, Suriye, Filistin gibi ülkelerden raporlanan araştırmaların bulguları birbirine benzer denilebilir.

Sorun yaygın bir şekilde ele alınmasına rağmen çözüme ilişkin araştırmalarda ciddi bir eksikliğin olduğu göze çarpmaktadır. Yapılan çalışmalar ilaç geri alım sistemlerinin sorununa kalıcı bir çözüm getirebileceğini iddia etmektedir. Sonuç olarak her ne kadar güncel literatür gelişmemiş ve gelişmekte olan ülkelerde ağırlık kazansa da gelişmiş ülkelerin bu sorunu çözdüklerine dair araştırmalara rastlanılmamıştır. Global düzeyde, basit, uygulanabilir, sürdürülebilir ve ekonomik bir ilaç geri toplama sistemine ihtiyaç duyulduğu ve bu sistemin sorunun çözülmesinde etkin bir rol oynayabileceği düşünülmektedir.

Anahtar Kelimeler: İlaç İmha Yöntemi, Gelişmemiş ve Gelişmekte Olan ülkeler, Kullanılmayan İlaçlar, Geri alım sistemleri.

THE PROBLEM OF UNUSED OR LEFTOVER MEDICINES IN DEVELOPING OR UNDEVELOPED COUNTRIES

ABSTRACT

In undeveloped countries, leftover or unused medications after treatment pose a serious public health problem. These medications contribute to other issues such as self-medication, improper disposal, sharing with others, and environmental damage. The literature highlights the prevalence of this problem in almost every geography, country, and culture. The studies generally focus on unused/leftover drugs, expired drugs, their types and classification using various methods, disposal methods, their environmental impact, and self-medication, which is a significant public health issue. Households generally contain medications such as painkillers,

antibiotics, and cold remedies that work through specific mechanisms. It has been shown that household waste is frequently used as a disposal method, that early recovery is the main reason for the accumulation of medicines at home, and that the reason for keeping them at home is related to the expectation of using them for similar situations in the future. It is also noteworthy that these findings are similar in almost all countries. For example, the results of studies reported from countries such as Ghana, Nigeria, Eritrea, Tanzania, Pakistan, Indonesia, Afghanistan, the United Arab Emirates, Saudi Arabia, Turkey, Syria, and Palestine can be said to be similar.

Although the problem is widely addressed, there is a noticeable lack of research on solutions. Studies claim that drug take-back systems can provide a permanent solution to the problem. As a result, although the current literature focuses on developing and undeveloped countries, there is no research indicating that developed countries have solved this problem. Globally, there is a need for a simple, feasible, sustainable, and economical drug take-back system, and it is believed that such a system could play an effective role in solving the problem.

Keywords: Drug Disposal Methods, Underdeveloped and Developing Countries, Unused Drugs, Drug Take-Back Systems.

GİRİŞ

Uzunca bir süreden beri bilinmesine rağmen son zamanlarda özellikle gelişmemiş ülkelerden ve bazı gelişmekte olan ülkelerden kullanılmayan veya arta kalan ilaçların durumlarını özetleyen çok sayıda makale yayınlanmıştır (Kahsay ve ark.,2020; Marwa ve ark., 2021; Aluko ve ark., 2022; Köksoy, 2024). Bu çalışmalar genel olarak kullanılmayan ilaçlar, süresi dolan ilaçlar, onların türleri ve çeşitli yöntemlerle sınıflaması, imha yöntemleri, çevreye verdiği zararlar ve önemli bir halk sağlığı sorunu olan self-medikasyon gibi konuları derlemektedir. Burada ele alınacak konu ise bu ülkelerdeki mevcut durumun genel bir değerlendirmesidir.

Yapılan bir çalışmada, hanelerin %62,4'ünün son kullanma tarihi geçmiş veya kullanılmayan ilaçları sakladığını, en sık saklanan ilaçlar ağrı kesiciler, antibiyotikler ve soğuk algınlığı ilaçları olduğunu, ilaçların saklanma nedenleri arasında benzer durumlara karşı tekrar kullanmanın ve ihtiyacı olanlarla paylaşma olduğu, imha yöntemi olarak evsel çöpün kullanıldığı gibi bulgular ön plana çıkmıştır (Yimer ve ark., 2024). Bir meta analizde kullanılmayan ilaç prevalansının %44,34 olduğu, kırsal ile kentsel yapılar arasında ciddi farkların olduğunu, kullanılmayan ilaçlar etki mekanizmalarına göre sınıflandığında antibiyotiklerde %31,49, analjeziklerde %26,14 ve sindirim sisteminde asit düzenleyici olarak görev yapan antiasitlerde ise sıklığın %8,7 olduğu bildirilmiştir. İlaçların evlerde birikme nedeni olarak erken iyileşme, kendi isteği, ileride kullanabilme durumu gibi olaylar ön plana çıkmıştır (Alemeyahu ve ark., 2025). Başka bir çalışmada ilaç imha yöntemi olarak ev çöpü (65,6%), toprağa gömülmesi (38,7%) ve kanalizasyona atma (15,2%) bulguları ön plana çıkarken 70,5% sıklığında evlerde kullanılmamış/son kullanma tarihi geçmiş ilaçların bulunduğu bildirilmiştir. İleride kullanma düşüncesi (%83,9) saklamanın en yaygın nedeni olarak gösterilmiştir. Evlerde en çok bulunan ilaçlar analjezikler ve antibiyotiklerin olduğu raporlanmıştır (Habte ve ark., 2024).

Güncel literatür sorunu oldukça etkili bir şekilde özetlemektedir. Genel olarak ülkelerdeki bulgular çeşitli olmakla birlikte birbirine benzer olduğu düşünülmektedir. Örneğin Gana'da (Amoabeng ve ark., 2022; Opare-Addo ve ark., 2022), Nijerya'da (Akande-Sholabi ve ark., 2023), Eritre'de (Habte ve ark., 2024), Tazanya'da (Marwa ve ark., 2021), Pakistan'da (Shoaib ve ark., 2022; Shah ve ark., 2023), Endonezya'da (Insani ve ark., 2020), Afganistan'da (Bashaar ve ark., 2017), Birleşik Arap Emirlikleri'nde (Abbas ve ark., 2025), Suudi

Arabistan'da (Khan ve ark., 2025), Türkiye'de (Köksoy, 2024), Suriye'de (Samha ve ark., 2024) ve Filistin'de (Nairat ve ark., 2023) benzer bulguların elde edildiği gözlemlenmektedir. Gelişmiş ülkelerdeki literatür özetleri ize genel olarak 2020 yılı öncesine dayanmaktadır ve konuyla olan ilgilerinin koptuğu göze çarpmaktadır (Law ve ark., 2015).

Sorun yaygın bir şekilde ele alınmasına rağmen çözüme ilişkin araştırmalarda ciddi bir eksikliğin olduğu göze çarpmaktadır. Literatürde en fazla önerilen ise konu ile ilgili politika eksikliklerinin giderilmesi, mevzuat eksikliklerinin giderilmesi, farkındalık eğitimlerinin arttırılması gibi çözüm önerilerinden oluşmaktadır. Yapılan çalışmalar ilaç geri alım sistemlerinin sorununa kalıcı bir çözüm getirebileceğini iddia etmektedir (Ehrhart ve ark., 2020; Alfian ve ark., 2024; Wu ve ark., 2025). Ancak bu iddiaların çoğu görüş ve araştırma düzeyinde kalmaktadır. Herhangi bir aksiyon alınmadığı sürece mevcut sorun büyüyerek tüm çevre için problem olmaya ve problem yaşatmaya devam edecektir.

SONUÇ

Sonuç olarak her ne kadar güncel literatür gelişmemiş ve gelişmekte olan ülkelerde ağırlık kazansa da gelişmiş ülkelerin bu sorunu çözdüklerine dair araştırmalara rastlanılmamıştır. Global düzeyde, basit, uygulanabilir, sürdürülebilir ve ekonomik bir ilaç geri toplama sistemine ihtiyaç duyulduğu ve bu sistemin sorunun çözülmesinde etkin bir rol oynayabileceği düşünülmektedir.

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GREEN HYBRID NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

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Abstract

Green hybrid nanoparticles have emerged as a promising class of nanomaterials that combine the advantages of multiple components synthesized via environmentally friendly methods. Unlike conventional chemical and physical techniques, green synthesis utilizes plant extracts, microorganisms, and biopolymers, offering safer, cost-effective, and sustainable approaches. Hybrid nanoparticles, such as metal–metal oxide, metal–polymer, and multi-metal composites, exhibit enhanced physicochemical properties, including high stability, biocompatibility, and multifunctionality. These unique features make them particularly valuable in biomedical fields, ranging from antimicrobial and anticancer therapies to wound healing, bioimaging, biosensing, and drug delivery. Their mechanisms of action typically involve reactive oxygen species (ROS) generation, membrane disruption, DNA and protein interactions, and synergistic effects arising from the hybrid composition. Despite their promise, challenges such as cytotoxicity, large-scale synthesis, reproducibility, and regulatory approval hinder clinical translation. This review highlights recent advances in the green synthesis, characterization, and biomedical applications of hybrid nanoparticles, with a focus on their therapeutic potential and future prospects in precision medicine.

Keywords: Green, Hybrid, Nanoparticles, Biomedical Application, Reactive Oxygen Species.

GÖÇ VE MADDE BAĞIMLILIĞI: TÜRKİYE'DEKİ SURİYELİ GÖÇMEN ÇOCUKLAR ÜZERİNE BİR DEĞERLENDİRME

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ÖZET

Suriye İç Savaşı sonrasında milyonlarca insan zorunlu olarak göç etmek zorunda kalmış, Türkiye bu göç dalgasının en büyük hedef ülkelerinden biri olmuştur. Türkiye'de geçici koruma statüsü altında bulunan 2,5 milyon Suriyeli göçmenin yaklaşık yarısını (yaklaşık 1,2 milyon) çocuklar oluşturmaktadır. Göç süreci, özellikle çocuklar açısından, savaş travmaları, ebeveyn kayıpları, yoksulluk, eğitime erişim güçlükleri ve sosyal dışlanma gibi pek çok riski beraberinde getirmektedir. Bu durum, Suriyeli çocukların toplumsal uyum ve bütünleşme süreçlerini olumsuz etkilemekte; onları suç mağduru, suça sürüklenen ya da madde kullanımına yönelen gruplar haline getirme potansiyeli taşımaktadır.

Çalışmada göç ile madde bağımlılığı arasındaki ilişki Suriyeli göçmen çocuklar üzerinden ele alınmıştır. Göç sonrası göçmen çocukların içinde bulundukları dezavantajlı koşullar, sosyal destek eksiklikleri ve dışlanma deneyimleri madde kullanımını artırıcı bir risk faktörü oluşturmaktadır. Özellikle ekonomik yetersizlikler nedeniyle çocuk işçiliği ve sokakta çalışma, akran baskısı, okuldan uzak kalma gibi durumlar çocukların madde bağımlılığına sürüklenmesini kolaylaştırmaktadır. Ayrıca, göçmen çocukların psikososyal sorunları – depresyon, travma sonrası stres bozukluğu, kaygı ve kimlik sorunları – bağımlılık eğilimini güçlendiren etkenler arasında yer almaktadır.

Sonuç olarak, Suriyeli göçmen çocukların maruz kaldığı riskler yalnızca bireysel değil, aynı zamanda toplumsal düzeyde önemli sonuçlar doğurmaktadır. Bu nedenle Türkiye'de göçmen çocuklara yönelik bütüncül sosyal politikalar geliştirilmesi gerekmektedir. Eğitim, mesleki kurslar, spor olanakları, psikososyal destek ve bağımlılık önleme programları ile çocukların hem bireysel gelişimleri hem de topluma uyum süreçleri desteklenmelidir. Böylelikle göçmen çocukların dezavantajlı konumları azaltılarak madde bağımlılığına yönelmelerinin önüne geçilebilecektir.

Anahtar Kelimeler: Göç, Zorunlu Göç, Madde Bağımlılığı, Suriyeli Çocuklar

MIGRATION AND SUBSTANCE ADDICTION: AN EVALUATION ON SYRIAN MIGRANT CHILDREN IN TÜRKİYE

ABSTRACT

Following the outbreak of the Syrian Civil War, millions of people were forced into displacement, with Türkiye becoming one of the primary host countries for this mass migration. Approximately half of the 2.5 million Syrıan mıgrant under temporary protection in Türkiye are children (around 1.2 million). The migration process, particularly for children, involves multiple risks such as war-related trauma, loss of parents, poverty, limited access to education, and social exclusion. These challenges negatively affect the social integration and cohesion of

Syrian children, making them vulnerable to becoming victims of crime, being driven into delinquency, or engaging in substance use.

This study examined the relationship between migration and substance abuse among Syrian immigrant children. The disadvantaged conditions experienced by immigrant children after migration, lack of social support, and experiences of exclusion are risk factors that increase substance use. Economic hardship, particularly child labour and street work, peer pressure, and being away from school, facilitates children's propensity for substance abuse. Furthermore, psychosocial issues such as depression, post-traumatic stress disorder, anxiety, and identity issues also increase addiction tendencies.In conclusion, the risks faced by Syrian refugee children generate significant consequences not only at the individual level but also at the societal level. Hence, there is a pressing need for the development of comprehensive social policies targeting refugee children in Türkiye. Initiatives such as education programs, vocational training, sports opportunities, psychosocial support, and addiction prevention interventions should be implemented to foster both individual development and social integration. By doing so, the disadvantaged position of refugee children can be mitigated, reducing their vulnerability to substance addiction.

Keywords: Migration, Forced Migration, Substance Addiction, Syrian Children

COVID-19 PANDEMİSİNİN NÜKLEER TIP İŞLEYİŞİ VE ONKOLOJİK SONUÇLAR ÜZERİNE ETKİSİ: TEK MERKEZ DENEYİMİ

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ÖZET

COVID-19 pandemisi, sağlık hizmetlerine erişimde ciddi kısıtlamalara yol açmış ve nükleer tıp uygulamalarını da doğrudan etkilemiştir. Bu çalışmada, pandeminin tetkik sayıları ve onkolojik hasta sonuçları üzerindeki etkisi araştırıldı. Manisa Celal Bayar Üniversitesi Nükleer Tıp Anabilim Dalı'nda yapılan retrospektif değerlendirmede, ülkemizde pandemi öncesi dönem olan Mart–Haziran 2019 ile pandemi kapanma dönemi olan Mart–Haziran 2020 karşılaştırıldı; ayrıca pandemi sonrası normalleşme dönemine denk gelen Haziran–Eylül 2020 verileri de incelendi. Onkoloji hastalarında PET/BT raporları üzerinden klinik yanıt kategorileri (yeni tanı, progresyon, stabil hastalık, tam ve parsiyel metabolik yanıt), yaş ve cinsiyet dağılımları değerlendirildi. Mart–Haziran 2020 döneminde tetkik sayılarında toplam %64 azalma izlendi. En belirgin düşüşler tiroid sintigrafisi (%92), miyokard perfüzyon sintigrafisi (%86) ve paratiroid sintigrafisinde (%88) gözlendi. PET/BT sayıları da %36 oranında azaldı. Normalleşme sonrası tetkik sayıları artış gösterse de 2019'daki düzeylere ulaşamadı. Onkoloji hastalarında progresyon oranı 2019'da %19 iken, 2020'de %30'a yükseldi ($p<0.001$, OR≈1.8). Ayrıca 2020'de tam ve parsiyel metabolik yanıt oranları anlamlı şekilde azaldı ($p<0.01$), bu da pandemi koşullarının tedaviye verilen yanıtı olumsuz etkilediğini göstermektedir. Her iki grubun yaş ortalamaları benzerdi (62 vs 61 yıl) ve cinsiyet dağılımı erkeklerde hafif üstünlük gösterdi (%56 vs %44). Sonuç olarak, COVID-19 pandemisi nükleer tıp tetkiklerinde belirgin azalmaya yol açmış, normalleşme döneminde kısmi toparlanma görülse de pandemi öncesi seviyelere ulaşılamamıştır. En önemli bulgu, kapanma süreci sonrasında başvuran onkoloji hastalarında progresyon oranlarının anlamlı biçimde artması ve tedaviye yanıtlı hasta sayısının azalmasıdır. Bu bulgular, pandeminin en ağır yükünü onkoloji hastalarının taşıdığını göstermekte ve gelecekte benzer krizlerde bu hastaların tanı, takip ve tedavilerinin aksamadan sürdürülmesinin kritik önemini vurgulamaktadır.

Anahtar Kelimeler: COVID-19, nükleer tıp, PET/BT, progresyon, onkoloji

IMPACT OF THE COVID-19 PANDEMIC ON NUCLEAR MEDICINE OPERATIONS AND ONCOLOGICAL OUTCOMES: A SINGLE INSTITUTIONAL EXPERIENCE

ABSTRACT

The COVID-19 pandemic significantly restricted access to healthcare and directly affected nuclear medicine practice. This study investigated its impact on procedure volumes and oncological patient outcomes. A retrospective analysis was performed in the Department of Nuclear Medicine, Manisa Celal Bayar University. In our country, the pre-pandemic period (March–June 2019) was compared with the lockdown period (March–June 2020); in addition,

data from the post-lockdown normalization period (June–September 2020) were also evaluated. In oncological patients, PET/CT reports were reviewed for clinical response categories (newly diagnosed, progression, stable disease, complete and partial metabolic response), as well as age and sex distribution. During the lockdown period of March–June 2020, nuclear medicine procedures decreased by 64% compared with the same months of 2019. The most prominent reductions were observed in thyroid scintigraphy (−92%), myocardial perfusion scintigraphy (−86%), and parathyroid scintigraphy (−88%). PET/CT procedures also decreased by 36%. In the post-lockdown period, procedure numbers increased but did not reach pre-pandemic levels. Among oncological patients, the progression rate increased from 19% in 2019 to 30% in 2020 ($p<0.001$, $OR\approx1.8$). Importantly, the number of patients achieving complete or partial metabolic response significantly declined in 2020 ($p<0.01$), indicating that the pandemic conditions negatively affected treatment outcomes. Mean age was similar in both groups (62 vs 61 years), with a slight male predominance (56% vs 44%). In conclusion, the COVID-19 pandemic caused a marked reduction in nuclear medicine procedures, with only partial recovery after normalization. The most striking finding was the significant increase in progression and the decrease in treatment response among oncological patients presenting after the lockdown. These results demonstrate that oncology patients bore the heaviest burden of the pandemic and emphasize the critical importance of maintaining uninterrupted diagnostic and therapeutic pathways for these patients during future crises.

Keywords: COVID-19, nuclear medicine, PET/CT, progression, oncology

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) was first identified in Wuhan, China, in December 2019 (Zhu et al. 2019). The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the disease it causes (COVID-19) turned into an international public health emergency. These patients presented with symptoms of severe pneumonia, including fever, fatigue, dry cough, and respiratory distress. COVID-19 is a highly contagious viral infection transmitted through respiratory droplets (Chan et al., 2020). Due to the high transmission rate and the morbidity and mortality it caused, COVID-19 was declared a pandemic on March 11, 2020. The first COVID-19 case in Turkey was also announced on March 11, 2020, and subsequent periods of full and partial lockdown were implemented until June. During this period, hospitals experienced significant slowdowns, with non-urgent procedures being postponed, except for emergency and oncological cases. Although health authorities emphasized that diagnosis, treatment, and follow-up of oncology patients should not be delayed, a decline in oncology visits was observed, likely due to patient concerns regarding COVID-19 exposure.

Beyond Turkey, the COVID-19 pandemic has caused unprecedented disruptions in healthcare delivery worldwide. Lockdown measures, restrictions on hospital admissions, and patient hesitancy to seek medical care led to profound changes in diagnostic and therapeutic pathways. Nuclear medicine, which plays a critical role in both diagnostic imaging and therapeutic interventions, was not exempt from these challenges. The dependence of nuclear medicine on radiopharmaceutical supply chains, the necessity of in-person procedures, and the prevalence of patient groups with compromised immune systems, particularly oncology patients, have made this discipline especially vulnerable to the consequences of the pandemic.

Several international surveys and multicenter reports have highlighted a significant decline in nuclear medicine procedure volumes during the first wave of the pandemic. The most pronounced reductions were observed in elective examinations. At the same time, oncological

procedures like positron emission tomography/computed tomography (PET/CT) were relatively preserved due to their critical role in cancer management. However, even a partial decrease in oncological imaging due to postponed or canceled scans can have negative consequences on early diagnosis, evaluation of treatment response, and disease monitoring. Evaluating not only the procedural workload but also the oncological outcomes is therefore essential to understanding the broader clinical impact of the pandemic.

Against this background, we aimed to investigate the impact of the COVID-19 pandemic on nuclear medicine operations and oncological outcomes in a single institutional setting. Specifically, we compared procedure volumes before and during the lockdown period, as well as in the post-lockdown normalization phase. In addition, we analyzed oncological PET/CT reports to determine whether there were measurable differences in clinical response categories, such as disease progression or metabolic response, between the pre-pandemic and pandemic periods. This dual approach allows for a comprehensive assessment of how the pandemic affected both service delivery and patient outcomes.

MATERIAL AND METHODS

Study Design and Data Collection

This retrospective, single-center study was conducted in the Department of Nuclear Medicine at Manisa Celal Bayar University, Turkey. Three time frames were defined for analysis: the **pre-pandemic reference period** (March–June 2019), the **lockdown period** (March–June 2020, corresponding to nationwide restrictions), and the **post-lockdown normalization period** (June–September 2020). All diagnostic nuclear medicine procedures performed during these periods were included, comprising conventional scintigraphic examinations (thyroid, parathyroid, myocardial perfusion, renal DTPA/MAG3, DMSA, bone, and whole-body scans) as well as oncological PET/CT investigations. Procedure volumes were extracted from the institutional PACS and hospital information system (PROBEL). For oncological patients undergoing PET/CT, reports were reviewed and categorized into clinical response groups: new diagnosis, progressive disease, stable disease, complete metabolic response (CMR), and partial metabolic response (PMR). Demographic variables, including patient age and sex, were also recorded.

Statistical Analysis

Descriptive statistics were used to summarize demographic and clinical variables. Examination volumes from 2019 and 2020 were compared in terms of absolute numbers and percentage changes. PET/CT response categories were analyzed as categorical variables using the chi-square test or Fisher's exact test, as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to estimate relative risks. A p-value <0.05 was considered statistically significant. Statistical analyses were performed using SPSS software, version 26.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A significant reduction in nuclear medicine procedures was observed during the lockdown period. Compared with March–June 2019, overall activity decreased by 64% in March–June 2020. The steepest reductions occurred in elective scintigraphic studies, whereas PET/CT examinations were relatively preserved but still declined by 36% (Table 1).

Table 1. Nuclear medicine procedure volumes in March–June 2019 vs March–June 2020

Modality	2019 (n)	2020 (n)	Change (%)
PET/CT	612	392	-36%
Myocardial perfusion (MPS)	291	40	-86%
Bone scintigraphy	86	18	-79%
Thyroid scintigraphy	189	15	-92%
Parathyroid scintigraphy	33	4	-88%
DMSA	120	15	-88%
DTPA/MAG3	22	9	-59%
Whole-body scan (TxWBS)	28	9	-68%
Whole-body scan (DxWBS)	25	9	-64%
Total	1406	511	-64%

In the post-quarantine period (June–September 2020), procedure numbers increased compared with the quarantine months. Despite this partial recovery, overall figures remained below pre-pandemic levels, indicating persistent service disruption. PET/CT volumes were 680 in 2019 versus 574 in 2020, while total scintigraphy examinations were 265 in 2019 versus 119 in 2020.

Significant differences in oncological outcomes were observed between 2019 and 2020 (Table 2). The proportion of patients with progressive disease increased significantly, while complete and partial metabolic response rates declined compared with those during the same month period in 2019.

Table 2. PET/CT oncological outcomes in June–September 2019 vs June–September 2020

Category	2019 (n=680)	2020 (n=574)	Percentage	p-value
New diagnosis	288 (42.4%)	215 (37.5%)	≈ similar	0.088
Progression	129 (19.0%)	170 (29.6%)	↑ in 2020	<0.001
Stable disease	73 (10.7%)	112 (19.5%)	↑ in 2020	<0.001
Complete metabolic response (CMR)	88 (12.9%)	25 (4.4%)	↓ in 2020	<0.001
Partial metabolic response (PMR)	101 (14.9%)	52 (9.1%)	↓ in 2020	0.002

DISCUSSION

The COVID-19 pandemic profoundly disrupted nuclear medicine services, and our study provides important insights into its impact within a single institutional setting. We observed an overall 64% reduction in nuclear medicine procedures during the lockdown period. Our observations are consistent with the first international survey conducted by Annunziata et al., in which more than 90% of departments worldwide reported a significant reduction in diagnostic procedures and over 70% reported reductions in therapeutic procedures, with nuclear cardiology and radioiodine therapy being among the most affected areas. In our institution, elective scintigraphic procedures such as thyroid, myocardial perfusion, and parathyroid scans showed the most dramatic reductions (Annunziata et al. 2020).

In our institution, PET/CT, although relatively preserved due to its essential role in oncological care, still demonstrated a substantial decline of 36%. In the United States, similar reductions were observed. Parikh et al. reported a 61% decline in nuclear medicine procedures, including PET, across the University Hospitals system in Ohio, with mammography (−93%) and other imaging modalities also severely affected (Parikh et al. 2020). Antonios et al. likewise found marked decreases in March–April 2020, particularly in nuclear cardiology, a decline that coincided with increased cardiovascular mortality (Antonios et al. 2022). At Yale University, PET/CT utilization reached a nadir of −62.5% in April 2020, with only partial recovery thereafter (Adin et al., 2021). Compared to our institution, where PET/CT utilization decreased by 36%, the U.S. experience demonstrated even greater reductions; however, the overall pattern remained consistent, highlighting the vulnerability of nuclear medicine services to pandemic Dynamics.

In Europe, the impact of the pandemic on nuclear medicine showed heterogeneity. Kirienko et al. reported variable reductions in PET/CT, ranging from almost unchanged volumes (−4%) in some Italian centers to declines of 14–36% in multicenter surveys, while conventional scintigraphic procedures decreased by 40–70% (Kirienko et al. 2022). In contrast to our findings, where a significant reduction in PET/CT procedures was observed during the lockdown period (−36% compared with 2019), Maurea et al. reported that the number of FDG-PET/CT studies in a southern Italian center remained essentially unchanged during the pandemic (299 in 2020 vs. 335 in 2019, $p = 0.74$) (Maurea et al. 2020). This discrepancy may be explained by differences in healthcare organization, local pandemic burden, and national policies. In the United Kingdom, Wong et al. analyzed the National Health Service (NHS) England data and found PET/CT volumes decreased by approximately 30–32% in April and May 2020, with near-complete recovery by June. Their analysis also revealed the greatest decreases in lung and oesophageal cancer referrals, which may help explain the higher progression rates observed in our population (Wong et al. 2021).

Freudenberg et al. reported an average 54% decrease in diagnostic procedures worldwide in their global study analyzing 434 centers from 72 countries. PET/CT decreased by **36%**, while thyroid, myocardial perfusion, and bone scintigraphy declined by approximately **60–67%**. In our institution, the overall reduction was greater (**64%**), with elective scintigraphic studies such as thyroid (−92%), myocardial perfusion (−86%), and parathyroid (−88%) scans being most affected, whereas PET/CT (−36%) mirrored the global average (Freudenberg et al. 2020).

Importantly, analysis of PET/CT reports in our cohort revealed a significant increase in progressive disease and a decline in metabolic response rates, reflecting the negative oncological consequences of delayed imaging. Similar trends have been documented. In Italy, the ONCOVIPET study showed a 1.5-fold increase in advanced-stage disease and nearly twofold increases in nodal and metastatic involvement at PET/CT staging in 2020 compared with 2019 (Caldarella et al. 2022). Individual case reports from Belgium also described clear

progression on PET/CT following treatment interruptions (Mileva et al. 2020). Collectively, these observations reinforce our findings and emphasize the need to prioritize oncological imaging during crises. As highlighted in international recommendations, nuclear medicine departments must adopt flexible strategies to manage backlogs and ensure continuity of critical services in preparation for future disruptions (Huang et al. 2020).

CONCLUSIONS

The COVID-19 pandemic caused a marked reduction in nuclear medicine procedures in our institution. Although authorities emphasized that diagnosis, treatment, and follow-up of oncological patients should not be delayed, a decline in oncology visits was observed, largely due to fear of COVID-19. PET/CT has a critical role in oncology. PET/CT procedure volumes showed a substantial decline in the lockdown period, and an increased rate of disease progression was observed in the post-pandemic months. These findings underline the importance of maintaining access to essential oncological imaging during global crises. Nuclear medicine departments should adopt flexible strategies to prioritize critical procedures and ensure continuity of care in preparation for future disruptions.

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MOBİL UYGULAMA KATILIMI ÖLÇEĞİNİN TÜRKÇEYE UYARLANMASI: GEÇERLİK VE GÜVENİRLİK ÇALIŞMASI

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ÖZET

Klasik bir akıllı telefon kullanıcısı, günde on, ayda otuz uygulama kullanmaktadır. Mobil uygulamalar, işletmelerin müşterilerle iletişim kurmasını, müşterilerin şirketlerle etkileşimde bulunabileceği sanal bir alan oluşturmasını ve ürün ve hizmet tanıtımını kolaylaştırmasını sağlar. Türkiye'de mobil uygulama kullanım oranlarının ve mobil ticaret hacminin hızla artmasına rağmen, kullanıcıların bu uygulamalara yönelik katılım düzeylerini ölçmeye yönelik Türkçe, geçerli ve güvenilir bir ölçek bulunmamaktadır. Bu durum, hem akademik araştırmalar hem de uygulamalı pazarlama çalışmaları için önemli bir boşluk oluşturmaktadır. Bu araştırmanın temel amacı, George, Edward ve Joseph (2025) tarafından geliştirilen Mobil Uygulama Katılımı Ölçeği'nin (Mobile App Engagement Scale) Türkçeye uyarlanarak geçerlik ve güvenirliğinin test edilmesidir. Ölçeğin orijinali 12 madde ve dört alt boyuttan oluşmaktadır. Araştırmada 219 e-ticaret mobil uygulamam kullanıcısına ulaşılmıştır. Elde edilen verilere uygulanan DFA analizi sonucunda orijinal ölçekte yer alan 12 madde ve dört alt boyutlu yapı korunmuştur. Yapılan güvenirlik ve geçerlik analizi sonuçlarına göre ölçeğin Türkiye bağlamında kullanılabilir olduğunu ortaya konulmuştur. Araştırmanın sonuçları hem teorik hem de uygulamalı açıdan önemli katkılar sunmaktadır. Teorik olarak, Türkiye bağlamında mobil uygulama katılımını ölçmeye yönelik güvenilir bir ölçek geliştirilerek, literatürdeki ölçüm eksikliği giderilmiştir. Uygulamalı açıdan ise, işletmelerin kullanıcıların mobil uygulamalara yönelik bilişsel ve duygusal bağlılıklarını ölçerek, uygulama tasarımı, kullanıcı deneyimi ve pazarlama stratejilerini optimize etmelerine katkı sağlanabilir.

Anahtar Kelimeler: Mobil uygulama, e-ticaret, teknoloji, müşteri, dijital

ADAPTATION OF THE MOBILE APPLICATION PARTICIPATION SCALE INTO TURKISH: A VALIDITY AND RELIABILITY STUDY

ABSTRACT

A typical smartphone user uses ten apps a day and thirty apps a month. Mobile apps enable businesses to communicate with customers, create a virtual space where customers can interact with companies, and facilitate product and service promotion. Despite the rapid increase in mobile app usage rates and mobile commerce volume in Turkey, there is no valid and reliable Turkish-language scale to measure users' engagement levels with these apps. This situation creates an important gap for both academic research and applied marketing studies. The main objective of this study is to adapt the Mobile App Engagement Scale developed by George, Edward, and Joseph (2025) into Turkish and test its validity and reliability. The original scale consists of 12 items and four sub-dimensions. The study reached 219 users of e-commerce mobile applications. As a result of the DFA analysis applied to the obtained data, the original

scale's 12 items and four sub-dimensions were preserved. According to the results of the reliability and validity analysis, it was determined that the scale is usable in the Turkish context. The results of the study provide important contributions from both theoretical and practical perspectives. Theoretically, a reliable scale for measuring mobile application participation in the Turkish context has been developed, thereby addressing a gap in the literature. From a practical perspective, by measuring users' cognitive and emotional commitment to mobile applications, businesses can optimize application design, user experience, and marketing strategies.

Keywords: Mobile app, e-commerce, technology, customer, digital

THE ROLE OF NURSES IN EARLY DIAGNOSIS OF CRITICALLY ILL PATIENTS

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ABSTRACT

Critical illnesses are clinical conditions that can progress rapidly, threaten vital functions, and increase mortality and morbidity rates if timely interventions are not applied. For healthcare professionals working in intensive care units and emergency departments, early recognition of such conditions is of great importance. Early diagnosis not only improves treatment outcomes but also prevents complications, ensures patient safety, and enhances quality of life. In this process, the role of the nurse is at the center of patient care. Nurses are among the first healthcare professionals capable of detecting subtle changes in patients' vital signs. This early recognition ability is further strengthened through the integration of clinical intuition with assessment protocols developed by education and experience. In modern healthcare systems, the use of Early Warning Scoring Systems (EWS), electronic health record–based alarms, and even artificial intelligence–supported analyses increase the accuracy of detecting early patient deterioration. In this context, the effectiveness of nursing care in critically ill patients depends significantly on: clinical observation and assessment, the use of early warning systems, strong intra-team communication, patient and family education, and the utilization of technological equipment. Especially when nurses are well-trained in these areas, the integration of patient experience and technology enhances their ability to recognize early clinical deterioration. The active role of nurses in the early diagnosis of critically ill patients makes a major contribution to the healthcare system. Updating nursing education in this regard, incorporating simulation-based training, and developing clinical decision-making skills support the more effective implementation of this role.

Keywords: Critically ill patient, Early diagnosis, Nursing

KRİTİK HASTALARIN ERKEN TANILANMASINDA HEMŞİRENİN ROLÜ

ÖZET

Kritik hastalıklar, hızlı ilerleyebilen, hayati fonksiyonları tehdit eden ve zamanında müdahale edilmediğinde mortalite ve morbidite oranlarını artıran klinik durumlardır. Yoğun bakım ünitelerinde ve acil servislerde çalışan sağlık profesyonelleri için bu tür durumların erken tanınması büyük önem taşımaktadır. Erken tanı, yalnızca tedavi sonuçlarını iyileştirmekle kalmaz; aynı zamanda komplikasyonları önler, hasta güvenliğini sağlar ve yaşam kalitesini artırır. Bu süreçte hemşirenin rolü, hasta bakımının merkezinde yer almaktadır. Hemşireler, hastaların hayati bulgularındaki küçük değişiklikleri fark edebilen ilk sağlık profesyonellerindendir. Bu erken fark etme becerisi, eğitim ve deneyimle gelişen değerlendirme protokollerinin klinik sezgiyle bütünleştirilmesi sayesinde daha da güçlenmektedir. Modern sağlık sistemlerinde Erken Uyarı Skorlama Sistemleri (EWS), elektronik hasta kayıt tabanlı alarmlar ve hatta yapay zekâ destekli analizlerin kullanımı, hasta kötüleşmesinin erken saptanmasında doğruluğu artırmaktadır. Bu bağlamda kritik hastalarda

hemşirelik bakımının etkinliği büyük ölçüde şunlara bağlıdır: klinik gözlem ve değerlendirme, erken uyarı sistemlerinin kullanımı, güçlü ekip içi iletişim, hasta ve aile eğitimi ile teknolojik donanımların kullanımı. Özellikle hemşireler bu alanlarda iyi eğitim aldığında, hasta deneyimi ile teknolojinin entegrasyonu onların erken klinik kötüleşmeyi tanıma yeteneğini artırmaktadır. Kritik hastaların erken tanısında hemşirelerin aktif rol alması, sağlık sistemine büyük katkı sağlamaktadır. Bu bağlamda hemşirelik eğitiminin güncellenmesi, simülasyon temelli eğitimlerin dahil edilmesi ve klinik karar verme becerilerinin geliştirilmesi, bu rolün daha etkili şekilde uygulanmasını desteklemektedir.

Anahtar Kelimeler: Kritik hasta, Erken tanı, Hemşirelik

INTRODUCTION

The timely recognition of critically ill patients is essential for reducing morbidity and mortality, optimizing the effectiveness of therapeutic interventions, and safeguarding patient safety. Within high-acuity environments—such as intensive care units and emergency departments—prompt detection of even subtle alterations in a patient's clinical status and the initiation of appropriate interventions are of paramount significance. Nurses occupy a pivotal position in this process owing to their continuous presence at the bedside, systematic monitoring of vital signs, and advanced observational skills. The integration of early warning systems, thorough physical assessments, and refined clinical decision-making capacities further empowers nurses to identify clinical deterioration at an early stage and to mitigate adverse outcomes (Grealy et al., 2019).

THE ROLE OF NURSİNG İN THE EARLY RECOGNİTİON OF CRİTİCALLY ILL

The early recognition of critically ill patients constitutes a complex process that integrates nurses' extensive knowledge, clinical skills, and professional experience. This process encompasses the continuous surveillance of patients' overall condition, meticulous assessment of vital parameters, and identification of potential risk factors. Through vigilant monitoring of both physiological and psychological changes, nurses possess the capacity to anticipate impending deterioration and to initiate timely and appropriate interventions (González-Rincón et al., 2019).

EARLY WARNİNG SYSTEMS

Early Warning Systems (EWS), often implemented as part of clinical decision support systems (CDSS), represent standardized instruments designed to facilitate the early detection of patient deterioration. These systems employ scoring algorithms based on key vital parameters—including respiratory rate, heart rate, blood pressure, body temperature, level of consciousness, and oxygen saturation—to stratify patients according to their risk level. Elevated scores signify clinical instability and necessitate immediate intervention. Through the systematic application of such tools, nurses are able to objectively monitor physiological fluctuations and rapidly identify patients at heightened risk of adverse outcomes (Burns et al., 2018).

The effective implementation of early warning systems fosters the refinement of nurses' observational capabilities and clinical reasoning skills. By providing structured guidance, these systems support the early recognition of subtle physiological changes and facilitate informed decision-making regarding their potential implications. Within high-acuity environments such as intensive care units and emergency departments, early warning systems contribute

significantly to enhancing patient safety while simultaneously alleviating nursing workload. In addition, their adoption establishes a shared clinical language among healthcare professionals, thereby promoting timely and efficient communication regarding patient status (Lee et al., 2020).

COMPREHENSİVE PHYSİCAL ASSESSMENT AND CLİNİCAL MONİTORİNG

Among the most fundamental responsibilities of nurses in the early recognition of critically ill patients is the performance of thorough and ongoing physical assessments. Such evaluations extend beyond routine vital sign measurements to encompass the patient's overall appearance, skin coloration, respiratory patterns, level of consciousness, pain status, and other relevant clinical manifestations. Mastery of refined observational skills is essential for nurses to discern even subtle changes in patient status; for example, pallor, diaphoresis, agitation, or alterations in breath sounds may serve as early indicators of impending deterioration (Lee et al., 2020). Continuous monitoring represents an indispensable component in capturing the dynamic trajectory of critically ill patients. Leveraging advanced technological tools—including cardiac monitoring systems, pulse oximetry, and invasive blood pressure measurement devices—nurses are able to observe physiological parameters in real time. The integration of these data streams with clinical observations facilitates the recognition of emerging trends and the anticipation of potential complications. By synthesizing objective measurements with bedside assessments, nurses provide a holistic evaluation of patient status—an approach that is crucial for the initiation of timely and effective interventions (Le Lagadec et al., 2024).

CLİNİCAL DECİSİON PROCESSES AND NURSİNG DİAGNOSES

In the context of early recognition of critically ill patients, the role of nurses extends beyond the mere collection of data to include the analytical and interpretive processes required for sound clinical decision-making. By synthesizing the information gathered during patient assessment, nurses are able to formulate potential nursing diagnoses. These diagnoses represent clinical judgments that capture actual or potential health problems and serve as the cornerstone for the development of individualized nursing care plans (Lee et al., 2017). The process of clinical decision-making necessitates the application of critical thinking skills by nurses. Within this framework, nurses synthesize patient symptoms, vital parameters, laboratory findings, and medical history to ascertain both the severity and the urgency of the clinical situation. For instance, when confronted with a patient exhibiting signs of respiratory distress, a nurse interprets this manifestation not solely as an isolated symptom but as a potential indicator of underlying physiological compromise, thereby formulating an appropriate nursing diagnosis (e.g., Ineffective Breathing Pattern). These diagnostic judgments provide the foundation for the development and implementation of tailored, goal-oriented nursing interventions (Diogo et al., 2021; Lee et al., 2017). Although clinical decision-making is indispensable to the provision of safe and effective patient care, it is frequently impeded by several challenges. Among the most prominent are excessive workload, time pressure, limited clinical expertise, and inadequate access to current evidence-based knowledge. Furthermore, the complexity and unpredictability of critically ill patients often complicate the synthesis and interpretation of clinical information, thereby heightening the likelihood of diagnostic errors or delayed interventions. To mitigate these barriers, nurses employ strategies such as lifelong learning and professional development, interprofessional collaboration, reliance on evidence-based protocols, and the use of clinical decision-support systems. Collectively, these strategies strengthen critical thinking and diagnostic accuracy, enabling the delivery of timely and patient-centered interventions while optimizing clinical outcomes (Lee et al., 2017).

NURSİNG INTERVENTİONS AND PATİENT CARE

The timely recognition of critically ill patients necessitates the rapid and efficient implementation of targeted nursing interventions. By responding promptly to alterations in patient status, nurses play a pivotal role in preventing complications and promoting hemodynamic stabilization. Such interventions are designed not only to sustain vital physiological functions but also to ensure patient comfort and expedite the recovery trajectory. Core responsibilities include hemodynamic surveillance, delivery of oxygen therapy, preservation of airway patency, provision of invasive or non-invasive ventilatory support, maintenance of fluid and electrolyte homeostasis, and the administration of pharmacological therapies as prescribed (Diogo et al., 2021; Lee et al., 2017). Beyond physiological stabilization, nursing interventions directed toward promoting patient comfort and safety encompass pain management, sedation monitoring, preservation of skin integrity, infection control strategies, and nutritional support. Critically ill patients—particularly those in intensive care units—are highly susceptible to adverse outcomes such as pressure ulcers, nosocomial infections, and muscular atrophy as a result of prolonged immobility and invasive procedures. To mitigate these risks, nurses employ evidence-based preventive care protocols, including routine repositioning, comprehensive skin care, strict adherence to aseptic techniques, and early mobilization initiatives (Etafa et al., 2018; Miyazaki et al., 2010; Hicks et al., 2003). The experience of critical illness presents significant psychological and emotional challenges for both patients and their families. In this context, nurses assume a pivotal role in delivering education and psychosocial support tailored to the needs of patients and their caregivers. Through the provision of transparent and comprehensible information regarding the patient's condition, therapeutic plan, and anticipated outcomes, nurses foster active engagement of both patients and families in the care trajectory. Such a holistic approach has been shown to exert a beneficial influence on the overall recovery process (Cabete et al., 2019).

CONCLUSİON

The early recognition of critically ill patients constitutes a multifaceted and complex process in which nurses serve as indispensable agents within contemporary healthcare systems. By engaging in continuous surveillance, rigorous monitoring of vital parameters, judicious application of Early Warning Systems, comprehensive physical assessments, and advanced clinical reasoning, nurses are uniquely positioned to identify subtle clinical changes at the earliest possible stage. This proactive detection is pivotal in preventing deterioration, minimizing complications, and enhancing overall patient outcomes. Importantly, nursing interventions extend beyond physiological stabilization to encompass patient comfort, safety, and psychosocial well-being, thereby embodying a holistic approach to care. Such integrative practices not only expedite recovery trajectories but also alleviate systemic burdens on healthcare institutions. Looking forward, nursing education must prioritize the cultivation of early recognition and intervention competencies in critical care, while the incorporation of emerging technologies—such as artificial intelligence and big data analytics—offers promising opportunities to refine and optimize clinical decision-making. Ultimately, nurses remain a dynamic and indispensable professional group, central to advancing quality of life and improving health outcomes among critically ill populations.

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THE EFFECTIVENESS OF NURSING INTERVENTIONS IN POSTOPERATIVE WOUND HEALING

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ABSTRACT

The effectiveness of nursing interventions in postoperative wound healing has been extensively examined in numerous scientific studies conducted in recent years. Nursing practices encompass a wide range of areas, including optimizing wound care, preventing infections, providing patient education, and offering nutritional support. Clinical evidence demonstrates that these interventions play a significant role in accelerating wound healing and reducing complications. The implementation of protocols by nurses such as aseptic techniques, regular wound assessment, and patient education substantially improves wound healing and decreases complication rates. Meta-analyses indicate that comprehensive nursing care delivered in the postoperative period significantly reduces surgical site infections and overall complication rates. Particularly with the use of enhanced recovery nursing and holistic care models, remarkable reductions in both wound infections and complication rates have been observed. The use of evidence-based protocols including infection control, patient education, nutritional support, and innovative dressing techniques facilitates complication reduction and shortens recovery time. Interdisciplinary collaborations and integrated care models further support functional recovery in depth. Increasing evidence also highlights that multidisciplinary exercise interventions provided to patients improve wound healing and reduce scar formation. Meta-analyses conducted after knee osteoarthritis surgery have shown that exercise positively influences REEDA and Manchester Scar Scale scores. In terms of wound dressing techniques, the integration of advancing technologies with innovative applications provides significant advantages in patient care. In this field, enhancing nurse education is essential to improving the quality of practice.

Keywords: Postoperative care, wound healing, nursing

POSTOPERATİF YARA İYİLEŞMESİNDE HEMŞİRELİK UYGULAMALARININ ETKİNLİĞİ

ÖZET

Postoperatif yara iyileşmesinde hemşirelik uygulamalarının etkinliği son yıllarda yapılan çok sayıda bilimsel araştırmada detaylı biçimde incelenmiştir. Hemşirelik uygulamaları, yara bakımının optimize edilmesi, enfeksiyonların önlenmesi, hasta eğitimi ve beslenme desteği gibi çok sayıda alanı kapsamaktadır. Klinik kanıtlar, bu uygulamaların, yara iyileşmesini hızlandırmada ve komplikasyonları azaltmada önemli rol oynadığını göstermektedir. Hemşirelerin aseptik teknikler, düzenli yara değerlendirmesi ve hasta eğitimi içeren protokolleri uygulaması, yara iyileşmesini anlamlı şekilde iyileştirir ve komplikasyon oranını düşürmektedir. Meta-analizler, ameliyat sonrası dönemde uygulanan kapsamlı hemşirelik bakımının cerrahi alan enfeksiyonlarını ve genel komplikasyon oranlarını ciddi oranda

azalttığını göstermektedir. Özellikle hızlı rehabilitasyon hemşireliği ve bütüncül bakım modelleriyle hem yara enfeksiyonu hem de komplikasyon oranında anlamlı düşüşler ortaya çıkmaktadır. Kanıta dayalı protokollerin kullanılması, enfeksiyon kontrolü, hasta eğitimi, beslenme desteği ve inovatif pansuman uygulamaları ile komplikasyonların azaltılması ve iyileşme süresinin kısaltılması sağlanabilmektedir. Disiplinler arası iş birlikleri ve entegre bakım modelleri de fonksiyonel olarak iyileşmeyi derinlemesine desteklemektedir. Hastalara verilen multidispliner egzersiz uygulamalarının yara iyileşmesini iyileştirdiği ve skar oluşumunu azalttığına dair kanıtlar artmaktadır. Diz osteoartriti cerrahisi sonrası yapılan metaanalizlerde, egzersizlerin REEDA ve Manchester Scar Scale skorlarını olumlu etkilediği belirtilmektedir. Yara pansuman tekniklerinde ise, gelişen teknolojinin yenilikçi uygulamalarla entegrasyonu hasta bakımında önemli avantajlar sağlamaktadır. Bu alanda hemşire eğitiminin arttırılması, uygulama kalitesinin yükseltilmesi için zorunludur.

Anahtar Kelimeler: Postoperative bakım, yara iyileşmesi, hemşirelik

INTRODUCTION

Surgical interventions represent an indispensable pillar of contemporary medicine, serving a crucial function not only in the treatment of a wide spectrum of diseases but also in the promotion of patients' overall quality of life. Nevertheless, the ultimate success of such procedures extends beyond the operative act itself and is closely contingent upon the effective management of postoperative wound healing (Alotaibi et al., 2024). Postoperative wound healing exerts a critical influence on patients' overall health, comfort, and duration of hospitalization. Potential complications in this phase may not only prolong hospital stays and escalate treatment costs but also increase the risks of morbidity and mortality. Fundamentally, wound healing represents a highly complex and dynamic biological process through which the body restores structural and functional integrity to damaged tissue. This process encompasses the sequential phases of inflammation, proliferation, and remodeling, and is modulated by a wide range of intrinsic factors (including age, nutritional status, comorbid conditions, and immune competence) as well as extrinsic determinants (such as wound characteristics, infection, and wound care strategies). In the postoperative context, ensuring optimal wound protection, preventing infection, and fostering a microenvironment favorable to tissue repair are particularly vital (Dings et al., 2017). Nursing interventions are pivotal in the context of postoperative wound healing, constituting a cornerstone of patient care during the recovery phase after surgery. The efficacy of such interventions particularly in enhancing the rate of wound healing, mitigating complications, and improving overall quality of life has been comprehensively substantiated by a wide body of clinical research. Conceptually, postoperative wound healing denotes the successful closure of a surgical site and the reestablishment of tissue integrity in the absence of infection, hemorrhage, or other adverse events (Alotaibi et al., 2024). During the postoperative recovery period, nurses undertake a broad spectrum of responsibilities encompassing wound assessment, dressing management, pain control, and patient education. The quality and efficacy of these nursing interventions exert a direct impact on the rate of wound healing, the frequency of complications, and overall patient satisfaction. Evidence-based nursing practice, by integrating scientifically validated best practices into wound care, seeks to optimize clinical outcomes and elevate the standard of patient care (Dings et al., 2017). Against this backdrop, the present study aims to provide a comprehensive evaluation of the effectiveness of nursing interventions in promoting postoperative wound healing.

PHYSİOLOGİCAL MECHANİSMS OF WOUND HEALİNG

Wound healing represents a complex and intricately coordinated cascade of biological processes through which the body seeks to repair injured tissue and re-establish structural integrity. Conventionally, this process is characterized by four distinct yet overlapping phases: hemostasis, inflammation, proliferation, and remodeling (maturation) (Gonzalez et al., 2016).

- **Hemostasis Phase:** Initiated at the moment of injury, this phase serves to arrest bleeding through vasoconstriction, platelet aggregation, and the activation of coagulation cascades. It establishes a provisional extracellular matrix that forms the foundation for subsequent reparative events (Gonzalez et al., 2016).
- **Inflammatory Phase:** Commencing immediately after tissue injury and persisting for approximately 4–6 days, this stage is characterized by the removal of cellular debris and pathogens as well as the recruitment of immune and reparative cells to the wound bed. Neutrophils, macrophages, and lymphocytes migrate to the site of injury. Macrophages play a dual role by phagocytosing necrotic tissue and microorganisms, while also secreting growth factors and cytokines that initiate the proliferative cascade (Gonzalez et al., 2016).
- **Proliferative Phase:** Typically spanning days 4–24 post-injury, this phase is defined by active wound closure and tissue regeneration. Fibroblasts deposit collagen to establish granulation tissue, while angiogenesis facilitates neovascularization, ensuring adequate oxygenation and nutrient supply. Concurrently, keratinocytes migrate across the wound margins, promoting epithelialization and accelerating wound surface closure (Gonzalez et al., 2016).
- **Remodeling (Maturation) Phase:** Beginning approximately three weeks after injury and potentially extending for up to one year, this final phase involves tissue strengthening and structural reorganization. Collagen fibers undergo realignment and cross-linking, resulting in enhanced tensile strength. Although a scar ultimately forms, the repaired tissue invariably fails to reach the biomechanical strength of uninjured native tissue (Gonzalez et al., 2016).

COMPLİCATİONS OF POSTOPERATİVE WOUND HEALİNG

Postoperative wound complications represent critical challenges that may impede the recovery process following surgery and substantially elevate both morbidity and mortality risks. Such complications not only extend hospital stays and increase healthcare expenditures but also compromise patients' overall quality of life. The most prevalent postoperative wound complications are outlined below (Yao et al., 2013; Murthy et al., 2007).

Surgical Site Infections (SSI): Among the most prevalent postoperative complications, surgical site infections constitute a leading contributor to morbidity and mortality in hospitalized patients. These infections are categorized into superficial incisional, deep incisional, and organ/space infections. Their occurrence is influenced by multiple risk factors, including impaired immune function, underlying comorbidities such as diabetes, prolonged operative duration, wound contamination, and deficiencies in surgical technique (Berríos-Torres et al., 2017).

Wound Dehiscence: Defined as the partial or complete separation of a surgical incision, wound dehiscence is typically manifested by the divergence of wound margins and the subsequent exposure of underlying tissue layers. Contributing risk factors include obesity, malnutrition, persistent coughing, vomiting, infection, and inappropriate suturing methods (Webster & Osborne, 2015).

Hematoma and Seroma: A hematoma refers to localized blood accumulation within the wound cavity, while a seroma denotes the buildup of serous fluid. Both conditions may hinder the healing process, heighten the susceptibility to infection, and exacerbate patient discomfort. Preventive strategies rely heavily on meticulous hemostasis and effective drainage management (Agrawal & Chauhan, 2020).

YARA İYİLEŞMESİNE YÖNELİK HEMŞİRELİK UYGULAMALARI

Evidence-based nursing (EBN) refers to the integration of the most current and best available scientific evidence with the nurse's clinical expertise and the patient's preferences in nursing practice. In the context of postoperative wound care, EBN practices play a critical role in improving wound healing outcomes and reducing complications. Numerous studies have demonstrated the positive effects of EBN on wound healing (Boga, 2019; Welsh, 2018).

The Importance of Aseptic Techniques: Adherence to aseptic techniques constitutes a cornerstone in preventing surgical site infections. Rigorous implementation of hand hygiene, the use of sterile equipment and gloves, and strict compliance with sterilization standards during wound cleansing and dressing procedures substantially mitigate infection risks (Seidelman et al., 2023; Boga, 2019).

Appropriate Selection of Wound Dressings: The selection of an appropriate wound dressin tailored to the wound type, exudate volume, and phase of the healing process is essential for maintaining a moist wound environment, which facilitates tissue repair and minimizes the risk of infection. A wide range of advanced wound dressings are available, including hydrocolloids, alginates, foam-based dressings, and antimicrobial options (Wasiak et al., 2009).

Nutritional Support: Optimal intake of proteins, vitamins (especially vitamins C and A) and trace elements such as zinc is essential for collagen biosynthesis and the maintenance of immune competence. Malnutrition constitutes a major impediment to wound repair, predisposing patients to delayed healing and heightened complication rates. Tailored nutritional interventions, including dietary counseling and, when indicated, enteral or parenteral supplementation, play a critical role in supporting the wound healing process (Ghaly et al., 2021).

Pain Management: Postoperative pain can significantly compromise patient comfort and mobility, thereby impeding the wound healing process. Comprehensive pain management not only alleviates discomfort but also promotes early mobilization, facilitates respiratory exercises, and enhances nutritional intake. An integrated approach that combines pharmacological interventions with non-pharmacological strategies is recommended to achieve optimal outcomes (Matsuzaki et al., 2013).

Patient and Family Education: Comprehensive education of patients and their families regarding wound care practices, recognition of infection symptoms, nutritional needs, and activity limitations is essential to ensure the continuity of wound management following discharge and to facilitate the early detection of complications. Educational interventions further promote active patient engagement in self-care and contribute to expediting the overall recovery process (Callender et al., 2021).

SONUÇ

Postoperative wound healing constitutes a multifaceted process that is essential to safeguarding patients' health and quality of life after surgery. Evidence demonstrates that nurses exert a direct influence on wound healing outcomes and play a pivotal role in complication prevention through evidence-based practices, including wound assessment, aseptic dressing management, pain control, nutritional support, mobilization, and patient and family education. High-quality

nursing interventions have been shown to reduce the incidence of complications (such as surgical site infections and wound dehiscence) thereby shortening hospitalization and lowering healthcare expenditures. In addition, by optimizing pain management and enhancing patients' quality of life, these practices significantly contribute to patient satisfaction. Nevertheless, challenges such as practice variability, insufficient knowledge, and resource limitations continue to constrain the full realization of their potential.

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REVOLUTIONIZING CHRONIC DISEASE MANAGEMENT WITH AI-DRIVEN PREDICTIVE ANALYTICS

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Abstract

The incorporation of AI-driven predictive analytics into the management of chronic diseases presents significant advantages enhanced diagnostic precision, decreased workload for clinicians, and improved decision-making support utilizing technologies such as image and speech recognition, chatbots, and e-Health applications. This review methodically assesses ten high-quality studies, revealing widespread endorsement for the adoption of AI, alongside apprehensions regarding privacy, medicolegal ramifications, and the psychosocial impact on patients. Simultaneously, the implementation of these systems introduces considerable regulatory and ethical dilemmas. Current frameworks, including FDA regulations, the General Data Protection Regulation (GDPR), and the Health Insurance Portability and Accountability Act (HIPAA), are scrutinized concerning fundamental ethical concerns: patient confidentiality, algorithmic bias, transparency, and informed consent. Key stakeholders healthcare providers, policymakers, and AI developers must navigate the complexities associated with data security and fairness in automated decision-making. This paper provides practical recommendations, advocating for rigorous data protection, the development of interpretable and transparent AI models, and collaboration among multiple stakeholders to establish coherent ethical standards. Future research should focus on creating standardized evaluation frameworks, strategies for bias mitigation, seamless integration with electronic health records, and interdisciplinary approaches to diminish systemic healthcare disparities. AI should be regarded as a complementary resource that enhances, rather than supplants, clinical expertise. By prioritizing patient safety, equity, and accountability, healthcare systems can responsibly leverage AI's potential to enhance efficiency and outcomes in chronic disease management.

Keywords: Health Insurance Portability and Accountability Act (HIPAA), General Data Protection Regulation (GDPR), Electronic health records, Disease management, Chatbots.

YEMEN TARİH YAZIMINDA ÖZGÜN BİR KAYNAK:İBNÜ'L-MÜCÂVİR'İN *TÂRÎHU'L-MÜSTEBSIR* ADLI ESERİ

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ÖZET

Tam adı Ebûbekir b. Muhammed b. Mes'ûd b. Alî b. Ahmed İbnü'l-Mücâvir el-Bağdâdî en-Nîsâbûrî olan İbnü'l-Mücâvir'in (ö. 630/1233'ten sonra) hayatı ile ilgili başlıca kaynağımız *Târîhu'l-Müstebsır*'ın kendisidir. *Târîhu'l-Müstebsır*'den anlaşıldığı kadarıyla İbnü'l-Mücâvir, Horasan'da yaşamış, ticaretle uğraşmış, Hac için gittiği Hicaz'dan Yemen'e, oradan da Hindistan ve Doğu Afrika'ya seyahatler düzenlemiştir. Keskin bir gözlem gücüne sahip olan İbnü'l-Mücâvir, *Târîhu'l-Müstebsır* adlı eserinde Arap Yarımadası'nın topoğrafyası, burada yaşayan insanların inançları, sosyal gelenekleri, kıyâfetleri, yemek kültürleri ve tarımsal faalliyetleri ile ilgili tasvirler yaptığı gibi ihraç ve ithal edilen malların fiyatları, gümrük vergileri, piyasada kullanılan para birimleri gibi iktisadi konularda da önemli bilgiler vermiştir. İbnü'l-Mücâvir'in eseri, Aden limanının işleyişi, gümrük sistemi ve ticaret gemilerine muamele konusunda döneminin en tafsilatlı bilgilerini içermektedir. Müellif bizzat ziyaret etmediği San'a, Me'rib seddi, Cevf, Sa'de, Hadramut'taki Şibâm, Sokotra ve Bahreyn gibi yerler hakkında kendisine aktarılan malumatı da eserine dâhil etmiştir. *Târîhu'l-Müstebsır,* 1200'den fazla yer ismi içermesi bakımından coğrafya tarihi için eşsiz bir kaynaktır. Yerel folklor, sihir, evlilik âdetleri ve garip hadiselere özel ilgi gösteren ve İbn Battûta'dan bir asır önce bölgeyi ziyaret eden İbnü'l-Mücâvir'in *Târîhu'l-Müstebsır* adlı eseri, Eyyûbîler dönemi başta olmak üzere Ortaçağ Yemeni'nin sosyal ve ekonomik tarihi için vazgeçilmez bir kaynak olarak kabul edilmektedir. Bu bildiri, 7./13. yüzyılın ilk çeyreğinde Yemeni ziyaret eden İbnü'l-Mücâvir'in *Târîhu'l-Müstebsır* adlı seyahatnamesinin Yemen tarih yazımındaki özgün yerini incelemektedir.

Anahtar Kelimeler: Tarih, İbnü'l-Mücâvir, Târîhu'l-Müstebsır, Yemen, Eyyubiler.

AN ORIGINAL SOURCE IN YEMENI HISTORIOGRAPHY: IBN AL-MUJĀWIR'S TĀRĪKH AL-MUSTABṢIR

ABSTRACT

The primary source for the life of Ibn al-Mujāwir (d. after 630/1233), whose full name was Abū Bakr b. Muḥammad b. Masʿūd b. ʿAlī b. Aḥmad Ibn al-Mujāwir al-Baghdādī al-Naysābūrī, is his own work *Tārīkh al-Mustabṣir*. As understood from *Tārīkh al-Mustabṣir*, Ibn al-Mujāwir lived in Khurasan, engaged in trade, and traveled from the Ḥijāz, where he went for pilgrimage, to Yemen, and from there to India and East Africa. Possessing keen observational skills, Ibn al-Mujāwir in his work *Tārīkh al-Mustabṣir* provided descriptions of the topography of the Arabian Peninsula, the beliefs, social customs, clothing, culinary culture, and agricultural activities of its inhabitants, as well as important information on economic matters such as prices of exported and imported goods, customs duties, and currencies used in

the markets. Ibn al-Mujāwir's work contains the most detailed information of his era regarding the operation of the port of Aden, the customs system, and the treatment of merchant ships. The author also included in his work information transmitted to him about places he did not personally visit, such as Ṣanʿāʾ, the Maʾrib dam, al-Jawf, Ṣaʿda, Shibām in Ḥaḍramawt, Socotra, and Bahrain. *Tārīkh al-Mustabṣir* is a unique source for geographical history as it contains more than 1,200 place names. The work of Ibn al-Mujāwir, who showed special interest in local folklore, magic, marriage customs, and strange incidents, and who visited the region a century before Ibn Baṭṭūṭa, is considered an indispensable source for the social and economic history of medieval Yemen, particularly during the Ayyubid period. This paper examines the distinctive place of Ibn al-Mujāwir's travelogue *Tārīkh al-Mustabṣir* in Yemeni historiography, written by an author who visited Yemen in the first quarter of the 7th/13th century.

Keywords: History, Ibn al-Mujāwir, Tārīkh al-Mustabṣir, Yemen, Ayyubids

IDENTIFICATION OF FUNGI RESPONSIBLE FOR THE DECOMPOSITION OF SOIL ORGANIC MATTER

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Abstract

The study was aimed to isolate, identify and determine the percentage of fungi species present in contaminated soil samples from Waste-contaminated soil and Mechanic workshop or garage within Katsina State, Katsina city. Soil samples were obtained from two different locations within Katsina metropolis and twenty-five gram of samples were added to two hundred and twenty-five milliliter of distilled water and one milliliter of each was added to nine milliliter of distilled water to give a tenfold serial dilution of which was made up to (10-6) dilution for the isolation and identification of fungi. One milliliter aliquot of 10-5 and 10-6of each sample was spread on surface of prepared Potato Dextrose Agar (PDA) and incubated at room temperature for 3 to 7 days for the isolation of fungi. Nine species of fungi were isolated from the soil samples and then characterized macroscopically and microscopically. The fungi were Saccharomyces cerevisiae, Candida albicans, Aspergillus niger, Aspergillus terreus, Aspergillus flavus, Penicillium chrysogenum, Fusarium spp., Rhizopus spp, and Mucor spp. The fungal counts ranged from 5.5 $\times 10^{-6}$(cfu/ml) to 102 $\times 10^{-5}$(cfu/ml). The percentage occurrence amongst the fungal isolates from the two places was higher in Waste-contaminated soil with 58.3% and lower in Mechanic garage or workshop with 48.6% this variation occur as a result of direct released of hydrocarbons that are toxic to the living organisms (particularly microorganisms and Plants) present in the soil, while these fungi in Waste disposal area soil are involved in the degradation of complex organic compounds which increases the soil health and quality. Therefore, these complex organic compounds-degrading microbes are abundant in soil and can be applied for bioremediation of soils contaminated with recalcitrant compounds and petroleum products.

Keywords: Fungi, complex organic compounds, decomposition.

CONCRETE PRODUCTION USING WASTE WATER

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ABSTRACT

Water is one of the most vital natural resources essential for life. As the most widely used liquid worldwide, its conservation is critical particularly in industries with high water demands, such as construction. With growing water scarcity, especially of freshwater, the construction sector is exploring alternatives, including the use of treated wastewater in concrete production. This study investigates the feasibility of substituting potable water with treated wastewater in concrete mixing and curing, aiming to understand the mechanical and durability performance of such concrete.

The research utilized three types of water: tertiary treated wastewater (TTWWW), secondary treated wastewater (STWW), and conventional tap water (TWWW), replacing TWW entirely (100%) in the concrete mix. A constant water-to-cement ratio of 0.47 was maintained. Concrete cubes were tested for compressive strength at 7, 28, and 90 days, and flexural strength at 28 and 90 days. Durability tests included chloride penetration, carbonation resistance, and abrasion resistance after 28 days of curing.

Results showed that concrete mixed with TTWWW and cured in both TWWW and TTWWW exhibited 85–94% of the compressive strength of conventional concrete, meeting ASTM C-94 standards. Flexural strength also remained within acceptable limits. However, increased carbonation depth was noted in wastewater mixes, and chloride concentration rose with decreasing water quality. Despite some reduction in early-age strength, the findings suggest that treated wastewater especially TTWWW can effectively replace potable water in concrete production, contributing to water conservation and environmental sustainability.

INTRODUCTION

Concrete is among the most widely used construction materials globally, second only to water in consumption. Each year, approximately 5 billion cubic yards of concrete are produced worldwide, and its demand continues to rise with growing infrastructure development. The concrete industry consumes a significant volume of water for mixing and curing processes. According to IS:10262–2009, about 186 liters of water are needed per cubic meter of concrete. On average, 150 liters are consumed for each cubic meter, making water a critical resource in construction.

Historically, potable water has been the standard for concrete production since the time of the Romans. However, with increasing global population and industrial activities, the demand for freshwater has surged, pushing resources to the brink. Reports from the United Nations (UN) and World Meteorological Organization (WMO) suggest that by 2025, nearly half the world's population may face freshwater shortages.

Freshwater constitutes only 2.5% of all water on Earth, most of which is locked in glaciers and ice caps. The small fraction available as groundwater and surface water is under increasing pressure. As the construction industry expands, it consumes an enormous quantity of freshwater—estimated at one trillion gallons annually for concrete mixing and curing alone.

Given the current water crisis, it is imperative to find alternatives to reduce freshwater consumption. One such solution is the reuse of treated wastewater. While public perception may resist its use for drinking, treated wastewater can be a viable option for non-potable applications such as in concrete manufacturing.

Traditionally, concrete specifications have followed the principle that if water is safe to drink, it is suitable for concrete. However, recent research indicates that treated wastewater can be used effectively in concrete without compromising strength or durability. In fact, utilizing such water can alleviate the environmental burden of wastewater disposal.

Numerous studies have explored partial and full replacement of tap water with treated wastewater in concrete. Findings show that the compressive strength of concrete can remain stable or even improve, especially when cured with treated water. However, factors such as setting time, carbonation, chloride ingress, and durability must also be evaluated to assess feasibility thoroughly.

This research aims to assess the mechanical and durability performance of concrete when 100% of the tap water is replaced with tertiary and secondary treated wastewater, both for mixing and curing. By examining compressive strength, flexural strength, abrasion resistance, chloride penetration, and carbonation resistance, this study explores whether treated wastewater can serve as a sustainable alternative in concrete production.

MATERIAL CHARACTERIZATION AND TEST SPECIMEN PREPARATION

Raw Materials

The study used Ordinary Portland Cement (OPC) of 43 grade, conforming to IS 8112:1989. Natural river sand (Zone III as per IS 383:1970) served as the fine aggregate, while a combination of 20 mm and 10 mm crushed stone aggregates (in a 60:40 ratio) were used as coarse aggregate. Treated wastewater, both tertiary and secondary, was employed as a full substitute for tap water in mixing and curing processes. The chemical composition of the water samples was also analyzed.

Mix Preparation and Testing Procedures and Methodology

Five mix combinations were prepared:

(a) Control mix with 100% tap water (TWW)

(b) 100% tertiary treated wastewater (T TWWWW) with TWW curing

(c) 100% TTWWWW with TTWWWW curing

(d) 100% secondary treated wastewater (STWW) with TWW curing

(e) 100% S TWWW with STWW curing

Concrete was designed for M25 grade following IS 10262:2010, with a water-to-cement ratio of 0.47. Standard cubes (100 mm³) were cast for compressive strength testing at 7, 28, and 90 days, while beams (100×100×500 mm) were used for flexural strength at 28 and 90 days. Workability was assessed using slump tests (IS:1199–1959), and all specimens were prepared under indoor temperatures of 25–30°C.

Durability testing included:

Carbonation Resistance (RILEM CPC-18 guidelines): Specimens were dried, epoxy-coated, and placed in a chamber with 5% CO_2, 50±5% RH, and 27±1°C. After 28 days, phenolphthalein spray was used to measure carbonation depth.

Chloride Penetration (ASTM C1556): Concrete discs (70 mm × 50 mm) were tested using a dual-cell migration setup containing NaCl and distilled water. Chloride concentration was measured via titration at regular intervals over 56 hours.

Abrasion Resistance (IS:1237–1980): Depth of wear was calculated based on weight loss and surface area of 100 mm³ concrete specimens.

Table 1. Properties of cement and concrete

Physical properties of ordinary Portland cement.			
S.No	Characteristics	Values obtained	Values as per IS 8112:1989
1	Consistency	28.00%	–
2	Initial setting time	95 min	Not less than 30 min
3	Final setting time	310 min	Not greater than 600 min
4	Fineness	289.5 m^2/kg	Not less than 225 m^2/kg
5	Specific gravity	3.14 (g/cc)	–
Physical properties of fine aggregate.			
S.No.	Characteristics	Value	
1	Type	Natural Sand	
2	Specific Gravity	2.695 (g/cc)	
3	FinenessModulus	3.15	
4	Grading Zone	Type III	

Methodology

1. Reuse of Waste Wash Water in Ready-Mix Concrete Plants

Several researchers have focused on the potential for reusing waste wash water generated from ready-mix concrete plants. Ghrair et al. (2020) [1] presented a detailed investigation into the chemical and physical properties of waste wash water (WWW) and its effects on fresh and

hardened concrete properties. The study concluded that up to certain limits, WWW could be effectively reused without negatively impacting performance.

Similarly, Sandrolini and Franzoni (2001) [2] earlier established foundational understanding in this area by characterizing WWW from Italian plants. Their results confirmed that recycling wash water is feasible, especially when the water is regularly monitored for solid content and chemical stability.

Klus et al. (2019) [5] extended this work with a case study on the reuse of waste sludge water (WSW) in cement composites. Their experimental findings indicated that WSW could be used in partial replacement without compromising compressive strength, provided the sludge content is within regulated limits.

Chen et al. (2022) [9] further confirmed these findings, highlighting changes in mechanical strength and microstructure when WWW and slurry are introduced. Their results showed marginal declines in strength, which can be mitigated through mix design optimization.

2. Recycled Rubber, Wastewater, and Hybrid Approaches

Svoboda et al. (2020) [3] took a more hybrid approach by combining recycled rubber from waste tires with WWW from concrete plants to produce new cement composites. This study stands out by examining the synergistic effects of two waste materials. Although the inclusion of rubber affected workability, the mechanical strength remained acceptable, indicating promise for pavement and non-structural applications.

3. Alternative Wastewater Sources in Concrete and Geopolymers

Beyond concrete plant wastewater, other industrial sources have also been explored. Moni et al. (2020) [6] investigated the use of alkaline wastewater from foundry sand regeneration in fly ash-based geopolymer concrete. The study demonstrated that such alkaline wastewater can replace commercial alkaline activators, leading to both economic and environmental benefits without sacrificing performance.

Mathur and Chhipa (2023) [4] provided a statistical analysis on the effects of various types of mixing and curing water (including treated wastewater) on M-sand concrete. Their robust experimental design offered insights into strength variations and affirmed that treated wastewater, when properly analyzed, is suitable for both mixing and curing.

Vanitha and Rajan (2023) [8] explored the effects of pre-treated wastewater combined with encapsulated nanoparticles on green concrete. The incorporation of nanomaterials helped mitigate some potential negative effects of wastewater, improving strength and durability properties—showcasing an innovative approach in sustainable concrete technology.

4. Solid Waste and Sludge Utilization in Concrete

The reuse of solid waste, especially waste silt and sludge, is another area of active investigation. Solouki et al. (2022) [7] focused on optimizing concrete paving blocks containing waste silt, aiming to balance performance and sustainability. Through mixture optimization techniques, they showed that silt could be incorporated without major losses in strength, especially for non-structural applications.

5. Historical Perspectives on Wastewater in Concrete

The earliest documented study in this field by Fay (1967) [10] already emphasized the potential for treated wastewater reuse in concrete. Although lacking in modern testing methods, this work laid the groundwork for future investigations by proving the concept's viability over 50 years ago.

RESULTS AND DISCUSSION

Workability

Slump tests revealed that replacing tap water with treated wastewater reduced workability. TTWWW caused a 25% slump reduction, and STWW caused a 50% reduction. This is attributed to solid particles in wastewater and their absorption characteristics. Plasticizers may be required to maintain desired workability.

Compressive Strength

Compressive strength declined as the quality of mixing water decreased. Using 100% TTWWW and curing in TWWW resulted in a strength reduction of 14.70% at 7 days, 14.32% at 28 days, and 6.41% at 90 days. However, when curing was done in TTWWW, strength decreased more significantly.

Using S TWWW further lowered compressive strength across all age groups, but by 90 days, values remained within ASTM C94 standards. Concrete mixed with TTWWW consistently performed better than that made with STWWW.

Table 2: Chemical properties of water

Chemical properties of water						
S.no.	Test	Treated water		Kurnool water	IS Standard (treated water)	IS Standard (fresh water)
		Sec.	Ter.			
1	B.O.D (mg/l)	20	14	–	< 30	–
2	Hardness (mg/l)	256	248	148	–	200–600
3	Chlorides (mg/l)	269.91	257.92	484.8	–	200–1000
4	Turbidity (NTU)	0.305	0.586	0.1	–	0.1325–0.53
5	pH	7.48	7	8.16	5.5–9.0	7–8.5
6	Conductivity (ms/cm)	1.59	1.59	–	–	–
Mix proportions for different samples.						
Designation	Cement (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)	Tap water (kg/m^3)	Tertiary water (kg/m^3)	Secondary water (kg/m^3)
CCC	395	631	1159.5	189.7		
TTWWW100 + CTWW	395	631	1159.5		189.7	

TTWWWW100 + CTTWW	395	631	1159.5		189.7	
STWWW100 + CTWW	395	631	1159.5			189.7
STWWWW100 + CSTWW	395	631	1159.5			189.7

Flexural Strength

Flexural strength also decreased with wastewater use, more notably in early stages. After 28 and 90 days, concrete mixed with TTWWWW and cured in TWWW showed better flexural strength than other wastewater mixes. S TWWW mixes showed the greatest strength loss.

Table 3: Flexural strength of concrete at 28 and 90 days.

Mix	Flexural strength	
	28 days	90 days
CCC	10.6	12.3
TWWW + TW	9.73	10.50
TWWW + TWWW	8.63	9.04
SWWW + TWWW	7.56	10.20
SWWW + SWWW	5.83	8.46

Carbonation Resistance

Carbonation depth increased with wastewater use, especially TTWWWW. Maximum carbonation depth reached 9.33 mm at 28 days, indicating reduced resistance due to the lower quality of mixing water.

Table 4: Carbonation Resistance

Mix	DEPTH(MM)			
	7 days	14 days	21 days	28 days
CC	0	0	2.32	2.98
TWW + TW	0	4.30	5.34	8.44
TWW + TWW	0	6.66	9.29	9.55

Chloride Migration Resistance

Concrete made with TTWWWW showed increased chloride ion concentration early on, with a concentration 1.12 times higher than the control mix at 4 hours. However, resistance improved over time, and chloride levels reduced significantly by 56 hours. TTWWWW mixes allowed greater chloride ingress initially but became more stable at later stages.

3.6 Abrasion Resistance

Abrasion resistance improved when using TTWWWW, especially when both mixing and curing used T TWWWW. Capillary absorption and micro-porosity were reduced, improving surface durability. Increases of 2.06% and 8.09% in abrasion resistance were observed for curing in TWW and TTWWWW, respectively.

Time (hour)	CCC (mg/l)	TWWW + TWW (mg/l)	TWWW + TWWW (mg/l)
4	96.465	101.505	206.042
8	113.86	113.93	211.012
12	118.83	123.87	218.467
16	126.285	126.355	232.383
20	133.74	133.81	240.832
24	146.165	146.235	265.682
28	151.135	151.205	283.077
32	156.105	158.66	283.077
36	156.105	166.115	289.538
40	161.572	173.57	305.442
44	168.53	181.025	320.352
48	175.985	182.516	327.807
52	183.44	185.995	327.807
56	183.44	185.995	327.807

. CONCLUSION

This study evaluated the feasibility of using treated wastewater as a complete replacement for tap water in concrete mixing and curing. Key conclusions are:

1. Using treated wastewater, particularly S TWWW, significantly reduces the slump value of fresh concrete, indicating the need for chemical admixtures to improve workability.
2. Compressive strength of concrete mixed with TTWWWW (and cured in either TWW or TTWWWW) retained 85–94% of the strength of conventional concrete, meeting ASTM standards.
3. Carbonation resistance decreased with wastewater usage, as carbonation depth increased.

4. Abrasion resistance improved with TTWWWW use, especially when used for both mixing and curing.
5. The application of TTWWWW in concrete presents a promising approach to reducing freshwater consumption while providing comparable strength and durability characteristics.

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GELENEKLERDE GEÇMİŞİN İZLERİ: KUDÜS'E GİRİŞTEN KIRMIZI HALIYA

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Özet

Tarihsel süreç içerisinde aynı topraklarda farklı zamanlarda çeşitli toplumların ve bu toplumlara ait kültürlerin yaşadığı bilinmektedir. Bu toplumlar zaman içerisinde kültürel etkileşim içerisine girmiş ve birbirlerinden etkilenmiş aynı zamanda birbirlerini etkilemişlerdir. Geçmişten günümüze kültürel aktarımla gelen çeyiz sandığı, kırmızı halı, adak adama, sağlık ocağı gibi birçok gelenek bulunmaktadır. Çalışma kapsamında incelenecek olan 'kırmızı halı" da geçmişten bugüne gelmeyi başarmıştır. Kırmızı Halı geleneği İsa'nın Kudüs'e girişi sırasında Kudüs halkından bir kişinin kırmızı hırkasını çıkartıp İsa'nın ayaklarının altına sermesiyle başlamıştır. Nasıl ki İsa kırmızı halının üzerinden geçerek Kudüs şehrine girmiştir, yüzyıllardır da toplum tarafından önemli sayılan kişiler kırmızı halı üzerinde yürümektedirler. Çalışmanın amacı, kültürel bir değer olan, günümüzde hala vazgeçilemeyen, üzerinde yürürken insanların kendilerini önemli hissettikleri "Kırmızı Halı" geleneğinin geçmişten bugüne hikayesini anlatmaktır. Asıl amaç ise geleneklerde geçmişin izlerinin bulunduğunu ve kültürel etkileşimim devam ettiğini vurgulamaktır.

Anahtar Kelimeler: Gelenek, Kırmızı Halı.

TRACES OF THE PAST IN TRADITIONS: FROM THE ENTRANCE TO JERUSALEM TO THE RED CARPET

Abstract

It is known that various societies and cultures belonging to these societies lived in the same lands at different times throughout the historical process. These societies have entered into cultural interaction over time and have influenced and influenced each other. There are many traditions such as dowry chests, red carpets, vows, and health centers that have been transmitted culturally from past to present. The 'red carpet', which will be examined within the scope of the study, has also managed to come from the past to the present. The Red Carpet tradition started when Jesus entered Jerusalem, when a member of the people of Jerusalem took off his red cardigan and laid it under Jesus' feet. Just as Jesus entered the city of Jerusalem by walking on the red carpet, people who are considered important by society have been walking on the red carpet for centuries. The aim of the study is to tell the story of the "Red Carpet" tradition, which is a cultural value, is still indispensable today, and people feel important while walking on it, from past to present. The main purpose is to emphasize that there are traces of the past in traditions and that cultural interaction continues.

Keywords: Tradition, Red Carpet.

Giriş

Payendaz[6] serme geleneği, günümüzde tören ya da önemli resmi ziyaretlerde protokolde kullanılan kırmızı halı serme geleneğinin Osmanlı dönemindeki yansımasıdır. Kırmızı halı, kutlama, açılış veya resmî ziyaretler gibi karşılama ve uğurlama törenlerinde protokoldeki kişilerin geçiş yollarına sermek için kullanılmaktadır. Kırmızı halı serme geleneği çok eski dönemlerden günümüze kadar gelmiş bir gelenektir. İlk olarak, Aiskhylos'un M.Ö. 5. yüzyılda yazıldığı tahmin edilen, Antik Yunan'da Eshilos'un Yunan mitolojisinden esinlenen oyunu Agamemnon isimli tragedyasında şunları yazmaktadır:

> *"Miken kralı Agememnon'un karısı Clytemnestra, kocasını karşılamak için tanrıların kullandığı bir yönteme başvurmuş ve yoluna kırmızı işlemeli bir halı sermiştir. Agamemnon önce "Kral tanrı değil, sadece ölümlü bir insan" diyerek halının üstünde yürümemiştir. Clytemnestra ısrar edince, mağrur Agamemnon halının üzerinde yürümüştür. Böylece Clytemnestra, kocasının kendini beğenmiş biri olduğunu kanıtlamıştır (Oyman, 2020: 1624).*

Şüpheli davranan Agamemnon, halının üzerinde yürümekte tereddüt etmiştir, çünkü yalnızca tanrıların bu değerde olduğunu bilmektedir. Ancak karısı ısrar edince kırmızı halıda yürümüş ve eşi tarafından öldürülmüştür. Çoğu referans, oyunda bahsedilen kırmızı halıların aslında mor olduğunu iddia etmektedir (https://trendomi.com/protokolde-neden-kirmizi-hali-serilir/, Erişim Tarihi: 17.05.2024). Bu olay, Batılılar için genellikle kırmızı halı serme geleneğinin miladı olarak kabul edilmektedir denilmesine rağmen Agamemnon yalnızca tanrıların bu değerde olduğu bilmektedir dolayısıyla bu gelenek Agamemnon öncesine dayanmaktadır. Agamemnon'un da dediği gibi bir tanrı'dan gelmektedir.

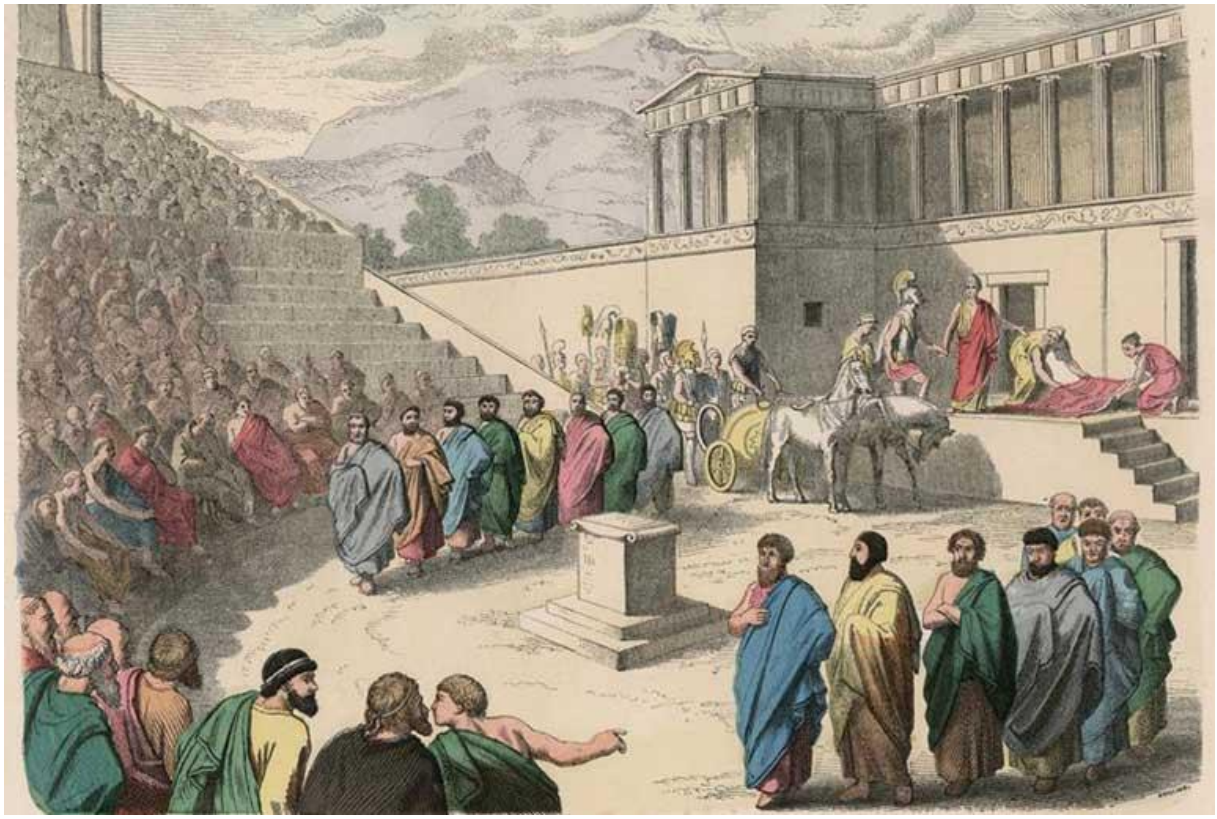
İsa 33 yılında çarmıha gerilmiştir. Kudüs'e giriş tarihi net olmamakla beraber Agamemnon'dan öncesine tarihlenmektedir.

Kırmızı Halı Geleneği

Törenlerin vazgeçilmez geleneği olan önemli kişilerin geçtiği yola değerli bir kumaş serme geleneği, Osmanlı döneminde Payendaz kumaşlarla devam etmiştir. Osmanlı Sarayında padişah, kılıç kuşanma töreninden sonra atla Topkapı Sarayı'na dönerken perde kapısından kubbe altına kadar giden yol şallarla kaplanmaktaydı (Oyman, 2020: 1624).

> *Alman İmparatoru II. Wilhelm'in 1898 yılında Hereke Fabrikasını Ziyareti için Hereke ve ziyaret edilecek fabrikada da bazı hazırlık ve düzenlemeler yapılmıştır. Nitekim Hereke Fabrika-yı Hümayunu, misafirler için özel olarak hazırlanmış olup fabrikanın bahçesi taklar, kamelyalar ve defneyapraklarıyla süslenmiştir. Yollar, istasyondan İmparatorun kalacağı köşke kadar kırmızı halı ile kaplanmıştır (Karacagil, 2015: 918).*

[6] Payendaz: Padişah ve maiyetindekilerin bir kente girişinde, atının ayaklarının altına serilen kumaşlara verilen isimdir (Esiner Özen 1982: 329).



Resim 1: Agamemnon Oyunu Sahnesi

Kaynak: https://trendomi.com/protokolde-neden-kirmizi-hali-serilir/, Erişim Tarihi: 17.05.2024.

Doğu ve Rönesans sanat eserlerinde kırmızı desenli halılar gösterilmekteydi. Halılar genellikle, taht ya da dini öneme sahip ayinlerin yapılacağı kürsüye serilmekte kırmızı halı yüksek statüyü ifade etmektedir (https://www.haberturk.com/kirmizi-hali-gelenegi-nereden-geliyor-kirmizi-hali-neden-torenlerde-serilir-3610984/2, Erişim Tarihi: 17.05.2024). 1821'de ABD Başkanı James Monroe'nin Güney Carolina eyaletindeki Georgetown'a gemiyle varışı sırasında yere kırmızı halı serilmesi, önemli görülen olaylarda kırmızı halı kullanımının başlangıcı oldu denebilir (https://www.sozcu.com.tr/kirmizi-hali-gelenegi-nereden-geliyor-wp1109781, Erişim Tarihi: 17.05.2024). Fransız imparatoru III. Napolyon bu uygulamayı sürekli hale getirmişse de, kırmızı halının ancak 19. yüzyıl sonlarında yaygınlaşmaya başladığı görülmüştür. Ama o tarihten sonra, dünyadaki tüm karşılama ve uğurlama törenlerinde görülmeye başlamıştır (https://kirkindansonra.net/kirmizi-hali-gelenegi-ve-kirmizinin-gucu/, Erişim Tarihi: 17.05.2024).

1902 yılında modern dünyada öne çıkan kırmızı halı, New York ve Chicago demiryolu hizmetinde kullanılmıştır. Yolcular vagonlara yönelirken kırmızı halıdan geçiyorlardı. Artık halı lüks olarak görülmekte ve birçok prestijli etkinlik için kullanılmaktaydı (https://www.haberturk.com/kirmizi-hali-gelenegi-nereden-geliyor-kirmizi-hali-neden-torenlerde-serilir-3610984/2, Erişim Tarihi: 17.05.2024).

1961'de kırmızı halı Oscar ödül törenlerinde kullanılmıştır. 1964'te televizyon kameraları konukların tören salonuna girişini dışarıda görüntüleme kararı almıştır. Böylece kırmızı halı dünya çapında yıldızlar geçidinin odak noktası haline gelmiştir. Kırmızı halıda geçit kendi başına bir gösteriş fırsatıydı. Film yıldızlarının bu geçit sırasında ne giydiği, kiminle yürüdüğü,

ne kadar şık, provokatif ya da özgün olduğu tartışmalara konu olmaktaydı. Örneğin Barbra Streisand'ın 1969 töreninde giydiği pullu şeffaf pantolon takımı, Funny Girl filmindeki rolü için En İyi Kadın Oyuncu Oscar'ı alması kadar haber konusu olmuştur (https://t24.com.tr/haber/kirmizi-hali-gelenegi-nereye-dayaniyor,329659, Erişim Tarihi: 17.05.2024). Kırmızı halı, 33. Akademi Ödülleri sırasında 1961 yılında ödül verme konusu ile yolunu bulmuştur. İzleyiciler, 38. Akademi Ödülleri sırasında kırmızı halı rengini 1966 yılında görmeyi başarmışlardır. Kırmızı halı üzerinde yürümek ünlüleri bağlamamaktadır, ancak çoğu, imajını artırmaya yardımcı olduğundan bunu yapmayı tercih etmektedir (https://trendomi.com/protokolde-neden-kirmizi-hali-serilir/, Erişim Tarihi: 17.05.2024).

Çağımızda devlet adamlarının ve değerli insanların ziyareti sırasında uygulanan yollarına kırmızı halı serme âdeti divan şiiri beyitlerinde kırmızı ya da yeşil atlas serme şeklinde karşımıza çıkmaktadır Öztoprak, 2010: 109).

Kırmızı Halının Sosyal ve Kültürel Etkileri:

- **Moda ve Tasarım:** Kırmızı halının etkinliklerdeki yeri sadece yıldızları sergilemekle sınırlı değil, aynı zamanda moda dünyası için de bir vitrin görevi görmektedir.

- **Toplumsal Değerler ve Algılar:** Kırmızı halının sembolize ettiği prestij ve lüks, aynı zamanda toplumun başarı ve statüye verdiği değerin de bir göstergesidir (https://www.kamudanhaber.net/onemli-etkinliklerde-neden-kirmizi-hali-seriliyor, Erişim Tarihi: 17.05.2024).

Tarihsel Süreçte Kırmızı Halı:

Cihangir Şah (1605): Babür imparatoru Cihangir Şah kardeşini ziyaret ettiği esnada; Cihangir Şah'ın kardeşinin kendi evine kadar Cihangir Şah için kırmızı halı serdirdiği bilinmektedir. Ayrıca bu adet Hintlilerde o sıralarda yaygındır.

James Monroe: 1821'de Amerika Birleşik Devletleri Başbakanı James Monroe için bir kırmızı halı yayarak açılmıştır.

Victoria (24 Mayıs 1819 – 22 Ocak 1901): Londra Paddington tren garında Büyük Britanya Kraliçesi Victoria için kırmızı halı serildiği düşünülmektedir.

III. Napolyon (1852): Fransız imparatoru 3. Napolyon kırmızı halı serme işini sürekli hale getirerek yaygınlaştırmıştır.

New York Merkez Demiryolları: 1902'de New York Merkez Demiryolunda yolcuları trenle karşılamak için kırmızı halılar kullanılmıştır. Bu, yolcuların onur duydukları için kullanılan bir pazarlama taktiğidir.

Mısır Tiyatrosu: Hollywood kırmızı halısı ilk kez 1922 yılında Hollywood'da açılan Mısır Tiyatrosunun galası Robin Hood filminde kullanılmıştır.

İsa'nın Kudüs'e Giriş Sahnesi – Vaiforos

Resim 2: İsa'nın Kudüs'e Giriş Sahnesi (Vaiforos)

Kaynak: https://www.meisterdrucke.com.tr/fine-art-baski/Russian-School/66274/%C4%B0sa%27n%C4%B1n-Kud%C3%BCs%27e-Giri%C5%9Fini-g%C3%B6steren-simge.html, Erişim Tarihi: 22.05.2024.

Yahudi olan ilk Kudüs cemaatinin İsa'ya dair Tanrı Oğlu tanımlaması yapmıştır. Başka bir deyişle, Tanrı Oğlu ifadesi ilk Kudüs cemaati tarafından İsa'ya atfen kullanılan bir tabirdir; fakat bu tabir Tanrı Oğlu olarak nitelenen İsa'nın beşer bir Yahudi kralı olduğuna işaret etmektedir (Duygu, 2018: 176). İsa'nın Kudüs'e girişi akıbetini oluşturan aşamalardan ilkidir. İsa'nın Kudüs'e bir eşek sırtında gelmesi ve halkın onu bir kral gibi karşılaması, ona sevgi göstermesi ve bunun sonucu olarak Romalı idarecilerin bu durumu ileriye dönük oluşabilecek bir isyan durumu olarak algılamaları ve bundan korkmalarıdır (Aydın, 2015: 170).

Sahnenin ortasında sağ eli ile insanları takdis eden İsa peygamber, bir eşeğin üzerinde oturmakta, koyu renklerin hakim olduğu bir kaftan ve pelerin giymekte olup (Başçı, 2014: 479) cepheden başı hafif sağa dönük vaziyette gösterilmiş, üzerine bindiği eşek ise yandan resmedilmiştir. İsa Peygamber'in solunda Kudüslü kadınlar yer almaktadır. Kadınların arkasında ise Kudüs'ü temsil eden binalar görülmektedir. İsa peygamberin sağında Kudüslü erkekler arkalarında ise kayalıklar arkasında bir ağaç motifi tasvir edilmiştir. Eşeğin ayakları dibinde ise yere kilim seren ve kurban kesen insanlar yer almaktadır. İkonografiye tamamen uygun tarzda yapılmış ikona da gerek üslup gerekse teknik açıdan Ortodoks geleneklerinin devam ettirildiği görülmektedir. İkonada nefti zemin üzerine oldukça canlı renkler; lacivert, kırmızı, pembe, sarı ve kahverenginin tonları kullanılmıştır (Yılmaz, 1992: 24).

Sonuç

İsa'nın Kudüs'e giriş sahnesinde de görüldüğü gibi İsa'yı karşılamaya gelen halktan bir kişi sırtındaki kırmızı hırkasını çıkartmış ve İsa'nın ayakları altına sermiştir. Kendince bir Tanrı oğlunun toprağa değil hırkanın üzerine basması gerektiğini düşünmüştür. Toprağa basamayacak kadar önemli olduğunu vurgulamıştır. Daha sonra Agamemnon'un savaş dönüşü karısının kırmızı halı sermesi, Babür İmparatoru Cihangir Şah'ın kardeşinin Cihangir Şah'ı karşılamak için kendi evine kadar kırmızı halı sermesi, A.B.D. Başbakanı James Monroe, 3. Napolyon, New York Merkez Demiryolu, Hollywood'da açılan Mısır Tiyatrosunun galası ve 1961 yılından beri de Oscar ödül törenlerinde de kullanılmaya başlamış ve hala devam etmektedir.

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GELENEKLERDE GEÇMİŞİN İZLERİ: TÜMÜLÜSLERDEN TOPRAĞI BOL OLSUNA

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Özet

Tarihsel süreç içerisinde aynı topraklarda farklı zamanlarda çeşitli toplumların ve bu toplumlara ait kültürlerin yaşadığı bilinmektedir. Bu toplumlar zaman içerisinde kültürel etkileşim içerisine girmiş ve birbirlerinden etkilenmiş aynı zamanda birbirlerini etkilemişlerdir. Geçmişten günümüze kültürel aktarımla gelen çeyiz sandığı, kırmızı halı, adak adama, sağlık ocağı gibi birçok gelenek bulunmaktadır. Çalışma kapsamında incelenecek olan 'toprağı bol olsun" deyimi de geçmişten bugüne gelmeyi başarmıştır. "Toprağı bol olsun" deyimi önemli kişilerin Tümülüslere gömülmesiyle başlamıştır. Nasıl ki Frig Kralı Midas bir tümülüse gömülmüş ve üzerine bol bol toprak atılmıştır, yüzyıllardır da ölen kişiler gömülürken sevenleri üzerine bol bol toprak atarak kişinin ne kadar değerli ve önemli olduğunu göstermektedirler. Çalışmanın amacı, kültürel bir aktarım olan, günümüzde hala kullanılan, ölen kişinin değerini ve önemini simgeleyen "toprağı bol olsun" deyiminin geçmişten bugüne hikayesini anlatmaktır.

Anahtar Kelimeler: Gelenek, Tümülüs, Toprağı Bol Olsun.

TRACES OF THE PAST IN TRADITIONS: FROM TUMULI TO EARTH

Abstract

It is known that various societies and cultures belonging to these societies lived in the same lands at different times throughout the historical process. These societies have entered into cultural interaction over time and have influenced and influenced each other. There are many traditions such as dowry chests, red carpets, vows, and health centers that have been transmitted culturally from past to present. The phrase 'may he have plenty of land', which will be examined within the scope of the study, has also managed to come from the past to the present. The phrase "May he have plenty of land" started with important people being buried in tumuli. Just as the Phrygian King Midas was buried in a tumulus and a lot of soil was thrown on him, for centuries, when the deceased were buried, their loved ones threw a lot of soil on them to show how valuable and important the person was. The aim of the study is to tell the story of the phrase "may he have plenty of land", which is a cultural transfer, still used today, and symbolizes the value and importance of the deceased, from past to present.

Keywords: Tradition, Tumulus, May It Have Plenty of Land.

Giriş

Hayatın en acı gerçeği kabul edilen ölüm, soğuk ve tatsız olması sebebiyle en az tercih edilen sohbet konusudur. Ölüm karşısında çok şey hissedilmekte, az şey söylenmektedir. Duygu taşkınlıkları ancak atasözü, deyimlerin, kalıplaşmış sözlerin, ağıtların, mersiyelerin, taziyetnamelerin içinde kendine yer bulmaktadır (Ergun, 2013: 134).

Ölü defnedildikten sonra her aileden büyükler baş sağlığına cenaze sahiplerine ve yakınlarına giderek acılarını hafifletmeye, paylaşmaya ve onları teselli etmeye çalışırlar. Ölümün Allah'ın emri olduğunu hatırlatarak ölüm acısını paylaştığını Başınız sağ olsun, Ölüm Allah'ın emri, Kepeği Gitmiş, Ölüme çare olmaz, Toprağı bol olsun, Allah rahmet etsin, Ölüm girmeyen ev olmaz, Eceli bugün bu saatmiş ve Ölenle ölünmez gibi dua ve temenni niteliğinde sözler ifade edilmektedir (1914).

Toprağı bol olsun ifadesi, Türkçede çoğunlukla gayrimüslimler için kullanılan ve "ruhu sükûn içinde olsun" anlamında kullanılan bir sözdür (Çağlar ve Kalkan, 2021: 472). "Toprağı bol olsun" sözü Hıristiyan gelenekleri ve inançları ile ilintili bir söylemi oluşturmaktadır (Dalkılıç, 2018: 138).
Gayri müslimler için kullanılan "Toprağı bol olsun" söyleminin yanında, Müslüman bir kişi i çin bu söz kullanılıyorsa aslında o kişinin inancının olmadığı da ima edilmektedir (Ergönenç, 2019: 514). 'Toprağı bol olsun' sözü, hayatımıza Hıristiyanlardan geçmiş fakat Türk kültürüne aitmiş gibi yanlış bir şekilde kullanılmaktadır (Tansü ve Turgut, 2020: 420).

Toprağı bol olsun "Hayırla anılacak kişiydi; rahat uyusun" anlamında kullanılmaktadır (Türkmen, 2009: 135). Osmanlı kültüründe azınlıklarla bir arada yaşamaktan kulak aşinalığı olmasının yanında, Türk sözlü kültürünün bilinçaltı kalıplarına girmesine ve günlük hayatta yadırganmadan kullanılmasına sebep olmuştur (Ergun, 2013: 144).

Gayrimüslimlerin ölmüşleri için kullanıldığı bilinen ve Türkçe Sözlükte de "Müslüman olmayanlar için "ruhu sükûn içinde olsun" anlamında söylenen bir söz" olarak tanımlanan "toprağı bol olsun", Tunceli'den derlenmiş olan bu örnekte Müslüman kaynak kişi tarafından ölmüş ninesine hayır dua etmek maksadıyla söylenmektedir.

"nenem anama diiḏi: ana kurban dėrdi: siz baḫasız bu ḳızın sonŭna. (...) torpağı bol olsun."

Van'dan derlenmiş olan bir örnekte de "toprağın bol olsun yap" ifadesi, cenazeye katılanların sırayla mezara toprak atması âdetinin adı olarak kullanılmıştır. Burada bahsedilen de yine bir Müslüman cenazesidir. Toprak atma ritüeliyle birlikte "Toprağı bol olsun" duası eylem yoluyla edilmiş olur. Aynı zamanda ölünün ardından çok fazla üzülüp, ağlayan bir yakını varsa acısını azaltmak için o kişinin başına taze mezarın toprağından saçma pratiği de anlatılmaktadır. Bu örnekte geçen tüm toprak kelimeleri "mezar toprağı" anlamında kullanılmıştır (Bal, 2023: 258).

Türkiye, Niğde iline bağlı Çamardı' da halk tarafından sevilen iyi kimseler vefat ettikleri zaman o kimseler için "Toprağı bol olsun." ifadesi kullanılmaktadır (Yalçın, 2015: 35).

Kırgızcada ölen kimseyi anarken ya da yakınlarına başsağlığı dilerken "mezarı rahat olsun, yumuşak toprakta yatsın, toprağı bol olsun" anlamlarında söylenen alkış sözlerdendir. Bilindiği üzere Türkler, insanların öbür dünyada da hayatlarını sürdürebileceğine, dünyadaki eşyalarından, atından, yiyecek ve içeceklerinden, hatta eşi, hizmetçileri ve öldürmüş oldukları düşmanlarından faydalanabileceğine inanmışlar ve mezarını da ölenin öteki dünyadaki evi olarak görüp buna göre hazırlamışlarıdır. Eski Türklerce yapılan bu adet ve uygulamaların izleri, bugün de Kırgızlar arasında yaygın görülmektedir. Günümüzde de Kırgızlar mezarın hazırlanışına (genişliğine, toprağının yumuşaklığına) ve naaşı yerleştirirken altının yumuşak olmasına çok dikkat etmektedirler (Orozobaey, 2013: 213).

Türk geleneklerinde önderlerini anmak ve unutturmamak için zengin ve çeşitli tipolojilere sahip anıt mezarlar inşa edilmiştir. Türk anıt mezar mimarisinin ilk örneklerine "kurgan" denilirken, yaygın adıyla Anadolu'da türbe olarak adlandırılan anıt mezarlar zaman içinde, "kümbet, makam, meşhed, buk'a, darîh, kubbe, ravza" gibi isimler almışlardır. Türk tarihinin ilk anıt mezarı olan kurgan, zeminin kazılıp etrafının tomruklarla çevrilmesi, içine oda veya odaların yapıldıktan sonra üzerinin yine tomruklardan sıyrılan dal, çalı veya benzeri malzemeyle kapatılmasıyla oluşturulan tavanın üzerlerine toprak atılmasıyla meydana gelen tümseklerdir. Halk arasında "toprağı bol olsun" tabirini kurganla ilişkilendirmek de mümkündür. Zira kurganın (toprak tümseğin, tepecek) yüksekliği, obanın büyüklüğünü ve o öndere duyulan saygı ve sevgiyi göstermektedir (Dere, 2023: 204).

Ölü gömme geleneğinde günümüze kadar gelen en bilindik söylemlerden biri, insanın topraktan yaratıldığı ve tekrar ona döneceğidir. İnsanın hangi topraktan yaratıldıysa tekrar o toprağa gömülmesi, toprağın onu çekmesi gibi inanışlar, ölümle birlikte çürümeye başlayan bedenin bir an önce gömülmesinin tinsel karşılığıdır. Örneğin, Alevi Türklerde ölünün defnedilmesi, toprağın sırlanması şeklinde ifade edilmektedir. Ölünün gömülmesinde orada hazır bulunan uzak-yakın pek çok kişinin toprak bırakması, bir helallik verme ritüeli olarak kabul edilip toprak atanın çok olsun duasında karşılık bulmuştur. Mezarın üzerinin örtülmesi safhasındaki bu ve benzeri ritüellerin toprağı bol olsun söylemiyle karşılık bulması ile tümülüslü mezarlar arasında ilişki kurulmaktadır (Kef, 2022: 990).

TÜMÜLÜS

MM Tümülüsü 300 metre çapında ve 50 metre yüksekliğinde olup Gordion'daki tümülüslerin en büyüğüdür. Tümülüs, zemin üzerine oturtulmuş ahşap bir odadan oluşmaktadır. Ahşap oda mezarın üzeri toprakla örtülmüştür. Tümülüsten ölü hediyeleriyle birlikte bir insan iskeleti çıkarılmıştır. 1957 yılı Gordion Kazı raporunda iskeletin 60 yaşlarında ve 1,59 boylarında bir erkeğe ait ve Kral Midas olduğunu düşündüklerini açıklamıştır. Gordion'da 1982 yılında yürütülen kazılarda MM tümülüsünün MÖ 7. yüzyıl başlarına ait olduğunu ve mezar odasındaki ahşap sedye parçasının üzerinde hayvan figürlü ve hafif oyulmuş panoların bulunduğunu aktarmıştır. Mezar odasının dış duvarlarını çevreleyen ahşap kütükler üzerinde yapılan tarihlendirme çalışmalarında MM tümülüsünün MÖ 740 yılında inşa edildiği tespit edilmiştir. Tarihlendirme çalışması tümülüsün Kral Midas'a ait olma ihtimalini ortadan kaldırmaktadır. Kral Midas (yaklaşık MÖ 740-696) yılları arasında yaşamıştır. Buradan MM tümülüsünün 60 yaşlarındayken ölmüş Midas'ın babası Kral Gordias için yapıldığı anlaşılmaktadır (Mandaloğlu, 2024: 325).

Yassıhöyük Köyü'nün doğusundaki geniş vadide Gordion'da yaşamış olan Frig krallarının aile bireyleri ile varlıklı kişiler için yapılmış olan tümülüsler dağınık bir şekilde bulunmaktadır. Bunlar üstleri yığma toprak tepeciklerle örtülmüş ve ağaçtan yapılmış oda şeklindeki mezarlardır. Bu tümülüslerin sayısı 80'nin üzerindedir (İdil, 1993: 98).

Büyük Tümülüs(Tümülüs MM)

Gordion'daki Frig Tümülüslerinin en büyüğü yaklaşık olarak 300 m. çapında ve 53 m. yüksekliğindeki Midas Tümülüsü de denilen Büyük Tümülüs'tür; bu, Anadolu Tümülüslerinin, Lydia'daki Alyattes Tümülüs'ünden sonra en büyük olanıdır" (Sevin, 1982:261). "Yığma toprak kütlesinin altındaki bu mezar ardıç ve sedir ağacı tomruklarının yatay olarak üst üste konulmasıyla yapılmış olan bir mezar odası ile bunun etrafını çeviren poros taşından yapılmış bir duvardan oluşmuştur. Taş duvar ile mezar odasını ahşap duvarlarının arası moloz taşlarla doldurulmuştur. Mezar odasının içi düzgün kirişlerle biçimlendirilmiş ve ölü ile hediyeleri yerleştirildikten sonra yandaki kirişlerin de desteğiyle

üzerine üçgen çatı oluşturulmuştur. Daha sonra bunun üzeri çakıl taşlarıyla doldurulup sağlamlaştırılmış ve üzerine yine ağaç kütüklerinden yapılmış olan ikinci bir düz çatı konmuştur. Bu çatının üzerine yaklaşık 4 m. yüksekliğine değin taş doldurulmuş ve orada da killi bir toprak tabakası oluşturulduktan sonra üzerine esas toprak yığılmıştır" (İdil, 1993:99).

" Mezar odası, olağan Frig tipinden farklıdır. Yer altına kazılan bir çukurun içine değil de toprak düzeyine yapılmıştır. Mezar odasında büyük bir yatak üzerinde bulunan iskelet, altmış yaşını aşkın ve yaşamı sırasında 1.59 m. boyunda olan kısa boylu bir erkeğe aittir. Odada çok sayıda ölü hediyeleri ele geçirilmiştir. Bunlar arasında dokuz masa, iki kakma paravan, üç büyük bronz kazan ve 166 adet küçük bronz kap parçası ile 154 fibula (çengelli iğne) bulunmaktadır. Eserlerin çoğunluğu ;Ankara Anadolu Medeniyetleri Müzesi'ndedir; küçük bir bölümü ise Gordion'daki yerel müzede sergilenmektedir"(Akurgal, 1998a: 433,434).

"Gordion'daki bu büyük tümülüsün kazısını gerçekleştiren Amerikalı Profesör Radney S. Young, mezarda ele geçen bazı eserlerin sitiline göre mezarın kral Gordios'a ait olabileceğini ve bu nedenle de M.Ö, 725-720 yılları arasında yapılmış olduğunu düşünmüştür. Ancak yine mezarda bulunan bronz Urartu kazanlarından birisinin yuvarlak kulplarının ve protonlarının kuş kuyruğu şeklindeki alt kısımlarının eksik oluşu bu kazanın oldukça uzun bir süre kullanıldıktan sonra mezara konulduğunu göstermekte ve ayrıca bazı stil özellikleri de mezarın M.Ö. 696 yılında ölen Kral Midas'a ait olduğu konusundaki düşüncemizi güçlendirmektedir. Çünkü Kimmerler'in saldırısı Gordion'daki Frig egemenliğini hemen yok etmemiştir. Antik kentteki Frig kültürü bir süre daha devam etmiştir ve Frigler de ünlü kralları Midas'ın ölümünde sonra ona bu anıtsal mezarı yaptırmışlardır.(İdil, 1993:99).

Tümülüs P

"Gordion'da Büyük Tümülüs'ün batısındaki başka bir tümülüs de Korte kardeşlerin 1900'lerde kazdığı P tümülüsü denilen çocuk mezarıdır. 12 m. yükseklikte ve 80 m. genişliğindeki tümülüste bulunan bu mezarda iskelet dağılmıştır. Bulunan aslan, at, koşan geyik gibi eşyalar da bu çocuğun oyuncakları olmalıdır. Ayrıca burada bulunan 40 toprak kap ve hayvan biçimli kaplar ile dağın tepesinde ve diğer tümülüslerde ele geçen eserler Gordion ve Ankara Anadolu Medeniyetleri Müzeleri'nde sergilenmektedir" (Akşit, 1997:150).

Sonuç

'Toprağı Bol Olsun' deyiminin genellikle Hıristiyanlıktan geldiği ve gayri Müslimler için kullanıldığı gibi yanlış bir algı oluşmuştur. Oysaki tamamen kültürel aktarımla Friglerden bugüne kadar kullanıla gelmiş ölen kişinin ne kadar önemli ve değerli bir kişi olduğunu ifade eden bir söylemdir. Sadece gayri Müslimlerde değil tüm ölülerin arkasından söylenmektedir. Kökleri defin yapan kişilerin kendilerince çok değerli olan ölenlerinin üzerine ne kadar çok toprak atarlarsa o kadar değerli olduğuna inanarak oluşturdukları Tümülüslere dayanmaktadır.

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KOMPLEKSİTE VE TÜKETİCİ DAVRANIŞLARI

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ÖZET

Kompleksite, ekonomi gibi çeşitli alanlarda ortaya çıkan gelişmelerin bir toplamı olarak, kompleks sistemleri "bütüncül" bir yaklaşımla ele almaktadır. Tüketici davranışları da kompleks bir yapıya sahiptir. Araştırma, tüketicilerin karar verme süreçlerindeki detaylar ve çok sayıda seçeneğin olduğu pazarlarda bu faktörlerin tüketicilerin davranışlarını nasıl etkilediğini ele almaktadır. Kompleks bir yapıya sahip olan tüketici davranışlarını etkileyen birçok faktör vardır. Artan ürün ve hizmet çeşitliliği, tüketicilerin karmaşıklık algısını artırarak karar yorgunluğuna neden olabilmektedir. Bu bağlamda, karmaşıklık ve satın alma davranışları arasındaki ilişki, pazarlama stratejilerinin etkinliği ve tüketici memnuniyeti üzerindeki etkileri ele alan önemli soruları gündeme getirmektedir. Çalışmada Engel-Kollat-Blackwell (EKB) Modelinden faydalanılmıştır. Engel-Kollat-Blackwell Modeli, tüketicilerin karmaşıklık algısı ve dürtüsel davranışları arasındaki bağlantıyı anlamada kullanılan önemli modellerden biridir. Bu çalışmada veriler doğrulayıcı örnekleme yöntemiyle elde edilmiştir. Katılımcılar, çalışma konusuyla ilişkili olarak belirli bir zaman diliminde plansız satın alma davranışı sergilemiş olmaları esas alınarak seçilmişlerdir. Çalışmanın analizi MAXQDA.24 programı kullanılarak gerçekleştirilmiştir. Bu çalışma, Engel-Kollat-Blackwell (EKB) Modeli'ni temel alarak tüketici davranışlarının karmaşık yapısnı anlamaya yönelik nitel bir analiz sunmuştur. Katılımcı ifadeleri, tüketici tercihlerinin yalnızca fiziksel ihtiyaçlara dayalı rasyonel kararlar değil, aynı zamanda duygusal, sosyal ve çevresel faktörlerle şekillendiğini göstermektedir. Araştırma bulguları, satın alma süreçlerinin çok boyutlu bir yapıya sahip olduğunu ve bu süreçlerin hem bireysel motivasyonlar hem de dışsal uyaranlar tarafından etkilendiğini ortaya koymaktadır.

Anahtar Kelimeler: Engel-Kollat Blackwell Modeli, Tüketici tercihleri, Kompleksite

COMPLEXITY AND CONSUMER BEHAVIOR

ABSTRACT

Complexity is a collection of developments in various fields such as economics, and deals with complex systems with a "holistic" approach. Consumer behavior, likewise, exhibits a complex structure. This research addresses the details of consumers' decision-making processes and how these factors influence behavior in markets with numerous available options. There are multiple factors influencing consumer behavior that possesses a complex structure. The growing diversity of products and services may increase consumers' perception of complexity,

potentially leading to decision fatigue. In this context, the relationship between complexity and purchasing behavior raises significant questions regarding the effectiveness of marketing strategies and their impact on consumer satisfaction. The study utilized the Engel-Kollat-Blackwell (EKB) Model. The EKB Model is among the important frameworks used to understand the relationship between consumers' perception of complexity and their impulsive behaviors. Data for this research were obtained through the confirmatory sampling method. Participants were selected on the basis of having engaged in unplanned purchasing behavior within a specific period related to the research topic. The analysis was conducted using MAXQDA 24 software. This study, based on the EKB Model, presents a qualitative analysis aimed at understanding the complex nature of consumer behavior. Participant statements indicate that consumer preferences are shaped not only by rational decisions based on physical needs but also by emotional, social, and environmental factors. The findings reveal that purchasing processes have a multidimensional structure and are influenced by both individual motivations and external stimuli.

Keywords: Engel-Kollat-Blackwell Model, Consumer Preferences, Complexity

GİRİŞ

Kompleksitenin (Karmaşıklık) ve karşıtı olan basitliğin ne anlama geldiğine dair tüm sezgisel kavramlarımızı kapsamak için pek çok farklı kavram gerekirdi. Ancak günlük konuşmada ve çoğu bilimsel söylemde anlamla en iyi uyuşan kavram, etkili karmaşıklıktır. Kabaca, bir varlığın etkili karmaşıklığı, düzenliliklerinin çok özlü bir tanımının uzunluğudur. Bu nedenle, birçok farklı alt parça, sahne ve karaktere sahipse yeni bir karmaşık olarak adlandırılır. Benzer şekilde, uluslararası bir holding şirketi, farklı ülkelerde farklı ürünlere, yönetim tarzlarına vb. sahip birçok farklı şubeye sahipse karmaşıktır (Gell-Mann, M. 2002:13).

Kompleks bir yapıya sahip olan iktisat, kompleksite iktisadı, etmenlerin farklı olduğunu, diğer etmenler hakkında eksik bilgiye sahip olduklarını ve bu nedenle karşılaştıkları durumu anlamlandırmaya çalışmaları gerektiğini varsayar. Etmenler, birlikte yarattıkları sonuçlara yanıt olarak eylemlerini ve stratejilerini sürekli olarak keşfeder, tepki verir ve değiştirirler (Arthur, W.B. 2021:136).

İktisatta tüketim olgusu da kompleks bir yapıya sahiptir. Çünkü tüketici davranışları, kişilerin aldığı kararlar sonucunda ortaya çıkar. Kişilerin aldığı kararlar da stabil değildir. Farklı faktörlerden etkilenir ve diğer kişileri de etkiler.

Günümüz tüketim ortamı, artan ürün çeşitliliği ve dijitalleşmenin etkisiyle daha önce olmadığı kadar karmaşık bir hale gelmiştir. Ürün portföylerinin genişlemesi, firmalar açısından rekabet avantajı yaratmanın önemli bir aracı olarak görülürken; tüketiciler açısından bilgi yükünü artırmakta ve karar verme süreçlerini daha zahmetli hale getirmektedir (Kotler, 1997: 172).

Arenas, Sanz ve Ramirez (2019), tüketici davranışlarının karmaşık sistemler içerisinde gerçekleştiğini ve bu nedenle tüketici motivasyonlarını ve satın alma davranışlarını anlamanın güç olduğunu vurgulamaktadır. Çalışmada, artan ürün çeşitliliği ve değişen talepler karşısında pazarlamacıların stratejilerini bu karmaşıklığa uyum sağlayacak şekilde yeniden yapılandırmaları gerektiği ifade etmişlerdir.

Asriyan, Foarta ve Vanasco (2020), karmaşıklığın, tüketicilerin bir ürünün kalitesi hakkında bilgi edinme maliyetini etkilediğini ortaya koymuştur. Tüketici ile tasarımcı arasındaki uyum arttıkça, ürünlerin daha karmaşık ancak daha yüksek kaliteli hale geldiği belirtilmiştir. Buna karşılık, talebin yüksek olması ya da rekabetin düşük olması durumunda, ürünlerin hem daha karmaşık hem de daha düşük kaliteli olma eğiliminde olduğu vurgulanmıştır.

Tretyak ve Bakulin (2023), Engel-Kollat-Blackwell modelini eğitim hizmetleri bağlamında tüketici davranışlarını analiz etmek amacıyla kullanmıştır. Çalışmada, dışsal faktörler (motivasyon, algı) ile içsel faktörlerin (ekonomik ve sosyal unsurlar) karar verme süreci üzerindeki etkileri incelenmiştir. Ayrıca, eğitim kurumlarının tercih edilmesinde pazarlama stratejilerinin belirleyici rolüne dikkat çekmiştirler

Gantulga (2023), plansız satın alma davranışlarının içsel ya da dışsal tetikleyiciler sonucu ortaya çıktığını belirtmektedir. Çalışma bulgularına göre, keyif alma eğilimi, dürtüsellik eğilimi, mağaza kalabalıklığı, arkadaşlar ve aile üyeleri gibi sosyal çevre faktörleri, dürtüsel satın alma davranışını anlamlı düzeyde etkilemektedir.

Nyrhinen, Sirola, Koskelainen, Munnuka ve Wilska (2023), dürtüsel satın alma davranışını, satın alma kararından hemen önce gerçekleşen plansız alımlar olarak tanımlamaktadır. Çalışmada, Delhi/NCR bölgesindeki kentsel tüketiciler arasında bu süreci incelenmiş; cinsiyet, yaş ve gelir gibi demografik faktörlerin yanı sıra, kişilik özellikleri ve görsel mağaza düzenlemeleri gibi psikografik unsurların da dürtüsel satın alma üzerinde etkili olduğu ortaya koymuştur.

Agustinna ve Sudarusman (2024), hedonik alışveriş motivasyonunun dürtüsel giyim satın alma davranışları üzerinde etkili olduğunu bulgulamıştır. Çalışmada, alışveriş yaşam tarzı ve modaya yönelik ilgi düzeyinin de dürtüsel satın alma davranışı üzerinde anlamlı bir etkiye sahip olduğu ifade edilmiştir. Özellikle öğrenciler arasında bilinçdışı şekilde ortaya çıkan bu davranışın; hedonik alışveriş motivasyonu, alışveriş yaşam tarzı ve modaya olan ilgi gibi faktörlerden etkilendiği vurgulanmaktadır.

Sheoran (2024), dürtüsel satın alma davranışını, tüketicilerin ürün özelliklerinden ziyade marka tercihi ve markaya olan bağlılık gibi etkenlerin etkisiyle gerçekleştirdiği plansız satın alımlar olarak tanımlamaktadır. Çalışmada, Hindistan'ın Haryana bölgesindeki tüketicilerin büyük bir kısmının özellikle gıda ve içecek ürünleri bağlamında bu tür davranışlar sergilediği bulgulanmıştır.

Bu çalışmada da, **Engel-Kollat-Blackwell (EKB) Modeli** temelinde, **MAXQDA 24** nitel veri analiz programı kullanılarak tüketici tercihlerini, karar verme süreçlerini etkileyen faktörleri tespit etmeyi amaçlamıştır.

TÜKETİCİ DAVRANIŞLARI VE KARMAŞIKLIK

Davranışsal ekonomi, psikoloji ve ekonomik teorileri bir araya getirerek tüketicilerin rasyonel kararlardan sapmasının nedenlerini inceleyen bir disiplindir. Özellikle tüketicilerin irrasyonel davranışlarının açıklanmasına odaklanır. (Kahneman ve Tversky, 1979: 279). Tüketicilerin rasyonel ya da irrasyonel davranışları çok boyutlu ve dinamik bir yapıya sahiptir. Bu süreçte tüketiciler, bilgi toplama ve değerlendirme aşamalarında sıklıkla bilişsel önyargılardan ve sezgisel yollarından yararlanarak kararlarını şekillendirmektedir. Klein (2025) tarafından belirtildiği üzere, bu süreç içsel faktörlerin yanı sıra kişiler arası dinamikler ve demografik farklılıklar gibi dışsal faktörlerden de etkilenmektedir. Dolayısıyla kompleks bir yapı söz konusudur.

Ürün çeşitliliğinin artışı, günümüzde şirketlerin karşılaştığı temel organizasyonel karmaşıklık unsurlarından biri haline gelmiştir. Dirwan ve Latief'e (2023) göre, son beş yıl içerisinde birçok işletme ürün portföyünü genişletmiş, bu durum ise operasyonel süreçlerdeki karmaşıklığı belirgin biçimde artırmıştır. Özellikle tüketim malları sektöründe faaliyet gösteren firmalar, yenilik beklentilerine yanıt vermek adına ürün çeşitliliğini stratejik bir zorunluluk olarak görmekte; bu da rekabet avantajını sürdürme çabasını beraberinde getirmektedir. Ancak, artan

çeşitlilik yönetimsel anlamda önemli zorluklar yaratmakta ve karar alma süreçlerinin etkinliğini azaltabilmektedir. Bu bağlamda, ürün çeşitliliği bir yandan müşteri taleplerine yanıt verme kapasitesini artırırken, diğer yandan işletmelerin sürdürülebilir verimlilik ve stratejik uyum sağlamasını güçleştiren bir unsur olarak değerlendirilmektedir. Karmaşıklığın işletme performansı üzerindeki etkilerini inceleyen teorik çalışmalar hâlâ gelişmekte olup, karmaşıklığın maliyet, kalite ve esneklik gibi işletme fonksiyonları üzerindeki etkileri net olarak anlaşılamamıştır (Dirwan ve Latief, 2023: 2).

Karmaşıklığın Satın Alma Davranışı Üzerindeki Etkisi

Finansal olarak yüksek maliyetli ve risk içeren satın alma durumlarında tüketiciler, karar verme süreçlerine yüksek katılım gösterirler ve kapsamlı araştırma faaliyetlerinde bulunurlar (Dittmar, 2004: 411). Bu bağlamda tüketicilerin otomobil satın alımı gibi kritik kararlarda güvenlik, yakıt verimliliği ve marka imajı gibi çeşitli özellikleri titizlikle değerlendirdikleri gözlemlenmektedir. Bu durum, tüketicilerin finansal riskleri minimize etmek ve satın alma sonrası olası pişmanlıkları azaltmak amacıyla kararlarını detaylı ve bilinçli bir şekilde şekillendirdiklerini göstermektedir. Bunun için bilgiye ulaşmak önemlidir.

Bilgi arama süreci genel olarak iki farklı boyutta ele alınabilir: içsel arama ve dışsal arama. İçsel arama süreci, tüketicinin geçmiş deneyimleri ve mevcut bilgi birikimine dayanırken, dışsal arama süreci arkadaş çevresi, aile üyeleri, medya ve diğer çeşitli kaynaklardan bilgi edinimini kapsar. Bu çift boyutlu bilgi arama süreci, özellikle tüketicilerin finansal ve psikolojik açıdan önemli gördüğü satın alma kararlarında, bilgiye duyulan ihtiyacın kapsamlılığını ve önemini ortaya koymaktadır. Yeterli düzeyde bilgi ediniminin ardından tüketiciler, satın almayı düşündükleri alternatifleri fiyat, kalite ve özellik gibi kriterlerle kapsamlı bir değerlendirme sürecine tabi tutarlar (Klein, 2025). Bu değerlendirme, her ne kadar objektif kriterlere dayalı görünse de, bilişsel önyargılar ve sosyal etkiler gibi faktörlerin etkisine açık olup, tüketicilerin karar alma süreçlerinde karmaşık ve öznellik içeren unsurların varlığını ortaya koymaktadır.

ENGEL-KOLAT- BLACKWELL MODELİ

EKB Modeli, tüketici karar alma süreçlerini açıklamaktadır. Blackwell, Miniard ve Engel (2006) EKB modelini yedi aşamada ele almışlardır. Bu aşamalar şu şekilde özetlenebilir:

- İhtiyaç Tanıma: Bu ilk aşamada tüketici, bir ürün veya hizmete yönelik ihtiyacını veya problemini fark eder. İhtiyaç tanıma, içsel uyaranlardan (örneğin açlık, susuzluk) veya dışsal uyaranlardan (örneğin reklamlar, sosyal çevre) kaynaklanabilir (Tan, 2010:64). Günümüz dijital ortamında sosyal medyanın tüketici ihtiyaçlarının tanınmasında önemli bir dışsal uyaran olarak ortaya çıktığı görülmektedir.
- Bilgi Arama: İhtiyaç belirlendikten sonra ikinci aşamada tüketici, potansiyel çözümler hakkında bilgi toplamaya başlar. Günümüzde teknolojik imkanların fazlalığı bilgiye ulaşımı kolaylaştırmıştır. Böylece tüketiciler, ihtiyaç duydukları mallar hakkında daha bilinçli ve detaylı araştırma yapabilmektedirler.
- Alternatiflerin Değerlendirilmesi: Tüketiciler bu aşamada, ihtiyaç duyduğu mal/mallar hakkında geniş bir değerlendirme yapar. Böylece alternatifler arasından seçim yapabilir. Dijitalleşme, tüketicilere daha geniş karşılaştırma olanakları sunarak değerlendirme aşamasını daha kritik hale getirmektedir.

- Satın Alma Kararı: Alternatifleri değerlendirdikten sonra tüketici, en uygun seçeneği belirleyerek satın alma kararını verir. Bu aşamada tüketici, tercih ettiği ürünü satın alma konusunda hâlâ tereddüt yaşayabilir. İşletmeler, tüketici güvenini artırmak ve belirsizlikleri azaltmak amacıyla garantiler, iade politikaları ve etkin müşteri hizmetleri gibi çeşitli stratejiler uygularlar (Gupta, 2024). Özellikle alışverişte tüketici güvencesi sağlayan unsurların satın alma kararını büyük oranda etkilediği gözlemlenmektedir.
- Tüketim: Satın alınan ürün veya hizmet tüketici tarafından kullanılır. Bu kullanım sonucunda ürünün tüketicinin ihtiyacını karşılama kapasitesini göstermesi açısından önemlidir.
- Satın Alma Sonrası Değerlendirme: Satın alma işleminden sonra tüketici, ürün veya hizmet hakkındaki memnuniyet düzeyini değerlendirir. Bu değerlendirme, tüketicinin gelecekteki davranışlarını etkileyebildiği gibi, diğer tüketiciler üzerinde de etkili olur. Günümüzde sosyal medyanın etkisiyle, satın alma sonrası değerlendirmeler daha geniş kitlelere ulaşarak marka imajını hızlı ve derinden etkileyebilmektedir.
- Elden Çıkarma: Ürünün kullanım ömrünü tamamladıktan sonra tüketici, ürünü satmak, bağışlamak veya geri dönüşüme göndermek gibi çeşitli yöntemlerle elden çıkarabilir. Bu aşamanın döngüsel ekonomi açısından önemi yüksektir. Elden çıkarma kullan-at anlayışıyla olmamalıdır. Çevresel kaygıların ve sürdürülebilirliğin giderek önem kazandığı günümüzde elden çıkarma döngüsel ekonomi anlayışı içerisinde, Kullan; tamir et-geri dönüştür-yeniden kullan-dönüştür-üret olmalıdır.

  EKB Modeli, tüketicilerin yalnızca rasyonel karar alıcılar olmadığını ve kararlarının kişisel deneyim, duygusal durumlar ve sosyal etkiler gibi birçok faktörden etkilendiğini vurgulamaktadır (Fiveable, 2023). Bu kapsamlı yaklaşım, pazarlama alanındaki uygulayıcılar ve akademisyenler tarafından tüketici davranışlarını analiz etmek için önemli bir kuramsal çerçeve olarak değerlendirilmektedir. Özellikle tüketici karar süreçlerinin karmaşık yapısını açıklamada sıklıkla başvurulan EKB modeli dijitalleşmenin ivme kazandığı günümüzde, çevrimiçi tüketici davranışlarının ve dijital platformlardaki satın alma karar süreçlerinin anlaşılmasında da etkin bir analiz aracı olarak kullanılmaktadır (Tan, 2010:63).

ARAŞTIRMA YÖNTEMİ

Bu çalışmada, **Engel-Kollat-Blackwell (EKB) Modeli** temel alınmıştır. Araştırmada veri toplama süreci, plansız satın alma davranışı sergileyen tüketiciler aracılığıyla gerçekleştirilmiştir. Katılımcıların belirlenmesinde, **doğrulayıcı örnekleme yöntemi** tercih edilmiştir. Bu doğrultuda, son dönemde plansız satın alma davranışında bulunmuş olan toplam 15 kadın ve 15 erkekten oluşan **30 katılımcı** araştırma örneklemini oluşturmuştur.

Elde edilen veriler, MAXQDA nitel veri analiz yazılımı kullanılarak analiz edilmiştir. Bu süreçte, katılımcıların verdikleri yanıtlar EKB Modeli'nin yedi aşaması referans alınarak temalaştırılmıştır. İhtiyaç tanıma, bilgi arama, alternatiflerin değerlendirilmesi, satın alma kararı, tüketim, satın alma sonrası değerlendirme ve elden çıkarma bu yedi aşamayı oluşturmaktadır. Çalışmada, katılımcı ifadelerinin yoğunlaştığı noktaları belirlemek amacıyla kod matrisi, davranışlar arasındaki ilişkileri görselleştirmek üzere ise kod haritası kullanılmıştır.

Bulgular

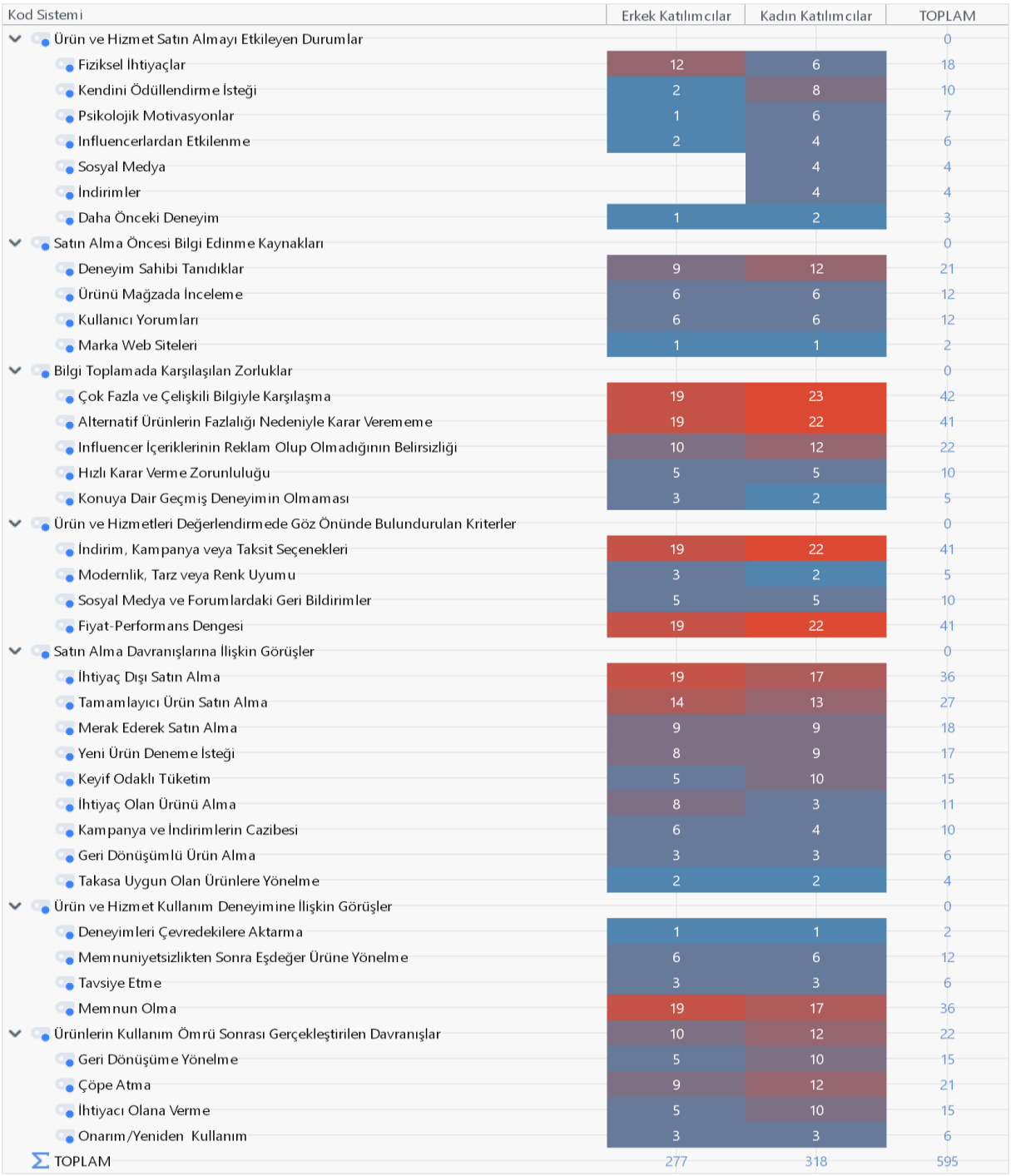
Çalışma kapsamında elde edilen bulgular, EKB modelinin tüm aşamalarında tüketici davranışlarının hem rasyonel hem de duygusal unsurlarla şekillendiğini ortaya koymuştur. **İhtiyaç tanıma** aşamasında fiziksel gereksinimler kadar kendini ödüllendirme ve psikolojik motivasyonların da etkili olduğu gözlemlenmiştir. **Bilgi arama** sürecinde kullanıcı yorumları ve tanıdık deneyimleri öne çıkarken, bilgi fazlalığı ve çelişkili içerikler karar sürecini

zorlaştırmaktadır. **Alternatiflerin değerlendirilmesi** aşamasında fiyat-performans dengesi ile indirim ve kampanyalar öncelikli kriterler olurken, estetik ve sosyal geri bildirimler de karar üzerinde etkili olmuştur. **Satın alma kararı** noktasında ise ihtiyaç dışı, tamamlayıcı ya da meraka dayalı alışverişlerin yaygın olduğu, bunun yanında kampanya ve indirimlerin davranışları yönlendirdiği görülmüştür. **Satın alma sonrası değerlendirmede** çoğunlukla memnuniyet bildirilmiş ve bu durum, yeniden satın alma ya da tavsiye etme davranışlarını desteklemiştir. **Elden çıkarma** aşamasında ise geri dönüşüm, ihtiyaç sahiplerine verme ve çöpe atma arasında dağılım gözlemlenmiş; sürdürülebilirlik bilincinin bazı bireylerde geliştiği, ancak yaygınlaşmadığı anlaşılmıştır. Tüm bu aşamalar birlikte değerlendirildiğinde, tüketici davranışlarının yalnızca ihtiyaç temelli değil, aynı zamanda duygusal, sosyal ve çevresel etmenlerle şekillendiği çok boyutlu bir yapıya sahip olduğu sonucuna ulaşılmaktadır.

Aşağıdaki Şekil 1'e göre;

-EKB modelinin "İhtiyaç Tanıma" aşamasına ilişkin analiz bulguları, kadın ve erkek katılımcıların satın alma süreçlerinde farklı güdülerle hareket ettiğini ortaya koymaktadır. Kadın katılımcılar özellikle **"Kendini Ödüllendirme İsteği"** kodunda daha yüksek yoğunluk göstermiştir. Bu durum, kadın tüketicilerin yalnızca fiziksel ihtiyaçlarını karşılamakla kalmayıp, aynı zamanda duygusal doyum ve kişisel tatmin arayışıyla da satın alma davranışlarını yönlendirdiklerini göstermektedir. Öte yandan erkek katılımcıların **"Fiziksel İhtiyaçlar"** kodunda daha yüksek yoğunluk göstermesi, erkek tüketicilerin ihtiyaç tanıma sürecinde daha işlevsel ve gereksinim temelli bir yaklaşıma sahip olduğunu göstermektedir. Bu farklılık, cinsiyete göre ihtiyaçların tanımlanmasında bilişsel ve duygusal yönelimlerin değişebileceğini ve pazarlama stratejilerinde bu ayrımın dikkate alınması gerektiğini ortaya koymaktadır.

-EKB modelinin "Bilgi Arama" aşamasına ilişkin analiz bulguları, kadın ve erkek katılımcıların bilgi edinme sürecinde sosyal temelli kaynaklara daha fazla yöneldiğini ortaya koymaktadır. Özellikle **"Deneyim Sahibi Tanıdıklar"** kodunda yoğunlaşan katılımcılar, bilgi arama sürecinde kurumsal kanallardan ziyade güven duydukları bireyler ve toplulukların deneyimlerine öncelik vermiştir.



Kod Sistemi	Erkek Katılımcılar	Kadın Katılımcılar	TOPLAM
Ürün ve Hizmet Satın Almayı Etkileyen Durumlar			0
Fiziksel İhtiyaçlar	12	6	18
Kendini Ödüllendirme İsteği	2	8	10
Psikolojik Motivasyonlar	1	6	7
Influencerlardan Etkilenme	2	4	6
Sosyal Medya		4	4
İndirimler		4	4
Daha Önceki Deneyim	1	2	3
Satın Alma Öncesi Bilgi Edinme Kaynakları			0
Deneyim Sahibi Tanıdıklar	9	12	21
Ürünü Mağzada İnceleme	6	6	12
Kullanıcı Yorumları	6	6	12
Marka Web Siteleri	1	1	2
Bilgi Toplamada Karşılaşılan Zorluklar			0
Çok Fazla ve Çelişkili Bilgiyle Karşılaşma	19	23	42
Alternatif Ürünlerin Fazlalığı Nedeniyle Karar Verememe	19	22	41
Influencer İçeriklerinin Reklam Olup Olmadığının Belirsizliği	10	12	22
Hızlı Karar Verme Zorunluluğu	5	5	10
Konuya Dair Geçmiş Deneyimin Olmaması	3	2	5
Ürün ve Hizmetleri Değerlendirmede Göz Önünde Bulundurulan Kriterler			0
İndirim, Kampanya veya Taksit Seçenekleri	19	22	41
Modernlik, Tarz veya Renk Uyumu	3	2	5
Sosyal Medya ve Forumlardaki Geri Bildirimler	5	5	10
Fiyat-Performans Dengesi	19	22	41
Satın Alma Davranışlarına İlişkin Görüşler			0
İhtiyaç Dışı Satın Alma	19	17	36
Tamamlayıcı Ürün Satın Alma	14	13	27
Merak Ederek Satın Alma	9	9	18
Yeni Ürün Deneme İsteği	8	9	17
Keyif Odaklı Tüketim	5	10	15
İhtiyaç Olan Ürünü Alma	8	3	11
Kampanya ve İndirimlerin Cazibesi	6	4	10
Geri Dönüşümlü Ürün Alma	3	3	6
Takasa Uygun Olan Ürünlere Yönelme	2	2	4
Ürün ve Hizmet Kullanım Deneyimine İlişkin Görüşler			0
Deneyimleri Çevredekilere Aktarma	1	1	2
Memnuniyetsizlikten Sonra Eşdeğer Ürüne Yönelme	6	6	12
Tavsiye Etme	3	3	6
Memnun Olma	19	17	36
Ürünlerin Kullanım Ömrü Sonrası Gerçekleştirilen Davranışlar	10	12	22
Geri Dönüşüme Yönelme	5	10	15
Çöpe Atma	9	12	21
İhtiyacı Olana Verme	5	10	15
Onarım/Yeniden Kullanım	3	3	6
TOPLAM	277	318	595

Şekil 1. Kadın ve Erkek Tüketicilerin Ayrımı Kod Matrisi

-EKB modelinin "Bilgi Toplamada Karşılaşılan Zorluklar" temasına ilişkin analiz bulguları, hem kadın hem de erkek katılımcıların yoğun şekilde bilgi fazlalığı ve alternatiflerin çokluğu karşısında zorluk yaşadığını göstermektedir. Kadın katılımcılar özellikle **"Çok Fazla ve Çelişkili Bilgiyle Karşılaşma"**, **"Alternatif Ürünlerin Fazlalığı Nedeniyle Karar Verememe"** kodlarında yüksek yoğunluk göstermiştir.. Bu bulgular, her iki cinsiyetin de bilgi yorgunluğu, alternatif bolluğu ve dijital içeriklerin güvenilirliğine dair kaygılar yaşadığını ortaya koymaktadır.

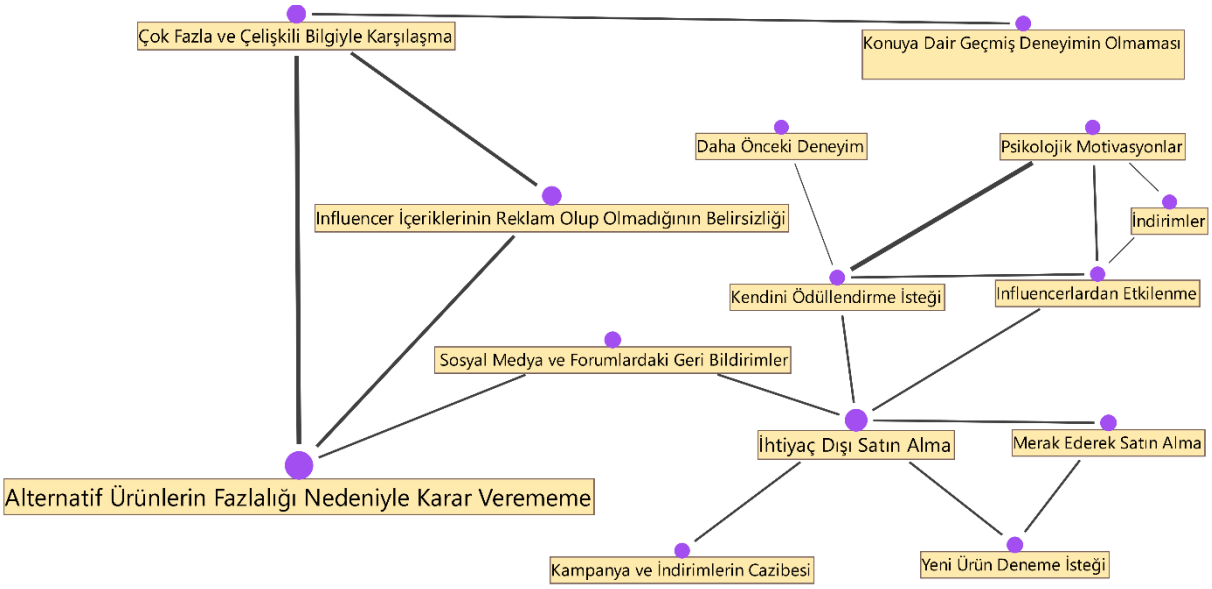
-"Alternatiflerin Değerlendirilmesi" temasına ilişkin bulgular, hem kadın hem de erkek katılımcıların ekonomik temelli değerlendirme kriterlerine öncelik verdiğini göstermektedir. Kadın katılımcılar, özellikle **"Fiyat-Performans Dengesi"** ve **"İndirim, Kampanya veya**

Taksit Seçenekleri” kodlarında yüksek düzeyde yoğunlaşmıştır. Benzer şekilde, erkek katılımcılar da bu iki kodda sırasıyla seviyesinde yer almıştır. Bu sonuçlar, her iki cinsiyetin de değerlendirme sürecinde maliyet-yarar analizi yaptığını ve satın alma kararlarını fiyat duyarlılığı, kampanya avantajları ve ürünün performans beklentisiyle uyumu üzerinden şekillendirdiğini ortaya koymaktadır.

-“Satın Alma Kararı” temasına ilişkin analiz bulguları, kadın ve erkek katılımcıların satın alma davranışlarında **duygusal, işlevsel ve hedonik motivasyonların bir arada etkili olduğunu** göstermektedir. Bu bulgular, her iki cinsiyetin de alışveriş sürecinde yalnızca rasyonel ihtiyaçlara değil, aynı zamanda içsel merak, tamamlayıcılık gereksinimi ve hedonik dürt**ülere** dayalı satın alma eğilimleri sergilediğini ortaya koymaktadır.

-EKB modelinin “Satın Alma Sonrası Değerlendirme” temasına ilişkin analiz bulguları, katılımcıların genel olarak satın alma kararlarına yönelik olumlu bir tutum geliştirdiklerini ortaya koymaktadır. Kadın katılımcılar arasında en yüksek frekans, **“Memnun Olma”** kodunda gözlemlenmiştir. Benzer şekilde, erkek katılımcılar da bu kodda yoğunluk göstermiştir. Bu bulgular hem kadın hem de erkek katılımcıların satın alma sonrasında kararlarından memnuniyet duyduklarını ve sürecin sonunda olumlu bir tüketici deneyimi yaşadıklarını göstermektedir.

-Son olarak “Elden Çıkarma” temasına ilişkin analiz bulguları, kadın ve erkek katılımcıların kullanım ömrü sona eren ürünleri değerlendirme biçimlerinde **pratik** hem de toplumsal sorumluluk bilinciyl**e** hareket ettiklerini göstermektedir. Kadın katılımcıların ürünleri elden çıkarma konusunda erkeklere göre daha işlevsel davrandıkları görülmektedir.



Kod haritası, katılımcı ifadeleri doğrultusunda oluşturulan kodlar arasındaki ilişkileri görsel olarak sunarak, temalar arası bağlantıların daha açık bir biçimde anlaşılmasına katkı sağlamaktadır. Kod haritası incelendiğinde, katılımcıların satın alma davranışlarının ardında yatan bilişsel ve duygusal süreçlerin birbiriyle yoğun biçimde ilişkili olduğu görülmektedir. **Alternatif Ürünlerin Fazlalığı Nedeniyle Karar Verememe** kodu, özellikle **Çok Fazla ve Çelişkili Bilgiyle Karşılaşma** ve **Influencer İçeriklerinin Reklam Olup Olmadığının Belirsizliği** gibi bilgi kirliliğine dayalı kodlarla doğrudan ilişkilidir. Bu durum, tüketicilerin karar verme sürecinde bilgi fazlalığı ve güven sorunları nedeniyle karmaşıklık yaşadıklarını ortaya koymaktadır.

İhtiyaç Dışı Satın Alma kodu, **Sosyal Medya ve Forumlardaki Geri Bildirimler**, **Kampanya ve İndirimlerin Cazibesi**, **Merak Ederek Satın Alma**, **Yeni Ürün Deneme İsteği**, **Kendini Ödüllendirme İsteği** ve **Influencerlardan Etkilenme** gibi çok sayıda motivasyonla doğrudan ilişkilidir. Bu bulgu, ihtiyaç dışı satın alma davranışlarının yalnızca bireysel dürtülerle değil, aynı zamanda sosyal ve dijital etkileşimlerle şekillendiğini göstermektedir. Ayrıca ihtiyaç dışı satın alma kodunun ilişkili olduğu kodlara hedonik davranışların tetikleyicileri olarak öne çıkmaktadır. Sonuç olarak, haritada yer alan kavramlar birbirini tamamlayarak tüketici davranışlarının çok boyutlu bir yapıya sahip olduğunu göstermektedir. Bilgi kirliliği, sosyal medya etkisi, deneyim düzeyi ve psikolojik ihtiyaçlar gibi değişkenler hem karar sürecini hem de satın alma davranışının niteliğini doğrudan etkilemektedir.

SONUÇ

Yapılan analizler sonucunda, tüketici davranışlarının yalnızca fiziksel ihtiyaçlara dayalı rasyonel kararlar değil, aynı zamanda duygusal, sosyal ve çevresel faktörler tarafından da etkilendiğini göstermiştir. Araştırma bulguları, satın alma süreçlerinin çok boyutlu bir yapıya sahip olduğunu ve bu süreçlerin hem bireysel motivasyonlar hem de dışsal uyaranlar tarafından etkilendiğini ortaya koymaktadır.

EKB modelinin yedi aşaması üzerinden yapılan analizde, tüketici davranışlarının yalnızca bilgi arama ve karar verme süreçlerine dayalı olmadığı, aynı zamanda duygusal ve toplumsal faktörlerin de önemli bir belirleyici olduğu vurgulanmaktadır. Katılımcıların bilgi arama sürecinde çevrimiçi platformlara yönelmeleri, sosyal medya ve kullanıcı yorumlarının güvenilir bilgi kaynakları olarak görülmesi, dijitalleşmenin tüketici davranışları üzerindeki etkilerini ortaya koymaktadır. Ayrıca, kampanyalar, indirimler ve influencer etkisi gibi çevresel faktörlerin, özellikle ihtiyaç dışı satın alma davranışlarını tetiklediği anlaşılmaktadır. Sonuç olarak, bu çalışma, tüketici davranışlarının çok boyutlu ve dinamik bir yapıya sahip olduğunu, bireysel, sosyal, ekonomik ve çevresel faktörlerin bu davranışları şekillendiren temel unsurlar olduğunu ortaya koymaktadır. Bu bulgular, tüketici davranışlarını daha iyi anlayabilmek için yalnızca geleneksel ekonomik modellerin değil, aynı zamanda psikolojik ve sosyal faktörlerin de göz önünde bulundurulması gerektiğini vurgulamaktadır.

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CEVAT RİFAT ATİLHAN'IN MİLLİ İNKILAP DERGİSİ VE DERGİDEKİ YAHUDİ KARŞITLIĞININ İNCELENMESİ

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ÖZET

Osman Senai Bey tarafından 1 Nisan 1933'te İzmir'de yayım hayatına başlayan İnkılap dergisi, 1 Ağustos 1933 tarihli beşinci sayısından itibaren adını "Milli İnkılap" olarak değiştirmiştir. 1 Eylül 1933'te çıkarılan altıncı sayı ile birlikte derginin sahibi ve başyazarı Cevat Rifat Atilhan olmuştur. 1933-1934 yılları arasında yayımlanan derginin yayın politikasının en önemli özelliği hemen her sayısında Yahudi toplumunu hedef alması ve derginin bütün bölümlerinde Yahudi aleyhtarlığının yapılmasıdır. Derginin ilk sayılarında özellikle edebiyat ve sanat içerikli konular ele alınırken, dördüncü sayıdan itibaren Yahudi aleyhtarlığı içeren yazılara daha fazla yer verilmeye başlanmıştır. Dergide özellikle "hain" ve "casus" Yahudi figürü üzerinde durulmuş ve neredeyse derginin bütün sayılarında bu konuya değinilmiştir. Cevat Rifat, Milli İnkılap dergisindeki yazılarından sonra Türk basınında, "Nazi hayranı", "Yahudi düşmanı" gibi eleştirilere maruz kalmıştır. Dergi, "Trakya Olaylarının yaşanmasında pay sahibi olduğu gerekçesiyle" İcra Vekilleri Heyeti tarafından 7 Temmuz 1934'te kapatılmıştır. Yahudilerden duyduğu rahatsızlığı içeriğindeki makaleler ile açık bir şekilde ortaya koyan ve yakın tarihimizde çokça tartışılan Milli İnkılap dergisi, kısa ömürlü olmasına rağmen kamuoyunda meydana getirdiği izlenimler ile uzun yıllar hafızalarda yer etmiştir. Bu çalışmada, Milli İnkılap dergisinin yayın politikası, Yahudi aleyhtarı yayımları ve dergiye karşı yöneltilen eleştiriler dönemin arşiv vesikaları, basın-yayın organları ve diğer telif eserlerinden yararlanılarak ele alınmıştır.

Anahtar Kelimeler: Cevat Rifat Atilhan, Milli İnkılap Dergisi, Antisemit, Yahudi.

AN ANALYSIS OF CEVAT RİFAT ATİLHAN'S NATIONAL REVOLUTION MAGAZINE AND ITS ANTI-SEMITISM

ABSTRACT

İnkılap magazine, which started its publication life in Izmir on April 1, 1933 by Osman Senai Bey, changed its name to "Milli İnkılap" starting from the fifth issue dated August 1, 1933. With the sixth issue, published on September 1, 1933, Cevat Rifat Atilhan became the owner and editor-in-chief of the magazine. The most important feature of the publishing policy of the magazine, which was published in 1933-1934, was that it targeted the Jewish community in almost every issue and that anti-Semitism was expressed in all sections of the magazine. While the first issues of the magazine primarily dealt with literary and artistic topics, anti-Semitic articles began to be included more frequently from the fourth issue onwards. The National Revolution magazine, which openly revealed its discomfort with the Jews through its articles and was much discussed in our recent history, has been remembered for many years with the impression it created on the public, despite its short life. The magazine particularly focused on the figure of the "traitor" and "spy" Jew, and this issue was touched upon in almost all issues

of the magazine. After his articles in the National Revolution magazine, Cevat Rifat was subjected to criticisms such as “Nazi fan” and “Semitic enemy” in the Turkish press. The magazine was closed by the Board of Enforcement Deputies on July 7, 1934, “on the grounds that it had a share in the Thrace Events”. In this study, the publishing policy of the National Revolution magazine, which stands out with its anti-Semitic feature, its anti-Semitic publications and the criticisms directed against the magazine are discussed by examining the archive documents, press and other copyrighted works of the period.

Keywords: Cevat Rifat Atilhan, Milli İnkılap Magazine, Antisemit, Jew.

GİRİŞ

Osman Senai Bey tarafından 1 Nisan 1933 tarihinde İzmir’de “İnkılap” adıyla yeni bir dergi yayım hayatına başlamıştır (Bali, Ağustos 1998, s. 85). Derginin ilk sayısı *“siyasi, içtimai, edebi, aylık mecmua”* başlığı ile çıkarılmış, başyazarı ve umumi neşriyat müdürü de Cevat Rifat Atilhan olmuştur (İl, 2018, s. 22). Derginin adı 1 Ağustos 1933 tarihli beşinci sayısında, “Milli İnkılap” olarak değiştirilmiştir. 1 Eylül 1933 tarihli altıncı sayıdan itibaren de derginin sahibi ve başyazarı Cevat Rifat olmuştur.

Derginin ilk sayılarında özellikle edebiyat ve sanat içerikli konular ele alınırken, dördüncü sayıdan itibaren Yahudi aleyhtarlığı içeren yazılara daha fazla yer verilmeye başlanmıştır. Hatta yine dördüncü sayıdan itibaren derginin kapağına, *“Taşkın Milliyetperver Mecmua”* ifadesi eklenmiş ve bu ifadeyle de dergi dikkatleri üzerine çekmiştir (İnkılap, Temmuz 1933). Cevat Rifat’ın sert bir dille Yahudi toplumunu hedef alan yazıları, Türk ve Yahudi kamuoyunda tepkiyle karşılanmış ve basında uzun süreli bir tartışmaya sebep olmuştur. Cevat Rifat, Aralık 1933’te Almanya’ya bir gezi gerçekleştirmiş ve yaklaşık 6 ay burada kalmıştır. Almanya gezisinden dolayı derginin yayımına 8 ay ara veren Cevat Rifat, yeni yayın döneminde dergiyi İstanbul’da 15 günde bir olarak çıkarmaya başlamıştır (Bozkurt, 2011b, s. 177).

1933-1934 yıllarında 12 sayı olarak çıkan dergi, 1934 Trakya Olayları’nda sorumlu olarak görülmüş ve hükümet tarafından 7 Temmuz 1934’te kapatılmıştır (T.C. Cumhurbaşkanlığı Devlet Arşivleri Başkanlığı Cumhuriyet Arşivi [BCA], 30.18.1.2/46.48.2, 07.07.1934). Ancak derginin olaylarda rolü olup olmadığı konuyu araştıran yazarlar arasında tartışılmış ve araştırmacılar bu konuda bir fikir birliğine varamamışlardır.

Çalışma, 1933-1934 yıllarında yayın hayatında önemli bir yer bulan Milli İnkılap dergisinin Yahudiler hakkındaki düşüncelerine ve toplumsal hayatta Yahudilerin sebep oldukları iddia edilen olayların dergide işleniş biçimine odaklanmaktadır. Yahudilerden duyduğu rahatsızlığı içeriğindeki makaleler ile açık bir şekilde ortaya koyan ve yakın tarihimizde çokça tartışılan Milli İnkılap dergisi, kısa ömürlü olmasına rağmen kamuoyunda meydana getirdiği izlenimler ile uzun yıllar hafızalarda yer etmiştir. Literatürde Milli İnkılap dergisi ile ilgili yapılmış muhtelif eserler bulunmaktadır. Ancak bu araştırmaların oldukça sınırlı sayıda olması ve yüzeysel kalması, çalışmanın önemini ortaya çıkarmaktadır.

Çalışma, derginin yayımlandığı 1933-1934 arasındaki dönem ile sınırlandırılmıştır. Ancak konuda bütünlük sağlamak amacıyla derginin sahibi ve başyazarı olan Cevat Rifat Atilhan’ın hayatına, Yahudi karşıtlığı düşüncesinin oluşmasındaki temel etkenlere de değinilmiştir. Çalışmada, nitel araştırma metotlarından doküman analizi ya da belge tarama olarak bilinen yöntem kullanılmış ve bu bağlamda elde edilen veriler objektif bir şekilde değerlendirilmiştir.

Çalışmada ağırlıklı olarak Milli İnkılap dergisinden istifade edilmiştir. Arşiv kaynakları, basın-yayın organları ve diğer telif eserlerden de yararlanılarak hazırlanan çalışma literatüre katkı sağlamayı amaçlamıştır.

CEVAT RİFAT ATİLHAN'IN HAYATI

Cevat Rifat, 1892 yılında İstanbul'un Vefa semtinde dünyaya gelmiştir. Babası, Manastır askeri kaymakamlarından Hasan Rıfat Paşa, annesi Huriye Hanım'dır. Cevat Rifat, babası Hasan Rıfat Paşa'nın görevi gereğince çocukluğunun ilk yıllarını Şam'da geçirmiştir. İlköğrenimine İstanbul'da Fatih İptidaisinde başlayan Cevat Rifat, ardından Kuleli Askeri Lisesi'ne devam etmiştir. 1909 yılında başladığı Harbiye Mektebinden 1912 yılında mezun olmuş ve aynı yıl orduya katılmıştır (Bozkurt, 2011a, s. 2). Balkan Savaşları, Birinci Dünya Savaşı ve Milli Mücadele'ye katılan Cevat Rifat, cesareti ve kahramanlığıyla da adından çok söz ettirmiştir.

Cevat Rifat, I. Balkan Savaşı sırasında Edirne'de yaklaşık 6 ay boyunca Bulgar ordularına karşı mücadele etmiş ancak Bulgarlara esir düşerek Sofya'ya götürülmüştür (Soykan, 2010, s. 19). 8 aylık esaretinden sonra da İstanbul'a geri dönmüştür. 29 Ekim 1914-30 Ekim 1918 tarihleri arasında Birinci Dünya Savaşı'nda bulunan Cevat Rifat, Filistin-Suriye Cephesi'nde görev yapmıştır. Ardından İngiltere ile Türk orduları arasında gerçekleşen Gazze Savaşı'na katılmış ve bu sırada gösterdiği kahramanlıktan dolayı 8. Kolordunun Harekât Şubesi Başkanlığı'na getirilmiştir. 1916 yılında Yahudiler tarafından kurulan ve amacı Filistin'de bağımsız bir devlet kurmak olan "NİLİ" isimli casusluk teşkilatının faaliyetlerini açığa çıkarmıştır. "NİLİ" teşkilatı savaş sırasında Filistin-Suriye Cephesi'nde bulunan Osmanlı ordularının faaliyetlerini gizlice İngilizlere bildirmekteydi (Bozkurt, 2018, s. 105; Bozkurt, 2014, s. 89-114). Yahudi casuslara karşı vermiş olduğu mücadele Cevat Rifat'ın, Yahudi aleyhtarı bir kişiliğe bürünmesinde önemli bir etken olmuştur.

1918 Mondros Ateşkes Antlaşması'nın ardından Mersinli Cemal Paşa ile birlikte İstanbul'a gelen Cevat Rifat, milli faaliyetlerde önemli hizmetlerde bulunmuştur. Ancak 16 Mart 1920 tarihinde İtilaf Devletleri İstanbul'u işgal edince, Cemal Paşa tutuklanmış ve Malta'ya sürgün edilmiştir. Bunun üzerine Cevat Rifat Anadolu'ya geçmiş ve Mustafa Kemal Paşa önderliğinde başlatılan Milli Mücadele'ye katılmıştır. Mustafa Kemal Paşa'nın ve Ali Fuat Paşa'nın isteği doğrultusunda da merkezi Çaycuma'da bulunan Bartın ve Havalisi Komutanlığı'na getirilmiştir (Bozkurt, 2018, s. 106). Stratejik açıdan son derece önemli bir bölgenin savunmasını yapan Cevat Rifat, bölgeyi Fransız işgalinden korumuş ve Fransız ordularını geri püskürtmeyi başarmıştır. Milli Mücadele'de dönemindeki önemli başarılarından dolayı kendisine 11 Mart 1928 tarihinde "S17142 numaralı İstiklal Madalyası" verilmiştir. Cevat Rifat, 17 Ekim 1925 tarihinde kendi isteği ile askerlik hayatını sonlandırmış ve emekliye ayrılmıştır (Bozkurt, 2018, s. 106).

Askeri hayatını sonlandırdıktan sonra ticari hayata atılan Cevat Rifat, bu alanda da oldukça hareketli bir dönem yaşamıştır. Ticaret alanındaki ilk deneyimini Ermeni milyonerlerinden "Bakırcıyan Kardeşlerin" şirketine ortak olmasıyla yaşamıştır. Cevat Rifat bu konuda şöyle demiştir: *"Hemşerileri arasında benim kadar itimat edecek kadar bir insan bulamadıkları için ticari vekâletlerini bana veren milyoner Bakırcıyan Biraderler ve Hint Müslümanları sayesinde, emek ve alnımın teri ve doğruluğum yüzünden milyonlar kazandım"* (Atilhan, 1963, s. 194).

Cevat Rifat Manchester'dan "Bakırcıyan Kardeşlerle" patiska (pamuk ipliği), Paris'ten de "Kavukcıyan Biraderlere" ait firmalar ile yünlü kumaş ticareti yapmış ve sermayesini daha da arttırmıştır. Ayrıca Suriye'den gelen Hint Müslümanlarının liderlerinden olan Abdürrahman

Ayyaz'ın desteği ile de "Büyük Hint Müslümanları Ticarethaneleri Vekili" olmuştur. 1927 yılında İstanbul'da Triks marka bir kundura fabrikası açan Cevat Rifat, diğer yandan da müteahhitlik çalışmalarına katılmıştır. Bu bağlamda Eskişehir'de Sivrihisar-Sarı Köy şosesinden 7,5 kilometrelik yeni bir yol ihalesi ve çeşitli büyüklükte 9 köprünün yapımını üstlenmiştir (Atilhan, 1963, s. 210-211).

Kısa sürede büyük bir servet kazanan Cevat Rifat, İstanbul'un sayılı iş adamlarından biri haline gelmiştir. Ancak Cevat Rifat'ın işleri bir anda bozulmaya başlamış ve büyük bir iflasın içine sürüklenmiştir. 28 Ekim 1928'de Cevat Rifat'ın Şişli'deki kundura mağazası mühürlenmiştir. Cevat Rifat bu işin sorumlusu olarak mağaza sahibi Albert Saltiel adında bir Yahudi iş adamını görmüştür. Cevat Rifat'ın ifadesine göre; *"Albert Saltiel, mağazanın eski kiracısı Koço Gramatopolo Biraderler'den kalma kontratlarından birini Beyoğlu Beşinci İcra Dairesi'ne vermiş ve bir tahliye ihbarnamesi hazırlatmıştır. Bunun üzerine İcra Hâkimi Sabri Bey de mağazayı mühürlemiştir"* (Milli İnkılap, 1 Haziran 1934, s. 1). Yine Cevat Rifat'ın iddiasına göre, Albert Saltiel bu olayın ardından Cevat Rifat'ı aramış ve şöyle demiştir: *"Siyonizm'in ne olduğunu öğrendiniz mi beyefendi? Yahudilerin intikamı işte böyle olur!"* Cevat Rifat, Albert Saltiel'in bu sözleriyle yaşanan olayın bir Yahudi komplosu olduğunu ima ettiğini ileri sürmüştür (Milli İnkılap, 1 Haziran 1934, s. 1).

Cevat Rifat ve Albert Saltiel arasındaki krizden sonra Amerikan Express Bank Cevat Rifat'a verdiği kredileri sonlandırmıştır. Bu durum karşısında 100 bin liralık zarara uğrayan Cevat Rifat, Siyonistler ve Farmasonlar'ın bu duruma neden olduğunu ileri sürmüştür (Bali, Temmuz 1998, s. 17). Özellikle Albert Saltiel ile olan mücadelesi Cevat Rifat'ın Yahudi aleyhtarlığını üst noktaya taşımış ve bundan sonraki süreçte Yahudilere olan düşmanlığını gerek basın gerekse siyaset aracılığı ile yaşamının sonuna kadar sürdürmüştür (Çay, 2013, s. 9).

1945 yılından itibaren siyasetle ilgilenmeye başlayan Cevat Rifat, Milli Kalkınma Partisi, Türk Muhafazakâr Partisi ve İslam Demokrat Partisi'nin kurucu üyelerinden biri olmuştur (Bozkurt, 2018: 112-114). Türk siyasi hayatında derin izler bırakan Cevat Rifat, 4 Şubat 1967 tarihinde 75 yaşındayken İstanbul'da vefat etmiştir.

MİLLİ İNKILAP DERGİSİNİN YAYIN POLİTİKASI VE YAHUDİ KARŞITI YAYINLARINDAN BAZILARI

1 Nisan 1933 tarihinde Osman Senai Bey tarafından İzmir'de "İnkılap" adıyla yeni bir dergi yayım hayatına başlamıştır (Bali, Ağustos 1998, s. 85). Derginin ilk sayısı "siyasi, içtimai, edebi, aylık mecmua" başlığı ile çıkarılmış, derginin başmuharrir ve umumi neşriyat müdürü de Cevat Rifat olmuştur (İl, 2018, s. 22). Derginin yayın politikasının en önemli özelliği hemen her sayısında Yahudi toplumunu hedef alması ve edebiyat, spor, fen, moda gibi köşelerinde dahi Yahudi aleyhtarlığı vurgusunun yapılmasıydı. Nitekim dergi daha ilk sayısında içeriğindeki yazılar ile bu politikasını açıkça belli etmiştir. İlk sayının kapağında Mustafa Kemal Atatürk'ün bir fotoğrafı yer almış ve ardından derginin yayın amacı, ilkeleri ve hedefleri açıklanmıştır. Buna göre, derginin yayın amacı şu şekilde belirtilmiştir:

> *"İnkılap, maskesiz inkılapçıların fikir ve ideal mecmuasıdır. Bu mecmua inkılabı siper gibi kullanıp hüviyetlerini örtmek veyahut onu basamak yapıp yükselmek kaygısından azade hür ve samimi mefkûrecilerin ve hakiki inkılapçıların kalem ve mücadele vasıtasıdır. İnkılap neşrine saik olan tek zihniyet, Gazi inkılabının en çabuk ve en kestirme yollardan hedefine ulaşmasını ve bu inkılabın hiçbir surette sarsılmayacak derecede kökleştiğini görmekten ibarettir. Bu mecmua tam manasıyla inkılapçı Türklerin, yani Gazi inkılabına canla başla ve bilfiil iştirak etmiş ve bu uğurda mesai sarf etmiş insanların tezlerini neşr ve müdafaaya hadimdir. Bu tezlerin başında inkılabı, kendilerine vasıta-i şöhret ve menfaat*

edinen ikiyüzlü insanlardan ayıklamak gelir. Bu milleti düşmandan kurtaran deha, bu milleti zillet içinde yaşatan köhne bağları da koparıp atmıştır. Onun kıymetini bilmek ve genç neslin bu yeni ve nurlu yolda emniyet ve itimat içinde, sarsılmaz bir iman ile yürüdüğünü görmek İnkılapçıların en esaslı endişe ve gayelerini teşkil eder. Yeni nesli, evet bugünün genç Türklerini, tarihin büyük Türklüğüne yakışır bir seviyede görmek bütün inkılap çocuklarının en baş vazifesi ve cümlemizin namus borcudur. İnkılap için hiçbir tehlike ve tereddüdün yeri kalmadığını görmek ve bu muazzam eser üzerindeki çalışmaların meyvelerini verip nihayete erdiğine inanmak mesaimizi ve gayemizi çerçeveleyen esaslı noktalardır. Bunun için İnkılap mecmuasının tezi, inkılabı yüzden öze işletmek noktasında toplanır. Yine bunun için de sadece gözlerimizi büyük adamlara çevirmeyi ellerimizi yalnız onlara alkışlamaya hasretmeyi kâfî görmüyoruz. İşte saygılı okuyucular, İnkılap'ın her sayısında okuyacağınız fikirler ve yazılar bu düşüncelerin ve bu prensiplerin muhassalası olacaktır" (İnkılap, 1 Nisan 1933, s. 1).

Derginin ilk sayılarında çoğunlukla edebiyat ağırlıklı konulara yer verilmiştir. Edebiyat köşesinde, zamanın genç şairlerinden olan Oktay Rıfat, Melih Cevdet, Faruk Mümtaz ve Orhan Veli'nin ilk şiirleri yer almıştır (Doğan, 2020, s. 60). Birinci sayının "İktisadiyat" kısmında 1929 Dünya Ekonomik Buhranının bütün dünyada olduğu gibi Türkiye üzerinde de birçok açıdan etkili olduğuna değinilmiştir (Ruşen, 1933, s. 10). "İçtimaiyat" kısmında ise *"Darülfununlu Gençleri Alkışlamalıyız"* başlığı altında Taksim'de meydana gelen "Vagon Li" olayında öğrencilerin "Vagon Li" şirketini tahrip etmeleri övülerek anlatılmıştır (Halıcı, 2007, s. 64-68; İnkılap, 1 Nisan 1933, s. 12). Yazının içeriği incelendiğinde ise Yahudilere karşı atıfta bulunulduğu göze çarpmaktadır. Söz konusu yazının bir kısmında şöyle denilmektedir:

"Onlar şimdiye kadar bizim nezaket ve insanlığımızdan şımarmış küstahlıklara lazım gelen mukabelede bulunmuş oldular. Bu gençler bütün medeniyet dünyasına, asil Türkün en küçük bir istihfaf ve istihkara tahammülü olmadığını göstermiş oldular. Bu memleketten para kazanıp, bu memleketin dilini tahkir eden bir yabancıya haddini bildirdiler. Bu hareket bütün manası ile alkışlanmaya değer asri, medeni ve milli bir varlığa alamettir" (İnkılap, 1 Nisan 1933, s. 12).

Yazının devamında ise Yahudilerin ne kendilerine "Türk" denilmesine tahammül ettiklerine ne de Türk dilini konuşmaya tenezzül ettiklerine üstü kapalı bir şekilde vurgu yapılmıştır. Ayrıca Türkiye'ye aciz, muhtaç ve sefil bir halde gelen Yahudilerin, Türkler sayesinde zengin olduğu ancak buna rağmen Türk halkının kıymetini bilmedikleri ileri sürülmüştür (İnkılap, 1 Nisan 1933, s. 12). Yine derginin ilk sayısında "Siyasi Sahife" kısmında, *"Dünya Siyasetinde Yeni Hadiseler"* başlığı altında bir yazı kaleme alınmış ve son zamanlarda dünyanın en büyük hadisesinin Almanya'da Hitlerin başa gelmesi olduğu vurgulanmıştır. Yahudilerin, Hitler teşkilatının Alman Yahudilerine karşı tatbik ettikleri yıldırma politikasına karşı şikâyetçi oldukları ve bu sebeple de yoğun bir şekilde göç gerçekleştirdikleri ifade edilmiştir. Ayrıca Türkiye'deki Yahudilere de bir gönderme yapılan yazıda şöyle denilmiştir: *"Dünya üzerinde en ziyade Türkiye'de emniyet ve refaha mazhar oldukları halde burada da kendilerini sevdiremeyen ve Türklerden gördükleri büyük alicenaplık ve nimetine istihfaf ile mukabele eden ve hatta bunca arzu ve tezahürlere rağmen Türkçe konuşmayı günah sayan Yahudiler"* (İnkılap, 1 Nisan 1933, s. 16). Bu yazı, dergide Yahudi karşıtlığının daha da şiddetleneceğini göstermesi bakımından önem arz etmektedir.

Cevat Rifat, Yahudi aleyhtarlığı içerikli yazılara sonraki sayılarda daha fazla yer vermeye başlamıştır. Mayıs 1933'teki ikinci sayıda derginin giriş kısmına, *"Hadiseler Karşısında Türk Gençliği Uyan"* başlığı atılmış ve özellikle Türk gençliğinin dikkati çekilmeye çalışılmıştır. Derginin yazarlarından Osman Oğlu Lemi, *"Almanya'dan Alınacak Dersler"* başlığı altında

bir yazı kaleme almış ve Hitler'in Yahudileri temizleme amacını programında ilk sıraya koymasının hakikat olduğunu ve bu programın çok derin ilmi esaslar üzerine kurulduğunu vurgulamıştır (Osman Oğlu Lemi, Mayıs 1933, s. 1). Osman Oğlu Lemi yazısının devamında, Türkler için Yahudiliğin büyük bir afet olduğunu, Yahudilerin bulunduğu yerde samimiyet, insanlık, fazilet, selamet, din ve iman olmadığını, "Türk" olduklarını iddia eden Yahudilerin aslında Türklüğü benimsemediklerini, sokaklarda ve gittikleri her yerde kendi dillerini konuşmaya devam ettiklerini ve Türkçeyi kullanmaktan kaçındıklarını vurgulamıştır (Osman Oğlu Lemi, Mayıs 1933, s. 2-3).

Cevat Rifat'a göre, bütün dünyada uzun zamandan beri bir Yahudi düşmanlığı vardı. Bu düşmanlık neredeyse Tevrat'ın yeryüzüne indiği güne kadar uzanmaktaydı. Zaman zaman Yahudi katliamlarının yapılması ve Yahudileri bulundukları topraklardan kovmak da bu düşmanlığın açık bir göstergesiydi. Eğer Türkiye'de bir Yahudi aleyhtarlığı varsa bunun sebebi de Yahudilerdi. Çünkü İspanya'dan kovulan, orada hakaret ve zulüm gören Yahudiler sadece Türkiye'de adalet ve emniyet görmüşlerdi. Dünyanın en misafirperver kavmi olan Türkler, onlara elini uzatmış, bağrına basmış, yaşamaları ve servet sahibi olmaları için de imkânlar vermişlerdi. Bugün Türkiye'de yaşayan bütün Yahudiler, Türklerden bin kat daha iyi şartlarda yaşadıkları gibi aynı zamanda da daha fazla servet ve sermaye sahibi olmuşlardı (Atilhan, Haziran 1933, s. 1). Cevat Rifat, Yahudilerin Türkiye'deki bütün ihracat ve ithalat işlerini de ellerinde tuttuklarını ileri sürmekteydi. O'na göre, Yahudiler kendilerine sunulan imkânların kıymetini de bilmemekteydi (Atilhan, Haziran 1933, s. 1).

Cevat Rifat, "*Bir cemaat ki kovulduğu, malı ve canı yağma edildiği bir milletin dilini muhafaza eder de ekmeğini yediği, iyiliğini gördüğü nimetine mazhar olduğu misafirperver, kahraman ve asil bir milletin lisanını nasıl ihmal eder nasıl istihkar eder?"* ifadeleri ile Yahudilerin Türk topraklarında hala İspanyolca konuştuklarını ve Türkçe konuşmaktan kaçındıklarını ileri sürmüştür (Atilhan, Haziran 1933, s. 2). Cevat Rifat, derginin neredeyse bütün sayılarında Yahudilerin Türkçe konuşmamasını eleştirmiş ve bu durumu Türk milletine karşı yapılan bir hürmetsizlik, milletin bayrağına ve izzeti nefsine karşı saygısızlık olarak görmüştür (Atilhan, Haziran 1933, s. 2).

Derginin dördüncü sayısından itibaren kapağına, *"Taşkın Milliyetperver Mecmua"* ifadesi eklenmiştir (İnkılap, Temmuz 1933). Bununla birlikte derginin üslubu biraz daha sertleşmiş ve Yahudi aleyhtarlığı içeren yazılara daha fazla yer verilmiştir. Aynı sayı içerisinde Cevat Rifat, *"L'antisemitisme (Yahudi Aleyhtarlığı)"* başlığı altında bir yazı kaleme almıştır. Yahudi aleyhtarlığının dünya için eski ancak Türkiye için yeni olduğunu vurgulayan Cevat Rifat, antisemitizmin Türkiye'de ne zaman doğduğu ile ilgili şöyle bir yorumda bulunmuştur:

> *"Büyük harp kara bir talih ile neticelenip de vatan afakını zulmetler kapladığı mütareke senelerinde kendilerinden hiç ummadığımız halde Yahudiler, İstanbul sokaklarını altı köşeli yıldızlara gark etmişler, felaketlerimize karşı lakayt, azabı vicdaniden azade çirkin bir sima ve menfur bir çehre ile kendilerini göstermişlerdir. İşte Türkiye'de antisemitizm o zaman doğmuş ve bu cereyan o zaman vicdanı ammeyi istila etmiştir"* (Atilhan, Temmuz 1933, s. 1).

Cevat Rifat yazısının devamında, Türk milletinin Gazinin arkasında başardığı mucizevi zafer ve harikaların maddi menfaatlerini Türklerden ziyade Yahudilerin elde ettiğini vurgulamıştır. Ayrıca önceki yazılarında olduğu gibi Yahudilerin Türkçe konuşmadığını, İspanyolcayı terk edenlerin de Fransızca konuştuğunu, Türk kültür ve medeniyetine yabancı olduklarını, Türklerden alışveriş yapmadıklarını, mağazalarında, ticarethanelerinde ve diğer müesseselerinde Türklere iş vermediklerini ve çocuklarını da ayrı mekteplerde okuttuklarını ileri sürmüştür (Atilhan, Temmuz 1933, s. 1-2).

Dergi, neredeyse bütün sayılarında Yahudilerin kati surette Türkçe konuşmak istemediklerini, Türkçe konuşmayı günah saydıklarını, konuşanların da bilerek ve isteyerek bozuk bir Türkçe konuştuklarını ve bu haliyle de Türkçe ile alay ettiklerini ileri sürmüştür. Ayrıca Yahudi cemiyetlerini de suçlayan dergi, Yahudi toplumunun cemiyetler aracılığıyla düşmanlıklarını gizlediğini, Türk dilini ve benliğini kirlettiklerini iddia etmiştir. Aslında dergide asıl vurgulanan husus Yahudileri Türkleştirmek ya da Türkçe konuşturmak değil, onları Türk topraklarından tamamen silmek ve böylece Türkçenin de sadece "saf kan" Türkler tarafından konuşulmasını sağlamaktı (Doğan, 2020, s. 65).

Derginin adı 1 Ağustos 1933 tarihli beşinci sayısından itibaren "Milli İnkılap" olarak değiştirilmiştir. 1933 yılında Almanya'da Hitlerin iktidara gelmesi ile birlikte çok sayıda Yahudi başka ülkelere göç etmeye başlamıştır. Bu sırada Yahudilerin Türkiye'ye yerleşmelerine müsaade edildiği yönünde bir takım haberler çıkmış ve Milli İnkılap da bu duruma çok sert tepki göstermiştir. Cevat Rifat'ın, *"Asla! Bu Vatan Yeni Bir Yahudi Kafilesini Kabul Edemez!"* başlığı altında kaleme aldığı yazı da bu tepkiye bir örnek teşkil etmektedir (Atilhan, Ağustos 1933, s. 1-2).

Yazının içeriğinde Almanya'dan tahliye edilen Yahudilerin Türkiye'ye yerleşmelerine asla müsaade edilmeyeceğinden bahsedilmiştir. Cevat Rifat'a göre, Osmanlı Devleti İspanya'dan kaçan Yahudileri kabul etmekle büyük bir hata yapmıştı. Şimdi Almanya'dan kovulan Yahudilerin Türkiye'ye yerleşmesine müsaade etmek "büyük ve tarihi bir günahı" tekrar etmek demekti (Atilhan, Ağustos 1933, s. 1). Tarihten örnekler de veren Cevat Rifat, Yahudilerin "casus" ve "nankör" olduklarını bir kez daha ileri sürmüş ve şöyle demiştir:

> *"Büyük harpte Filistin Yahudilerinin yaptıkları nankörlükler, ordu aleyhine işledikleri casuslukları unutmuş değiliz. Muratlarına erdiler, Filistin'de mirasımıza kondular. Kahraman evlatlar ile birlikte kan döktüğümüz o güzel topraklar şimdi onlara müstemleke oldu. Oralarda altı köşe yıldızlı siyon bayrakları bol bol temevvüç ediyor. Fakat bu acı tecrübe, Gazi Türkiye'sinde bir daha tekrar edemez. İnkılap hükümeti ve inkılap nesli eski hükümetlerin işledikleri günahı tekrarlayamaz. Tarihin lanetinden korkar"* (Atilhan, Ağustos 1933, s. 1-2).

Cevat Rifat yazısını, *"Türkiye'de yeni bir Filistin, yeni bir Telavim göremeyiz. Yahudileri istemeyiz. Kapılarımızı sımsıkı kapıyoruz"* şeklinde sonlandırmıştır (Atilhan, Ağustos 1933, s. 2). Cevat Rifat bu yazısında düşman olarak betimlediği Yahudi nüfusunun değil, Türk nüfusunun arttırılması gerektiğini de savunmuştur. O'na göre, Türkiye zaten mevcut Yahudi nüfusuyla baş edemiyordu ve yeni bir Yahudi kafilesinin gelmesi Türkiye için daha büyük sorunlara yol açacaktı (Doğan, 2020, s. 65).

Derginin 1 Eylül 1933 tarihli altıncı sayısından itibaren sahibi ve başyazarı Cevat Rifat olmuştur. Derginin kapağında, *"Türklük İdeali Güder Taşkın Milliyetçi Mecmuadır"* ifadesi eklenmiştir. Yine dergi kapağında dikkat çeken diğer bir husus da "Hilalli Kurt" sembolünün kullanılmasıdır. Nitekim bu sembol Hüseyin Nihal Atsız'ın 1931-1932 arasında yayımladığı "Atsız" isimli mecmuasıyla başlatmış olduğu geleneğe uygun olarak kullanılmıştır (Bozkurt, 2011b, s. 178). "Hilalli Kurt" sembolünün altında da *"Fert Ölür, Mefkûre Yaşar"* ifadesi yer almıştır. Milli İnkılap, altıncı sayısından sonra yayımına 8 ay ara vermiştir.

Cevat Rifat, Aralık 1933'te *Der Stürmer* adlı antisemit derginin yayıncısı Julius Streicher'in özel daveti ile Almanya'ya gitmiştir (Bozkurt, 2018, s. 107). Burada Nazilerin ünlü bakanlarından olan Alfred Rozenberg ile tanışan Cevat Rifat, Berlin'de kurulan Oranienburg toplama kampını gezmiş ve buradaki izlenimlerini, *"Tarih Boyunca Yahudi Mezalimi İğneli Fıçı"* adlı eserinde detaylı olarak yazmıştır (Bozkurt, 2018, s. 107; Atilhan, 1978). Cevat Rifat, yaklaşık 6 ay Almanya'da kalmış, ardından Türkiye'ye geri dönmüştür.

Almanya gezisinin Cevat Rifat'ı fazlasıyla etkilediği Milli İnkılap dergisinde yapılan değişimler ile kendisini göstermiştir. Dergi, Cevat Rifat'ın Almanya dönüşünde yeni yayın dönemine girmiş ve İstanbul'da 15 günlük olarak çıkarılmaya başlanmıştır. Derginin 1 Mayıs 1934'te yayımlanan ilk sayısında yayın politikası okuyuculara şöyle duyurulmuştur:

> *"Milli İnkılap, neşriyat sahasını dolduran edebi ve fantezi mecmuaların hiçbirisine benzemez. O, muayyen bir gaye ve iman ile çıkıyor. Bu gaye içinde hiçbir menfaat hiçbir hususi emel hiçbir ticaret fikri yoktur. Milli İnkılap, bu yurtta her şeyden evvel Türkleri hâkim ve mesut görmek ve Türkün cihan değer mevki ve şerefini üstün görmek kaygısı için çalışacaktır. Milli İnkılap, bu vatanda asırlarca kan döken temiz ve temiz kanlı Türk evlatlarının iktisadi ve hayati menfaatlerini bütün dünyada olduğu gibi fena halde istismar ve gasp eden teşekküllere şiddetle aleyhtardır…"* (Atilhan, 1 Mayıs 1934, s. 1).

Aynı sayıda *"Bilinmelidir"* başlığı altında, Yahudi karşıtlığı kısa ifadelerle okuyuculara verilmeye çalışılmıştır. Bu ifadelerden bazı örnekler şöyledir: *"Türk çocuğu! Sina Cephesi'nde çarpışırken yapılan casusluğu ve hıyaneti unutma." "En zenginlerden elli Yahudi ortadan kalksa artık dünya yüzünde harp olmaz!" "Türk devlet dairelerinde elhamdülillah hiçbir Yahudi memur yoktur. Fakat Türkiye'de para kazanan şirketlerin büyük memurları hep Yahudi'dir." "İktisaden hâkim olmayan milletlerin istiklali zayıftır. Yahudi'yi iktisadi sahada mağlup etmeliyiz." "Bir Yahudi ismini değiştirmekle ve Müslüman oldum demekle asla Türk olmaz. Türklük bir kan ve karakter meselesidir"* (Milli İnkılap, 1 Mayıs 1934, s. 5).

Cevat Rifat'ın Yahudi karşıtlığı ve bu yöndeki mücadelesi yabancı basında da ilgi görmüştür. Almanya gezisinde tanıştığı İsveçli Yahudi aleyhtarı gazeteci Elof Eriksson'un sahibi olduğu *Nationen* gazetesi 1 Mayıs 1934 tarihli nüshasının ilk sayfasında Cevat Rifat'a geniş yer vermiş ve kendisinden övgü ile bahsetmiştir. Bu habere dergisinde yer veren Cevat Rifat, İsveç'in sakin bir memleket olduğunu ve ülkede büyük bir Yahudi düşmanlığı bulunduğunu belirtmiştir (Milli İnkılap, 15 Mayıs 1934). Cevat Rifat ilerleyen yıllarda farklı ülkelerin basınında da yer almış ve Yahudi karşıtlığı ile ün kazanmıştır.

Dergi, 15 Mayıs 1934 tarihli ikinci sayısından itibaren *"Beni İsrail Hükemasının Protokollerine Ait İfşaat"* adı ile 5 bölümlük bir yazı dizisi yayımlamaya başlamıştır. Yazı, İsveç'in Stockholm şehrinde yayımlanan *Nationen* gazetesinden W. Creutz imzasıyla iktibas edilmiş ve yazının amacı şu şekilde açıklanmıştır: *"Bu sahifaları yazmaktaki maksadımız meraklı ve edebi bir mevzuun tetkiki değil, bütün insaniyetin mukadderatını tehdit eden karanlık esrarın aydınlanmasına hizmet etmektir"* (Creutz, 15 Mayıs 1934, s. 12). Yazının içeriğinde, Yahudi âlimlerin dünya hâkimiyeti için 22 maddelik siyasi, sosyal ve ekonomik hedefleri içeren gizli bir "Protokol" hazırladıklarından ve Yahudilerin de bu program kapsamında faaliyette bulunduklarından bahsedilmektedir (Bozkurt, 2011b, s. 187). Adı geçen Protokolde, dikkat çeken maddeler şu şekildedir:

> *"Aile hayatını yıkmalıdır.*
>
> *Sanatı düşürerek edebiyatı müstehcen, şehvi kalıba dökmelidir.*
>
> *Hudutsuz bir lüks, baş döndürücü modaları ve çılgınca sarfiyatı teşvik etmeli, makul ve basit şeylerden zevk almak hassasını derece derece ortadan kaldırmalı.*
>
> *Umumi bir hoşnutsuzluk yaratarak içtimai sınıflar arasına kin ve itimatsızlık sokmalı.*
>
> *Bütün hükümet şekillerini değiştirerek mühim makamları ifşa edilemeyecek gizli sırları olan kimselere tevdi etmeli ve onlara hâkim olmalı.*
>
> *Siyasi buhran zamanlarında servetleri mahvedecek ticaret usulleri bulmalı.*

Meşru hükümet şekillerini derece derece değiştirerek mutlak istibdat tesis etmeli.

Hükümetlerin ölümünü hazırlamalı, insaniyeti ıstırap, elem ve yoksullukla zayıf düşürmeli çünkü açlık esirler doğurur" (Creutz, 15 Mayıs 1934, s. 13-14).

Yazının devamına derginin 1 Haziran 1934 tarihli üçüncü sayısında yer verilmiş ve bu Protokollerin doğruluğu ispatlanmaya çalışılmıştır. Dergide, Protokollerin birçok nüshasının her tarafta neşr edildiği, bir tercümesinin Londra'da "Yahudi Tehlikesi" adı ile basıldığı, *Morning Post* ve *Times* gazetelerinin bu konuya geniş yer verdiği ve *Times* gazetesinin Protokollerin neyi ifade ettiği ve hakikate uygunluğu konusunda tartışılmalar yayımladığı belirtilmiştir (Creutz, 1 Haziran 1934, s. 10). Dergide, *Times* gazetesinden aynen verilen, "*Eğer Protokoller hakikaten beni İsrail hükemeasının eseri ise Yahudilere karşı söylenebilecek her söz girişilecek her cidal, yapılacak her hareket meşrudur, elzemdir ve müstaceldir*" ifadeleri ile de bir anlamda Yahudilerle mücadele meşrulaştırılmaya çalışılmıştır (Creutz, 1 Haziran 1934, s. 10). Yahudi aleyhtarı çevrelerce kullanılan ve bir el kitabı olan Protokoller, Milli İnkılap dergisi ile ilk kez Türk kamuoyuna girmiş ve bundan sonraki süreçte de farklı yayıncılar tarafından basılmıştır (Bozkurt, 2011b, s. 188).

Dergide öne çıkan figürlerin başında "hain" ve "casus" Yahudi figürü yer almış ve derginin çoğu sayısında bu konuya değinilmiştir. Dergiye göre Yahudiler, Sina ve Filistin Cephelerinden itibaren hıyanet ve casusluk faaliyetleri içerisindeydi. Cephe gerisinde çok zengin ve mesut bir hayat sürmekteydiler. Türklerin müsamahası sayesinde de emniyet içerisinde yaşamlarını devam ettirmekteydiler (Milli İnkılap, 1 Haziran 1934, s. 4). Yahudilerin "nankör" olduğunu savunan dergi, Gazinin dehası sayesinde Türklerin siyasi istiklalini kurtardığını, ancak iktisadi istiklalin de Yahudilerin elindeki ekonomik gücün alınmasıyla sağlanacağını ileri sürmüştür. Yazının devamında ise şöyle denilmekteydi:

> *"Gümrük komisyonculuğundan, borsa simsarlığından en büyük taahhütlere kadar bütün işler hemen hemen bu meşum insanların elindedir. Ecnebi şirketlerini onlar temsil ediyorlar, hatta Yahudi aleyhtarı Almanya'nın bile bütün işlerini onlar görüyorlar. Hülasa iktisadi sahada kazanılacak bütün işlere leş kargaları gibi hücum etmişlerdir. Köylülerimizin mahsullerini onlar satıyor. Malımızın her zaman her yerde kıymetini kıyasiye düşürüyorlar. Vatanda para kazanmaktan, kanımızı emmekten başka bir alakaları olmadığı, her biri başka bir idealin, mev'ut toprakların yolcusu olduğu için ellerini uzattıkları iktisadiyatı daima ve merhametsizce tahrip ediyorlar"* (Milli İnkılap, 1 Haziran 1934, s. 4).

Derginin 1 Temmuz 1934 tarihli beşinci sayısında Yahudilerin, *"Oğuzhan, Kayihan, Tekinalp, Cengiz, Bozkurt"* gibi Türk isimlerini kullanmaları eleştirilmiş ve yazıya şu şekilde devam edilmiştir: *"Ticari ve iktisadi zararları yetmiyormuş gibi ellerini şimdi de en mukaddes noktalara kadar uzatıyorlar. Kirli eller buralara kadar uzanmamalı ve Yahudiler tarihi Türk adlarının birer bitpazarı metaı olmadığını bilmelidirler…"* (Milli İnkılap, 1 Temmuz 1934, s. 6).

Derginin 15 Haziran 1934 tarihli dördüncü, 1 Temmuz 1934 tarihli beşinci ve 15 Temmuz 1934 tarihli altıncı sayılarında kullandığı kapak klişelerinin, Alman *Der Stüermer* dergisinin klişeleriyle aynı olması da dikkat çeken diğer bir husustur (Bozkurt, 2011b, s. 187). Derginin son sayısı 15 Temmuz 1934'te yayımlanmış ve kapağında, *"Yahudi, beşer hayatının kâbusu ve insan cemiyetlerinin kirli bir köpüğüdür. Onun çekildiği yerlerde bahar havası altında ebedi saadetler vücut bulur"* ifadeleri yer almıştır (Milli İnkılap, 15 Temmuz 1934).

Milli İnkılap dergisi, 1934 Haziran ayının ikinci yarısında ortaya çıkan Trakya Olayları'ndan sorumlu olarak görülmüştür. Trakya Olayları, ilk olarak Çanakkale'de ortaya çıkmış (Hâkimiyet-i Milliye, 15 Temmuz 1934, s. 1; Aktar, 2018, s. 71-101), ardından Edirne,

Tekirdağ ve Kırklareli'ne sıçramıştır. Olayların ilk aşaması Yahudilerin Çanakkale'yi terk etmesini isteyen tehdit mektuplarının Yahudilere iletilmesiyle başlamıştır (Benbassa ve Rodrigue, 2001, s. 242-244). Tehditlere dövme ve yağmalama olaylarının da eklenmesiyle 1.500 Yahudi, Çanakkale'den ayrılarak İstanbul'a göç etmiştir (BCA, 30.10.0.0/110.734.14, 11.08.1934; Şimşek, 2009, s. 144). Bildiri, tehdit ve boykot olaylarının ardından 3-4 Temmuz gecesi Kırklareli'nde daha büyük hadiseler yaşanmıştır (Vakit, 7 Temmuz, s. 1). Neticede hükümet kısa sürede olayları kontrol altına almış ve Trakya bölgesinde sıkıyönetim ilan etmiştir.

1934 Trakya Olaylarının ardından savcılık, Milli İnkılap dergisi ve Cevat Rifat hakkında adli tahkikat yapılmasına karar vermiştir. Bu durum basında şu şekilde geçmiştir: "*Çıkardığı Milli İnkılap adındaki neşriyatı memleketteki anasır arasında nifak tevlit eder mahiyette görülen Cevat Rifat Bey'in hakkında takip icrası için vilayet makamı tarafından müdde-i umumiliğe müracaat edilmiştir"* (Son Posta, 10 Temmuz 1934, s. 3; Vakit, 10 Temmuz 1934, s. 9; Akşam, 10 Temmuz 1934, s. 2). Milli İnkılap dergisi, basında kapatılacağı yönünde çıkan haberler karşısında şöyle bir açıklamada bulunmuştur:

> *"Trakya ve Çanakkale'de musanna Yahudi paniği muazzam bir teşkilatın gürültülü, velveleci propaganda ve yaygaralarıyla yapılmış yeni bir hıyanet numunesidir. Bunu Milli İnkılap'ın sırtına yüklemek isteyenlere sarahat ve katiyetle açık ve merdane olarak beyan ederim ki: Benim ve kardeşlerimin kan döktüğü bir vatan toprağı üzerinde envaı yalan ve hıyanetleri, olanca cüret ve küstahlıkla mebzulden koşan Siyonist propaganda organları burada apaşikâr on binlerce nüsha sattıkça Milli İnkılap'ta doğruluğuna iman etti ki hakikatleri izah ve ispat etmekten asla korkmayacak ve meşru bildiği mücadelesine devamdan geri durmayacaktır. Hükümete ve kanunlara son derece hürmetimiz vardır. Hükümet ve milletin yüksek menfaati icap ettiği zaman hiçbir ihtara ve formaliteye hacet kalmadan neşriyatımı durdurabilirim. Fakat şunu bilmelidir ki memlekette ve memleket haricinde Yahudi propagandası alabildiğine yürüdüğü bir sırada hürriyetimize gem vurmayı beklemek bütün Türklüğü rencide etmek demektir. Şunu de söylemek isteriz ki Milli İnkılap tatil edilse de kitap halinde vaki olacak neşriyatımız kanun ve adaletin müsaadesiyle karilerimizle temasımızı idame ve büyük hakikatlerin ortaya atılmasına yardım edecektir"* (Milli İnkılap, 15 Temmuz 1934, s. 1).

Milli İnkılap dergisi, Trakya Olaylarının yaşanmasında pay sahibi olduğu gerekçesiyle İcra Vekilleri Heyeti tarafından 7 Temmuz 1934'te kapatılmıştır (BCA, 30.18.1.2/46.48.2, 07.07.1934). Derginin kapanma nedeni ise şöyle açıklanmıştır: "*Milli İnkılap mecmuasının neşriyatıyla memleket içinde ve dışında fena bir cereyan husule getirmek ve milli vahdeti bozmak gayesini takip ettiği anlaşıldığından, matbuat kanununun 50. maddesi gereğince tatili İcra Vekilleri Heyetince kabul olunmuştur"* (Cumhuriyet, 17 Temmuz 1934, s. 1). Dergi dışında, Cevat Rifat'ın "Suzi Liberman" adındaki eseri de "zararlı yazılar içerdiği" gerekçesiyle toplatılmış ve satışı yasaklanmıştır (BCA, 30.18.1.2/68.77.19, 17.09.1936). Theodor Fritsch tarafından yazılıp, İsmet Uskent'in Türkçeye çevirdiği ve Cevat Rifat'ın İstanbul Selamet matbaasında bastırdığı "Yahudilik ve Masonluk" isimli kitap da yine "zararlı yazılar" içerdiği gerekçesiyle toplatılmıştır (BCA, 30.18.1.2/65.49.11, 08.06.1936). Cevat Rifat'ın "İğneli Fıçı" adındaki broşürü de İcra Vekilleri Heyeti onayı ile satıştan kaldırılmıştır (BCA, 30.18.1.2/72.13.06, 16.02.1937).

MİLLİ İNKILAP DERGİSİNE TÜRK BASININDAN TEPKİLER

Cevat Rifat Milli İnkılap dergisindeki yazılarından sonra "Nazi hayranı", "Yahudi düşmanı" gibi eleştirilere maruz kalmış, ancak bu eleştirilere dergide kaleme aldığı birçok yazı ile karşılık vermiştir. Örneğin, derginin 1 Haziran 1934 tarihli nüshasında kaleme alınan *"Maskeler Aşağı"* başlıklı yazı, bir cevap mahiyeti taşımaktadır. Söz konusu yazıda şöyle denilmekteydi:

> "*Efendiler, aceleniz ne? Bu hücumların sebebi nedir? Almanya'da, bütün dünyada kıyamet kopsa kendi hesabıma umurumda bile değildir. Ben yalnız Türklük ve yalnız Türkiye ile alakadar bir insanım. Bütün hayatım, bütün mevcudiyetim bu ideal uğrunda geçmiştir… Biz ne ırk, ne din, ne de hiçbir millete düşman değiliz. Biz sadece milletlerin kanını emen, ekmeğini yediği memlekete nankörlük eden, misafirperverlik kıymeti bilmeyen ve insanlıktan öç almayı kendilerine ideal edinen muzur teşekküllere ve bu teşekküllerin tahribatına düşmanız. Mücadelemiz samimi, milli ve namuskârdır"* (Milli İnkılap, 1 Haziran 1934, s. 4-6).

Türk basını ilk başlarda Milli İnkılap dergisinin Yahudi aleyhtarı yayınlarına karşı kayıtsız kalmıştır. Ancak dergide Yahudi karşıtı politikaların şiddetlenmesi üzerine *Yeni Savaş, Son Posta, Haber Akşam Postası ve Vakit* gibi gazeteler dergi ile uzun soluklu bir mücadeleye başlamıştır. *Son Posta* gazetesi 13 Mayıs 1933'te yayımladığı bir haberinde, İzmir'de "İnkılap" isminde bir mecmuanın çıktığını ve bu mecmuanın Almanya'da Hitlerin Yahudi düşmanlığından etkilendiğini, Türkiye'de de bu düşmanlığı yaymak istediklerini ve bunun içinde Yahudi aleyhtarı makaleler ve şiirler neşrettiğini ileri sürmüştür. Ayrıca Teşkilat-ı Esasiye Kanunu gereğince, Yahudilerin de Türk vatandaşı olduğunu ve vatandaşlar arasına husumet sokacak neşriyatların da yasak olduğunu vurgulamıştır (Son Posta, 13 Mayıs 1933, s. 3).

Son Posta gazetesinin bu haberine karşılık İnkılap dergisi, gazeteye hitaben bir yazı yayımlamıştır. Yazıda ilk olarak kendilerine "taşralı" denilmesine tepki gösterilmiş ve şöyle denilmiştir:

> *"Evvela kendisini geçmiş devirlerin Babıalisinde farzeden Muhabir Efendi, bize taşralı ithamında bulunmuştur. Vaktiyle İstanbul saraylar etrafında imtiyazlı bir payitaht, devletin bütün yükünü sinesinde taşıyan kahraman Anadolu da bir taşra idi. Bu İkinci İnönü zaferine kadar böyle devam etti. Devir değişti, rejim değişti, dünya değişti ve İstanbul da bugün, Cumhuriyet Hükümeti'nin İzmir gibi bir vilayet merkezi olduğu halde Muhabir Efendi'nin kafası hala değişmedi!"* (İnkılap, 1 Haziran 1933, s. 28-29).

Yazının devamında Almanya'nın etkisinde kalınarak bir Yahudi aleyhtarlığı yapılmadığı, 16 seneden beri bu mücadeleye devam ettikleri, Filistin Cephesi'nin gerisinde yaşananları hatırlatmak istedikleri, mütareke günlerinin çabuk unutulduğu, gazetenin "vatandaş" diye tasvir ettiği Yahudilerin hala Türk diline ve benliğine aykırı davrandığı belirtilmiştir (İnkılap, 1 Haziran 1933, s. 28-29).

Milli İnkılap dergisine bir tepki de *Yeni Savaş* gazetesinden gelmiş ve gazete Cevat Rifat'ın İstanbul Üniversitesi önünde öğrencilere Hitler rozeti dağıttığını ve Nazi propagandası yaptığını ileri sürmüştür. Ayrıca gazete Cevat Rifat'ı ırkçılıkla, Hitlerin propagandasını yapmakla ve Hitlerin Türkiye'deki ajanı olmakla suçlamıştır (Yeni Savaş, 10 Mayıs 1934; Yeni Savaş, 17 Mayıs 1934). *Yeni Savaş* gazetesinin bu haberine karşı Milli İnkilap dergisi, cevap niteliğinde bir yazı yayımlamıştır. Dergi, *Yeni Savaş* gazetesinin Yahudilerin savunuculuğunu yaptığını, Cevat Rifat'ın kim olduğunu bilmeden araştırmadan saygısız bir şekilde hakaret ettiğini, vatan ve milli istiklal mücadelesinde çok yüksek görevlerde bulunan bir şahsa, Hitleri

taklit etme ve onun rozetini gençlere takma iftirasının atıldığını ileri sürmüştür. Yazının devamında ise şöyle denilmekteydi:

> *"Sen herhalde düşüncesiz, şuursuz ve mefkuresiz hareket eden bir oyuncaksın. Evvela kendini anlat kimsin? Memleket için yaptığın hizmet nedir? Kimi temsil ediyorsun? Hangi gençlik sana bu salahiyeti verdi? Hangi hükümet ve kanunlara yazılarımız uygun değil? Dikkat et! Yahudinin asıl rolü budur. Fertleri, cemiyetleri ve hükümetleri birbirine düşürmek ve onların mücadelesinden istifade etmektir. Biz Yahudiyi ve onun beşeriyet için bir mikrop olduğunu nazari, ameli ve ilmi bir tez olarak hatta kendi lisanlarından ispat ediyoruz. Sende bunun aksini ispat edecek kudret ve iktidar var ise o yoldan yürü! Yalan ve iftira ile işe başlama"* (Milli İnkılap, 15 Mayıs 1934, s. 14).

Son Posta gazetesinin 16 Mayıs 1934 tarihli sayısında, Türkiye'de Hitlercilerin propaganda için teşkilat yaptığı, Alman firmalarını temsil eden bir Türk'ün de bu vazifeyi üzerine aldığı ve faaliyete geçtiği ileri sürülmüştür (Son Posta, 16 Mayıs 1934, s. 3). *Haber Akşam Postası* da Milli İnkılap dergisine tepki gösteren gazetelerdendi. Gazetenin, "*Yahudi Düşmanlığına Düşmanız"* başlıklı yazısında şöyle denilmekteydi:

> *"İstanbul'da Musevi aleyhtarlığını şiddetle güden bir mecmua intişara başladı. İsmi milli inkılabımızdan mülhem. Baş tarafında Gazi Hazretlerine dair bir makale var. Fakat, maksat eğer Kemalizm ise Kemalizmin umdeleri arasında Yahudi düşmanlığı yoktur. Hitlercilikse, bunun Türkiye şeraitine uydurulmasını kimse zaten beceremez. Farzı muhal ve maazallah becerse de memleketin menfaatine, asrın telakkiyatına zıt olan, 'onu kovalım, bunu ezelim', icraatından zarar husule gelir. Cumhuriyet Türkiyesi, kendi tebaasından olanları temsil etmek siyasetini takip eden milliyetçi bir devlettir. Türkiye'de Yahudi düşmanlığına düşmanız"* (Haber Akşam Postası, 17 Mayıs 1934, s. 1-3).

Vakit gazetesi 6 Mayıs 1934 tarihli nüshasında, "*Köylü, Bezirganların Elinden Kurtarılmalı"* başlıklı yazısında bir köylünün gazeteye yolladığı mektubu yayımlamıştır. Mektupta Çanakkale'nin iktisadi açıdan tamamen Yahudiler'in eline geçtiğinden, iki yüz bin nüfusluk koca bir vilayetin Yahudilerden şikayetçi olduğundan, İcra Dairesi dosyaları içinde en çok alacaklı olanların Yahudiler olduğundan ve köylerde bütün tarlaların da Yahudilerin eline geçtiğinden bahsedilmiştir (Vakit, 6 Mayıs 1934, s. 6). Milli İnkılap da 15 Mayıs 1934 tarihli sayısında *Vakit* gazetesinden alıntı yaparak bu mektubu aynen yayımlamış ve hükümetin bu duruma bir an evvel müdahale etmesi gerektiğini vurgulamıştır (Milli İnkılap, 15 Mayıs 1934, s. 3).

Mehmet Asım Us, *Vakit* gazetesinin 20 Mayıs 1934 tarihli nüshasında "*Türkiye'de Yahudi Düşmanlığı Var mıdır?"* başlığı altında bir yazı kaleme almıştır. Mehmet Asım yazısında Milli İnkılap dergisinin *"Köylü, Bezirganların Elinden Kurtarılmalı"* başlıklı yazıyı *Vakit* gazetesinden alıp aynen yayımlamasına tepki göstermiştir (Asım, 20 Mayıs 1934, s. 1-4). Mehmet Asım'a göre, Çanakkale'den gönderilen bu mektup belirli bir kesime ait olabilirdi ve bütün Yahudi vatandaşları bu olaydan sorumlu tutmak doğru değildi. Mehmet Asım bir neşriyat yolu ile ortaya çıkan Yahudi düşmanlığının Türkiye'ye Almanya'dan geldiğini, ancak Almanya'daki Hitlerizm ile Türkiye'deki Kemalizm arasında milliyet prensibi açısından farklılıklar olduğunu vurgulamıştır (Asım, 20 Mayıs 1934, s. 1-4).

Cevat Rifat'a ve Milli İnkılap dergisine karşı tepkiler sadece basından gelmemiş, Türkiye'deki Yahudi cemaatlerinden de birçok tepki gelmiştir. Yahudi cemaat liderleri "La Turquie" gazetesine vermiş oldukları bir demeçte, Milli İnkılap dergisinin Yahudi karşıtı tutumunun yabancılarda yanlış bir algıya sebep olabileceğini ve bu konuda da kendilerinin endişe

duyduklarını belirtmişlerdir (İl, 2018, s. 26). Türkiye Hahambaşılığı ise derginin yasaklanması için bir takım girişimlerde bulunmuş ancak herhangi bir netice alamamıştır. Hahambaşılığın bu girişimleri karşısında Milli İnkılap dergisi şu şekilde bir cevap vermiştir:

> *"Kulaklarımıza uzaktan yakından fısıltılar ulaştı. Yahudiler yaygarayı koparmışlardı. Mecmuayı kapatacakları ve mahkemeyi aleyhimize harekete geçireceklerini duyurmadıkları kimse kalmadı. Yahudilerle karşılaştığımız ne de belli. Bu satırları yazan insanlar bu hürriyet uğrunda kan dökmüş insanlardır. Onlar kuru gürültüye pabuç bırakmayacakları gibi inkılapçı Türk Hükümetini ve adil Türk mahkemelerini Yahudi yaygaralarına kulak asacak kadar zayıf zannetmek de Yahudilerin Türkiye'deki son hüsranları olacaktır. Efendiler! Filistin'de değil, Türkiye'desiniz"* (İnkılap, 1 Haziran 1933, s. 11).

Milli İnkılap dergisi Bakanlar Kurulu'nun 6 Şubat 1946 tarihli izniyle tekrar yayımlanmaya başlamıştır (BCA, 030.18.01.02/110.10.17, 06.02.1946). Sadece 6 sayı yayımlanabilen derginin dağıtımını hiçbir bayi yapmak istemediğinden dergi yayımını kendiliğinden sonlandırmıştır (Bozkurt, 2011b, s. 199).

SONUÇ

Milli İnkılap dergisi 1933-1934 yılları arasında 12 sayı olarak yayımlanmıştır. Derginin yayın politikasının en önemli özelliği hemen her sayısında Yahudi toplumunu hedef alması ve bütün bölümlerinde Yahudi aleyhtarlığının yapılmasıdır. Derginin içeriği incelendiğinde reklamlar dışında, ön ve arka kapaklarının, ara başlıkların, köşe yazılarının ve hatta karikatürlerin bile Yahudi karşıtı ifadeler ile verildiğini görmek mümkündür.

Dergide "hain", "casus" ve "nankör" Yahudi figürü ön plana çıkmış ve derginin çoğu sayısında bu konuya değinilmiştir. Dergiye göre Yahudiler, Sina ve Filistin Cephelerinden itibaren hıyanet ve casusluk faaliyetleri içerisindeydi. Cephe gerisinde çok zengin ve mesut bir hayat sürmekteydiler. Türklerin müsamahası sayesinde de emniyet içerisinde yaşamlarını devam ettirmekteydiler. Buna rağmen Yahudilerin Türk milletine karşı hürmetsizlik ettiği, milletin bayrağına ve izzeti nefsine karşı saygısızlık yaptığı dergi içerisinde en çok eleştirilen konu olmuştur. Yine dergide Yahudilerin bilerek ve isteyerek Türkçe konuşmadığı, Türk kültür ve medeniyetine yabancı oldukları, Türklerden alışveriş yapmadıkları, ekonomik durumlarının Türklere göre çok daha ileri bir seviyede olduğu gibi konulara da sık sık yer verildiği görülmektedir.

Türk ve Yahudi kamuoyunda zaman zaman tepkiyle karşılanan ve basında da uzun süreli tartışmalara sebep olan Milli İnkılap dergisi, 1934 Trakya Olaylarının yaşanmasında pay sahibi olduğu gerekçesiyle 7 Temmuz 1934'te kapatılmıştır. Derginin Trakya Olayları üzerinde etkisi olup olmadığı konuyu araştıran yazarlar arasında uzun bir süre tartışılmış ancak araştırmacıların bu konuda bir fikir birliğine varamadıkları görülmüştür.

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BİREYSEL YATIRIM TERCİHLERİNDE PSİKOLOJİK ETKENLER: BELİRSİZLİKTEN KAÇINMA VE STRES

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ÖZET

Bu çalışmanın amacı, yatırım tercihlerinde belirleyici rol oynayan psikolojik etkenlerin finansal kararlar üzerinde ne ölçüde ne ölçüde etkide bulunduğunu ortaya çıkarmaktır. Belirsizlik, bireylerin karar alma süreci ile finansal davranışlarını etkileyen hem psikolojik hem de davranışsal yönleri bulunan önemli bir faktördür. Bireylerin sahip oldukları stres düzeyi ve belirsizlikten kaçınmaya yönelik eğilimleri özellikle finansal seçimlerin yapıldığı ortamlarda bireylerin tutum ve eğilimlerini önemli ölçüde etkilemektedir. Davranışsal finans yaklaşımı, bireylerin karar süreçlerini yalnızca rasyonel değerlendirmelere indirgememekte; bunun yerine, duyguların, bilişsel çarpıtmaların ve stres gibi psikolojik etmenlerin etkisini ön plana çıkarmaktadır. Bu çerçevede, geleneksel finansın rasyonellik varsayımı eleştirel biçimde sorgulanmaktadır.

Belirsizlikten kaçınma eğilimi ve stres düzeyinin yatırım kararlarına olan etkisini ölçmek amacıyla İstanbul ilinde faaliyet gösteren teknoloji, bankacılık, lojistik, gıda ve giyim sektörlerinde, aktif olarak yatırım yapan mali işler departmanlarında görev alan 273 katılımcıdan geçerli veri elde edilmiştir. Araştırma modeli Kısmi En Küçük Kareler Yapısal Eşitlik Modellemesi (PLS-YEM) kullanılarak test edilmiştir. Araştırma bulgularına göre, belirsizlikten kaçınma düzeyi yüksek olan bireylerin daha muhafazakâr ve ihtiyatlı davranarak yatırım tercihlerine karar verdikleri sonucuna ulaşılmıştır. Bu eğilime sahip olan bireyler, risk içeriği düşük, getirisi öngörülebilir yatırım araçlarına yönelmekte bununla birlikte karmaşık yapıya sahip, belirsizlik düzeyi yüksek ve istikrarsız piyasa koşullarıyla karakterize edilen yatırım alanlarından uzak durmaktadırlar. Ayrıca stres düzeyi yüksek bireylerin, düşük riskli ve güvenli yatırım araçlarına yöneldiği belirlenmiştir. Stres arttıkça, bireylerin kararlarını kısa vadeli hedefler doğrultusunda şekillendirdiği ve riskli tercihlerden uzak durma eğilimlerinin güçlendiği tespit edilmiştir. Elde edilen sonuçlar, yatırım kararlarının sadece ekonomik rasyonaliteye değil aynı zamanda bireylerin psikolojik yapılarına ve stresle başa çıkma kapasitelerine de bağlı olduğunu göstermektedir. Bu bağlamda, bireylerin finansal karar süreçlerinin iyileştirilmesi adına psikolojik farkındalıkların artırılması, stres yönetimi becerilerinin geliştirilmesi ve belirsizlikle başa çıkma stratejilerinin öğretilmesi önemli bir gereklilik olarak öne çıkmaktadır. İleride yapılacak araştırmalarda farklı sektörler, yaş grupları

veya eğitim düzeylerine göre karşılaştırmalı analizler gerçekleştirilerek bu ilişkinin genellenebilirliği daha da güçlendirilebilir.

Anahtar Kelimeler: Davranışsal Finans, Stres, Belirsizlik, Yatırım Kararları

PSYCHOLOGICAL FACTORS IN INDIVIDUAL INVESTMENT PREFERENCES: AVOIDANCE OF UNCERTAINTY AND STRESS

ABSTRACT

The primary objective of this study is to examine the extent to which psychological factors, which play a decisive role in investment preferences, influence financial decision-making. Uncertainty is a critical factor that affects individuals' decision-making processes and financial behavior, encompassing both psychological and behavioral dimensions. Individuals' levels of stress and their tendencies to avoid uncertainty significantly shape their attitudes and behavioral inclinations, particularly in environments where financial decisions are made.

The behavioral finance perspective does not reduce decision-making processes to purely rational evaluations; rather, it emphasizes the influence of emotions, cognitive biases, and psychological factors such as stress. Within this framework, the rationality assumption of traditional finance is critically challenged.

In order to assess the influence of uncertainty avoidance tendencies and stress levels on investment decisions, valid data were collected from 273 participants working in finance departments actively engaged in investment decisions across various sectors, including technology, banking, logistics, food, and apparel in Istanbul. The research model was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM).

Findings indicate that individuals with a high tendency to avoid uncertainty exhibit more conservative and cautious behavior when making investment decisions. These individuals tend to prefer low-risk, predictable-return investment instruments while avoiding investment areas characterized by high uncertainty and volatile market conditions. Moreover, it was observed that individuals experiencing high levels of stress are more inclined to choose low-risk and secure investment options. As stress levels increase, individuals tend to focus their decisions on short-term goals and demonstrate a stronger tendency to avoid risky alternatives.

The results suggest that investment decisions are not solely driven by economic rationality but are also significantly influenced by individuals' psychological profiles and their capacity to cope with stress. In this context, enhancing psychological awareness, developing stress management skills, and teaching strategies to cope with uncertainty emerge as critical requirements for improving individuals' financial decision-making processes. Future research could strengthen the generalizability of these findings by conducting comparative analyses across different sectors, age groups, or educational levels.

Keywords: Behavioral Finance, Stress, Uncertainty, Investment Decisions

Yazar Notu: Bu çalışma ilk yazarın ikinci yazar danışmanlığında hazırladığı yüksek lisans tezininin bir kısmından üretilmiştir.

ADVANCED OXIDATION PROCESSES FOR EFFICIENT AZO DYE DEGRADATION: EXPERIMENTAL AND TOXICITY INSIGHTS

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Abstract

Background: Aquatic environments today face contamination from various compounds originating from industrial wastewater. Advanced oxidation processes (AOPs) are one of the very efficacious solutions for the degradation and mineralization of refractory contaminants from industrial wastewater such as the hazardous Ponceau S dye (PS).

Methods: In this novel experimental work, the PS degradation with the Fenton-like process was inspected. The Full Factorial Design (FFD) was applied to study the effect of operating parameters on the PS degradation efficiency. Molecular docking was investigated to study the PS's toxicity, mutagenicity and carcinogenic effect.

Significant Findings: The statistical optimization demonstrated a coefficient R^2 of 0.9638. The underlying reasons of each factor's effect on the PS degradation were comprehensively discussed. The optimal conditions established by the experimental design were as follows: the initial dosage of cobalt ions at 0.12 mM, PS dosage at 0.06 mM, and initial H_2O_2 dosage at 1 mM. At optimum conductions, the expected PS degradation was 20.14%.

Ponceau S docked effectively with all five targets, showing the strongest and cleanest binding to CDK8. AKT and PR had strong but slightly less favorable interactions. Hydrophobic and electrostatic forces played a major role in ligand stabilization.

Keywords: Ponceau S; Fenton-like process; Industrial wastewater; molecular docking; full factorial design; Toxicity

MAKROEKONOMİK GÖSTERGELER KULLANILARAK AĞAÇ TABANLI MAKİNE ÖĞRENİMİ YÖNTEMLERİ İLE İŞSİZLİK ORANI TAHMİNİ

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ÖZET

Makroekonomik göstergelerin doğru bir şekilde tahmin edilmesi karar alıcılar ve politika yapıcılar için ekonomi politikalarının etkin bir şekilde uygulanabilmesi ve karar alıcıların riskleri öngörebilmesi açısından oldukça önemlidir. Bu çalışma ekonomik büyüme ve istihdamın en önemli makroekonomik göstergelerinden birisi olan işsizlik oranını tahmin ederken ekonomik güven endeksi, tüketici güven endeksi, istihdam oranı, iş gücüne katılım oranı, sanayi üretim endeksi, tüketici fiyat endeksi (TÜFE), çekirdek enflasyon, TÜFE bazlı reel efektif döviz kuru, kapasite kullanım oranı ve Türk Lirası cinsinden tüketici kredi faiz oranı değişkenlerini dikkate almaktadır. Çalışmada kullanılan veriler Türkiye İstatistik Kurumu (TÜİK) veri tabanından temin edilmiş olup 01.01.2007 – 01.02.2025 dönemine ait aylık verileri kapsamaktadır. Analiz, karar ağacı (DT), rassal orman (RF), AdaBoost, Extra Trees, Gradient Boosting (GBDT), XGBoost olmak üzere 6 farklı ağaç tabanlı makine öğrenimi tekniği kullanmaktadır. Analiz sonucunda modellerin performans değerlendirmesi, R^2, RMSE, MAE ve MAPE metrikleri üzerinden yapılmıştır. Tüm modeller arasında en yüksek açıklama gücüne sahip olanların Extra Trees (%95.37) ve XGBoost (%95.36) olduğunu göstermektedir. Bu iki model, veri setindeki varyansı yüksek oranda açıklayarak güçlü bir tahmin performansı sergilemiştir. Hata metrikleri incelendiğinde ise farklı bir sıralama ortaya çıkmaktadır. RMSE değerine göre en düşük hata oranını XGBoost (0.398) verirken, MAE ve MAPE metriklerinde en iyi performans Extra Trees modeline aittir (sırasıyla 0.301 ve 2.78%). Bu bulgular, Extra Trees modelinin mutlak ve yüzde hata oranlarını en iyi şekilde minimize ettiğini, XGBoost modelinin ise büyük hataları daha iyi dengelediğini göstermektedir. Genel olarak, Extra Trees ve XGBoost modellerinin hem açıklama gücü hem de hata metrikleri açısından diğer modellere kıyasla üstün bir performans sergilediği sonucuna varılmıştır. Bu sonuçlar, her iki modelin de farklı metrikler bazında birbirine yakın ve başarılı tahminler sunduğunu doğrulamaktadır.

Anahtar Kelimeler: İşsizlik Oranı, Makroekonomik Göstergeler, Makine Öğrenimi, Tahmin

PREDICTION OF UNEMPLOYMENT RATE USING MACROECONOMIC INDICATORS WITH MACHINE LEARNING METHODS

ABSTRACT

Accurate forecasting of macroeconomic indicators is crucial for decision-makers and policymakers to effectively implement economic policies and anticipate risks. This study forecasts the unemployment rate, one of the most important macroeconomic indicators of economic growth and employment, taking into account the economic confidence index, consumer confidence index, employment rate, labor force participation rate, industrial production index, consumer price index (CPI), core inflation, CPI-based real effective exchange rate, capacity utilization rate, and consumer credit interest rate in Turkish Lira. The data used in the study were obtained from the Turkish Statistical Institute (TÜİK) database and cover monthly data for the period 01.01.2007 – 01.02.2025. The analysis uses six different tree-based machine learning techniques: decision tree (DT), random forest (RF), AdaBoost, Extra Trees, Gradient Boosting (GBDT), and XGBoost. The analysis evaluated model performance using the R^2, RMSE, MAE, and MAPE metrics. Among all models, Extra Trees (95.37%) and XGBoost (95.36%) demonstrated the highest explanatory power. These two models exhibited strong prediction performance by explaining a high proportion of the variance in the dataset. However, a different ranking emerges when examining the error metrics. While XGBoost (0.398) had the lowest error rate according to the RMSE value, the Extra Trees model had the best performance in the MAE and MAPE metrics (0.301 and 2.78%, respectively). These findings show that the Extra Trees model minimizes absolute and percentage error rates best, while the XGBoost model balances large errors better. Overall, it was concluded that the Extra Trees and XGBoost models demonstrate superior performance compared to other models in terms of both explanatory power and error metrics. These results confirm that both models provide similar and successful predictions based on different metrics.

Keywords: Unemployment Rate, Macroeconomic Indicators, Machine Learning, Prediction

A BIBLIOGRAPHIC STUDY ON THE POETIC FORMS OF DIVAN LITERATURE

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ABSTRACT

The Turks, after accepting the religion of Islam, came under the influence of Persian literature, which had accepted Islam earlier. Just as they adopted terms and concepts from Arabic as the language of religion, they also began to adopt words and concepts from Persian as the language of literature. In Divan literature, the differences in form are called poetic forms (eşkâl-i nazm, nazım şekilleri). Poetic form is determined by the rhyme scheme and the verse unit. The aesthetic power in poetry is achieved through harmony. Although there are many elements of harmony in Divan literature, the most important ones are meter (vezin) and rhyme. In Divan poetry, poetic forms defined by tradition were not deviated from. Although the concept of form, which relates to the external structure used in poetry, carries great importance, it has also varied according to literary movements and periods. Divan poetry was continued within certain poetic forms, and although there are many sources describing and explaining these forms, it is also seen that the poems written by some poets in a specific poetic form are treated separately. This bibliography study is a work aimed at collectively presenting such existing studies.

Keywords: poetic forms, Divan, poetry, bibliograp

DİVAN EDEBİYATI NAZIM ŞEKİLLERİ ÜZERİNE BİBLİYOGRAFYA ÇALIŞMASI

ÖZET

İslâm dinini kabul eden Türkler, daha önce Müslümanlığı kabul etmiş bulunan İran edebiyatı etkisi altında kaldılar. Türkler, din dili olarak Arapçadan kavramlar ve kelimeler aldıkları gibi edebiyat dili olarak da Farsçadan da kelimeler ve kavramlar almaya başladılar. Divan edebiyatında biçimde gösterdikleri farklılıklara nazım biçimleri (eşkâl-i nazm, nazım şekilleri) denir. Nazım biçimlerini belirleyen kafiye düzeni ve nazım birimidir. Şiirde etkileyicilik ahenk ile sağlanır. Divan edebiyatında pek çok ahenk unsuru olmasına rağmen bunlardan en önemlisi ölçü (vezin) ve kafiyedir. Divan şiirinde geleneğin belirlediği nazım şekilleri dışına çıkılmamıştır. Şiirde kullanılan bu dış yapıyla ilgili olan şekil kavramı büyük önem taşımakla birlikte edebi akım ve dönemlere göre farklılık göstermiştir. Divan şiiri de belli nazım biçimleri içerisinde sürdürülmüş ve bu nazım şekillerini tanıtan, anlatan birçok kaynak bulunmakla birlikte bazı şairlerin de belli bir nazım biçimiyle yazmış olduğu şiirleri ayrı şekilde ele alındığı görülmektedir. Bu bibliyografya çalışması da yapılmış olan bu çalışmaları toplu olarak ortaya çıkarmak üzerine yapılan bir çalışmadır.

Anahtar Sözcükler: nazım şekilleri, divan, şiir, bibliyografya

GİRİŞ

Divan edebiyatı, XIII. yüzyıl sonlarından XIX. yüzyılın ikinci yarısına kadar olan süreci kapsar. Klâsik dönem Türk şairlerinin çeşitli nazım şekilleri ile yazdıkları şiirler, "dîvân" adı verilen kitaplarda toplanmıştır. Divan Edebiyatı, örnek aldığı Fars edebiyatının etkisi altında şekillenen, Arap ve Fars edebiyatının etkisini taşıyan yazılı bir edebiyattır. Kuralcılığın ve geleneğin ağır bastığı bir Türk edebiyatı dönemidir.

Türklerin X. yüzyıldan başlayarak İslam dinini kabul etmeleri ve XIX. yüzyılın ortalarından itibaren Batı uygarlığının etkisi altına girmeleri Türk Tarihinde önemli dönüm noktası olmuştur ve bu dikkate alınarak Türk edebiyatı da "İslâmiyet öncesi Türk edebiyatı", "İslâmî dönem Türk edebiyatı", "Batı etkisindeki Türk edebiyatı" olmak üzere üç ana döneme ayrılmıştır. "İslâmî dönem Batı Türk edebiyatı" XIII. yüzyıl sonlarında Anadolu'da doğmuş ve varlığını XIX. yüzyıl başlarına kadar sürdürmüştür. XIX. yüzyıl başlarından itibaren tükenmeye yüz tutmuş olan "İslami Dönem Batı Türk edebiyatı" bu yüzyılın ikinci yarısından sonra yerini yeni bir edebi anlayışa bırakmaya başlamıştır. Bu yeni edebiyatı öncekinden ayırmak için eskisine edebiyyât-ı kadime (eski edebiyat) ya da şi'r-i kudemâ (eskilerin şiiri) gibi adlar verilmiştir. Fakat bu adlarla yetinilmemiştir. Onu yalnızca toplumun belli kesimlerine hitap eden bir edebiyatmış gibi gösteren havâs edebiyatı (yüksek zümre edebiyatı), sarây edebiyatı, Enderun edebiyatı, edebiyyât-ı Osmâniyye (Osmanlı edebiyatı), Osmanlı şiiri, Divan edebiyatı, ümmet edebiyatı, ümmet çağı Türk edebiyatı, İslamî Türk edebiyatı, Klâsik Türk edebiyatı ve Eski Türk edebiyatı gibi adlarla da anılmıştır. Günümüzde bu adlandırmaların bir kısmı terkedilmiştir. Bu adlandırmalardan daha çok "Eski Türk edebiyatı", "Divan edebiyatı", "Klasik Türk edebiyatı" adları tercih edilmiştir (Saraç, 2011: 45).

Divan edebiyatı nazım şekilleri kafiye düzeni ve mısra sayıları bakımından üç bölümde incelenebilir. Divan edebiyatı nazım biçimleri, "beyitlerden oluşan nazım biçimleri", "dört mısralı nazım biçimleri" ve "bendlerden oluşan nazım biçimleri" olmak üzere üçe ayrılmıştır.

Tablo 1. Divan Edebiyatı Nazım Biçimleri

Beyitlerden Oluşanlar	Dörtlüklerle Oluşanlar	Bendlerle Oluşanlar
Gazel	Rubâî	Murabba
Kaside	Tuyuğ	Şarkı
Mesnevî		Muhammes
Kıt'a		Tercî-i Bend, Terkîb-i Bend
Müztezad		

Eski edebiyatımızda her beytin bir anlam bütünlüğü vardır. Beytin anlamı kendi içinde tamamlanır. Ama çok az görülmekle birlikte bu kaidenin dışına çıkıldığı da olmuştur. Böyle, bir nazım parçasının içinde anlamı kendi içinde tamamlanmayıp alttaki beyitlere de geçen beyitlerin her birine **Merhûn** adı verilir. Nefi'nin Sultan Ahmed vasfında söylediği ve Edirne şehrini anlattığı kasidesinin bazı beyitleri bu tür merhûn beyitlere iyi bir örnek sayılabilir (İpekten, 2019: 3).

BİRİNCİ BÖLÜM

Çalışmanın Amacı

Nazm, sözlüklerde “dizmek, düzeltmek, ipliğe inci dizmek” anlamlarındadır. (İpekten 2018: 58). Nazım, şiirin kafiyeli hali olarak belirtilebilir. Nazım birimi, nazım biçiminin en küçük parçası olarak söylenebilir. Türk edebiyatında pek çok nazım şekli kullanılmıştır. İslami Türk edebiyatının başlarında nazım şekilleri X. asırda İran edebiyatında şeklini tamamlamış ve değişmeden asırlarca devam ederek teknik şeklini tamamlamıştır. Fars ve Arap edebiyatlarından etkilenen divan edebiyatının nazım birimi ise beyittir.

Nazım şekli, manzumenin "şekil, biçim, form, tip" gibi kelimelerle de ifade edilen ve kafiye düzenine bağlı olarak şiirin dış yapısını, onun nasıl göründüğünü belirten bir kavramdır. (Çeltik, 2007: 191). Nazım şekilleri, şiirde kelimeleri belirli bir şemaya göre sıralayarak mısraları rastgele bir yığın olmaktan çıkarır. Divan edebiyatında nazım şekli olarak Gazel, Rubâî, Kaside, Tuyuğ, Mesnevî, Murabba, Kıt'a, Şarkı, Müstezad, Terkîb-bent, Tercî-bent, Musammat kullanılmıştır.

Ekrem Sakar, “Divan Edebiyatında Nazım Şekli” adlı makalesinde nazım şekilleri konusunu ele alan kaynakları “Geleneksel şekil bilgisi” ve “Yeni şekil bilgisi” olmak üzere iki başlık altında değerlendirmiştir (2017: 548-554). Nazım şekillerini belirleyen unsurların neler olduğu konusunda ele alınan bazı kaynakların hepsi aynı şeyleri söylemektedir. Tâhirü’l-Mevlevî, “Mısraların sayısına ve kafiyelerin tertibine göre bir manzumenin heyetine şekil, şekillerin hepsine birden eşkâl-i nazm denilir.” (1994: 115) diyerek nazım birimini ve kafiyeyi esas almıştır. İsmail Habib, "Bütün nazım şekillerini vücuda getiren kafiyedir." (1942: 89) der. Cem Dilçin, “Nazım biçimleri dize ve uyağın bir düzen içinde birleşmesinden oluşur.” (2005: 95) derken Haluk İpekten ise “Mısraların değişik kafiye düzeni içinde ve değişik sayılarda birleşmelerinden ayrı ayrı adlandırılan nazım şekilleri ortaya çıkmıştır.” (2003: 11) der. Sonuç olarak bu kaynaklardan da anlaşıldığı gibi nazım şeklini belirleyen nazım birimi ve kafiye olmak üzere iki unsur bulunmaktadır.

Nazım şekillerini belirleyen unsurların ne olduğu hususunda aynı düşünceler olsa da nazım şekillerini tarif ederken ihtilafa düşmüşlerdir. İsmail Habib, "beyit ile ölçülenler" diyerek altına gazel, kaside, terkîb-bent, tercî-bent, kıt'a biçimlerini koymuş "mısra ile ölçülenler" diyerek altına rubai, murabba, şarkı, muhammes, müseddes, müsemmen, muaşşer biçimlerini yerleştirmiştir. Mesneviyi ise hariçte tutarak bu iki gruptan ayrı bir şekil olarak kabul etmiştir. Cem Dilçin ise beyitlerle kurulanlar (gazel, kaside, mesnevi, kıta, müstezad) ve bentlerle kurulanlar (tek dörtlüler ve musammatlar) olarak ikiye ayırdığı nazım şekillerini tasnif ederken nazım şeklini oluşturan kafiyeyi dikkate almamış, sadece nazım birimini esas alarak bir sınıflandırmaya girişmiştir. İpekten de aynı yolu takip etmiş, sadece beyitlerle oluşan nazım şekillerinde mesnevi şeklini diğerlerinden ayırmak için tek kafiyeli olanlar ve çok kafiyeli olanlar biçiminde bir ayrıma gitmiştir. (Sakar 2017: 552-553). Özetle, nazım şeklini oluşturan iki şeyin nazım birimi ve kafiye olduğu konusunda hemfikir olmalarına rağmen nazım şekillerini sınıflandırırken yalnızca nazım birimini ölçüt kabul etmişlerdir.

Geleneksel kaynaklar yüzyıllar içinde oluşmuş, üzerinde büyük ölçüde aynı düşüncede kalınmış olsa da yeni yaklaşımlar bu tasnifin tutarsızlıklarını ortaya koymaktadır. Cemal Kurnaz ve Halil Çeltik’in Divan Şiiri Şekil Bilgisi adlı eserinde örneklerle ortaya koyduğu bu yeni yaklaşımda, şiirlerin nazım şeklini belirlerken “vezin, kısalık-uzunluk, mahlas içerip içermeme, bestelenmek için yazılıp yazılmama ve muhteva” gibi hususların bir ölçüt olarak kullanılmaması gerektiği vurgulanmaktadır. Bu konu üzerine akademik çalışmalar yapacak araştırmacılar için Cemal Kurnaz ve Halil Çeltik’in “Divan Şiiri Şekil Bilgisi” adlı eseri önemli bir kaynak olarak yer almaktadır.

Çalışmamızın konusunu teşkil eden, divan şiirinin belli nazım biçimleri içerisinde sürdürülmüş olması ve bu nazım şekillerini tanıtan, anlatan birçok kaynak bulunması, nazım biçimleri ile ilgili henüz çözülememiş birtakım sorunların bulunması üzerine akademik çalışmalar yapılmıştır. Bu yönden çalışmamız, bu türden çalışmaları bir araya getirmiştir.

Çalışmanın Hazırlanmasında İzlenen Yöntem

1. Çalışmanın hazırlanmasında öncelikle çeşitli kütüphanedeki kaynaklar taranmıştır. Yüksek Öğretim Kurulu Başkanlığının Ulusal Tez Merkezi'nde yer alan tezler, üniversitelerin açık erişim kaynaklarında yer alan makaleler taranmıştır.
2. Çalışma, Divan edebiyatı nazım şekillerini kapsayan akademik çalışmaların derlenmesini içermekle birlikte, bazı şairlerin belirli nazım şekliyle yazmış olduğu eserler de alınmıştır.
3. Dergilerde yayımlanmış makaleler, daha sonra bildiri olarak sunulmuş ise aynı akademik çalışma bildiriler bölümünde tekrardan yazılmıştır.
4. Bazı kitaplar içinde geçen Divan edebiyatı nazım şekilleriyle alakalı olan kısımlar kitap bölümleri şeklinde ayrı kategorize edilmiştir.
5. Çalışma, kendi içinde iki ana bölümden oluşmaktadır. İlk bölümde divan edebiyatı nazım şekilleri hakkında bilgi verilmiş ve giriş kısmında divan edebiyatı oluşumu ile ilgili bilgiler verilmiştir. İkinci bölümde bibliyografya çalışmasına yer verilmiştir. Aynı zamanda tablo şeklinde oluşturulmuş bibliyografyaların istatistikleri ve çalışmanın tamamı sonuç bölümünde değerlendirilmiştir.
6. Künyeler yayımlanma yıllarına göre sıralanmıştır. Aynı yıl yayımlanan eserler alfabetik sıraya göre dizilmiştir.

İKİNCİ BÖLÜM
BİBLİYOGRAFYA

Tablo 1. KİTAPLAR

	KİTABIN KÜNYE BİLGİLERİ			
Sıra	**Yazar Adı**	**Yıl**	**Kitabın Adı**	**Yayın Yeri**
1	Mehmed Fuad Köprülü	1926	Türk Klasik Edebiyatındaki Hususi Nazım Şekilleri: Tuyuğ	Milli Matbaa Yayınları
2	Murad Uraz	1940	Divan Edebiyatı Nazım Şekilleri	İnkılap Kitabevi Yayınları
3	Hikmet İlaydın	1951	Türk Edebiyatında Nazım	Üçler Basımevi Yayınları

4	Cem Dilçin	1983	Örneklerle Türk Şiir Bilgisi (Ölçüler - Uyak - Nazım Biçimleri - Söz Sanatları)	Türk Dil Kurumu Yayınları
5	Adem Çalışkan	1992	Fuzûlî'nin Su Kasidesi ve Şerhi	Diyanet İşleri Başkanlığı Yayınları
6	Ahmet Atilla Şentürk	1994	Ahmed Paşa'nın Güneş Kasidesi Üzerine Düşünceler	Enderun Kitabevi Yayınları
7	Haluk İpekten	1994	Eski Türk Edebiyatı Nazım Şekilleri ve Aruz	Dergah Yayınları
8	Metin Akar	1994	Su Kasidesi Şerhi	Türkiye Diyanet Vakfı Yayınları
9	Ali Yılmaz	1995	Kanûnî Sultan Süleyman'a Yazılan Kasideler	Kültür Bakanlığı Yayınları
10	Ali İhsan Öbek	1995	Divan Edebiyatında Sosyal ve Dini Konulu Rubâîler	İnsan Yayınları
11	H. İbrahim Şener	1995	Kasîde-i Bürde, Kasîde-i Bür'e ve Su Kasîdesi: metin-mukayese-tahlil	İrfan Kültür Eğitim Derneği Yayınları
12	Cemal Kurnaz	1997	Türküden Gazele Halk ve Divan Şiirinin Müşterekleri Üzerine Bir Deneme	Akçağ Yayınları
13	Hikmet İlaydın	1997	Türk Edebiyatında Nazım	Akçağ Yayınları
14	Adem Çalışkan	1999	Fuzûlî'nin Su Kasidesi ve Şerhi	Diyanet İşleri Başkanlığı Yayınları
15	Amil Çelebioğlu	1999	Türk Edebiyatında Mesnevî (XV. yy'a kadar)	Kitabevi Yayınları
16	Muhittin Eliaçık	2001	Türk Edebiyatında Ahlaki Mesnevîler	Yayınevi yok
17	Ahmet Atilla Şentürk	2002	XVI. Asra Kadar Anadolu Sahası Mesnevîlerinde Edebî Tasvirler	Kitabevi Yayınları
18	Mustafa Erdoğan	2002	Türk Edebiyatında Muhammes	Kültür Bakanlığı Yayınları
19	Hasan Kavruk	2003	Türkçe Mesnevîlerde Sebeb-i Telif	Özserhat Yayınları
20	Cemal Kurnaz, Halil Çeltik	2005	Klasik Nazım Şekillerinin Oluşumu ve Sistematiği	Gazi Kitabevi Yayınları
21	Fahir İz	2008	Eski Türk Edebiyatında Nazım	Akçağ Yayınları
22	Şahin Özge	2008	Ziya Paşa Terkîb-i Bend Tercî-i Bend	Çağrı Yayınları

23	Menderes Coşkun, Ali İhsan Öbek, Yavuz Bayram	2009	Gazel Şerhleri	Kriter Yayınları
24	Ahmet Kartal	2010	XVIII Asırda Mesnevî Türk Edebiyatı Tarihi c: II	Bakı Yayınları
25	Haluk İpekten	2011	Eski Türk Edebiyatı Nazım Şekilleri ve Aruz	Dergah Yayınları
26	İsa Kocakaplan, Mehmet Açа, Haluk Gökalp	2011	Başlangıçtan Günümüze Türk Edebiyatında Tür ve Şekil Bilgisi	Kesit Yayınları
27	Melike Gökcan	2011	Klasik Türk Edebiyatında Yûsuf u Züleyhâ Mesnevîleri	Kültür Bakanlığı Yayımlar Daire Başkanlığı e-kitap
28	Cemal Kurnaz, Halil Çeltik	2012	Şekiller Arasında Nazım Şekli Araştırmaları	Kurgan Edebiyat Yayınları
29	Fahir İz	2012	Eski Türk Edebiyatında Nazım Cilt: 2	Akçağ Yayınları
30	Gencay Zavotçu	2012	Dîvân Şairlerinden Gazeller I Nesre Çeviri Açıklama Terimler Kişiler ve Sanatlar Dehhânî-Nesîmî-Şeyhî-Zâtî	Umuttepe Yayınları
31	Abdullah Uçman	2013	Kasideye Medhiyye: Biçime İşleve ve Muhtevaya Dair Tespitler	Klasik Yayınları
32	Cemal Kurnaz, Halil Çeltik	2013	Divan Şiiri Şekil Bilgisi	Kurgan Yayınları
33	Ebu Bekir Sıddık Şahin	2013	Kasideye Medhiye: Biçime, İşleve ve Muhtevaya Dair Tespitler	Klasik Yayınları
34	Mustafa Güneş	2014	Klasik Türk Edebiyatında Hz. Peygamber Konulu Türler ve Su Kasidesi Şerhi	Hoşgörü Yayınları
35	Fahir İz	2015	Eski Türk Edebiyatında Nazım Cilt: 1	Akçağ Yayınları
36	Mehmet Sait Çalka	2015	Divan Şiirinde Rubâî	Kriter Yayınları
37	Nazire Erbay	2015	Klasik Türk Şiiri Gazellerinde Leyla	Fenomen Yayınları
38	Harun Yıldız, Hidayet Duyar	2016	Tercî-i Bend Terkîb-i Bend	Palet Yayınları
39	Hatice Aynur, Müjgân Çakır, Hanife Koncu, Selim	2016	Eski Türk Edebiyatı Çalışmaları XI Gazelden gazele: Dünün Şiirine Bugünden Bakışlar	Klasik Yayınları

	S. Kuru, Ali Emre Özyıldırım			
40	Nazire Erbay	2016	Gelenekten Bugüne Gazel Şerhleri	Fenomen Yayınları
41	Tâhirü'l Mevlevî	2016	Tedrisât-ı Edebiyyeden Nazm ve Eşkâl-i Nazm	Kesit Yayınları
42	Ahmet Topal	2017	Klasik Türk Şiirinde Kaside-i Masnu'a ve Nağzı'nin Masnu' Kasideleri	Fenomen Yayınları
43	Lokman Turan	2017	Mesnevîyi Gazelle Okumak	Kesit Yayınları
44	Mehmet Sait Çalka	2017	Divan Şiirinde Rubâî	Kriter Yayınları
45	Amil Çelebioğlu	2018	Türk Mesnevî Edebiyatı	Dergah Yayınları
	İsmail Güleç	2018	Süruri'nin Şehzade Mustafa Medhiyyesi Yahut Kaside-i Masnu'a	Kitabevi Yayınları
46	Rasıh Erkul	2018	Klasik Türk Şiirinde Şarkı	Kriter Yayınları
47	Reyhan Keleş	2018	Divan Şiirinde Mi'râciyye Kasideleri -Tespit ve Tahlil-	Kitabevi Yayınları
48	Sadık Armutlu	2018	Klâsik Fars ve Türk Edebiyatında Şem'ü Pervâne Mesnevileri	Fenomen Yayınları
49	Bahir Selçuk, Beyhan Kesik, Özer Şenödeyici, Ramazan Ekinci, Hamza Koç	2019	Eski Türk Edebiyatı Teorik Bilgiler Nazım Şekilleri, Edebi Türler, Aruz ve Edebi Sanatlar	Kut Yayınları
50	İsa Işık	2019	Gazelin Dilinden Leyla ve Mecnun Mesnevisi	Grafiker Yayınları
51	İskender Pala	2019	…ve Gazel Yeniden	Kapı Yayınları
52	Mehmet Sait Çalka	2019	Klasik Türk Şiirinde Tuyuğ	Kriter Yayınları
53	Nazire Erbay	2019	Klasik Türk Şiiri Gazellerinde Şair ve Şiir Karakteri	Fenomen Yayınları
54	Murat Ali Karavelioğlu, Fatih Koyuncu, Hatice Özdil, H. Sercan Koşik	2021	Divan Edebiyatından Gazel Şerhleri	Kut Yayınları
55	Yunus Kaplan, Zahide Efe	2021	Klasik Türk Edebiyatından Bir Kırkambar: Mecmû'a-i Musammat	Atatürk Üniversitesi Yayınları
56	M. A. Yekta Saraç	2022	Klasik Edebiyat Bilgisi / Biçim-Ölçü-Kafiye	Gökkubbe Yayınları

57	Nazire Erbay	2022	Gelenekten Bugüne Gazel Şerhleri - Genişletilmiş 2. Baskı	Paradigma Akademi Yayınları
58	Tâhirü'l-Mevlevî, Mehmet Atalay	2022	Aruz-Kafiye-Nazım Türleri ve Nazım Şekilleri	İstanbul, Büyüyenay Yayınları
59	Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş	2023	Su Kasîdesi (Şerh – Tahlil) / Töreli Türk Edebiyatı Çalışmaları 1	DBY Yayınları

Tablo 2. KİTAP BÖLÜMLERİ

	KİTAP BÖLÜMÜNÜN KÜNYE BİLGİLERİ				
Sıra	**Yazar Adı**	**Yıl**	**Kitap Bölümünün Adı**	**Kitabın Adı**	**Yayın Yeri**
1	Halil Erdoğan Cengiz	1972	Nazım Şekilleri	Divan Şiiri Antolojisi	Bilgi Yayınevi, s.39-79
2	Önder Göçgün	1987	Biçim	Yeni Türk Edebiyatı Metinleri	Selçuk Üniversitesi, s.15,189
3	Fuat Köprülü	2004	"Tuyug"	Edebiyat Araştırmaları 2	Akçağ Yay, s. 181-209.
4	Cem Dilçin	2009	Nazım Biçimleri ve Türleri	Örneklerle Türk Şiir Bilgisi	Türk Dil Kurumu, s. 95-250
5	Mehmet Açа, Haluk Gökalp, İsa Kocakaplan	2009	Eski Türk Edebiyatında Tür ve Şekil Bilgisi	Başlangıçtan Günümüze Türk Edebiyatında Tür ve Şekil Bilgisi	Kriter Yayın, s. 175-254
6	M.A. Yekta Saraç	2010	Klasik Edebiyat Bilgisi (Biçim-Ölçü-Kafiye)	Klasik Edebiyat Bilgisi Biçim-Ölçü-Kafiye	Gökkubbe Yayın, s. 21-189
7	Yaşar Aydemir	2011	Mecmualara Yansıyan Mesnevî Zevki	Eski Türk Edebiyatı Çalışmaları VI, Mesnevî: Hikâyenin Şiiri	(Ed. Hatice Aynur, Müjgan Çakır, Hanife Koncu, Selim S. Kuru, Ali Emre Özyıldırım) Turkuaz Yayınları, s. 287 - 298

8	Abdullah Uçman	2013	Kasidenin 19. Yüzyıldaki Serüveni	Kasideye Methiyye Biçime İşleve ve Muhtevaya Dair Tespitler	Klasik Yayınları, s. 456
9	Tülün Değirmenci Tural	2013	Şiirin Resmi: Nâdirî'nin Kasîdeleri, Nakşî'nin Resimleri	Eski Türk Edebiyatı Çalışmaları VIII Kasîdeye Medhiye Biçime İşleve ve Muhtevaya Dair Tespitler	(Ed. Hatice Aynur, Müjgan Çakır, Hanife Koncu, Selim S. Kuru, Ali Emre Özyıldırım) Klasik Yayınları, s. 314 - 337
10	Ahmet Mermer, Sebahat Deniz, Yavuz Bayram, Lütfi Alıcı, Muvaffak Eflatun, Neslihan Koç Keskin	2015	Eski Türk Edebiyatında Nazım Şekilleri	Eski Türk Edebiyatına Giriş	Akçağ Yayınları, s.75-151
11	Cafer Mum	2016	Gazelde Üslûb-i Muâdele veya Bercesteli Beyit Yapısı	Eski Türk Edebiyatı Çalışmaları IX Gazelden Gazele Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur, Müjgân Çakır) Klasik Yayınları, s. 88 -101
12	Lokman Turan	2016	Mesnevîyi Gazelle Okumak: Hüsrev ü Şîrîn'deki Gazeller ve İşlevleri	Eski Türk Edebiyatı Çalışmaları XI Gazelden Gazele: Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur, Müjgan Çakır) Klasik Yayınları, s. 136-156
13	Lokman Turan, Rıfat Kütük	2016	Mesnevîlerin Sebeb-i Telif ve Hâtime Bölümlerini Türk Edebiyatı Kaynağı Olarak Okumak	Eski Türk Edebiyatı Çalışmaları	(Ed. Hatice Aynur) Turkuaz Yayınları, s. 221 -230
14	Murat Umut İnan	2016	İran Edebiyatından Osmanlı Edebiyatına Gazelde Konu Bütünlüğü Meselesi	Eski Türk Edebiyatı Çalışmaları XI Gazelden gazele: Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur - Hanife Koncu) Klasik Yayınları, s. 102-135
15	Mustafa İsen, Osman Horata, Muhsin Macit, Filiz Kılıç, İ.	2016	Nazım Şekilleri	Eski Türk Edebiyatı	(Ed. Mustafa İsen) Grafiker Yayınları, s. 246-287

	Hakkı Aksoyak				
16	Sadık Armutlu	2016	Arap Edebiyatında Bir Tür: Gazel	Eski Türk Edebiyatı Çalışmaları XI Gazelden Gazele Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur - Hanife Koncu) Klasik Yayınları, s. 158-231
17	Sami Dural, Bilen Işıktaş	2016	Şiirden Doğaçlamaya Güftenin Nağmeyle Sarmalı: Osmanlı-Türk Müziğinde Gazel İcrası	Eski Türk Edebiyatı Çalışmaları IX Gazelden Gazele Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur - Hanife Koncu) Klasik Yayınları, s. 266-287
18	Selami Turan	2016	Türk Edebiyatında Gazel: Başlangıcından On Altıncı Yüzyıla Kadar	Eski Türk Edebiyatı Çalışmaları IX Gazelden Gazele: Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur, Müjgan Çakır) Klasik Yayınları, s. 30 -65
19	Veysel Öztürk	2016	Romanın Gazelle Dansı: Aşk-ı Vatan'da Gazelin İşlevi	Eski Türk Edebiyatı Çalışmaları IX Gazelden Gazele: Dünün Şiirine Bugünden Bakışlar	(Ed. Hatice Aynur, Müjgan Çakır) Klasik Yayınları, s. 232-245
20	Yavuz Bayram	2016	Şerhten Çözümlemeye Tahlilden İncelemeye Gazel	Eski Türk Edebiyatı Çalışmaları IX Gazelden Gazele Dünün Şiirine Bugünden Bakışlar	(Ed. Aynur, Hatice Çakır, Müjgân Koncu, Hanife Kurum, Selim S. Özyıldırım, Ali Emre) Klasik Yayınları, s. 102 - 135
21	Ünsal Yılmaz Yeşildal	2019	Türk Edebiyatında Nazım Şekilleri, Edebi Türler ve Bu Türlerin Özellikleri	Edebiyat Bilgi ve Kuramları	(Ed. Ahmet Mermer, Yavuz Bayram) Nobel Yayın Dağıtım, s. 121-140
22	Fatih Koyuncu	2021	17. Yüzyıl	Divan Edebiyatından Gazel Şerhleri	Kut Yayınları, s. 169-222
23	Halil Sercan Koşik	2021	14. - 15. Yüzyıl (Hoca Dehhani, Ahmedi, Nesimi, Şeyhi, Ahmed Paşa, Necati Bey)	Divan Edebiyatından Gazel Şerhleri	(Ed. H. Sercan Koşik) Kut Yayınları, s.9 -86
24	Murat Ali Karavelioğlu	2021	16. Yüzyıl	Divan Edebiyatından Gazel Şerhleri	(Ed. Halil Sercan Koşik) Kut Yayınları, s. 87 -168

25	Adnan Uzun	2023	Toprağa Hasret Su	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 391 -401
26	Ahmet Tanyıldız	2023	Benzemez Kimse Sana	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 95 -103
27	Ahmet Uğur	2023	Korku ile Ümit Arasında: Beyne'l-Havfi ve'r-Recâ	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 471 -477
28	Bilal Kemikli	2023	Zevk-i Tığ'dan Murat Nedir?	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar-Erhan Çapraz-Ertuğrul Karakuş) DBY Dün Bugün Yarın Yayınları, 55 -62
29	Emrullah Yakut	2023	Taşra Taşan Mânâ: Taşın Zikri	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 297 - 302
30	Erdem Sarıkaya	2023	Benzemez Kimse Sana	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 117 - 124
31	Erdoğan Uludağ	2023	Parmak Isırtan Mucize	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 325 -333
32	Erhan Çapraz	2023	Miraçtaki Sevgili	Su Kasidesi (Şerh - Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY

					Yayınları, s. 439 - 448
33	Gülçin Tanrıbuyurdu	2023	Aşk Toprağında Su'ya Hasretlik: Fuzûlî'nin Su Kasîdesi'nin Bir Beyti Üzerine	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 69 -77
34	Hakan Yekbaş	2023	Suya Teşne Olmak ya da Şefaat yâ Resulallâh!	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 423 -431
35	İbrahim Halil Tuğluk	2023	Dosta Âb-ı Hayat, Düşmana Zehr-i Mâr -Fuzûlî'nin Su Kasidesi'nin 21. Beyti'nin Şerhi	Su Kasidesi Şerhi Tahlili	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 347 - 355
36	İsmail Güleç	2023	Kurtulan kim? Gül mü, Bülbül mü?	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 413 - 421
37	Mahmut Kaplan	2023	Su Kasidesinin "Çâk Çâk" Beytinin Şerhi	Su Kasidesi (Şerh-Tahlil)	Dün Bugün Yarın Yayınları, s. 45 -53
38	Mehmet Kırbıyık	2023	Gönülden Gök Kubbeye Gözyaşları	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 29 -36
39	Mehmet Korkut Çeçen	2023	Güneş Çeşmesinden Hücre-i Saâdete Akan Feyz Bağlamında Su Kasidesi'nin Bir Beytinin Şerhi	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün Yarın Yayınları, s. 449 -455
40	Osman Ünlü	2023	Korku ile Ümit Arasında	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) Dün Bugün

					Yarın Yayınları, s. 465 -470
41	Seyit Yavuz	2023	İ'câzdan Mu'cize Hakîkat Yolu	Su Kasidesi (Şerh - Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 317 - 323
42	Şeyma Nur Zararsız	2023	Hû Hû Hû	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 227 - 237
43	Vildan Coşkun	2023	Galiba Aşık Olmuş	Su Kasidesi (Şerh-Tahlil)	(Ed. Abdülkadir Dağlar, Erhan Çapraz, Ertuğrul Karakuş) DBY Yayınları, s. 522

Tablo 3. TEZLER

	TEZİN KÜYE BİLGİLERİ					
Sıra	**Yazar Adı**	**Yıl**	**Tez Adı**	**Türü**	**Üniversite**	**Danışman**
1	Cevat Yerdelen	1991	Azmi-zâde Haleti'nin Rubâîleri	Doktora	Atatürk	Prof. Dr. Haluk İpekten
2	Ayşe Gülay Keskin	1994	Klasik Türk Edebiyatında Kaside Nazım Şekli; 13. - 14. - 15. asırlar	Yüksek Lisans	Gazi	Prof. Dr. Cemal Kurnaz
3	Yaşar Aydemir	1994	XVII. yüzyıl Türk Edebiyatında Kaside	Yüksek Lisans	Gazi	Prof. Dr. Cemal Kurnaz
4	Bilal Çakıcı	1996	Eski Türk Edebiyatında Kaside Nazım Şekli: 16. yüzyıl	Yüksek Lisans	Gazi	Prof. Dr. Mustafa İsen
5	Mürüvvet Çetinkaya	1996	Türk Edebiyatında Murabba	Yüksek Lisans	Gazi	Prof. Dr. Cemal Kurnaz

6	Recai Yıldız	1996	Türk Edebiyatında Tercî-i Bend ve Terkîb-i Bendler(13-16 yy)	Yüksek Lisans	Gazi	Prof. Dr. Cemal Kurnaz
7	Abdul Samet Şengil	1997	Başlangıcından İtibaren XVI. yüzyıl Sonuna Kadar Kıt'a	Yüksek Lisans	Kırıkkale	Prof. Dr. Mustafa İsen
8	Gencay Zavotçu	1997	Türk Edebiyatında Gül ve Bülbül mesnevileri (mukayeseli çalışma) (2 cilt)	Doktora	Atatürk	Yrd. Doç. Dr. Turgut Karabey
9	Muvaffak Eflatun	1997	Türk Edebiyatında Müstezad	Yüksek Lisans	Kırıkkale	Prof. Dr. Mustafa İsen
10	İsrafil Babacan	2001	XIX. yy. Türk Edebiyatında Kaside Nazım şekli; Şekil ve İçerik / 19. yüzyıl Türk edebiyatında Kasidelerin Karakterleri	Yüksek Lisans	Gazi	Doç. Dr. Filiz Kılıç
11	Mehmet M. Türe	2003	Divanlardaki Bahariye Başlıklı Kasideler	Yüksek Lisans	Çukurova	Yrd. Doç. Dr. Hanife Dilek Batislam
12	İbrahim Yavuz	2006	Türk Edebiyatında Tercî-i Bend ve Terkîb-i Bendler (XVII-XIX. yy)	Yüksek Lisans	Muğla Sıtkı Koçman	Prof. Dr. Pervin Çapan
13	Deniz Yağcı	2007	16. yüzyıl Kasidelerinde Medhiye	Yüksek Lisans	Celal Bayar	Prof. Mahmut Kaplan
14	Abdulmuttalip İpek	2008	Klâsik Türk Şiirinde Gül Redifli Kasideler	Yüksek Lisans	Fırat	Prof. Dr. Sabahattin Küçük
15	Esra Onur	2008	17. yüzyıl Kasidelerinde Medhiye	Yüksek Lisans	Celal Bayar	Prof. Dr. Mahmut Kaplan
16	Gülnihal Perk	2008	18. yüzyıl Kasidelerinde Medhiye	Yüksek Lisans	Celal Bayar	Prof. Dr. Mahmut Kaplan
17	Melike Gökcan Türkdoğan	2008	Klasik Türk Yûsuf u Züleyhâ Mesnevileri Üzerine Mukayeseli Bir Çalışma	Doktora	Atatürk	Prof. Dr. Turgut Karabey
18	Olgu Gürdal	2008	15. yüzyıl Divanlarındaki Kasidelerde Nesib Bölümü	Yüksek Lisan	Celal Bayar	Prof. Dr. Mahmut Kaplan
19	Ülkü Çetinkaya	2008	Aşk Mesnevîlerinde Kadın: Yûsuf u Züleyhâ	Doktora	Ankara	Prof. Dr. İsmail Ünver

			ve Husrev ü Şirin Mesnevîleri			
20	Yücel Ünlü	2008	Divanlarda Kısa Mesnevîler (XIV-XVI. yüzyıl)	Yüksek Lisans	Gazi	Prof. Dr. İsmail Hakkı Aksoyak
21	Evrim Belet	2009	Klasik Türk Edebiyatında Tasavvufi Mesnevîlerden Hüsn ü Aşk ve Gülşen-i Aşk'ın Alegorik Yönden Mukayeseli İncelemesi	Yüksek Lisans	Trakya	Yrd. Doç. Dr. Ayşegül Mine Yeşiloğlu
22	Sonay Büyük	2009	Hüseyin Ayvansarâyî'nin Eş`ârnâme-i Müstezâd Adlı Eseri (100b - 150a) İnceleme - Metin	Yüksek Lisans	Marmara	Prof. Dr. Nihat Öztoprak
23	Fazile Eren Kaya	2010	Mesnevîlerin dîbâce, Sebeb-i Te'lîf ve Hâtime Bölümlerinde Edebiyat Eleştirisi	Yüksek Lisans	Hacettepe	Doç. Fatma Sabiha Kutlar Oğuz
24	İsmail Gülcü	2010	XVI. yüzyıl Bazı Leylâ ve Mecnûn Mesnevîleri Üzerine Bir İnceleme	Yüksek Lisans	Dumlupınar	Yrd. Doç. Dr. Kadir Güler
25	Sebahat Özenmiş Tuzalan	2010	Şeyhülislamlara Sunulan Kasideler	Yüksek Lisans	Selçuk	Prof. Dr. Ahmet Yılmaz
26	Ayşe Nacar	2011	Divan Edebiyatında Aşk Redifli Gazeller ve Şerhleri	Yüksek Lisans	Kahramanmaraş Sütçü İmam	Yrd. Doç. Dr. Ahmet Yenikale
27	Handan Ayangil	2011	17. yüzyıl Türk Edebiyatında Gazel	Yüksek Lisans	İnönü	Yrd. Doç. Dr. Sadık Armutlu
28	Cemal Özyön	2013	Mecmua-i Gazeliyyat, Milli Kütüphane, 06 Hk. 319/1: İnceleme-çevriyazı	Yüksek Lisans	Nevşehir	Yrd. Doç. Dr. Ömer Bayram
29	Duygu Karagöz	2013	Mecmûa-i Gazeliyat(Milli Kütüphane 06 Hk 319/1) Metin-İnceleme	Yüksek Lisans	Afyon Kocatepe	Prof. Dr. Ali İrfan Aypay
30	Hatice Kübra Özçelik	2014	Kaside İle Gazel Arasında Divan Şiirinde Müzeyyel Gazel	Yüksek Lisans	Gazi	Yrd. Doç. Dr. Neslihan İlknur Keskin

31	İpek Taşdemir	2014	Milli kütüphanedeki 06 HK 319 numaralı Mecmu'a-ı Gazeliyyat (79A-154B)(İnceleme-çeviriyazılı metin-tıpkıbasım)	Yüksek Lisans	Anadolu	Yrd. Doç. Halit Biltekin
32	Kamile Çetin	2014	Divan Şiirinde Kaside Nesiblerinin Yansımaları ve Anlatım Teknikleri	Doktora	Gazi	Prof. Dr. Ahmet Mermer
33	Mehmet Sait Çalka	2014	Klasik Türk Şiirinde Rubâî	Doktora	Atatürk	Prof. Dr. Selami Ece
34	Esra Uslu	2015	Kasidede Övgü Kalıpları ve Divan Şiiri Öğretimindeki Yeri	Yüksek Lisans	Dokuz Eylül	Yrd. Doç. Dr. İlyas Yazar
35	Süreyya Yalçın	2015	Fatih Sultan Mehmed'e Sunulan Kasideler	Yüksek Lisans	Muğla Sıtkı Koçman	Yrd. Doç. Dr. Aydın Kırman
36	Bünyamin Derse	2016	Klâsik Türk Edebiyatında Yûsuf u Züleyhâ Mesnevilerinin Yûsuf Sûresine Uygunluğunun İncelenmesi	Yüksek Lisans	Kafkas	Yrd. Doç. Dr. Meheddin İspir
37	Gökhan Güler	2016	Millet Kütüphanesi'nde AEMNZ587 numarayla kayıtlı olan Mecmu'a-ı Eş'ar ve Gazeliyyat isimli şiir mecmuasının transkripsiyonu ve incelenmesi	Yüksek Lisans	Boğaziçi	Yrd. Doç. Dr. Tülay Demircioğlu
38	Ayşe Eryılmaz	2017	Klasik Türk Edebiyatında Kaynaklar/Mesneviler	Doktora	Atatürk	Prof. Dr. Metin Akkuş
39	Sadık Beklen	2017	Milli Kütüphane 8121 numarada kayıtlı Mecmûa-i Gazeliyyât adlı (İnceleme-metin) The poem Mecmûa-i Gazeliyyâ	Yüksek Lisans	Fırat	Doç. Dr. Hasan Şener
40	Zeynep Kılıç	2017	İstanbul Üniversitesi Kütüphanesi Nadir Eserler Bölümü TY-615 numarada kayıtlı bulunan "Mecmua-i	Yüksek Lisans	Cumhuriyet	Yrd. Doç. Dr. Ahmet Ölmez

			Gazeliyyat" inceleme/ Transkripsiyonlu Metin			
41	Ahmet Öntürk	2018	Klasik Türk Şiirinde Valilere Sunulan Kasideler	Yüksek Lisans	Van Yüzüncü Yıl	Doç. Dr. Recep Demir
42	Nefise Kurum	2018	Türk Edebiyatında Mesnevilerde Mesnevi Dışı Nazım Şekilleri (15. yüzyıla kadar)	Yüksek Lisans	Fatih Sultan Mehmet Vakıf	Prof. Dr. Kemal Yavuz
43	Elif Nadime Aydın	2019	Divan Şairlerinin Kasidelerinde Dua Kısmı	Yüksek Lisans	Ankara Hacı Bayram Veli	Prof. Dr. Ahmet Mermer
44	Enes Yıldız	2019	Divanlarda Küçük Mesneviler	Doktora	Çukurova	Prof. Dr. Haluk Gökalp
45	Mahmut Aslan	2019	Divan Edebiyatında Hat Redifli Gazeller	Yüksek Lisans	Çukurova	Prof. Dr. Haluk Gökalp
46	Özcan Tunçadam	2019	Klâsik Türk Şiirinde Şeyhülislâmlara Sunulan Kasideler	Yüksek Lisans	Van Yüzüncü Yıl	Doç. Dr. Recep Demir
47	Adem Kebapçı	2020	Türk Edebiyatında Mesnevîlerde Mesnevî Dışı Nazım Şekilleri	Yüksek Lisans	Fatih Sultan Mehmet Vakıf	Prof. Dr. Kemal Yavuz
48	Münevver Sevim	2020	Fâiz Efendi ve Şâkir Bey Mecmuasında Fihrist, Tercî-i Bend, Terkîb-i Bendler	Yüksek Lisans	Amasya	Doç. Dr. Metin Hakverdioğlu
49	Alı Banı Alı	2021	Arap ve Türk Edebiyatında Kaside	Doktora	Eskişehir Osmangazi	Prof. Dr. Ahmet Kartal
50	Arzu Oda	2021	XV-XIX. Yüzyıllardaki Gazellerde Redif Kullanımı ve Tasnifi	Yüksek Lisans	Zonguldak Bülent Ecevit	Doç. Dr. Muhittin Turan
51	Aslıhan Kaya	2021	Milli Kütüphane'de kayıtlı 06 Mil Yz A 3904'te Mecmua-ı Tercî-i Bend ve Terkîb-i Bend adlı şiir mecmuası (inceleme-metin-MESTAP'a Göre tasnif)	Yüksek Lisans	Eskişehir Osmangazi	Prof. Dr. Muhsin Macit
52	Elif Aslan	2021	Türk Mesnevî Edebiyatında Hz.	Yüksek Lisans	Fatih Sultan	Prof. Dr. Kemal Yavuz

			Peygamber (15. yüzyıla kadar)		Mehmet Vakıf	
53	Merve İnci	2021	XVI. Asır Aşk Mesnevîlerinde Edebî Tasvirler	Doktora	Eskişehir Osmangazi	Prof. Dr. Ahmet Kartal
54	Ali Fuat Otal	2022	18. Yüzyıl Klasik Türk Edebiyatında Kaside	Yüksek Lisans	Çankırı Karatekin	Doç. Dr. Fatih Sona
55	Bengü Didem Özüyılmaz	2022	XVII. Yüzyılda Bestelenmiş Zencir Murabbaların Yapısal Özellikleri	Yüksek Lisans	Ankara Hacı Bayram Veli	Prof. Dr. Burçin Uçaner Çifdalöz
56	İbrahim Direkli	2022	Musammat Mecmuaları ve Gencîne-i Eş'âr (Milli Ktp. Yz. A 1641) İsimli Musammat Mecmuası (Metin-inceleme)	Doktora	İstanbul Medeniyet	Prof. Dr. Sadık Yazar
57	Pınar Çelik Önal	2022	Klasik Türk Edebiyatında Realist Aşk Mesnevileri	Doktora	Hacettepe	Prof. Dr. Osman Horata
58	Rümeysa Ünal	2022	Mecmû'a-i Gazeliyât ve Eş'âr, İstanbul Üniversitesi Nadir Eserler Kütüphanesi, numara: NEKTY03296 (38b-73b) (İnceleme-MESTAP tablosu-karşılaştırmalı metin)	Yüksek Lisans	Sakarya	Dr. Öğr. Üyesi Orhan Kaplan
59	Sena Tural Doğru	2022	İstanbul Üniversitesi Nadir Eserler Kütüphanesi TY00818 numarada kayıtlı Mecmû'a-ı Gazeliyyât (İnceleme-Metin-MESTAP'a göre tasnifi)	Yüksek Lisans	İstanbul	Doç. Dr. Esra Güz
60	Bünyamin Aksoy	2023	Klasik Türk Şiiri Dinî Tasavvufi Mesnevîlerinde Hz. İsa, Hz. Meryem ve Hristiyanlık	Doktora	Selçuk	Dr. Öğr. Üyesi Erol Çöm
61	Fatma Seyrek	2023	Klasik Türk Edebiyatı Mesnevilerînde Antropomorfik Unsurlar	Yüksek Lisans	Mersin	Dr. Öğr. Üyesi Hilal Nayir Ekinci

62	Gülşah Ertürk	2023	Mevlânâ'nın Rubâîleri - Tenkitli Metin ve İnceleme- (1000-1866)	Yüksek Lisans	Kırıkkale	Prof. Dr. Adnan Karaismailoğlu
63	Hülya Erdoğan	2023	18. yüzyıl Şairlerinden Hıfzî'nin Rubâî ve Kıtaları(Metin-tahlil)	Yüksek Lisans	Marmara	Doç. Dr. Ümran Ay Say
64	Ömer Faruk Yazıcı	2023	Mecmû'a-i Gazeliyyât ve Eş'âr, İstanbul Üniversitesi Nadir Eserler Kütüphanesi, Numara: NEKTY03296 (1b-38a) İnceleme-karşılaştırmalı Metin	Yüksek Lisans	Sakarya	Dr. Öğr. Üyesi Orhan Kaplan
65	Sahra Mezarcı	2023	Aşk Mesnevîlerinde Bulunan Farklı Nazım Şekilleri, Kurgudaki Yeri ve İşlevleri	Doktora	İstanbul 29 Mayıs	Prof. Dr. Orhan Bilgin
66	Yasin Çamkömürü	2023	İstanbul Üniversitesi Nadir Eserler Kütüphanesi T1951 Numaralı Mecmua-i Gazeliyyât-ı Müntehabe'nin incelenmesi, çeviri yazılı metni ve Mecmuaların Sistematik Tasnifi Projesi'ne (MESTAP) göre tasnifi	Yüksek Lisans	Bartın	Dr. Öğr. Üyesi Yılmaz Top
67	Akif Yakışır	2023	Türk Edebiyatında Musammatlar (Bentlerden Oluşan Nazım Biçimleri)	Doktora	İnönü	Prof. Dr. Süleyman Çaldak

Tablo 4. MAKALELER

	MAKALENİN KÜNYE BİLGİLERİ			

Sıra	Yazar Adı	Yıl	Makale Adı	Yayın Yeri
1	Fuad Köprülü	1928	Türk Klasik Edebiyatındaki Hususi Nazım Şekilleri	Türkiyat Mecmuası, 2, s. 219-242.
2	Harun Tolasa	1982	15. yy. Türk Edebiyatı Anadolu Sahası Mesnevîleri	Ege Üniversitesi Türk Dili ve Edebiyatı Araştırmaları Dergisi, s. 1-13
3	Cem Dilçin	1986	Divan Şiirinde Gazel	Türk Dili Türk Şiiri Özel Sayısı II (Divan Şiiri), s. 415-416-417
4	Halil Erdoğan Cengiz	1986	Divan Şiirinde Musammatlar	Türk Dili, s. 415–416–417
5	İsmail Ünver	1986	Mesnevî	Türk Dili, Türk Şiiri Özel Sayısı II (Dîvân Şiiri), TDK Yayınları, s. 445-446
6	Mehmet Çavuşoğlu	1986	Kaside	Türk Dili-Türk Şiiri Özel Sayısı II (Divan Şiiri), s. 415-416-417
7	Sabahattin Küçük	1992	Musammat Gazel	I. Eski Türk Edebiyat› Kollogyumu, s. 17-18
8	Erdoğan Uludağ	1995	Mesnevî Araştırmaları Bibliyografyası	Müteferrika, c:7, s. 55–86
9	Mehmet Törenek	1995	Ziya Paşa ve Terkîb-i Bend	Yedi İklim, s. 5-9
10	Yaşar Aydemir	1995	Girizgaha Dair	Türk Kültürü, (389), s. 546–551.
11	Yaşar Aydemir	1996	Kasidede Muhteva Unsurları	Gazi Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi, s. 137–159
12	Halil Çeltik	1997	Divan Edebiyatında Yeni Nazım Şekilleri mi?	Türk Kültürü, s. 410, 1997
13	İsmail Hakkı Aksoyak	1998	"Mesnevîlerin Giriş Bölümünde ‘Din Ulularına Övgü’"	Türklük Bilimi Araştırmaları, s. 213- 21.
14	Sabahattin Küçük	1998	Musammat Gazel	Journal of Turkish Studies=Türklük Bilgisi Araştırmaları: Hasibe Mazıoğlu Armağanı II, s. 149-169
15	Ali Canip Yener	2000	Gazel, Anlam ve Gelenek	Virgül, sy. 33, s. 48-51

16	Fatma S. Kutlar	2000	Mesnevî Nazım Şekline Genel Bir Bakış ve Türk Edebiyatında Mesnevi Araştırmalarıyla İlgili Bir Kaynakça Denemesi	Türkoloji Araştırmaları Dergisi, 1(1), s. 102-157.
17	Ahmet Kartal	2001	Türkçe Mesnevîlerin Tertip Özellikleri	Bilig Türk Dünyası Sosyal Bilimler Dergisi, s. 71-76
18	Osman Uyanık	2002	Mesnevînin Kaynağı Üzerine	Selçuk Üniversitesi Eğitim Fakültesi Dergisi
19	Yaşar Aydemir	2002	Türk Edebiyatında Kaside	Bilig, s. 133–168
20	Ahmet Mermer	2003	Hayyâm ve Rubâîleri'nin Türk Edebiyatına Yansımaları	Hacı Bektaş Velî Araştırma Dergisi, s. 235-242
21	İsmail Güleç	2003	Türk edebiyatında Mesnevî Tercüme ve Şerhleri	Türklük Bilgisi Araştırmaları, s. 286
22	Saadet Karaköse	2004	Divan Şiiri Gazellerinde Tasvir ve Tahkiye	İlmi Araştırmalar, (18), s. 45–59.
23	Emine Yeniterzi	2005	Divan Şiirinde Gazel Redifli Gazeller	Türkiyat Araştırmaları Dergisi, s. 1-10
24	Muvaffak Eflatun	2005	Yeni Bulgular Işığında Müstezad	Türklük Bilimi Araştırmaları, s. 83-102
25	Turan Selami	2005	Türk Edebiyatında Gazel	İnsan Bilimleri Araştırmaları, s. 158-159
26	Ali Fuat Bilkan	2006	Mesnevîler	Türk Edebiyatı Tarihi, c:2, Kültür ve Turizm Bakanlığı Yayınları, s. 291-306
27	Halil Çeltik	2006	Gazel Merkezli Klasik Nazım Şekillerini Öğretimi	Milli Eğitim Dergisi, c:34, s.1-12
28	Mustafa Çınar	2006	Kaside Nazım Şeklinin Tarihi Gelişimi	Ekev Akademik Dergisi, s. 203–222.
29	Ahmet Kartal	2007	Eski Türk Edebiyatında Mesnevî	Türkiye Araştırmaları Literatür Dergisi, s. 353–432
30	Cemal Aksu	2007	Fuzuli'nin Su Kasidesi Hakkında	Kültür Dergisi, s. 78–83.
31	Halil Çeltik	2007	Tenkitli Divan Neşirlerinde Nazım Şekli Problemleri	Türkoloji Araştırmaları, s. 190-199
32	Murat Ali Karavelioğlu	2007	Klasik Türk Edebiyatında Kaside	Türkiye Araştırmaları Literatür Dergisi, s. 253-270
33	Selami Turan	2007	*9)* ***Aşkın Terennümü: Eski Türk Edebiyatında Gazel***	Türkiye Araştırmaları Literatür Dergisi(10), s. 155-196
34	Ahmet Atilla Şentürk	2008	Mesnevîlerin Doğuşu ve Türk Edebiyatındaki Gelişmesi	Kültür Bakanlığı E-Kitap Projesi

35	Necdet Şengün	2008	Klasik Türk Şiirinde Kalem Kasideleri Kalemiyyeler	Turkish Studies İnternational Periodical for the Languages, Literature and History of Turkish or Turkic, 3(4), s. 730–758.
36	Recai Kızıltunç	2008	Türk Edebiyatında Tuyuğ ve Bazı Problemleri	A.Ü. Türkiyat Araştırmaları Enstitüsü Dergisi Sayı 37, s. 107-125
37	Şerife Yalçınkaya	2008	Gazelde Kırılma Beyitleri: Beytü'l-Gazeller	Türk Dili ve Edebiyatı Araştırmaları Dergisi, s.149-162
38	Cemal Kurnaz, Halil Çeltik	2009	Muaşşerden Uzun Musammatlar ve Bilinmeyen Nazım Şekillerinden Yirmilik	Turkish Studies, 4(2), s. 864–899.
39	Lokman Turan, Rıfat Kütük	2009	Türk Mesnevî Geleneğinde Gazelin Kullanımı	Turkish Studies International Periodical For the Languages, Literature and History of Turkish or Turkic, 4(7), s. 636–682.
40	Muhsin Macit	2009	Gazelde Bir Anlatım Biçimi Terdîd Sanatı	Journal of Turkish Studies-Türklük Bilgisi Araştırmaları, s. 35-41
41	Soner Akdağ	2009	Klâsik Türk Edebiyatında Adına Mesneviler Yazılan Kadın: Züleyha	A.Ü. Türkiyat Araştırmaları Enstitüsü Dergisi Say 40, s. 59-74
42	Yaşar Aydemir, Halil Çeltik	2009	Gazelde İkileme Redif ve İkilime Kafiye	Turkish Studies, 4(2), s. 79–118.
43	Zehra Göre	2009	Kerem Kasidelerine Dair	Atatürk Üniversitesi, Türkiyat Araştırmaları Enstitüsü Dergisi, s. 919–958.
44	Fuad Köprülü	2010	Klasik Türk Nazmında Rubâî Şeklinin Eskiliği	Türkiyat Mecmûası, c:2, s. 437-441
45	Melike Gökcan	2010	Klâsik Türk Edebiyatında Kur'an Kıssalarını Konu Alan Mesnevîler	Uluslararası Sosyal Araştırmalar Dergisi, 3(15), s. 64-92
46	Nazire Erbay	2010	Mesnevî ve Mekân	Edebiyat Ortamı, (14), s. 49–54.
47	Ahmet Kartal	2011	XVIII Yüzyıl Klasik Türk Edebiyatı Mesnevîler	Turkish Studies, (6/1), s. 213–235.
48	Musa Kaval	2011	Mesnevî'de Aşk ve Aşık	Ekev, 15(49), s. 117–127.
49	Mahmut Kaplan	2012	Şairlere Göre Gazel veya Gazel Poetikası	Berceste, (119), s. 213-230

50	Osman Ünlü	2012	Müzeyyel Gazellerde Fahriye	Selçuk Üniversitesi Türkiyat Araştırmaları Dergisi, s. 33-53
51	Murat Öztürk	2013	Klasik Türk Şiirinde Kişilere Yazılan Gazeller	Uluslararası Türk Dili ve Edebiyatı Kongresi, Saraybosna.
52	Sadık Yazar	2013	XVI Yüzyılda Derlenmiş Bir Musammat Mecmûası	Turkish Studies / Türkoloji Araştırmaları, s. 601-650
53	Sedat Kardaş	2013	Cem Sultân'ın Cemşîd ü Hurşîd Mesnevîsinin Edebî Tarzlar Açısından Değerlendirmesi	Turkish Studies - International Periodical For The Languages, Literature and History of Turkish or Turkic s. 1899-1909
54	Burak Beken	2015	Divan Şiirinde Rubâî	Littera Turca Journal of Turkish Language and Literature, 1(1), s. 113-115.
55	Nazire Erbay	2015	*10)* ***Klasik Türk Şiirinde Kıt'a ve Kıt'alardaki Poetik Söyleyişler***	Sosyal Bilimlerde Güncel Araştırmalar, 1(3), s. 52-62.
56	Tuğçe Erdal	2015	*11)* ***Tür ve Şekil Tartışmalarına Genel Bir Bakış***	International Journal Of Eurasia Social Sciences, s. 254-265
57	İlyas Yazar, Esra Beyhan	2016	Kasidelerde Şâir Algısı	The Journal of International Social Research, s. 487–504
58	Kamil Ali Gıynaş	2016	Eskicumalı Ahmed Hamid Divanı'nda Yirmili Nazım Şekline Bir Örnek	Uluslararası Sosyal Bilimler Dergisi, Sayı: 43, s. 397-411
59	Muhittin Eliaçık	2016	Rubâî Müstezad Şeklinde Yazılmış Arapça Bir Manzum Fetva	Journal Of History School, s. 709-717
60	Turgut Koçoğlu	2016	Deneysel Edebiyat Yönüyle Divan Şiirinde Bir Tarz: Gazel-i Musanna yahut Gazel Ender Gazel	Hikmet, (5), s. 336–342.
61	Cafer Gariper	2017	Rubâî Bağlamında Şiir ve Felsefe	Yeni Türk Edebiyatı Araştırmaları, s. 105–116
62	Ekrem Sakar	2017	Divan Edebiyatında Nazım Şekli Meselesi	International Periodical for the Languages, Literature and History of Turkish or Turkic, s. 545-556
63	Ömür Ceylan	2017	"Kanuni Sultan Süleyman'a Yazılan Kasideler"	AKM Bilge, (14), s. 43-45

64	Mehmet Pektaş	2018	Türk Edebiyatına Mahsus Bir Nazım Şekli: Tuyuğ	Hecetaşları 36.sayı, s.16-18
65	Nazire Erbay	2018	Metinlerarasılık Bağlamında Gazel ve Mesnevî Arasındaki İlişkiye Bir Örneklem: Hayali Beg'in Gazellerinde Mesnevi Okumaları	Atatürk Üniversitesi Sosyal Bilimler Dergisi, 22(1), s. 183–198.
66	Şerife Yalçınkaya	2018	Gazelin Beyit Sıralamasının Değişmezliği -Hafız-ı Şirazi'nin Bir Gazeli Örneği-	Çeşm-ı Cihan (Tarih Kültür ve Sanat Araştırmaları Dergisi) E-Dergisi, s. 18-29
67	Yunus Kaplan	2018	İstanbul Üniversitesi Nadir Eserler Kütüphanesi'nde Kayıtlı "T 5480" Numaralı Musammat Mecmuası ve MESTAP'a Göre Tasnifi	Divan Edebiyatı Araştırmaları Dergisi, (21), s. 401–540.
68	Neşe Yeşim Altınel Çoban, Şirin Karadeniz	2020	Hamamizade İsmail Dede Efendi'nin 25 Murabba Bestesinin Biçim Analizi	İdil, (75), s. 1715–1736.
69	Ruken Karaduman, Soner İşimtekin	2020	Fuzûlî'nin Bir Murabbasının Metindilbilimsel Açıdan İncelenmesi	Uluslararası Türkçe Edebiyat Kültür Eğitim Dergisi, 9(4), s. 1425–1441.
70	Bilal Çakıcı	2021	Medhiye Olmayan Kasideler ve Kasidenin Bölümlerine Bir Bakış	Belleten, (71), s. 193–203.
71	Ali Fuat Otal	2022	XIII. Yüzyıldan XIX. Yüzyıla Kadar Klasik Türk Edebiyatında Kaside Nazım Şeklinin Şekil ve Muhtevasına Dair	Türkiyat Araştırmaları Dergisi, 2(2), s. 171-197
72	Fatma Özçakmak	2022	Türk Edebiyatında Kasîde-i Hamriyye Tercüme ve Şerhleri ve Kitâb-ı Şerh-i Hamriyye-i Fârıziyye	The Journal of Turkic Language and Literature Surveys, 7(2), s. 106–126.
73	Mehmet Nuri Çınarcı, Melinda Botaliç	2022	Türkçe Mesnevî Şerhlerinin Kaynakları	Journal of the Faculty of Humanities and Social Sciences University of, s. 57–84.
74	Mehmet Sait Çalka	2022	Türk Edebiyatının Tek Dörtlük Nazım Şekillerine Dair Tespitler: Mâni, Tuyuğ ve Rubâî	Recep Tayyip Erdoğan Üniversitesi Fen-Edebiyat Fakültesi Türk Dili ve Edebiyatı Dergisi, 3(2), s. 41-56.

75	Melike Kübra Çaycıoğlu	2022	Klasik Türk Şiirinde Beşer Mısralık Bentlerden Teşekkül Etmiş Nazımların Tanım, Biçim ve Kapsamı Üzerine	Hacettepe Üniversitesi Türkiyat Araştırmaları, s. 273-298
76	Zahide Efe	2022	XVIII. Yüzyılda Derlenmiş Bir Musammat Mecmuası: Mecmû'atü'l-Letâ'if (Milli Kütüphane "06 Mil Yz Cönk 163")	Turkish Studies - Language and Literature, 17(2), s. 441–521.
77	Armağan Zöhre	2023	Klasik Türk Şiirinde "Perçem" Redifli Gazeller Üzerine	Rumelide Dil ve Edebiyat Arastirmalari Dergisi, (32), s. 782–799.
78	Handan Belli	2023	Klasik Türk Edebiyatı Mesnevilerinde Mecaz ve Hakikat Söylemi	Journal of History School, s. 3027-3059.
79	Mehmet Göktaş	2023	*12)* ***Divan Şiirinde Mi'râciyye Kasideleri -Tespit ve Tahlil***	Hitit İlahiyat Dergisi 22/1 s. 501-510.
80	Özlem Batğı Akman	2023	*13)* ***15. Yüzyıl Mesnevilerinin Hatime Bölümleri Üzerine Karşılaştırmalı Bir İnceleme***	Türklük Bilimi Araştırmaları, (54), s. 29–47.
81	Yunus Kaplan, Zahide Efe	2023	XVII. Yüzyılda Derlenmiş Bir Musammat Mecmuası (Yapı Kredi Sermet Çifter Kütüphanesi "Y-362") ve MESTAP'a Göre Tasnifi	Dede Korkut Uluslararası Türk Dili ve Edebiyatı Araştırmaları Dergisi, (30), s. 183–258.

Tablo 5. BİLDİRİLER

	BİLDİRİNİN KÜNYE BİLGİLERİ			
Sıra	**Yazar Adı**	**Yıl**	**Bildirinin Adı**	**Yayın Yeri**
1	Mehmet Ali Yekta Saraç	1999	Kaside-i Hamriyye ve Türk Edebiyatına Tesirleri	7. Milletlerarası Türkoloji Kongresi
2	Ayabek Baınıyazov	2006	Gazel Nazım Şekli ve Türk Edebiyatındaki Tekamülü	PedagojiUzmanlarını Yetiştirmenin Aktüel Sorunları ve Fen Bilimlerinin Gelişme Perspektivleri konulu konferans

3	Recai Kızıltunç	2007	Türk Edebiyatında Tuyuğ ve Bazı Problemleri	Uluslararası Türklük Bilgisi Sempozyumu
4	Abdullah Azmi Bilgin	2008	Fuzuli ve Su Kasidesi	Eyüp, Dil ve Edebiyat Derneği Konferans Salonu
5	Halil İbrahim Haksever	2009	Kasidelerde Dua Geleneği ve Devlete Dua	Adıyaman Üniversitesi Eski Türk Edebiyatı Sempozyumu
6	Halil Çeltik	2012	Şekilden Türe Kaside Tarzı	Kasideye Methiye: Biçime, İşleve ve Muhtevaya Dair Tespitler
7	Murat Ali Karavelioğlu	2012	Tarihin Edebiyatı 15 ve 16 Yüzyıl Kasidelerinde Tarihi Arka Plan	Kasideye Medhiye (Biçime, İşleve ve Muhtevaya Dair Tespitler) Uluslararası Sempozyumu
8	Sadık Armutlu	2012	Klasik Şiirde Bir Tür: Uzri Gazel	Uluslararası Klasik Türk Edebiyatı Sempozyumu
9	Murat Öztürk	2014	Klasik Türk Edebiyatında Hamasi Gazeller	III International Congress of Turkology
10	Sadık Armutlu	2014	Klasik Şiirde Bir Tür: Hadari Gazel	XI. Milli Türkoloji Kongresi
11	Özlem Batğı Akman	2015	15. Yüzyıl Mesnevilerinin Hatime Bölümleri Üzerine Bir Değerlendirme	VIII. European Conference on Social and Behavioral Sciences
12	Volkan Karagözlü	2016	Memduhun Övgüsünden Kültür Tarihine: Kasideye Farklı Bir Bakış	II. Uluslararası Nevşehir Tarih ve Kültür Sempozyumu
13	Funda Bugan Özkızıltaş	2017	Divan Edebiyatında Mesnevî ve Mesnevîler İçinde Bulunan Farklı Nazım Şekilleri Üzerine Bir İnceleme	Uluslararası Felsefe, Eğitim, Sanat ve Bilim Tarihi Sempozyumu
14	Muhittin Turan	2018	XV. Yüzyıl Divan Şairlerinden Amasyalı Münîrî'nin "Güneş" Redifli Kasidesinde Güneş'in Övgü Unsuru Olarak Kullanımı	Uluslararası Amasya Şairleri Bilim Şöleni
15	Sedat Kurt	2018	Mesnevîlerde Kahramanın Ölümü: Leylâ ve Mecnûn Mesnevîlerinde Ölüm	Turkologentag 2018 3rd European Convention on Turkic, Ottoman Turkish Studies
16	Yunus Kaplan	2018	İstanbul Üniversitesi Nadir Eserler Kütüphanesi'nde	Uluslararası Türk Kültürü ve Tarihi Sempozyumu

			Kayıtlı 5480 Numaralı Musammat Mecmuası Üzerine	
17	İsmail Hakkı Gerçek, Feyzi Berat Kaplan	2023	Dilde Sadeleşme Bağlamında 18. Yüzyılda Şarkı Biçimi ve Enderunlu Vâsıf	Cumhuriyet'in 100. Yılında Bilge Kağan'dan Atatürk'e Uluslararası Türkçe ve Türk Dili Kurultayı
18	Taha Erdem Geze	2023	Klasik Türk Şiirinde “idi” Redifli Gazeller Üzerine Bir İnceleme	III. Uluslararası Filoloji Çalışmaları Kongresi
19	Talip Çukurlu	2023	Klasik Türk Edebiyatında Şam-ı Şerif ve Vehbî'nin Şam-ı Şerif Redifli Murabbası	Karadeniz 14. Uluslararası Sosyal Bilimler Kongresi
20	Yasin Karakuş	2023	Klasik Edebiyatımızda Kendisine Kutsiyet Atfedilen Arapça Kasideler	6. Internatıonal Scıentıfıc Researches And Innovatıon Congress
21	Lokman Taşkesenlioğlu	2024	Klasik Türk Şiirinde Nazire Geleneği Bağlamında “itmek dilersin itmegil” Redifli Gazeller	II. Uluslarararı Sosyal ve Beşeri Bilimler Kongresi

Tablo 6. ANSİKLOPEDİ MADDELERİ

	ANSİKLOPEDİ MADDELERİ			
Sıra	**Ansiklopedi**	**Yıl**	**Madde**	**Yayın Yeri**
1	Türk Dili ve Edebiyatı Ansiklopedisi	1979	Gazel	Dergah Yayınları, c:3, s. 297-300
2	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Gazel	Gelişim Yayınları, İstanbul, c:4, s.1105-1106
3	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Kaside	Gelişim Yayınları, İstanbul, c:6, s.1512
4	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Mesnevî	Gelişim Yayınları, İstanbul, c:7, s. 1814-1815
5	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Tercî-i Bend Terkîb-i Bend	Gelişim Yayınları, İstanbul, c:9, s. 2385

6	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Tuyuğ	Gelişim Yayınları, İstanbul, c:9, s.2452
7	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Rubâî	Gelişim Yayınları, İstanbul, c:8, s. 2135
8	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Musammat	Gelişim Yayınları, İstanbul, c:7, s. 1884
9	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Müstezad	Gelişim Yayınları, İstanbul, c:7, s.1892
10	Gelişim Gençlik Alfabetik Ansiklopedi	1980	Şarkı	Gelişim Yayınları, İstanbul, c:9, s. 2309
11	Türk Dili ve Edebiyatı Ansiklopedisi	1982	Kaside	Dergah Yayınları, c:5, s. 205-212
12	Türk Dili ve Edebiyatı Ansiklopedisi	1982	Kıt'a	Dergah Yayınları, c:5, s. 337-338
13	Türk Ansiklopedisi	1982	Kıt'a	Milli Eğitim Basımevi, Ankara, c:22, s.77-78
14	Türk Ansiklopedisi	1982	Rubâî	Milli Eğitim Basımevi, Ankara, c:27, s. 445
15	Türk Ansiklopedisi	1982	Tercî-i Bend	Milli Eğitim Basımevi, Ankara, c:31, s.107
16	Türk Ansiklopedisi	1982	Terkîb-i Bend	Milli Eğitim Basımevi, Ankara, c:31, s. 118-119
17	Türk Ansiklopedisi	1982	Tuyuğ	Milli Eğitim Basımevi, Ankara, c:32, s. 41-42
18	Türk Ansiklopedisi	1982	Şarkı	Milli Eğitim Basımevi, Ankara, c:30, s.213
19	Türk Ansiklopedisi	1982	Mesnevî	Milli Eğitim Basımevi, Ankara, c:24, s.46
20	Türk Ansiklopedisi	1982	Murabba	Milli Eğitim Basımevi, Ankara, c:24, s. 413
21	Türk Ansiklopedisi	1982	Müstezad	Milli Eğitim Basımevi, Ankara, c:25, s. 40
22	Yeni Türk Ansiklopedisi	1985	Gazel	Ötüken Yayınları, İstanbul, c:3, s. 1008-1009

23	Yeni Türk Ansiklopedisi	1985	Kaside	Ötüken Yayınları, İstanbul, c:5, s. 1736-1739
24	Yeni Türk Ansiklopedisi	1985	Kıt'a	Ötüken Yayınları, İstanbul, c:5, s.1850
25	Yeni Türk Ansiklopedisi	1985	Mesnevî	Ötüken Yayınları, İstanbul, c:6, s. 2312
26	Yeni Türk Ansiklopedisi	1985	Murabba	Ötüken Yayınları, İstanbul, c:7, s.2497
27	Yeni Türk Ansiklopedisi	1985	Musammat	Ötüken Yayınları, İstanbul, c:7, s.2509
28	Yeni Türk Ansiklopedisi	1985	Müstezad	Ötüken Yayınları, İstanbul, c:7, s. 2544
29	Yeni Türk Ansiklopedisi	1985	Rubâî	Ötüken Yayınları, İstanbul, c:9, s. 3290-3291
30	Yeni Türk Ansiklopedisi	1985	Tercî-i Bend Terkîb-i Bend	Ötüken Yayınları, İstanbul, c:10, s.4058
31	Yeni Türk Ansiklopedisi	1985	Tuyuğ	Ötüken Yayınları, İstanbul, c:11 s. 4226-4227
32	Yeni Türk Ansiklopedisi	1985	Şarkı	Ötüken Yayınları, İstanbul, c:10, s.3820-3821
33	Türk Dili ve Edebiyatı Ansiklopedisi	1986	Mesnevî	Dergah Yayınları, c:6, s. 282-288
34	Türk Dili ve Edebiyatı Ansiklopedisi	1986	Murabba	Dergah Yayınları, c:6, 440
35	Türk Dili ve Edebiyatı Ansiklopedisi	1986	Musammat	Dergah Yayınları, c:6, 447
36	Türk Dili ve Edebiyatı Ansiklopedisi	1986	Müstezad	Dergah Yayınları, c:6, 483-484
37	Meydan Larousse	1990	Murabba	İstanbul, Meydan Yayınevi, c:9, s. 63
38	Meydan Larousse	1990	Musammat	İstanbul, Meydan Yayınevi, c:9, s. 79
39	Meydan Larousse	1990	Müstezad	İstanbul, Meydan Yayınevi, c:9, s. 164
40	Meydan Larousse	1990	Rubâî	İstanbul, Meydan Yayınevi, c:10, s. 730
41	Meydan Larousse	1990	Şarkı	İstanbul, Meydan Yayınevi, c:11, s. 722-723

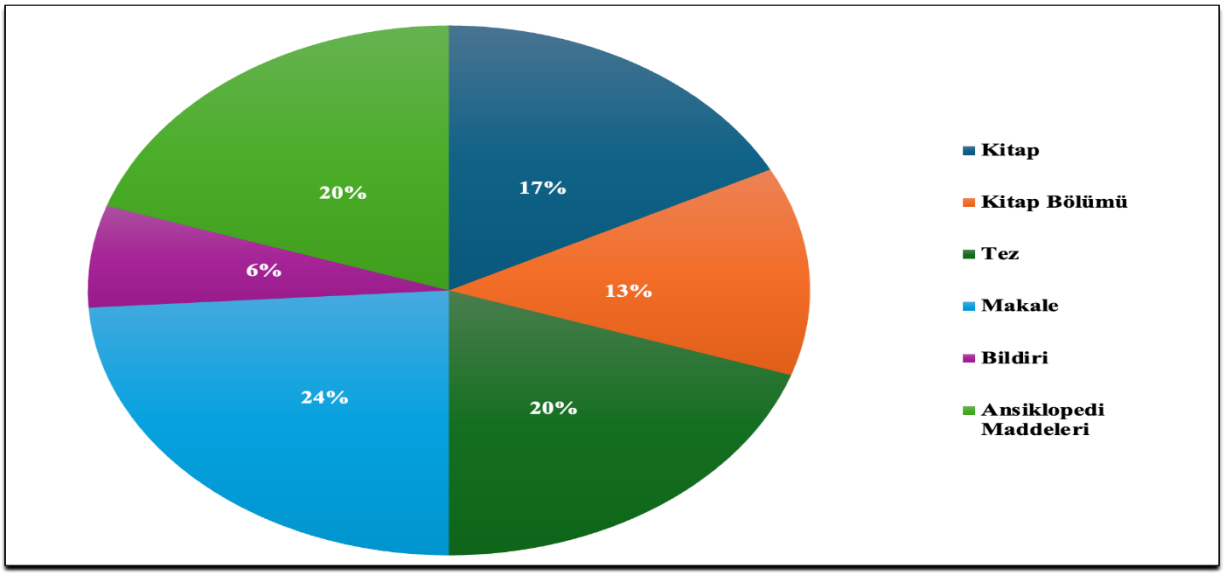
42	Meydan Larousse	1990	Tercî-i Bend	İstanbul, Meydan Yayınevi, c:12, s. 71
43	Meydan Larousse	1990	Terkîb-i Bend	İstanbul, Meydan Yayınevi, c:12, s. 76
44	Meydan Larousse	1990	Tuyuğ	İstanbul, Meydan Yayınevi, c:12, s. 328
45	Türk Dili ve Edebiyatı Ansiklopedisi	1990	Rubâî	Dergah Yayınları, c:7, 350-351
46	Türk Dili ve Edebiyatı Ansiklopedisi	1998	Şarkı	Dergah Yayınları, c:8, 106-107
47	Türk Dili ve Edebiyatı Ansiklopedisi	1998	Tercî-i Bend	Dergah Yayınları, c:8, s. 317
48	Türk Dili ve Edebiyatı Ansiklopedisi	1998	Terkîb-i Bend	Dergah Yayınları, c:8, s. 322-323
49	Türk Dili ve Edebiyatı Ansiklopedisi	1998	Tuyuğ	Dergah Yayınları, c:8, s. 397-398
50	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Mesnevî	İstanbul, Kapı Yayınları, s. 309-311
51	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Murabba	İstanbul, Kapı Yayınları, s. 333-334
52	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Musammat	İstanbul, Kapı Yayınları, s. 336
53	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Müstezad	İstanbul, Kapı Yayınları, s. 343-344
54	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Rubâî	İstanbul, Kapı Yayınları, s. 378-379
55	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Şarkı	İstanbul, Kapı Yayınları, s. 420-421

56	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Tercî-i Bend, Terkîb-i Bend	İstanbul, Kapı Yayınları, s. 448-451
57	Ansiklopedik Divan Şiiri Sözlüğü İskender Pala	2004	Tuyuğ	İstanbul, Kapı Yayınları, s. 461-462
58	TDV İslam Ansiklopesi	2004	Mesnevî	Ankara, c:29, s. 322-324
59	TDV İslam Ansiklopesi	2004	Mesnevî	Ankara, c:29, s. 320-322
60	TDV İslam Ansiklopesi	2006	Müstezad	İstanbul, c:32, s. 148-149
61	TDV İslam Ansiklopesi	2008	Rubâî	İstanbul, c:35, s. 176-177
62	TDV İslam Ansiklopesi	2008	Rubâî	İstanbul, c:35, s. 177-178
63	TDV İslam Ansiklopesi	2010	Şarkı	İstanbul, c:38, s. 357-358
64	TDV İslam Ansiklopesi	2011	Tercî-i Bend, Terkîb-i Bend	İstanbul, c:40, s. 487-489
65	TDV İslam Ansiklopesi	2012	Tuyuğ	İstanbul, c:41, s. 450-451
66	TDV İslam Ansiklopesi	2020	Musammat	Ankara, c:31, s. 233-235
67	TDV İslam Ansiklopesi	2022	Kıt’a	Ankara, c:25, s. 504-505

3. İSTATİSTİKLER

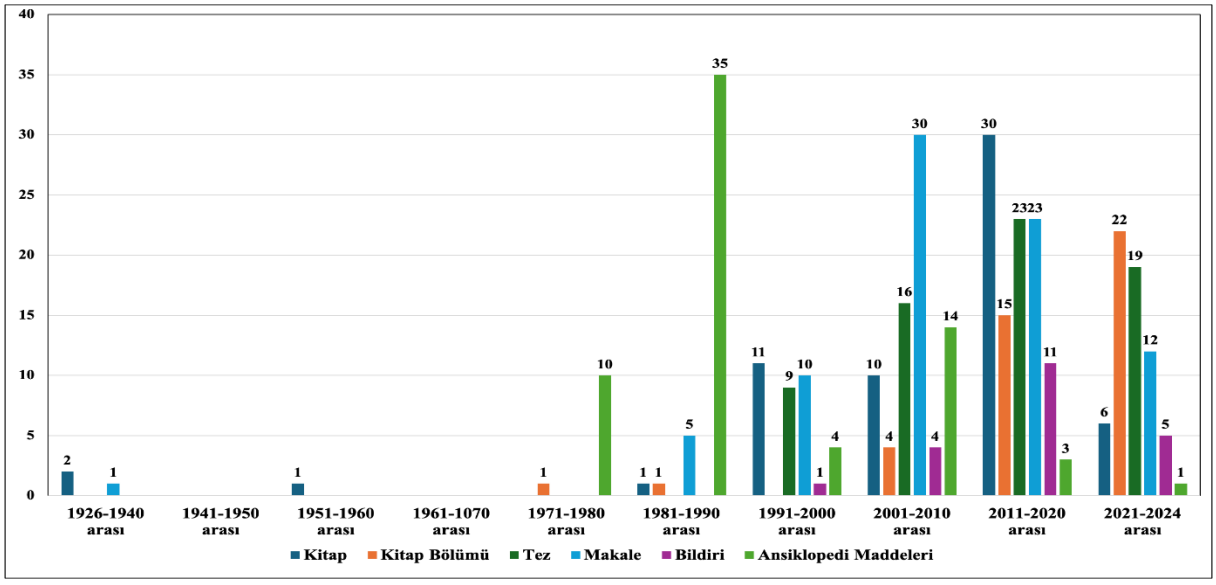
Bu bölümde tablo halinde verilen ve listelenen çalışmalara ait birtakım istatistiki veriler grafik olarak sunulmuş ve grafiklerin her birinin analizleri yapılmıştır. Bu yöntemin çalışmaların farklı değişkenlere göre nasıl bir dağılım oluşturduğunu gözlemlemek adına araştırmacılara kolaylık sağlayacağını düşünüyoruz.

Şekil 1. Çalışmaların Türlere Göre Dağılımı



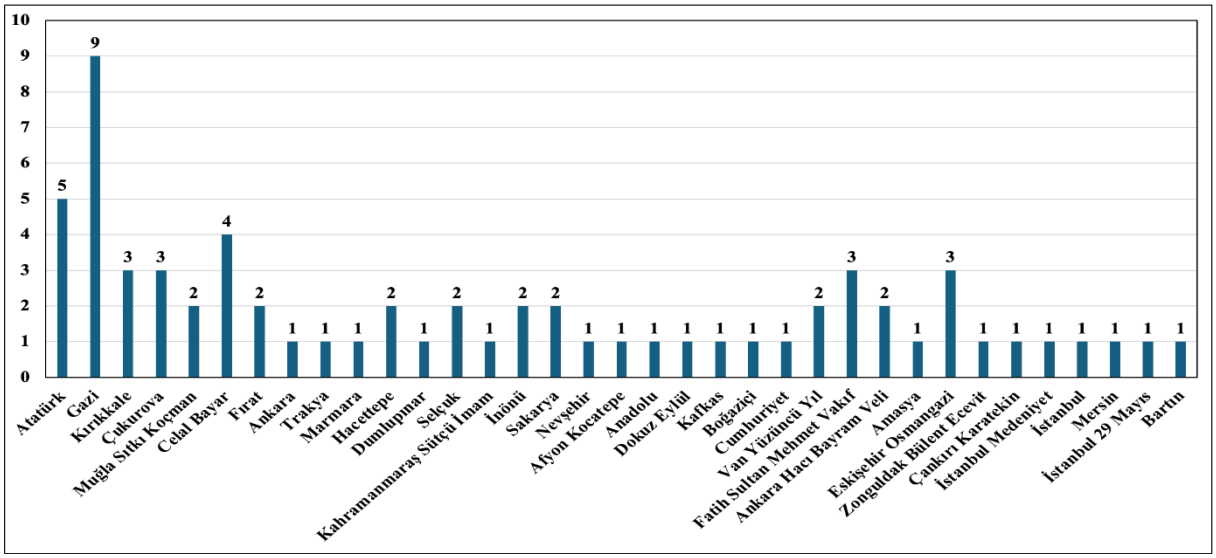
Bu grafik, "Çalışmaların Türlere Göre Dağılımı" başlığı altında çeşitli türlerdeki akademik ve bilimsel çalışmaların oranlarını göstermektedir. Grafik, türler arasındaki dağılımın yüzdelik dilimlerle ifade edildiği bir pasta grafiktir. Buna göre; en fazla akademik çalışma 81 makale ile en yüksek orana sahiptir. En az akademik çalışma ise 21 bildiri ile en az orana sahiptir. Yapılan çalışmalardan 59 kitap ve doktora düzeyindeki akademik çalışma ile yüksek lisans düzeyinde toplam 67 çalışma yapılmıştır. Ayrıca çalışma konumuz ile ilgili 43 kitap bölümü ve 67 Ansiklopedi maddeleri bulunmaktadır. Toplamda 339 çalışma bulunmaktadır.

Şekil 2. Çalışmaların Yıllara Göre dağılımı



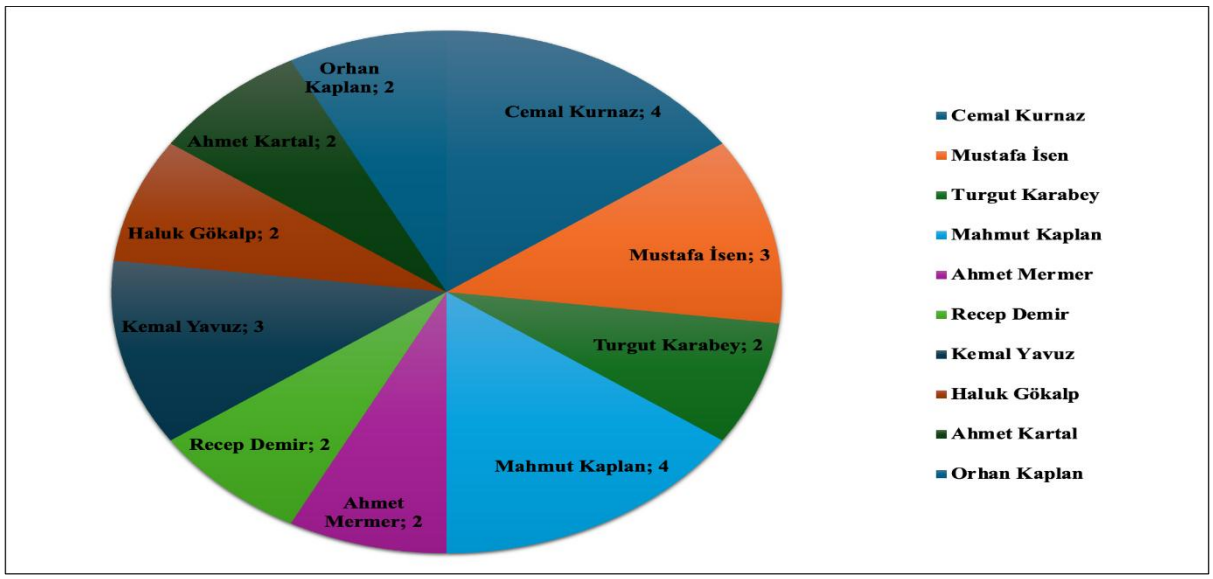
Bu grafik, çalışmaların yıllara göre dağılımını göstermekte ve farklı akademik türlerin yıllar içinde nasıl bir değişim sergilediğini ortaya koymaktadır. Grafik, akademik çalışmaların zaman içinde belirgin bir şekilde arttığını ortaya koymaktadır. Özellikle 1980 sonrası bu artış görülmektedir. Son yıllarda ise akademik çalışmaların ciddi oranda artış gösterdiği görülmektedir. Özellikle 2000 yılından sonra kitap ve makale çalışmalarının diğer çalışma türlerine göre daha fazla artış gösterdiği gözlenmektedir.

Şekil 3. Tezlerin Üniversitelere Göre Dağılımı



Grafik, tez üretiminde belirli üniversitelerin öne çıktığını göstermektedir. Grafikte görüldüğü gibi 35 farklı üniversitede doktora ve yüksek lisans düzeyinde çalışma yapılmıştır. Atatürk ve Gazi üniversitelerin daha fazla çalışma yaptığı görülmektedir. En çok çalışma yapılan üniversite 8 yüksek lisans tez çalışması ve 1 doktora tez çalışması ile Gazi üniversitesi olmuştur.

Şekil 4. Tezlerin Danışmanlara Göre Dağılımı[7]

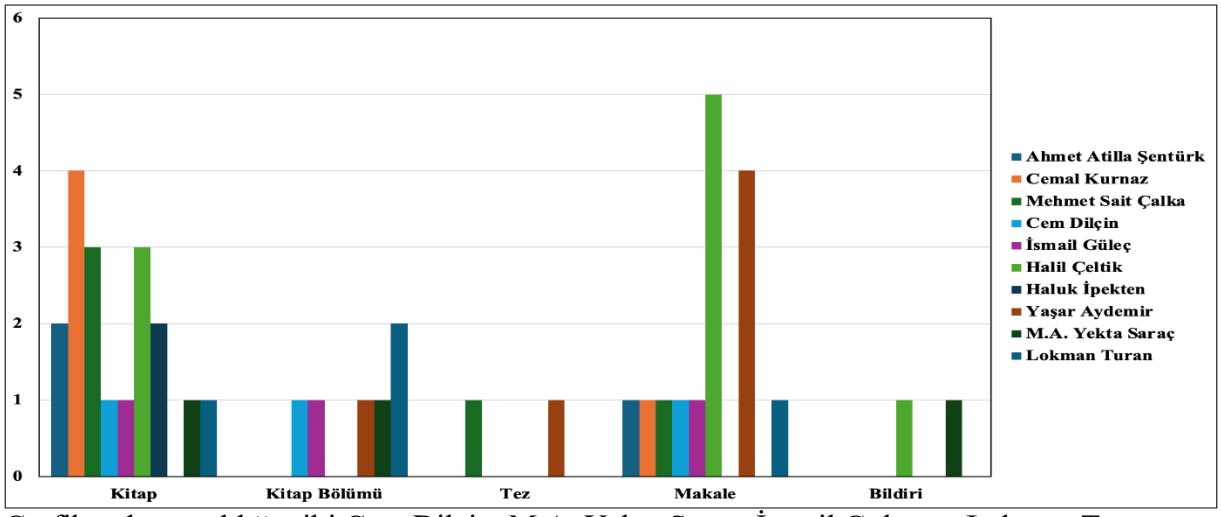


Grafikte, tezlerin danışmanlara göre dağılımı pasta grafiği şeklinde gösterilmiştir. Cemal Kurnaz, Mahmut Kaplan, 4'er tez danışmanlığı ile öne çıkmıştır. Mustafa İsen ve Kemal Yavuz ise 3'er tez danışmanlığı yaptığı görülerken, diğer akademisyenlerin 2'şer tez danışmanlığı yaptığı görülmüştür

Şekil 5. Çalışmaların Yazarlara Göre Dağılımı[8]

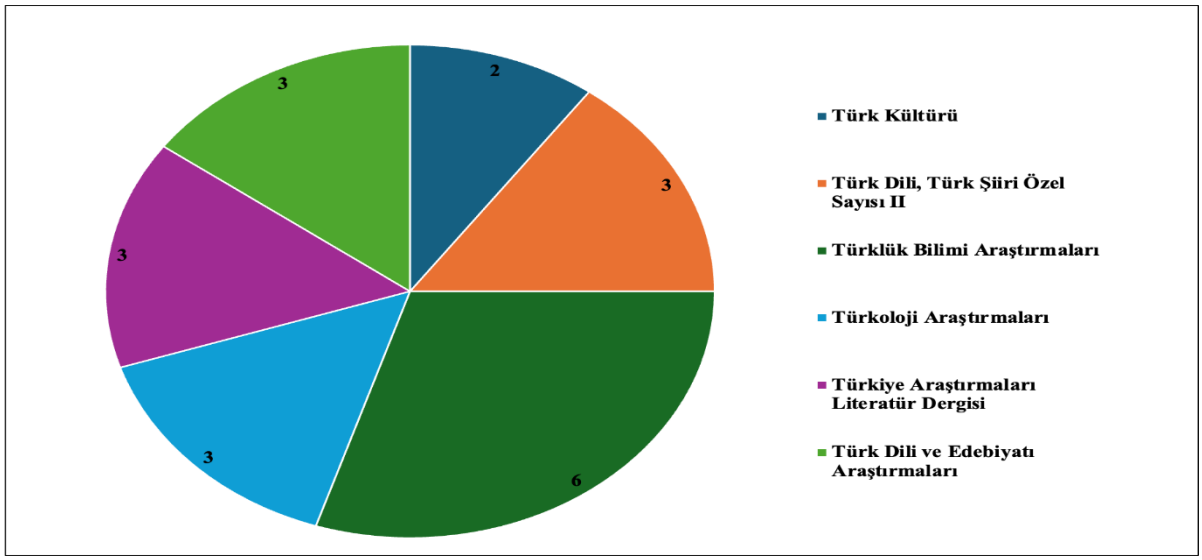
[7] Bu grafik, tez danışmanlarının sayısının fazlalığı nedeniyle yalnızca belirli danışmanları içermekte olup, tüm tez danışmanlarını kapsamamaktadır.

[8] Grafikte, yazar sayısının fazlalığı nedeniyle yalnızca daha fazla çalışması bulunan yazarlara yer verilmiştir.



Grafikte de yer aldığı gibi Cem Dilçin, M.A. Yekta Saraç, İsmail Güleç ve Lokman Turan gibi yazarlar arasında kitap yazımı dengeli bir şekilde paylaşılmıştır. En çok çalışma yapan 3 kitap, 5 makale, 1 bildiri ile Halil Çeltik olmuş ve onu 1 kitap bölümü, 1 tez danışmanlığı ve 4 makale ile Yaşar Aydemir takip etmiştir.

Şekil 6. Makalelerin Yayım Yerine Göre Dağılımı[9]



Bu grafikte makalelerin yayımlandığı yerlere göre dağılımı pasta grafiği ile gösterilmiştir. Konu ile ilgili akademik makale, 6 çalışma ile en çok Türklük Bilimi Araştırmaları adlı dergide yayımlanmıştır. Bunu 3 çalışmanın yayımlandığı Türk Dili, Türk Şiiri Özel Sayısı II, Türkiye Araştırmaları Literatür Dergisi, Türkoloji Araştırmaları ve Türk Dili ve Edebiyatı Araştırmaları Dergisi takip etmektedir. Ayrıca makalelerin farklı dergilerde dengeli bir şekilde yayıldığı görülmektedir.

SONUÇ VE DEĞERLENDİRME

Bu çalışmanın amacı, Divan edebiyatında kullanılan nazım şekilleri üzerine yapılan çalışmaların bir bibliyografyasını değerlendirmek ve bu alanda ortaya çıkan eğilimleri ele almaktır. Bu nazım şekilleri üzerine yapılan bibliyografik çalışmalar, Divan edebiyatının anlaşılması ve yorumlanması açısından oldukça değerlidir. Konu üzerine yazılmış kitap, tez,

[9] Makalelerin yayımlandığı yerlerin fazlalığı nedeniyle, grafikte yalnızca belirli yayımlara yer verilmiştir.

makale, bildiri ve ansiklopedi maddeleri tablo şeklinde listelenmiştir. Divan edebiyatı nazım şekillerine dair yapılan bibliyografya çalışması, bu edebi geleneği anlamak ve farklı nazım şekillerini detaylı bir şekilde incelemek için bir kaynak sunmaktadır. Konuyla ilgili en eski akademik çalışmadan başlayarak 2024 tarihine kadar yapılan çalışmalar tespit edilmiştir. Bu konuda en çok çalışmanın makale üzerine olduğu ve çalışmaların özellikle 2000 yılından sonra büyük artış gösterdiği sonucuna varılmıştır.

Bibliyografyanın hazırlanmasında künyeler yayımlanma yıllarına göre sıralanmıştır. Aynı yıl yayımlanan eserler alfabetik sıraya göre dizilmiştir. Çalışma, Divan edebiyatı nazım şekillerini kapsayan akademik çalışmaların derlenmesini içermekle birlikte, bazı şairlerin belirli nazım şekliyle yazmış olduğu eserler de alınmıştır. Giriş ve çalışma amacında Divan edebiyatı nazım şekilleri üzerine daha derin bilgiler verilmiştir. Bibliyografik çalışmanın sonucunda araştırmacılara kolaylık sağlaması açısından istatistikler bölümünde çalışmaların farklı yönlerden dağılımlarını içeren grafiklere yer verilmiştir ve grafik sonlarında bu veriler analiz edilerek yorumlanmıştır. Bu bilgilerden yola çıkarak özellikle bu çalışma ile ilgili en çok çalışmanın 81 makale ile yapıldığı görülmektedir. Makale düzeyindeki akademik çalışmaların istatistiklerden yola çıkarak en çok Türklük Bilimi Araştırmaları adlı dergide yer aldığı görülmüştür. Bu çalışma ile nazım şekillerine dair yapılan bibliyografik araştırmaların istatiksel verilerle değerlendirilmesini ve genel durumunu daha açık bir şekilde ortaya koymuştur.

Sonuç olarak, bibliyografik bir yaklaşım benimseyerek bu nazım şekillerine dair kaynaklar derlenmiş ve bu kaynakların önemi vurgulanmıştır. Bu çalışma Divan edebiyatı nazım şekillerine dair önemli kaynaklara ulaşılmasını sağlamıştır.

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NATURAL MODULATION GUT MICROBIOTA IN PSYCHOPATOLOGICAL STRESS: IMPACT OF DENIPLANT NUTRACEUTICALS

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Background The gut microbiota may contribute to depressive symptoms. The gut microbiota may play a role in psychopatological stress responding. The gut microbiota constitutes a dynamic microbial system constantly challenged by many biological variables, including environmental factors. Inflammation elevates risk for depression. Mounting evidence suggests that these anti-inflammatory effects are mediated by the microbiome. Psychopatological stress and depression can increase gut barrier permeability. In turn, the gut bacteria release metabolites, toxins, and neurohormones.

Objectives To examine how diet and psychopatological stress reciprocally interact with the gut microbiota and inflammation. To review different interventions that can modulate microbiota and could modulate the psychopatological stress according to the underlying mechanisms whereby the gut-brain axis influences psychopatological stress.

Materials and methods Since the gut microbiota constitute a changeable and experience-dependent ecosystem, they provide potential therapeutic targets that can be modulated as new interventions for dysbiosis-related disorders.

Results A better understanding of the mechanism underlying psychopatological stress modulation through the microbiota may open new avenues for the design of therapeutics that could boost the pursued clinical benefits. Diet functions as a major pathway from psychopatological stress to gut dysbiosis. Healthier diets can reduce the risk of depression. Deniplant nutraceuticals improved sleep, autonomic balance, and bowel habits and reduced psychopatological stress and cortisol levels

Conclusion The influence of psychopatological stress on gut microbiota and gut microbiota on psychopatological stress modulation is clear for different stressors, but although the preclinical evidence is so extensive, the clinical evidence is more limited.

Keywords: diet, gut dysbiosis, gut-brain axis, psychopatological stress, Deniplant nutraceuticals

MATEMATİK NEREDE? MATEMATİK HER YERDE!

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ÖZET
Bu bildiride, Odunpazarı İlçe Milli Eğitim Müdürlüğü ile Eskişehir Osmangazi Üniversitesi ve Anadolu Üniversitesi iş birliğiyle yürütülen TÜBİTAK 4004 "Matematik Nerede? Matematik Her Yerde!" isimli projenin, uygulama süreci ve sonuçları ışığında değerlendirilmesi amaçlanmıştır. Projede, 7. sınıf öğrencilerinin okul dışında matematiği keşfetmelerini ve deneyimlemelerini sağlamak, matematik öğrenmeye yönelik isteklerini artırmak ve matematiğe yönelik olumlu inanç ve tutum geliştirmelerine katkı sunmak hedeflenmiştir. Eskişehir ili Odunpazarı ilçesinde bulunan ortaokullardan, 2025 yılında 7. Sınıfa başlayan 24 katılımcı öğrencinin seçiminde, benzer projelere katılmamış olmak, projeye katılım konusunda gönüllü ve istekli olmak, dezavantajlı grupta olmak, farklı okullarda ve sınıflarda öğrenim görmek öncelik nedenlerindendir. Öğrencilerin farklı disiplinler ile matematik ilişkisini kurabilmeleri ve matematiği deneyimleyebilmeleri için proje sürecinde okul dışı ortamlarda (Matematik Noktası Müzesi, Eğitim Karikatürleri Müzesi, Odunpazarı

Modern Müze, Thales Sanal Matematik Müzesi, Anadolu Üniversitesi Çocuk Üniversitesi, Üstün Yetenekliler Eğitim Merkezi, Suat Çelik Gençlik Merkezi, Eskişehir DENEYAP Atölyesi, Emine-Emir Şahbaz Bilim ve Sanat Merkezi, Sabancı Uzay Evi, Japon Bahçesi, Eskişehir Girişimcilik Merkezi, Türk Dünyası Kültür Başkenti Araştırma Merkezi) etkileşimli ve uygulamalı etkinlikler yapılmıştır. Hedef kitleyi oluşturan öğrencilere verilecek eğitim öncesinde ve sonrasında öğrencilerin matematik ile ilgili düşüncelerini değerlendirmek ve projenin niteliğinin ölçülmesi için Yıldız ve Çiftçi (2020) tarafından geliştirilen "Matematik İnancı Ölçeği" uygulanmıştır. Proje, Eskişehir Osmangazi Üniversitesi, Anadolu Üniversitesi, Eskişehir Teknik Üniversitesi akademisyenleri ile birlikte Milli Eğitim Bakanlığına bağlı farklı okullarda görev yapan öğretmenlerin desteğiyle çok paydaşlı bir yapıda yürütülmüş; elde edilen olumlu çıktılar sayesinde projenin sonunda öğrencilerdeki matematiğe yönelik önyargıların kırıldığı ve öğrencilerin matematiğe yönelik olumlu tutum geliştirdikleri gözlenmiştir.

Anahtar Kelimeler: Matematik Öğretimi, İlköğretim Matematik Eğitimi, Teknoloji Destekli Matematik Eğitimi, Matematik Başarısı, Matematik ve Oyun

WHERE IS MATHEMATICS? MATHEMATICS IS EVERYWHERE!

ABSTRACT

In this paper, it is aimed to evaluate, in light of the implementation process and results, the TÜBİTAK 4004 project titled "Where is Mathematics? Mathematics is Everywhere!", carried out in cooperation with the Odunpazarı District Directorate of National Education, Eskişehir Osmangazi University, and Anadolu University. The project aimed to enable 7th-grade students to discover and experience mathematics outside the school setting, to increase their willingness to learn mathematics, and to contribute to the development of positive beliefs and attitudes toward mathematics. In the selection of 24 participating students who began the 7th grade in 2025 from secondary schools in the Odunpazarı district of Eskişehir, priority was given to those who had not participated in similar projects, who were willing and enthusiastic to participate, who belonged to disadvantaged groups, and who studied in different schools and classes. In order for students to establish connections between mathematics and different disciplines and to experience mathematics, interactive and hands-on activities were carried out in out-of-school environments during the project, including the Mathematics Point Museum, the Educational Cartoons Museum, the Odunpazarı Modern Museum, the Thales Virtual Mathematics Museum, Anadolu University Children's University, the Center for the Education of Gifted Students, the Suat Çelik Youth Center, the Eskişehir DENEYAP Workshop, the Emine-Emir Şahbaz Science and Art Center, the Sabancı Space House, the Japanese Garden, the Eskişehir Entrepreneurship Center, and the Research Center of the Turkic World Capital of Culture. Before and after the training provided to the target group of students, the "Mathematics Belief Scale" developed by Yıldız and Çiftçi (2020) was administered in order to evaluate the students' thoughts on mathematics and to measure the quality of the project. The project was carried out in a multi-stakeholder structure with the support of academics from Eskişehir Osmangazi University, Anadolu University, and Eskişehir Technical University, as well as teachers working in various schools affiliated with the Ministry of National Education. Thanks to the positive outcomes obtained, it was observed that by the end of the project, students' prejudices toward mathematics had been broken and they had developed positive attitudes toward mathematics.

Keywords: Mathematics Teaching, Elementary Mathematics Education, Technology Supported Mathematics Education, Math Success, Math and Game.

MATEMATİK ÖĞRETMEN ADAYLARININ CEBİR ÖĞRENME ALANINDAKİ WEB 2.0 ARAÇLARI KULLANIMINA İLİŞKİN GÖRÜŞLERİNİN TEKNOLOJİK PEDAGOJİK ALAN BİLGİLERİ BAĞLAMINDA İNCELENMESİ

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ÖZET

Ortaokul düzeyinde öğrencilerin somuttan soyuta geçiş döneminde karşılaştıkları kavramsal güçlükler, cebir öğretimini daha da kritik hale getirmektedir. Bu bağlamda Teknolojik Pedagojik Alan Bilgisi (TPAB), öğretmen adaylarının teknoloji, pedagojik yaklaşım ve alan bilgisini bütünleştirerek etkili öğretim tasarlamalarını sağlayan bir çerçeve sunmaktadır. Bu çalışmada, matematik öğretmen adaylarının TPAB düzeyleri ile cebir öğrenme alanındaki Web 2.0 araçlarını kullanım tercihleri arasındaki ilişki incelenmiştir.

Araştırma, İstanbul'daki üç üniversitenin ilköğretim matematik öğretmenliği programında öğrenim gören 3. ve 4. sınıf düzeyinde toplam 103 öğretmen adayı ile yürütülmüştür. Veri toplama aracı olarak, TPAB ölçeğinin üç alt boyutu (Teknoloji Bilgisi, Alan Bilgisi ve Teknolojik Pedagojik Bilgi) kullanılmıştır. Bulgular, öğretmen adaylarının özellikle Alan Bilgisi boyutunda yüksek yeterlilik algısına sahip olduklarını; buna karşın Teknoloji Bilgisi boyutunda görece daha düşük algıya sahip olduklarını ortaya koymuştur. Çalışmada ayrıca Alan Bilgisi ve Teknolojik Pedagojik Bilgi alt boyutlarının Web 2.0 araçlarının tercih sıklığıyla ilişkisi incelenmiştir. Bulgular, farklı yeterlilik düzeylerine sahip katılımcıların tercih sıralamalarında benzer eğilimler gösterdiğini ortaya koymuştur. Özellikle Alan Bilgisi ve

Teknolojik Pedagojik Bilgi boyutlarında yüksek ortalamaya sahip öğretmen adayları, Mathigon ve Wordwall araçlarını en işlevsel seçenekler olarak öne çıkarmış; buna karşın AAAKnow ve Oryx Learning araçları düşük tercih sıralarında kalmıştır. Çalışma sonucunda, katılımcıların TPAB düzeyleri ile Web 2.0 araçları kullanım tercihleri arasında anlamlı bir ilişki gözlenmemiştir. Cebir öğretimi için dijital içerik tasarımı ve araç seçiminde adayların teknoloji yeterliklerinin artırılması önerilmiştir.

Anahtar kelimeler: Matematik, cebir, Web 2.0, öğretmen adayı, TPAB

ANALYSIS OF MATHEMATICS TEACHER CANDIDATES' VIEWS ON THE USE OF WEB 2.0 TOOLS IN THE ALGEBRA LEARNING WITHIN THE CONTEXT OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

ABSTRACT

The conceptual difficulties encountered by middle school students during the transition from concrete to abstract thinking make algebra teaching even more critical. In this context, Technological Pedagogical Content Knowledge (TPACK) provides a framework that enables teacher candidates to design effective teaching by integrating technology, pedagogical approaches, and subject knowledge. This study examined the relationship between pre-service mathematics teachers' TPACK levels and their preferences for using Web 2.0 tools in the field of algebra learning.

The research was conducted with a total of 103 teacher candidates in their third and fourth years of study in the mathematics teacher education programs at three universities in Istanbul. The TPACK scale's three subscales (Technology Knowledge, Content Knowledge, and Technological Pedagogical Knowledge) were used as the data collection tool. The findings revealed that teacher candidates had a high perception of competence, particularly in the Content Knowledge dimension; however, they had a relatively lower perception in the Technology Knowledge dimension. The study also examined the relationship between the Content Knowledge and Technological Pedagogical Knowledge sub-dimensions and the frequency of preference for Web 2.0 tools. The findings revealed that participants with different proficiency levels showed similar trends in their preference rankings. Teacher candidates with high averages, particularly in the Content Knowledge and Technological Pedagogical Knowledge dimensions, highlighted Mathigon and Wordwall tools as the most functional options; in contrast, AAAKnow and Oryx Learning tools remained low in the preference rankings. The study found no significant relationship between participants' TPACK levels and their preferences for using Web 2.0 tools. It is recommended that teacher candidates' technological competencies be enhanced in the design of digital content and tool selection for algebra instruction.

Keywords: Mathematics, algebra, Web 2.0, teacher candidates, TPACK

GİRİŞ

Teknolojik Pedagojik Alan Bilgisi (TPAB) modeli, öğretmenlerin alan, pedagojik ve teknolojik bilgilerini ayrı ayrı ve karşılıklı ilişkilendirmeler ile ele alarak çok boyutlu bilgi türleri arasındaki ilişkiyi modelleyen, bu üç bilginin etkileşiminden doğan bütünleşik yapıyı ortaya koyarak öğretimi desteklemeyi hedefleyen bütüncül bir çerçevedir (Koehler & Mishra, 2005). Niess'e (2008) göre TPAB, öğretmenin, bir konu için planlama, düzenleme, eleştirme ve

özetlemede, öğrenci ihtiyaçlarını, sınıf koşullarını düşünerek öğrencilerin öğrenmesini desteklemek için 21. yüzyıl teknolojilerini kullanmasıdır. TPAB kavramı kısaca belirli bir içeriğin öğretiminde pedagojik bilgiyi teknolojik bilgiyle ilişkilendirmek olarak ifade edilmiştir. Bu modelin temelinde Shulman'ın 1986 yılında pedagojik içerik bilgisi olarak bahsettiği mesleki anlamda öğretmenlik bilgisinin yatmakta olduğu belirtilmiştir (Koehler ve Mishra, 2006; Akt. Uslu ve Güner, 2022). TPAB' de öğretmenlerin, ideal teknolojiler ve uygun pedagojik yaklaşımlar kullanılarak içerikler öğretmeleri gerektiğine değinilmiştir. Öğretmenler bilginin üç ana bileşeni olan alan bilgisi, pedagojik bilgi ve teknolojik bilgi arasındaki karmaşık etkileşimi sezebilmelerinin önemli olduğu vurgulanmıştır (Schmidt ve ark., 2009; Akt. Üredi ve Ulum, 2020).

Eğitimde güncel öğretim teknolojilerinin etkili kullanımı, yalnızca teknolojik bilgiye değil; öğretmenlerin teknoloji, pedagojik ve alan bilgilerini bütünleştirebilme yeterliklerine de bağlıdır. Bu bağlamda, öğretmen adaylarının TPAB düzeyleri ile Web 2.0 araçlarını tercih etme eğilimleri arasındaki ilişkinin incelenmesi, öğrenme ortamlarının niteliğini artırmaya yönelik önemli bir araştırma alanı oluşturmaktadır. Bu çalışmada, matematik öğretmen adaylarının cebir öğretimi sürecinde kullanılabilecekleri Web 2.0 araçlarına Teknoloji Bilgisi, Alan Bilgisi ve Teknolojik Pedagojik Bilginin etkisi incelenmiştir. Mevcut araştırma, öğretmen adaylarının teknolojik ve pedagojik bilgi düzeylerini anlamak ve matematik öğretimini güncel teknolojiler ile zenginleştirirken dikkate alınabilecek boyutları değerlendirmek açısından önemlidir.

YÖNTEM

Bu araştırma, İstanbul'daki üç devlet üniversitesinde öğrenim gören toplam 103 ilköğretim matematik öğretmeni adayıyla tarama deseni kapsamında gerçekleştirilmiştir. Katılımcılar teknoloji kullanımına ilişkin alan eğitimi derslerini tamamlamış 3. ve 4. sınıf öğrencileri arasından seçilmiş olup, katılımcıların 16'sı erkek, 87'si kadındır.

Veri Toplama Aracı ve Veri Analizi

Çalışmanın veri toplama sürecinde web tabanlı bir anket kullanılmıştır. Uygulama aşamasında öğretmen adaylarına TPAB ölçeği tanıtılmış ve sonrasında adayların TPAB düzeylerini belirlemek amacıyla ölçek uygulanmıştır. Hacıömeroğlu, Şahin ve Arcagök (2014) tarafından geçerlik ve güvenirlik çalışması sonucu geliştirilen ''Türkçeye Uyarlanan Öğretmen Adaylarının Teknolojik Pedagojik Alan Bilgisi Değerlendirme Ölçeği'' başlıklı ölçek kullanılmıştır. Orijinal TPAB ölçeği "Teknoloji Bilgisi, Alan Bilgisi, Pedagojik Bilgi, Pedagojik Alan Bilgisi, Teknolojik Alan Bilgisi, Teknolojik Pedagojik Bilgi, Teknolojik Pedagojik Alan Bilgisi (TPAB)'' alt boyutlarından oluşmaktadır. Bu çalışmada TPAB ölçeğinin, Web 2.0 araçlarının tercih sıklığı ile ilişkili olduğu değerlendirilen üç alt boyutuna ilişkin bölümleri (Teknoloji Bilgisi, Alan Bilgisi ve Teknolojik Pedagojik Bilgi) ve çapraz karşılaştırma verileri üzerinden web tabanlı anket uygulanmıştır.

Öğretmen adaylarının cebir öğrenme alanında tercih edecekleri Web 2.0 araçları üzerinde TPAB düzeylerinin etkisinin var olup olmadığını incelemek amacıyla ölçek kapsamındaki "Teknoloji Bilgisi, Alan Bilgisi, Teknolojik Pedagoji Bilgisi" alt boyutları ele alınmıştır. Her katılımcının "Teknoloji Bilgisi, Alan Bilgisi, Teknolojik Pedagoji Bilgisi" alt boyutlarına ait ortalama, standart sapma, maksimum ve minimum değerleri hesaplanmıştır. Katılımcıların alt boyutlara ait hesaplanan ortalama değerleri "1-3 düşük, 3 orta, 3-5 yüksek" olacak şekilde sınıflandırılmıştır.

Öğretmen adaylarının cebir öğrenme alanında tercih edecekleri Web 2.0 araçları üzerinde TPAB düzeylerinin etkisini belirlemek amacıyla sınıflandırılan ortalama değerlere sahip katılımcı sayısı belirlenmiştir. Belirlenen katılımcıların anketin ilk kısmında yer alan "Aşağıdaki uygulamaları, cebir öğrenimi ve öğretimi sürecindeki kullanışlılık açısından, en sık

tercih edeceğiniz uygulamadan en az tercih edeceğiniz uygulamaya doğru sıralayınız" maddesine verdikleri yanıtlara göre ilk ve son Web 2.0 aracı tercihlerine ait veriler "Teknoloji Bilgisi, Alan Bilgisi- Matematik, Teknolojik Pedagoji Bilgisi" alt boyutları altında tablo halinde sunulmuştur. Katılımcıların bahsedilen alt boyutlara ait ortalama değerlerinin Web 2.0 aracı tercihleri üzerindeki etkisi betimsel analiz yöntemiyle incelenmiştir. Veriler incelendiğinde 120 öğretmen adayının verdikleri cevaplardan 103'ü anket kapsamında değerlendirmeye alınmış, 17'si ankete uygun olarak değerlendirilmemiştir.

BULGULAR

Çalışma bulguları sunulurken TPAB ölçeğinin değerlendirilmesine yönelik ankette yer alan başlıklar tablolar eşliğinde sunulmuştur. Bu alt boyutlardan ilki "Teknoloji Bilgisi" şeklindedir. Tablo 1'de öğretmen adaylarının Teknoloji Bilgisi altında yer alan yedi maddeye verdikleri yanıtlar yer almaktadır. Bu yanıtlar beşli likert tipi ölçek çerçevesinde incelendiğinde sırasıyla 1. madde 368, 2. madde 411, 3. madde 374, 4. madde 377, 5. madde 339, 6. madde 378, 7. madde 368 puana sahiptir. Tablo 1'de yer alan maddeler arasından "Teknolojiyi kolayca öğrenebilirim" maddesinde katılımcıların kendilerini daha yeterli buldukları belirlenmiştir. Bununla birlikte, katılımcıların dikkate değer bir bölümü farklı teknolojilerin bilinmesine yönelik maddede kararsız veya yetersiz olduklarını ifade etmiştir.

Tablo 1. Teknoloji Bilgisi

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1. Teknolojik problemleri nasıl çözeceğimi biliyorum.	8	48	42	5	0
2. Teknolojiyi kolayca öğrenebilirim	18	67	17	1	0
3. Yeni teknolojileri takip ederim.	12	53	27	10	1
4. Teknoloji ile sıklıkla uğraşırım.	17	47	27	11	1
5. Farklı birçok teknolojiyi biliyorum.	6	37	42	17	1
6. Teknoloji kullanmak için gerekli	10	58	26	9	0

teknik becerilere sahibim.					
7. Farklı teknolojilerle çalışmak için yeterli ola ağa sahip oldum.	12	47	34	8	2

Ankette yer alan ikinci alt boyut “Alan Bilgisi” şeklinde olup, Tablo 2'de öğretmen adaylarının bu başlık altındaki maddelere verdikleri yanıtlar yer almaktadır. Bu yanıtlar beşli likert tipi ölçeğe atfedilen puanlar çerçevesinde incelendiğinde sırasıyla 8. madde 402, 9. madde 417, 10. madde 416 puana sahiptir. Katılımcılar, Tablo 2’de yer alan maddelerde benzer oranlarda kendilerini daha yeterli bulduklarını ifade etmiştir.

Tablo 2. Alan Bilgisi

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
8. Matematik hakkında yeterli bilgiye sahibim.	15	66	19	3	0
9. Matematiksel düşünme yolunu kullanabilirim.	16	77	9	1	0
10. Matematiği anlamamı geliştirecek çeşitli yollara ve stratejilere sahibim.	18	72	12	1	0

Ankette yer alan üçüncü alt boyut “Teknolojik Pedagojik Bilgi” şeklinde olup, katılımcıların bu başlık altındaki maddelere verdikleri yanıtlar Tablo 3’te yer almaktadır. Bu yanıtlar beşli likert tipi ölçeğe atfedilen puanlar çerçevesinde incelendiğinde sırasıyla 19. madde 388, 20. madde 394, 21. madde 403, 22. madde 383, 23. madde 401, 24. madde 402 puana sahiptir. Tablo 3’te yer alan maddeler arasından “Derste öğrencilerin öğrenmelerini artıracak teknolojileri seçebilirim.” maddesinde katılımcıların kendilerini daha yeterli buldukları belirlenmiştir.

Tablo 3. Teknolojik Pedagojik Bilgi

	Kesinlikle	Katılıyorum	Kararsızım	Katılmıyorum	

	Katılıyorum				Kesinlikle Katılmıyorum
19-Matematiği anlamak ve öğretmek için kullanabileceğim teknolojileri biliyorum.	8	67	24	4	0
20- Ders için öğretim yaklaşımlarını geliştirecek teknolojileri seçebilirim.	9	69	23	2	0
21- Derste öğrencilerin öğrenmelerini artıracak teknolojileri seçebilirim.	9	79	12	3	0
22- Öğretmen yetiştirme programı, sınıfta kullanacağım öğretim yaklaşımlarımı teknolojinin nasıl etkileyebileceği konusunda derinlemesine düşünmeme sebep oldu.	6	69	21	7	0
23- Teknolojiyi sınıfımda nasıl kullanabileceğim hakkında ciddi olarak düşünüyorum.	16	64	19	4	0
24- Öğrendiğim farklı öğretim etkinliklerine teknoloji kullanımını uyarlayabilirim.	10	74	18	1	0

Çalışma bulguları sunulurken TPAB ölçeğinin değerlendirilmesine yönelik ankette yer alan "Teknoloji Bilgisi, Alan Bilgisi, Teknolojik Pedagoji Bilgisi" alt boyutlar ortalama puanlar eşliğinde sunulmuştur. Web 2.0 araçları Mathigon (M), Wordwall (W), Learning Apps (L), AAAKnow (A) ve Oryx Learning (O) şeklinde kodlanmıştır. Tablo 4'te Web 2.0 araçlarının

seçim sırasına göre Teknolojik Bilgisi boyutuna ait katılımcı sayısı verilmiştir. Teknoloji Bilgisi boyutu için ortalama değeri 1-3 aralığında olan 13 katılımcı bulunmaktadır. Bu katılımcıların %61,53'ü Mathigon, %23,07'si Wordwall, %7,69'u Learning Apps ve %7,69'u AAAKnow araçlarını kullanım tercihlerinde ilk sıraya koymuştur. Bu katılımcıların %15,38'i Wordwall, %23,07si Learning Apps, %23,07'si AAAKnow, %38,46'sı Oryx Learning araçlarını kullanım tercihlerinde son sıraya koymuştur. Teknoloji Bilgisi boyutu için ortalama değeri 3-5 aralığında olan 85 katılımcı bulunmaktadır. Bu katılımcıların %43,52'si Mathigon, %27,05'i Wordwall, %16,47'si Learning Apps, %2,35'i AAAKnow, %10,38'i Oryx Learning araçlarını kullanım tercihlerinde ilk sıraya koymuştur. Bu katılımcıların %5,88'i Mathigon, %15,29'u Wordwall, %5,88'i Learning Apps, %36,47'si AAAKnow, %36,47'si Oryx Learning araçlarını kullanım tercihlerinde son sıraya koymuştur.

Teknoloji Bilgisi ortalama değeri 3-5 aralığında yer alan katılımcıların Web 2.0 aracı kullanışlılık sıralamasında Mathigon ve Wordwall araçlarını ilk sırada, AAAKnow ve Oryx Learning araçlarını son sırada tercih ettiği görülmüştür. Bu durum 1-3 ve 3 ortalama değere sahip katılımcıların tercihlerinde de görülmüştür. Dolayısıyla katılımcıların ortalama Teknoloji Bilgisi değerleri ile Web 2.0 araçları kullanım tercihleri arasında anlamlı bir ilişki gözlenmemiştir.

Tablo 4. Web 2.0 araçları kullanım tercihlerinin Teknoloji Bilgisine göre değişimi

	İLK					SON				
	M	W	L	A	O	M	W	L	A	O
1-3 puan aralığı (1 dahil)	8	3	1	1	0	2	0	3	3	5
3 puan	5	0	0	0	0	0	1	0	2	2
3-5 puan aralığı (5 dahil)	37	23	14	2	9	5	13	5	31	31

Tablo 5'te Web 2.0 araçlarının seçim sırasına göre Alan Bilgisi boyutuna ait katılımcı sayısı sunulmuştur. Alan Bilgisi boyutu için ortalama değeri 3-5 aralığında olan 97 katılımcı bulunmaktadır. Bu katılımcıların %46,39'u Mathigon, %26,80'i Wordwall, %14,43'ü Learning Apps, %3,09'u AAAKnow, %9,27'si Oryx Learning araçlarını kullanım tercihlerinde ilk sıraya koymuştur. Bu katılımcıların %5,15'i Mathigon, %15,46'sı Wordwall, %8,24'ü Learning Apps, %35,05'i AAAKnow, %36,08'i Oryx Learning araçlarını kullanım tercihlerinde son sıraya koymuştur.

Alan Bilgisi boyutu için ortalama değeri 3-5 aralığında yer alan katılımcıların Web 2.0 aracı kullanışlılık sıralamasında Mathigon ve Wordwall araçlarını ilk sırada, AAAKnow ve Oryx Learning araçlarını son sırada tercih ettiği görülmüştür. 3 ortalama değere sahip katılımcıların tercihlerinde ilk sırada Mathigon ve Lerning Apps'i; son sırada ise 3-5 aralığındaki katılımcılar ile aynı tercihlerde bulunarak Oryx Learning ve AAAKnow araçlarına yer verdikleri görülmüştür. Dolayısıyla Alan Bilgisi değerleri ile Web 2.0 araçları kullanım tercihleri arasında anlamlı bir ilişki gözlenmemiştir.

Tablo 5. Web 2.0 araçları kullanım tercihlerinin Alan Bilgisine göre değişimi

	İLK					SON				
	M	W	L	A	O	M	W	L	A	O
1-3 puan aralığı (1 dahil)	1	0	0	0	0	0	0	0	0	1
3 puan	4	0	1	0	0	0	0	0	1	4
3-5 puan aralığı (5 dahil)	45	26	14	3	9	5	15	8	34	35

Tablo 6'da Web 2.0 araçlarının seçim sırasına göre Teknolojik Pedagojik Bilgisi boyutuna ait katılımcı sayısı sunulmuştur. Teknolojik Pedagojik Bilgisi boyutuna ait ortalama değeri 3-5 aralığında olan 97 katılımcı bulunmaktadır. Bu katılımcıların %48,45'i Mathigon, %27,74'ü Wordwall, %15,46'sı Learning Apps, %4,12'si AAAKnow, %7,21'i Oryx Learning Web 2.0 araçlarını kullanım tercihlerinde ilk sıraya koymuştur. Bu katılımcıların %5,15'i Mathigon, %15,46'sı Wordwall, %8,24'ü Learning Apps, %34,02'si AAAKnow, %37,11'i Oryx Learning Web 2.0 araçlarını kullanım tercihlerinde son sıraya koymuştur.

Teknolojik Pedagojik Bilgisi boyutuna ait ortalama değeri 3-5 aralığında yer alan katılımcıların Web 2.0 aracı kullanışlılık sıralamasında Mathigon ve Wordwall araçlarını ilk sırada, AAAKnow ve Oryx Learning araçlarını son sırada tercih ettiği görülmüştür. Bu durum 3 ortalama değere sahip katılımcıların tercihlerinin aynı olduğunu göstermiştir. Dolayısıyla katılımcıların ortalama Teknolojik Pedagojik Bilgisi değerleri ile Web 2.0 araçları kullanım tercihleri arasında anlamlı bir ilişki gözlenmemiştir.

Tablo 6 Web 2.0 araçları kullanım tercihlerinin Teknolojik Pedagojik Bilgisine göre değişimi

	İLK					SON				
	M	W	L	A	O	M	W	L	A	O
1-3 puan aralığı (1 dahil)	1	0	0	0	0	0	0	0	0	1
3 puan	2	2	0	0	1	0	0	0	3	2
3-5 puan aralığı (5 dahil)	47	24	15	4	7	5	15	8	33	36

TARTIŞMA, SONUÇ VE ÖNERİLER

Bu araştırmada, ilköğretim matematik öğretmeni adaylarının TPAB düzeylerinin, cebir öğrenme alanında Web 2.0 araçlarını tercih etme süreçleri üzerindeki etkisi incelenmiştir. Bu amaç doğrultusunda anket aracılığıyla öğretmen adaylarının TPAB alt boyutlarına ilişkin yeterlik algıları ile Web 2.0 araçlarına yönelik kullanım tercihleri değerlendirilmiştir. Bulgular, TPAB ölçeğinin "Teknoloji Bilgisi, Alan Bilgisi-Matematik ve Teknolojik Pedagoji Bilgisi" alt boyutları temelinde tablolar eşliğinde sunulmuştur. Katılımcıların özellikle "Alan Bilgisi" boyutunda kendilerini daha yeterli gördükleri, "Pedagojik Bilgi" açısından da benzer bir yeterlik algısına sahip oldukları, ancak "Teknoloji Bilgisi" boyutunda görece daha düşük düzeyde yeterlik bildirdikleri belirlenmiştir. Bununla birlikte, teknoloji bilgisi bağlamında yetersizlik algılarının mevcut literatürde de benzer biçimde rapor edildiği görülmektedir (Archambault ve Crippen, 2009).

Web 2.0 araçlarının kullanışlılık sıralamaları incelendiğinde, farklı TPAB düzeylerine sahip öğretmen adaylarının benzer tercih eğilimleri gösterdikleri tespit edilmiştir. Bulgular, özellikle Teknoloji Bilgisi, Alan Bilgisi ve Teknolojik Pedagoji Bilgisi alt boyutlarında farklı ortalama değerlere sahip katılımcıların Mathigon ve Wordwall araçlarını ilk sırada, AAAKnow ve Oryx Learning araçlarını ise son sırada tercih ettiklerini ortaya koymuştur. Örneğin, Teknoloji Bilgisi ve Teknolojik Pedagoji Bilgisi ortalaması 3-5 aralığında olan katılımcılar, ilk tercihlerinde Mathigon ve Wordwall'u öne çıkarırken; düşük ortalamalara sahip katılımcılar da benzer sıralamalar yapmıştır. Dolayısıyla, katılımcıların TPAB düzeyleri ile Web 2.0 araçlarını tercih sıralamaları arasında anlamlı bir ilişki gözlenmemiştir. Çalışmanın sonuçları, öğretmen adaylarının alan bilgisi ve pedagojik bilgiye dayalı güçlü yeterlik algılarına rağmen teknoloji bilgisi alanında gelişime ihtiyaç duyduklarını göstermektedir. Ayrıca, Web 2.0 araçlarının seçiminde TPAB alt boyutlarının belirleyici bir etkisinin bulunmaması, adayların araç tercihlerini daha çok kullanım kolaylığı ve işlevsellik temelli olarak yaptıklarını düşündürmektedir. Bu doğrultuda, cebir öğretimi için dijital içerik tasarımında ve araç seçiminde öğretmen adaylarının teknoloji yeterliklerinin artırılmasına yönelik destekleyici uygulamaların geliştirilmesi önerilmektedir.

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MEASUREMENT OF MEDICATION ADHERENCE AMONG TYPE II DIABETES PATIENTS ATTENDING PRIMARY HEALTHCARE FACILITIES IN MOROCCO

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Abstract

Background: The aim of this study was to assess medication adherence among Moroccan patients with type 2 diabetes.

Methods: To achieve this objective, a quantitative cross-sectional study was conducted among patients with type 2 diabetes in Morocco. The General Medication Adherence Scale (GMAS) was used to measure medication adherence in this target population. The study received ethical approval from the Moroccan Association for Research and Ethics.

Results: A total of 284 patients were included in the study. Among them, 90.30% of type 2 diabetes patients demonstrated high adherence to their medication treatment, while 5.30% were considered to have moderate adherence and only 4.40% showed partial adherence. However, when the cumulative evaluation of medication adherence towards antidiabetic drugs was conducted, the results confirmed an adherence rate of approximately 95.78%.

Conclusions: The study's findings revealed a high level of medicationadherence among type 2 diabetes patients. To sustain these encouraging results, it will be crucial to maintain and value the efforts made by healthcare professionals involved in the care of these patients.

Keywords: Medication adherence; type 2 diabetes; oral antidiabetic drugs; Morocco

KADINLARIN AİLE İÇİ ŞİDDETİ TANIMLAMA VE ALGILAMA BİÇİMLERİ: BİR FARKINDALIK ARAŞTIRMASI

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ÖZET

Bu araştırma, kadınların aile içi şiddete ilişkin farkındalık düzeylerini ölçmeyi ve bu farkındalık düzeylerinin farklı demografik özelliklere göre nasıl değişiklik gösterdiğini incelemeyi amaçlamaktadır. Çalışma, aile içi şiddeti tanımlama, şiddetin sonuçlarını algılama, şiddeti kabullenmeme ve şiddetin normalleştirilmesi boyutları üzerine yoğunlaşmaktadır. Araştırma evrenini İstanbul'da yaşayan kadınlar oluşturmuş, örneklemi ise kartopu örnekleme yöntemiyle ulaşılan ve gönüllü katılım sağlayan 214 kadın meydana getirmiştir. Katılımcılara, Özyürek ve Kurnaz (2019) tarafından geliştirilmiş ve araştırmacı tarafından izin alınarak kullanılan "Aile İçi Şiddet Farkındalık Ölçeği" uygulanmıştır. Ölçek, 20 maddeden ve dört alt boyuttan (tanımlama, sonuçları algılama, kabullenmeme, normalleştirmeme) oluşmakta ve üçlü Likert tipinde düzenlenmiştir. Veriler SPSS 26 programında analiz edilmiş; betimsel istatistiklerin yanı sıra güvenirlik analizleri, Mann–Whitney U ve Kruskal–Wallis testleri yapılmıştır. Ölçeğin genel Cronbach's alfa katsayısı 0.83 bulunmuş, bu da ölçeğin güvenilir olduğunu göstermiştir.

Sonuçlara göre kadınların toplam farkındalık düzeyi yüksek bulunmuştur (Ort.=2.83/3). En yüksek ortalama "normalleştirmeme" (Ort.=2.89), en düşük ortalama ise "kabullenmeme" (Ort.=2.76) boyutunda belirlenmiştir. Kadınlar aile içi şiddeti yalnızca fiziksel değil; ekonomik, duygusal, cinsel ve sosyo-kültürel boyutlarıyla da tanımlayabilmekte ve şiddetin intihar, aile dağılması, sağlık sorunları ve toplumsal yozlaşma gibi sonuçlarını güçlü biçimde algılamaktadır. Ancak bu farkındalık, şiddeti her durumda reddetmeye dönüşmemekte; bazı katılımcılarda "disiplin ya da baskı" gerekçesiyle kabullenme eğilimleri sürmektedir. Eğitim düzeyi farkındalık üzerinde anlamlı ve güçlü bir etkiye sahiptir ($p<0.001$, $\eta^2 \approx 0.12$); lisansüstü eğitim almış kadınlar farkındalık konusunda en yüksek puana sahiptir. Ayrıca çalışan kadınların farkındalık düzeyi çalışmayanlara göre daha yüksektir ($p=0.025$). Yaş ve gelir değişkenlerinde anlamlı fark saptanmamış, ancak 25–34 yaş grubunda farkındalık oranı görece daha yüksek çıkmıştır.

Bulgular, kadınların şiddeti tanımlama ve algılama konusunda bilinçli olduklarını, ancak kabullenmeme boyutunda kültürel ve toplumsal normlardan kaynaklanan bir direnç bulunduğunu göstermektedir. Bu nedenle, özellikle eğitim düzeyi düşük ve çalışmayan kadınlara yönelik farkındalık artırıcı programların geliştirilmesi gereklidir.

Anahtar Kelimeler: Aile içi şiddet, farkındalık, kadın, eğitim düzeyi

WOMEN'S CONCEPTUALIZATION AND PERCEPTION OF DOMESTIC VIOLENCE: AN AWARENESS STUDY

ABSTRACT

This study aims to measure women's awareness levels regarding domestic violence and to examine how these levels vary according to different demographic characteristics. The research focuses on four dimensions: defining domestic violence, perceiving its consequences, rejecting its acceptance, and rejecting its normalization. The study population consisted of women living in Istanbul, and the sample comprised 214 women who were reached through the snowball sampling method and participated voluntarily. Participants completed the "Domestic Violence Awareness Scale" developed by Özyürek and Kurnaz (2019), which was used with permission from the authors. The scale consists of 20 items and four sub-dimensions (definition, perception of consequences, non-acceptance, and non-normalization) and is structured on a three-point Likert scale. Data were analyzed using SPSS 26, employing descriptive statistics, reliability analysis, Mann–Whitney U, and Kruskal–Wallis tests. The overall Cronbach's alpha coefficient of the scale was found to be 0.83, indicating good reliability.

Findings revealed that women's overall awareness level was high (M=2.83/3). The highest mean score was obtained in the "non-normalization" dimension (M=2.89), while the lowest was in "non-acceptance" (M=2.76). Women were able to define domestic violence not only as physical acts but also in economic, emotional, sexual, and socio-cultural dimensions, and strongly recognized its consequences such as suicide, family breakdown, health problems, and social disintegration. However, this awareness did not always translate into outright rejection; some participants still displayed attitudes of acceptance under the guise of "discipline or coercion." Educational level had a significant and strong effect on awareness ($p<0.001$, $\eta^2 \approx 0.12$), with postgraduate women achieving the highest scores. Working women also demonstrated higher awareness compared to non-working women ($p=0.025$). No significant differences were observed in age and income groups, although awareness was relatively higher among women aged 25–34.

In conclusion, the findings indicate that while women are generally aware of the definitions and consequences of domestic violence, cultural and societal norms continue to exert resistance in the dimension of non-acceptance. Therefore, the development of awareness-raising programs targeting women with lower education levels and those outside the workforce is essential.

Keywords: Domestic violence, awareness, women, education level

NEONATAL SEPSIS – CLASSIFICATION, DIAGNOSTIC APPROACH AND MANAGEMENT IN NICU

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ABSTRACT:

Neonatal sepsis, which can be either early-onset sepsis (EOS) or late-onset sepsis (LOS), continues to be a leading cause of morbidity and mortality during the first 28 days of life. Group B Streptococcus and Escherichia coli are the most common pathogens in high-resource environments, whereas Gram-negative bacteria are more common in low-resource environments. EOS, which typically happens within 72 hours, is associated with vertical transmission. LOS, which appears three to seven days later, frequently indicates nosocomial or community acquisition and is caused by bacteria like multidrug-resistant Gram-negatives, coagulase-negative staphylococci, and Staphylococcus aureus. Blood cultures are the gold standard for diagnosis, however their sensitivity is restricted by small quantities and previous antibiotics. Early recognition is supported by adjunct markers such as procalcitonin, C-reactive protein, and new cytokine-based assays; molecular diagnostics and point-of-care platforms are being developed to increase accuracy and timeliness. Clinical algorithms continue to be essential for diagnosis in environments with limited resources. Rapid commencement of empirical antibiotics specific to probable infections is necessary for NICU management. For EOS, this means ampicillin + gentamicin, whereas for LOS, it calls for more comprehensive regimens like vancomycin with aminoglycosides or β-lactam/β-lactamase inhibitors. To minimize resistance and needless exposure, antimicrobial stewardship guidelines drive the refinement of therapy based on culture results. Improved results require supportive measures, such as rigorous infection control, nutritional assistance, and respiratory and hemodynamic stabilization. Particularly when tailored to the disease spectrum and resource context, developments in biomarker identification, quick diagnostics, and stewardship frameworks have the potential to lower mortality. The cornerstone of NICU treatment continues to be the successful integration of supportive care, reasonable therapy, and early detection.

A STUDY OF RIGHTS OF MUSLIM WOMEN AND CHALLENGES OF ISLAMIC FUNDAMENTALISM IN NOOR ZAHEER'S '*MY GOD IS A WOMAN*'

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Abstract

This paper attempts to explore Noor Zaheer's novel *My God is a Woman* (2008) as a critical intervention in the discourse on Muslim women's rights and the challenges posed by Islamic fundamentalism in India. Written against the backdrop of the Shah Bano case (1986) and the political debates on Muslim Personal Law, the novel foregrounds the intersection of religion, gender, and law in shaping the status of Muslim women. Through the experiences of its protagonist Safia and other women characters, Zaheer interrogates practices such as purdah, meher, polygamy, forced marriages, divorce, and restrictions on women's education. The narrative not only exposes the contradictions within socio-religious traditions but also underscores the complicity of patriarchal structures and political powers in curbing women's rights. By critiquing both conservative orthodoxy and state policies, Zaheer situates the struggle of Muslim women within broader frameworks of social justice, identity, and reform. The paper highlights how Zaheer's progressive outlook, rooted in her Marxist and feminist lineage, contributes to ongoing debates on gender equality, cultural authenticity, and the necessity of reform within Muslim communities in contemporary India.

Keywords: Forced marriages, divorce, Islamic fundamentalism, meher, purdah, polygamy, women's education.

Noor Zaheer is a third world Indian novelist who has focused on rights, status and challenges of Muslim women in her writing. Noor Zaheer, born in India in 1956, is daughter of renowned Urdu writer Sajjad Zaheer and Razia Sajjad Zaheer. Sajjad Zaheer was known as one of the greatest Marxist thinkers and a cofounder of the All India Progressive Writers Association (PWA) in 1936, an association that spearheaded the progressive movement in Urdu literature by leading a struggle against socio-economic oppression. Noor's mother Razia Sajjad Zaheer, like her husband, was a progressive thinker and writer. Through her writing she truly highlighted the image of 'new woman' and raised the question of social restrictions imposed over women in a patriarchal society. Noor Zaheer, carrying the legacy of her parents, is an activist and a member of the Communist Party of India. In modern day India she highlights the socio- economic problems of women. Despite being born a Muslim, Zaheer claims that she was raised in a communist to household, which gave her a sense of being nonreligious. She practises Sufi and Buddha Dharma and identifies as an atheist. Noor Zaheer writes;

> "… to expose or reveal certain practices and beliefs that … are not fair or just or that I am uneasy about. Sometimes, I succeed and sometimes I don't. It's all part of being a writer. One of the lessons I learnt early is that once you are published you have strangers reading your work… Criticism, perhaps warranted, but also unwarranted, is hurled at you. You just have to learn to deal with it, but it is never easy" (Kapur 15).

Apart from her novels in English and Hindi she has also written the biography of prominent Urdu poet Faiz Ahmed Faiz. The present paper is a study of her 2008 novel *My God is a Woman*. The novel represents the issue of women empowerment against the backdrop of pre and post-partition of India. It shows the crisis of identity of Muslim community in social, political and ideological changes in India after partition. The major concern of the novel is the social, economic and legal reform of Muslim women in India. It is written, though after a long gap of twenty-one years, in response to the introduction of the Bill for the Protection of Muslim Women passed in 1986. The Shah Bano case which created a huge controversy during 1986 to enforce the separate religious identity of Muslims was the real impetus for Zaheer to write the novel to expose the real status of Muslim women in India.

The novel represents the real issues of rights of Muslim women and with the Shah Bano Case as a sub plot it questions the Muslim Personal Laws and Legislation. It also represents the concerns of the progressive people and criticizes the decision of the Rajiv Gandhi Government to quash the historic judgment of the Supreme Court of India which granted the maintenance to a Muslim woman after the divorce; the Shah Bano case in 1986. The novel touches upon a lot of sensitive issues relating to Muslim women; marriage, meher, education, purdah, property inheritance, domestic violence, freedom, identity, socio-economic status and their participation in decision making in the second half of the twentieth century. Through her protagonist Safia, the writer tries to revive the debate on reform in the status and rights of Indian Muslim women.

Safia, though belongs to an educated family, starts wearing burqa at the age of nine and gets married at the age of seventeen to twenty eight year old Abbas. Safia's marriage ceremony highlights the custom of meher in Muslim community which is considered as the security of woman as per Islamic Law.

> "… a sum of money or other property which the wife is entitled to receive from the husband in consideration of the marriage" (Hidayatullah 270).

> "Marriage in Islam is based on a civil contract which has two important components – dower (mahr) and maintenance. 'Mahr' is a promise made by the husband before Mullah and depends upon the status of the husband … . This promise is the basic foundation of a civil contract between a husband and wife and insures wife's legal right …(Women in Muslim Personal Law 5).

The concept of meher was a revolutionary and unique custom to provide financial security to women as in the pre Islamic times it was given to bride's father or oldest male member. It started to be given to directly to the bride in Islamic period without which marriage was illegal. The meher (money, jwellery or land) can be used in any way by the bride but it is generally used after the marriage is dissolved. In the historical dictionary of Islam, Quranic Surah 4:4 and 4:20 says

> "And give the women (on marriage) their dower as an obligation; but if they, on their own good pleasure, remit any part of it to you, take it and enjoy it with right good cheer…But if ye decide to take one wife in place of another, even if ye had given the latter a whole treasure for dower, take not the least bit back" (Adamec 197).

Safia's father Syed Murtaza Mehdi fixes fifty thousand asharfis as meher on the advice of his friend Mirza Saheb for the security of his daughter. As soon as he announce the amount it creates a flutter in the family of Abbas. Zeenat Begum, mother of Abbas, immediately responds with such harsh words,

> "Please sit down Syed Saheb. Sons in our family do not divorce their wives. Women are respected and honoured in clans like ours…. Your proposal for the maher is accepted and will be formally agreed upon at the time of nikaah and to be paid at the time of talaaq" (MGW 3).

On the other hand the novel also depicts a totally opposite incident where daughter of Mujataba Sahib, commits suicide after her divorce. The scene shows the reality of discrepancies in 'mahr' system. The meher fixed for Mujataba Sahib's daughter was 'fatmahi meher' of five rupees (Bibi Fatmah, Prophet's daughter, was granted minimum Mahr at her time of marriage which is still considered as an ideal mahr proudly in many Muslim households) that is why it was very easy for her husband to pay at the time of divorce. Because of the humiliation, Mujataba Sahib's daughter killed herself. She could have felt less like a financial burden to her father had the "mahr" amount been set at a larger amount. Muslim daughters' mentality has been horribly warped by the so-called social norms, making them feel that they have extra responsibilities and were created to serve others. If their marriages don't work out, they lose their standing in their parents' homes and in society. The untimely death of his only child profoundly alters his life. He starts raising voice for girls' education and soon becomes legend for opening the Sajeda Hussain Muslim Girls School promoting female education although the uproar against him is predictable when people around him said: "What? A school for Muslim girls? The man was raving mad. Even madness should have its limits. The man deserved a good beating." (49) Education for Muslim women seems unthinkable and inexplicable for religiously conventional people. In the novel, Zaheer through her characters uses all the possible persuasive ways to make the Muslims aware of their rights under the umbrella of religion. Mujataba Sahib addresses the gathering:

> "I need not remind the gathering that Islam had been a storm of liberal and progressive ideas; that it had brought about radical and much needed changes and that Allah had bestowed the Holy Quran as a book to be referred and read by every Muslim" (77).

In order to emphasize the importance of education for girls and the modesty of women, he says;

> "No one can deny the fact that Prophet Mohammed's first wife, (Bibi Khadija) was an educated woman, operating her own business, she and his other wife's daughter Bibi Sayeda, were all educated women, who moved amongst other women and taught them the Holy Book … if Allah had wished to deny education to the women, he would have restricted them from reading the Holy Quran. India is on the brink of achieving freedom. The Muslims have to participate in building its future… It is not me or the girls who have anything to hide. It is the man in the hedge who had to something to hide … from the minute a girl leaves her house to come to my school, till the moment, she steps back into her house, she is my daughter and my responsibility" (79).

Safia's life changes completely after marriage with Abbas because he is shown as a progressive thinker who professes liberal views on women and religion. He is a member of Communist Party of India. With her husband, Safia starts her new journey of life; she rejects wearing 'burqa' and acquires a new identity as a liberal thinker. But her mother in law does

not like her bold and decisive attitude. She is shown as a stereotypical image of a Muslim woman, she buys female servants for domestic work and beats them. Safia fails in maintaining a good relation with her mother in law because of their different mentality. In Muslim community it is the general belief about the practice of purdah that it was enforced on women.

The practice of purdah is one of the central issues Zaheer raises in the novel. Traditionally defended as a religious requirement, purdah has been used as a mechanism to enforce women's seclusion and control their mobility. Zaheer exposes how purdah is less about spiritual modesty and more about sustaining patriarchal authority in the guise of religion. Safia initially accepts purdah without resistance, but her later rejection of the veil signifies a conscious break from imposed gendered norms. Zaheer contrasts women like Safia, who challenge the practice, with conservative figures such as Zeenat Begum, who embody the traditionalist justification of purdah. By doing so, the novel shows how purdah becomes a cultural symbol manipulated by religious leaders and family elders to restrict women's education, participation in public life, and individual freedom. Thus, Zaheer makes purdah not just a physical veil but a metaphorical curtain separating Muslim women from their rights and identities.

Another important issue raised by Noor Zaheer is the educational rights for Muslim women. In spite of the fact that Quran preaches that every individual should seek and explore knowledge and wisdom, Muslim community has failed in giving the rights and status to its women which are given by Islam. As far the educational rights of women in Islam are concerned, Zakir Naik states in *'Rights of Women in Islam'* that the first five verses from Surah Alaq or Surah Iqra of Holy Qur'an say:

> "Read, recite or proclaim in the name of the Lord, who has created the human beings from a congealed blood, a leech like substance. Read, thy Lord is most bountiful who has taught the use of the pen, who has taught the human beings that which he knew not" (22-23).

Abbas encourages Safia to go for higher education. She moves to Allahabad with her father in law and takes admission in BA. This proves a great opportunity for her to know more about the rights of women and about the outer world. Safia and Gayatri, only two girls take admission among the batch of twenty eight students in B.A. at the Allahabad University. Noor Zaheer portrays men like Abbas who wants women to be educated, emancipated and liberated, on the other hand men like Sadaqat Rehmani who are educated but fundamentalist and wants women to follow the religious codes of seclusion to symbolize Muslim cultural authenticity. He states,

> "Women should not study. What use is education for them? … Which respectable household would allow its daughters to work? They would end up cooking and keeping house. Women do not possess the capacity to channelize education to proper use. It only spoils their brains that become an easy prey of Satan. Imagine women from respectable Muslim households have given up Purdah!" (38*)*

The issues of polygamy and forced marriages are highlighted by the writer with her minor character, Nigar, one of Safia's student who comes to her for help. Nigar is forced by her parents to marry a man of her father's age. The man who is marrying fourth time is pitied by the relatives rather the poor young girl;

> "Yes he is, poor man. Lost his first two wives in childbirth. Luckily, the children survived. So he had to marry a third time, after all someone has to look after the children. However, the third wife has turned out barren….

> But these are God's ways of finding bridegrooms for girls from poor families." (62)

Abbas and Safia encourages Nigar to raise her voice against her forced marriage and tell her that this is her right given by Islam. in Islam, a forced marriage is not considered lawful. According to the shari'ah the willingness of the bride-to-be is a compulsory condition. Abbas supports her when she refuses at the time of her Nikah;

> "What do you mean? No persuasion, threat or blackmail can be used to make a girl marry against her wishes. The Holy Book is very clear on this point. Let me show it to you…Are you out of your mind? You want to rewrite the Quran? You want to interfere with His dictates, want to be a Prophet yourself?" "God forbid!" Maulvi Sahib was visibly trembling. "Then stop a marriage where the Quran is being insulted. Your work is to see that the word of Allah is maintained and that no distortions are committed in the Holy Scriptures." (62)

The novel brings into focus the practice of polygamy which is very common in the Muslim communities. The practice became popular in India during the Muslim rule when the royal families used to have harems and enjoyed plurality of wives from both Muslim and Hindu communities. The Qur'an, in its Surah 4 Al- Nis'a on women, permits polygamy but also lays down certain conditions regarding the treatment of wives along with the restriction of the maximum number of contemporaneous wives to four:

> 'And if you fear that you cannot act equitably towards orphans, then marry such women as seem good to you, two three or four; but if you fear that you will not do justice between them, But if you fear that you cannot do justice, marry one only" (Women between Islam and Western Society, p378)

Maulana Wahiduddin in his book *'Women between Islam and Western Society'*, says, It is one of the commandments given in Qur'an that

> "… was revealed after the 'Battle of Uhud' (Shawaal 3 A.H. in which seventy Muslims were martyred … seventy homes in Medina were bereft of all male members, and the question arose as to how all these widows and orphans were to be cared for. This was an acute social problem. It was solved by the revelation of this verse asking the people who could afford it to take care of the orphans, by marrying the widows and keeping their orphaned children under their guardianship." (Women between Islam and Western Society, p379)

Thus, polygamy is allowed in Islam under certain circumstances. Noor Zaheer highlights the issue of polygamy in Muslim Personal Law through her novel to show the miserable plight of women in order *to* emphasis that;

> "… if women's rights are a problem for some modern Muslim men, it is neither because of Koran not the prophet, nor the Islamic tradition, but simply because those rights conflict with the interests of a male elite" (Mernissi, The Veil and The Male Elite ix).

Mernissi adds that elite group of males is mostly trying to convince that their egoistic, subjective and mediocre view of culture and society has a sacred basis.

Another important subplot involves the servant girl in Safia's household who becomes pregnant outside marriage. Rather than being treated with compassion, she is condemned,

beaten, and stigmatized by the family, especially by women like Zeenat Begum. The incident underlines how class and gender intersect to produce compounded marginalization. The servant girl, doubly disadvantaged as a poor and voiceless woman, becomes a target of moral policing, while the men responsible for her condition escape accountability. Zaheer uses this episode to critique the hypocrisy of patriarchal morality, where women—particularly those from lower social strata—bear the full burden of honor and shame. The subplot highlights the necessity of reform not only in religious and legal structures but also in entrenched social attitudes that perpetuate violence against women. The Shah Bano case is central to Zaheer's critique of Muslim Personal Law. By weaving this landmark legal battle into the novel, she underscores the clash between constitutional rights and religious identity politics. The Supreme Court's 1985 judgment granting maintenance to Shah Bano under Section 125 of the Criminal Procedure Code was celebrated as a victory for women's rights. However, the subsequent passage of the Muslim Women (Protection of Rights on Divorce) Act, 1986, under political pressure from orthodox groups, nullified this ruling. Zaheer's narrative condemns this betrayal of justice, pointing out how the state sacrificed women's rights for the sake of vote-bank politics. Similarly, the issue of triple talaq appears in the novel as a tool of instant disposability of women. By presenting these themes, Zaheer situates her novel within the real political debates of the time, making literature an active participant in the struggle for gender justice. The novel also brings attention to Safia's experience with divorce and the subsequent practice of iddat, the mandatory waiting period imposed on Muslim women. While intended in Islamic tradition to ascertain lineage and ensure fairness, Zaheer highlights how iddat often becomes another form of control over women's lives. Safia, despite her education and progressive outlook, finds herself subjected to the stigma and restrictions of divorce, reflecting the social reality of countless Muslim women. Through Safia's plight, Zaheer questions why such laws are disproportionately harsh on women while men retain the privilege of multiple marriages and unilateral rights to talaq. By reimagining Safia's journey, Zaheer emphasizes that true reform must come from reinterpreting religious practices in light of gender justice rather than preserving patriarchal privileges.

14) Conclusion

Noor Zaheer's *My God is a Woman* emerges as a powerful feminist critique of Islamic fundamentalism, patriarchal traditions, and political opportunism in post-independence India. By intertwining fictional narrative with real historical debates such as the Shah Bano case, Zaheer exposes the contradictions of Muslim Personal Law and the challenges faced by women in negotiating their rights. Issues such as purdah, meher, polygamy, forced marriages, education, and divorce are not presented in isolation but as interconnected structures of oppression reinforced by both community orthodoxy and state policies. At the same time, the novel projects resistance through characters like Safia and reformist men like Abbas, who advocate for equality, education, and dignity for women. Ultimately, Zaheer's work insists that the oppression of Muslim women is not inherent to Islam but rooted in patriarchal interpretations that exploit religion for social control. The novel calls for a re-examination of law, religion, and culture in the light of justice, equality, and human rights, positioning women at the center of the struggle for reform.

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ORTOPİROKSENİT İÇİNDE KROMİTİT DAMARI OLUŞUMU: LİKYA OFİYOLİTLERİNDEN NADİR BİR ÖRNEK (GB TÜRKİYE)

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ÖZET

Bu çalışmada, Güneybatı Türkiye'deki Likya ofiyolitlerinin manto kesiminde, harzburjitler içinde yer alan ortopiroksenit içinde gömülü bir kromitit damarı ayrıntılı olarak incelenmiştir. Kromitit oluşumu açısından olağandışı olan bu örneğin mineral kimyası verileri, harzburjitin oldukça tükenmiş bir yapıya sahip olduğunu, ortopiroksenitin ise kümülatif karakterli bir kökene işaret ettiğini göstermektedir. Kromitit damarı içerisindeki krom spineller düşük TiO_2 içeriği ve orta-yüksek Al_2O_3 ve Cr_2O_3 seviyeleriyle tipik ofiyolitik kromitit özellikleri sergilerken, bazı eser ve nadir toprak elementlerinde belirgin farklılıklar sunmaktadır. Ana magma bileşimleri, okyanus ortası sırtı (MORB-benzeri) ve boninit-benzeri ergiyikler arasında bir afinite sergilemektedir. Silikat minerallerinde gözlenen bileşimsel değişimler, harzburjit ile ergimiş malzeme arasında iki aşamalı bir metasomatik sürece işaret etmektedir. İlk aşamada kromitit damarı muhtemelen ergiyik-peridotit etkileşimiyle ince bir dünit zarfı içinde gelişmiştir. Daha sonra, yüksek silisli hibrit bir ergiyikle gerçekleşen etkileşim, olivinin kısmi çözünmesine ve ortopiroksen kristallenmesine neden olmuş, böylece kromitit damarını çevreleyen ortopiroksenit oluşumuna yol açmıştır.

Anahtar Kelimeler: Ortopiroksenit, kromitit damarı, harzburjit, mineral kimyası, GB Türkiye

CHROMITITE VEIN FORMATION WITHIN ORTHOPYROXENITE: A RARE EXAMPLE FROM THE LYCIAN OPHIOLITE (SW TURKEY)

ABSTRACT

In this study, a chromitite vein enclosed within orthopyroxenite hosted by mantle harzburgites of the Lycian ophiolites in southwestern Turkey is examined in detail. Mineral chemistry data from this unusual occurrence of chromitite formation indicate that the harzburgite represents a highly depleted mantle residue, whereas the orthopyroxenite points to a cumulate-like origin. Chromian spinels within the chromitite vein exhibit typical characteristics of ophiolitic chromitites, with low TiO_2 contents and moderately high Al_2O_3 and Cr_2O_3 levels, while displaying notable variations in certain trace and rare earth elements. The parental magma compositions show an affinity between mid-ocean ridge basalt (MORB-like) and boninite-like melts. Compositional variations observed in the silicate minerals indicate a two-stage metasomatic process between the harzburgite and percolating melt. In the first stage, the chromitite vein likely formed within a thin dunite envelope as a result of melt–peridotite interaction. Subsequently, interaction with a high-silica hybrid melt caused partial dissolution of olivine and crystallization of orthopyroxene, leading to the formation of orthopyroxenite surrounding the chromitite vein.

Keywords: Orthopyroxenite, chromitite vein, harzburgite, mineral chemistry, SW Turkey

APRON KAZALARI SONRASI HAVALİMANI EMNİYET VE KALİTE YÖNETİMİ

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ÖZET

Havacılık emniyeti, olası kaza veya risklere karşı tehlikelerden kaçınmak amacıyla kural ve düzenlemelere uyma konusunda gerçekleştirilen faaliyetlerden oluşmaktadır. Havacılık sektörü farklı sistemlerin bir araya gelmesinden oluşmaktadır ve havacılık emniyeti, uçak operasyonları, hava trafik yönetimi, havalimanı ve yer operasyonları, kullanılan ekipman ve teçhizatların kullanımı ve insan faktörleri gibi unsurların bütüncül bir bakış açısıyla yönetilmesi süreçlerini kapsamaktadır. Süreçlerin yönetilmesinde yapılacak küçük bir hata geri dönüşü olmayan kazalara yol açabilmekte, can veya mal kaybına neden olmaktadır. Bu hususta uçuş operasyonlarının yanı sıra yer operasyonlarının havacılık emniyetindeki rolü dikkat çekici düzeydedir. Kazaların engellenmesi veya en az hasarla atlatılması amacıyla apron yönetimi ve yer operasyonları belirli kurallar ve düzenlemelere tabidir. Ayrıca apronda operasyon gerçekleştiren işletmeler de kalite ve kontrol yönetimi kapsamında, iş sağlığı ve güvenliği gibi uygulamalar gerçekleştirmektedir. Çalışmanın amacı apron kazaları sonrasında işletmelerdeki emniyet ve kalite yönetimi süreçlerini incelemektir. Ayrıca emniyeti olumsuz etkileyen risk unsurlarının belirlenmesi, yönetim süreçlerinin değerlendirilmesi ile emniyet ve kalite yönetimine katkı sunulması amaçlanmaktadır. Çalışmada nitel araştırma yöntemi kullanılmış olup veriler yarı yapılandırılmış görüşmelerle toplanmıştır. Araştırma kapsamına, havaalanı apron sahasında görev alan; apron memurları, emniyet alanındaki eğitimciler, denetimciler ve kalite departmanı çalışanları dahil edilmiştir. Toplanan veriler MAXQDA programı ile analiz edilmiş ve yorumlanmıştır. Araştırma bulguları apron kazalarının iletişim eksikliği, kural ve prosedürlere uyulmaması, eğitim eksikliği ve dikkat eksikliği gibi unsurlardan kaynaklandığını göstermektedir. Denetimlerin sıklaştırılmasıyla birlikte emniyet yönetim sisteminin aktif yürütülmesi ve kalite yönetiminin geliştirilmesi sonucunda apron emniyetinin daha proaktif bir şekilde yönetilmesi mümkün olmaktadır. Sonuç olarak apron emniyeti yönetiminde kalite yönetim süreçlerinin azaltıcı etkisi dikkat çekmekte ve yaşanan kaza veya ramak kalalar sonrasında otoritelerin belirledikleri kurallar doğrultusunda güncellemelerin yapıldığı anlaşılmaktadır. Buna ek olarak, eğitimlerin artırılmasıyla birlikte bilgi ve tecrübe eksikliğinin giderilmesinin ve denetlemelerin artırılmasının apron emniyetinin yönetilmesine katkı sunacağı beklenmektedir.

Anahtar Kelimeler: Apron yönetimi, Emniyet, Kalite yönetimi, Kaza, Yer operasyonları

AIRPORT SAFETY AND QUALITY MANAGEMENT FOLLOWING APRON ACCIDENTS

ABSTRACT

Aviation safety consists of activities carried out to comply with rules and regulations in order to avoid hazards in the event of potential accidents or risks. The aviation sector consists of different systems working together, and aviation safety encompasses processes that manage elements such as aircraft operations, air traffic management, airport and ground operations, the use of equipment and machinery, and human factors from a holistic perspective. A small mistake in managing these processes can lead to irreversible accidents, resulting in loss of life or property. In this regard, the role of ground operations in aviation safety is noteworthy, in addition to flight operations. Apron management and ground operations are subject to specific rules and regulations to prevent accidents or minimize damage. Furthermore, companies operating on the apron also implement practices such as occupational health and safety within the scope of quality and control management. The aim of this study is to examine the safety and quality management processes in companies following apron accidents. It also aims to identify risk factors that negatively affect safety, evaluate management processes, and contribute to safety and quality management. The study employed a qualitative research method, and data were collected through semi-structured interviews. The scope of the research included apron officers, safety trainers, inspectors, and quality department employees working in the airport apron area. The collected data were analyzed and interpreted using the MAXQDA program. The research findings show that apron accidents stem from factors such as lack of communication, failure to comply with rules and procedures, lack of training, and lack of attention. With more frequent inspections, active implementation of the safety management system, and improvement of quality management, it is possible to manage apron safety more proactively. As a result, the mitigating effect of quality management processes in apron safety management is noteworthy, and it is understood that updates are made in accordance with the rules determined by the authorities after accidents or near misses. In addition, it is expected that increasing training, eliminating lack of knowledge and experience, and increasing inspections will contribute to the management of apron safety.

Keywords: Apron management, Safety, Quality management, Accident, Ground operations

VAN VE VAN GÖLÜ ULAŞIMININ MEVCUT DURUMU VE GELECEK POTANSİYELİ: SENARYO ANALİZİ TEMELLİ BİR DEĞERLENDİRME

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ÖZET

Bu çalışma, Van ili ve Van Gölü ulaşımının mevcut durumunu ve gelecekteki potansiyelini resmi veriler ışığında analiz etmektedir. Van, 31 bini aşkın öğrenciye sahip Yüzüncü Yıl Üniversitesi ve yıllık 700 bini bulan turist ziyaretçileriyle bölgesel ölçekte önemli bir ulaşım ve turizm merkezidir. Kentte belediye otobüsleri, özel halk otobüsleri ve minibüsler günlük yaklaşık 44 bin yolcu taşımakta; yalnızca üniversite–kent merkezi hattında günlük 23 bin yolcu seyahat etmektedir. Buna karşın yoğun trafik, yol kalitesi sorunları ve sınırlı konfor, alternatif ulaşım çözümlerini gündeme getirmektedir. Araştırmada, "YYÜ – İskele Caddesi – Edremit" arasında önerilen deniz hattının potansiyeli üç senaryo üzerinden değerlendirilmiştir. Düşük senaryoda yıllık 939 bin yolcu, orta senaryoda 1,7 milyon yolcu, yüksek senaryoda ise 2,6 milyon yolcu taşınabileceği hesaplanmıştır. Bu kapsamda yıllık gelir potansiyeli 43–185 milyon TL arasında değişmektedir. Projenin uygulanmasıyla karayolu trafiğinin azalması, karbon emisyonlarının düşmesi, öğrenci ve personel memnuniyetinin artması, turizm çeşitliliğinin gelişmesi ve yeni istihdam olanaklarının doğması beklenmektedir. Sonuçlar, Van Gölü'nde düzenli deniz ulaşımının yalnızca ulaşım sorunlarını hafifletmekle kalmayıp, aynı zamanda ekonomik ve sosyal kalkınmaya katkı sağlayacak sürdürülebilir bir seçenek olduğunu göstermektedir. Çalışma, senaryo analizleri ve resmi verilerle desteklenmiş olup, bölgesel ulaşım planlaması ve yatırım kararları için yol gösterici niteliktedir.

Anahtar Kelimeler: Van, Van Gölü, toplu taşıma, deniz ulaşımı, senaryo analizi, sürdürülebilirlik

CURRENT SITUATION AND FUTURE POTENTIAL OF VAN AND LAKE VAN TRANSPORTATION: A SCENARIO-BASED EVALUATION

ABSTRACT

This study analyzes the current situation and future potential of transportation in Van and across Lake Van, based on official data. With more than 31,000 students at Van Yüzüncü Yıl University and nearly 700,000 annual tourist arrivals, Van is a key regional center for transportation and tourism. Public buses, private buses, and minibuses serve approximately 44,000 passengers daily, with the university–city center corridor alone handling around 23,000 passengers per day. However, traffic congestion, road quality issues, and limited comfort highlight the need for alternative solutions. The research evaluates the potential of a proposed ferry route between "Van Yüzüncü Yıl University – İskele Street – Edremit" under three demand scenarios. Annual passenger numbers are projected at 939,000 in the low-demand scenario, 1.7 million in the medium-demand scenario, and 2.6 million in the high-demand scenario. Accordingly, annual revenue potential ranges between 43 and 185 million TL. The project is expected to reduce road congestion, lower carbon emissions, increase satisfaction among students and staff, enhance tourism diversity, and create new employment opportunities. The findings suggest that introducing regular ferry services on Lake Van would not only ease existing transportation challenges but also contribute to economic and social development as a sustainable alternative. Supported by scenario analyses and official statistics, this study provides guidance for regional transportation planning and investment decisions.

Keywords: Van, Lake Van, public transport, ferry transportation, scenario analysis, sustainability

GİRİŞ

Türkiye'nin doğusunda yer alan Van ili, gerek coğrafi konumu gerekse demografik özellikleri bakımından stratejik bir öneme sahiptir. Doğu Anadolu Bölgesi'nin en büyük kentlerinden biri olan Van, İran sınırına yakınlığı nedeniyle tarih boyunca hem ticaret hem de kültürel etkileşim açısından önemli bir merkez olmuştur (Azizi and Tsuboi, 2021; Deniz and Enlil, 2022). Kentin en dikkat çekici doğal unsuru olan Van Gölü, yüzölçümü bakımından Türkiye'nin en büyük gölü olmasının yanı sıra, ulaşım ve turizm açısından da büyük bir potansiyel barındırmaktadır (Sanli and Yılmazel, 2021). Yüzey alanı yaklaşık 3.713 km² olan göl, çevresindeki yerleşimlerle birlikte bölgenin hem ekonomik hem de sosyal yaşamında belirleyici bir rol üstlenmektedir (Bilgili and Şahin, 2023).

Son yıllarda artan nüfus ve kentleşme, Van'da ulaşım talebini önemli ölçüde artırmıştır. Özellikle Van Yüzüncü Yıl Üniversitesi'nin (YYÜ) 30 bini aşkın öğrenci nüfusu ve yaklaşık 5 bin personeli, şehir merkezinden kampüse düzenli ve yoğun bir yolcu akışı yaratmaktadır (Van Olay, 2024). Günlük ortalama 23 bin yolcunun kullandığı YYÜ–kent merkezi hattı, mevcut karayolu ulaşımının en yoğun akslarından birini oluşturmaktadır. Bu yoğunluk, sabah ve akşam saatlerinde ciddi trafik sıkışıklıklarına ve konforsuz yolculuk deneyimlerine yol açmaktadır. Van'ın artan ulaşım talebi, alternatif sistemlerin geliştirilmesini zorunlu kılmaktadır (ŞehriVan, 2024).

Van Gölü bu noktada stratejik bir çözüm alanı sunmaktadır. Dünya genelinde birçok kentte iç su yolları, ulaşım sisteminin önemli bir parçası olarak kullanılmaktadır. Örneğin, İstanbul'da Marmara Denizi üzerindeki şehir içi deniz hatları veya Stockholm ve Helsinki gibi kuzey Avrupa kentlerinde iç su taşımacılığı, kent içi ulaşımın yükünü hafifletmekte ve turizmi çeşitlendirmektedir (Jarviluoma, 2009; Roso *et al.*, 2020). Van Gölü'nde hâlihazırda yalnızca turistik amaçlı deniz otobüsü seferleri (Edremit–Akdamar Adası hattı) ve yük taşımacılığı

(Van–Tatvan feribotu) yapılmaktadır (Bilgili and Şahin, 2023). Bu tablo, gölün ulaşım potansiyelinin büyük ölçüde atıl kaldığını göstermektedir.

Sürdürülebilir ulaşım anlayışı, günümüzde şehir planlamasının temel unsurlarından biri hâline gelmiştir. Karayolu taşımacılığına aşırı bağımlılık, çevresel kirlilik, trafik kazaları, gürültü ve enerji verimsizliği gibi olumsuzluklara yol açmaktadır (Profillidis *et al.*, 2014). Buna karşılık, su yolu taşımacılığı daha düşük emisyon, daha yüksek enerji verimliliği ve daha konforlu ulaşım imkânı sağlamaktadır (Kuciaba, 2018). Birleşmiş Milletler'in Sürdürülebilir Kalkınma Amaçları da çevre dostu ulaşım sistemlerinin yaygınlaştırılmasını vurgulamaktadır (Cotera and Arias, 2020). Van özelinde de gölün ulaşım entegrasyonuna katılması hem çevresel sürdürülebilirlik hem de sosyal refah açısından önemli bir katkı sağlayacaktır.

Van'ın turizm potansiyeli de dikkate alınmalıdır. 2023 yılında yaklaşık 700 bin turistin ziyaret ettiği kent, özellikle Akdamar Adası, Van Kalesi ve Van Müzesi gibi destinasyonlarla öne çıkmaktadır. Turistlerin önemli bir kısmı İran'dan gelmekte, yaz sezonunda göl çevresinde hareketlilik artmaktadır (Mücadele, 2024). Bu bağlamda, göl üzerinde yeni deniz hatlarının açılması yalnızca ulaşımı çeşitlendirmekle kalmayacak, aynı zamanda bölgenin turistik çekiciliğini artıracaktır.

Bu çalışmanın temel amacı, Van ili ve Van Gölü ulaşımının mevcut durumunu resmi veriler ışığında ortaya koymak ve geleceğe dönük olası senaryoları analiz etmektir. Çalışmada üç temel soruya yanıt aranmıştır:

1. Van'da mevcut ulaşım sistemi hangi güçlü ve zayıf yönlere sahiptir?
2. YYÜ–İskele Caddesi–Edremit hattında düzenli deniz seferleri başlatılması hâlinde potansiyel yolcu talebi ve gelir düzeyi nasıl şekillenecektir?
3. Bu hattın ekonomik, sosyal ve çevresel etkileri neler olabilir?

Metodolojik olarak çalışma, resmi istatistiklerin betimsel analizi, senaryo temelli talep tahminleri ve maliyet–gelir projeksiyonlarına dayanmaktadır. Bu sayede hem mevcut durumun fotoğrafı çekilmiş hem de geleceğe yönelik uygulanabilirlik değerlendirmesi yapılmıştır. Çalışma aynı zamanda yerel yönetimler için politika önerileri sunmayı, akademik literatüre ise iç su taşımacılığı bağlamında yeni bir örnek kazandırmayı amaçlamaktadır.

Sonuç olarak, Van Gölü üzerinde önerilen deniz hattı, kent ulaşımında yeni bir paradigma yaratma potansiyeline sahiptir. Bu girişim, yalnızca YYÜ öğrencileri ve kent sakinleri için alternatif bir ulaşım modeli sunmakla kalmayacak, aynı zamanda Van'ın turizm ve çevre politikalarına da entegre edilerek bölgesel kalkınmaya katkı sağlayacaktır.

METODOLOJİ

Bu çalışma, Van kenti ve Van Gölü ulaşımının mevcut durumunu ortaya koymak ve olası deniz hattı projeksiyonlarını değerlendirmek amacıyla betimsel analiz ve senaryo tabanlı tahmin yöntemlerini kullanmaktadır. Çalışmada hem nicel (kantitatif) hem de nitel (kalitatif) veriler bir araya getirilmiştir.

Veri Kaynakları ve Analiz Tekniği

Çalışmada kullanılan veriler, resmi kurum ve kuruluşların yayımladığı güncel raporlar ve istatistiklerden derlenmiştir:

- Van Büyükşehir Belediyesi'nin toplu taşıma istatistikleri (2022–2023 yolcu sayıları, araç dağılımı, hat bilgileri).
- Sayıştay raporları (araç türleri, lisanslı taşımacılık verileri).
- Van Yüzüncü Yıl Üniversitesi'nin öğrenci ve personel sayıları.

- Kültür ve Turizm Bakanlığı ile yerel basın kaynaklarında yayımlanan turizm verileri.
- TCDD tarafından işletilen Van–Tatvan feribotlarına ilişkin kapasite bilgileri.

Araştırma üç aşamalı bir analiz çerçevesine dayandırılmıştır:

1. Mevcut Durum Analizi: Van kent merkezi ve Van Gölü çevresindeki mevcut toplu taşıma ve deniz ulaşımı sistemlerinin incelenmesi.
2. Senaryo Analizi: Üniversite–İskele Caddesi–Edremit hattında işletilecek olası deniz otobüsü seferleri için düşük, orta ve yüksek talep senaryolarının geliştirilmesi. Bu senaryolar, öğrenci ve personel taşımacılığı ile turistik talebin farklı oranlarda deniz yoluna kayması varsayımına dayalıdır.
3. Etki ve Gelir Analizi: Senaryolardan elde edilen yolcu sayıları üzerinden gelir projeksiyonları yapılmış, çevresel ve sosyal etkiler değerlendirilmiştir.

Senaryo oluşturma sürecinde şu temel varsayımlar yapılmıştır:

- Deniz hattının güzergâhı YYÜ sahili – İskele Caddesi – Edremit olarak belirlenmiştir.
- Hat uzunluğu yaklaşık 8 km olup, sefer süresi 20–25 dakika olarak öngörülmüştür.
- Deniz otobüslerinin yolcu kapasitesi 70 kişi, günlük sefer sayısı 10 (yaz sezonunda 12) kabul edilmiştir.
- Yolcuların %70'inin öğrenci, %30'unun tam biletli yolcu olacağı varsayılmıştır.
- Fiyatlandırma iki düzeyde test edilmiştir: düşük fiyat (öğrenci 40 TL, tam 60 TL) ve yüksek fiyat (öğrenci 60 TL, tam 90 TL).
- Mevsimsel farklılıkları yansıtmak amacıyla yıl, yaz dönemi (4 ay) ve kış dönemi (8 ay) olarak ikiye ayrılmıştır.

Analiz yöntemleri:

- Yolcu Talebi Tahmini: Günlük yolcu sayılarına ilişkin düşük (%10), orta (%20) ve yüksek (%30) geçiş oranları hesaplanmıştır.
- Gelir Hesaplamaları: Ortalama bilet fiyatı öğrenci ve tam bilet oranlarına göre ağırlıklandırılmış; senaryo bazında yıllık gelir projeksiyonları yapılmıştır.
- Çevresel Etki Analizi: Uluslararası ulaşım emisyon faktörlerinden (Our World in Data, UK Department for Transport) yararlanılarak kara yolu ve deniz yolu arasındaki CO_2 emisyon farkı değerlendirilmiştir.
- Sosyal ve Ekonomik Etki: Öğrenci memnuniyeti, trafik yoğunluğu ve turizm çeşitliliği gibi nitel unsurlar, mevcut literatür ve bölgesel raporlar ışığında analiz edilmiştir.

Bu yöntemsel çerçeve, çalışmanın hem resmi verilere dayalı nesnelliğini hem de senaryo analizinin öngörücü gücünü birleştirerek, önerilen deniz hattının uygulanabilirliğine ilişkin bütüncül bir değerlendirme sunmayı amaçlamaktadır.

Mevcut Durum Analizi

Van'da toplu taşıma (otobüs–minibüs–taksi)

Van ili ulaşım altyapısında karayolu taşımacılığı hâkim konumdadır. Van Büyükşehir Belediyesi verilerine göre 2022 yılında belediye ve özel halk otobüsleri toplamda yaklaşık 16,1 milyon yolcu taşımıştır (ŞehriVan, 2023). Bu sayı 2023 yılında da benzer düzeyde gerçekleşmiş ve günlük ortalama 44 bin yolcuya karşılık gelmiştir (Van Bölge Gazetesi, n.d.).

2023 yılı itibarıyla Van ilinde 112 belediye ve özel halk otobüsü aktif hizmet verirken, 318 minibüs, 1.347 V-plaka minibüs, 340 servis aracı ve yaklaşık 971 taksi kayıtlıdır (serhatnews, 2023). Bu veriler, karayolu taşımacılığının kent içi ulaşımda kritik bir rol oynadığını göstermektedir.

Üniversite – Kent merkezi hattı

Van Yüzüncü Yıl Üniversitesi (YYÜ) kampüsü ile şehir merkezi arasındaki hat, özellikle İskele Caddesi üzerinden yoğun bir ulaşım aksı oluşturmaktadır. İçişleri Bakanlığı verilerine göre 2023 yılı sonunda bu hattı günlük ortalama 23 bin yolcu kullanmıştır (ŞehriVan, 2024).

Belediye otobüsleri ve minibüsler günün erken saatlerinden gece yarısına kadar sefer yapmaktadır. Ancak yoğun dönemlerde otobüs ve minibüslerde ciddi kalabalıklar oluşmakta, öğrenciler ve çalışanlar konforsuz yolculuktan şikâyet etmektedir (ŞehriVan, 2024).

Van Gölü'nde mevcut deniz ulaşımı

Van Gölü üzerinde hâlihazırda sınırlı sayıda deniz ulaşımı seçeneği bulunmaktadır:

- Edremit–Akdamar Adası hattı: Van Büyükşehir Belediyesi tarafından işletilen deniz otobüsleriyle sağlanmakta olup, hafta sonları düzenli seferler yapılmaktadır. 70 kişilik kapasiteye sahip bu seferler, turizm amaçlıdır.
- Van–Tatvan hattı (TCDD feribotu): Yük ve demiryolu vagonu taşımacılığı için kullanılan feribotlar şehir içi yolcu taşımacılığına hizmet etmemektedir.

Bu tablo, göl üzerinde turistik amaçlı bir hareketlilik olduğunu, ancak kent içi ulaşım için deniz taşımacılığının henüz kullanılmadığını göstermektedir.

YYÜ öğrenci sayısı ve demografisi

Van Yüzüncü Yıl Üniversitesi 2024 itibarıyla 31.711 öğrenci, 1.674 akademik personel ve 3.310 idari personel barındırmaktadır. Her yıl yaklaşık 5.500 yeni öğrenci üniversiteye kayıt olmaktadır (Van Olay, 2024). Bu büyüklük, şehir ile kampüs arasında ciddi bir ulaşım talebi doğurmakta ve deniz hattı önerisi için temel bir potansiyel oluşturmaktadır.

Turizm verileri

2023 yılında Van ili yaklaşık 700 bin turist ağırlamıştır. Bunların 170 bini Akdamar Adası'nı ziyaret etmiştir. Van Kalesi ve Van Müzesi gibi destinasyonlar da yoğun ilgi görmüştür. Özellikle yaz sezonunda İranlı turistlerin gelişiyle birlikte göl çevresinde turizm hareketliliği artmaktadır. Bu durum, olası deniz hattının sadece ulaşım değil, aynı zamanda turizm çeşitliliğini artırma işlevi görebileceğini ortaya koymaktadır (Mücadele, 2024).

Ulaşım altyapısı ve mevcut sorunlar

- İskele Caddesi: Yaklaşık 7 km uzunluğunda düz bir yol olup, yoğun saatlerde trafik sıkışıklığı yaşanmaktadır.
- Karayolu sorunları: Bazı segmentlerde bakım eksikliği nedeniyle yol yüzeyinde bozulmalar gözlenmektedir.
- İskeleler: Edremit ve kent merkezinde 70 yolcu kapasiteli deniz otobüslerinin yanaşabileceği küçük iskeleler bulunmaktadır. YYÜ kıyısında ise hâlen bir iskele yoktur.
- Ödeme sistemleri: Belediyenin uygulamaya aldığı Belvan Kart ve QR kod sistemi, entegrasyon potansiyeli açısından güçlüdür.

Bu mevcut tablo, Van'da karayolu ağırlıklı bir ulaşım sisteminin hakim olduğunu, buna karşın deniz ulaşımının turistik amaçlı sınırlı bir rol oynadığını göstermektedir. YYÜ öğrenci nüfusu, kent merkezindeki yoğun yolcu trafiği ve turizm hareketliliği göz önüne alındığında, deniz yolu taşımacılığı kentsel ulaşımda güçlü bir alternatif olma potansiyeli taşımaktadır.

SENARYO VE POTANSİYEL ANALİZİ

Varsayımlar

YYÜ – İskele Caddesi – Edremit hattı için senaryo geliştirme sürecinde aşağıdaki varsayımlar dikkate alınmıştır:

- Hat uzunluğu: Yaklaşık 8 km, sefer süresi 20–25 dakika. Karayolu ile aynı güzergâh 12 km olup yoğun saatlerde 30–45 dakika sürmektedir.
- Araç ve kapasite: Mevcut deniz otobüsleri 70 yolcu kapasitesine sahiptir. Senaryolarda 2 gemi ve günde 10 sefer (toplam 1.400 koltuk), yaz döneminde 12 sefer (1.680 koltuk) varsayılmıştır.
- Hedef kitle: YYÜ öğrencileri ve personeli (31.711 öğrenci, yaklaşık 5.000 personel), kent merkezi ve Edremit'te yaşayanlar, turistik yolcular.
- Fiyat politikası: İki farklı düzey öngörülmüştür:
    - Düşük fiyat: öğrenci 40 TL, tam 60 TL.
    - Yüksek fiyat: öğrenci 60 TL, tam 90 TL.
- Yolcu kitlesinin %70 öğrenci, %30 tam biletli yolcu olacağı kabul edilmiştir.
- Mevsimsellik: Yaz dönemi 4 ay (Haziran–Eylül), kış dönemi 8 ay (Ekim–Mayıs) olarak hesaplamalara yansıtılmıştır.

Potansiyel yolcu tahmini

1. YYÜ – Kent Merkezi hattı

2023 verilerine göre hattı günlük 23.000 yolcu kullanmaktadır. Senaryolarda bu yolcuların deniz hattına geçiş oranları dikkate alınmıştır:

- Düşük senaryo: %10 → 2.300 yolcu/gün (yazın ≈2.760).
- Orta senaryo: %20 → 4.600 yolcu/gün (yazın ≈5.520).
- Yüksek senaryo: %30 → 6.900 yolcu/gün (yazın ≈8.280).

2. Kent Merkezi – Edremit hattı

Toplam günlük 44.000 yolcunun yaklaşık 5.000–8.000'inin İskele Caddesi üzerinden Edremit'e gittiği tahmin edilmektedir.

- Düşük senaryo: %5 → 250 yolcu/gün.
- Orta senaryo: %10 → 500 yolcu/gün.
- Yüksek senaryo: %15 → 1.200 yolcu/gün.

3. Turistik ve rekreasyonel talep

Yaz döneminde manzara ve turistik amaçlı günlük 50–200 yolcu öngörülmektedir. Kışın bu talep yok denecek düzeydedir.

4. Toplam yolcu senaryoları

Yıllık bazda yolcu sayısı aşağıdaki şekilde hesaplanmıştır:

- Düşük senaryo: ≈939.000 yolcu/yıl
- Orta senaryo: ≈1.720.000 yolcu/yıl
- Yüksek senaryo: ≈2.684.000 yolcu/yıl

5. Gelir Projeksiyonu

Ortalama bilet fiyatı öğrenci ve tam yolcu dağılımına göre hesaplanmıştır:

- Düşük senaryo: 939.000 yolcu → 43–64,7 milyon TL
- Orta senaryo: 1.720.000 yolcu → 79,1–118,7 milyon TL

- Yüksek senaryo: 2.684.000 yolcu → 123,5–185,2 milyon TL

Bu gelirler KDV, işletme maliyetleri ve yatırım giderleri düşülmeden hesaplanmıştır.

6. Potansiyeli Etkileyen Faktörler

- YYÜ öğrenci nüfusu: Yüksek öğrenci yoğunluğu, hattın sürekli bir talep tabanı oluşturmasını sağlamaktadır.
- Turizm ve mevsimsellik: Yaz döneminde turist sayısındaki artış talebi %20–30 oranında yükseltebilir.
- Karayolu sorunları: İskele Caddesi'ndeki trafik sıkışıklığı ve yol kalitesi, yolcuları alternatif ulaşım arayışına yöneltmektedir.
- Fiyat politikası: Uygun fiyatlandırma yolcu sayısını artırırken, yüksek fiyatlar öğrenci talebini azaltabilir.
- Entegrasyon: Deniz hattının otobüs/minibüs sistemiyle entegre edilmesi (aktarma indirimi, Belvan Kart uyumu) talebi güçlendirecektir.
- Altyapı yatırımları: YYÜ sahilinde yeni iskele yapılması ve mevcut iskelelerin güçlendirilmesi gerekmektedir.

Ekonomik ve sosyal etki analizi

1. Trafik Rahatlaması ve Çevresel Etkiler

Trafik yükünün azalması:

YYÜ – kent merkezi hattında günlük 23.000 yolcunun %20–30'unun deniz hattına kayması durumunda karayolu üzerindeki yoğunluk belirgin şekilde azalacaktır. Orta senaryoda yaklaşık 4.600 yolcu/gün karayoldan deniz hattına yönelmiş olacak; bu da özellikle sabah ve akşam saatlerinde sıkışıklığı azaltacaktır.

Emisyon ve çevresel faydalar:

Karayolu otobüslerinde kişi başı CO_2 emisyonu yaklaşık 90–100 g/km iken, deniz otobüslerinde bu değer ortalama 20–30 g/km'dir (Our World in Data; UK Department for Transport). Bu fark sayesinde, deniz hattı karayolu yerine tercih edildiğinde toplam sera gazı emisyonlarının önemli ölçüde azalması mümkündür. Bu durum, Van'ın hava kalitesini iyileştirecek ve iklim dostu ulaşım politikalarıyla uyumlu olacaktır.

Gürültü ve ekosistem etkileri:

Karayolu araçlarının yoğun trafiği gürültü kirliliğine neden olurken, deniz otobüsleri daha düşük ses seviyeleriyle çalışmaktadır. Ancak göl ekosisteminin korunabilmesi için seferlerde hız limiti, motor bakımı ve atık yönetimi konularında sıkı çevresel denetimler uygulanmalıdır.

2. Sosyal etkiler

Öğrenci ve personel memnuniyeti:

YYÜ öğrencileri ve çalışanları için alternatif bir ulaşım modeli, yolculuk süresini kısaltacak ve daha konforlu bir deneyim sunacaktır. Manzaralı yolculuk, öğrenci yaşam kalitesini artırabilir. Düzenli ve ucuz bilet politikası, hattın benimsenmesini kolaylaştıracaktır.

Turizm çeşitliliği:

Van Gölü çevresi özellikle yaz aylarında turistik çekim merkezi hâline gelmektedir. Üniversite – İskele – Edremit hattı, sadece ulaşım değil aynı zamanda panoramik turizm deneyimi sunarak turistik çeşitliliği artırabilir. Bu durum kente gelen turistlerin kalış süresini uzatabilir ve yerel ekonomiye katkı sağlayabilir.

3. Ekonomik Sürdürülebilirlik

Gelir – gider dengesi:

Senaryolar bazında yıllık 43–185 milyon TL aralığında gelir potansiyeli hesaplanmıştır. İşletme maliyetleri (yakıt, personel, bakım, sigorta) ve yatırım giderleri (iskele yapımı, gemi alımı) düşüldüğünde dahi düşük talep senaryosunda tek gemi işletimi kârlı olabilir. Yüksek talep senaryosunda ise ek gemi ihtiyacı doğacak ancak gelirler de katlanacaktır.

Fiyat esnekliği:

Öğrenci ağırlıklı bir yolcu kitlesi bulunduğundan, bilet fiyatlarının karayolu biletleriyle rekabet edebilir düzeyde tutulması önemlidir. Belvan Kart entegrasyonu, aktarma indirimleri ve abonman seçenekleri, gelir sürekliliğini sağlayacaktır.

Yatırım maliyetleri:

YYÜ kampüsünde yeni bir iskele inşası, mevcut iskelelerin güçlendirilmesi ve en az iki deniz otobüsünün temini, milyonlarca liralık yatırım gerektirmektedir. Finansman için belediye bütçesi, Ulaştırma ve Altyapı Bakanlığı destekleri veya kamu–özel ortaklığı (PPP) modelleri değerlendirilebilir.

4.1 İstihdam Olanakları

Deniz hattı işletmesi doğrudan ve dolaylı istihdam yaratacaktır:

Doğrudan istihdam: kaptan, denizci, bakım ekibi, iskele görevlileri.

Dolaylı istihdam: turizm işletmeleri, kafe ve ulaşım entegrasyonu sağlayan hizmetler.

Yüksek talep senaryosunda sefer sayısı arttıkça istihdam ihtiyacı da paralel şekilde büyüyecektir.

SONUÇ VE ÖNERİLER

Bu çalışma, Van ili ve Van Gölü ulaşım sistemini mevcut durum verileri üzerinden analiz etmiş ve YYÜ – İskele Caddesi – Edremit hattında işletilebilecek bir deniz otobüsü hattının potansiyelini senaryo analizleriyle değerlendirmiştir. Bulgular hem ulaşım kolaylığı hem de çevresel ve ekonomik sürdürülebilirlik açısından deniz taşımacılığının yüksek bir potansiyele sahip olduğunu göstermektedir. Van'da kent içi ulaşım ağı büyük ölçüde karayolu tabanlıdır; 2023 yılında otobüs ve minibüslerle günlük ortalama 44 bin yolcu taşınmıştır. YYÜ – kent merkezi hattında günlük 23 bin yolcu taşınmakta olup, bu yoğunluk yeni ulaşım alternatiflerine duyulan ihtiyacı göstermektedir. Van Gölü üzerinde mevcut deniz ulaşımı yalnızca turistik (Edremit–Akdamar) ve yük odaklı (Van–Tatvan feribotu) faaliyetlerle sınırlıdır. Senaryo analizleri, önerilen deniz hattının düşük talep senaryosunda bile yıllık yaklaşık 1 milyon yolcu çekebileceğini, yüksek senaryoda ise bu sayının yaklaşık 2,7 milyon yolcuya ulaşabileceğini göstermiştir. Gelir projeksiyonları 43–185 milyon TL arasında değişmektedir. Bu tutar, işletme ve bakım maliyetleri göz önüne alındığında hattın ekonomik olarak sürdürülebilir olduğunu ortaya koymaktadır.

Deniz hattının hayata geçirilebilmesi için öncelikle YYÜ sahilinde yeni bir iskele inşa edilmeli, mevcut İskele ve Edremit iskeleleri kapasite artırımı ve güvenlik standartlarına uygun biçimde rehabilite edilmelidir. Öğrenci yoğunluğu dikkate alınarak bilet fiyatları karayolu ulaşımıyla rekabet edebilir düzeyde tutulmalı; Belvan Kart entegrasyonu, aktarma indirimleri ve abonman seçenekleri sunulmalıdır. İlk aşamada ücretsiz deneme seferleri uygulanarak hattın tanıtımı yapılabilir. Deniz hattı, belediye otobüsleri ve minibüslerle entegre bir sistemin parçası olarak planlanmalı, sefer saatleri karayolu taşımacılığıyla uyumlu olacak şekilde düzenlenmelidir.

Başlangıçta yaz sezonunda sınırlı sayıda seferle pilot uygulama yapılmalı, yolcu memnuniyeti ve talep ölçülerek kalıcı işletme modeli buna göre şekillendirilmelidir.

Ayrıca, göl ekosisteminin korunabilmesi için çevresel etki değerlendirmesi (ÇED) yapılmalı, hız limitleri, atık yönetimi ve yakıt teknolojileri konularında sıkı denetimler uygulanmalıdır. Hat yalnızca ulaşım işleviyle değil, aynı zamanda turizmi çeşitlendirecek şekilde planlanmalıdır. Panoramik turlar ve kültürel etkinliklerle entegrasyon, bölge ekonomisine katma değer sağlayacaktır.

Sonuç olarak, YYÜ – İskele Caddesi – Edremit deniz hattı Van'da ulaşım sistemini çeşitlendirecek, karayolu üzerindeki yoğunluğu azaltacak, çevre dostu bir ulaşım alternatifi sunacaktır. Uygun fiyatlandırma, güçlü entegrasyon ve çevreye duyarlı altyapı yatırımları ile bu proje hem öğrenciler ve kent sakinleri hem de turistler için cazip bir seçenek hâline gelecektir.

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FİTNESS İŞLETMELERİNDEKİ YÖNETİCİLERİN LİDERLİK BECERİLERİNİN KRİZ YÖNETİMİNE ETKİSİ

Ünal SAKİ

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ÖZET

Araştırmanın amacı, fitness işletmelerindeki yöneticilerin liderlik becerilerinin kriz yönetimine etkisini incelemektir. Araştırmanın örneklemini, Ağrı ve Van ilinde özel fitness işletmelerindeki 51 kadın ve 76 erkek toplam 127 yöneticiden oluşturmaktadır. Araştırmanın veri toplama kısmında araştırmacı tarafından düzenlenen "Kişisel Bilgi Formu", Arslan (2023) tarafından geliştirilen "Liderlik Becerileri Ölçeği ve Çalışkan (2020) tarafından geliştirilen "Kriz Yönetimi Ölçeği" kullanılmıştır. Fitness işletmelerindeki yöneticilerin liderlik becerileri ile kriz yönetimleri arasındaki ilişkiyi incelemek için verilerin normal dağılım göstermesinden dolayı Pearson korelasyon katsayısı, etkiyi belirlemek için ise regresyon testinden yararlanılmıştır. Araştırmanın sonucunda, LBÖ ile KYÖ arasında pozitif anlamlı güçlü düzeyde bir ilişki tespit edilmiştir (r=.579, p=.000). LBÖ ile KYÖ alt boyutu olan Kriz öncesi faaliyetler (r=.579, p=.000), Kriz sırası faaliyetler (r=.535, p=.000) ve Kriz sonrası faaliyetler (r=.517, p=.000) arasında ise pozitif anlamlı güçlü düzeyde ilişki belirlenmiştir. LBÖ'nün KYÖ'ye pozitif anlamlı orta düzeyde bir etkisinin olduğu belirlenmiştir. (R_2=.335; p=.000). Bu değer, KYÖ değişkeninin (varyansın) %33.5'inin modeldeki bağımsız değişken olan, LBÖ tarafından açıklandığını göstermektedir. Bu durum fitness işletmelerindeki yöneticilerin ilgili alanda nitelik sahibi olması, personel ve müşterileri ile etkili iletişim kurabilmesi ve geleceğe yönelik kısa ve uzun vadeli hedeflerini belirleyebilmesi, potansiyel bir kriz anını yönetme noktasında dengeli bir yol izleyebilecekleri anlamı taşıyabilir.

Anahtar Kelimeler: Fitness işletmeleri, liderlik becerileri, kriz yönetimi

THE IMPACT OF MANAGERS' LEADERSHIP SKILLS IN FITNESS BUSINESSES ON CRISIS MANAGEMENT

ABSTRACT

The aim of this study is to examine the effects of managers' leadership skills in fitness businesses on crisis management. The research sample consists of 127 managers (51 females and 76 males) in private fitness businesses in Ağrı and Van provinces. In the data collection part of the study, 'Personal Information Form' organized by the researcher, 'Leadership Skills Scale' developed by Arslan (2023) and 'Crisis Management Scale' developed by Çalışkan (2020) were used. To examine the relationship between leadership skills and the crisis management of managers in fitness businesses, the Pearson correlation coefficient was used because of the normal distribution of the data, and a regression test was used to determine the effect. As a result of the study, a strong positive significant relationship was found between LLS and CQS (r=.579, p=.000). A strong positive significant relationship was found between LOS and the sub-dimensions of the CQS, namely pre-crisis activities (r=.579, p=.000), during-crisis activities (r=.535, p=.000), and post-crisis activities (r=.517, p=.000). LBI had a positive

and significant moderating effect on PBI (R2=.335; p=.000). This value shows that 33.5% of the variable (variance) of the PFM is explained by the independent variable in the LBM model. This may mean that managers in fitness businesses should have qualifications in the relevant field, be able to communicate effectively with their staff and customers, determine their short- and long-term goals for the future, and follow a balanced way of managing a potential crisis.

Keyword: Fitness businesses, leadership skills, crisis management

GİRİŞ

Günümüzün hızla değişen ve rekabetin yoğun olduğu fitness sektöründe, yöneticilerin sergilediği liderlik becerileri işletmelerin başarısını doğrudan etkileyebilir (Teece, 2007). Fitness sektöründe liderlik becerileri bir işletmenin hedeflerine ulaşmasını sağlamak için çalışanları motive etme, müşteri deneyimini iyileştirme, yenilikçi çözümler sunma ve kriz alanlarında etkili kararlar alma yeteneğidir (Lennick ve Kiel, 2011). Yöneticilerin sergilediği liderlik becerileri, fitness işletmelerinde çalışan motivasyonu, verimlilik, müşteri memnuniyeti, yenilikçilik, rekabet avantajı, finansal performans, büyüme, kriz yönetimi ve esneklik açısından doğrudan etkilemektedir (Hitt vd. 1998). Ayrıca liderlik becerileri bir fitness işletmesinin hem iç dinamiklerini hem de dış pazardaki konumunu belirleyen en önemli unsurlardan biri olarak belirtilmektedir (Schoemaker vd., 2018). Bir işletmenin kriz anlarında ayakta kalabilmesi, yalnızca mali gücü ve liderlik becerileri ile değil, aynı zamanda yöneticilerinin kriz yönetimindeki yetkinliğine de bağlıdır (Dirani vd., 2020). Zor zamanlarda ekibini bir arada tutabilen, motive edebilen ve etkili kararlar alabilen liderler, işletmelerini krizlerden güçlenerek çıkarabilir (Rothwell, 2010). Ancak liderlik becerileri yetersizse, kriz dönemleri yönetilemez hale gelebilir ve işletmenin sürdürülebilirliği riske girebilmektedir. Bu noktada, liderlik becerileri kriz yönetimini doğrudan etkileyen bir faktör haline gelmektedir (Hazaa vd., 2021). Güçlü liderlik becerilerine sahip yöneticiler, yalnızca krizlerin olumsuz etkilerini azaltmakla kalmaz, aynı zamanda krizleri fırsata çevirebilirler. Örneğin, kriz sırasında çalışan motivasyonunu yüksek tutabilen bir lider, işletmenin uzun vadeli başarısını garanti altına alabilir (Pearson ve Mitroff, 1993). Bunun yanı sıra, kriz dönemlerinde alınan stratejik kararlar, işletmenin piyasadaki konumunu yeniden şekillendirebilir. Tersine, etkisiz bir liderlik yaklaşımı, işletmenin krizden daha fazla zarar görmesine neden olabilir (Robbins ve Alvy, 2003). Günümüzde etkili liderlik becerilerine sahip olmak, bireylerin ve toplumların başarısına katkı sunmaktadır (Petrick vd., 1999). İyi bir lider, sadece yönetmekle kalmaz, aynı zamanda insanlara ilham vererek onları daha ileriye taşımanın yanında ekip yönetimi, iletişim, vizyoner bakış açısı ve stratejik düşünme gibi yetkinlikleri kullanarak işletmenin sürdürülebilir büyümesini desteklediği ifade edilmektedir (Adair, 2010). Dolayısıyla, yöneticilerin liderlik becerileri, kriz yönetiminde belirleyici bir değişkendir ve işletmelerin geleceğini doğrudan etkileyebilir (Hussein, 2022).

Liderlik becerileri ve kriz yönetimi kavramları birbirinden bağımsız gibi görünse de aslında iç içe geçmiş kavramlar olarak değerlendirilmektedir (Bass ve Riggio, 2006). Etkin bir kriz yönetimi için güçlü liderlik becerilerine sahip olmak gereklidir. Literatürde de liderlik ve kriz yönetimi arasındaki ilişki farklı araştırma desenleriyle ele alınmıştır. Özellikle fitness sektöründe yapılan çalışmalar, yöneticilerin kriz yönetiminde ne kadar etkili olduğunun işletmelerin sürdürülebilirliğini doğrudan etkilediğini ortaya koymaktadır (Yukl, 2013). Dolayısıyla liderlik becerileri işletmeler açısından krizin yönetilmesinde belirleyici bir faktör olduğu yadsınamaz bir gerçek olarak karşımıza çıkmaktadır. Bu açıdan etkili liderlik becerileri krizin yönetilmesini kolaylaştırıcı ve azaltıcı etkiye sahip olduğu düşünülmektedir. Bu kapsamda çalışmanın amacı, fitness işletmelerindeki yöneticilerin liderlik becerilerinin kriz yönetimine etkisini incelemektir.

YÖNTEM

Araştırma Modeli

Bu araştırmada, nicel desenli betimsel modellerden iki ve üzeri sayıdaki değişkenlerin karşılıklı aralarındaki farklılığın düzeyini ortaya koymayı hedefleyen, değişiklik durumunda ise nasıl ortaya çıktığını tespit etmeye yönelik yol haritası belirleyen ilişkisel tarama modeli (Karasar, 2006) ve değişkenler arasındaki ilişkiyi nedensellik çerçevesinde ele alan bu çalışma, etki düzeylerini belirlemek amacıyla çoklu regresyon analizinden yararlanılmıştır (Tabachnick ve Fidell, 2013). Bu yaklaşım, değişkenler arasındaki etkilerin daha iyi anlaşılmasını ön göreceği beklenmektedir.

Evren-Örneklem

Araştırmanın örneklemi, 2024-2025 yılında Ağrı ve Van ili özel fitness işletmelerindeki 51 kadın 76 erkek toplam 127 yöneticiden kolayda örnekleme (Büyüköztürk vd., 2011) yöntemi kullanılarak belirlenmiştir. Araştırmaya katkı sunulmasında gönüllülük anlayışına göre hareket edilmiştir.

Araştırma Yayın Etiği

Ağrı İbrahim Çeçen Üniversitesi Bilimsel Araştırmalar Etik Kurulu'nun 24/04/2025 tarihli 175 sayılı kararıyla etik yönden uygun olduğuna karar verilmiştir.

Veri Toplama Araçları

Çalışmada, kişisel bilgi formu, liderlik becerileri ölçeği ve kriz yönetimi ölçeğinden faydalanılmıştır. Fitness işletmelerinin demografik niteliklerini belirlemek için araştırmacının oluşturduğu kişisel bilgi formu; cinsiyet, eğitim durumu ve iş deneyimi sorularını içermektedir. Anket verileri katılımcılara online olarak uygulanmıştır.

Liderlik Becerileri Ölçeği

Arslan (2023) tarafından geliştirilen "Liderlik Becerileri Ölçeği", uzmanlık becerileri (1.2.3.4.5.6), etkili iletişim becerileri (7.8.9.10.11.12) ve stratejik beceriler (13.14.15.16.17) olmak üzere üç alt boyut 17 maddeden oluşmaktadır. Ölçek 5'li Likert tipi olarak ''kesinlikle katılmıyorum'', "katılmıyorum", "kararsızım", "katılıyorum", "kesinlikle katılıyorum" şeklinde ifadelere göre derecelendirilmiştir. Ölçeğin Cronbach Alfa değeri üç alt boyuta bakıldığında, uzmanlık becerileri 0.85, etkili iletişim becerileri 0.76, stratejik beceriler 0.73 olarak belirlenirken, toplam değer 0.88 olarak hesaplanmıştır (Arslan, 2023).

Kriz Yönetimi Ölçeği

Ölçek, Çalışkan (2020) tarafından 5'li Likert tipi olarak geliştirilmiş olup ''kesinlikle katılmam'', "katılmam", "kararsızım", "katılırım", "kesinlikle katılırım" şeklinde ifadelere göre derecelendirilmiştir. Ölçekte, kriz öncesi faaliyetler (9 madde), kriz esnası faaliyetler (10 madde) ve kriz sonrası faaliyetler (4 madde) olmak üzere üç alt boyut toplamda 23 madde yer almaktadır. Ölçeğin, Cronbach alpha değeri 0.92 olarak belirlenmiştir. Geliştirilen ölçeğin, eğitim, sağlık, sanayi alanlarının yanı sıra kamu, özel işletme veya kurumlar bünyesinde kullanılabileceği belirtilmiştir (Çalışkan, 2022).

Verilerin Analizi

Bu araştırmada fitness işletmelerindeki yönetticilerin cinsiyet, eğitim durumu ve iş deneyimi bağımsız değişken olarak belirlenip, tanımlayıcı istatistikleri, yüzde ve frekansları tablolar şeklinde verilmiştir. Fitness işletmelerindeki yöneticilerin liderlik becerileri puanlarının ve kriz yönetimi ölçeği alt boyut ve toplam puanları dağılımının normalliği Skewness (çarpıklık) ve Kurtosis (basıklık) katsayıları ile incelenmiştir. Araştırmanın ölçeklerinin iç tutarlılık

katsayıları Cronbach Alpha güvenirlik analizi ile belirlenmiştir. Araştırmada, Ölçeklerden alınan puanların her alt boyut için ilişki seviyesini ortaya koymak amacıyla Pearson Korelasyon testi uygulanmıştır. Araştırmada, Fitness işletmelerindeki yöneticilerin liderlik becerileri ve kriz yönetimleri arasındaki etkiyi belirlemek amacıyla regresyon analizinden faydalanılmıştır.

BULGULAR

Tablo 1. Katılımcıların demografik özelliklerine göre dağılımları

		f	%	N	$\bar{X}$	S	Min.	Max.
Cinsiyet	Kadın	51	40.2	127				
	Erkek	76	59.8	127				
Eğitim Durumu	Ön Lisans	17	13.4	127				
	Lisans	102	80.3	127				
	Lisansüstü	8	6.3	127				
İş Deneyimi				127	3,99	4,18		
Liderlik Becerileri Ölçeği				127	68.65	13.08	20.00	85.00
Becerileri	Uzamnlık Becerileri			127	24.43	4.85	6.00	30.00
	Etkili İletişim			127	19.86	4.15	8.00	25.00
	Stratejik Beceriler			127	20.30	4.67	5.00	25.00
Kriz Yönetimi Ölçeği				127	82.66	20.48	26.00	115.00
	Kriz öncesi faaliyetler			127	31.59	8.64	9.00	45.00
	Kriz sırası faaliyetler			127	36.29	9.22	10.00	50.00
	Kriz sonrası faaliyetler			234	14.78	3.69	4.00	20.00

Katılımcılara “Cinsiyetiniz nedir?’’ sorusu yöneltildiğinde; %40,2’sİ Kadın, %59,8’İ Erkek, cevabını vermiştir. Eğitim durumu sorulduğunda; %13,4’ü Ön lisans, %80,3’ü Lisans %6,3’ü

Lisansüstü ile mezun olduğunu belirtmiştir. İş deneyimleri sorulduğunda (Xişdeneyimi=3,99±4,18) ortalamasına ulaşılmıştır (Tablo 1).

Tablo 2. Ölçeklerin iç tutarlılık ve normallik dağılımı değerleri

LBÖ: Liderlik Becerileri Ölçeği; KYÖ: Kriz Yönetimi Ölçeği

Yukarıdaki verilere göre tüm ölçeklerin ve alt boyutların iç tutarlılık katsayısı için hesaplanan Cronbach Alpha değerleri 0.60 seviyesini üstünde ve kabul edilebilir düzeyde olduğu, normallik dağılımını tespit etmek için yapılan analize göre Skewness (çarpıklık) ve Kurtosis (basıklık) katsayıları -2 ve +2 değerleri arasında gözlemlendiğinden (Tabachnick ve Fidell, 2013) verilerin normal dağıldığı belirlenmiştir (Tablo 2).

Değişkenler		**Skewness**	**Kurtosis**	**Cronbach Alpha**	
LBÖ		-.882	600	0.946	
Uzmanlık Becerileri		-.940	0.884	0.875	
Etkili İletişim Becerileri	r	-633 0.579	0.579	-.242 0.535	0.890 0.517
LBÖ Stratejik Beceriler	p	-1.145 0.000**	0.000** 0.875	0.000** 0.900	0.000**
KYÖ	r	-.403 0.533	0.535	-.361 0.463	0.965 0.468
Uzmanlık Becerileri	p	0.000**	0.000**	0.000**	0.000**
Kriz öncesi faaliyetler	r	-.502 0.489	0.517	-.203 0.452	0.915 0.434
Kriz sırası faaliyetler	p	-467 0.000**	0.000**	-.159 0.000**	0.936 0.000**
Etkili İletişim Becerileri					
Kriz sonrası faaliyetler	r	-.437 0.550	0.512	-.259 0.538	0.852 0.504
Stratejik Beceriler	p	0.000**	0.000**	0.000**	0.000**

Tablo 3. Liderlik Becerileri ile Kriz Yönetimleri arasındaki korelasyon ve anlamlılık değerleri

***p<0.05, **p<0.001;** LBÖ: Liderlik Becerileri Ölçeği; KYÖ: Kriz Yönetimi Ölçeği

Zayıf ilişki: |r|<0,3; Orta düzeyde ilişki: 0.3≤|r|<0.5; Güçlü ilişki: |r|≥0.5 (Tabachnick & Fidell, 2013).

Pearson korelasyon testi sonuçlarına göre; LBÖ ile KYÖ arasında pozitif anlamlı güçlü düzeyde bir ilişki tespit edilmiştir (r=.579, p=.000). LBÖ ile KYÖ alt boyutu olan Kriz öncesi faaliyetler (r=.579, p=.000), Kriz sırası faaliyetler (r=.535, p=.000) ve Kriz sonrası faaliyetler (r=.517, p=.000) arasında ise pozitif anlamlı güçlü düzeyde ilişki belirlenmiştir. LBÖ alt boyutlarından uzmanlık becerileri ile KYÖ toplam puanı (r=.533, p=.000), alt boyutlarından kriz öncesi faaliyetler (r=.535, p=.000) arasında pozitif anlamlı güçlü düzeyde ilişki saptanırken kriz sırası faaliyetler (r=.463, p=.000) ve kriz sonrası faaliyetler (r=.468, p=.000) arasında pozitif anlamlı orta düzeyde ilişki belirlenmiştir. LBÖ alt boyutlarından etkili iletişim becerileri ile KYÖ alt boyutlarından kriz öncesi faaliyetler (r=.517, p=.000) arasında pozitif anlamlı güçlü düzeyde ilişki gözlemlenirken kriz sırası faaliyetler (r=.452, p=.000) ve kriz sonrası faaliyetler (r=.434, p=.000) arasında pozitif anlamlı orta düzeyde ilişki tespit edilmiştir. LBÖ alt boyutlarından stratejik beceriler ile KYÖ alt boyutlarından Kriz öncesi faaliyetler (r=.512, p=.000), Kriz sırası faaliyetler (r=.538, p=.000) ve Kriz sonrası faaliyetler (r=.504, p=.000) arasında ise pozitif anlamlı güçlü düzeyde ilişki ortaya çıkmıştır (Tablo 3).

Tablo 4. Liderlik Becerileri ile Kriz Yönetimleri arasındaki regresyon ve anlamlılık değerleri

Bağımsız Değişken	Bağımlı Değişken	R2	ß	Ss	t	p
LBÖ	**KYÖ**	.335	.579	7.97	2.56	**.000****
LBÖ	Kriz öncesi faaliyetler	.336	.579	3.36	1.57	**.000****
	Kriz sırası faaliyetler	.287	.535	3.72	2.78	**.000****
	Kriz sonrası faaliyetler	.267	.517	1.51	3.15	**.000****
Uzmanlık Becerileri	Kriz öncesi faaliyetler	.322	.567	3.10	2.62	**.000****
	Kriz sırası faaliyetler	.215	.463	3.57	4.44	**.000****
	Kriz sonrası faaliyetler	.219	.468	1.42	4.57	**.000****
Etkili İletişim Becerileri	Kriz öncesi faaliyetler	.241	.491	3.45	2.96	**.000****
	Kriz sırası faaliyetler	.204	.452	3.77	4.05	**.000****
	Kriz sonrası faaliyetler	.188	.434	1.52	4.40	**.000****
Stratejik Beceriler	Kriz öncesi faaliyetler	.263	.512	2.95	4.17	**.000****
	Kriz sırası faaliyetler	.289	.538	3.09	4.76	**.000****
	Kriz sonrası faaliyetler	.254	.504	1.27	5.27	**.000****

***p<0.05, **p<0.001**; LBÖ: Liderlik Becerileri Ölçeği; KYÖ: Kriz Yönetimi Ölçeği

Regresyon testi sonuçlarına göre, LBÖ ile KYÖ arasındaki etkinin belirlenmesine yönelik yapılan regresyon analizi sonucunda, % 5 anlamlılık düzeyinde kurulan regresyon modelinin p<.05 anlamlı olduğu görülmüştür. LBÖ'nün KYÖ'ye pozitif anlamlı orta düzeyde bir etkisinin olduğu belirlenmiştir. Modelin açıklama gücü olarak ifade edilen R_2 değeri .823 olarak hesaplanmıştır. (R_2=.335; p=.000). Bu değer, KYÖ değişkeninin (varyansın) %33.5'inin modeldeki bağımsız değişken olan, LBÖ tarafından açıklandığını göstermektedir. Buna göre LBÖ p<.05 olduğu için KYÖ üzerinde anlamlı bir etkiye sahiptir. LBÖ toplam puanı (R_2=.336; p=.000), uzmanlık becerileri (R_2=.322; p=.000), etkili iletişim becerileri (R_2=.241; p=.000) ve stratejik beceriler (R_2=.263; p=.000) alt boyutlarının KYÖ'nün kriz öncesi faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu saptanmıştır. LBÖ toplam puanı (R_2=.287; p=.000), uzmanlık becerileri (R_2=.215; p=.000), etkili iletişim becerileri (R_2=.204; p=.000) ve stratejik beceriler (R_2=.289; p=.000) alt boyutlarının KYÖ'nün kriz sırası

faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu belirlenmiştir. LBÖ toplam puanı (R_2=.267; p=.000), uzmanlık becerileri alt boyutu (R_2=.219; p=.000), etkili iletişim becerileri (R_2=.188; p=.000) ve stratejik beceriler (R_2=.254; p=.000) KYÖ'nün kriz sonrası faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu gözlenmiştir (Tablo 4).

TARTIŞMA VE SONUÇ

Fitness işletmelerindeki yöneticilerin liderlik becerileri ile kriz yönetimleri arasındaki ilişki ve etki incelenmiştir. LBÖ ile KYÖ arasında pozitif anlamlı güçlü düzeyde bir ilişki tespit edilmiştir (r=.579, p=.000) (Tablo 3). Buna göre, fitness işletmelerindeki liderlik becerileri düzeyi artıkça kriz yönetimlerinin artığı ortaya çıkmıştır. LBÖ ile KYÖ alt boyutu olan kriz öncesi faaliyetler (r=.579, p=.000), kriz sırası faaliyetler (r=.535, p=.000) ve kriz sonrası faaliyetler (r=.517, p=.000) arasında ise pozitif anlamlı güçlü düzeyde ilişki belirlenmiştir. Buna göre, fitness işletmelerindeki liderlik becerileri düzeyi artıkça kriz öcesi, sırası ve sonrası faaliyetlerin yönetiminin artığı saptanmıştır. LBÖ alt boyutlarından uzmanlık becerileri ile KYÖ toplam puanı (r=.533, p=.000), alt boyutlarından kriz öncesi faaliyetler (r=.535, p=.000) arasında pozitif anlamlı güçlü düzeyde ilişki saptanırken kriz sırası faaliyetler (r=.463, p=.000) ve kriz sonrası faaliyetler (r=.468, p=.000) arasında pozitif anlamlı orta düzeyde ilişki olduğu, LBÖ alt boyutlarından etkili iletişim becerileri ile KYÖ alt boyutlarından kriz öncesi faaliyetler (r=.517, p=.000) arasında pozitif anlamlı güçlü düzeyde ilişki gözlemlenirken kriz sırası faaliyetler (r=.452, p=.000) ve kriz sonrası faaliyetler (r=.434, p=.000) arasında pozitif anlamlı orta düzeyde ilişki tespit edildiği ve LBÖ alt boyutlarından stratejik beceriler ile KYÖ alt boyutlarından kriz öncesi faaliyetler (r=.512, p=.000), kriz sırası faaliyetler (r=.538, p=.000) ve kriz sonrası faaliyetler (r=.504, p=.000) arasında ise pozitif anlamlı güçlü düzeyde ilişki ortaya çıkması (Tablo 3), yöneticilerin uzmanlık becerileri, etkili iletişim becerileri ve stratejik becerileri artıkça kriz öncesi, sırası ve sonrası faaliyetlerin yönetimi artığı sonucuna ulaşılmıştır. Bu sonuç, yöneticilerin uzmanlık, etkili iletişim ve stratejik becerileri, kriz yönetiminde karar alma ve koordinasyonu güçlendirebileceğinden dolayı bu beceriler kriz öncesi risklerin doğru öngörülmesini, kriz sırasında hızlı müdahaleyi ve kriz sonrası iyileştirmeyi sağlayarak kriz süreçlerinin etkin yönetilmesi mümkün kılabilir. Konu ile ilgili yapılan araştırmalarda, Northouse (2025), kriz durumlarında dönüşümcü liderlik sergileyen yöneticilerin çalışanlarında motivasyon ve bağlılığın arttığı, benzer şekilde, fitness işletmelerinde dönüşümcü liderlik sergileyen yöneticilerin kriz öncesi hazırlık, krizler anında hızlı karar alma ve krizler sonrasında toparlanmada daha başarılı oldukları gözlemlenmiştir (Ayar ve Barut, 2023). Bunun yanı sıra, krizlerin anında açık, şeffaf ve etkili iletişim kurmanın, çalışanların güvenini artırdığı ve kriz yönetiminin koordine edilmesini güçlendirdiğini (Coombs, 2010), Fitness işletmelerinde, yenilikçi ve esnek kültürlerin liderlik becerileriyle desteklenmesi, krizlere karşı dayanıklılığı artırdığı (Bhaduri, 2019), kriz dönemlerinde liderlerin tüm iletişim boyutlarında etkin liderlik yapmasının önemini vurgulamanın yanında franchise ve çok şubeli fitness işletmelerinde koordinasyon ve stratejik karar alma süreçlerinin sağlıklı işlemesi için gerektiğini (Ietto-Gillies, 2017; Sarris, 2025), kriz yönetimi sadece olumsuzlukları engellemekle kalmayarak fırsatları tanımlama ve değerlendirme süreci olduğu (Coombs, 2007), fitness işletmelerinde liderlerin kriz yönetimi becerilerinin geliştirilmesi, krizlerden güçlenerek çıkmayı mümkün kıldığı belirtilmektedir.

Regresyon analizi sonuçları incelendiğinde, KYÖ değişkeninin (varyansın) % 33.5'inin modeldeki bağımsız değişken olan, LBÖ tarafından açıklandığını göstermektedir (Tablo 4). Buna göre, fitness işletmelerindeki yöneticilerin liderlik becerileri tatmin edilmesi durumunda, kriz yönetimi beceri düzeylerinin olumlu olarak etkileneceğini ortaya koymaktadır. LBÖ toplam puanı (R_2=.336; p=.000), uzmanlık becerileri (R_2=.322; p=.000), etkili iletişim becerileri (R_2=.241; p=.000) ve stratejik beceriler (R_2=.263; p=.000) alt boyutlarının KYÖ'nün

kriz öncesi faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu saptanmıştır. LBÖ toplam puanı (R_2=.287; p=.000), uzmanlık becerileri (R_2=.215; p=.000), etkili iletişim becerileri (R_2=.204; p=.000) ve stratejik beceriler (R_2=.289; p=.000) alt boyutlarının KYÖ'nün kriz sırası faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu belirlenmiştir. LBÖ toplam puanı (R_2=.267; p=.000), uzmanlık becerileri alt boyutu (R_2=.219; p=.000), etkili iletişim becerileri (R_2=.188; p=.000) ve stratejik beceriler (R_2=.254; p=.000) KYÖ'nün kriz sonrası faaliyetler alt boyutu ile pozitif anlamlı düşük düzeyde bir etkiye sahip olduğu gözlenmiştir (Tablo 4). Bu durum, fitness işletmelerindeki yöneticilerin, liderlik becerilerinin (uzmanlık etkili iletişim ve stratejik) düzeylerini artırdıkça, kriz öncesi, sırası ve sonrası faaliyetlerin yönetiminin de gelişim kaydedeceği sonucuna varılabilir. Konu ile ilgili yapılan araştırmalarda, stratejik liderler, krizlerin görüldüğü yerlerde kriz öncesi hazırlık yaparak, potansiyel riskleri önceden tanımladığı ve uzun vadeli stratejilere odaklandığı (Al Thani ve Obeidat, 2020), organizasyonlarda bilgi paylaşımının kriz yönetiminde kritik bir rol oynadığı (Argote vd., 2000), liderlerin bilgi paylaşımını teşvik etmesi, krizlerin sağlıklı bir şekilde atlatılmasında etkili bir faktör olduğu (Bartsch vd., 2021), şeffaf iletişim ve empati odaklı yönetim, kriz sırasında çalışanların (çalışanların, halkın, kamuoyunun) güvenini koruduğu (Vansteenkiste vd., 2024), liderlerin şeffaf iletişim kuramaması, üyelerin arasında güvenliksizliğe yol açarak kriz yönetimini zorlaştırdığı, zayıf iletişim değişikliklerinin kontrol noktalarını engellediğini (de Príncipe, 2021), görev odaklı yöneticilerin hızlı ve etkili çözümler alabildiğini, ancak insanların psikolojik ihtiyaçlarının göz ardı edilmesinin uzun vadeli olumsuz sonuçlar doğurduğunu (Scase ve Goffee, 1990) belirtmişlerdir.

Sonuç olarak, liderlik becerilerinin kriz öncesi hazırlık ve planlama süreçlerinde etkili olduğunu ve kriz yönetiminde başarılı olmanın temelinde bu becerilerin yer aldığını ortaya koymaktadır. Dolayısıyla, fitness işletmelerinde kriz yönetimi performansını artırmak için yöneticilerin uzmanlık, iletişim ve stratejik düşünme becerilerini geliştirmeleri kritik önem taşımaktadır. Bu becerilerin güçlendirilmesi, kriz öncesi alınan önlemlerin etkinliğini artırarak işletmelerin krizlere karşı daha dirençli ve uyumlu olmasını sağlayabilir. Uzmanlık becerileri, etkili iletişim becerileri ve stratejik becerilerin birlikte kullanılması, krizlerin olumsuz etkilerini minimize ederken, organizasyonların krizden güçlenerek çıkmasına zemin hazırlayabilir. Dolayısıyla, kriz yönetiminde uzmanlık, iletişim ve stratejik becerilerin entegrasyonu, liderlerin ve organizasyonların esnekliğini artırarak başarı şansını yükseltebileceği söylenebilir. Mevcut çalışmada liderlik becerilerinin genel etkisi ele alınmıştır. Gelecek araştırmalarda transformasyonel, otokratik, demokratik gibi farklı liderlik stillerinin kriz yönetimi üzerindeki etkileri ayrıntılı olarak incelenebilir. Fitness işletmeleri dışındaki spor ve hizmet sektörlerinde de benzer analizler yapılarak, liderlik becerilerinin kriz yönetimi üzerindeki etkilerinin sektörel farklılıkları ortaya konabilir. Nicel verilerin yanı sıra, mülakat ve odak grup görüşmeleri gibi nitel yöntemlerle liderlerin kriz anındaki deneyimleri ve beceri kullanımları detaylandırılabilir.

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SOLID MODEL-BASED ANALYSIS OF MATERIAL PROPERTY VARIATIONS ON THE STRUCTURAL RESPONSE OF HIGH-RISE BUILDINGS WITH DIAPHRAGM DISCONTINUITIES

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ABSTRACT

This study investigates the effect of material property variations on the seismic performance of high-rise reinforced concrete buildings with diaphragm discontinuities using a **three-dimensional solid modeling approach.** A representative **12-story structure,** common in Turkish construction practice, featuring a ground floor recess (commercial or parking use) and a slab indentation dividing the diaphragm into two interacting segments, was analyzed under **three-directional nonlinear dynamic seismic loading** using a solid-meshed model. Two scenarios were considered: **Scenario 1** employed low-strength concrete (C10) and minimal column reinforcement (~1%), resulting in progressive collapse and roof displacements exceeding 0.5 m; **Scenario 2** utilized higher-strength concrete (C30) and increased column reinforcement (>2%), leading to minor local damage in non-structural walls and negligible global displacements. In addition, for taller configurations, the 15-story case under the same C30 and 2% reinforcement conditions exhibited similar minor damage, whereas the 18-story counterpart experienced major displacements, indicating a pronounced sensitivity to height. The model captured **stress concentrations and out-of-phase motion induced by the slab indentation,** highlighting the importance of material quality and reinforcement ratios. The results align with observations from the 2023 Kahramanmaraş earthquakes, underscoring the value of nonlinear analysis.

Keywords: High-rise buildings; Diaphragm discontinuity; Material properties; Nonlinear dynamic analysis; Solid modeling

DİYAFRAM SÜREKSİZLİKLERİNE SAHİP YÜKSEK KATLİ BİNALARDA MALZEME ÖZELLİKLERİNDEKİ DEĞİŞİMLERİN YAPİSAL TEPKİSİ ÜZERİNE KATİ MODEL TABANLİ ANALİZ

ÖZET

Bu çalışma, diyafram süreksizliklerine sahip yüksek katlı betonarme binalarda malzeme özelliklerindeki değişimlerin deprem davranışı üzerindeki etkilerini, üç boyutlu katı modelleme ve doğrusal olmayan dinamik analiz yaklaşımıyla incelemektedir. Türkiye'de yaygın olarak inşa edilen bir 12 katlı referans yapı ele alınmış; zemin katı ticari alan veya otopark olarak kullanılan bir girinti ve diyaframı iki etkileşimli parçaya bölen bir döşeme çıkıntısı içeren bu yapı, üç eksenli doğrusal olmayan deprem yüklemesi altında solid-mesh model ile analiz edilmiştir. İki senaryo üzerinden değerlendirme yapılmıştır: Senaryo 1, düşük dayanımlı beton (C10) ve sınırlı kolon donatısı (~%1) ile modellenmiş ve kademeli çökme, çatı deplasmanlarının 0,5 m'yi aşması gibi ciddi yapısal hasarlar gözlenmiştir. Senaryo 2 ise yüksek

dayanımlı beton (C30) ve artırılmış kolon donatısı (> %2) ile analiz edilmiş; yapısal olmayan duvarlarda sınırlı hasar ve ihmal edilebilir global deplasmanlar gözlenmiştir. Ek olarak, daha yüksek yapı konfigürasyonlarında, aynı C30 ve %2 donatı koşulları altında 15 katlı durumda benzer şekilde hafif hasar gözlenirken, 18 katlı yapı ise büyük deplasmanlar sergilemiş ve yüksekliğe karşı belirgin bir duyarlılık ortaya koymuştur. Katı modelleme, döşeme çıkıntısı nedeniyle oluşan gerilme yoğunlaşmalarını ve kütlelerin faz dışı hareketini başarılı şekilde yakalamış, malzeme kalitesi ve donatı oranlarının çökme riskini azaltmadaki kritik rolünü ortaya koymuştur. Sonuçlar, 2023 Kahramanmaraş depremlerinde gözlemlenen hasarlarla uyumlu olup, doğrusal olmayan analizlerin önemini vurgulamaktadır.

Anahtar Kelimeler: Yüksek katlı yapılar; Döşeme/diyafram süreksizliği; Malzeme özellikleri; Doğrusal olmayan dinamik analiz; Katı modelleme

INTRODUCTION

High-rise buildings are essential components of modern urban landscapes, providing efficient land use in densely populated cities [1]. However, their structural performance under lateral and vertical loading is significantly influenced by the continuity and integrity of diaphragms, which are critical elements for transferring seismic and wind-induced forces [2,3]. Diaphragm discontinuities, caused by openings for elevators, stairs, or architectural requirements, introduce stress concentrations, irregular load paths, and potential weaknesses in both stiffness and strength distribution [4,5].

The catastrophic Kahramanmaraş earthquakes of February 2023, which struck the southeastern region, especially Kahramanmaraş [6], Hatay [7], Malatya [8], Adıyaman [9] and Gaziantep [10] of Türkiye with moment magnitudes reaching 7.8, revealed severe vulnerabilities in the existing building stock as well as historical structures [11]. Thousands of mid- to high-rise reinforced concrete structures suffered partial or total collapse, largely due to poor construction practices, inadequate material quality, and structural irregularities. Among the common recurrent deficiencies observed were diaphragm discontinuities and soft-story mechanisms [12-14].

In addition to the vertical irregularities, another critical weakness arises from plan irregularities in the slabs, where diaphragm discontinuities are created by recesses or openings that effectively divide the structure into two partially independent segments [15,16]. In such cases, the recessed portion of the building exhibits a more flexible and unstable seismic response, leading to out-of-phase movements between structural segments. This condition was commonly observed in the damaged building stock during the Kahramanmaraş earthquakes, where torsional effects and uncoordinated displacements accelerated structural degradation and collapse [6].

Material properties such as elasticity modulus, compressive strength, and stress–strain behavior play a fundamental role in defining the structural response of buildings with such irregularities. Even slight variations in these properties may alter deformation demands, load redistribution mechanisms, and the overall collapse resistance of high-rise systems [17-19]. Understanding the sensitivity of diaphragm-discontinuous structures to material property changes is therefore vital for ensuring safety and resilience, especially in seismic regions.

Previous research has addressed diaphragm irregularities primarily through simplified analytical models or conventional numerical methods, demonstrating that stiffness and strength discontinuities may lead to stress concentrations and localized damage [20]. While these approaches provide valuable insights, they may overlook local stress distributions, nonlinearities, and progressive failure mechanisms. A more refined modeling strategy is thus

required to capture the complex interaction between diaphragm irregularities and material variability. The observed damage patterns in Kahramanmaraş further underscore the necessity for advanced modeling approaches that can simulate collapse mechanisms and differentiate between failure modes driven by material strength, reinforcement deficiencies, and diaphragm plan separations.

This study aims to fill this gap by employing a solid model-based framework to systematically investigate how material property variations influence the structural response of high-rise buildings with diaphragm discontinuities. The outcomes are expected to contribute to both academic understanding and practical guidelines, supporting safer design practices and more resilient urban development.

The study further incorporates **real-world photographic evidence from the Kahramanmaraş disaster**, illustrating parallels between observed collapse patterns and the outcomes of the numerical simulations. By systematically contrasting these scenarios, the research provides insights into the interaction between diaphragm discontinuities—both vertical and plan-related—and material variability, offering valuable implications for both design codes and retrofitting strategies in earthquake-prone regions.

Figure 1 illustrates real-world examples of high-rise reinforced concrete buildings in Turkiye exhibiting diaphragm discontinuities, which served as the motivation for the numerical investigations presented in this study, showing ground-floor recesses and slab indentations commonly observed in contemporary construction.

Fig. 1 Representative examples of reinforced concrete high-rise buildings with diaphragm discontinuities and damages

MATERIAL AND METHODS

In this study, at first, 12-story reinforced concrete building representative of common Turkish construction practice—featuring both (i) a discontinuous diaphragm at the ground floor, functioning as either a shop or a parking lot, and (ii) a slab recess that divides the diaphragm into two interacting parts—was modeled using a three-dimensional solid framework. Two scenarios were examined to evaluate the sensitivity of the structure to material property variations. Subsequently, in addition to the 12-story building, 15- and 18-story structures were also analyzed for the C30 and 2% reinforcement scenario.

Structural Configuration

The reference structure modeled in this study is a 12-story reinforced concrete building designed to reflect common Turkish construction practices, particularly those frequently observed in the building stock affected during the 2023 Kahramanmaraş earthquakes. The

building has overall plan dimensions of 22.60 m × 28.10 m, with an inter-story height of 3.0 m, yielding a total height of 36 m.

The structural system consists of:

- **Columns:** 90 × 90 cm, subdivided to account for plastic hinge formation at both ends. To capture potential nonlinear behavior, columns were discretized into 50 cm segments, with localized plasticization zones considered over approximately half the section depth near column ends.
- **Beams:** 30 × 30 cm cross-sections, distributed along the floor framing.
- **Slabs:** 15 cm thick reinforced concrete diaphragms, including a recess that divides the diaphragm into two interacting segments, representing the discontinuity and irregularity observed in practice.

A three-dimensional solid model was developed to capture the detailed stress distribution, plastic hinge development, and progressive collapse mechanisms. To ensure numerical stability and accuracy, the mesh was generated with compatibility across slabs, beams, and columns, minimizing discontinuities at element interfaces.

The base supports were fixed to represent full restraint at the foundation level. Nonlinear material models were applied, allowing for cracking, plasticity, and stiffness degradation. Plastic hinge behavior was particularly emphasized in column ends to simulate realistic inelastic deformation under seismic loading.

Table 1. Building Geometry and Modelling Assumptions

Parameter	Value / Assumption	Notes
Building typology	12-story reinforced concrete frame building; ground floor used as **commercial/parking**	Representative of common Turkish practice
Plan dimensions	**22.60 m × 28.10 m**	Rectangular floor plan
Story height	**3.0 m**	Uniform throughout
Total height	**36.0 m**	12 × 3.0 m
Structural members	**Columns:** 90 × 90 cm; **Beams:** 30 × 30 cm; **Slab:** 15 cm	Same in both scenarios
Diaphragm irregularity	**Slab recess dividing diaphragm into two segments**; induces out-of-phase response and torsional effects	Observed in collapsed buildings
Vertical irregularity	**Soft/weak ground story** due to commercial/parking usage	Frequently reported in Kahramanmaraş failures
Modelling approach	**3D solid model**	Captures stress distribution and progressive collapse
Mesh strategy	Compatible meshing across columns, beams, slabs; interface discontinuities minimized	For numerical stability
Column discretisation	**50 cm segments**; plastic zone length ≈ 0.5 × section depth at ends	Allows hinge development
Boundary conditions	**Fixed base support**	Full restraint at foundation

Table 1. Building Geometry and Modelling Assumptions

Parameter	Value / Assumption	Notes
Loading protocol	Gravity loads applied first, followed by **three-directional seismic input (X, Y, Z simultaneously)**	Replicates realistic strong ground motion
Calibration	Linked with **field evidence from the 2023 Kahramanmaraş earthquakes**	Enhances reliability of outcomes

Figure 2 presents the three-dimensional solid models of the 12-, 15-, and 18-story reinforced concrete buildings analyzed in this study.

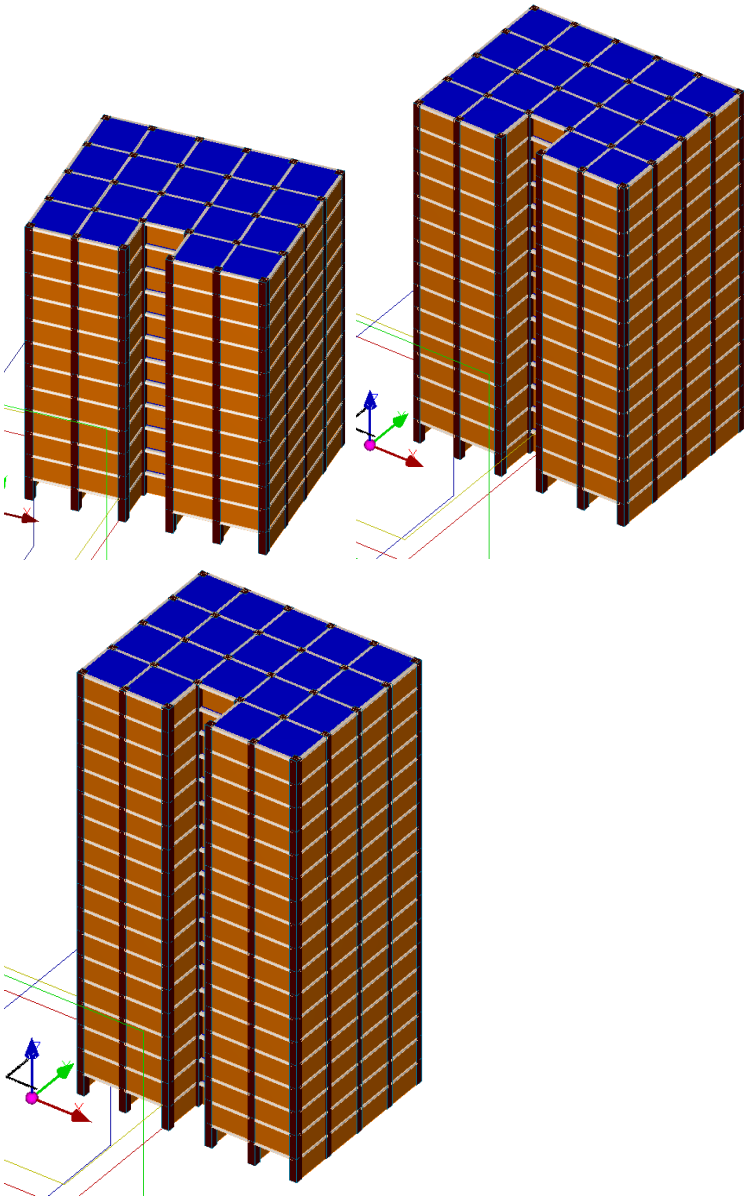

Fig. 2 Three-dimensional solid representations of the 12-, 15-, and 18-story structures used in the nonlinear dynamic analyses

Figure 3 highlights the location at the roof corner of the building where peak displacement was recorded during the seismic excitation, accompanied by a zoomed-in view for clarity.

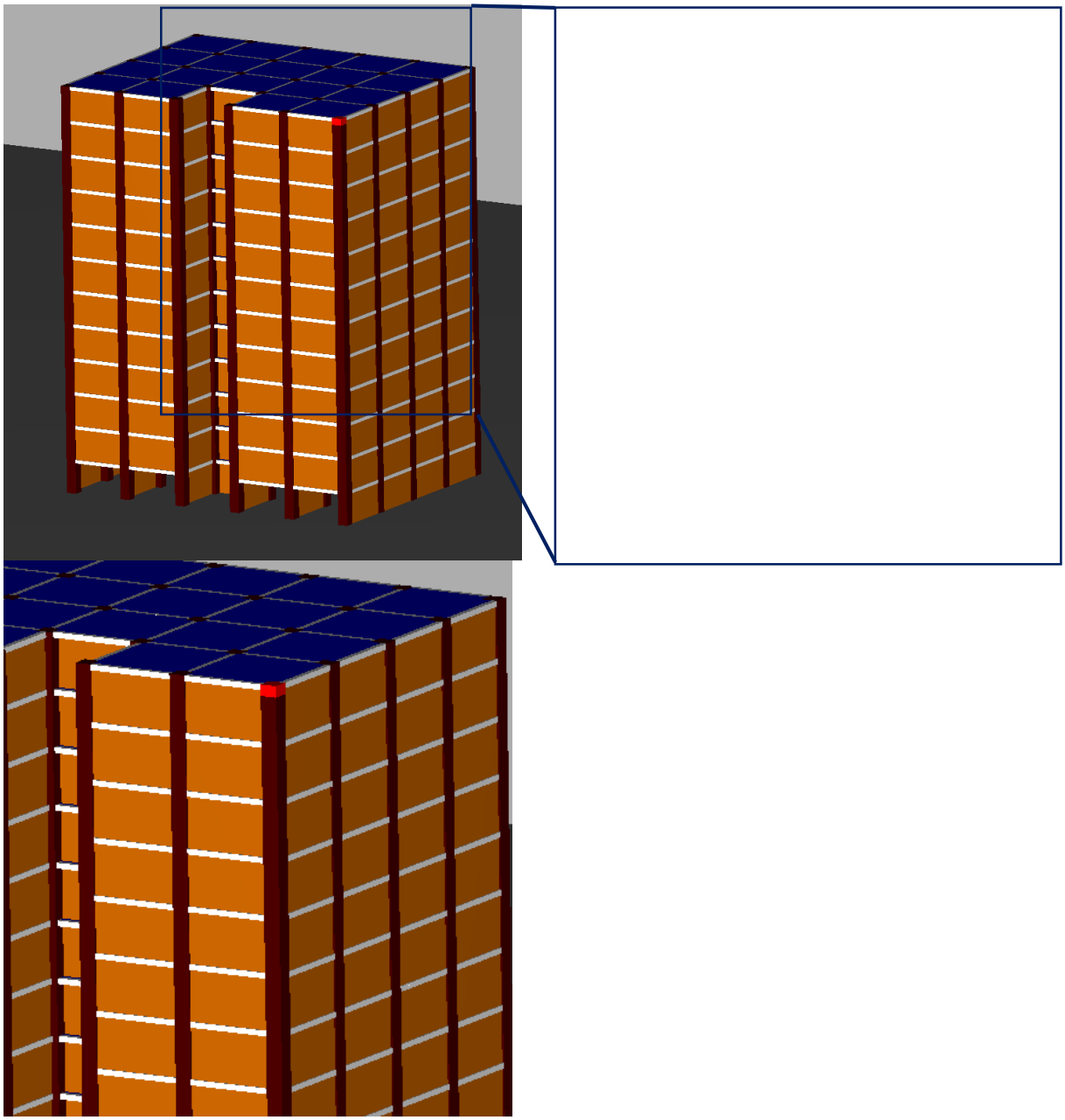

Fig. 3 Roof corner location of maximum displacement response under seismic loading

Figure 4 provides the plan view of the building together with the column grid spacing expressed in meters.

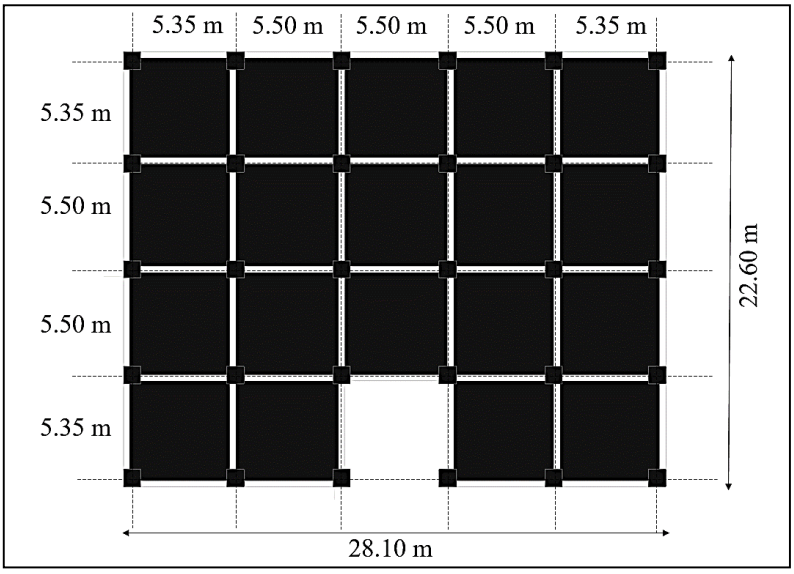

Fig. 4 Plan layout of the structure showing column axes and spacing dimensions in meters

A simultaneous three-component ground motion was imposed along the X, Y, and Z axes to account for the combined effects of seismic excitation. The selected input represents realistic ground motion features consistent with strong earthquakes such as the Kahramanmaraş sequence. Prior to the dynamic analysis, gravity loads arising from slab self-weight and superimposed dead loads were applied. Figure 5 illustrates the corresponding ground motion record in graphical form.

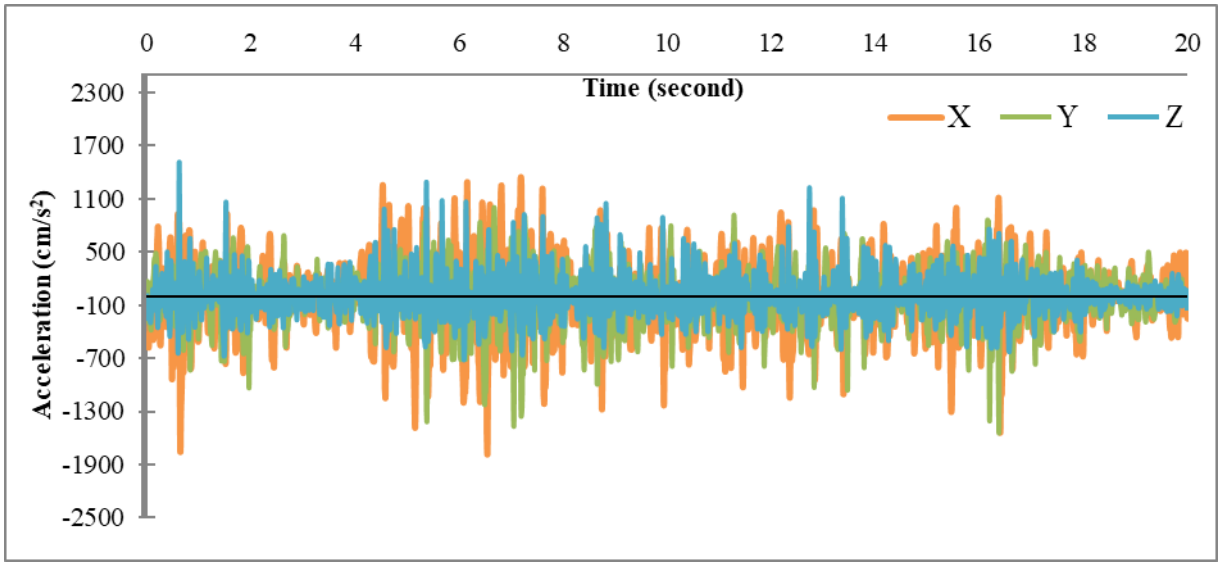

Fig. 5 Time history representation of the three-directional earthquake record

Slabs were reinforced with two layers of 16 mm diameter bars, spaced at 150 mm in both the short and long directions. Beams were reinforced with ten longitudinal bars of 16 mm diameter.

Table 2. Material Properties and Reinforcement (Scenario-Based)

Item	**Scenario 1** **Low-Strength Configuration**	**Scenario 2** **Improved Configuration**	Notes
Concrete class/fck	**C10 / 10MPa**	**C30 / 30 MPa**	Based on typical deficient vs. improved quality
Column longitudinal reinforcement	**20Ø24** (≈ just above 1% ratio)	**40Ø24** (> 2% ratio)	Governs overall ductility and axial load capacity
Beam longitudinal reinforcement	**10Ø16**	**10Ø16**	Unchanged between scenarios
Slab reinforcement	**2Ø16/15/15**	**2Ø16/15/15**	Unchanged between scenarios
Steel grade	S420	S420	420 MPa

RESULTS AND DISCUSSIONS

Scenario 1: The building was modeled with low concrete strength (C10, 10 MPa) and a reinforcement ratio slightly above 1% in column sections. Under three-directional earthquake loading, the structure experienced severe instability, culminating in total collapse. The displacement time-history of the roof demonstrated peak lateral displacements approaching 0.5 m, reflecting a high vulnerability consistent with field observations from collapsed buildings in the 2023 earthquakes. Figure 6 presents the structural section details of the building model, including column, beam, and slab reinforcement arrangements.

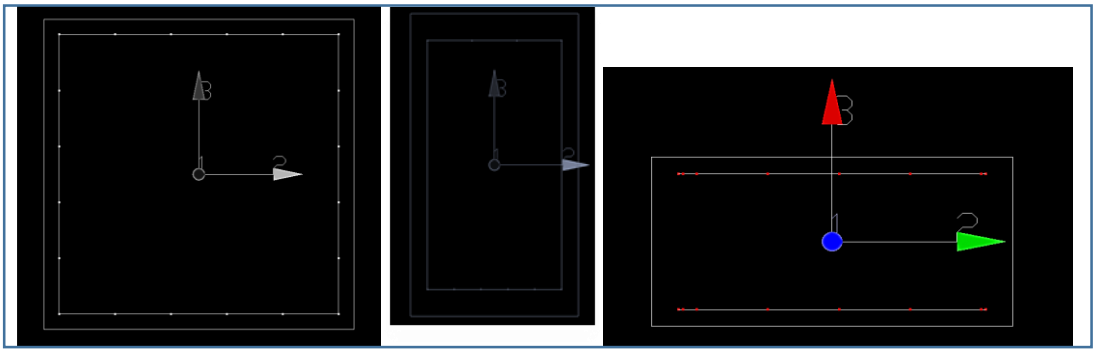

Fig. 6 Sectional view of the structural members with reinforcement details: Columns (20Ø24), Beams (10Ø16), and Slab (2Ø16/15/15)

Figure 7 illustrates the stress distribution of the 12-story building with C30 concrete and 1% column reinforcement ratio, highlighting stress concentrations in the diaphragm indentation zones at the ground floor.

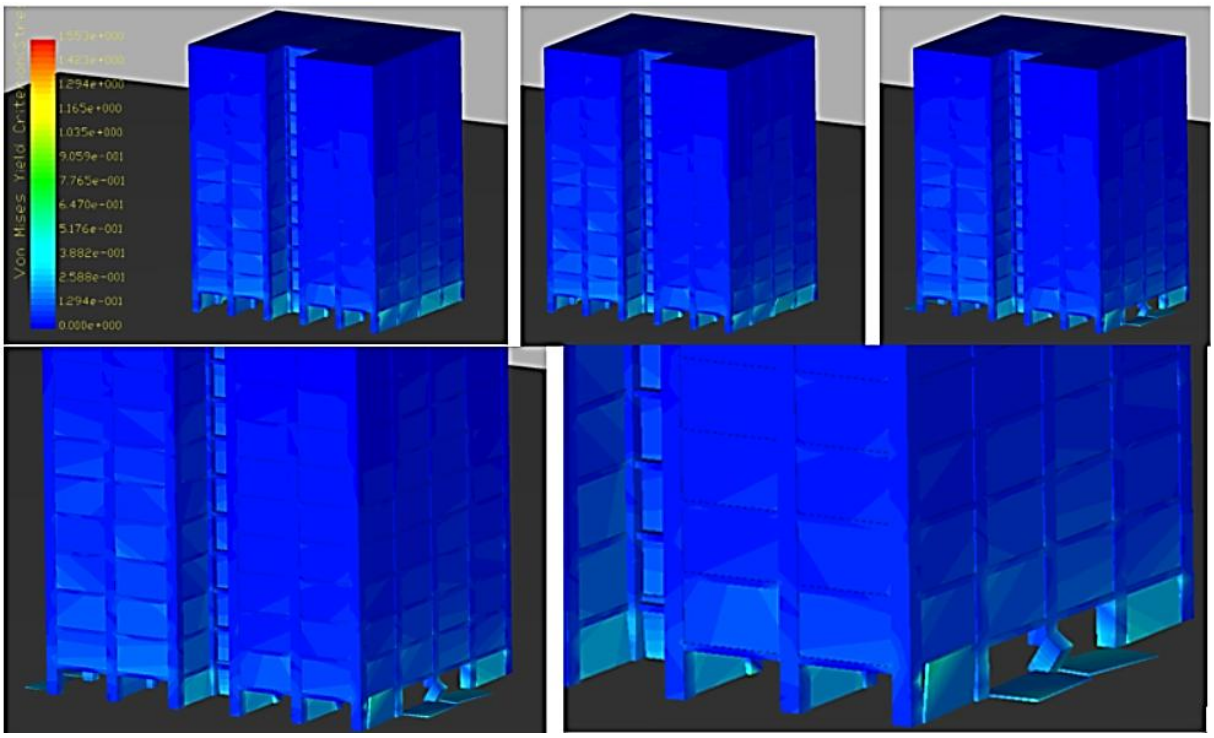

Fig. 7 Stress distribution for the 12-story structure with C30 concrete and 1% column reinforcement

Significant stress concentrations are visible in the ground-floor diaphragm indentation zones, consistent with real-life damage patterns. A zoomed-in view of column failure due to severe structural damage is also presented in Figure 7.

Scenario 2: The same structural configuration was analyzed with improved concrete strength (C30) and an increased reinforcement ratio above 2%. To preserve ductile behavior while increasing the reinforcement ratio, the concrete strength was also enhanced. This approach aligns with established design principles and international codes, such as Eurocode 8 and ACI 318, which emphasize the balance between reinforcement ratio, concrete strength, and ductility. Higher reinforcement ratios without adequate concrete capacity may lead to premature crushing and reduced energy dissipation. By upgrading the concrete class in parallel, the section maintains sufficient strength and deformation capacity. It should be noted, however, that ductility is not solely determined by material properties but also depends on detailing provisions, including confinement reinforcement, stirrup spacing, and overall section configuration. This integrated approach ensures compliance with both safety and performance requirements under seismic or extreme loading scenarios.

As a result, while non-structural walls around the diaphragm discontinuities sustained localized damage, the overall structure remained stable, with negligible roof displacement and only minor residual deformations. This finding highlights the critical influence of material quality and reinforcement ratios on seismic resilience. Figure 8 presents the structural section details of the building model, including column, beam, and slab reinforcement arrangements.

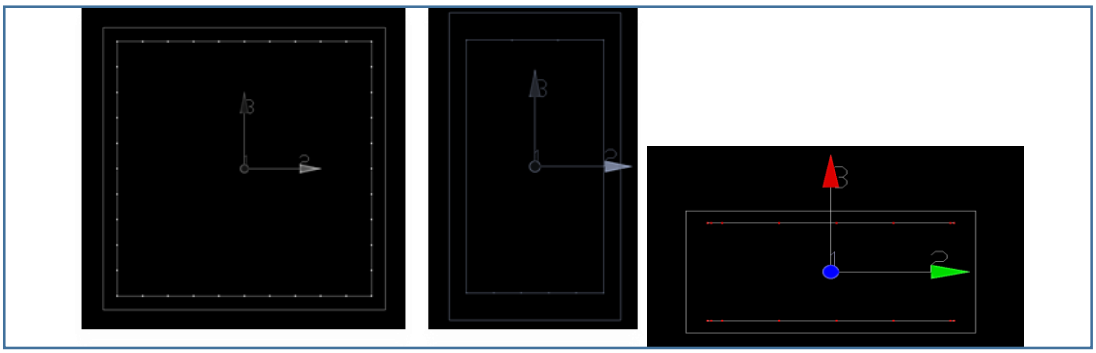

Fig. 8 Sectional view of the structural members with reinforcement details: Columns (40Ø24), Beams (10Ø16), and Slab (2Ø16/15/15)

In the second scenario, where C30 concrete and a 2% column reinforcement ratio were adopted, the building exhibited only localized damage concentrated around the diaphragm regions. Figure 9 illustrates representative views of these stress concentrations together with the corresponding member reinforcement details (Columns: 40Ø24, Beams: 10Ø16, Slab: 2Ø16/15/15).

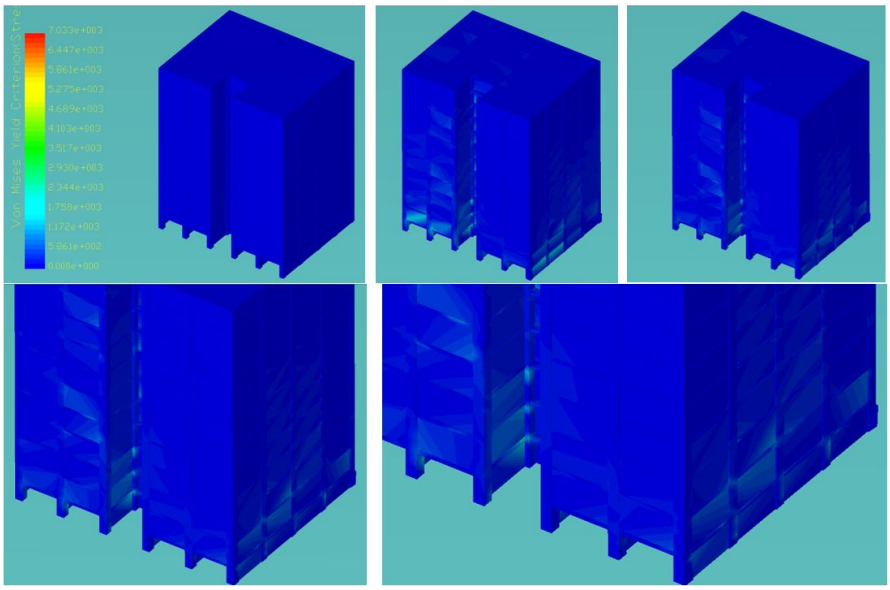

Fig. 9 Damage patterns observed in the second scenario with C30 concrete and 2% column reinforcement for 12-story building

Since no significant damage was observed in the second scenario with C30 concrete and 2% column reinforcement, the same material and reinforcement configuration was further applied to a 15-story building. Figure 10 presents the corresponding stress distribution in the columns of the 15-story structure.

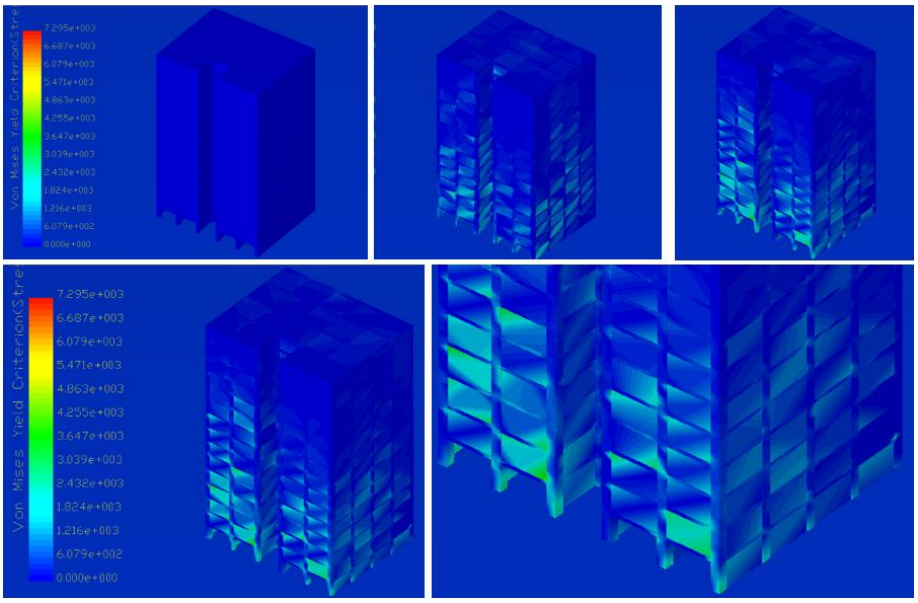

Fig. 10 Stress distribution in the 15-story building with C30 concrete and 2% reinforcement

As the 15-story model with C30 concrete and 2% column reinforcement did not exhibit significant damage, the building height was further increased to 18 stories. Figure 11 presents the stress distribution obtained for this taller configuration.

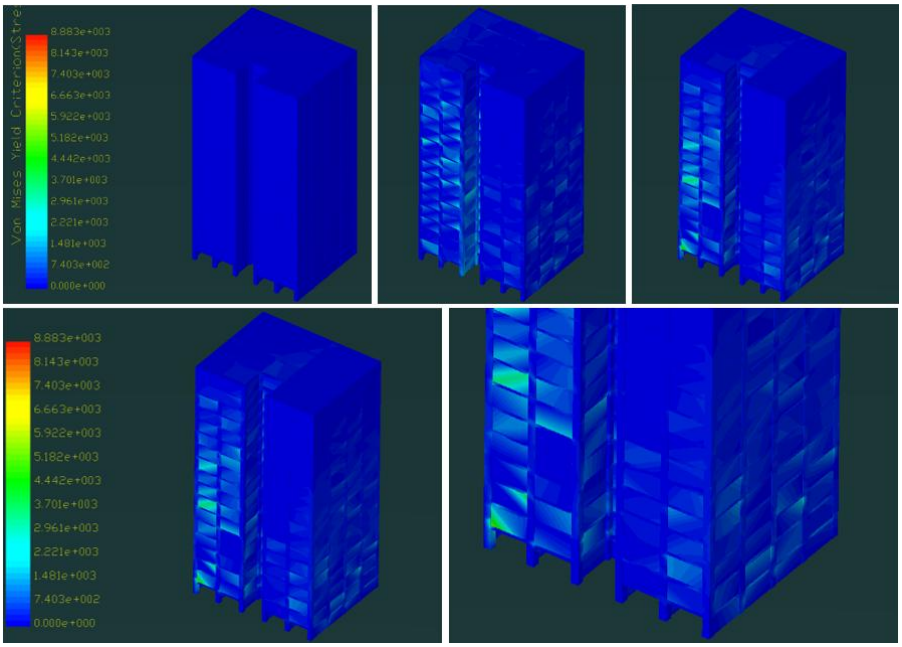

Fig. 11 Stress distribution in the 18-story building with C30 concrete and 2% reinforcement

Figure 12 summarizes the roof displacement time histories for all building configurations analyzed. As can be seen, under the specified material configuration, the structures exhibit significant and permanent displacements, particularly for the 18-story building model and for the first scenario.

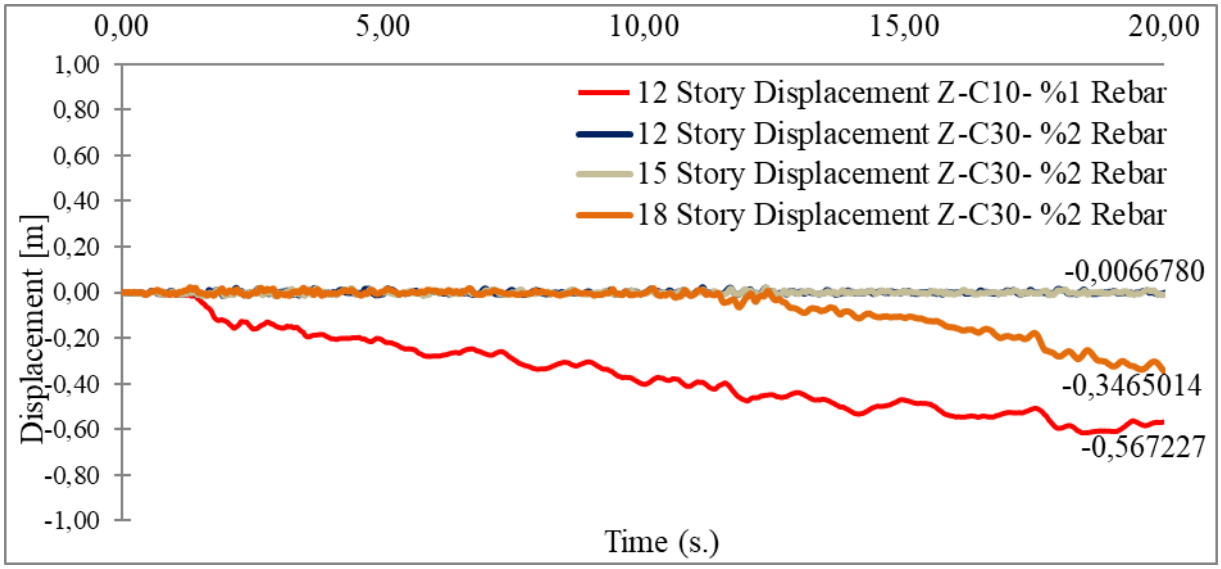

Fig. 12 Time-history of roof displacements for all scenarios

When extended to taller cases, the 15-story structure under C30 and 2% reinforcement behaved similarly to the 12-story model with only minor damage, whereas the 18-story case underwent major displacements, highlighting the role of height.

Figure 13 illustrates the temporal variation of the total input and dissipated energy throughout the seismic analysis, while Figure 14 presents the time history of the vertical (Z-direction) seismic forces acting on the structure.

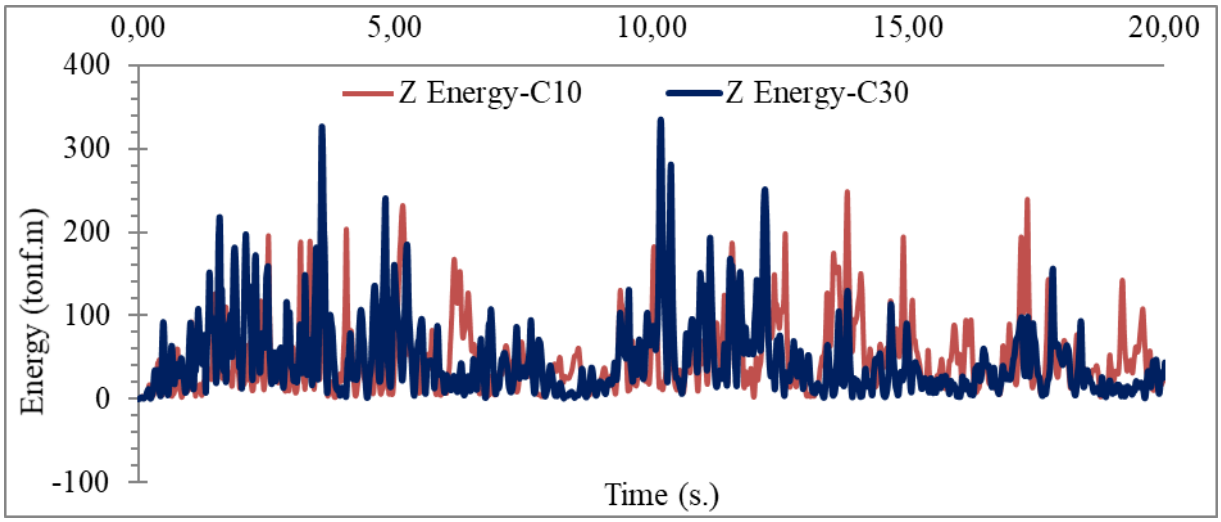

Fig. 13 Time-history of energy variation during seismic loading

The analyses demonstrate that while the applied vertical force remains essentially unchanged across all cases (Figure 14), the energy response varies significantly with the material properties and reinforcement configurations (Figure 13).

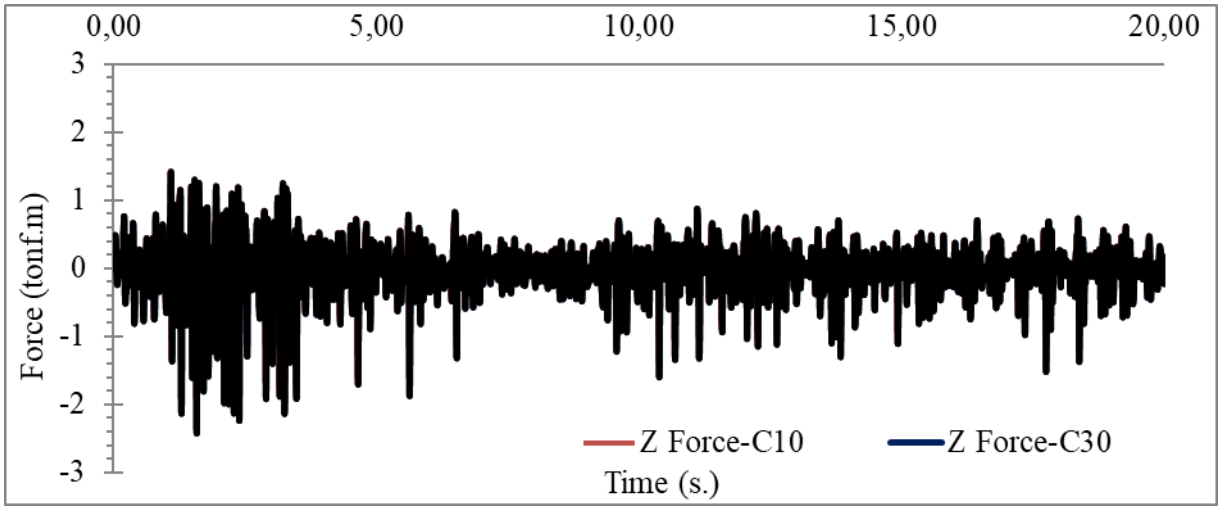

Fig. 14 Vertical (Z-direction) force response of the building under seismic excitation

Although the section reinforcement ratio of 2% adopted in this study lies within the code-specified range of 1% to 4%, a marked improvement in structural performance was observed when increasing the ratio from 1% to 2%. To capture this influence and sensitivity, the reinforcement ratio was deliberately increased by a single increment, while the concrete strength was simultaneously enhanced to maintain ductile behavior. These findings highlight that both material quality and reinforcement ratio are critical parameters governing structural response. In practice, however, higher reinforcement ratios are frequently prescribed in the project, which underscores the considerable risks faced by structures that are not designed in accordance with appropriate provisions, particularly under extreme loading scenarios.

16) ## *4. CONCLUSIONS*

This study employed a three-dimensional solid modeling approach to investigate the seismic performance of reinforced concrete high-rise buildings with diaphragm discontinuities, focusing on the role of material quality and reinforcement ratio. A representative 12-story building, typical of construction practice, was analyzed under nonlinear three-directional dynamic loading for two material scenarios, and the investigation was further extended to 15- and 18-story counterparts. The analyses revealed distinct performance patterns that provide important implications for both design and assessment of irregular high-rise systems.

Key findings can be summarized as follows:

Effect of material strength and reinforcement:

In the low-strength case (C10 with ~1% reinforcement), the structure experienced progressive collapse, with roof displacements exceeding 0.5 m.

In contrast, the C30 with 2% reinforcement configuration demonstrated stable behavior with only minor non-structural damage and negligible global displacements.

Influence of building height:

The 15-story building with C30 and 2% reinforcement maintained similar performance to the 12-story model, exhibiting only limited local stress concentrations.

However, the 18-story counterpart under the same material and reinforcement conditions developed major displacements, indicating a pronounced sensitivity of diaphragm-discontinuous systems to building height.

Stress distribution and irregularities:

Both the slab recess and the ground-floor discontinuity caused stress concentrations and out-of-phase diaphragm motion, consistent with damage patterns observed in the 2023 Kahramanmaraş earthquakes.

Energy and force demands:

The applied vertical (Z-direction) forces remained essentially the same across scenarios (Fig. 14), yet the energy time histories (Fig. 13) varied significantly depending on material strength and reinforcement level, underscoring the importance of material configuration on energy dissipation capacity.

Global displacement response:

The roof displacement histories (Fig. 12) clearly demonstrate that material and reinforcement upgrades can mitigate collapse risk in medium-rise structures, but for taller systems (≥18 stories), permanent and excessive displacements may still occur despite higher material strength.

Overall, the findings emphasize that while improvements in material quality and reinforcement detailing can ensure seismic safety up to some configurations, additional measures are required for taller buildings with diaphragm discontinuities. In particular:

- Increasing reinforcement ratios in critical columns and beams can enhance ductility and delay failure mechanisms [21].
- Introducing RC shear walls can provide additional lateral stiffness and significantly reduce global displacements [22].
- For existing structures, various retrofitting techniques—such as jacketing, FRP wrapping, or infill wall strengthening—may be employed to improve seismic resilience [23-26].
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SANATIN SESSİZ YANKISI: SANAT TERAPİSİNİN İŞİTME YETERSİZLİĞİ OLAN BİREYLERİN SOSYAL BECERİ VE PSİKOLOJİK İYİ OLUŞ DÜZEYLERİNE ETKİSİ

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ÖZET

Bu araştırmanın amacı, sanat terapisi programının işitme yetersizliği olan bireylerin sosyal beceri ve psikolojik iyi oluş düzeyleri üzerindeki etkisini incelemektir. Çalışmada öntest–sontest kontrol gruplu deneysel desen kullanılmıştır. Katılımcılar, 19–24 yaş aralığında işitme yetersizliği olan 23 yetişkinden oluşmaktadır. Deney grubuna sekiz hafta boyunca, haftada bir kez 120 dakika süren Sanat Terapisi Programı uygulanmış, kontrol grubuna ise herhangi bir müdahale yapılmamıştır. Veri toplamak amacıyla Psikolojik İyi Oluş Ölçeği ve Sosyal Becerileri Değerlendirme Ölçeği kullanılmıştır. Verilerin analizinde, grupların kendi içindeki öntest–sontest karşılaştırmaları için Wilcoxon İşaretli Sıralar Testi, gruplar arası sontest karşılaştırmaları için ise Mann–Whitney U Testi kullanılmıştır. Bulgular, sanat terapisine katılan bireylerin psikolojik iyi oluş düzeylerinde anlamlı bir artış olduğunu göstermiştir. Sosyal beceri alt boyutlarından Grupla Bir İşi Yapma ve Yürütme ile İlişkiyi Başlatma ve Sürdürme Becerilerinde gelişim gözlenirken, Kendini Kontrol Etme Becerilerinde anlamlı bir farklılık bulunmamıştır. Sonuç olarak, sanat terapisi işitme yetersizliği olan bireylerde özellikle grup etkileşimlerine dayalı sosyal becerilerin gelişiminde ve psikolojik iyi oluşun desteklenmesinde etkili bir yöntem olarak değerlendirilmektedir.

Anahtar Kelimeler: Sanat Terapisi, İşitme Yetersizliği, Sosyal Beceri, Psikolojik İyi Oluş.

THE SILENT ECHO OF ART: THE EFFECT OF ART THERAPY ON THE SOCIAL SKILLS AND PSYCHOLOGICAL WELL-BEING OF INDIVIDUALS WITH HEARING IMPAIRMENTS

ABSTRACT

The aim of this study was to examine the effects of an art therapy program on the social skills and psychological well-being of individuals with hearing impairments. A pretest–posttest control group experimental design was employed. The participants consisted of 23 adults with hearing impairments aged between 19 and 24. The experimental group received an eight-week Art Therapy Program, with one 120-minute session held per week, while no intervention was provided to the control group. Data were collected using the Psychological Well-Being Scale and the Social Skills Assessment Scale. For data analysis, the Wilcoxon Signed-Rank Test was used for within-group pretest–posttest comparisons, and the Mann–Whitney U Test was applied for between-group posttest comparisons. The findings indicated a significant increase in psychological well-being among individuals who participated in the art therapy program. In terms of social skills, improvements were observed in the subscales of Task Completion and Maintaining Interpersonal Relationships, whereas no significant difference was found in the Self-Control subscale. In conclusion, art therapy can be considered an effective method for enhancing group interaction–based social skills and supporting psychological well-being in individuals with hearing impairments.

Keywords: Art Therapy, Hearing Impairment, Social Skills, Psychological Well-Being

GİRİŞ

İşitme yetersizliği, artan düzeyde ruhsal sıkıntılarla ilişkili olup bireylerin günlük işlevselliklerini ve genel sağlık durumlarını olumsuz etkileyebilmektedir (Brennan & Bally, 2007; Kvam vd., 2007). İşitme yetersizliği bulunan bireyler, çoğunlukla çeşitli engellerle karşılaşmakta ve bu engeller onların duygusal ve psikolojik gelişim süreçleri üzerinde olumsuz yansımalar yaratmaktadır. Nitekim Olsson ve arkadaşlarının (2021) çalışmasında da vurgulandığı üzere, işitme yetersizliği olan bireyler iletişimde güçlükler yaşamakta ve işiten bireyler tarafından çoğu zaman tam olarak anlaşılamamaktadır. Bu durum, bireylerin sosyal, duygusal ve bilişsel gelişimlerini etkilemekte ve onların genel psikolojik iyi oluş düzeylerinde kritik bir rol oynamaktadır (Marzuki vd., 2018).

Psikolojik iyi oluş, bireyin yaşamda karşılaştığı varoluşsal zorluklarla başa çıkabilme kapasitesi olarak ele alınmakta ve bireyin kendini kabul etme, kişisel gelişim, yaşamda anlam bulma, başkalarıyla olumlu ilişkiler kurma, çevresine hâkim olma ve özerklik gibi alt boyutlar üzerinden açıklanmaktadır (Keyes vd. 2002; Ryff, 1995). Bu boyutların, bireylerin sosyal becerileriyle yakından ilişkili olduğu ifade edilmektedir. Sosyal beceriler; kişilerarası ilişkilerde etkili iletişim kurma, başkalarına saygı gösterme, kendini uygun biçimde ifade edebilme ve grup kurallarına uyum sağlayabilme gibi unsurları içermektedir (Ogilvy, 1994).

Sanat terapisi, bireylerin duygu, düşünce ve yaşantılarını görsel, işitsel ve dokunsal ifade biçimleriyle ortaya koymalarına yardımcı olan, sanatsal üretim sürecini merkezine alan bir terapi yöntemi olarak tanımlanmaktadır (Malchiodi, 2005). Bu yöntem, ruhsal, gelişimsel, nörolojik ve davranışsal birçok sorun alanında uygulanabilen bir müdahale biçimi olarak kullanılmaktadır (Malchiodi, 2012). Sanat terapisi, işitme yetersizliği olan bireylerde sözel ya da işaret diline dayalı iletişimin sınırlı kaldığı durumlarda, görsel/sembolik ifade kanalları üzerinden duygusal dışavurumu kolaylaştıran bir yaklaşım olarak ele alınmaktadır (Hoggard, 2006).

İşitme yetersizliği olan bireylerle çalışırken sanat terapisi, geleneksel tedavi yaklaşımlarına yardımcı bir yöntem olarak ek katkılar sağlayabilmektedir. Sözel iletişime dayalı terapötik müdahalelere kıyasla, sanat temelli süreçler bu bireyler için daha az zorlayıcı bir deneyim sunabilmekte ve bu yönüyle önemli bir alternatif olarak değerlendirilebilmektedir (Liao, 2025). Bu bağlamda sanat terapisi, işitme yetersizliği olan bireylerin sosyal ve duygusal gereksinimlerini karşılamaya yönelik psiko-sosyal bir müdahale aracı olarak öne çıkmaktadır (Dahan & Regev, 2025). Türkiye'de işitme yetersizliği olan bireyler üzerinde sanat terapisinin etkililiğini inceleyen bir çalışmaya rastlanmamış olması, bu araştırmayı alandaki öncü girişimlerden biri yapmaktadır. Çalışmanın bulguları, sanat temelli programların geleneksel rehabilitasyon yaklaşımlarına eklemlenerek sosyal beceri ve psikolojik iyi oluş açısından sağlanacak yararı artırabileceğini göstermesi bakımından önem taşımaktadır. Bu doğrultuda araştırmada aşağıdaki hipotezler test edilmiştir.

- Sanat Terapisi Programına katılan deney grubundaki bireylerin psikolojik iyi oluş ve sosyal beceri düzeyleri (Grupla Bir İşi Yapma ve Yürütme Becerileri, İlişkiyi Başlatma ve Sürdürme Becerileri, Kendini Kontrol Etme Becerileri) sontest puan ortalamaları öntest puan ortalamalarına oranla anlamlı düzeyde artacaktır.
- Sanat Terapisi Programına katılmayan kontrol grubunda bulunan bireylerin psikolojik iyi oluş ve sosyal beceri düzeyleri (Grupla Bir İşi Yapma ve Yürütme Becerileri, İlişkiyi Başlatma ve Sürdürme Becerileri, Kendini Kontrol Etme Becerileri) sontest puan ortalamaları öntest puan ortalamalarına oranla anlamlı düzeyde farklılaşma olmayacaktır.
- Deney ve kontrol grubunun psikolojik iyi oluş ve sosyal beceri düzeyleri (Grupla Bir İşi Yapma ve Yürütme Becerileri, İlişkiyi Başlatma ve Sürdürme Becerileri, Kendini Kontrol Etme Becerileri) sontest puanlarında deney grubu lehine anlamlı bir farklılık olacaktır.

YÖNTEM

Araştırma Modeli

Bu araştırma, nicel araştırma yöntemlerinden biri olan deneme modeline dayalı olarak tasarlanmıştır. Deneme modelleri, araştırmacının bağımsız değişken üzerinde doğrudan müdahale edebildiği ve bu müdahalenin bağımlı değişken üzerindeki etkisini neden-sonuç ilişkisi çerçevesinde test etmeye olanak tanıyan desenlerdir. Araştırmanın amacı doğrultusunda, sanat terapisi uygulamasının etkililiğini incelemek üzere deneme modellerinden "öntest–sontest kontrol gruplu desen" kullanılmıştır. Bu desen, her iki gruba da uygulama öncesinde ve sonrasında aynı ölçme araçlarının uygulanması yoluyla, bağımsız değişkenin bağımlı değişken üzerindeki etkisinin karşılaştırmalı olarak değerlendirilmesine imkân tanımaktadır (Karasar, 2000).

Katılımcılar

Araştırmanın katılımcılarını, İstanbul'da yaşayan ve işitme yetersizliği tanısı almış bireyler oluşturmaktadır. Katılımcılar, Bütün Engellileri Destekleme Derneği (BEDER) aracılığıyla gönüllülük esasına göre belirlenmiştir. Katılımcıların yaşları 19 ile 24 arasında değişmektedir. Çalışmaya deney grubunda 12, kontrol grubunda 12 olmak üzere toplam 24 kişi dâhil edilmiştir. Gruplar, yaş, eğitim düzeyi ve işitme düzeyi açısından birbirine benzer özellikler göstermektedir. Araştırma başlamadan önce katılımcılar, çalışmanın amacı, uygulama süreci ve gizlilik esasları hakkında bilgilendirilmiş, katılımın gönüllülük esasına dayalı olduğu açıklanmış ve tüm katılımcılardan yazılı onam alınmıştır. Çalışmanın tüm aşamalarında işaret dili uzmanı desteği veya yazılı iletişim yoluyla katılımcılarla etkin etkileşim sağlanmıştır. Araştırmaya katılım için belirli ölçütler tanımlanmıştır. Çalışmaya dâhil edilebilmek için

bireylerin işitme yetersizliği tanısına sahip olması, 18–65 yaş aralığında bulunması, en az beş yıl süreyle örgün eğitim almış olması ve bilgilendirilmiş gönüllü onam formunu imzalaması gerekmektedir. Bunun yanında, ciddi nörolojik ya da psikiyatrik tanısı olan, madde kullanım öyküsü bulunan veya genel tıbbi durumu araştırma sürecine katılımını engelleyebilecek bireyler çalışmaya dâhil edilmemiştir.

Veri Toplama Araçları

Araştırmada veri toplamak amacıyla Psikolojik İyi Oluş Ölçeği ve Sosyal Becerileri Değerlendirme Ölçeği kullanılmıştır. Çalışmada kullanılan ölçekler için, geliştirici ve uyarlama çalışmalarını yapan araştırmacılardan kullanım izni alınmıştır. Ölçeklerin psikometrik özellikleri aşağıda yer almaktadır.

Psikolojik İyi Oluş Ölçeği (PİOÖ),

Diener ve arkadaşları tarafından 2010 yılında geliştirilmiştir. Ölçek toplam sekiz maddeden oluşmaktadır. Katılımcılar her bir maddeye, "kesinlikle katılıyorum" ile "kesinlikle katılmıyorum" arasında değişen yedili Likert tipi bir derecelendirme üzerinden yanıt vermektedir. Ölçekten alınabilecek toplam puan 8 ile 56 arasında değişmekte olup, yüksek puanlar bireyin sahip olduğu psikolojik kaynakların ve güçlerin daha fazla olduğuna işaret etmektedir. Geliştirici çalışmalarda ölçeğin iç tutarlılığı Cronbach alfa katsayısı .87 olarak belirlenmiştir. Ölçek, Telef (2013) tarafından Türkçe'ye uyarlanmış ve yapılan güvenirlik çalışmalarında Cronbach alfa katsayısı .80 olarak rapor edilmiştir. Ayrıca test-tekrar test yöntemiyle yapılan incelemelerde, birinci ve ikinci uygulama sonuçları arasında yüksek düzeyde pozitif ve anlamlı bir ilişki olduğu saptanmıştır ($r = .86$, $p < .01$). Mevcut araştırmada Psikolojik İyi Oluş Ölçeği'nin (PİOÖ) Cronbach alfa güvenirlik katsayısı .94 olarak bulunmuş, bu değer ölçeğin yüksek düzeyde iç tutarlılığa sahip olduğunu göstermektedir.

Sosyal Becerileri Değerlendirme Ölçeği (SBDÖ)

Sosyal Becerileri Değerlendirme Ölçeği, Kara ve Çam'ın (2007) yürüttükleri *"Yaratıcı Drama Yönteminin Bazı Sosyal Becerilerin Kazandırılmasına Etkisi"* başlıklı araştırma kapsamında geliştirilmiştir. Ölçek, genç yetişkinlerin sosyal becerilerini ölçmeye yönelik olarak hazırlanmış ve üç alt boyuttan oluşmaktadır. Toplam 15 maddeden oluşan ölçekte yanıtlar, beşli Likert tipi derecelendirme ile "kesinlikle katılmıyorum" (1) ile "kesinlikle katılıyorum" (5) arasında puanlanmaktadır. Ölçekten elde edilebilecek toplam puan 15 ile 75 arasında değişmekte, yüksek puanlar bireylerin sosyal beceri düzeyinin yüksekliğine işaret etmektedir. Alt boyutlar; "grupla bir işi yapma ve yürütme becerileri", "ilişkiyi başlatma ve sürdürme becerileri" ve "kendini kontrol etme becerileri"dir. Ölçeğin geliştirilme sürecinde, yapı geçerliğini incelemek amacıyla Atatürk Üniversitesi Bayburt Eğitim Fakültesi İlköğretim Bölümü'nde öğrenim gören ve deney–kontrol gruplarına dahil edilmeyen 100 üniversite öğrencisinden veri toplanmıştır. Elde edilen veriler üzerinde Temel Bileşenler Analizi yapılmış, özdeğeri 1'in üzerinde olan faktörler belirlenmiş ve varimax döndürme yöntemi uygulanmıştır. Analiz sonucunda üç faktörlü bir yapı elde edilmiş ve bu faktörler toplam varyansın %51,16'sını açıklamıştır. Faktör yükleri birinci boyutta .76–.78, ikinci boyutta .62–.73, üçüncü boyutta ise .43–.73 arasında değişmiştir. Ölçeğin güvenirliğine ilişkin Cronbach alfa katsayıları, ölçeğin bütünü için .84; alt boyutlar için sırasıyla .79, .71 ve .70 olarak rapor edilmiştir. Mevcut araştırmada ise SBDÖ'nün alt boyutlarına ilişkin Cronbach alfa güvenirlik katsayıları; Grupla Bir İşi Yapma ve Yürütme Becerileri (GBİY) için .79, İlişkiyi Başlatma ve Sürdürme Becerileri (İBVS) için .76 ve Kendini Kontrol Etme Becerileri (KKEB) için .75 olarak hesaplanmıştır. Bu bulgular, ölçeğin mevcut örneklemde kabul edilebilir düzeyde güvenirliğe sahip olduğunu göstermektedir.

Verilerin Analizi

Araştırmada kullanılan ölçme araçlarıyla elde edilen veriler, araştırmanın genel amaçları doğrultusunda analiz edilmiştir. Verilerin çözümlenmesinde gerekli istatistiksel işlemler için SPSS 25.0 paket programından yararlanılmıştır. Literatürde, katılımcı sayısının düşük olduğu durumlarda dağılımın normal olmama olasılığına dikkat çekilmekte ve bu tür durumlarda parametrik olmayan testlerin tercih edilmesi gerektiği belirtilmektedir (Drew vd., 1996). Bu doğrultuda, çalışmada hem denek sayısının sınırlı olması hem de verilerin normal dağılım göstermemesi nedeniyle parametrik olmayan testler kullanılmıştır. Verilerin analizinde, gruplar arası karşılaştırmalar için Mann-Whitney U testi, grup içi karşılaştırmalar için ise Wilcoxon İşaretli Sıralar Testi uygulanmıştır.

Sanatla Terapi Programının Hazırlanması ve Uygulanması

Program, işitme yetersizliği olan bireylerin ihtiyaçları dikkate alınarak düzenlenmiştir. Oturumlarda ağırlıklı olarak görsel, dokunsal ve yazılı materyaller kullanılmış, yönergeler işaret dili ve yazılı metin desteğiyle sunulmuştur. Böylece katılımcıların etkinlikleri kolayca takip etmeleri ve sürece aktif olarak katılmaları sağlanmıştır. Bazı oturumlarda yer alan gözler kapalı imgeleme çalışmaları, yazılı ve işaret dili aracılığıyla desteklenmiş, katılımcıların güvenli biçimde hayal süreçlerine katılmaları teşvik edilmiştir. Yaratıcı drama ve grup çalışmalarında iletişimin güçlenmesi için yazılı yönergeler ve senaryo desteği sunulmuştur. Bu uyarlamalar sayesinde program, işitme engelli bireylerin katılımına uygun hale getirilmiş ve onların duygusal, sosyal ve sanatsal ifade olanaklarını geliştirmeleri için erişilebilir bir yapı kazanmıştır. Oturumlar proje yürütücüsü tarafından çeşitli kaynaklardan yararlanılarak geliştirilmiş (Akfırat, 2004; Eracar, 2013; Hoggard, 2006; Jalali vd., 2021).

I. Oturum

Amaç
Katılımcıların kendi duygu ve düşüncelerini görsel olarak ifade etmelerine olanak sağlamak

Malzemeler
Resim kâğıdı, pastel boya, keçeli kalem, renkli kâğıtlar, makas ve yapıştırıcı.

Süreç

1. Katılımcılara şu yönerge verilmiştir: “Bir çiçek hayal edin. Bu çiçek sizin aklınıza gelen ilk çiçek olabilir. Çiçeği seçerken güzel olup olmamasına bakmayın, aklınıza gelen ilk görüntüyü kullanın.
2. Katılımcılardan, zihinde beliren ya da görsellerden ilham aldıkları çiçeği kendi seçtikleri renk ve biçimde kâğıda çizmeleri istenmiştir. Çizim tamamlandıktan sonra katılımcılardan, dilerlerse yanına kısa bir kelime yazarak (örn. “mutluluk”, “özgürlük”, “güç”) o çiçeğin kendilerine ne hissettirdiğini ifade etmeleri beklenmiştir.

II. Oturum

Amaç

Katılımcıların "şimdi ve burada" yaşadıkları duyguların farkına varmaları ve bu duyguları uygun yollarla ifade etme becerilerini geliştirmek.

Malzemeler

Kâğıt ve yazı gereçleri, boya kalemleri, pastel boya ya da keçeli kalem.

Süreç

1. Katılımcılardan gözlerini kapatmaları ve zihinlerinde bir çember canlandırmaları istenmiştir. Canlandırırken renklere, desenlere odaklanmaları sağlanmıştır.
2. Zihinlerinde beliren çemberi kâğıt üzerinde istedikleri gibi şekillendirip, renklendirmeleri istenmiştir.
3. Ortaya çıkan mandala hakkında ne hissediyorsunuz? Bu mandala sizin için ne anlam ifade ediyor? Bu mandala size ne söylüyor? Hangi renkleri kullandınız? Kullandığınız renkler sizin için ne anlama geliyor?" gibi sorular eşliğinde katılımcılar mandalaları üzerinden duygu ve düşüncelerini paylaşmışlardır. Paylaşımlar sırasında işaret dili desteği sağlanmış, böylece tüm katılımcıların sürece aktif biçimde katılımı kolaylaştırılmıştır.

III. Oturum

Amaç

Katılımcıların başa çıkamadıkları duygularını yok saymaları, değiştirmeleri yerine onlarla olan ilişki biçimlerini değiştirerek başa çıkılamayan durumlara karşı dayanıklılıklarını kazandırmak.

Malzemeler

Kâğıt ve yazı gereçleri, kil ve her türlü sanat materyalleri.

Süreç

1. Katılımcıların rahat bir şekilde oturmaları sağlanmış ve işaret dili desteği ile nefes egzersizleri uygulanmıştır. Katılımcıların, zorlayıcı duygularını yok saymadan bedensel duyumlarına odaklanmaları istenmiştir. Daha sonra "Bu duygunun şekli nasıl olurdu? Rengi nedir? Sıcak mı soğuk mu? Yumuşak mı sert mi? Büyük mü küçük mü? Ağırlığı ne kadar?" gibi sorular yazılı ve görsel desteklerle yöneltilmiştir. Katılımcılardan önlerine konulan kili ve diğer sanat malzemelerini kullanarak kendilerini zorlayan duygularının bir heykelini yapmaları istenmiştir.
2. Katılımcılar, yapmış oldukları heykellerin boyutu, rengi ve şekilleri üzerinden değerlendirme yapmışlardır. "Bu zorlayıcı duyguyu deneyimlediğiniz için kendinizle ilgili neler düşündünüz? Bu duyguyu hissettiğinizde kendinizi yargıladınız mı?" gibi sorular yöneltilmiş ve grup tartışmaları yapılmıştır. Ardından, katılımcıların heykelleri üzerinden neleri değiştirebilecekleri ve neleri değiştiremeyecekleri üzerine düşünmeleri sağlanmıştır. İsteyen katılımcılar heykellerinde değişiklik yapmış ya da yeni bir heykel oluşturmuştur.

IV. Oturum

Amaç

Katılımcıların şimdi ve burada duygularını fark etmeleri ve bu duyguları yazılı ya da görsel yollarla ifade etme becerilerini geliştirmeleri amaçlanmıştır.

Malzemeler

Kâğıt ve yazı gereçleri, boya kalemleri, pastel boya ya da keçeli kalem, resim kâğıdı, renkli kağıtlar.

Süreç

1. Duygu manzarasının katılımcının tüm duygularının bir resmi olarak tanımlanır ve katılımcılara manzarayı yaratmak, duygularını temsil etmek için renkleri kullanacakları belirtilmiştir.
2. Katılımcılar, resimlerini kendi duygularının bir ifadesi haline getirmeleri için teşvik edilmiş ve resimlerinin sanatsal olması ya da bir şeye benzemesi gerekmediği hatırlatılmıştır.
3. Katılımcılar, resimleri ve kullandıkları renkler hakkında konuşarak, duygularını ifade etmeleri için davet edilmiştir (örn., "Ben sarıyım ve utanıyorum").
4. Katılımcılara "Duygularının görünür kılmak sana nasıl hissettirdi? Kendinle ile ilgili bir şey fark ettin mi?" gibi sorular yöneltilerek çalışma tamamlanmıştır.

V. Oturum

Amaç

Görsel ve somut bir biçimde duygularının farkına varma ve duygularını ifade etme becerilerini geliştirmek.

Malzemeler

Kâğıt ve yazı gereçleri, dergi, gazete gibi basılı görsel materyaller, boya kalemleri, renkli kağıtlar, yapıştırıcı ve kişisel tercihe bağlı olarak; tüy, sim, pul, boncuk, kurdele, ip, düğme, pamuk, kumaş parçaları gibi her türlü sanat materyalleri.

Süreç

1. Katılımcıların kendileriyle ilgili hangi yönlerini keşfedebilecekleri (Katılımcıların duyguları, konuları, olaylar, ilişkiler vb.) belirlenecek ve seçilen konuya odaklanmaları istenmiştir.
2. Katılımcılardan dergilerden çalışmış olduğu konuya ilişkin yakın hissettikleri resimleri kesip karton üzerine yapıştırmaları sağlanmıştır.
3. Kolaj tamamlandıktan sonra kolajın bütününün nasıl göründüğü ve neler hissettirdiği katılımcılar tarafından yorumlanması istenmiştir.

VI. Oturum

Amaç

Grup üyelerinin kendilerinde öfke duygusunu uyandıran durumlar ve öfkelendiklerinde verdikleri tepkilerin neler olduğu yönünde farkındalık geliştirmelerini sağlamak.

Malzemeler

Karton, elişi kâğıdı, boncuklar, kurdeleler, boyalar, düğmeler, müzik, masa, sandalye.

Süreç

1. Katılımcılara kendilerine verilen malzemelerle öfkeli bir görünümde maske yapmaları istenmiştir. Maskelerin keskin dişler, çatık kaşlar ya da ağızdan sarkan bir dil gibi öfkeyi temsil eden unsurlarla zenginleştirilmesi sağlanmıştır.

~~2.~~1. Katılımcılar gruplara ayrılmış ve hazırlamış oldukları maskeler üzerinden kısa bir yaratıcı drama etkinliği gerçekleştirmiştir. Drama süreci işaret dili desteği ve beden dili odaklı uygulamalarla yürütülmüş, böylece işitme engelli katılımcıların etkinliğe aktif katılımı sağlanmıştır. Katılımcılar maskelerini kullanarak öfke duygusunu temsil eden kısa sahneler sergilemiş, ardından bu deneyim üzerinden duygu ve düşünceler paylaşılmıştır.

VII. Oturum

Amaç

Katılımcıların spontanite ve yaratıcı çözüm becerilerini geliştirmek

Malzemeler

Yazı araçları.

Süreç

Katılımcılar iki gruba ayrılmıştır. Her bir gruptan, sonu önceden belirlenmeyen ve içinde grup üyeleri kadar rollerin bulunduğu bir hikâye oluşturmaları istenmiştir. Gruplar senaryolarını oluşturduktan sonra hikâyelerini diğer grupla paylaşmış ve roller dağıtılmıştır. Katılımcılar, hazırladıkları hikâyeyi canlandırmış ve hikâyeyi spontan biçimde sonlandırmışlardır. Etkinlik sürecinde katılımcıların aktif katılımını sağlamak için işaret dili desteği ve beden dili odaklı canlandırmalar kullanılmıştır. Böylece katılımcılar hem sözel hem de sözel olmayan yollarla rol deneyimlerini ifade edebilmişlerdir. Son aşamada, “Senaryoda hangi rolü alacağınıza nasıl karar verdiniz? Aldığınız rolle ilgili duygularınız neydi? Senaryo dışında kendinizden role neler kattınız? Role kattıklarınız sizi nasıl hissettirdi?” gibi sorular üzerinden grup tartışması yürütülmüştür.

VIII. Oturum

Amaç

Katılımcıların kendilerini keşfetmeleri, güçlü yönlerini keşfetmelerini sağlamak.

Malzemeler

A3 resim kağıtları, A4 kâğıdı, kalem ve her türlü sanat malzemesi ve kartondan hazırlanmış saksılar

Süreç

1. Benim Bahçem" etkinliği için "*Şimdi elinizdeki iki boyutlu saksıyı almanızı istiyorum. Bu saksıya bir bitki hayal edin. Bitkiniz bilinen bir bitki veya hayalinizdeki yarattığınız bir bitki olabilir. Bu bitkinin yaprakları, çiçekleri ve meyveleri olacak. Bu yapraklara, meyvelere ve çiçeklere tek kelime ile kendi güçlü yönlerinizi yazın. Bitkilerinizi tamamladığınızda önünüzde bulunan büyük kâğıda bitkinizi yapıştırın. Burası senin bahçen. Saksının dışında kalan yerlerde bahçe oluşturun. Hayvanlar, başka bitkiler, oyun alanları, su, oturma alanları belki de insanlar çizebilirsiniz ve bahçenize bir isim verebilirsiniz.*" yönergesi verilmiştir.
2. Etkinlik sonrasında katılımcılara "Bitkiniz burada kendini nasıl hissediyor?" ve "Bitkinizin ihtiyacı olan şeyler var mı?" gibi sorular yöneltilmiştir. Ardından, katılımcılardan, bitkilerini temsil edecek bir sembol (örneğin yıldız, güneş, dalga gibi) çizmeleri istenmiştir. Bu sembol aracılığıyla kendi güçlü yönlerini görsel ve simgesel bir biçimde ifade etmeleri teşvik edilmiştir.

2.6. Veri Toplama Süreci

Bu çalışma için İstanbul Gelişim Üniversitesi Etik Kurulu'ndan 29.07.2024 tarihinde 2024-11 no'lu karar ile etik onay alınmıştır. Ayrıca araştırma, İstanbul Gelişim Üniversitesi tarafından desteklenen ve proje numarası SHIZ-2025-288 olan bilimsel araştırma projesi kapsamında yürütülmüştür. Program sekiz oturumdan oluşmuş ve başlangıçta her bir oturum 180 dakika olarak planlanmıştır. Katılımcıların dikkat süreleri, iletişim gereksinimleri ve uygulamaların niteliği dikkate alınarak deney grubu iki alt gruba ayrılmış, her bir oturum süresi 120 dakika olarak düzenlenmiştir. Deney grubunda başlangıçta 12 katılımcı yer almış, ancak bir katılımcının oturumlara düzenli katılım göstermemesi nedeniyle analizler 11 kişi üzerinden gerçekleştirilmiştir. Deney grubu 6'şar kişiden oluşan iki alt grup halinde çalışmıştır. Oturumlarda işaret dili uzmanı görev almış, bu sayede katılımcıların sanat temelli etkinliklere etkin biçimde katılımları sağlanmış ve tüm yönergeler ile grup paylaşımları işaret dili desteğiyle yürütülmüştür. Araştırma uygulamaları 03.07.2025 tarihinde başlamış ve 21.08.2025 tarihinde tamamlanmıştır.

BULGULAR

Bu bölümde verilere ait analiz sonuçlarına yer verilmiştir

Tablo 1. Deney ve Kontrol Gruplarının Psikolojik İyi Oluş Ölçeği ve Sosyal Beceriler Alt Boyutları (Grupla Bir İşi Yapma ve Yürütme, İlişkiyi Başlatma ve Sürdürme, Kendini Kontrol Etme) Öntest Puanlarının Mann-Whitney U Testi Sonuçları

	Grup	n	Sıra ortalaması	Sıra toplamı	U	Z	p
PİOÖ	Deney	11	14,32	157,50	40.50	-1,573	,116
	Kontrol	12	9,88	118,50			
GBİY	Deney	11	12,05	132,50	65.50	-,031	,975
	Kontrol	12	11,96	143,50			
İBVS	Deney	11	12,50	137,50	60.50	-,342	,732
	Kontrol	12	11,54	138,50			
KKTB	Deney	11	10,18	112,00	46.00	-1,242	,214
	Kontrol	12	13,67	164,00			

Not. PİOÖ= Psikolojik İyi Oluş; GBİY = Grupla Bir İşi Yapma ve Yürütme; İBVS = İlişkiyi Başlatma ve Sürdürme; KKTB = Kendini Kontrol Etme Becerileri.

Tablo 1'de görüldüğü üzere deney ve kontrol gruplarının Psikolojik İyi Oluş Ölçeği ile Sosyal Becerileri Değerlendirme Ölçeği'nin alt boyutlarına ilişkin öntest puanları karşılaştırıldığında istatistiksel olarak anlamlı bir fark bulunmamıştır ($p > .05$). Bu bulgu uygulama öncesinde grupların başlangıç düzeylerinin benzer olduğunu göstermektedir.

Tablo 2. Deney ve Kontrol Gruplarının Psikolojik İyi Oluş Ölçeği ve Sosyal Beceriler Alt Boyutları (Grupla Bir İşi Yapma ve Yürütme, İlişkiyi Başlatma ve Sürdürme, Kendini Kontrol Etme) Öntest ve Sontest Puan Ortalamaları

		Deney Grubu			Kontrol Grubu		
		n	Ortalama	Ss	n	Ortalama	Ss
PİOÖ	Ön Test	11	29,27	9,18	12	23,41	7,03
	Son Test	11	34,09	10,19	12	21,33	4,96
GBİY	Ön Test	11	13,45	4,30	12	12,91	3,70
	Son Test	11	16,81	5,19	12	13,58	3,70
İBVS	Ön Test	11	13,90	3,59	12	13,16	2,08
	Son Test	11	16,18	3,12	12	14,16	4,01
KKEB	Ön Test	11	11,36	2.83	12	12,83	3,06
	Son Test	11	12,00	3,92	12	10,75	3,79

Not. PİOÖ= Psikolojik İyi Oluş; GBİY = Grupla Bir İşi Yapma ve Yürütme; İBVS = İlişkiyi Başlatma ve Sürdürme; KKTB = Kendini Kontrol Etme Becerileri.

Tablo 2'de görüldüğü üzere deney grubundaki katılımcıların Psikolojik İyi Oluş Ölçeği ve Sosyal Becerileri Değerlendirme Ölçeği'nin tüm alt boyutlarında sontest puan ortalamaları öntest puan ortalamalarına kıyasla artış göstermektedir. Kontrol grubunda ise öntest ve sontest ortalamaları arasında belirgin bir değişim gözlenmemektedir.

Tablo 3. Deney Grubundaki Katılımcıların Psikolojik İyi Oluş Ölçeği ve Sosyal Beceriler Alt Boyutları (Grupla Bir İşi Yapma ve Yürütme, İlişkiyi Başlatma ve Sürdürme, Kendini Kontrol Etme) Öntest–Sontest Puanlarının Wilcoxon İşaretli Sıralar Testi Sonuçları

	Sıra İşaretleri	n	Sıra Ortalaması	Sıra Toplamı	Z	p
PİOÖ	Negatif Sıra	2	5,00	10,00	-2,052	,040
	Pozitif Sıra	9	6,22	56,00		
	Eşit	0				
GBİY	Negatif Sıra	2	2,00	4,00	-2,419	,016
	Pozitif Sıra	8	6,38	51,00		
	Eşit	2				
İBVS	Negatif Sıra	1	4,50	4,50	-2,144	,032
	Pozitif Sıra	8	5,06	40,50		
	Eşit	2				
KKEB	Negatif Sıra	3	5,17	15,50	-1,253	,210
	Pozitif Sıra	7	5,64	39,50		
	Eşit	1				

Not. PİOÖ= Psikolojik İyi Oluş; GBİY = Grupla Bir İşi Yapma ve Yürütme; İBVS = İlişkiyi Başlatma ve Sürdürme; KKTB = Kendini Kontrol Etme Becerileri.

Tablo 3 incelendiğinde deney grubunun Psikolojik İyi Oluş Ölçeği öntest ve sontest skorları arasında istatistiksel olarak anlamlı bir farklılık olduğu görülmektedir ($z= -2,052$. $p < .05$). Benzer şekilde. Sosyal Becerileri Değerlendirme Ölçeği'nin Grupla Bir İşi Yapma ve Yürütme Becerileri ($z= -2,419$. $p < .05$) ve İlişkiyi Başlatma ve Sürdürme Becerileri ($z= -2,144$. $p < .05$) alt boyutlarında da sontest lehine anlamlı artışlar bulunmuştur. Buna karşın Kendini Kontrol Etme Becerileri alt boyutunda öntest ve sontest skorları arasında anlamlı bir farklılık saptanmamıştır ($z= -1,253$. $p > .05$).

Tablo 4. Kontrol Grubundaki Katılımcıların Psikolojik İyi Oluş Ölçeği ve Sosyal Beceriler Alt Boyutları (Grupla Bir İşi Yapma ve Yürütme, İlişkiyi Başlatma ve Sürdürme, Kendini Kontrol Etme) Öntest–Sontest Puanlarının Wilcoxon Testi Sonuçları

	Sıra İşaretleri	n	Sıra Ortalaması	Sıra Toplamı	Z	p
PİOÖ	Negatif Sıra	6	7,83	47,00	-1,250	,211
	Pozitif Sıra	5	3,80	19,00		
	Eşit	1				
GBİY	Negatif Sıra	5	5,60	28,00	-,871	,384
	Pozitif Sıra	7	7,14	50,00		
	Eşit	0				
İBVS	Negatif Sıra	5	5,70	28,50	-,836	,403
	Pozitif Sıra	7	7,07	49,50		
	Eşit	0				
KKEB	Negatif Sıra	8	6,75	54,00	-1,875	,061
	Pozitif Sıra	3	4,00	12,00		
	Eşit	1				

Not. PİOÖ= Psikolojik İyi Oluş; GBİY = Grupla Bir İşi Yapma ve Yürütme; İBVS = İlişkiyi Başlatma ve Sürdürme; KKTB = Kendini Kontrol Etme Becerileri.

Tablo 4 incelendiğinde kontrol grubunun Psikolojik İyi Oluş Ölçeği ve Sosyal Becerileri Değerlendirme Ölçeği'nin alt boyutlarında öntest ve sontest puanları arasında anlamlı bir farklılık saptanmamıştır. PİOÖ ($Z = -1,250$. $p > .05$). GBİY ($Z = -,871$. $p > .05$). İBVS ($Z = -,836$. $p > .05$) ve KKEB ($Z = -1,875$. $p > .05$) için öntest–sontest puanları arasında istatistiksel olarak anlamlı bir değişim gözlenmemiştir.

Tablo 5. Deney ve Kontrol Gruplarının Psikolojik İyi Oluş Ölçeği (PİOÖ) ve Sosyal Beceriler Alt Boyutları (Grupla Bir İşi Yapma ve Yürütme, İlişkiyi Başlatma ve Sürdürme, Kendini Kontrol Etme) Sontest Puanlarının Mann-Whitney U Testi Sonuçları

	Grup	n	Sıra ortalaması	Sıra toplamı	U	Z	p
PİOÖ	Deney	11	16,50	181,50	16,50	-3,052	,002
	Kontrol	12	7,88	94,50			
GBİY	Deney	11	14,36	158,00	40,00	-1,614	,107
	Kontrol	12	9,83	118,00			
İBVS	Deney	11	14,05	154,50	43,50	-1,390	,164
	Kontrol	12	10,13	121,50			
KKEB	Deney	11	13,14	144,50	53,50	-,778	,437
	Kontrol	12	10,96	131,50			

Not. PİOÖ= Psikolojik İyi Oluş; GBİY = Grupla Bir İşi Yapma ve Yürütme; İBVS = İlişkiyi Başlatma ve Sürdürme; KKTB = Kendini Kontrol Etme Becerileri.

Tablo 5 incelendiğinde, deney ve kontrol gruplarının Psikolojik İyi Oluş Ölçeği sontest skorları arasında istatistiksel olarak anlamlı bir farklılık olduğu görülmektedir ($U = 16,50$, $Z = -3,052$, $p < .01$). Bu bulgu, sanat terapisi programına katılan bireylerin psikolojik iyi oluş düzeylerinin kontrol grubuna göre anlamlı şekilde yükseldiğini göstermektedir. Ancak Sosyal Becerileri Değerlendirme Ölçeği'nin alt boyutları olan Grupla Bir İşi Yapma ve Yürütme Becerileri, İlişkiyi Başlatma ve Sürdürme Becerileri ve Kendini Kontrol Etme Becerileri açısından deney ve kontrol gruplarının sontest puanları arasında anlamlı bir farklılık saptanmamıştır ($p > .05$).

TARTIŞMA

Bu araştırmada, Sanat Terapisi Programının işitme yetersizliği olan bireylerin psikolojik iyi oluş ve sosyal beceri düzeylerine etkisi incelenmiştir. Araştırmadan elde edilen bulgular, deney grubundaki katılımcıların psikolojik iyi oluş düzeylerinin anlamlı biçimde arttığını göstermiştir. Sosyal beceriler açısından ise Grupla Bir İşi Yapma ve Yürütme Becerileri ile İlişkiyi Başlatma ve Sürdürme Becerilerinde deney grubu lehine anlamlı bir artış gözlenmiş ancak Kendini Kontrol Etme Becerilerinde anlamlı bir değişim saptanmamıştır. Kontrol grubunda ise ölçümler arasında anlamlı bir farklılık bulunmamıştır. Deney ve kontrol gruplarının son-test puanları karşılaştırıldığında, psikolojik iyi oluş düzeylerinde deney grubu lehine anlamlı bir fark ortaya çıkarken, sosyal becerilerin alt boyutları açısından gruplar arasında anlamlı bir fark gözlenmemiştir.

Bu araştırmanın bulgularından biri, Sanat Terapisi Programının işitme yetersizliği olan bireylerin psikolojik iyi oluş düzeyleri üzerinde anlamlı bir etkiye sahip olduğudur. Elde edilen sonuçlar, sanat temelli müdahalelerin, bireylerin psikolojik iyi oluşunu desteklemede işlevsel bir araç olabileceğine işaret etmektedir. Bu bulgu, sanat temelli süreçlerin psikolojik iyi oluşu güçlendirebildiğine dair alanyazınla uyumludur (Macrì & Limoni, 2017; Sharmıla vd., 2021). Oturumlarda görsel üretime dayalı etkinliklerin özellikle sözel akışın sınırlanabildiği işitme yetersizliği bağlamında duyguların güvenli ve erişilebilir biçimde dışavurulmasını

kolaylaştırmış olabilir. Bunun yanında, grup içinde paylaşım yapabilme ve ortak üretim sürecine katılma, katılımcıların aidiyet hissini artırarak psikolojik iyi oluşu desteklemiş olabilir. Nitekim bazı çalışmalar, sanat terapisinin yalnızca bireysel değil, aynı zamanda grup bağlamında uygulandığında sosyal destek ve kabul algısını da güçlendirdiğini göstermektedir (Epp, 2008; Fraser & Keating, 2014). Dolayısıyla, bu çalışmanın bulguları sanat terapisinin hem bireysel içgörü hem de grup temelli destek yoluyla psikolojik iyi oluşu geliştirebileceğini ortaya koymaktadır

Araştırma bulgularından bir diğeri, Sosyal Becerileri Değerlendirme Ölçeği'nin Grupla Bir İşi Yapma ve Yürütme Becerileri ile İlişkiyi Başlatma ve Sürdürme Becerileri alt boyutlarında sontest lehine anlamlı artışların gözlenmesidir. Bu sonuç, çalışmamızda elde edilen psikolojik iyi oluş düzeylerindeki artış ile de tutarlı bir görünüm sergilemektedir. Nitekim işitme yetersizliği olan bireylerde psikolojik iyi oluşun kişilerarası işlevlerle yakından ilişkili olduğu önceki araştırmalarda ortaya konmuştur (Marzuki vd., 2018). Ayrıca, bu bireylerin günlük yaşamda iletişim engelleri ve sosyal dışlanma ile karşılaştıkları, bunun da yalnızlık ve toplumsal izolasyon duygularını pekiştirdiği literatürde vurgulanmaktadır (Olsson vd., 2021). Dolayısıyla, sanat terapisi programımızın görsel ve sembolik ifade yollarını kullanması, işitme yetersizliği olan bireylerde söz konusu engelleri aşmayı kolaylaştırarak sosyal becerilerde gelişim sağlaması açısından beklenen ve anlamlı bir bulgu olarak değerlendirilebilir. Öte yandan, Kendini Kontrol Etme Becerileri alt boyutunda anlamlı bir değişim saptanmamıştır. Bu bulgu, sanat terapisinin daha çok duygu farkındalığı ve sosyal etkileşim alanlarını güçlendirdiğini, buna karşılık duygusal olgunluk ve çatışma çözme gibi becerilerin ise genellikle daha uzun süreli ya da bireysel müdahaleler sonucunda geliştiğini düşündürmektedir.

Çalışmamızda elde edilen bulgulardan biri, deney ve kontrol gruplarının Psikolojik İyi Oluş Ölçeği sontest puanları arasında deney grubu lehine anlamlı bir farklılık bulunmasıdır. Bu sonuç, sanat terapisi programına katılan işitme yetersizliği olan bireylerin psikolojik iyi oluş düzeylerinde anlamlı bir gelişim sağlandığını göstermektedir. Alanyazında, sanat terapisinin işitme yetersizliği olan bireylerde sözel olmayan ifade yolları aracılığıyla benlik algısını güçlendirme ve olumsuz duygularla başa çıkma açısından yararlı olduğu vurgulanmaktadır (Dahan & Regev, 2025). Nitekim çocuklarla yapılan çalışmalarda sanat terapisi, değersizlik duygularının azaltılması ve olumlu bir benlik algısının geliştirilmesine katkı sağlayan bir yöntem olarak tanımlanmıştır (Boyle & Dunn-Snow, 2019). Bu bulgu, araştırmamızda yetişkin bireylerde gözlenen psikolojik iyi oluş artışını destekler niteliktedir. Buna karşın, Sosyal Becerileri Değerlendirme Ölçeği'nin alt boyutları açısından deney ve kontrol grupları arasında anlamlı bir farklılık gözlenmemiştir. Bu durum, sosyal becerilerin gelişiminin çoğunlukla daha uzun süreli ya da doğrudan kişilerarası etkileşim temelli müdahalelerle desteklenebildiğini düşündürmektedir.

Bu araştırmanın bazı sınırlılıkları bulunmaktadır. İlk olarak, çalışma grubu oldukça sınırlı bir örneklemden oluşmaktadır. Deney grubu 11, kontrol grubu ise 12 katılımcıdan oluşmuş olup toplam 23 kişiyle yürütülmüştür. Bu durum, elde edilen bulguların genellenebilirliğini sınırlandırmaktadır. İkinci olarak, katılımcıların yaş aralığı 19–24 ile sınırlı olduğundan, farklı yaş gruplarında benzer sonuçların elde edilip edilemeyeceği belirsizdir ve bu husus sonuçların yorumlanmasında dikkate alınmalıdır. Üçüncü olarak, uygulanan sanat terapisi programı sekiz oturumdan oluşmuş ve görece kısa süreli bir müdahale niteliği taşımaktadır. Çalışmada psikolojik iyi oluşta anlamlı artış ve sosyal becerilerin bazı alt boyutlarında gelişim sağlanmış olsa da daha uzun süreli veya farklı içeriklerle yapılandırılmış programların etkilerinin daha kapsamlı olabileceği göz önünde bulundurulmalıdır. Dördüncü olarak, araştırmada kullanılan ölçme araçları öz-bildirim temelli olduğundan, katılımcıların yanıtlarının araştırmacıların beklentilerini karşılama eğiliminden etkilenmiş olabileceği unutulmamalıdır. Ayrıca yalnızca

nicel verilere dayalı olması, sanat terapisi sürecinde ortaya çıkan öznel deneyimlerin derinlemesine anlaşılmasını sınırlandırmaktadır. Beşinci olarak, katılımcıların işitme kaybı derecelerindeki farklılıklar (örneğin, ileri ya da orta düzey işitme kaybı) dikkate alınmamıştır. Bu durum, sanat terapisinin etkilerinin bireysel farklılıklara göre değişebileceğini düşündürmektedir. Son olarak, işitme yetersizliği olan bireylerde sanat terapisinin etkililiğine yönelik literatürün oldukça sınırlı olması, elde edilen bulguların alanyazınla karşılaştırılmasını güçleştirmektedir.

Araştırma bulgularından yola çıkılarak aşağıdaki öneriler geliştirilmiştir:

- Sanat terapisi programlarının, işitme yetersizliği olan bireylerde psikolojik iyi oluşu artırmada etkili olduğu görülmüştür. Bu nedenle benzer programların farklı yaş gruplarında, daha geniş örneklemlere uygulanması önerilmektedir.
- Yalnızca öz-bildirim ölçeklerinin kullanılması yerine, aile değerlendirmelerinin de sürece dâhil edilmesi gelecekteki araştırmalar için önem taşımaktadır.
- Bu araştırmada psikolojik iyi oluş ve sosyal beceri değişkenleri ele alınmıştır. Gelecek çalışmalarda işitme yetersizliği olan bireylerin benlik saygısı, yaşam doyumu ve psikolojik belirtiler üzerinde de sanat terapisinin etkililiği incelenebilir.
- Gelecek araştırmalarda sanat terapisi programlarının uzun vadeli etkilerini değerlendirmek amacıyla takip ölçümleri yapılması, elde edilen kazanımların sürdürülebilirliğini ortaya koyabilir.
- Sanat terapisi uygulamalarının, yalnızca işitme yetersizliği olan bireylerle sınırlı kalmayıp farklı engel gruplarında da sınanması, yöntemin psiko-sosyal müdahale aracı olarak geçerliliğini daha geniş bir çerçevede ortaya koyacaktır.

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ALG NEXUS YAKLAŞIMI: ÇAPRAZ SEKTÖREL UYGULAMALAR VE KARBON NÖTRLÜK VİZYONU

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ÖZET

Küresel iklim krizi karşısında, karbon nötrlüğe giden yolda alg biyoteknolojisi stratejik bir çözüm olarak öne çıkmaktadır. Bu çalışma, tekil uygulamalardan ziyade enerji, çimento, tekstil, lastik, yem ve gıda gibi sektörleri bütünleştiren çok boyutlu bir "alg nexus" yaklaşımını tartışmaktadır. Alglerin temel avantajı, fotosentez yoluyla atmosferdeki CO_2'yi yüksek hızda yakalayarak bunu çok işlevli ürünlere dönüştürebilmeleridir; üstelik bu süreç, karbon sekestrasyonunun yalnızca biyokütle üretimiyle sınırlı olmadığını, aynı zamanda biyo-ürünlerin fosil bazlı muadillerin yerini alarak dolaylı emisyon azaltımı sağladığını da göstermektedir. Güncel çalışmalar, 1 ton kuru alg biyokütlesinin 1.6–2.0 ton CO_2 sekestre edebildiğini açık sistemlerde ise hektar başına 30–40 ton CO_2 azaltımı sağlandığını ortaya koymaktadır. Böylece aynı biyokütle enerji, biyoplastik, yem ve pigment gibi çoklu ürün akışlarına yönlendirilebilmekte; çimento, lastik ve gıda gibi sektörlerde eşzamanlı karbon azaltımı ve katma değer üretilebilmektedir.

Küresel ölçekte emisyonlar 2000 yılında 25 $GtCO_2$ iken 2015'te 40 $GtCO_2$'yi aşmış, 2024'te 41,5 $GtCO_2$ seviyesinde sabitlenmesine rağmen atmosferik yoğunluk 422 ppm'e ulaşmıştır. Türkiye'de 2023 toplam emisyonu 552,2 $MtCO_2$-eq olup %71,6'sı enerji sektöründen kaynaklanmıştır; 2021–2023 arasında görülen %1,4'lük azalma ise yapısal dönüşümden çok kısa vadeli dalgalanmaların sonucudur. Bu tablo, alg nexus'un önemini yalnızca karbon tutumunda değil, aynı zamanda ekonomik dirençlilik ve yeşil dönüşümün hızlandırılmasında ortaya koymaktadır. Farkı yaratan, alglerin aynı anda hem emisyon azaltımı hem de yeni değer zincirleri üretmesi; yani iklim politikasını ekonomik kalkınma ile doğrudan ilişkilendirebilmesidir. Bu nedenle alg nexus, yalnızca çevresel değil; aynı zamanda ekonomik, teknolojik ve finansal dönüşümün de katalizörü olarak öne çıkmaktadır. Doğa Temelli Çözümler (NbS), Mavi Ekonomi ve Birleşmiş Milletler'in SKH hedefleriyle uyumlu olan bu yaklaşım, Türkiye'nin güncel emisyon profili ışığında iklim eylemi için bütüncül bir yol haritası sunmaktadır.

Anahtar Kelimeler: Alg biyoteknolojisi, nexus, sürdürülebilirlik, sanayi entegrasyonu, döngüsel ekonomi, karbon nötrlük

ALGAL NEXUS APPROACH: CROSS-SECTORAL APPLICATIONS AND THE VISION OF CARBON-NEUTRAL

ABSTRACT

In the face of the global climate crisis, algal biotechnology emerges as a strategic pathway toward carbon neutrality. Rather than focusing on single applications, this study advances a multidimensional "algal nexus" framework that integrates energy, cement, textiles, automotive, feed, and food sectors. The fundamental advantage of algae lies in their ability to rapidly capture atmospheric CO_2 through photosynthesis and convert it into multifunctional products. Importantly, this process demonstrates that carbon sequestration is not confined to biomass accumulation alone but also extends to the substitution of fossil-based products with bio-based alternatives, thereby delivering indirect emission reductions. Recent studies show that one ton of dry algal biomass can sequester approximately 1.6–2.0 tons of CO_2, while open systems can achieve 30–40 tons of CO_2 reduction per hectare annually. Such biomass can then be directed into diverse product streams—including bioenergy, bioplastics, feed, and pigments—enabling simultaneous carbon mitigation and value creation in sectors such as cement, automotive, and food.

Globally, CO_2 emissions have risen from 25 Gt in 2000 to over 40 Gt by 2015, stabilizing at around 41.5 Gt in 2024, yet atmospheric concentrations have continued to climb, reaching 422 ppm. In Turkey, total emissions in 2023 amounted to 552.2 $MtCO_2$-eq, with 71.6% originating from the energy sector; the modest 1.4% reduction observed between 2021 and 2023 reflects short-term fluctuations rather than structural transformation. Against this backdrop, the algal nexus underscores its significance not only as a tool for carbon capture but also as a driver of economic resilience and an accelerator of green transition. What makes algae distinctive is their dual role: reducing emissions while simultaneously generating new value chains, thereby linking climate policy directly to economic development. Consequently, the algal nexus emerges not merely as an environmental intervention but as a catalyst for economic, technological, and financial transformation. Aligned with Nature-based Solutions (NbS), the Blue Economy, and the United Nations Sustainable Development Goals (SDGs), this approach offers a holistic roadmap for climate action, particularly within the context of Turkey's current emissions profile.

Keywords: algal biotechnology; nexus; sustainability; industrial integration; circular economy; carbon neutrality

Introduction

Framing the Ecosystem Crisis and Stock–Flow Dynamics

The prevailing "business as usual" model is unsustainable. Rapid population growth, urbanization, and fossil fuel–driven production continue to destabilize ecosystems (WEF, 2023; IPCC, 2022). Global CO_2 emissions rose from 25 Gt in 2000 to 41 Gt in 2023, driving atmospheric concentrations from pre-industrial 280 ppm to over 412 ppm in 2022. High-emission scenarios project ~685 ppm by 2050 (IEA, 2023; NOAA, 2024). These figures highlight a key insight: stabilizing annual emissions slows the rate of increase but does not reduce atmospheric concentrations. Because natural sinks absorb only half of the ~40 Gt emitted each year, the remainder—about 20 Gt—adds ~+2.5 ppm annually (Friedlingstein et al., 2022; NOAA, 2024). Achieving net zero, where inflows equal outflows, is essential; beyond that, negative-emission pathways are required to actively reduce accumulated stocks (IPCC, 2022; Fuss et al., 2018).

Algal Biotechnology as Dual Pathway

Algal systems are unique in simultaneously displacing fossil emissions and reducing atmospheric carbon stocks. The stoichiometric relationship between biomass and CO_2 fixation has been consistently validated: one ton of dry algal biomass sequesters ~1.6–1.9 tons of CO_2 (Chisti, 2007; Wang et al., 2008; Hoque, 2025; Li, 2024). Large-scale studies confirm similar ranges: the U.S. DOE (2024) estimated 1.76 tCO_2 per ton. Field-scale evidence shows open ponds can reduce 30–40 tCO_2 per hectare annually (Slade & Bauen, 2013; Kumar et al., 2011). This distinguishes algae from conventional renewables: solar and wind mitigate inflows, but algae additionally remove carbon from the atmospheric stock.

Evolution of the Nexus Concept

The nexus framework, first framed within the water–energy–food (WEF) paradigm (Hoff, 2011), now extends to biodiversity, climate governance, and circular economy dynamics (Bleischwitz et al., 2018). The algal nexus expands this approach by linking photosynthetic

efficiency and carbon capture with industrial substitution and financial innovation. Algae provide biomass that acts as both a carbon sink and a versatile feedstock for biofuels, bioplastics, and food–feed systems (Singh & Gu, 2010; Wijffels & Barbosa, 2010). Moreover, integration into carbon credit systems and green finance mechanisms embeds algal biotechnology into policy and investment frameworks. In this sense, the algal nexus articulates a holistic paradigm that unites nature-based solutions, industrial transformation, and financial viability.

The Energy Sector: The Core of Emissions

The energy sector remains the largest global source of greenhouse gases, responsible for ~60–65% of emissions when electricity, heat, transport, industry, and buildings are combined (IEA, 2023). In Turkey, this share is even higher at 71.6% (TÜİK, 2023). Energy therefore represents the most critical domain for achieving carbon neutrality.

Beyond its magnitude, energy is structurally linked to other sectors—industry, transport, agriculture, and buildings all depend on it (IPCC, 2022). Without fundamental transformation of energy systems, decarbonization in other sectors is unattainable.

Current transition strategies prioritize renewable electricity (solar, wind, hydro, nuclear), but these primarily reduce emission flows without directly lowering atmospheric carbon stocks. In contrast, algal biofuels and bioenergy perform a dual role: they substitute for fossil fuels while utilizing flue gas or atmospheric CO_2 as feedstock, thereby combining mitigation and removal functions (Chisti, 2007; Wijffels & Barbosa, 2010).

Accordingly, the algal nexus reframes the energy transition as more than flow reduction, positioning it as an opportunity to actively diminish accumulated atmospheric carbon.

Algal Oils and Energy Transition

Microalgae, capable of accumulating 20–60% of their biomass as lipids, represent a strategic feedstock for sustainable energy transition. These lipids consist mainly of palmitic (C16:0), stearic (C18:0), oleic (C18:1), and linoleic (C18:2) fatty acids. While saturated fatty acids improve oxidative stability, unsaturated fatty acids enhance cold-flow performance but may increase NOx emissions. Within this context, three taxa stand out for biodiesel production: *Botryococcus braunii*, *Chlorella vulgaris*, and *Nannochloropsis* spp. (Nazloo et al., 2024; Rautenberger et al., 2024; Patel et al., 2024).

B. braunii stores 40–86% of its dry weight as hydrocarbons with a calorific value of ~48 MJ/kg, nearly equivalent to fossil crude oil (Nazloo et al., 2024; Ennaceri et al., 2023). Because a large share of these hydrocarbons accumulates extracellularly, extraction requires less energy. Its key limitation, however, is its slow growth, with biomass productivity of only 0.1–0.2 g/L/day, restricting industrial scalability.

C. vulgaris offers higher growth rates, with certain strains reaching 264–265 mg/L/day and lipid contents around 38% (Je & Yamaoka, 2022). This yields substantial lipid output, but intracellular accumulation necessitates mechanical or chemical disruption, raising downstream costs.

Nannochloropsis combines robust lipid content (37–60% of dry weight) with a favorable fatty acid profile aligned with international fuel standards (Ma et al., 2016). Reported biomass productivities range from 120–250 mg/L/day, with lipid productivities of 40–120 mg/L/day.

Its advantage lies not only in biodiesel quality but also in the use of saline water, reducing competition for freshwater and reinforcing its sustainability within the algal nexus framework.

The comparative assessment highlights complementary strengths: *B. braunii* provides high energy density and easy extraction; *C. vulgaris* offers scalability through rapid growth; and *Nannochloropsis* integrates quality with ecological adaptability. Notably, the energy density of algal biodiesel (33–36 MJ/L) closely matches fossil diesel (~35.8 MJ/L), underscoring its competitiveness as production costs fall (Kumar et al., 2025). Still, sustainable deployment requires optimization of biomass and lipid yields, more efficient extraction technologies, and industrial-scale cultivation infrastructure.

Political and Institutional Framework

Global environmental governance emerged with the 1972 Stockholm Conference, where the principle of "protecting our common future" first entered the international agenda (UNEP, 1972). At the 1992 Rio Earth Summit, the UNFCCC and CBD were established, imposing obligations on states for climate mitigation and biodiversity conservation (UNFCCC, 1992). The 1997 Kyoto Protocol introduced binding reduction targets for developed nations, though its effectiveness was undermined by U.S. withdrawal and the lack of commitments from emerging economies (UNFCCC, 1997). The 2015 Paris Agreement universalized obligations by adopting the 1.5–2 °C target, yet voluntary NDCs and weak enforcement left significant implementation gaps (UNFCCC, 2015; Rogelj et al., 2016).

Despite these frameworks, emissions remain at critical levels. In 2022, average global fossil CO_2 emissions were ~4.7 tons per capita, with total greenhouse gases at ~6.6 tons CO_2-e/year (Ritchie & Roser, 2020; IPCC, 2021). Turkey reported 6.6 tons in 2022 and nearly 7 tons in 2023 (TÜİK, 2023). Disparities are stark: fossil-dependent Qatar reached ~35 tons per capita, the world's highest, while countries such as Chad and the DRC remained below 0.1 tons (World Bank, 2023). Aligning with the Paris 1.5 °C pathway requires reducing per capita emissions to ~2 tons/year by 2050 (IPCC, 2018).

Recent COP negotiations illustrate the evolving discourse. COP27 (Egypt, 2022) recognized Nature-based Solutions (NbS) for the first time, highlighting their role in ecosystem protection and restoration. COP28 (UAE, 2023) marked a historic step by calling for a "transition away from fossil fuels in energy systems, in a just, orderly, and equitable manner." COP29 (Azerbaijan, 2024) adopted the Article 6 Rulebook and the Baku Climate Finance Framework, establishing financing pathways for NbS, particularly in developing countries. Yet, despite these advances, binding targets and enforcement remain absent.

Within this context, the algal nexus can be positioned on two policy levels. First, it complements Paris Agreement commitments by enabling dual benefits within NDCs—carbon capture alongside sustainable energy generation. Second, it aligns with NbS, though algal biotechnology has not yet been explicitly recognized. This novelty enhances its strategic value, offering a science–policy bridge that integrates ecological innovation with institutional frameworks.

In sum, while international climate governance has expanded awareness and legitimacy, practice lags behind ambition. Holistic solutions such as the algal nexus are essential to bridge this gap, providing not only technical mitigation tools but also political and institutional leverage in the pursuit of carbon neutrality.

Circular Economy and Applications

Circular economy strategies seek to transform emissions-intensive industries by replacing fossil-derived inputs with bio-based alternatives. Plastics and tire production, for example, represent rapidly expanding carbon sources; plastic production alone emitted 2.1 $GtCO_2$-eq in 2021 and is projected to triple by 2050 (OECD, 2022). Such trajectories underscore the urgency of scalable bio-based pathways.

Algal systems can contribute at multiple levels: biochar from microalgae as a partial substitute for carbon black in tires (TRL ~5), and ulvan, agar, and alginate polysaccharides from macroalgae already validated at pilot scale for biodegradable plastics (TRL ~6) (Seifan et al., 2016; Mahmoud et al., 2025). These applications illustrate how a single biomass stream can deliver products that reduce embedded emissions across diverse industrial domains.

When combined with algal oils and biofuels in the energy sector, these options form not isolated solutions but part of an integrated portfolio: **flue gas → algal biomass → industrial feedstock → emission reduction**. Achieving industrial relevance, however, requires careful management of land, water, and nutrient demands as well as supportive regulatory frameworks.

In sum, algae-based innovations exemplify how circular economy principles can be operationalized—converting waste CO_2 into valuable feedstocks while simultaneously reducing reliance on fossil inputs.

Contribution of the Study

This study frames algae not simply as a source of isolated products but as a systemic connector across energy, industry, agriculture, and food systems under the "algal nexus" paradigm. While much of the existing literature treats algal biotechnology in fragmented contexts—such as biofuels, nutraceuticals, or wastewater treatment—this work emphasizes cross-sectoral integration, offering a novel synthesis.

Contributions unfold on three levels. Theoretically, the study positions algal biotechnology within global stock–flow dynamics, highlighting its dual role as a renewable energy option and as a negative-emission pathway that directly reduces atmospheric carbon (IPCC, 2022; NOAA, 2024). Methodologically, it introduces a framework that integrates Technology Readiness Levels, economic thresholds, and ecological balances. By treating technology and ecology as a coupled system rather than separate domains, the analysis fills a key gap in the literature (Chisti, 2007; Kumar et al., 2020). Policy-wise, the algal nexus is articulated as more than an environmental tool: it is a catalyst for economic, technological, and financial transformation. The approach aligns with Nature-based Solutions (NbS), the Blue Economy, and the United Nations Sustainable Development Goals (SDGs), while also providing an actionable roadmap for national strategies (UNEP, 2021; UNFCCC, 2022).

The inclusion of Turkey's emission profile further strengthens this contribution, situating the discussion within a context that bridges local applicability and global relevance. In this sense, the study not only enriches the academic discourse but also offers a multidimensional vision that combines scientific rigor, industrial feasibility, and political utility.

In conclusion, algal biotechnology is advanced here not as an incremental technology but as a paradigm shift—linking mitigation with removal, industry with ecology, and science with governance. By articulating this integrated framework, the study provides both conceptual depth and practical direction for navigating the climate–economy nexus.

MATERIAL AND METHODS

Method: Sector Selection Criteria

This study does not aim to provide an exhaustive literature review or a meta-analysis. Rather, its methodological approach is to identify representative sectoral cases that conceptually demonstrate how algae-based solutions can be integrated into the nexus framework. Accordingly, the method follows a purposeful modeling strategy grounded in four main criteria: **carbon intensity, bio-based substitution potential, economic scale, and policy alignment.**

Carbon intensity. Energy, cement, and iron–steel industries were prioritized as the core sectors because of their exceptionally high absolute CO_2 emissions (IEA, 2023; IPCC, 2022). By contrast, sectors such as transportation and agriculture were considered secondary, since the role of algal biotechnology is integrated mainly through product substitution (e.g., biofuels or feed additives).

Bio-based substitution potential. The biochemical diversity of algae—including lipids, pigments, polysaccharides, proteins, and omega-3 fatty acids—enables the substitution of fossil- or agriculture-based raw materials (Pulz & Gross, 2004; Wijffels & Barbosa, 2010).

Economic scale. Market projections highlight the industrial relevance of algal biotechnology: bioplastics are expected to reach USD 30 billion by 2030, feed additives USD 35 billion, and the overall algae-based products sector USD 45–50 billion (FAO, 2022; Allied Market Research, 2023).

Policy alignment. Within the frameworks of the Paris Agreement, the EU Green Deal (including CBAM), the U.S. Inflation Reduction Act (IRA, 2022), green transition strategies in China and Japan, and Turkey's Net Zero 2053 target, algal biotechnology emerges as a strategic enabler for carbon credit generation, cost advantages, and regulatory compliance (UNEP, 2021; Kanno et al., 2017; TÜBA, 2022).

The study employs the internationally recognized Technology Readiness Level (TRL) framework developed by the European Commission (EC, 2014) and NASA (Mankins, 1995). TRL-1 denotes basic conceptual ideas, TRL-3 laboratory-scale validation, TRL-5 pilot-scale applications, TRL-7 semi-industrial demonstrations, and TRL-9 full commercialization. Within this framework, algae-based biopolymers in the textile sector are positioned at TRL 5–6 (pilot production and limited field applications beyond laboratory validation), algal biochar in the tire sector at TRL 5 (R&D-based pilot trials), and high-protein microalgae in the feed and food sectors at TRL 7–8 (semi-industrial production and early market entry). These classifications are not arbitrary but reflect reported pilot projects, industrial field trials, and current commercialization status.

In this way, the methodological framework ensures a multidimensional evaluation consistent with both scientific literature and international policy documents.

Speculative Domains

While the primary focus of the study rests on high-carbon-intensity sectors (energy, cement, iron–steel, plastics, and tires), certain domains with relatively low direct emission loads but significant strategic potential are included as "speculative domains."

Financial sector. Although not a carbon-intensive production area, finance functions as a critical lever for the diffusion of algal biotechnology through instruments such as carbon

credits, green bonds, and ESG-oriented investment funds. By linking biotechnology with capital markets, it plays a pivotal role in accelerating adoption and scaling.

Space biotechnology. In closed life-support systems, algal bioreactors hold strategic importance because of their ability to capture CO_2, release O_2, and provide nutritional supplementation. These features make algae potential assets for long-duration space missions while simultaneously offering reference models for Earth-based closed ecological systems (Ciferri, 1983; ESA, 2022).

The inclusion of such speculative domains does not imply empirical generalization. Instead, it broadens the methodological scope to capture the long-term and visionary dimensions of algal biotechnology. In this sense, speculative domains function as complementary lenses, illustrating how algae-based solutions may extend beyond conventional industries into emerging technological and financial frontiers.

Nature of the Model

The model developed in this study maps the integration potential of algal biotechnology across industrial sectors according to four criteria: carbon intensity, bio-based substitution potential, economic scale, and policy alignment. Within this framework, cement, tire/automotive, textile, feed, food, pharmaceutical, energy, space, and financial sectors were selected as case domains.

The same methodology could be extended to other sectors; however, empirical validation would require market-based analyses or experimental data. This condition delineates the conceptual contribution of the study while clarifying the boundaries of generalization. In other words, the model offers a multidimensional mapping that highlights integration opportunities without claiming universal empirical validity.

Thus, the methodological design enables a dual perspective: it evaluates the near-term applicability of algal biotechnology in carbon-intensive industries, while also aligning with long-term visionary trajectories in speculative domains.

RESULTS AND DISCUSSION

Phylogenetic and Metabolic Diversity

Algae and algal-like phototrophs, encompassing cyanobacteria, green algae, red algae, brown algae, diatoms, dinoflagellates, and even symbiotic fern–cyanobacteria systems such as *Azolla*, represent the biological foundation of the algal nexus. Their relevance arises not only from their high photosynthetic efficiencies but also from their extensive metabolic diversity, which enables cross-sectoral applications that extend far beyond biomass accumulation.

Protein-rich cyanobacteria such as *Arthrospira* (*Spirulina*) have been long established in the food and feed industries, providing both nutritional proteins (~60% of dry biomass) and high-value pigments such as phycocyanin (Musa et al., 2025; Ma et al., 2025). Green algae illustrate a wider metabolic range: *Chlorella vulgaris* accumulates lipids suitable for biofuels and nutraceuticals, *Dunaliella salina* is a major source of β-carotene for natural colorants, and *Ulva* species produce ulvan polysaccharides that have gained traction in biomedical and bioplastic applications (Je & Yamaoka, 2022; Sayegh, 2025; Pari et al., 2025). Red algae add another layer of functional diversity: *Porphyridium* produces phycobiliproteins with applications in natural pigments, *Gracilaria* is a major source of agar and carrageenan, while *Asparagopsis* has attracted global attention for its capacity to synthesize bromoform, a halogenated

compound that significantly reduces enteric methane emissions when incorporated into ruminant diets (Roque et al., 2021; Han et al., 2024).

Among the heterokonts, *Nannochloropsis* is widely recognized as a lipid-rich microalga producing both biodiesel precursors and eicosapentaenoic acid (EPA, omega-3), thereby linking the energy and feed sectors (Nazloo et al., 2024). Diatoms such as *Phaeodactylum tricornutum* combine lipid accumulation with silica frustules, opening applications in nanotechnology (Guo et al., 2024). Brown algae such as *Laminaria* and *Saccharina* species contribute polysaccharides like alginate, fucoidan, and laminarin, with applications ranging from food to bioplastics, while simultaneously functioning as Blue Carbon reservoirs (Tran & Kim, 2023). Dinoflagellates such as *Amphidinium* or *Karenia* are studied for bioactive compounds and toxins, providing pharmaceutical opportunities (Russo, 2025). Finally, aquatic ferns such as *Azolla*, with nitrogen-fixing cyanobacterial symbionts, illustrate the integration of photosynthetic and microbial traits for agriculture, biogas, and bioethanol applications (Korsa et al., 2024).

Table 1. Phylogenetic overview of representative algal and cyanobacterial taxa, their key metabolites, and application domains within the algal nexus framework.

Phylogenetic Group	**Representative Species / Organism**	**Key Metabolites / Traits**	**Application Domains**	**References**
Cyanobacteria (Cyanophyta)	*Arthrospira* (Spirulina)	Protein (~60%), phycocyanin	Food, feed, nutraceuticals	Musa et al. (2025); Ma et al. (2025)
Green algae (Chlorophyta)	*Chlorella vulgaris*, *Dunaliella salina*, *Ulva* spp.	Lipids (20–30%), β-carotene, ulvan	Energy, cosmetics, bioplastics	Je and Yamaoka, 2022; Sayegh, (2025); Pari et al. (2025)
Red algae (Rhodophyta)	*Porphyridium* sp., *Asparagopsis taxiformis*, *Gracilaria* spp.	Phycobiliproteins, bromoform, agar, carrageenan	Pigments, livestock, food	Han et al. (2024); Roque et al. (2021); Khandwal et al. (2025); Machado et al. 2016
Heterokonts – Eustigmatophyceae	*Nannochloropsis* sp.	High lipids, EPA (omega-3)	Biodiesel, feed additives	Nazloo et al. (2024)
Heterokonts – Bacillariophyceae (Diatoms)	*Phaeodactylum tricornutum*, *Thalassiosira* sp.	Lipids, silica frustules, omega-3	Biofuels, nanotechnology, feed	Guo et al. (2024); Nurachman et al. (2012)

Phylogenetic Group	Representative Species / Organism	Key Metabolites / Traits	Application Domains	References
Brown algae (Phaeophyceae)	*Laminaria* spp., *Saccharina japonica*	Alginate, fucoidan, laminarin	Food, bioplastics, Blue Carbon	Tran & Kim (2023); Wan et al. (2025)
Dinoflagellates (Dinophyta)	*Amphidinium* sp., *Karenia brevis*	Polysaccharides, toxins, fatty acids	Pharmaceuticals (biochemicals)	Russo (2025)
Azolla & Water Ferns (Azollaceae)	*Azolla* spp. (with cyanobacterial endosymbiont)	Nitrogen fixation, lignocellulose	Agriculture, biogas, bioethanol	Korsa et al. (2024)

As summarized in **Table 1**, these phylogenetic groups illustrate a spectrum of metabolites—from proteins and lipids to polysaccharides, pigments, and halogenated compounds—each enabling sector-specific applications within the algal nexus framework. Importantly, this diversity underscores that algae are not generic biomass providers but multifunctional biotechnology platforms capable of simultaneously supporting food, feed, energy, health, and environmental services. Thus, phylogenetic and metabolic diversity is not merely descriptive but constitutes the biological foundation for cross-sectoral transformation, linking carbon capture to tangible functional outputs.

Carbon Fixation Thresholds and Species–Sector Mapping

The biological diversity highlighted in Table 1 translates directly into differential carbon capture capacities and sectoral applications. One of the most compelling arguments for algae is their superior carbon fixation efficiency compared to terrestrial plants. While forests or crops typically sequester 10–20 tCO_2/ha·yr, microalgae under optimized conditions often achieve 100–200 tCO_2/ha·yr, representing an order of magnitude increase (Adetunji et al., 2025). In certain systems, fixation rates as high as 500 tCO_2/ha·yr have been reported, with biomass yields exceeding 250–280 t/ha annually.

Species-specific assessments reinforce this claim. Chlorella species can yield ~82 t/ha biomass annually, linked with fixation rates of ~148 tCO_2/ha·yr (Vo et al., 2018). Nannochloropsis salina has shown fixation ranges from 45 to 208 tCO_2/ha·yr depending on the cultivation setup (Adetunji et al., 2025). Scenedesmus obliquus grown in flue-gas environments achieved 67% CO_2 removal efficiency, with fixation rates of ~0.44 kg CO_2/m^3·day (Wilson et al., 2016). Wastewater-based systems with Tetradesmus obliquus have demonstrated ~0.19 g/L·day productivity, illustrating dual benefits for carbon capture and nutrient removal (Adetunji et al., 2025). Collectively, these results show that microalgae can capture atmospheric CO_2 while simultaneously valorizing industrial effluents.

However, fixation efficiency is not static but highly contingent on cultivation conditions. Most algal strains thrive between 15–30 °C, though thermotolerant Chlorella strains can sustain growth up to 42 °C. Similarly, optimal CO_2 concentrations are typically around 5%, with Chlorella vulgaris growth inhibited above 15%, while other species tolerate up to 80–100%. Light intensities of 10–400 μmol/m^2·s sustain photosynthesis, though values above this threshold can cause photoinhibition (Adetunji et al., 2025). Thus, reported ranges such as 100–

200 tCO_2/ha·yr should be interpreted as potential intervals rather than guaranteed outcomes, as realized benefits depend on strain selection, reactor design, and input management.

Table 2 synthesizes this species-level evidence into sectoral contributions, mapping key algal taxa to their carbon mechanisms and Technology Readiness Levels (TRLs). For instance, Spirulina contributes ~1.5–2.0 tCO_2 fixation per ton of dry biomass while simultaneously producing biogenic $CaCO_3$, positioning it as a candidate for food, feed, nutraceuticals, and even biocement applications (Becker, 2007; Wang et al., 2008). Chlorella vulgaris plays a dual role in biofuel and nutraceutical applications as well as space life-support systems, though its carbon benefit is strongly dependent on CO_2 supply and energy source—requiring LCA validation to confirm net gains. Ulva species contribute through polysaccharide-based biopolymers (ulvan) that substitute for fossil-derived plastics. Nannochloropsis provides fossil substitution through biodiesel and EPA production, with fixation potential of ~120–150 tCO_2/ha·yr in photobioreactors. Asparagopsis taxiformis offers a radically different mechanism: methane abatement in livestock. With reported reductions of 60–90% in enteric methane, this species indirectly mitigates CO_2-equivalent emissions at the agricultural sector level (Roque et al., 2021; Kinley et al., 2020).

Table 2. Economically relevant algal species, major metabolites, and carbon contribution mechanisms

Species / Organism	**Main Metabolite / Product**	**Application Fields**	**Carbon Contribution***	**TRL**	**References**
***Spirulina* (*Arthrospira*)**	Protein (≈60%), phycocyanin; biogenic $CaCO_3$	Food, feed, nutraceuticals; **cement additive / biocement**	**~1.5–2.0 tCO_2 fixed per ton dry biomass** (biogenic C ~45–50%	**7–8**	Becker (2007); Ciferri (1983); Güroy et al. (2022); **Sigit et al. (2025)**; **Al-Mardeai et al. (2024)**; **Ariyanti (2012)**; Wang et al. (2008)
Chlorella vulgaris	Lipids (30–40%), chlorophyll; proteins	Biofuels, nutraceuticals, space LSS	**~100–150 tCO_2/ha·yr** under intensive culture; sequestration depends on **CO_2 supply & energy inputs** (validate with LCA/MRV)	**6–7**	Pulz & Gross (2004); Khan et al. (2018); **Je & Yamaoka (2022)**; **Detrell (2021)**;

Species / Organism	Main Metabolite / Product	Application Fields	Carbon Contribution*	TRL	References
					Wang et al. (2008)
Ulva spp. (*incl. *U. lactuca / U. rigida)	**Ulvan** (sulfated polysaccharide), other biopolymers	Bioplastics, food, biomedical	Biogenic C in biomass; **materials substitution** in plastics/packaging	**5–6**	**Lahaye & Robic (2007)**; **Akbal et al. (2023)**; **Cameselle et al. (2025)**; **Pari et al. (2025)**; Maray et al. (2023)
***Nannochloropsis gaditana* / sp.**	**High lipids (≈40–60%)**, EPA (ω-3)	**Biodiesel, bio-jet**, feed additives (aquaculture)	**~120–150 tCO_2/ha·yr** in PBRs (potential interval); **fossil substitution** via biodiesel/EPA	**5–6**	Wijffels & Barbosa (2010); **Ma et al. (2016)**; **Piyatilleke et al. (2024)**; Adissin et al. (2019); Kumar et al. (2020)
Asparagopsis taxiformis	**Bromoform ($CHBr_3$)**; halogenated metabolites	**Ruminant feed additive** (methane mitigation)	**60–90% enteric CH_4 reduction → indirect CO_2-eq abatement** (scope 3 agri)	**5**	**Roque et al. (2021); Kinley et al. (2020)**

*Carbon contribution refers to sequestration or substitution potential, depending on species-specific mechanisms.

The objective of Table 2 is not to establish absolute rankings but to illustrate the functional complementarity of different taxa within the nexus framework. Spirulina anchors food–feed–cement linkages, Chlorella and Nannochloropsis are pivotal for energy substitution, Ulva supports plastics and biomedical innovation, and Asparagopsis extends algal biotechnology into agriculture. Together, these mappings emphasize that carbon benefits emerge through both direct sequestration and indirect substitution mechanisms.

Critically, such mappings must be evaluated through the dual lenses of MRV (Measurement–Reporting–Verification) and LCA (Life Cycle Assessment). While MRV confirms reactor-level balances, LCA reveals whether biological fixation translates into real climate benefits once energy inputs, nutrient demands, and system boundaries are considered. For instance, high biomass yields in Chlorella do not guarantee net negative emissions if powered by coal-

intensive grids. Conversely, integration with renewable or geothermal energy can transform algal cultivation into a carbon-negative process, as demonstrated in Section 3.3. This dual requirement ensures that species–sector mapping is not merely biological optimism but evidence-based climate relevance.

In conclusion, phylogenetic and metabolic diversity (Table 1) provides the biological capacity, while species–sector mapping (Table 2) demonstrates the applied mechanisms through which this capacity materializes. Taken together, they form the biological and functional core of the algal nexus, illustrating how diverse taxa underpin both carbon sequestration and sectoral transformations across food, energy, materials, and agriculture. Moreover, this species–sector mapping framework goes beyond a mere compilation of biological data; it systematically reveals the principle of functional complementarity. Whereas much of the existing literature focuses on single species or isolated product pathways, this study emphasizes how different taxa contribute through direct sequestration (e.g., Spirulina, Chlorella, Nannochloropsis) and indirect substitution mechanisms (e.g., Ulva biopolymers, Asparagopsis methane abatement). This dual perspective provides both scientific novelty—through interdisciplinary synthesis—and policy relevance—through integration with MRV and LCA frameworks for validation. In this way, algal biotechnology is reframed not merely as biomass production, but as a multi-sectoral climate solution platform, bridging biological potential with real-world climate and sustainability outcomes.

Production Systems, MRV (Measurement–Reporting–Verification), and LCA (Life Cycle Assessment): Conceptual Framework and Application

The biological capacity of algae to fix carbon raises a central question: do these high capture rates translate into genuine climate benefits once the full production chain is considered? To answer this, MRV and LCA must be applied together.

MRV establishes the carbon balance at the reactor level by comparing incoming CO_2 with retention in biomass and losses in outflow gas. Since 45–50% of algal dry weight is carbon (Becker, 2007), sequestration can be estimated using the relation:

Biomass × (%C) × (44/12)

where 44/12 converts carbon mass into CO_2 equivalent. This method requires calibrated sensors, transparent reporting, and independent verification to ensure credibility in carbon markets (UNFCCC, 2014; 2022).

LCA, by contrast, evaluates upstream and downstream burdens, following ISO 14040/44. It considers cultivation energy (lighting, aeration, pumping), nutrient inputs, water and recycling, harvesting and drying, chemicals, and infrastructure. Photobioreactors typically consume 4–6 kWh/kg biomass, producing 2–3 kg CO_2-eq in fossil-based grids (Razzak et al., 2013). Since 1 kg of dry biomass biogenically stores ~1.6–1.8 kg CO_2, outcomes depend strongly on the energy mix: renewables enable net-negative balances, coal grids lead to net-positive emissions.

Protein yield is another key metric, often calculated as total nitrogen × 6.25. Yet this universal factor misrepresents algal composition because nitrogen is also stored in pigments and nucleic acids. Safi et al. (2013) reported species-specific nitrogen-to-protein (NTP) values: Chlorella (6.35→5.96), Nannochloropsis (6.28→5.86), Haematococcus (6.25→5.63), while Arthrospira and Porphyridium remained near 6.2–6.3. Using fixed factors risks overestimating protein yields and misreporting carbon and nutritional benefits.

Case studies clearly illustrate how system context determines outcomes. For example, in Iceland's Hellisheiði geothermal park, Spirulina cultivation powered entirely by geothermal

CO_2, heat, and electricity achieved exceptionally low environmental burdens: land use was limited to 0.0378 m^2/kg, freshwater consumption reached 8.36 m^3/kg, electricity demand was 54.48 kWh/kg, and the overall balance was slightly carbon negative (–0.008 kg CO_2-eq) (Tzachor et al., 2022). By contrast, in Portugal, a tubular photobioreactor integrated into a fossil-dominated grid produced 1 kg of dry biomass with a footprint of 68.34 kg CO_2-eq, of which 79% was attributed to electricity and 21% to nutrient production, while construction contributed only marginally (Mata et al., 2018). These two cases, drawn from independent studies, highlight that identical cultivation methods can lead to very different carbon outcomes depending on the supporting energy infrastructure.

Scenario analyses reinforce this outcome: coal-based grids result in +1.7 to +3.7 kg CO_2-eq per kg of biomass, while natural gas grids approach a neutral balance (–0.7 to +0.7). Renewable energy use leads to –1.5 to –1.7, and geothermal shows slightly negative results (–0.008) (IEA, 2022; Mata et al., 2018; Tzachor et al., 2022). In this context, novel design and operational strategies have emerged in the literature to further improve system performance. In next-generation photobioreactors, multi-stage CO_2 feeding and advanced control strategies can enhance both biomass production and carbon capture efficiency (Yahaya & Nandong, 2025a). However, operational challenges such as solubility limitations, pH fluctuations, and photoinhibition persist, and recent studies suggest that these can be mitigated through micro-bubble technology and intelligent sensor-based control systems (Yahaya, Yeo, Nandong, & Ngu, 2025b).

Collectively, these findings show that algae-based systems are not inherently carbon neutral. MRV provides reactor-level accuracy, while LCA reveals whether such capture translates into genuine system-wide benefits. Species-specific NTP values further improve reporting accuracy. Crucially, alignment with low-carbon energy inputs determines whether algae cultivation functions as a net sink or source of emissions. For policymakers and investors, the combined application of MRV and LCA thus provides the necessary evidence base for credible carbon market participation and industrial-scale deployment.

Sectoral Algal Nexus Analysis

Algal biotechnology is not a single production line but a multi-layered algae–industry interaction serving multiple sectors simultaneously. This interaction is grounded in three principles: **multifunctionality**, **synergy**, and **policy alignment**. Multifunctionality refers to the ability of a single biological process to deliver multiple product streams; for instance, *Spirulina* cultures can generate both protein and biogenic calcium carbonate. Synergy reflects the conversion of one sector's waste into a resource for another, as in the utilization of flue gas CO_2 in algal cultivation. Policy alignment requires integration with international frameworks such as the **Paris Agreement**, the **European Green Deal**, and the **Carbon Border Adjustment Mechanism (CBAM)**.

Key species including *Spirulina*, *Chlorella*, *Ulva*, and *Nannochloropsis* contribute not only through carbon capture but also by producing proteins, lipids, pigments, and polysaccharides that benefit diverse industries such as cement, tire/automotive, textiles, food–feed, and energy. To systematically evaluate these contributions, each sector can be analyzed through a **five-stage framework**:

1. **Emission logic** – identifying the main carbon burden, such as limestone calcination in cement production or the use of synthetic dyes in textiles.
2. **Algal mechanism** – explaining how algae can mitigate this burden, e.g., biogenic $CaCO_3$ from *Spirulina*, biopolymers from *Ulva*, or lipids from *Nannochloropsis*.

3. **Technology Readiness Level (TRL)** – indicating the maturity of applications, from laboratory and pilot scale to commercial deployment.
4. **Evidence** – supporting theoretical potential with international pilot projects and quantitative data.
5. **Limitations and risks** – transparently addressing challenges such as water and nutrient demand, cost competitiveness, or logistics.

This framework shows that algal biotechnology should not be considered a "niche technology" but a **multi-sectoral transformation paradigm**, validated by MRV and LCA processes. In the **short term (TRL 6–7)**, energy and feed sectors appear most applicable: lipid-rich microalgae (*Chlorella*, *Nannochloropsis*) are already entering biodiesel and bio-jet chains, while *Spirulina* and *Ulva* derivatives are being tested as feed additives in aquaculture and livestock with MRV–LCA support. These represent the strongest candidates for near-market applications.

In contrast, in the **long term (TRL 4–5)**, bioplastics and textiles hold considerable potential but remain in early stages. Ulvan from *Ulva* or polysaccharides from red algae offer prospects for biopolymer and packaging industries, while pigment- and fiber-based innovations are emerging in textiles. Yet without scaling, cost reduction, and regulatory alignment, their industrial integration will remain limited.

This distinction underscores both the **diversity of algae-based solutions** and the need to differentiate between sectors ready for immediate application and those requiring long-term investment. By doing so, the Algal Nexus framework gains stronger validity in policy and market contexts, offering a clear and systematic perspective for both reviewers and stakeholders.

Energy Sector and the Algal Nexus

The energy sector is the epicenter of the climate crisis, responsible for over 70% of global GHG emissions from both fuel combustion and upstream processes such as extraction, refining, and distribution (IPCC, 2021; IEA, 2023). Unlike conventional renewables that only displace fossil use, algae treat carbon as a feedstock, fixing 1.6–2.0 tons of CO_2 per ton biomass and achieving 30–40 tCO_2/ha annually in open pond systems (Hoque, 2025; Li, 2024). Emerging techniques such as microbubble injection further enhance dissolution efficiency and facilitate integration with flue gas or direct air capture (DAC) systems (Li & Yao, 2024).

Algae contribute to the energy sector through diverse biochemical routes (Table 5). *Nannochloropsis* lipids can be converted via hydrothermal liquefaction into refinery-compatible jet fuels, offering one of the most promising decarbonization pathways for aviation (Kumar et al., 2020; Deepika et al., 2024). *Ulva* and *Gracilaria* carbohydrates are suitable substrates for bioethanol fermentation (Razzak et al., 2024). Anaerobic digestion of *Ulva lactuca* yields up to 350 mL CH_4/g volatile solids, outperforming maize silage or manure (Border et al., 2025). *Chlamydomonas* generates biohydrogen via hydrogenase activity, aligning with green hydrogen strategies though still at TRL 4–5 (Tran & Kim, 2023). Microbial fuel cells (MFCs) directly convert photosynthetic electrons into electricity while simultaneously removing nitrogen and phosphorus in wastewater (Montoya-Vallejo et al., 2025). At the ecosystem level, macroalgal forests annually sequester ~173 Mt CO_2, reinforcing Blue Carbon frameworks (Krause-Jensen & Duarte, 2016).

Economic feasibility is increasingly demonstrated. U.S. biodiesel costs have fallen to $65–70/barrel (DOE, 2022), while a Turkish feasibility study estimated that 28,900 tons of annual

biomass could yield 49,300 barrels of biodiesel (İSTKA, 2021). Such evidence confirms that algae-based energy is not only technically viable but also moving toward cost competitiveness.

Table 5. Energy Products from Algal Biotechnology and Supporting Literature (2020+)

Energy Product	Algal Species / Pathway	Key Findings	Reference(s)
Biodiesel / Biojet	*Nannochloropsis*, diatoms	High lipid productivity; refinery-compatible fractions via HTL	Kumar et al. (2020); Deepika et al. (2024); Patel et al. (2024)
Bioethanol	*Ulva*, *Gracilaria*	Fermentative conversion of polysaccharides; sustainable biomass	Razzak et al. (2024); Gonzales et al. (2025)
Biogas (CH_4)	*Ulva lactuca*, brown seaweeds	Up to 350 mL CH_4/g VS; outperforming maize silage and manure	Border et al. (2025)
Biohydrogen (H_2)	*Saccharina japonica*, *Chlamydomonas*	Hydrogenase- and fermentation-based routes; TRL 4–5	Tran & Kim (2023)
Electricity (MFCs)	Microalgal cultures	Direct electricity via photosynthetic electron transfer	Ryu et al. (2021)
CCUS Integration	Microalgae (general)	Enhanced CO_2 dissolution and fixation; carbon-negative strategies	Li & Yao (2024)

The algal–energy nexus can be synthesized across five lenses:

1. **Emission logic:** The energy sector is the largest source of anthropogenic CO_2 emissions, making it the primary target for algal carbon capture and substitution.
2. **Mechanisms:** Algae convert lipids into biodiesel and biojet, carbohydrates into bioethanol, proteins into biogas, and photosynthetic electrons into direct electricity, thereby providing multiple renewable energy pathways.
3. **TRL:** Biodiesel, biojet, and biogas technologies are already demonstrated at TRL 5–7, while biohydrogen and microbial fuel cells remain at TRL 3–4 and require further development.
4. **Evidence:** Feasibility has been confirmed by hydrothermal liquefaction trials, high-yield anaerobic digestion of *Ulva*, declining biodiesel production costs in the U.S., and national-scale feasibility studies in Turkey and China.

5. **Limitations:** High energy, water, and nutrient demands, along with cost and logistics challenges, constrain large-scale deployment unless systems are coupled with low-carbon electricity and supported by co-product valorization.

In summary, algae-based energy systems embody a unique carbon logic: they consume CO_2, generate multiple energy products, and integrate into carbon markets through MRV and LCA verification. This positions algae not just as alternative fuels but as policy-relevant tools for climate mitigation and energy security.

Cement Sector and the Algal Nexus

The cement industry accounts for 7–8% of global CO_2 emissions, surpassing the aviation sector (IEA, 2022; IPCC, 2021). Roughly half derives from limestone calcination and the rest from kiln fuel combustion, placing cement among "hard-to-abate" sectors where efficiency gains alone cannot achieve neutrality. In this context, algal biotechnology combines direct CO_2 capture with material innovation.

Microalgal CO_2 fixation and biocalcite production show particular promise. *Spirulina* and *Chlorella* integrate flue gas CO_2 into biomass, delivering both sequestration and $CaCO_3$ formation. At PT Solusi Bangun Indonesia, raceway ponds achieved 8.5–23.7 mg CO_2/L/day (Sigit et al., 2025). Coccolithophorids such as *Emiliania huxleyi* and *Chrysotila carterae* reached >40% biogenic $CaCO_3$ within 14–18 days, supporting use as clinker substitutes (Al-Mardeai et al., 2024).

Algae-based biocementation (MICP) further elevates pH via photosynthetic metabolism, precipitating Ca^{2+} as $CaCO_3$. Recent studies confirm contributions to both CO_2 mitigation and self-healing of microcracks, extending durability (Zúñiga-Barra et al., 2024; Iqbal et al., 2021). Thus, algal biocementation offers dual environmental and structural benefits.

Macroalgae add value as nanomaterial additives. Sodium alginate from *Laminaria digitata* increased compressive strength to 6.8 MPa at 15% substitution while lowering thermal conductivity by 26% (El Mendili et al., 2025). Graphene oxide from invasive *Sargassum* enhanced mortar strength at only 0.05% dosage, reducing embodied carbon (Garcia et al., 2025). These findings show that algal polysaccharides and nanostructures can improve hydration dynamics and mechanical performance at minimal concentrations.

Overall, algae contribute to cement decarbonization via two pathways: (i) transforming flue gas CO_2 into biomass or $CaCO_3$, and (ii) integrating algal-derived $CaCO_3$, polysaccharides, or nanomaterials into cement matrices, enhancing durability, crack-healing, and thermal properties. Current readiness varies: carbon capture systems have reached TRL 6–7 (Sigit et al., 2025), biocementation is at TRL 4–5, and macroalgal additives remain at TRL 3–4.

Finally, as the cement sector is among the first regulated under the EU's CBAM, algae-based innovations serve not only as technical solutions but also as strategic tools for carbon credit generation, green finance, and compliance with global trade frameworks. The cement–algae nexus thus bridges industrial application with international climate policy.

Tire and Automotive Industry within the Algal Nexus

The automotive industry bears a heavy carbon footprint not only from fuel use and tailpipe emissions but also from fossil-derived materials embedded in production. Algal biotechnology

provides alternative pathways across the vehicle life cycle, from tires to interior trims, reducing both embedded and operational emissions.

Tire production is especially carbon-intensive, as carbon black generates ~2.5 tons of CO_2 per ton produced (IPCC, 2021). Mahmoud et al. (2025) showed that microalgal biomass can replace up to 50% of carbon black in NBR and SBR composites. This substitution preserved mechanical strength, accelerated vulcanization, and enhanced elasticity, proving that algae-based fillers function as both sustainable and performance-enhancing additives.

Lightweighting vehicle structures is another key mitigation route. Zgaverdea and Rațiu (2021) demonstrated that algae-derived carbon fibers match or even surpass conventional fibers. A 100-kg mass reduction saves 8–11 g CO_2/km, highlighting how "green carbon fibers" reduce emissions in both manufacturing and use phases.

Bioplastics further expand algae's role. Omokaro et al. (2025) reported that PHAs and PLA derived from *Chlorella*, *Spirulina*, and *Scenedesmus* offer properties comparable to petroleum plastics while being biodegradable, with LCAs showing up to 60% lower emissions. Applications in dashboards, panels, and trims reduce fossil dependency and plastic waste. Desikan et al. (2023) reinforced the viability of algae-derived polymers for interiors, emphasizing biodegradability within circular economy frameworks.

Beyond individual products, Geng et al. (2025) stressed the systemic value of microalgal biorefineries, which yield biofuels, bioplastics, and biochemicals from a single biomass stream. For automotive use, this model supplies biochar to replace tire carbon black, polymers for interiors, and specialty chemicals as additives. While biofuel production can be energy-intensive, the co-production of materials enhances economic feasibility and carbon performance, embedding circularity within industrial processes.

In conclusion, the algal–automotive nexus operates on four dimensions: (i) carbon black substitution in tires, (ii) lightweighting via algae-based carbon fibers, (iii) biopolymer use in plastics, and (iv) integrated biorefineries for multiple outputs. This multi-layered approach extends beyond tailpipe emissions to encompass the full vehicle life cycle, positioning algal biotechnology as a strategic enabler of net-zero mobility transitions.

Textile Sector and the Algae Nexus

The textile industry is one of the most environmentally intensive sectors, consuming vast amounts of water, chemicals, and energy. Annually, ~110 million tons of textiles are produced; 67% end in landfills and only 15% are recycled (Ütebay et al., 2020). Textiles account for 8–10% of global GHG emissions and ~20% of industrial wastewater (UNEP, 2020), making the sector central to sustainability debates.

Major burdens stem from synthetic dyes and petrochemical polymers. During dyeing, 10–15% of dyes are lost to wastewater, accompanied by high COD, BOD, and heavy metal loads (Rathour et al., 2024). These pollutants drive toxicity and carbon intensity, underscoring the need for alternatives.

Algal pigments and polymers offer such solutions. Phycocyanin from *Spirulina* has been applied to cotton and silk, and β-carotene from *Dunaliella* to cotton and wool, both with competitive fastness and biodegradability (Mutaf-Kılıç et al., 2023; Moldovan, 2021). Sulfated polysaccharides from *Porphyridium* add antiviral and antibacterial functionality, making them attractive for medical textiles (de Jesus Raposo et al., 2014; Gargouch et al., 2021). Extraction efficiency depends on cell-wall traits: thin-walled *Dunaliella* and permeable *Spirulina* allow

easier pigment recovery, while rigid-walled *Chlorella* requires advanced processing (Safi et al., 2013).

Beyond coloration, algal polysaccharides provide biofunctionalities. Ulvan from *Ulva* enhances UV protection and moisture balance (Lahaye & Robic, 2007). *Porphyridium* exopolysaccharides exhibit anti-inflammatory and regenerative effects (Liberti et al., 2023), while *Spirulina* polysaccharides add antioxidant, antibacterial, and immunomodulatory properties (Li et al., 2011; Kurd & Samavati, 2015). These traits support dye-free medical, infant, and eldercare textiles (Han et al., 2024).

Algae also contribute to carbon neutrality. In a Newcastle University study, cotton composites coated with *Chlorella* fixed up to 1.82 g CO_2/g biomass/day, nearly ten times higher than suspension cultures, and far above polyester controls (In-na et al., 2021). This demonstrates how textile wastes can be upcycled into carbon-negative materials.

In wastewater remediation, microalgae–bacteria consortia show strong efficacy: *Chlorella vulgaris* + *Enterobacter* removed 93% Cd, 79% Pb, and 74% COD; other pairings reduced N by 59%, P by 86%, and COD by 92% in textile effluents (Mubashar et al., 2020). Such systems target colorants, metals, and nutrients simultaneously.

Taken together, the algae–textile nexus enables (i) substitution of fossil-based inputs, (ii) sustainable coloration, (iii) functional enhancements like UV protection and antimicrobial action, and (iv) circularity via carbon fixation and wastewater treatment. These multi-layered contributions position algae as a transformative lever for achieving carbon neutrality—and in select cases, carbon negativity—in textiles.

Feed Sector and the Algae Nexus

The feed sector is strategically central to global food security but remains highly dependent on soybean meal and fishmeal, driving land-use change, freshwater demand, and greenhouse gas (GHG) emissions (FAO, 2020). Algal biotechnology offers transformative alternatives by providing high-value proteins, lipids, pigments, and bioactives that enhance animal performance while reducing environmental burdens.

Aquaculture. Microalgae are proven substitutes for fishmeal and soybean meal. *Spirulina platensis* (55–70% protein) and *Chlorella vulgaris* (40–50% protein, 20–30% lipids) improve growth and immunity in finfish, with studies in European seabass showing enhanced resistance to *Vibrio* infections (Güroy et al., 2022). Pigments such as astaxanthin from *Haematococcus pluvialis* improve salmonid coloration and mucosal immunity (Li et al., 2025). In shrimp, *Spirulina* extracts strengthen innate defenses, while *Nannochloropsis* replaces fish oil, improving n-3 HUFA deposition (Tayag et al., 2010; Adissin et al., 2019). A large-scale example is Norway's Finnfjord project, where flue gas CO_2 was used to cultivate algae that enriched salmon feeds with omega-3s, illustrating industrial–aquaculture integration (Andersson, 2024). IMTA systems further demonstrate synergy: macroalgae like *Ulva* and *Gracilaria* recycle nutrients from aquaculture effluents, improving water quality and providing antioxidant-rich feed biomass (Curcuraci et al., 2024).

Poultry. Algal supplements improve performance and resilience. *Spirulina* enhances weight gain and feed efficiency, while *Chlorella* boosts immunoglobulin levels (Hassan et al., 2022). Astaxanthin reduces oxidative stress in broilers and naturally enhances yolk pigmentation in layers (Kueh et al., 2024; Osawa et al., 2024). Integrating poultry manure with algal cultivation creates circular systems that reduce emissions while producing feed (Rajagopal, et al., 2021).

Ruminants. Ruminant livestock are major methane emitters. *Asparagopsis taxiformis* supplementation reduces enteric methane by 60–99% by inhibiting rumen methanogenesis, while simultaneously improving growth efficiency (Roque et al., 2021; Kinley et al., 2025). Microalgal supplementation during gestation also improves calf health by increasing colostrum IgG and n-3 fatty acid content, thereby enhancing neonatal survival and immunity (Altomonte et al., 2018; Tomaluski et al., 2021).

Swine. *Nannochloropsis* and *Schizochytrium* improve growth rates, reduce intestinal inflammation, and enrich pork with omega-3 fatty acids (Souza et al., 2021). Algal polysaccharides also act as prebiotics, mitigating post-weaning diarrhea and reducing reliance on antibiotics (Kalbe et al., 2018).

Companion animals. Pet food increasingly incorporates algal ingredients. *Chlorella* and *Nannochloropsis* promote gut health through prebiotic effects, while pigments such as astaxanthin and phycocyanin enhance coat quality, vitality, and longevity (Vasconcellos et al., 2023).

Overall, algae are not simply alternative proteins but climate-smart, health-promoting, and economically strategic feed solutions. Across aquaculture, poultry, ruminants, swine, and pets, they improve performance and immunity while reducing emissions and supporting circular bioeconomy models. The main challenges lie in cost, scalability, and regulatory approval. While *Asparagopsis* has robust validation for methane mitigation, many species still require large-scale trials to meet EFSA and FDA safety standards.

In conclusion, the algae–feed nexus represents a multidimensional transformation of animal production. By integrating algae, the feed sector can transition from linear, emission-intensive supply chains toward circular, resilient, and low-carbon biofeed platforms.

Food Sector and Algae Nexus – Packaging, Production, and Consumer Awareness

The food system is the second-largest contributor to global greenhouse gas (GHG) emissions after energy, accounting for roughly 26% of the total (Poore & Nemecek, 2018; IPCC, 2021). Emissions arise not only from agriculture and livestock but also from processing, packaging, and logistics. Among these, fossil-based plastics used in food packaging represent a critical hotspot, generating 2–3 tons of CO_2 per ton produced while remaining non-biodegradable. Packaging and distribution together account for 15–20% of the food system's footprint, making them a prime target for low-carbon innovation.

Algal biotechnology provides multiple avenues for mitigation. Polysaccharides such as agar, carrageenan, and alginate—traditionally food additives—have been reformulated as biodegradable packaging materials. Post-2020 studies show that seaweed-based films match the strength of PLA, extend shelf life by up to 20%, and reduce carbon intensity by more than one-third (Waseem et al., 2023). The global seaweed packaging market, valued at USD 559 million in 2024, is projected to double within a decade, reflecting both regulatory support under the EU Green Deal and growing consumer demand (Towards Packaging, 2025).

Among green macroalgae, *Ulva* species stand out. Ulvan polymers demonstrate high moisture resistance, thermal stability, and antioxidant properties (Cameselle et al., 2025; Gonzales, 2025). Our group optimized extraction from *Ulva rigida*, yielding bioactive polysaccharides suitable for both packaging and functional food applications (Akbal, Şahin, & Güroy, 2023). These findings indicate that algae-based packaging not only replaces fossil plastics but also adds value by enhancing food preservation.

On the production side, microalgae such as Spirulina and Chlorella fix 30–50 tons of CO_2 per hectare annually—several times higher than forests—and one ton of Spirulina biomass stores about 1.8 tons of CO_2 (Wijffels & Barbosa, 2010). This means that algal protein bars or beverages can potentially qualify as carbon-negative products when validated through life-cycle assessment (LCA). Beyond protein, algal metabolites deliver functional health benefits: sulfated polysaccharides from *Porphyridium* and *Ulva* show prebiotic effects, while Spirulina pigments reduce oxidative stress (Torres-Tiji et al., 2020). Given that Spirulina and Chlorella already hold GRAS (Generally Recognized as Safe) status, their incorporation into mainstream foods faces fewer regulatory barriers.

Consumer awareness is a critical enabler. Surveys show strong interest in algae-based packaging, though food products still face hesitancy due to taste and color differences (Future of Food Institute, 2021). To address this, algae can be positioned not only as nutritional enhancers but also as carbon-offsetting tools. For instance, high-emission foods such as dairy or meat could be paired with algae-based carbon credits or additives, aligning purchasing choices with climate goals. Such dual framing—health and emissions reduction—can accelerate adoption.

Nevertheless, several challenges remain. Algal packaging is still about 2.5 times more expensive than fossil plastics. Photobioreactor cultivation requires substantial energy, reducing benefits if grids remain fossil-intensive. Finally, long-term safety and toxicity testing of novel polysaccharides such as ulvan is incomplete, requiring further validation before full-scale commercialization.

In summary, algae extend the food system's sustainability potential far beyond protein supplementation. By providing biodegradable packaging, capturing CO_2 during production, and delivering health-promoting additives, algae contribute to both carbon-neutral and carbon-negative food pathways. Strategically, they align with global climate policies such as the Paris Agreement and the EU Green Deal, while meeting consumer demand for healthier, more sustainable products. Thus, the food–algae nexus exemplifies how biotechnology can transform not just agricultural outputs but the entire life cycle of food systems.

Pharmaceutical and Healthcare Sector – Algae Nexus

The pharmaceutical and healthcare sector, though less visible than energy or cement, contributes significantly to climate change. Healthcare systems account for ~4–5% of global GHG emissions, comparable to aviation, with pharmaceuticals and medical supply chains representing a quarter of healthcare's footprint in the UK (Health Care Without Harm, 2019; NHS, 2020). Emissions originate from pharmaceutical production, energy-intensive sterilization and labs, and complex logistics chains, making decarbonization a strategic priority.

Conventional production relies on heterotrophic microbes (E. coli, Bacillus, Pichia) that require sugar-based media and generate 2–5 tCO_2-eq per ton of product (Ritala et al., 2017). These carbon sources carry additional land and water burdens, undermining sustainability. In contrast, microalgae convert light and CO_2 directly into biomass, fixing ~1.5–1.8 tCO_2 per ton (Wijffels & Barbosa, 2010), while producing valuable bioactives: ulvan, phycocyanin, β-carotene, and sulfated polysaccharides with antiviral, antioxidant, and immunomodulatory properties. Thus, algae can function both as bioactive ingredient sources and as low-carbon production platforms.

Advances in algal genetic engineering further strengthen this potential. CRISPR/Cas9 tools in Chlamydomonas and Synechococcus enable chloroplast-targeted recombinant protein expression, producing antibody fragments, growth factors, and antibiotics using only CO_2 and

light (Gimpel et al., 2015; Rasala & Mayfield, 2015). This photosynthetic route avoids misfolding issues common in bacteria and reduces downstream purification costs.

An emerging concept is the substitution of peptones and yeast extract (YE)—major nitrogen sources in microbial media—with algal hydrolysates. Enzymatic hydrolysis of Chlorella or Spirulina biomass yields peptide-rich extracts that replace LB medium in E. coli and support Bacillus growth, boosting succinate and biosurfactant production (Callejo-López et al., 2023; Yun et al., 2020; Raisa et al., 2016). This approach reduces reliance on costly animal-derived inputs while lowering life-cycle burdens. Combining algal hydrolysates with crude glycerol from biodiesel production further improves fermentation efficiency, exemplifying circular integration.

Pharmaceutical plants also emit CO_2 from fermenters, boilers, and on-site energy. Integrating photobioreactors with process off-gases achieved up to 29% CO_2 capture in an industrial case, with biomass valorized into food or biofuels (Silkina et al., 2024). Similar on-site carbon loops in pharma facilities could recycle emissions into algal peptone or specialty metabolites, linking industrial ecology with climate mitigation.

Challenges remain. Algae grow more slowly than bacteria, photobioreactors demand high CAPEX/OPEX, and benefits vanish if powered by fossil grids. Regulatory hurdles are steep: GMP compliance, long-term safety, and toxicity validation are essential. Certain polysaccharides (e.g., carrageenan) have raised safety concerns (Weiner, 2014), underscoring the need for MRV and LCA validation. Without renewable energy integration and rigorous monitoring, claims of carbon neutrality risk being overstated.

Still, the case for algae is compelling. They deliver direct CO_2 sequestration, reduce dependence on sugar-based substrates, substitute costly animal-derived media inputs, and open new recombinant protein routes. The algae–pharma nexus thus represents more than an incremental innovation: it is a transformative platform that links climate mitigation with healthcare sustainability. With appropriate engineering, renewable integration, and strict verification, algae can reposition pharmaceutical production from carbon-intensive dependency toward carbon-negative potential.

Space Research and the Algae Nexus

Algae are central to closed ecological life support systems (CELSS) because of their unique ability to fix CO_2, generate oxygen, and produce biomass. In NASA's CELSS program, *Chlorella vulgaris* was tested for oxygen and carbon cycling, while ESA's MELiSSA project identified *Spirulina platensis* as an astronaut food source due to its high protein content and essential vitamins (Ciferri, 1983; Hendrickx & Mergeay, 2007).

Recent analyses show that microalgae can support hybrid life-support architectures on the Moon and Mars. The PBR@LSR experiment and Detrell (2021) confirmed that *Chlorella* photobioreactors can reliably deliver oxygen and edible biomass in closed loops and become advantageous over purely physico-chemical systems for multi-year missions. The benefits extend beyond basic respiration: algae provide continuous O_2 with in-situ CO_2 uptake, fresh-food supplementation, and modular, automatable platforms for resilience. Key challenges include radiation tolerance, fluid dynamics in partial gravity, efficient lighting, biofilm control, and culture stability.

Algae also extend the scope of space biotechnologies into Earth-based applications. Lasseur et al. (2020) emphasized that algal systems designed for extreme environments can also serve arid regions, polar stations, or post-disaster shelters by supplying oxygen and food with

minimal resources. Different taxa provide complementary roles: *Spirulina* supplies proteins and antioxidants, *Chlorella* offers high oxygen yields, *Dunaliella* produces carotenoids with radiation-protective potential, *Chlamydomonas* contributes to photobiological hydrogen production, and algal biopolymers may serve as sustainable materials (Kanno et al., 2017; Rawat et al., 2013).

Despite these strengths, algal CELSS remain at TRL-3/4. Scaling and long-term reliability in microgravity require further validation. However, projects by NASA, ESA, and CNSA increasingly position algae as mission-critical, not auxiliary, components. This shift highlights their dual value: ensuring life support in extraterrestrial habitats and offering transferable models for sustainable adaptation on Earth. The algae–space nexus therefore embodies a transformative framework linking aerospace innovation with planetary resilience.

Finance Sector and the Algae Nexus

Algal biotechnology is emerging not only as an environmental solution but also as a strategic actor in the transformation of global financial systems. Rising carbon prices, the mainstreaming of Environmental, Social, and Governance (ESG) criteria in corporate strategies, and the growing emphasis on climate finance within the Conference of the Parties (COP) processes directly link algae-based projects to next-generation investment instruments (UNEP, 2023).

Algal biotechnology is increasingly positioned as both an environmental solution and a strategic actor in climate finance. Rising carbon prices, the mainstreaming of ESG (Environmental, Social, and Governance) criteria, and COP-driven mechanisms directly connect algae-based projects to investment instruments such as carbon credits, green bonds, insurance, and ESG-aligned funds (UNEP, 2023).

Table 6. Algae–Industry Nexus: Comparative Sectoral Overview

Sector	**Emission Logic**	**Algae-Based Solution Mechanism**	**TRL (2025)**	**Example / Evidence (APA Referenced)**	**Limitation & Risk (incl. numerical data)**
Energy	73% of global emissions are fossil-fuel based (IPCC, 2021).	Microalgae → biodiesel, bioethanol, biogas, biohydrogen; macroalgal farms → "Blue Carbon."	4–7	Krause-Jensen & Duarte (2016); UNEP (2021).	High energy/cost. LCA sensitive to electricity mix: up to 40% advantage loss in coal-intensive countries.
Cement	7–8% of global emissions; half calcination, half energy (IEA, 2022).	Spirulina → biogenic $CaCO_3$ additive (5–15% substitution); Ulva → ulvan additive.	4–5	Ariyanti et al. (2012); Rhoten (2023).	Flue gas logistics. Homogeneity of additive. Workability problems at high

Sector	Emission Logic	Algae-Based Solution Mechanism	TRL (2025)	Example / Evidence (APA Referenced)	Limitation & Risk (incl. numerical data)
					substitution levels.
Automotive / Tires	17–25% of energy-related emissions; carbon black production 2.5 t CO_2/ton (IPCC, 2021).	Spirulina/Chlorella → biochar (carbon black substitute); Nannochloropsis → biobutadiene.	4–6	Bardha et al. (2024); Chang et al. (2021).	Scaling cost. Particle size standardization for biochar.
Textiles	Synthetic dyes are toxic and carbon-intensive (UNEP, 2020).	Spirulina → natural pigment (phycocyanin); Dunaliella → β-carotene; Ulva → ulvan additives.	4–5	Mutaf-Kılıç et al. (2023); Safi et al. (2014).	Color fastness 15–20% lower. Scalability issue.
Feed	Soy and fishmeal → high land, water, methane footprint (FAO, 2020).	Spirulina/Chlorella → high protein/lipid; Asparagopsis → methane suppressant; Ulva → prebiotic additive.	5–6	Roque et al. (2021); Khan et al. (2023).	Spirulina costs ~3× higher than fishmeal. Bromoform long-term safety risk.
Food	1 kg beef ≈ 27 kg CO_2-eq; Spirulina ≈ –1.8 t CO_2/ton biomass (Poore & Nemecek, 2018; Wijffels & Barbosa, 2010).	Spirulina/Chlorella → protein, vitamins, pigments; Porphyridium/Ulva → prebiotic polysaccharides.	6–7	Poore & Nemecek (2018); Torres-Tiji et al. (2020).	Consumer perception (taste/color). High large-scale production costs.
Health / Pharma	Rising healthcare costs, demand for natural bioactives.	Spirulina → antioxidant, antiviral; Dunaliella → β-carotene; Porphyridium → antiviral polysaccharides.	5–6	Zheng et al. (2018); Safi et al. (2014).	Lack of long-term clinical efficacy data. Insufficient toxicity studies.
Space / Closed Systems	Space missions require oxygen,	Chlorella → O_2 production; Spirulina	3–4	Ciferri (1983);	Low TRL. Technology transfer from

Sector	Emission Logic	Algae-Based Solution Mechanism	TRL (2025)	Example / Evidence (APA Referenced)	Limitation & Risk (incl. numerical data)
	food, and waste management.	→ protein; closed photobioreactors.		Becker (2007); Fais et al. (2022).	space to Earth costly.
Finance	Carbon pricing, ESG funds, COP processes (UNEP, 2023).	Algae projects → carbon credits, green bonds, ESG funds, climate insurance.	5–7	Kanno et al. (2017); Verra (2022); Sachs et al. (2019).	In 2022, ~40% of voluntary carbon market credits reported as "low quality" (Gold Standard, 2022). Greenwashing risk high.

At the center of this framework are **carbon credits**, certificates for verified reductions or sequestration of one ton of CO_2. Spirulina biomass, for instance, fixes ~1.8 tons of CO_2 per ton (Kanno et al., 2017), enabling credit issuance under standards such as VCS or Gold Standard. Unlike forestry projects, algal credits are highly measurable and traceable, reducing risks of double counting or leakage and enhancing market reliability.

Beyond credits, algal projects benefit from **climate-linked finance**: insurance products backed by carbon assets, green bonds that channel debt into bio-based ventures, and ESG funds that classify Spirulina and Chlorella cultivation as environmental and social benefits (Sachs et al., 2019). Together, these instruments diversify algae's financial value streams beyond simple product sales.

Recent **COP decisions** have accelerated this integration. COP26 (Glasgow) operationalized Article 6 for cross-border carbon credit transfers; COP28 (Dubai) established the Loss and Damage Fund, opening resources for food and carbon projects; COP29 (Baku, 2024) introduced the "Baku–Belém Roadmap," committing USD 1.3 trillion annually by 2035 and standardizing transparent carbon market rules. Critically, algae-based credits are now eligible for compliance markets such as the EU ETS, where carbon prices have reached €80–100/ton. Looking forward, COP30 (Belém, 2025) is expected to broaden climate finance through the USD 125 billion "Tropical Forests Forever Facility," explicitly extending Nature-based Solutions (NbS) to macroalgal "Blue Carbon" systems.

In conclusion, algae-based projects serve dual purposes: supporting voluntary corporate carbon neutrality and enabling governments to meet binding NDCs. By generating multiple financial streams—credits, bonds, ESG investments, and insurance—algal biotechnology is positioned not only as a biotechnological innovation but also as a transformative financial asset. As summarized in **Table 6**, algae sit at the intersection of ecological sustainability, economic investment, and political strategy.

Conclusion

Throughout human history (from Ancient Rome to the Industrial Revolution and into the 20th century), societies have exhibited a recurring behavioral pattern: the tendency not to question order "as long as things seem to be going well." This comfort-driven approach, when combined with modern consumption habits that extend far beyond basic needs and into the pursuit of luxury and excess, has produced an unsustainable global paradigm: **business as usual (BAU)**. Each historical era in which BAU remained unchallenged has triggered new crises; today, however, IPCC reports clearly demonstrate that the BAU trajectory is driving the climate system toward irreversible tipping points and is fundamentally unsustainable. In this context, the algal nexus offers a strategic opportunity to break this cycle through carbon capture and multi–value chain integration. The atmosphere has become the de facto carbon reservoir of human activity; as long as annual emissions continuously feed into this pool, the stock will grow and ppm concentrations—already above 420—will continue to rise.

Merely slowing the growth rate of emissions is insufficient; achieving balance requires net-zero, while reducing existing concentrations demands the deployment of negative-emission strategies.

In this context, algal biotechnology emerges not only as a pathway for biomass production but also as a transformative solution that integrates carbon capture, fossil and raw material substitution, and the co-production of diverse high-value by-products. With their high photosynthetic efficiency and capacity to thrive in marginal environments, micro- and macroalgae provide nature-based solutions capable of supporting both the stabilization of net zero and the realization of negative emissions. The critical feature lies in the "algal nexus" concept, which serves as a multi-sectoral bridge spanning energy, food, industry, and environmental domains.

Nonetheless, biological limitations must be acknowledged. Rubisco—the central enzyme of photosynthesis—remains constrained by its low carboxylation rate and competing oxygenase activity. Overcoming this structural bottleneck requires the combined application of systems biology, synthetic biology, and promoter engineering to enhance CO_2-concentrating mechanisms (e.g., pyrenoids and carboxysomes) and to optimize Rubisco in a species-specific manner. While promising progress has been reported, industrial-scale maturity will demand further research and pilot-scale validation.

Biological innovations must advance in parallel with engineering and policy mechanisms. For algal projects to deliver credible climate benefits, they must be rigorously documented through Measurement–Reporting–Verification (MRV) protocols and Life Cycle Assessment (LCA). Without such safeguards, paper-based gains can be easily erased by fossil-intensive grid electricity, logistical inefficiencies, or shortcomings in product standardization.

Among nature-based solutions, algae hold a distinctive position. Their ability to be cultivated on saline water, wastewater, or industrial sites—without competing for arable land—differentiates them from forestry or wetland restoration. Macroalgal ventures, in particular, integrate carbon sequestration with biodiversity gains, positioning them as central actors in Blue Economy and Blue Carbon strategies.

Multi-value chains are critical for sectoral transitions. In high-emission domains such as cement and energy, algae can provide direct substitution and measurable emission reductions. In sectors such as automotive, textiles, feed, food, and healthcare, they offer co-benefits and low-carbon integration pathways that enhance scalability. Success depends on building reliable CO_2 supply logistics, ensuring homogeneous incorporation of algal derivatives into material matrices, achieving product standardization, and maintaining resilient biomass supply chains.

Financial architecture represents the key lever of this transition. Projects rooted in robust MRV frameworks can access carbon credits, green bonds, and ESG funds with greater credibility, provided that risks of double counting and greenwashing are systematically addressed. National and international carbon markets, CBAM mechanisms, and COP decisions together constitute the institutional framework that underpins the bankability of algal projects.

In conclusion, when molecular innovations (Rubisco and CO_2-concentrating mechanism engineering), industrial integration (embedding algae into high-emission sectors), and financial instruments (carbon markets, ESG funds) advance in parallel, algal biotechnology will not only stabilize the net-zero threshold but also enable the deeper objective of negative emissions. The true value of the algal–industry nexus lies not in promises but in independently verified climate impacts. To transcend humanity's recurring "as long as things go well" complacency and to compensate for its delayed awareness, the algal nexus must be regarded not merely as a biotechnology, but as a paradigm for a new civilization.

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AFET YÖNETİM RİSKLERİ BAĞLAMINDA İKLİM MÜLTECİLERİ KAVRAMININ İNCELENMESİ

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Öz

İklim değişimi ve beraberinde gelen iklim mültecileri kavramı küresel iklim yönetişiminde önemi artan bir konu haline gelmeye başlamıştır. İklimdeki bu değişikliklerin, gıda güvensizliği, kuraklık ve içme suyunun bozulması, artan bulaşıcı hastalıklar dahil olmak üzere insanlar için bir dizi olumsuz olaya yol açması muhtemeldir. Çalışmada afet yönetimi açısından önem taşıyan iklim krizi ve iklim mültecilerine ilişkin veriler incelenmiş ve gelecek projeksiyonuna değinilmiştir. 2024 yılında kaydedilen afet kaynaklı yerinden edilmelerin %60'ından fazlası düşük veya orta-alt gelirli ülke veya bölgelerde meydana gelmiştir. 2050 yılında küresel iklim göçmenlerinin nüfustaki payının yüzde 2.3'ten fazla olacağı öngörülmektedir**.** Küresel ısınmanın yoksul bölgelerde yaygın siyasi istikrarsızlığa ve büyük mülteci hareketlerine yol açabileceği üzerinde durulmaktadır. İklim kaynaklı göç ve kaynak kıtlığının devletler arasında da şiddetli çatışmalara ve savaşlara yol açabileceği konusunda görüşler bulunmaktadır. Erken uyarı sistemlerini güçlendirmek, iklime dayanıklı altyapıya yatırım yapmak ve en çok risk altında olan kişileri koruyan ve yerinden edilmiş kişiler için kalıcı çözümler sunma hedefi olan politikalar tasarlamak için veri ve risk analizinden yararlanmak kritik öneme sahiptir. İklim değişiminin neden olabileceği doğal ve beşeri olası afetler açısından da afet risklerinin bu bağlamda tanımlanması ve iklim mültecilerinin bölgesel artışlarının da dikkate alınarak oluşabilecek farklı afet risklerinin de dahil edildiği afet yönetim politikalarının oluşturulmasının gerekli olduğunun önemine değinilmiştir.

Anahtar Kelimeler: Afet yönetimi, İklim mültecileri, İklim değişimi

AN EXAMINATION OF THE CONCEPT OF CLIMATE REFUGEES IN THE CONTEXT OF DISASTER MANAGEMENT RISKS

Abstract

Climate change and the accompanying concept of climate refugees have become an increasingly important issue in global climate governance. These changes in climate are likely to cause a series of adverse events for humans, including food insecurity, drought, contamination of drinking water, and increased infectious diseases. The study examined data related to the climate crisis and climate refugees, which are important from a disaster management perspective, and discussed future projections. More than 60% of disaster-related displacements recorded in 2024 occurred in low- or lower-middle-income countries or regions. It is projected that by 2050, the share of global climate migrants in the population will exceed 2.3%. The study highlights that global warming could lead to widespread political instability and large refugee movements in poor regions. There are views that climate-induced migration and resource scarcity could also lead to violent conflicts and wars between states. It is critical to utilise data and risk analysis to strengthen early warning systems, invest in climate-resilient infrastructure, and design policies that aim to protect those most at risk and provide durable

solutions for displaced persons. The importance of defining disaster risks in this context, taking into account the regional increase in climate refugees, and establishing disaster management policies that include different disaster risks that may arise has been emphasised.

Keywords: Disaster management, Climate refugees, Climate change

GİRİŞ

İklim değişikliği dünya nüfusunun büyük bir bölümünü tehdit etmektedir. İklim değişikliğinin en ciddi etkileri, milyonlarca insanın kıyı erozyonu, kıyı taşkınları ve şiddetli kuraklık nedeniyle yerinden edilmesiyle insan göçü üzerindeki etkiler olarak kabul edilmektedir. Tahminlerin çoğu ekolojik stresin artmasının dışarı göçü yoğunlaştırdığı yönündedir (Bettini, 2013). "İklim mültecisi" teriminin kavramsal kökeni, çevresel değişikliklere bağlı olarak zorunlu göçe maruz kalan kişileri tanımlamak için kullanılan "çevresel mülteci" terimiyle yakından ilişkilidir. Kötüleşen çevre koşullarıyla bağlantılı göç yeni bir olgu olmamakla birlikte, çevresel mülteci kavramı olarak 1970'lerde, özellikle Afrika'daki çölleşme gibi çevresel krizlerle paralel olarak ortaya çıkmıştır. Hem "çevresel mülteci" hem de "iklim mültecisi" terimleri, çevresel değişiklikler (önemli ölçüde iklim değişikliği) nedeniyle yerinden edilmiş veya yerinden edilme riski altında olan toplulukları tanımlamak için kullanılmaktadır (Farbotko & Lazrus , The First Climate Refugees? Contesting Global Narratives of Climate Change in Tuvalu, 2012).

İklim mültecisi terimi özellikle kuraklık, çölleşme, ormansızlaşma, toprak erozyonu, su kıtlığı ve yükselen deniz seviyeleri nedeniyle toprakların yok olması (örn, Tuvalu ve Kiribati gibi tüm ada ülkeleri ve Bangladeş gibi alçak alanlar) gibi iklim değişikliği etkileri nedeniyle kalıcı veya geçici olarak yerlerinden edileceği tahmin edilen çok sayıda insanı tanımlamak için kullanılmıştır (Farbotko & Lazrus , The First Climate Refugees? Contesting Global Narratives of Climate Change in Tuvalu, 2012). Tatlı suya erişimin olmaması, ekim ve yem için arazilerin azalması, seller, sıcak hava dalgaları, kuraklık, çölleşme, fırtınalar, kasırgalar ve hastalıklar da bu listeye dahil edilebilir. Dahası, bu nedenlerin kendileri de aşırı kalabalık şehirler, iş kaybı, yoksulluk, kıtlık ve (kıt) toprak ve kaynakların getirdiği sonuçlar da savaşlar ve çatışmalar gibi başka afetleri tetikleme olasılığını arttırmaktadır (Nils, 2022). Olumsuz iklim koşulları alışılmadık iklim koşullarını beraberinde getirme ile birlikte bireyler bölgelerinde temel yaşam gereksinimlerini sağlayamamaları nedeniyle bulundukları ülke içinden farklı bir bölgeye ya da yaşamaya daha elverişli farklı bölgelerdeki ülkelere doğru göç etmek durumunda kalmaktadırlar. Son yıllarda, sıcak hava dalgaları, kuraklık, artan yağış, sel ve deniz seviyesinin yükselmesi gibi olumsuz koşullar nedeniyle bu durumun arttığı da görülmektedir (Statista, 2025). İklim değişimi sosyal ve ekonomik etkileri ile ülkeleri de farklı yönlerden etkilemektedir.

Birleşmiş Milletler Çevre Programı (UNEP) raporu, çevresel mülteci terimini ön plana çıkardı ve Hükümetler arası İklim Değişikliği Paneli (IPCC) raporu, "[Küresel ısınmanın] büyük insan göçlerini başlatabileceğini ve yıllar içinde yerleşim düzenlerinde ciddi bozulmalara ve bazı bölgelerde sosyal istikrarsızlığa yol açabileceğini" savunan bir rapor hazırladılar. Artan kaynak kıtlığı, çölleşme, kuraklık ve sel riskleri ve yükselen deniz seviyelerinin milyonlarca insanı göç etmeye itebileceğine bu raporda vurgu yapılmıştır (Piguet, 2013). 2008'den bu yana her yıl ortalama 21,5 milyon insan, sel, fırtına, orman yangını ve aşırı sıcaklıklar gibi hava kaynaklı ani başlayan tehlikeler nedeniyle yerinden edilmiştir (Nils, 2022). 2050 yılına kadar iklim değişikliği nedeniyle yerinden edilecek insan sayısının 1,5 milyar olabileceği belirtilmektedir (Atapattu, 2020).

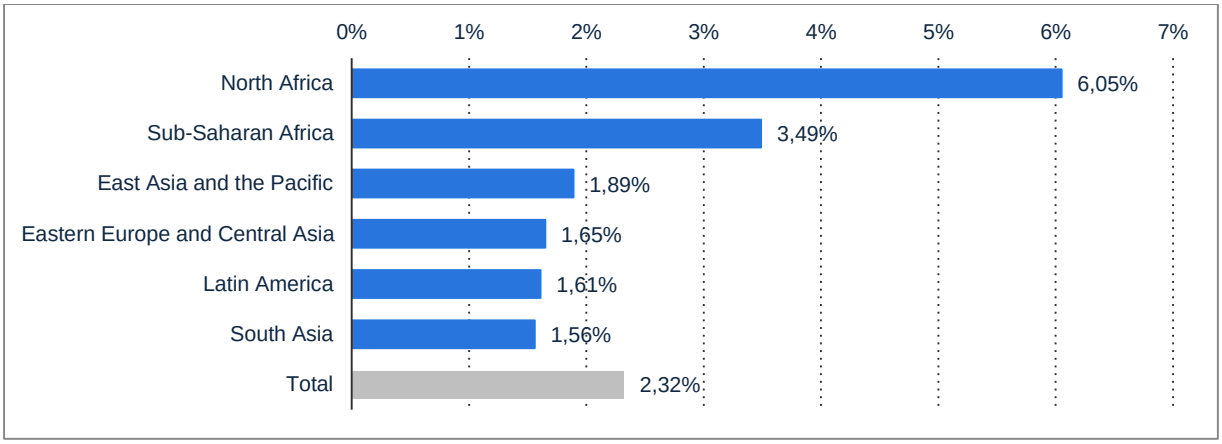
İç Göç İzleme Merkezi (IDMC)'nin yayınladığı rapora göre, 2015-2024 yılları arasında 210 ülkede 264,8 milyon insanın zorunlu göçünün afetler nedeniyle gerçekleştiği belirtilmiştir. Bu göçlerin yüzde 89'u fırtına ve sellerden kaynaklanırken, depremler, kuraklıklar ve orman yangınları da milyonlarca insanı göçe zorlamıştır. Afet kaynaklı yerinden edilmeler neredeyse her ülkede meydana gelmekle birlikte, en şiddetli etkileri insanların ve altyapının iklim değişikliğinin etkilerine en açık olduğu yerlerde görülmektedir. 2024 yılında kaydedilen afet kaynaklı yerinden edilmelerin %60'ından fazlası düşük veya orta-alt gelirli ülke veya bölgelerde meydana gelmiştir. Erken uyarı sistemlerini güçlendirmek, iklime dayanıklı altyapıya yatırım yapmak ve en çok risk altında olan kişileri koruyan ve yerinden edilmiş kişiler için kalıcı çözümler sunma hedefi olan politikalar tasarlamak için veri ve risk analizinden yararlanmak kritik öneme sahiptir (Internal Displacement Monitoring Centre, 2025). Pasifik'teki alçak adaların, iklim kaynaklı yerinden edilmenin ön saflarında yer aldığı yerler olarak sıklıkla vurgulanır; ancak Asya, Afrika ve Latin Amerika'daki çeşitli nüfuslar da iklim kaynaklı göç sorunuyla karşı karşıyadır (Farbotko & Lazrus , The First Climate Refugees? Contesting Global Narratives of Climate Change in Tuvalu, 2012).

Küresel ısınmanın yoksul bölgelerde yaygın siyasi istikrarsızlığa ve büyük mülteci hareketlerine yol açabileceği üzerinde durulmaktadır. İklim kaynaklı göç ve kaynak kıtlığının devletler arasında da şiddetli çatışmalara ve savaşlara yol açabileceği konusunda görüşler bulunmaktadır (Hartmann, 2010).

İklim mültecileri, kuraklık, çölleşme, ormansızlaşma, toprak erozyonu, su kıtlığı ve iklim değişikliği gibi alışılmadık çevresel faktörler ve ayrıca siklonlar, fırtına dalgaları ve seller gibi doğal afetler nedeniyle geleneksel anavatanlarında artık güvenli bir geçim kaynağı bulamayan kişilerdir. Bu çevresel tehditler karşısında, insanlar ister kendi ülkeleri içinde ister başka bir yerde, ister yarı kalıcı ister kalıcı olsun, geçimlerini başka yerlerde aramaktan başka çareleri olmadığını düşünürler (Hartmann, 2010). Bu durum, deniz seviyesinin yükselmesiyle karşı karşıya kalan Pasifik ada toplulukları bağlamında, yerinden edilmiş adalıların geleceğin iklim mültecileri olarak yaygın bir şekilde temsil edilmesinde kendini göstermektedir. Deniz seviyelerinin 21. yüzyılın sonuna kadar küresel olarak 0,79 m'ye kadar yükseleceği tahmin ediliyor. Hükümetler arası İklim Değişikliği Paneli, Grönland ve Antarktika'daki kara buzullarının erimesi nedeniyle daha büyük yükselmelerin mümkün olduğunu öne sürmektedir. (Farbotko & Lazrus , The First Climate Refugees? Contesting Global Narratives of Climate Change in Tuvalu, 2012).

Çalışmada afet yönetimi açısından önem taşıyan iklim krizi ve iklim mültecilerine ilişkin veriler incelenmiş ve gelecek projeksiyonuna değinilmiştir.

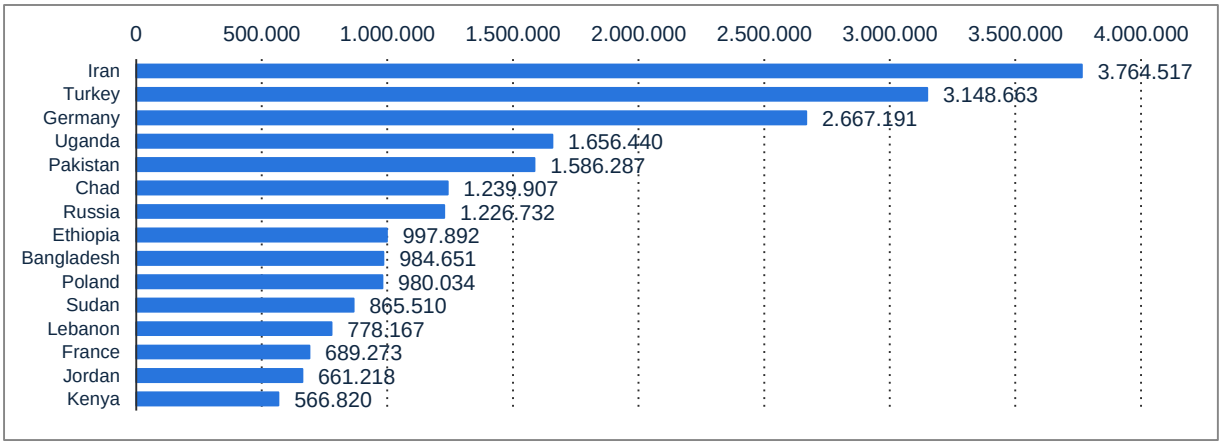
Şekil 1'de görüldüğü üzere 2050 yılına kadar, iç iklim göçmenleri Kuzey Afrika nüfusunun yüzde altısından fazlasını ve Sahra Altı Afrika nüfusunun yaklaşık yüzde 3,5'ini oluşturabilir. Bu tahmin, yüksek sera gazı emisyonu ve eşit olmayan kalkınmanın da dahil edildiği bir senaryoyu göstermektedir. İncelenen altı bölgede, nüfusun yüzde 2,3'ünden fazlasının yüzyılın ortasına kadar yerinden edileceğini göstermektedir (Statisca, 2025).



Şekil 1: 2050 yılında küresel iklim göçmenlerinin nüfustaki payı, bölgelere göre

Kaynak: (Statisca, 2025)

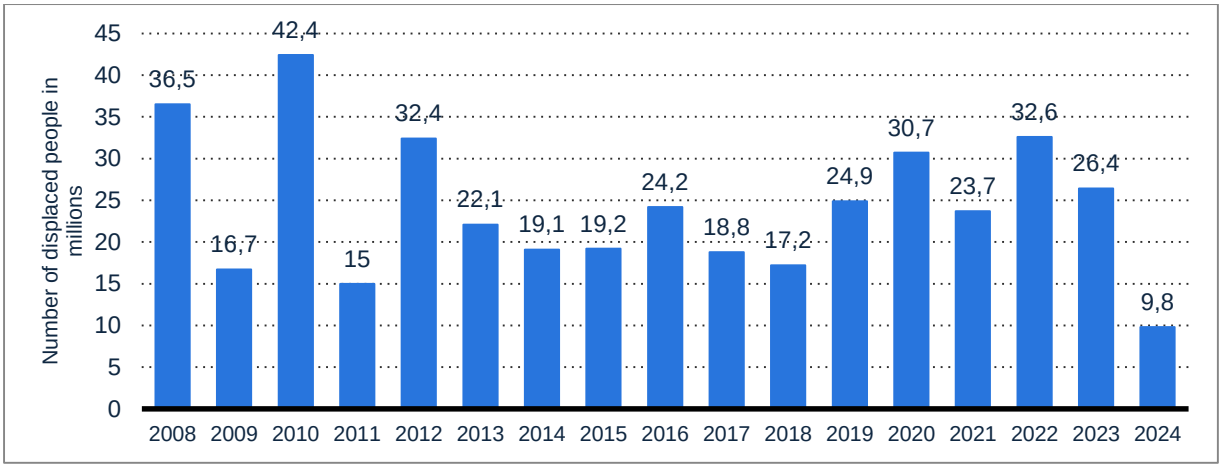
Şekil 2'de görüldüğü üzere, 2024 ortası itibarıyla İran, dünyanın en büyük mülteci barındıran ülkesiydi. BM Mülteciler Yüksek Komiserliği (UNHCR) verilerine göre, İran'da yaklaşık 3,8 milyon mülteci bulunuyordu. Türkiye, 3,1 milyondan fazla mülteciyle ikinci sıradaydı. (Statista, 2025). Ardından 2,6 milyondan fazla mülteci ile Almanya gelmektedir.



Şekil 2: 2024 yılı ortası itibarıyla en fazla mülteciye ev sahipliği yapan ülkelerin sıralaması

Kaynak: (Statista, 2025)

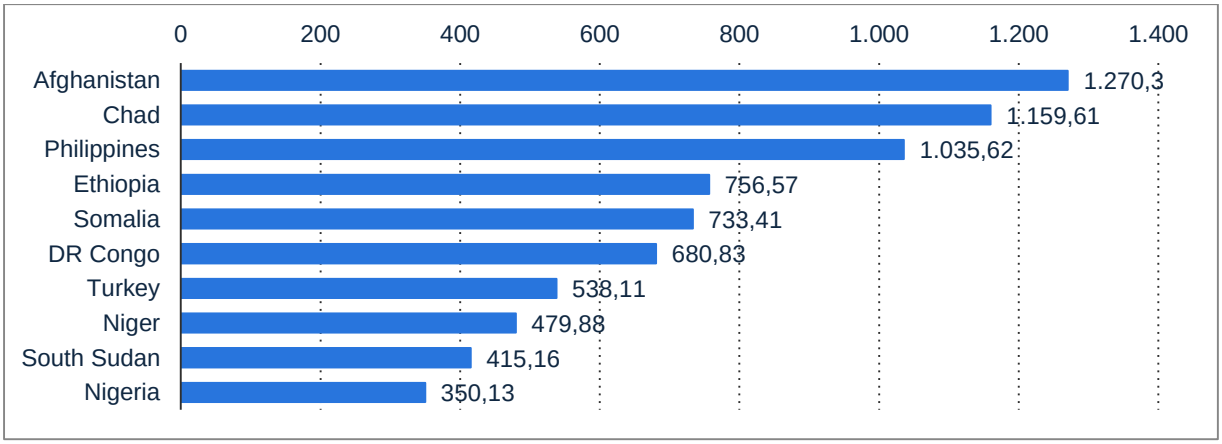
Şekil 3'de görüldüğü üzere, 2024 yılında, dünya genelinde yaklaşık 9,8 milyon insan afetler nedeniyle ülke içinde yerinden edildi. Bu rakam, 2010 yılındaki 42,4 milyonluk rekor seviyeyi bulmuştur. Sadece Afganistan'da, doğal afetler nedeniyle 1,3 milyon insan yerinden edildi (Statista, 2025). 2010 yılı iklim krizi ve mülteci krizleri konularının birlikte ön plana çıktığı yıl olarak görülmektedir. Suriye'den Avrupa'ya, Myanmar'dan Asya'ya ve Latin Amerika'dan Amerika Birleşik Devletleri'ne yaşanan göç dalgaları 2010'lu yıllarda ön plana çıkan konular olmuştur. Bu nedenle afetler nedeniyle rekora ulaşmış bir yerinden edilen kişi sayısına ulaştığı söylenilebilir (Kaygusuz, 2019). Ayrıca 2010 yılı dünyada pek çok afete neden olmuştur. Bunlardan bazıları Haiti'den 1,5 milyondan fazla kişinin evsiz kalmasına neden olan deprem, Ardından Şili de 8,8 büyüklüğünde meydana gelen deprem, ardından Yeni Zelanda'da meydana gelen 7,1 büyüklüğündeki deprem, Endonezya'daki Merapi Yanardağı'nın patlaması, Pasifikte görülen 13 fırtına sayılabilir (Israel, 2010).



Şekil 3: 2008-2024 yılları arasında dünya genelinde afetler nedeniyle yerinden edilen insan sayısı (milyon)

Kaynak: (Statista, 2025)

Şekil 4'de görüldüğü üzere, 2024 yılında Afganistan'da yaklaşık 1,3 milyon kişi doğal afetler nedeniyle ülke içinde yerinden edildi; bu, tüm ülkeler arasında en yüksek sayıyı oluşturmaktadır. Çad, yaklaşık 1,2 milyon kişiyle ülke içinde yerinden edilen kişi sayısına sahip ülkeler arasında ikinci sırada yer almaktadır ve onu takip eden ilk beşte yer alan ülkeler Filipinler, Etiyopya ve Somali oldu. Türkiye ise yaklaşık 540 bin kişi ile yedinci sırada yer almaktadır. 2024 Uluslararası Afet Veri Tabanı (EM-DAT) verilerine göre kıtalara göre afet sayısı, sıklığı ve boyutuna göre bakıldığında Afganistan 8. Sırada yer almaktadır. Afganistan'da, Afganistan Kızılayı (ARCS) ve Afganistan Ulusal Afet Yönetim Kurumu'na (ANDMA) göre, soğuk hava dalgaları, kar yağışı, tipi, toprak kayması ve seller gibi şiddetli kış koşullarının görüldüğü bildirilmiştir. Ayrıca 2024 en çok ölümün yaşandığı 2. ülke olarak şiddetli kış koşulları nedeni ile 1. sırada yer almaktadır. 2 sırada ise sıcak hava dalgası ile Suudi Arabistan yer almıştır (EM-DAT The International Disaster Database , 2025).

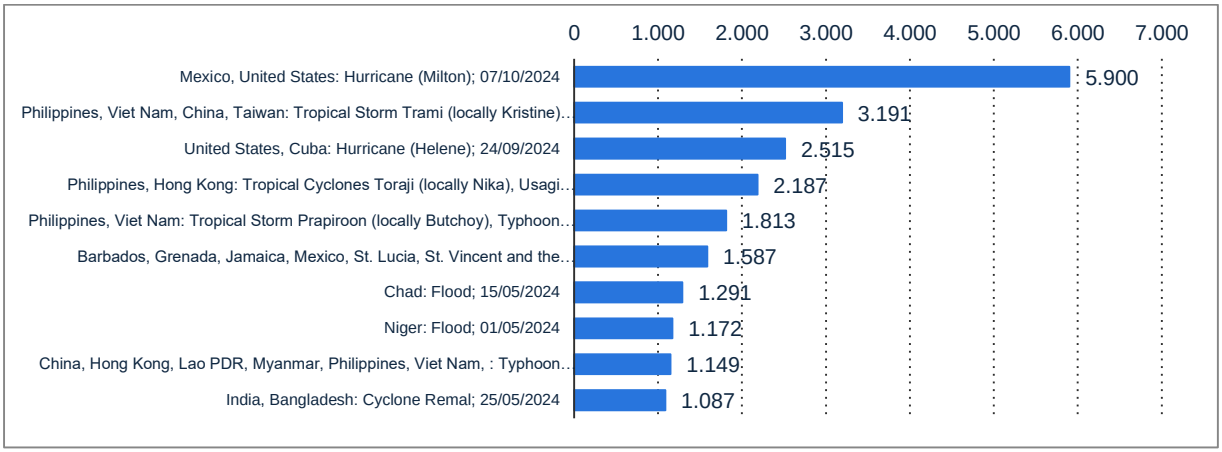


Şekil 4: 2024 yılı sonu itibarıyla afet nedeniyle ülkelerin kendi içinde yerinden edilen kişi sayısı

Kaynak: (Statista, 2025)

Şekil 5'de görüldüğü üzere, 2024 yılında, Ekim ayında Meksika ve Amerika Birleşik Devletleri'ni vuran kasırga, en fazla iç göçe neden olan doğal afet olarak görülmektedir. Kasırga nedeniyle 5,9 milyon kişi yerinden edilmiştir. Ayrıca, tropikal fırtına Trami, Güney

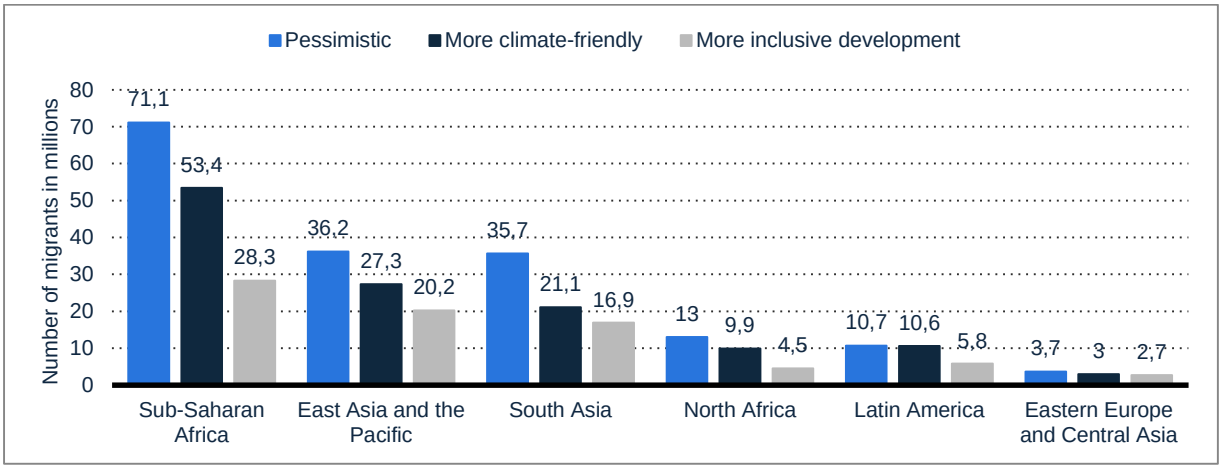
Asya'da üç milyondan fazla insanı yerinden etmiştir (Statista, 2025). Amerika ve Küba'yı vuran kasırganın 2,5 milyon kişiyi yerinden ettiği görülmektedir.



Şekil 5: 2024 yılında en çok yerinden edilmeye neden olan doğal afetler

Kaynak: (Statista, 2025)

Şekil 6'da görüldüğü üzere, İklim değişikliğinin yavaş yavaş ortaya çıkan etkileri nedeniyle, 2050 yılına kadar dünya çapında 170 milyondan fazla insan ülke içinde iç göç yaşayabilir. kötümser bir senaryoya dayanmaktadır. Daha iklim dostu bir senaryoda dahi, bu rakam yine de yaklaşık 125 milyon iklim göçmenine denk gelirken, daha kapsayıcı bir kalkınma planı uygulandığı takdirde yaklaşık 78 milyon göçmene yol açacağı ön görülmektedir (Statista, 2025). En yüksek göçün ise Sahra altı Afrika bölgesinde yaşanacağı öngörülmektedir. Şekil 4'de 2024 yılı sonu itibarıyla afet nedeniyle ülke genelinde yerinden edilen kişi sayısının da bu durumu teyit ettiği, Çad, Etiyopya, Somali, Kongo, Nijer, Güney Sudan ve Nijerya'nın ilk 10 ülke arasında yer aldığı görülmektedir (Republic of Türkiye Ministry of Foreign Affairs, 2025).



Şekil 6: Bölgelere göre 2050 yılına kadar küresel ölçekte öngörülen iç iklim göçmenleri

Kaynak: (Statista, 2025)

Afet yönetimi açısından iklim değişiminin taşıdığı risklerin başında, kuraklık, çölleşme, ormansızlaşma, toprak erozyonu, su kıtlığı ve iklim değişikliği gibi alışılmadık çevresel faktörler ve ayrıca siklonlar, fırtına dalgaları ve seller gibi doğal olayların yanın temiz suya erişimin zorlaşması ve seller nedeniyle oluşabilecek salgın hastalıklar görülmektedir. Ayrıca oluşabilecek kıtlığın iç çatışma ve savaş gibi insan eliyle oluşan beşeri afetleri de tetikleyebileceği söylenilebilir. İklim mültecileri kavramının iç ve dış göç de bölgesel olarak bölgelerin mevcut iklim riskleri göz önünde tutularak afet politikalarını bu kapsamda

genişletmeleri ve kalkınma politikalarının içine uyumlaştırmaları sürecin gelecekteki sağlıklı yönetimi için de önem taşıdığı görülmektedir.

V. SONUÇ

İklim değişikliği, önümüzdeki yıllarda halk sağlığı için en büyük tehdit olarak kabul edilmektedir. İklim krizi, dünyanın hemen hemen her bölgesinde bireyleri ve küresel halk sağlığı sistemlerini tehdit etmektedir. Bu durum özellikle kuraklıklara bağlı artan yetersiz beslenme vakalarında ve sellerden kaynaklanan kolera gibi su kaynaklı hastalıkların artan insidansında belirgin olarak kendini göstermektedir. Birincil basamak bakıma erişim ve sağlık hizmetlerinin sürekliliğinin genellikle göç, zayıf sağlık sistemi kapasitesi, çeşitli engeller (örneğin cinsiyet, kültürel, finansal, sosyal ve dilsel) nedeniyle kesintiye uğrayabilmektedir. Doğal afetler ve iklim değişikliği nedeniyle 2050 yılına kadar yaklaşık 1,2 milyar insanın yerinden edilebileceği tahmin edilmektedir. Veriler, deniz seviyelerinin yükselme riski yüksek olan kıyı bölgelerinde yaşayan insan sayısının son 30 yılda 160 milyondan 260 milyona yükseldiğini göstermektedir. Bu insanlardan bir kısmı yoksul ve gelişmekte olan ülkelerde yada küçük ada devletlerinde bulunmaktadır. Örneğin Bangladeş, bunun çarpıcı bir örneğidir; 2050'ye kadar 20 milyon insanın evlerini kaybedeceği tahmin ediliyor, çünkü ülkenin %17'sinin yükselen deniz seviyeleri nedeniyle su altında kalacağı öngörülmektedir (Saverio, Christian, Catello M, Maura, & Luca, 2023). Okyanusya adalarından olan Tavalu, iklim değişikliğinin takibinin yapıldığı bir laboratuvar olarak görülmektedir. Tuvalu adaları ve Tuvalulular deniz seviyesinin yükselmesine ilişkin tartışmalarının odak noktasında kalmakta ve takip edilmektedirler. Kaybolan adalar ve iklim mültecileri konusu da bu minvalde ele alınmaktadır (Farbotko, Wishful Sinking: Disappearing Islands, Climate Refugees and Cosmopolitan Experimentation, 2010). İklim değişikliğinin olumsuz etkisinin bir sonucu olarak, insanları daha güvenli bir ortamda yaşamak için arayışa gireceklerdir. Bu durumda da çok sayıda iklim mültecisinin önümüzdeki yıllarda ortaya çıkacağı öngörülmektedir (Nils, 2022). Ayrıca 2000'lerin başından bu yana iklim değişikliği bir güvenlik sorunu olarak çerçevelenmiştir. Bu konu hem BM Güvenlik Konseyi'nde hem de BM Genel Kurulu'nda gündeme gelmiştir. Birçok ulusal güvenlik stratejisinde bu konu yer almaktadır. İklim kaynaklı göç, iklim güvenliği söylemlerinin içinde yer almaktadır (Baldwin, Methmann, & Rothe, 2014). Uluslararası hukuk kapsamında iklim mültecileriyle ilgili mevcut yasal boşluğun sürdüğü de görülmektedir. İklim mültecileri yasal koruma elde etme konusunda sorunla karşı karşıyadır. 'İklim mültecileri' yasal bir terim değildir; iklim nedeniyle yerinden edilmiş kişileri yöneten yasal bir rejim de bulunmamaktadır. 'İklim mültecileri' terimi, sadece iklim değişikliğiyle ilişkili olumsuz sonuçlar nedeniyle göç etmek zorunda kalanları tanımlar. İklim değişikliği, göçü daha olası hale getirirken, iklim değişimine aşırı maruz kalan bölgelerdeki milyonlarca insan da ekonomik, politik ve sosyal nedenlerle bu savunmasız bölgelerden göç edememe durumunda da kalabilmektedirler (Atapattu, 2020). İklimdeki bu değişikliklerin, gıda güvensizliği, kuraklık ve içme suyunun bozulması, artan bulaşıcı hastalıklar ve artan vektör kaynaklı hastalıklar da dahil olmak üzere insanlar için bir dizi olumsuz olaya yol açması muhtemeldir. Kuraklıkların artması ile birlikte yaklaşık 1.5 milyon insanın su sıkıntısı çekeceği tahmin ediliyor. Yükselen deniz seviyeleri ve fırtınalar, özellikle Pasifik Adaları olmak üzere alçak kara kütleleri için potansiyel olarak felakettir; Kiribati ve Tuvalu'nun 2050 yılına kadar yaşanmaz olacağı da öngörülmektedir. Yiyecek ve içme suyu gibi hayati kaynakların kıtlığı arttıkça, çatışmaların ortaya çıkması muhtemeldir. Bu durumda iklim değişiminin beşeri diğer afetleri tetiklemesi de olası görülmektedir. Bunların hepsi, iklim bozulması nedeniyle nüfusun yerinden edilmesinin başlıca nedenleri arasında sayılabilir (Lea & Peter , 2018). Çevre mültecilerinin insani yardım hakları, devletlere bağlayıcı yükümlülükler yüklemektedir. Hızlı ve yeterli müdahaleler için bölgesel iş birliğinin önemi bu süreçte ortaya çıkmaktadır. İklim kaynaklı hasar nedeniyle yaşanan yaygın çevresel yerinden edilme vakaları, çevresel yıkımın

suç sayılması ve çevre eğitiminin verilmesi gibi koordineli önleyici tedbirlere ihtiyaç duyulması uluslararası hukukun da bu konuda daha güçlü uygulanmasını gerektirmektedir (Mohammad & Peyman , 2025). İklim değişiminin tetikleyeceği, doğal ve beşeri olası afetler açısından da afet risklerinin bu bağlamda tanımlanması ve iklim mültecilerinin bölgesel artışlarının da dikkate alınarak oluşabilecek farklı afet risklerinin de dahil edildiği afet yönetim politikalarının oluşturulmasına ihtiyaç duyulmaktadır.

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TÜRKİYE'DE ORMAN YANGINLARININ 2009-2025 DÖNEMİNDEKİ EĞİLİMLERİ VE AFET YÖNETİMİ SÜREÇLERİ AÇISINDAN DEĞERLENDİRİLMESİ

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Öz

Orman yangınları çevre, ekosistem, biyolojik çeşitlilik, iklim ve insanlar üzerinde yıkıcı etkilere sahiptir. Küresel iklim değişikliği, sıcak hava dalgaları, rüzgâr hızındaki artışlar ve insan kaynaklı faaliyetler yangınların sıklığını ve şiddetini artırmaktadır. Bu kapsamda orman yangınlarının bütünleşik afet yönetimi döngüsü bağlamında değerlendirilmesi ve tedbirlerin alınmasını gerekli kılmaktadır. Çalışmada analiz yöntemi olarak Türkiye'de 2009–2025 dönemi için yıllık yangın sayısı ve yanmış alan eğilimleri incelenmiştir. 2025 yılı için Türkiye'deki haftalık veriler Avrupa Orman Yangını Bilgi Sistemi (EFFIS)'in Hızlı Hasar Değerlendirme (RDA) sisteminden yararlanılarak haftalık yanmış alanlar ve haftalık yangın sayılarına yer verilmiştir. Bulgular afet yönetimi döngüsü ile ilişkilendirilmiş, uluslararası örneklerle (İspanya, İtalya ve Yunanistan) karşılaştırmalar yapılmıştır. Çalışmada ulaşılan sonuçlar ışığında, önleme kısmında, orman yangınlarını önleme konusunda faaliyet gösteren kamu kurumlarının ve sivil toplum kuruluşlarının varlığı, uluslararası işbirliklerinin mevcudiyeti ve arazi yakmaya ilişkin bireysel, kurumsal/topluluk için caydırıcı nitelik taşıyan kanun ve yönetmeliklerin gerekliliği üzerinde durulmuştur. Hazırlık kapsamında Erken Uyarı Sistemlerinin varlığı, ilçe düzeyinde afet müdahale biriminin mevcudiyeti, orman yangınlarıyla başa çıkma kapasitesinin iyileştirilmesine odaklanılmasının gerekliliğine yer verilmiştir. Müdahale sürecinde teknolojiden yararlanılması ve müdahale birimlerinin etkililiğinin önemi belirtilmiştir. İyileştirme sürecinde hasar alan alanların yeniden inşa edilmesi ile orman gençleştirme ve restorasyonunun önemine değinilmiştir. Sonuç olarak, orman yangınlarını önleme konusunda tutarlı politikalar uygulamanın, toplumu sürece dahil etmenin ve toplumu ormanların sürdürülebilirliğini sağlamanın önemi konusunda eğitmenin önemli olduğu belirtilmiştir.

Anahtar Kelimeler: Orman Yangınları, Afet Yönetimi, Afet Yönetim Süreçleri

ASSESSMENT OF FOREST FIRE TRENDS IN TURKEY BETWEEN 2009 AND 2025 AND DISASTER MANAGEMENT PROCESSES

Abstract

Forest fires have devastating effects on the environment, ecosystems, biodiversity, climate and people. Global climate change, heat waves, increases in wind speed and human activities are increasing the frequency and intensity of fires. In this context, it is necessary to assess forest fires within the framework of the integrated disaster management cycle and take appropriate measures. In this study, the analysis method involved examining annual fire counts and burned area trends for the 2009–2025 period in Turkey. Weekly data for Turkey for 2025 were

obtained from the Rapid Damage Assessment (RDA) system of the European Forest Fire Information System (EFFIS) and included weekly burned areas and weekly fire counts. The findings were related to the disaster management cycle and compared with international examples (Spain, Italy, and Greece). In light of the results obtained in the study, in the prevention section, emphasis was placed on the existence of public institutions and non-governmental organisations engaged in forest fire prevention, the existence of international cooperation, and the necessity of laws and regulations that act as a deterrent to individuals, institutions and communities regarding land burning. In terms of preparedness, the study emphasised the importance of early warning systems, the existence of disaster response units at the district level, and the need to focus on improving the capacity to deal with forest fires. The study also highlighted the importance of using technology and the effectiveness of response units in the response process. In the improvement process, the importance of rebuilding damaged areas and forest regeneration and restoration has been highlighted. In conclusion, it has been emphasised that it is important to implement consistent policies on forest fire prevention, involve the community in the process, and educate the community on the importance of ensuring the sustainability of forests.

Keywords: Forest Fires, Disaster Management, Disaster Management Processes

GİRİŞ

Orman yangınları, hava ve iklim değişiklikleri nedeniyle tekrar tekrar meydana gelerek çevreye zarar verebilen olaylardır. Yangınları etkileyen değişkenler arasında iklim değişkenleri, demografik değişiklikler, yangın kontrolünü iyileştirmeye yönelik protokollerin tasarlanmasındaki eksiklikler sayılabilir (Gusmira, Frinaldi, Putra, & Malini, 2025). Türkiye orman varlığı bakımından zengin bir ülke olmakla birlikte, Akdeniz iklim kuşağında yer aldığı için yangın riski yüksektir. Küresel iklim değişikliği, sıcak hava dalgaları, düşük nem, rüzgâr hızındaki artışlar ve insan kaynaklı faaliyetler yangınların sıklığını ve şiddetini artırmaktadır. Özellikle 2021 yılında yaşanan büyük yangınlar ile son zamanlarda artan orman yangınlarının yalnızca çevresel değil, aynı zamanda sosyal ve ekonomik bir afet niteliği taşıdığı da açıkça görülmektedir.

Çeşitli ülkelerde orman yangınlarının oluşumunu azaltmaya yönelik bazı çabalar orman yönetimi alanındaki hükümet politikaları aracılığıyla gerçekleştirilmektedir. Orman yangınını ele alan yasaların uygulanması, büyük olaylara göre şekillenmek ile birlikte, hükümetler, orman gelişiminin yanı sıra öncelikle yanan alanlara odaklanmaktadır. Ayrıca, orman yangınına ilişkin mevzuatlar, yasal araçların veya orman yönetimi ve planlamasının etkinliği de dahil olmak üzere diğer unsurlarla da ilişkilendirilmektedir. Orman yangını azaltma çalışmalarında, merkezi ve bölgesel yönetimler ile orman yangını önleme yönetişimini ve kamuoyunun bilgisini artırmayı amaçlayan eğitim programları arasında da bir etkileşime ihtiyaç duyulduğu görülmektedir. Ayrıca, yangın azaltma ve müdahale eylemlerinin planlanmasında bütünleşik bir yaklaşıma ihtiyaç duyulmaktadır. Çin hükümeti, orman yangınlarının önlenmesi konusuna verilen önemi artırmak için ilgili politikalar yayınlamıştır. Bu politikalar arasında, yoksul kırsal kesim sakinlerinin ekolojik orman bekçisi (EFR) olarak çalıştırılması da yer almaktadır. Britanya Kolumbiyası'ndaki (BC) yangın azaltma çalışmaları, Kanada'daki Topluluk Ormanları, Yerli ve/veya yerel topluluklara verilen uzun vadeli arazi temelli kullanım hakları, proaktif orman yangını yönetimini kolaylaştıran yerel savunucular olarak ortaya çıkmıştır. Bölgesel düzeyde geliştirilen yasal ve düzenleyici mekanizmalar, ulusal zorunluluklara yanıt olarak benimsenmiş ve mevcut orman yönetimi politikalarına entegre edilmiştir. Endonezya hükümetinin orman yangınlarını azaltma çabaları arasında, tarım arazisi temizliği için anız yakma uygulamasının katı bir şekilde yasaklanması da yer

almaktadır; ancak bu, çiftçileri eğitmediği için etkili olamamıştır (Gusmira, Frinaldi, Putra, & Malini, 2025). Ayrıca müdahale sürecinde a) Yangın yoğunluğunun en yüksek olduğu yerlerin belirlenmesi, b) Yangının yayılma yönü, c) Yangın yayılımının geçici veya sürekli değişen doğası vb. faktörler, yangın sınırlarını veya yangın cephelerini belirlemek için kritik öneme sahiptir. Bu süreçte kullanılan geliştirilmiş teknolojiler ve araçlar yangına hızlı ve doğru yöntemlerle müdahale edilmesinde destek olacaktır (Dhall, Dhasade, Nalwade, Raj V.K , & Kulkarni, 2020).

Bu çalışmanın amacı, 2009–2025 yılları arasındaki Türkiye'deki orman yangını verilerini incelemek, 2025 yılına ait haftalık yangın sayısı ve yanmış alan verileri üzerinden ayrıntılı analiz yapmak ve bu bulguları afet yönetimi döngüsü (önleme, hazırlık, müdahale, iyileştirme) çerçevesinde incelemektir.

ORMAN YANGINLARI VE AFET YÖNETİM SÜRECİ

Orman yangını, farklı rüzgar, hava koşulları ve bitki örtüsünün tetiklediği, çoğunlukla doğal alanlarda meydana gelen, ancak tarım arazilerini evleri ve hatta tüm yerleşim yerlerini de etkileyebilen kontrol edilemeyen bir yangın türüdür. Diğer doğal afetlerin aksine, orman yangınları genellikle insanlar tarafından başlatılır. Orman yangınları, yoluna çıkan her şeyi, insanları, hayvanları , yaban hayatını ve yapıları yok eder ve dakikalar içinde dönümlerce araziyi yakar (Dhall, Dhasade, Nalwade, Raj V.K , & Kulkarni, 2020).

Orman yangınları bütünleşik afet yönetimi döngüsü bağlamında değerlendirilmesini ve tedbirlerin alınmasını gerekli kılmaktadır.

- **Önleme:** Orman yangınlarının potansiyel bir afet tehdidi olduğuna dair basit farkındalığın gerek halk gerekse de bölge işletmeler tarafından yaratılması, hem afet sırasında hem de sonrasında yerel yönetimlerin ve kuruluşların rollerinin daha iyi anlaşılması bu konuda atılacak önemli adımlar arasındadır. Ayrıca acil bir durumda nereden bilgi alınabileceğine dair daha profesyonel bir anlayış benimsenmesi önemlidir (Hystad & Keller, 2008). Ormanlar ve yanan araziler, ekonomik faaliyetler, eğitim gibi toplumsal faaliyetleri aksatacak ve özellikle solunum ve görme bozuklukları olmak üzere halk sağlığını etkileyebilecek duman bulutuna neden olmaktadır. Afet azaltma hakkında temel bilgilerin topluma ve en önemlisi öğrencilere yaygınlaştırılması gerekmektedir. Orman yangını felaketlerinin nedenleri, önceden alınacak önlemler ve sonuçlarının yer aldığı bilgilendirme eğitimlerinin yapılması önem arz etmektedir (Noviana, Kurniaman, Zufriady, & Dewi, 2020). Orman yangınlarını önleme konusunda kurumlarında desteğine bu noktada ihtiyaç duyulmaktadır.

- Bakanlık düzeyinde orman yangını yönetim kurumunun varlığı
- Orman yangınlarına odaklanan sivil toplum kuruluşunun varlığı
- İlçe düzeyinde orman yangını izleme kurumunun varlığı
- Orman yangını azaltımı konusunda uluslararası iş birliği yapılmasının, orman yangınlarını önleme konusunda etkili olacağı söylenilebilir. Rusya, Brezilya, Kanada Endonezya ve Amerika'da ilgili kurumların mevcut olduğu görülmektedir (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

Ayrıca kanunlar ile de desteklenmesi orman yangınlarını önleme de etkili olabileceği söylenilebilir. Düzenleme yapılması gereken temel konularda şu şekilde sayılabilir:

- Arazi yakmaya ilişkin bireysel cezalara ilişkin kanun ve yönetmelik
- Arazi yakmaya karışan şirket/topluluk için cezalara ilişkin kanun ve yönetmelik

➢ Arazi yakmaya ilişkin kanun ve yönetmeliklerde uymayanları caydırıcı nitelik taşıyan ayrıca ormanları korumaya teşvik edici maddelere yer verilmesi de önem taşmaktadır (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

- **Hazırlık:** Orman yangınlarının sosyo-demografik ve sosyo-ekonomik etkileri açısından kayıpların büyüklüğü göz önüne alındığında, bu tür afetleri önlemek için erken müdahale yöntemlerine önemli miktarda zaman ve emek harcamak veya önlenemiyorsa hayat kurtarmanın ve afetin etkilerini azaltmanın daha etkili yollarını bulmak gerekmektedir (Dhall, Dhasade, Nalwade, Raj V.K , & Kulkarni, 2020). Bu durumda gerekli erken uyarı sistemlerinin oluşturulması, güvenlik mekanizmalarının arttırılmasına ihtiyaç duyulmaktadır. Hazırlık kapsamında temelde değinilmesi gereken konular aşağıda belirtilmiştir:

- İlçe düzeyinde afet müdahale biriminin mevcudiyeti

➢ Orman yangınlarıyla başa çıkma kapasitesinin iyileştirilmesi

➢ Erken Uyarı Sistemi (EWS)'nin orman yangınlarını önleme temelinde geliştirilmesi

➢ Afet önleme merkezinin varlığı

➢ Orman yönetimi konularına ilişkin hazırlık çalışmalarının güçlendirilerek sürdürülmesi gerekmektedir (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

Afet yönetimi için ayrıntılı ve güvenilir orman yangını duyarlılık haritaları üretmek bu kapsamda önemli bir hazırlık düzeyi aşamasıdır. Veriye dayalı makine öğrenmesi yöntemleri orman yangını duyarlılık haritalamasında uygulanabilir ve yangın envanterinin yanı sıra yüksek çözünürlüklü uydu görüntülerinden elde edilen veriler ile bu süreç daha etkili yönetilebilir (Kantarcioglu, Schindler, & Kocaman, 2023).

- **Müdahale:** Tipik bir orman yangını senaryosunda kullanılan "*tahliye, yangın söndürme, arama ve kurtarma"* operasyonlarından oluşmaktadır. Başlangıçta, yangın uyarısı, yangın ve yayılımı (yangın ve konturu) hakkında gerçek zamanlı mekansal ve zamansal verileri izlemek ve yakalamak için erken aşama yangın yeri belirlenmelidir. Yangın yayılma eğiliminin takibi yapılır. Afetzedelerin sağlık ve olaydan etkilenme durumu belirlenir. Öncelikli yangın cephesi verilerine dayanarak, itfaiyeciler ve destek sistemleri yangını söndürmek için görevlendirilir. Ayrıca, eş zamanlı olarak, yangın yayılma veya gelişme eğilimine, mağdurların konumuna ve sağlık durumlarının ciddiyetine bağlı olarak, sağlık görevlileri afetzedeleri güvence altına almak ve kurtarmak için sevk edilirler (Dhall, Dhasade, Nalwade, Raj V.K , & Kulkarni, 2020). Müdahale süreçleri için de uygulanması gereken temel bazı adımlarda şu şekilde eklenilebilir:

➢ Orman yangınları için uzaktan algılama uygulaması

➢ Orman yangını alanlarını azaltmak için hava kuvvetlerinin mevcudiyeti

➢ İlçe düzeyinde itfaiye birimlerinin mevcudiyeti

➢ Orman yangını alanlarına hızlı müdahale için askeri kuvvetlerin mevcudiyeti

➢ Orman yangını acil durumlarında sağlık ve solunum cihazının mevcudiyeti şeklinde sayılabilir. Son madde Brezilya' da hariç olmak üzere Rusya, Kanada Endonezya ve Amerika'da ilgili müdahale çalışmalarının tümünün mevcut olduğu görülmektedir (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

Afet yönetimi sürecinde kurumlar arası iletişim sürecinin yönetilmesi de önemli bir paya sahiptir. Aynı şey çevre koruma faaliyetleri ve orman ve arazi yangını afet yönetimi için de geçerlidir. İyi iletişim, bir kuruluşun faaliyetlerini kolaylaştıracağı gibi, afet yönetimi

faaliyetleri için de geçerlidir; sistematik iletişim koordinasyonu iyileştirebilir ve daha geniş bir etkiyle çevreyi kurtarabilir (Alfassa & Dewi, 2024).

- **İyileştirme:** Orman yangınları insanların evsiz kalmasına neden olmaktadır. Çoğu zaman yaşamlarını sürdürdükleri alanları terk etmelerine neden olmasının yanı sıra, verimli toprakların yanıp çoraklaşması ve hasarların neden olduğu acil durum ve sonrasında bakım ve onarım çalışmaları için milyonlarca dolar harcanması gibi sonuçları da doğurmaktadır. Ayrıca canlı ekosisteminin bozulması, nadir türlerin yok olması katlanılan diğer sonuçlar arasında yerini almaktadır. Havadaki yoğun duman, endişe verici düzeydeki toksisite oluşturması nedeniyle çevredeki alanların yaşanmaz hale getirmekte ve yaygın hava kirliliğine yol açtığından bu durumla da mücadele edilmesi gereken bir süreç başlamaktadır. İyileştirme sürecinde evlerin ve hayatın yeniden inşa edilmesi, yanan alanların ağaçlandırma sürecinin başlaması ve korunmasını içeren bir sürece girilmektedir (Dhall, Dhasade, Nalwade, Raj V.K , & Kulkarni, 2020). Özellikle orman gençleştirme ve restorasyonuna yönelik çalışmaların sürdürülmesi iyileştirme sürecinde süreklilik gerektiren bir konu olarak gündeme gelmektedir (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

Yerel halkın rolünü orman yangınlarını önleyici çalışmalar kapsamında belirlemek gibi bir çözüm, ormanlardaki yangın aktivitesi seviyesini kontrol etmede ve azaltmada yaşamları da ormana bağlı olan bölge halkı ve onu korumaya çalışır. Bu bağlamda, bölgenin yerel kapasitelerinin kullanılması ve ayrıca orman yönetiminde halkın yerel bilgisinden yararlanılması en ucuz ve en kolay olası çözümler arasında sayılabilir (Ansari, Bijani, Abbasi, & Goli, 2024). Kısacası; orman yangınlarını yönetmek, önleme, zamanında tanımlama ve aktif bastırmayı kapsayan kapsamlı bir strateji gerektirmektedir (Akhyar, et al., 2024).

ARAŞTIRMA VE BULGULAR

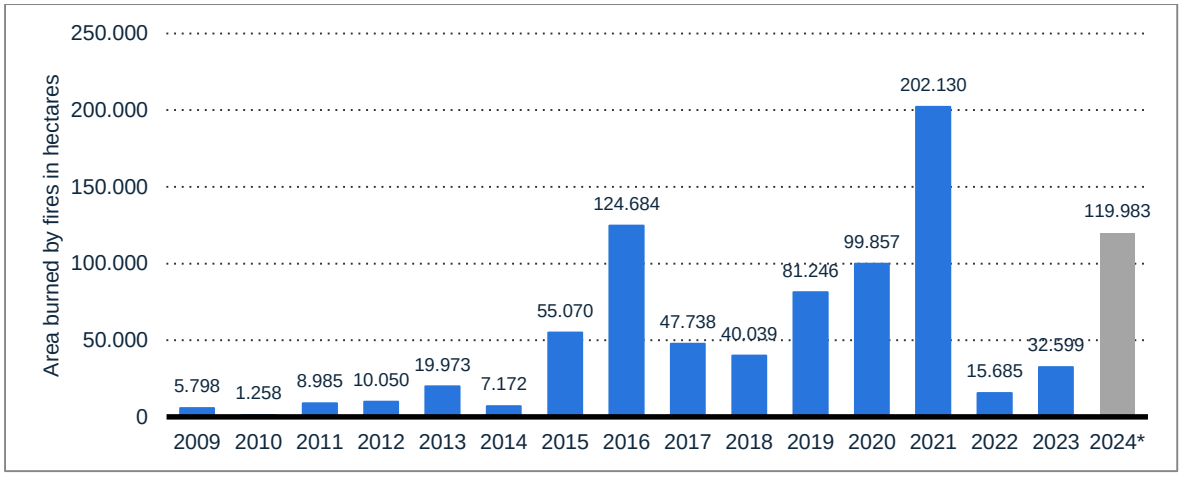
Analiz yöntemi olarak 2009–2024 dönemi için yıllık yangın sayısı ve yanmış alan eğilimleri incelenmiştir.

2025 yılı için Türkiye'deki haftalık veriler Avrupa Orman Yangını Bilgi Sistemi (EFFIS)'in Hızlı Hasar Değerlendirme (RDA) sisteminden yararlanılarak haftalık yanmış alanlar ve haftalık yangın sayılarına yer verilmiştir.

Bulgular afet yönetimi döngüsü ile ilişkilendirilmiş, uluslararası örneklerle (İspanya, İtalya ve Yunanistan) karşılaştırmalar yapılmıştır.

EFFIS 2003'ten 2018'e kadar, Hızlı Hasar Değerlendirmesi (RDA), Avrupa'da yaklaşık 30 hektar veya daha büyük yangınlar için yanmış alanların çevrelerinin günde iki kez günlük olarak güncel verilerine erişim sağlamaktadır. 2018'den beri, Sentinel-2 görüntülerinin kullanımı 30 hektar eşiğinin altındaki yangınların da tespit edilmesini sağlamaktadır ve EFFIS'te haritalanan alanların her yıl AB'de yanan toplam alanın yaklaşık %95'ini temsil ettiği tahmin edilmektedir (Copernicus Europe's Eyes on Earth, 2025).

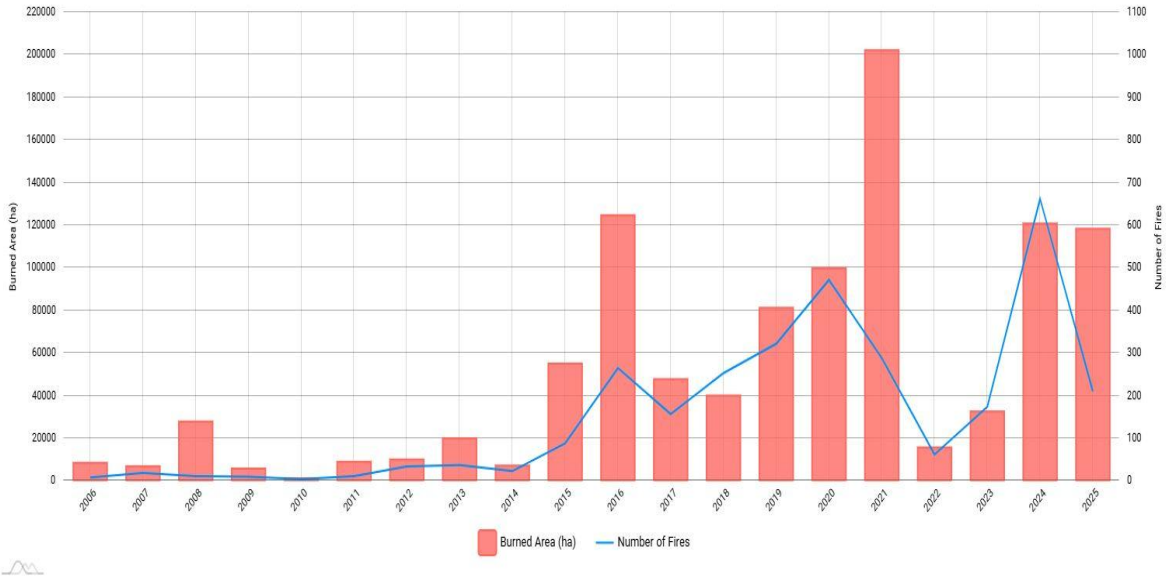
Şekil 1'de görüldüğü üzere Kasım 2024 itibarıyla Türkiye'de, o yıl orman yangınlarında yaklaşık 120.000 hektarlık alanın yok olduğu bildirilmiştir; bu rakam, bir önceki yılın dört katı kadardır. Söz konusu dönemde, Türkiye, ülke genelinde 200.000 hektardan fazla alanın yanması nedeniyle 2021 yılında orman yangınlarından en çok etkilenen bölge oldu (Salas, 2025). Avrupa Orman Yangını Bilgi Sistemi verilerine göre, 2021 yılında Akdeniz ülkeleri içinde en fazla orman alanı kaybı yaşayan ülke Türkiye olarak gösterilmektedir. Ülke tarihindeki en büyük orman yangınlarının yaşandığı dönem de 28 Temmuz-12 Ağustos 2021 tarihlerinde gerçekleşmiş olup, yanan yerlerin çoğunluğunun Ege ve Akdeniz bölgeleri oluşturmuştur (Tuygun, İşsever, & Elbir, 2023).



Şekil 1: Türkiye'de 2009-2024 yılları arasında çıkan orman yangınlarında yanan alanlar*(hektar cinsinden)*

Kaynak: (Salas, 2025)

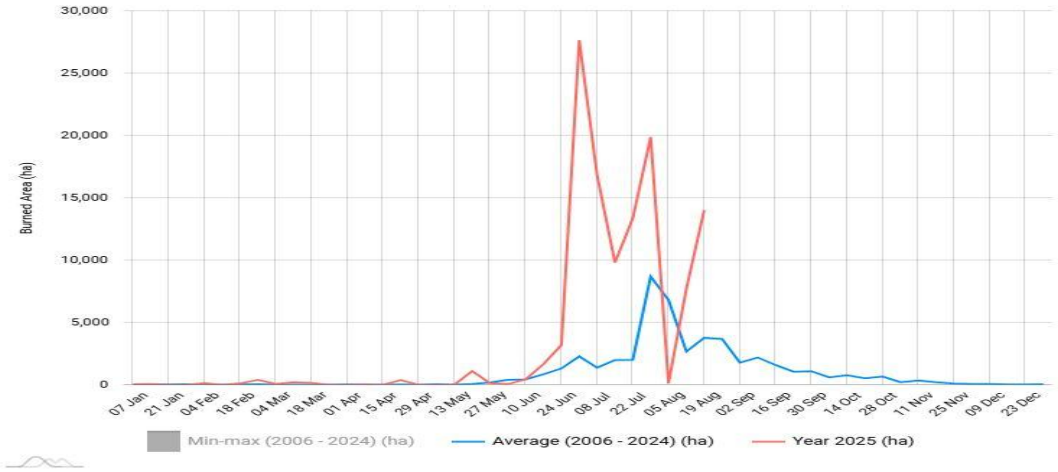
Şekil 2'de görüldüğü üzere 2006 -2025 yılları arasında Türkiye'de orman yangınlarının pik noktasını 2021 yılında 202.130 hektarlık yanan alan oluşturmaktadır. Onu 124.684 hektar ile 2016 yılı, 120.809 hektar ile 2024 yılı ve 118.328 hektar ile 2025 yılı izlemektedir. Özelikle son iki yıldır orman yangınlarındaki artış bu noktada dikkat çekmektedir. Bu duruma paralel olarak yangın sayısı ile bakıldığında ise farklılık görülmektedir. 2025 yılında çıkan yangın sayısı 2024 yılına göre daha az olmasına rağmen göreceli olarak daha fazla zarara neden olduğu söylenilebilir. 2024 yılında 662 yangına karşılık 2025 yılında 210 adet yangın çıktığı ve son zamanlarda çıkan yangınların daha büyük kapsamlı yangınlar olduğu görülmektedir. 2021 yılına bakıldığında ise 288 yangına maruz kalındığı görülmektedir. 2016 yılında da yanan 124.684 hektarlık alana karşılık 265 yangının çıktığı görülmektedir. Bu kapsamda çıkan yangın büyüklükleri açsından 2015, 2016, 2021, 2025 yıllarının ön plana çıktığı görülmektedir. En düşük yangın yılı ise 1258 hektar ve 4 yangın ile 2010 yılı olarak görülmektedir.



Şekil 2: EFFIS Türkiye Yıllık İstatistikleri (*EFFIS'te haritalanan yaklaşık 30 hektar veya daha büyük yangınlar.)*

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

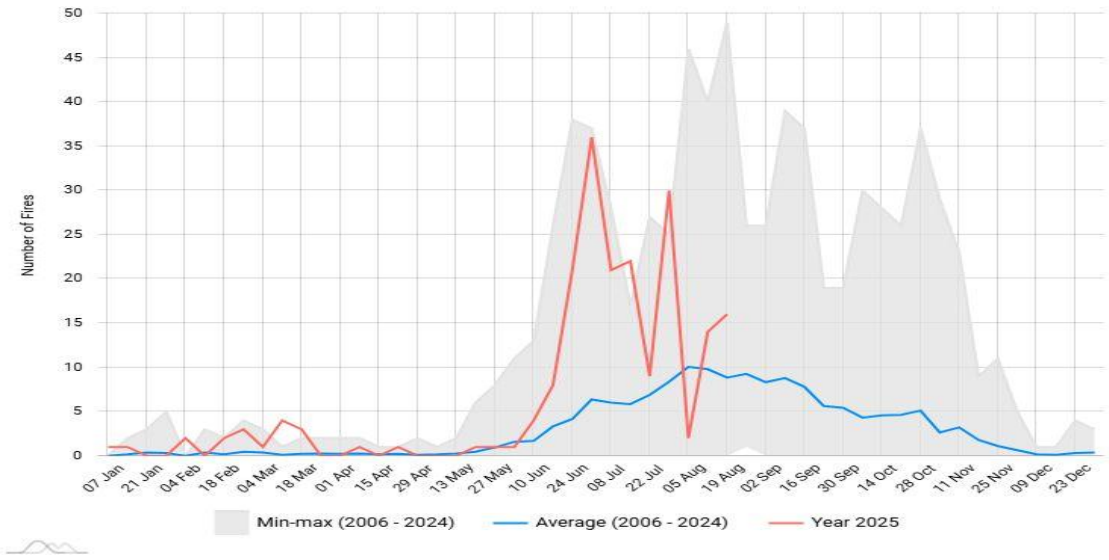
Şekil 3'de görüldüğü üzere 1 Temmuz 2025 (27,663 hektar); 29 temmuz (19,897 hektar) ve 19 ağustos (14,026 hektar) ile 2025'in en yüksek düzeyde yanmış alana ulaştığı dönemler olarak görülmektedir. 2006-2024 tarihleri arasındaki süreç ile kıyaslandığında 2025 yılı yaz aylarına ait grafikte diğer yıllara oranlara ciddi düzeyde bir artış olduğu görülmektedir.



Şekil 3: 2025 EFFIS Haftalık Yanmış Alanlar

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

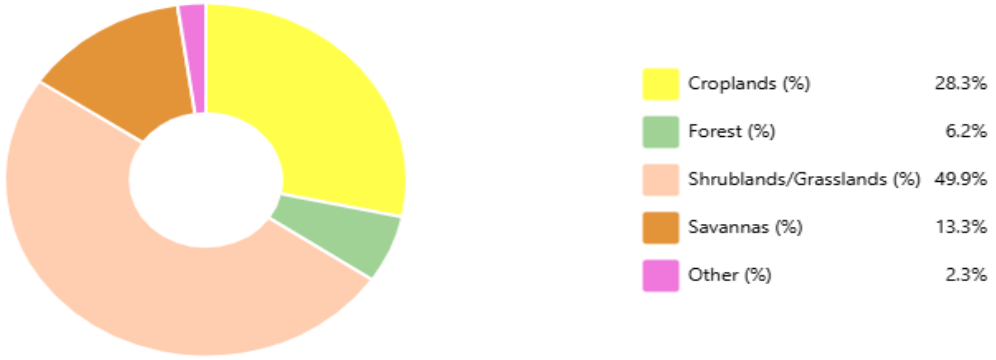
Şekil 4'de görüldüğü üzere 2025 yılı haftalık yangın sayısının 3 haziran itibariyle hızlı bir şekilde arttığı 1 temmuz da 38 yangın sayısına ulaşıldığı, ardından 15 temmuz tarihinde yine bir pik noktasına ulaşarak 22 adet yangın çıktığı, 22 temmuzda tekrar hızla yayılarak 30 adet yangın sayısına ulaşıldığı ve 5-19 ağustos tarihlerinde güncel veriler ışığında artarak devam ettiği ve son 19 ağustosta 16 yangının çıktığı görülmektedir. Özellikle bahar dönemi itibari ile yangın sayılarının 27 mayıs tarihi ile başladığı ve artarak devam ettiği görülmektedir. Verilere ilişkin 2006-2024 tarih aralığı dikkate alındığına yangınların mayıs itibari ile başladığı ağustos aylarında pik yaptığı görülmektedir. Ayrıca yaz döneminin ilgili yıllar da dikkate alındığında mayıs itibari ile başlayıp ekim sonuna kadar süren süreçte yoğun şekilde yangınların oluştuğu görülmektedir.



Şekil 4: 2025 EFFIS Haftalık Yangın Sayısı

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

Şekil 5’de görüldüğü üzere Türkiye’nin arazi örtüsüne ilişkin verilere göre % 49.9’luk kısmını çalılıklar/otlar, % 28.3’lük kısmını ekili alanlar, % 13.3’lük kısmını savanlar %6.2’lik kısmını ormanlar %2.3%lük kısmını da diğer bitki örtüsü türü oluşturmaktadır.

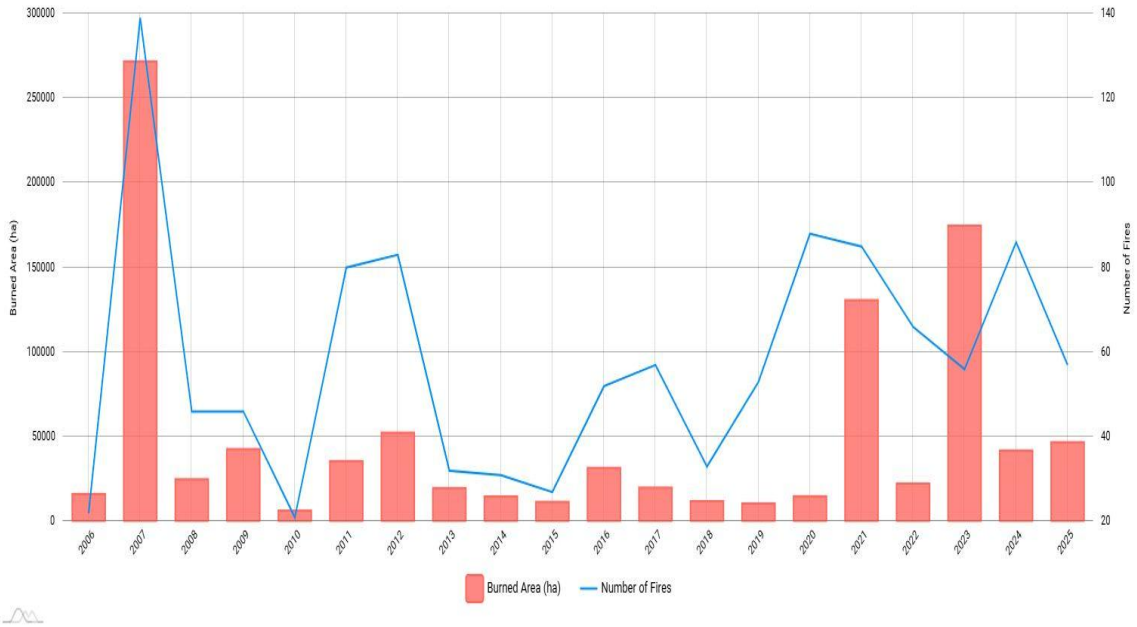


Şekil 5:Türkiye Arazi Örtüsü Genel Bakışı

Kaynak: (CopernicusEurope's Eyes on Earth, 2025)

Türkiye’yi diğer sıcak iklim kuşağındaki ülkelerden Yunanistan, İspanya ve İtalya ile karşılaştırdığımızda; durum aşağıdaki şekillerde mevcuttur.

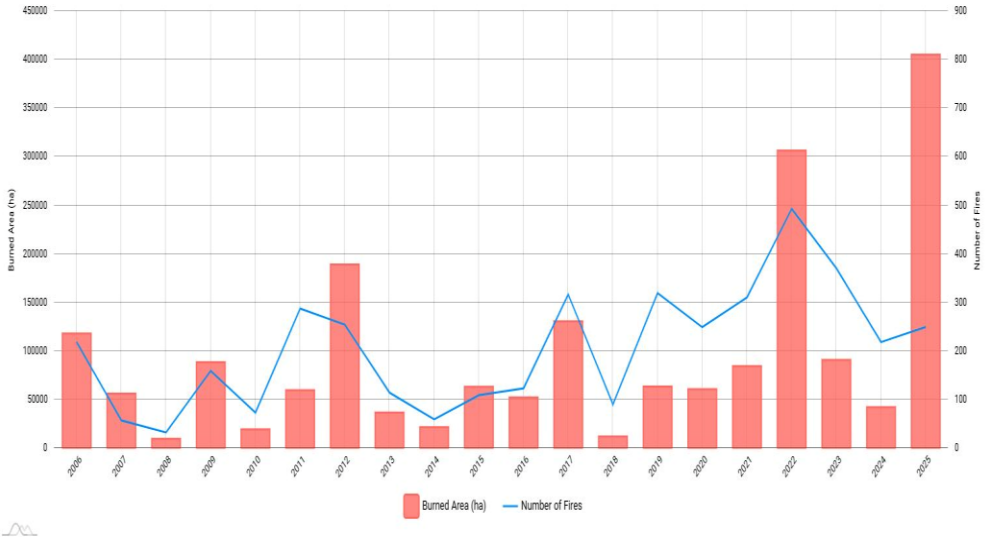
Şekil 6’da Yunanistan’a ait 2006-2025 yıllık istatistikleri mevcuttur. Yunanistan en yüksek yangın oranına 2007 yılında 139 yangın ve 271.715 hektar alanı yitirmiştir. 2023 yılında 56 yangın ile 174.773 hektar alan yanmıştır. 2021 yılında ise 85 yangın ile 130.774 hektar alan yanmıştır. Diğer yıllarda da yangın çıkmasına rağmen Türkiye’ye oranla çok daha küçük alanların yitirildiği ve yangınların hızlıca kontrol altına alındığı görülmektedir.2024 yılında 86 yangın çıkmış 41.948 hektar alan yanarken 2025 yılında ise 57 yangın çıkmış ve 46.873 hektar alan yanmıştır.



Şekil 6: EFFIS Yunanistan Yıllık İstatistikleri (EFFIS'te haritalanan yaklaşık 30 hektar veya daha büyük yangınlar.)

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

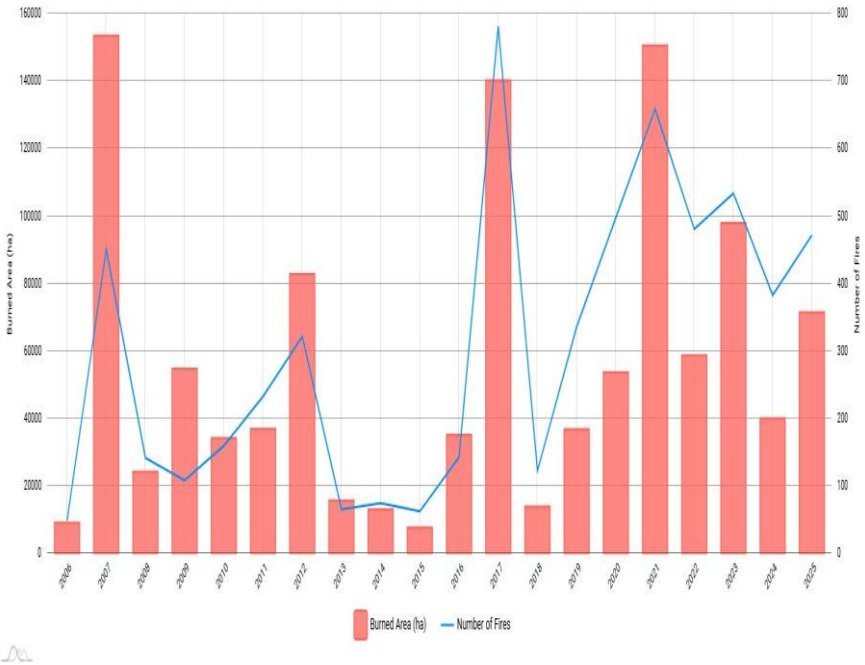
Şekil 7’de İspanya’ya ait yıllık istatistikler verilmiştir. 2025 yılı 250 yangın 405.222 hektar alanın yandığı görülmektedir. En yüksek oranda hektarın kaybedildiği yıl olarak da görülmektedir. 2022 yılında 493 yangın çıkmış ve 306.555 hektar alanın yandığı 2012 yılında da 255 yangın ile 189.376 alanın yandığı görülmüştür. Bu yıllar dışında yangın sayısını fazla olmasına rağmen kaybedilen alanın sayıya göre daha düşük olduğu söylenilebilir. 2024 yılında 219 yangın 42.615 hektar alan, 2023 yılında 371 yangın 91.220 hektar alan 2021 yılında 311 yangın 84.827 hektar alanın yandığı görülmektedir.



Şekil 7: EFFIS İspanya Yıllık İstatistikleri

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

Şekil 8’de görüldüğü üzere İtalya’da en yüksek yangın kaydedilen yıl 2017’ de 781 yangın ile 140.214 hektar alan olmuştur. 2021 yılında 659 yangın ile 150.552 hektar alan ön plana çıkmaktadır. Son yıllardaki yaşanan yangınlara bakıldığında 2025 yılında 472 yangın ile 71.531 hektar alan, 2024 yılında 383 yangın ile 40.122 hektar alan, 2023 yılında 534 yangın ile 97.984 hektar alanın yandığı görülmektedir. Genel itibari ile 2017 öncesi 2007 ‘ye kadar olan süreç içinde yangın sayısının ve kayıp alanın daha düşük düzeyde seyrettiği görülmektedir.



Şekil 8: EFFIS İtalya Yıllık İstatistikleri

Kaynak: (Copernicus Europe's Eyes on Earth, 2025)

İklim değişikliğinin neden olduğu aşırı kuraklığın da yangınları tetikleyebileceği söylenilebilir. Orman yangınları genellikle sorumsuz taraflarca yapılan yakma yoluyla arazi temizleme uygulamaları nedeniyle de meydana gelmektedir. Yakma, geniş alanlarda tarım yapabilmek amacıyla da yapılabilmektedir. Bu durum, çevre koruma bilincinin eksikliği nedeniyle her yıl tekrar tekrar yaşanmakta ve binlerce hektar ormanlık alanda kayba neden olmaktadır (Gusmira, Frinaldi, Putra, & Malini, 2025).

SONUÇ VE TARTIŞMA

Orman yangınları, ekosistem ve insan güvenliği için ciddi bir tehdit oluşturan en yaygın doğal afetlerden ve kamusal kriz olaylarından biridir. Bu tür doğal afetler anidir, yıkıcıdır ve genellikle kontrol altına alınması ve hafifletilmesi zordur (Yu, Liu, Chang, Li, & Shi, 2024). Ormanlar çevrenin korunması, ekonomik üretkenlik ve su ile toprağın korunması için hayati önem taşıyan doğal kaynaklardır. Sürdürülebilir bir şekilde yönetilen ormanlar, temel mal ve hizmetlerin üretilmesini sağlamakta ve dolayısıyla sürdürülebilir kalkınmada önemli bir rol oynamaktadır. Ormanlar, insan ihtiyaçları için gıda sağlamanın yanı sıra, tarımsal üretimin sürekliliğini belirleyen polenler için de yaşam alanları sağlar. Ancak, ormanların kullanımında, sanayi sektörü ile çevre arasında kaçınılmaz olarak her yerde çatışmalar yaşanmaktadır. Örneğin, ormanlar genellikle endüstriyel amaçlarla yok edilmektedir. Ekonomik büyümeyi artırmaya yönelik endüstriyel ihtiyaçlar, ormanlar gibi doğal kaynakların tükenmesine yol açmış ve bu da sonunda ekonomik ve ekolojik sürdürülebilirliği dengesizleştirmiştir (Agus, Cahyadi, Kurniadhini, Bachtiar, Apriyana, & Caraka, 2020).

Yangınlar önemli sosyal sorunlara, mali kayıplara ve çevresel zarara yol açmaktadır. Kara ve orman yangınlarının en dikkat çekici etkisi, hava, deniz, kara ve nehir ulaşım ağlarının yanı sıra halk sağlığını da ciddi şekilde bozan duman oluşumuna neden olmasıdır. Ulaşım, sağlık, ekonomik, ekolojik ve sosyal sektörlerin yanı sıra ülkenin komşuları ve uluslararası toplum nezdindeki itibarı da bu yangınlardan etkilenmektedir (Yuliani & Zulkarnaini, 2024).

Orman yangını yönetimini etkileyen birkaç faktör vardır: iklim değişkenleri, demografik değişiklikler, yangın kontrolünü iyileştirmek için protokollerin tasarlanması ve sosyal açıdan adil alternatif geçim kaynaklarıdır (Gusmira, Frinaldi, Putra, & Malini, 2025). Çoğu makale, hükümelerin yangın felaketlerinin üstesinden gelmek ve afetleri sürdürülebilir bir şekilde aşmak için politikaların uygulanmasında yerel kurumlar ve topluluklarla birlikte çalışması gerektiği sonucuna varmaktadır (Gusmira, Frinaldi, Putra, & Malini, 2025).

Orman yangınları afet yönetimi döngüsü bağlamında değerlendirildiğinde aşağıdaki sonuçlara dikkat çekilmiştir.

- **Önleme:** Yangın risk haritalarının güncellenmesi, kırsal yerleşimlerde tarım–orman sınırında koridorların oluşturulması ve halkın bilinçlendirilmesi.
- **Hazırlık:** Haftalık verilerden yararlanarak yangın sezonu için erken uyarı ve risk tahmin modelleri geliştirilmesi. Eğitimli gönüllü gruplar oluşturulması.
- **Müdahale:** Zirve haftalarda yangın söndürme kapasitesinin (uçak, helikopter, kara ekibi) artırılması, olay yerine erişim sürelerinin kısaltılması.
- **İyileştirme:** Ekosistem temelli restorasyon yaklaşımları; yangından etkilenen yerleşimlerde sosyal ve ekonomik destek mekanizmalarının oluşturulması.

Türkiye'de 2009–2025 döneminde orman yangınları ciddi bir afet riski olarak öne çıkmaktadır.

2025 haftalık verileri de incelendiğinde, yangınların mevsimsel zirvelerinin önceden öngörülebileceğini ve afet yönetiminde bu öngörünün kullanılabileceğini göstermektedir.

Uygulanabilecek politika önerileri olarak aşağıdaki öneriler temel olarak değerlendirilmeye alınabilir:

- Haftalık yangın verilerine dayalı erken uyarı oluşturulması ve operasyonel planlama yapılması
- Afet yönetimi süreçlerinde orman yangınları için bölgesel yangın risk merkezlerinin kurulması ve aktif olarak çalışarak bölgesel risk takibinin yapılması
- Yerel halkın yangın önleme ve müdahale süreçlerine aktif katılımının sağlanması konusunda eğitilmesi ve özellikle bölgesinin mevcut ormanlık alanlarını koruyucusu olarak gönüllü olması
- İklim değişikliğine uyum politikaları ile orman yangınları risk yönetiminin entegre edilmesi ve bütünleşik afet yönetim sistemine dahil edilerek her bir aşamada alınması gereken tedbirler ve yapılması gereken işlemlere yönelik uluslararası alanda yapılan çalışmaların takip edilmesi ve işbirliklerinin oluşturulması şeklinde özetlenebilir.

Sonuç olarak, orman yangınlarını önleme konusunda tutarlı politikalar uygulamanın, toplumu sürece dahil etmenin ve toplumu ormanların sürdürülebilirliğini sağlamanın önemi konusunda eğitmenin önemli olduğu görülmektedir.

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ET-TÂRÎH FÎ MEFHÛMİ'L-İSLÂM ESERİ BAĞLAMINDA ENVER CÜNDÎ'NİN BATI MERKEZCİ TARİH ANLAYIŞINA YÖNELİK ELEŞTİRİLERİ

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ÖZET

Modern dönemde Müslüman düşünürler, Batılı tarih anlayışının İslâm tarihini yorumlamadaki yetersizliklerine köklü eleştiriler geliştirmişlerdir. Bu eleştiriler, Batı merkezci yaklaşımların İslâm medeniyetinin özgün karakterini kavrayamadığı ve materyalist metodolojilerin İslâm tarihinin manevi yapısını göz ardı ettiği temelinde şekillenmektedir. Bu yazarlardan biri olan Mısırlı düşünür Enver Cündî, *"et-Târîh fî mefhûmi'l-İslâm"* adlı eserinde İslâm tarihine yönelik çarpıtma girişimlerini ve oryantalist yaklaşımları ele almaktadır. Cündî, mevcut tarih yazımı ekollerinin yetersiz olduğunu savunarak, İslâm'ın özgün karakterinden doğan bütüncül bir tarih metodolojisinin gerekliliğini vurgulamaktadır. Cündî'ye göre, İslâm tarihini anlamaya çalışan modern girişimlerin çoğu Batı kaynaklı teorilere dayanmakta ve bu teoriler eksik ve indirgemeci karakterdedir. Liberal teori İslâm'ın toplumsal ve ilahî boyutunu, Marksist teori manevî ve ahlakî boyutlarını, materyalist teori ise imanın tarihteki dönüştürücü gücünü göz ardı etmektedir. İslâm'ın parçalara ayrılamaz bütüncül yapısı nedeniyle, ruh-madde, dünya-ahiret, sabiteler-değişkenler gibi birbirini tamamlayan ikilikler üzerine kurulu olan İslâm, sadece maddî veya ruhanî bakış açısıyla anlaşılamamaktadır. Öte yandan İslâm tarihi, metodolojik yanlış anlamanın yanı sıra kasıtlı kültürel istila kampanyasıyla karşı karşıyadır. Akademik hegemonya yoluyla Müslüman tarihçiler kendi kaynaklarından uzaklaştırılmış, tarihî şahsiyetler sistematik olarak karalanmış ve güvenilir kaynaklar çarpıtılmıştır. Cündî'ye göre tarihi tek bir faktörle (coğrafya, ekonomi, çevre) açıklamak temelden hatalıdır. Batı düşüncesi hem metodolojik hem de perspektif açısından kusurludur; Avrupa tarihini evrensel standart kabul ederek diğer medeniyetleri küçümsemektedir. Bu bildiri, Enver Cündî'nin *"et-Târîh fî mefhûmi'l-İslâm"* adlı eseri çerçevesinde, modern Batılı tarih metodolojilerine yönelttiği köklü eleştirileri incelemekte ve onun alternatif İslâmî tarih felsefesi önerisini analiz etmektedir.

Anahtar Kelimeler: Tarih, Enver Cündî, et-Târîh fî mefhûmi'l-İslâm, Batılı tarih anlayışı, İslâm tarih felsefesi.

ANWAR JUNDI'S CRITIQUES OF WESTERN-CENTRIC HISTORICAL UNDERSTANDING IN THE CONTEXT OF HIS WORK AL-TARIKH FI MAFHUM AL-ISLAM

ABSTRACT

In the modern era, Muslim intellectuals have developed fundamental critiques regarding the inadequacies of Western historical understanding in interpreting Islamic history. These critiques are grounded on the premise that Eurocentric approaches fail to comprehend the distinctive character of Islamic civilization, and that materialist methodologies disregard the spiritual structure of Islamic history. Among these scholars, the Egyptian thinker Anwar Jundi, in his work "al-Tarikh fi Mafhum al-Islam," addresses attempts to distort Islamic history and orientalist approaches. Jundi argues that existing historiographical schools are inadequate and

emphasizes the necessity of a holistic historical methodology emerging from Islam's distinctive character. According to Jundi, most modern attempts to understand Islamic history are based on Western-derived theories, which are characterized as incomplete and reductionist. Liberal theory neglects Islam's social and divine dimensions, Marxist theory ignores its spiritual and moral aspects, while materialist theory overlooks the transformative power of faith in history. Due to Islam's indivisible holistic structure, built upon complementary dualities such as spirit matter, world-hereafter, constants-variables, Islam cannot be understood through purely material or spiritual perspectives alone. Furthermore, Islamic history faces not only methodological misunderstanding but also deliberate cultural invasion campaigns. Through academic hegemony, Muslim historians have been alienated from their own sources, historical figures have been systematically defamed, and reliable sources have been distorted. According to Jundi, explaining history through a single factor (geography, economy, environment) is fundamentally erroneous. Western thought is flawed both methodologically and perspectively, accepting European history as the universal standard while diminishing other civilizations. This paper examines Anwar Jundi's fundamental critiques of modern Western historical methodologies within the framework of his work "al-Tarikh fi Mafhum al-Islam" and analyzes his proposal for an alternative Islamic philosophy of history.

Keywords: History, Anwar Jundi, Al-Tarikh fi Mafhum al-Islam, Western historical understanding, Islamic philosophy of history.

GİRİŞ

Modern dönemde İslâm dünyası, Batı medeniyetinin entelektüel hegemonyasıyla yüzleşirken, kendi tarihsel anlatısını yeniden inşa etme ve yorumlama çabasına girişmiştir. Bu süreçte, Müslüman düşünürler ve yazarlar, Batılı tarih anlayışının İslâm tarihini yorumlamadaki yetersizliklerine ve çarpıtmalarına yönelik köklü eleştiriler geliştirmişlerdir. Bu eleştiriler, sadece akademik bir tartışmanın ötesinde, İslâm medeniyetinin özgün karakterini koruma, manevî ve kültürel kimliğini yeniden tanımlama arayışının bir parçası olarak ortaya çıkmıştır. Batı merkezci tarih yazımı, İslâm tarihini genellikle kendi değer yargıları, metodolojileri ve ön kabulleri üzerinden değerlendirme eğilimindedir. Bu yaklaşımlar, İslâm medeniyetinin kendine özgü dinamiklerini, manevî derinliğini ve bütüncül yapısını çoğu zaman göz ardı etmektedir. Batılı tarihçiler, İslâm medeniyetini genellikle Batı'nın gelişim çizgisiyle kıyaslayarak veya onu Batı'nın bir "ötekisi" olarak konumlandırarak anlamaya çalışmışlardır. Bu durum, İslâm medeniyetinin kendi iç dinamiklerinden kaynaklanan özgün gelişimini ve farklılıklarını yeterince takdir edememelerine yol açmıştır. İslâm'ın tevhid inancına dayalı dünya görüşü, ilim, ahlak ve toplum arasındaki organik bağı, Batılı materyalist ve seküler tarih anlayışının kavramsal çerçevesine sığdırmakta zorlanılmıştır. Batı tarih yazımının pozitivist ve materyalist eğilimleri, İslâm tarihinin manevî, metafizik ve ahlakî boyutlarını genellikle ikinci plana atmıştır. Oysa İslâm medeniyeti, sadece siyasî, ekonomik veya sosyal olaylardan ibaret olmayıp aynı zamanda derin bir inanç, değer ve anlam sistemine dayanmaktadır. Bu bütüncül yapının göz ardı edilmesi, İslâm tarihinin eksik ve çarpık bir şekilde yorumlanmasına neden olmuştur. Özellikle oryantalist çalışmalar, İslâm tarihine yönelik önyargılı ve indirgemeci bir tutum sergilemiştir. Bu çalışmalar, İslâm'ı ve Müslüman toplumları genellikle durağan, gerici veya şiddet yanlısı olarak tasvir etme eğiliminde olmuş, İslâm medeniyetinin bilimsel, felsefî ve sanatsal başarılarını ya küçümsemiş ya da Batı'dan ödünç alınmış unsurlar olarak göstermeye çalışmıştır. Bu tür yaklaşımlar, İslâm tarihinin sistematik olarak çarpıtılmasına ve Müslüman toplumların kendi tarihsel miraslarından uzaklaştırılmasına hizmet etmiştir.

Batıcı tarih anlayışına eleştiriler yönelten Müslüman yazarlar, İslâm tarihinin ancak kendi özgün metodolojisi ve değer sistemi çerçevesinde doğru bir şekilde anlaşılabileceğini

savunmuşlardır. Onlara göre, İslâm tarihini anlamak için Kur'an ve Sünnet'in rehberliğinde şekillenen bir dünya görüşüne sahip olmak, İslâm medeniyetinin temel prensiplerini kavramak ve tarihsel olayları bu bütüncül perspektiften değerlendirmek elzemdir. Bu yaklaşım hem entelektüel bağımsızlık arayışının hem de İslâmî kimliğin modern dünyada yeniden inşasının önemli bir parçası olarak değerlendirilmektedir. Bu bağlamda, İslâmî tarih felsefesi, sadece geçmişi anlamakla kalmayıp aynı zamanda geleceğe yönelik bir vizyon sunma potansiyeli taşımaktadır. Batı merkezli tarih anlayışına eleştiriler yönelten önemli düşünürlerden biri de Mısırlı yazar Enver Cündî'dir. Cündî, özellikle *et-Târîh fî mefhûmi'l-İslâm* adlı eseriyle, İslâm tarihine yönelik çarpıtma girişimleri, oryantalist yaklaşımlar ve İslâm'ın doğru anlaşılması gerektiği konularını ele almıştır. Cündî, eserinde Batı merkezci tarih anlayışının İslâm'ı nasıl yanlış yorumladığını, oryantalistlerin kullandığı metodolojilerin ne denli önyargılı olduğunu ve bu durumun Müslümanların kendi tarihlerine yabancılaşmasına nasıl yol açtığını detaylı bir şekilde ortaya koymaktadır. Bu çalışmamızda, Enver Cündî'nin söz konusu eseri bağlamında Batıcı tarih anlayışına yönelttiği eleştirileri ayrıntılı bir şekilde inceleyeceğiz. Bu incelemeye geçmeden önce, Cündî'nin hayatı, entelektüel birikimi ve eserleri hakkında kısaca bilgi vermek, onun düşünsel çerçevesini daha iyi anlamamıza yardımcı olacaktır. Bu sayede, Cündî'nin eleştirilerinin arka planını ve İslâm düşünce geleneğindeki yerini daha net bir şekilde ortaya koyabileceğiz.

ENVER CÜNDÎ'NİN HAYATI

Ahmed b. Enver Seyyid Ahmed el-Cündî Fergalî, 1916 yılında Yukarı Mısır'ın Asyût vilayetinde, Deyrût beldesinde dünyaya gelmiştir. Cündî ailesinin kökeni Yemen'deki Hudeyde bölgesine dayanmaktadır. Ahmed el-Cündî, babasına duyduğu saygıdan ötürü eserlerinde onun adını kullanarak Enver el-Cündî olarak tanınmıştır. Babası pamuk ticaretiyle uğraşan bir iş adamıydı, ancak ilim ve fazilet ehli insanları seven biriydi. İlmî bir muhitte büyüyen Cündî'nin anne tarafından dedesi vaktinin çoğunu yazma eserlerin tahkikine ayıran bir kadı idi. Cündî, küçük yaşta Kur'an'ı ezberlemiş, İbrâhim Emîn'den İbn Haldûn'un *Mukaddime*'sini, Şeyh Tâhâ'dan Gazzâlî'nin *İhyâ*'sını ve Şeyh Bekir'den Buhârî'nin *Ṣahîh*'ini okuyarak kendini geliştirmiştir. Cündî, eğitimine küçük yaşlardan itibaren başlamış ve ortaokul döneminde üstün yeteneği ortaya çıkmıştır. Bu dönemde modern Arap edebiyatı ve önde gelen şahsiyetleri hakkında bir konferans vermiştir. Bu eylem, dinleyiciler arasında şaşkınlık yaratmış; zira konferansın onun eseri olduğuna inanmakta zorlanmışlardır. Dinleyiciler, konferansın edebî üslubunun o yaştaki bir öğrencinin kapasitesinin üzerinde olması nedeniyle bunun mutlaka alıntı bir çalışma olduğu kanaatine varmışlardır. Babasının maddi koşulları, orta düzey ticarî eğitimini tamamladıktan sonra gençliğinin ilk yıllarında Mısır Bankası'nda çalışmaya başlamasına neden olmuştur. Daha sonra akşamları ticaret ve ekonomi alanında üniversite eğitimine devam etmiş, aynı zamanda Amerikan Üniversitesi'nde İngilizce dil eğitimini sürdürmüştür. Bu dil eğitimini, oryantalistlerin ve batılılaşmışların sapkınlıklarını ve yanılgılarını takip etmek, İslâm hakkındaki şüphelerini ortaya çıkarmak ve onlara cevap vermek amacıyla yapmıştır. Edebiyat dünyasına 1933 yılında Apollo dergisinin yarışmasında kazandığı başarıyla adım atan Cündî, çeşitli dergi ve gazetelerde makaleler yayımlamış, yirmi yaşından önce ilk edebî eseri olan *Mesâbîh 'ale't-tarîk*'ı yayımlamıştır. Fikir dünyasını Muhammed Fahreddîn, Zekî Mübârek ve Muhammed Hüseyin Heykel gibi isimlerin etkilediği Cündî'nin hayatında dönüm noktası, 1940 yılında Sir Hamilton Alexander Roskeen Gibb ve arkadaşlarının yazdığı *Vichetü'n-nazar* adlı eserini okuması olmuştur. Bu oryantalist eserin İslâm'ı sadece ibadetlere indirgeyen tasvirine karşı büyük bir komplo olarak gören Cündî, yoğun bir araştırma sürecine girerek geniş bir kütüphane kartı ve kaynakça oluşturmuştur. 1940'lı yıllarda İhvân-ı Müslimîn'in kurucusu Hasan el-Bennâ ile tanışması, Cündî'nin yazı hayatının seyrini değiştirmiştir. Bennâ'nın görüşlerini ve Kur'an ile sahih hadise dayalı bir

toplum inşa etme fikrini benimseyen Cündî, 1946 yılında Kahire'ye taşınarak teşkilatın önemli isimlerinden biri olmuştur. İhvân-ı Müslimîn'in yayınlarında yazılar yazmış ve mali işlerini üstlenmiştir. Ancak teşkilatın 1949 yılında kapatılmasıyla tutuklanmış, Cemal Abdünnâsır döneminde de baskılarla karşılaşmıştır. Sonraki dönemlerde Mısır Din İşleri Yüksek Konseyi üyesi olan Cündî, birçok uluslararası konferansa katılmış ve 1960 yılında İslâm kültürüne hizmetlerinden dolayı Mısır Devlet Takdir ödülüne layık görülmüştür. 1963 yılında yazılarına *Minberü'l-İslâm* dergisinde devam eden Cündî'nin çalışmaları Şevkî Dayf, Yûsuf el-Karadâvî, Abdülhalîm Uveys ve Ebü'l-Hasan en-Nedvî gibi âlimler tarafından takdir edilmiştir. Gözlerden uzak, zâhidâne bir hayatı tercih eden Cündî, konferans ücretlerini ve ödülleri reddetmiş, kitaplarından kazandığı parayı yeni eserlerinin basımında kullanmıştır. Kızı Fâyize'den vefatından sonra telif ücreti talep etmemesini, verildiği takdirde ise Allah rızası için harcamasını istemiştir. 28 Ocak 2002 tarihinde böbrek rahatsızlığı nedeniyle vefat eden Enver el-Cündî, Feyyûm şehrindeki aile mezarlığına defnedilmiştir (Meczûb, 1992, 2/45-59; Suayfân, 2006, 29-32, 35-40; Mes'ûdî, 2008, 31-37; Yağcı, 2020, EK-1/273-274; Abdürrezzâk, 2022, 165-166; Ebû Şebâne, 2023, 519-533).

ESERLERİ

Enver el-Cündî, genellikle ansiklopedik nitelikte kaleme aldığı eserleriyle tanınmaktadır. Fikrî üretim açısından oldukça verimli olan Cündî, İslâm düşüncesi ile kültürünün hemen tüm alanlarında çeşitli ve çok sayıda eseri bulunmaktadır. İslâm dini, tarih, edebiyat, siyaset, felsefe, sosyoloji ve biyografi gibi geniş bir yelpazede, seriler halinde yayımlanmış 350'den fazla kitap telif etmiştir. Ayrıca, çeşitli dergi ve gazetelerde 500'ü aşkın makalesi bulunmaktadır. Bu zengin külliyat, onun çok yönlü düşünce yapısını ve İslâm dünyasına bıraktığı derin fikri mirası gözler önüne sermektedir. Cündî'nin belli başlı eserleri şunlardır: *el-Fikrü'l-İslâmî, el-Luğa ve'l-edeb ve's-sekâfe, et-Tebşîr ve'l-istişrâḳ ve'd-da'avâtü'l-heddâme, el-Müctema'u'l-İslâmî, el-Ḥadâre ve'l-'ilm ve'l-'ulûmü'l-ictimâ'iyye, Tâbi'u'l-İslâm beyne'l-edyân ve'l-eydelûciyât, Târîhu'l-yekazati'l-İslâmiyye fî merâhilihe's-selâs, Usûlü's-sekâfeti'l-'Arabiyye ve mesâdirühe'l-İslâmiyye, Yekazatü'l-fikri'l-'Arabî fî müvâceheti'l-isti'mâr, el-'Âlemü'l-İslâmî ve'l-isti'mârü's-siyâsî, el-İslâm ve'l-'âlemü'l-mu'âsır, Sukûtü'l-Almâniyye, el-Fusha luğatü'l-Ḳur'ân, el-İslâm ve'd-da'avâtül'-heddâme, Ahtâ'ü'l-menheci'l-ğarbî el-vâfid, et-Terbiye ve't-ta'lîm ve's-sekâfe fî dav'i'l-İslâm, Hasâ'isü'l-edebi'l-'Arabî, Mefâhîmü'n-nefs ve'l-ahlâk ve'l-ictimâ' fî dav'i'l-İslâm, eş-Şübühât ve'l-ahtâ'ü'ş-şâ'i'a fi'l-edeb ve'l-ictimâ' ve't-târîh, el-İslâm ve ḥareketü't-târîh, el-Edebü'l-'Arabî el-hadîs fî ma'reketi'l-mukâveme ve't-tecemmü', el-Me'ârikü'l-edebiyye, el-Fikrü'l-'Arabî el-mu'âsır fî ma'reketi't-tağrîb ve's-sekâfe, Edebü'l-mer'eti'l-'Arabiyye tetavvürühû ve a'lâmühû, Asâletü'l-fikri'l-'Arabî el-İslâmî fî müvâceheti'l-ğazvi's-sekâfî, el-Meselü'l-a'lâ li'ş-şebâbi'l-müslim, Ehâdîs li'ş-şebâbi'l-müslim, Mevâkıf târîhiyye hâsime min ḥadâreti't-tevhîd, el-Vahdetü'l-İslâmiyye zarûretühâ ve'l-vesâ'ilü'l-'ilmiyye li-tahkîkıhâ, et-Teyyârâtü'l-vâfide, eş-Şebâbü'l-müslim ḳadâyâhü ve müşkilâtühû, 'Uyûnü't-türâs ve zehâ'irü't-târîh, et-Te'sîlü'l-İslâmî ve'l-hurûc mine't-tebe'iyye, el-Fikrü'l-İslâmî ve's-sekâfetü'l-'Arabiyyetü'l-mu'âsıra fî müvâceheti tehaddiyâti'l-istişrâḳ ve't-tebşîr ve'l-ğazvi's-sekâfî, Târîhu'l-ğazvi'l-fikrî ve't-tağrîb hilâle merhale beyne'l-ḥarbeyni'l-'âlemiyyeteyn 1920-1949, Me'âlimü târîhi'l-İslâmi'l-mu'âsır, Mine'l-yekaza ile's-sahve hilâle'l-merhale min 1933-1988, es-Sıhâfetü's-siyâsiyye fî Mısr münzü neş'etihâ ile'l-ḥarbi'l-'alemiyyeti's-sâniye, es-Sıhâfe ve'l-aklâmü'l-mesmûme, Tetavvürü's-sıhâfeti'l-'Arabiyye fî Mısr, Târîhu's-sıhâfeti'l-İslâmiyye, el-Ḳarnü'l-hâmis 'aşer ḳadâyâhü ve tehaddiyâtühû, İtârun İslâmî li'l-fikri'l-mu'âsır, Me'âlimü't-târîhi'l-İslâmî el-mu'âsır, Müşkilâtü'l-'asr ve ḳadâye'l-fikr, Nevâbiğu'l-İslâm, Tashîhu'l-mefâhîm fî ḍav'i'l-Kitâb ve's-Sünne, İ'âdetü'n-nazar fî kitâbâti'l-'asriyyîn fî ḍav'i'l-İslâm, eş-Şübühât ve'l-ahtâ'ü'ş-şâ'i'a, el-Meddü'l-İslâmî, es-Sahvetü'l-*

İslâmiyye, el-İslâm ve'l-ğarb, el-İslâm ve hareketü't-târîh, el-'Âlemü'l-İslâmî ve'l-isti'mârü's-siyâsî ve'l-ictimâ'î ve's-sekâfî, el-'Urûbe ve'l-İslâm, el-Vaḥdetü'l-İslâmiyye ve 'avdetü'l-hilâfe, Harîtatü'l-İslâmi'l-mu'âsır, Mısrü'l-'Arabiyyetü'l-İslâmiyye, el-Mu'âmera 'ale'l-İslâm, Târîhu'l-İslâm fî müvâceheti't-tehaddiyât, el-Mühattatâtü't-Talmûdiyyetü'l-Yehûdiyyetü's-Sahyûniyye fî ğazvi'l-fikri'l-İslâmî, Mukaddimetü'l-menâhic, Mine't-tebe'iyye ile'l-asâle fî mecâli't-ta'lîm ve'l-kânûn ve'l-luğa, Elfü milyûn müslim fî müvâceheti'l-aḥtâr ve't-tehaddiyât, Hareketü'l-yekazati'l-İslâmiyye fî müvâceheti'l-isti'mâr ve't-tağrîb ve'ş-şu'ûbiyye (Suayfân, 2006, 40-51; Mes'ûdî, 2008, 43-62; Yağcı, 2020, EK-1/274-275; Ebû Şebâne, 2023, 546-565).

CÜNDÎ'NİN BATI MERKEZCİ TARİH ANLAYIŞINA YÖNELTTİĞİ ELEŞTİRİLER

Tarih, insanlığın geçmişini, gelişimini ve dünya görüşlerini şekillendiren temel bir unsurdur. Ancak farklı kültürler, inanç sistemleri ve ideolojiler, tarihe bakış açılarında önemli farklılıklar gösterir. Kanadalı dinler tarihçisi ve şarkiyatçı Wilfred Cantwell Smith (1916-2000), *Islam in Modern History: The Tension Between Faith and History in the Islamic World* (Modern Tarihte İslam: İslam Dünyasında İnanç ve Tarih Arasındaki Gerilim) adlı önemli eserinde, bu farklılıkları çarpıcı bir şekilde ortaya koyar. Cündî'nin aktardığına göre Smith, Hintlilerin, Hıristiyanların ve Marksistlerin tarihe karşı hislerini, Müslümanların tarihe yönelik derin ve özgün anlayışıyla karşılaştırarak her bir grubun dünya görüşünün tarihe nasıl yansıdığını inceler ve şöyle der: *"Hintli, tarihe aldırış etmez ve onun varlığını hissetmez. Çünkü tarih, insanların madde ve duyular aleminde kaydettiği eylemlerden ibarettir. Hintli, her zaman ruh alemine, sonsuzluk alemine odaklanmıştır. Bu nedenle, sınırlı ve fani dünyadaki her şey onun için değersiz ve önemsizdir; tarih onun için hesaba katılması gereken bir şey değildir. Hıristiyan ise çift kişilikli veya birbiriyle bağlantısı olmayan iki ayrı dünyada yaşar. Onun için ideal olan, uygulanabilir değildir ve yeryüzündeki insan gerçekliği, arzulanan idealden kopuktur. Bu iki çizgi, onun ruhunda yan yana veya birbirinden uzak ama bağlantısız bir şekilde ilerler. Tarih, onun gözünde insanların zayıflık noktası, düşüşü ve sapmasıdır. Marksistin gözünde tarih, tarihin kaçınılmazlığına olan inançtır; yani her adımın bir sonraki adıma kaçınılmaz bir şekilde yol açtığına inanılır. Ancak Marksist, sadece bu duyusal dünyaya inanır, hatta bu dünyada sadece Marksist doktrine inanır ve bunun dışındaki her şey batıldır. Marksist, tarihin çarkını takip eder, onu yönlendirmez veya dışarıdan herhangi bir ölçütle değerlendirmez. Müslüman ise tarihi ciddi bir şekilde hisseder. O, Allah'ın hükümranlığının yeryüzünde gerçekleşeceğine inanır ve Allah'ın, insanların yeryüzünde ona göre hareket etmeleri için pratik ve gerçekçi bir sistem koyduğuna inanır. Bu sistem çerçevesinde yeryüzünün gerçekliğini daima şekillendirmeye çalışırlar. Bu nedenle, her bireysel veya kolektif eylemi ve her bireysel veya kolektif duyguyu, yeryüzünün gerçekliğine yakınlığı veya uzaklığı ölçüsünde yaşar, çünkü bu gerçekleştirilebilir bir şeydir. Müslümanın gözünde tarih, Allah'ın hükümranlığının yeryüzünde gerçekleştirme çabasının kaydıdır. Bu sebeple, her eylem ve her duygu, bireysel veya kolektif olsun, son derece önemlidir; çünkü şimdi geçmişin sonucudur ve gelecek şimdiye bağlıdır. İslam anlayışı açıkça pozitiftir. Müslüman olmayan kişi, yanlış tarihin çarkının kendisi hayattayken geçip gitmesini istemediği için kendini feda eder ve bu çarkın geçmesine izin verir. O, çarkın yoluna çıkar, böylece çark onu ezer ve öldürür; bu, Allah'a sunduğu en değerli kurban olur. Müslüman ise kendini feda ettiğinde, yeryüzünde uygulanması istenen ilahi bir sistemin varlığını hisseder ve kendini feda ederken bu sistemin çarkını bir adım ileriye taşıdığını hisseder."* Cündî, Wilfred Cantwell Smith'in bu ifadelerinin gerçeğe oldukça yakın olduğunu ve Müslümanların tarih anlayışı ile diğer grupların anlayışı arasındaki derin farkı net bir şekilde ortaya koyduğunu belirtir (Cündî, 1979, 4-5). Bu analiz, tarihin sadece geçmiş olayların bir kaydı olmaktan öte, inanç, ideoloji ve dünya görüşleriyle şekillenen dinamik bir kavram olduğunu anlamamıza yardımcı olur.

Tarih yazımı ve yorumu, her medeniyetin ve inanç sisteminin kendi değerleri, dünya görüşü ve metodolojisiyle şekillenen karmaşık bir alandır. Özellikle İslâm tarihi gibi köklü ve kapsamlı bir alanı anlamak, kendine özgü bir yaklaşım gerektirir. Cündî, bu konuda önemli bir tespitte bulunarak, İslâm tarihinin ancak kendi İslâmî yorum çerçevesinde anlaşılabileceğini savunur. Ona göre, dışarıdan dayatılan materyalist, ekonomik, coğrafi veya iklimsel gibi farklı tarih yorum ekolleri, İslâm tarihinin özünü ve kapsamını kavramakta yetersiz kalır. Cündî, İslâm tarihini Batı liberal teorileri, Marksist veya materyalist teoriler gibi dış kaynaklardan yorumlama girişimlerinin yetersiz olduğunu belirtir. Bu yetersizliğin temel nedeni, İslâm'ın kendine özgü ve bütüncül metodolojisidir. İslâm, ruh ve madde, hayat ve ölüm, dünya ve ahiret, nefis ve beden, sabiteler ve değişkenler, külli ve cüz'i gibi kavramların bütünlüğüne dayanan bir sistemdir. Bu nedenle ister materyalist ister tamamen ruhanî olsun, kısmi bir metotla İslâm'ı açıklamak mümkün değildir. İslâm'ın kendine özgü bir kimliği ve eşsiz, kapsayıcı bir yapısı vardır. Bu yapı, kimi zaman herhangi bir ideolojinin bir yönüyle örtüşse de materyalist metotlar ve kısmi yorum teorileri onu tam olarak kavrayamaz ve anlayamaz. İslâm, parçalı yaklaşımlarla indirgenemeyecek kadar bütünsel ve özgündür. Onun tarihini anlamak için, kendi iç dinamiklerini, değerlerini ve dünya görüşünü temel alan bir yorumlama metodolojisi benimsemek zorunludur (Cündî, 1979, 6-7). Cündî'nin bu görüşleri, İslâm tarihinin doğru bir şekilde anlaşılması için metodolojik bir çerçeve sunar ve dışarıdan dayatılan yorumların sınırlılıklarını ortaya koyar.

Tarih, bir milletin kimliğini, değerlerini ve geleceğe yönelik umutlarını şekillendiren en önemli unsurlardan biridir. Bu nedenle, tarihin nasıl yorumlandığı ve sunulduğu büyük bir önem taşır. Cündî'ye göre, İslâm tarihi, uzun süredir Batılılaşma ve kültürel işgal kampanyalarının hedefi haline gelmiştir. Bu kampanyaların temel amacı, İslâm tarihini mensuplarının gözünde değersizleştirmek, ona karşı şüphe ve kuşku uyandırmak ve böylece İslâm'ın bir diriliş ve uyanış gücü olarak taşıdığı önemi ortadan kaldırmaktır. Cündî, Batılılaşmanın hedefinin "itici bir İslâm tarihi uydurmak" olduğunu belirtir. Bu yolla, Müslümanların kendi geçmişlerine ve kimliklerine olan güvenleri sarsılmak, entelektüel miraslarından ve tarihlerinden koparılarak geçmişsiz bırakılmak istenmiştir. Bu durum, Müslümanların maneviyatlarını zayıflatacak, fikrî ve kültürel olarak üzerlerinde kontrol kurulmasını kolaylaştıracak ve nihayetinde askerî ve iktisadî kontrolün önünü açacaktır. Cündî, İslâm tarihinin yorumlanmasında Batı yöntemlerinin İslâmî çalışmalara alternatif olarak dayatıldığını ve Batı kaynaklarının eğitim kurumlarında zorunlu hale getirildiğini vurgular. Bu tür çalışmalar, İslâm'ın önde gelen şahsiyetlerine, liderlerine ve takipçilerine yönelik saldırılarla doludur. Güvenilir olmayan veya doğruluğu tartışmalı kaynaklara dayanarak, şüpheli haberler ve hikayelerle bu büyük şahsiyetler karalanmış, İslâm tarihi kahramanları hakkında şüpheler uyandırılmaya çalışılmıştır. Bu girişimler, İslâm tarihine karşı komplo kurmaya devam etmektedir ve Cündî'ye göre, bu durum İslâm'ın özgün kimliğini ve tarihsel mirasını koruma mücadelesinin önemini bir kez daha ortaya koymaktadır (Cündî, 1979, 7-8).

Modern çağda İslâm tarihini bekleyen ciddi tehlikelerden biri, Batı düşüncesindeki tarih kavramının dayattığı çeşitli yorumlardır. Cündî'ye göre, coğrafî, biyolojik, ekonomik, sosyal ve psikolojik gibi tek yönlü Batılı tarih yorumları, İslâm tarihinin bütüncül yapısını kavramakta yetersiz kalmaktadır. Bu teoriler, tarihin karmaşık yapısını tek bir faktöre indirgeyerek, sadece olasılıklar ve varsayımlar sunar. Cündî, Marx'ın ekonomik faktörü, Freud'un ruhsal krizleri veya Hegel'in siyasî yorumu gibi yaklaşımların, tarihin sadece belirli bir yönüne odaklandığını ve bu nedenle sınırlı kaldığını belirtir. İslâm'ın tarih yorumu ise bu kısmi yaklaşımlardan farklı olarak, evreni kuşatan Allah'ın iradesini, dünya ve ahiret arasındaki bağı, insanın iradesinin olaylar üzerindeki etkisini ve tüm maddî, manevî ve psikolojik faktörleri içeren kapsamlı bir anlayışa sahiptir. İslâm'a göre hiçbir faktör tek başına etkili olamaz; manevi faktörlerin (ruhanî, ahlakî ve psikolojik) etkisi, Batı düşüncesinin odaklandığı ekonomik ve sosyal faktörlerden

çok daha fazladır. Bu durum, İslâm tarihinin kendine özgü ve bütüncül bir metodolojiyle yorumlanması gerektiğini vurgular (Cündî, 1979, 9-11).

Tarih, farklı medeniyetler ve inanç sistemleri tarafından farklı şekillerde algılanır ve yorumlanır. Cündî'ye göre, Batı'nın tarihe ve onun çoklu çatışmalarına yönelik yorumları ile İslâm'ın yorumu arasında derin ve temel farklılıklar bulunmaktadır. Batı düşüncesi, özellikle Marksist teoride belirginleşen bir yaklaşımla, "Avrupa tarihini" dünya tarihi olarak kabul ederken, diğer medeniyetleri ve tarihleri göz ardı etme eğilimindedir. Bu durum, Batı'nın kendi tarihsel deneyimlerinden, özellikle Kilise ile modern Avrupa Rönesansı arasındaki çatışmadan kaynaklanan dine karşı karanlık bir bakış açısıyla birleşir. Cündî, Marx ve Engels gibi düşünürlerin materyalist tarih anlayışlarının, Avrupa'daki mücadelelerinden beslendiğini ve İslâm'ın bakış açısını dikkate almadığını vurgular. Batı'nın materyalist kökenli tarih yorumu, İslâm tarihinin maddî tasavvurun ötesinde olan gerçeklerini kavrayamamıştır. Örneğin, İslâm'ın şaşırtıcı yayılma hızı ve kısa sürede geniş coğrafyalara ulaşması, Batı düşüncesinin insan iradesi aracılığıyla geniş çaplı değişime yol açabilen derin imanın etkisine inanmaması nedeniyle şüpheli bulunur. Aynı şekilde, Batı yorumu, "Allah'ın izniyle büyük bir topluluğa galip gelen nice küçük topluluklar vardır" şeklindeki temel İslâmî kuralı anlayamaz. Materyalist değerlendirme, çokluğun her zaman galip geldiğini düşünürken, İslâm, sayı ve teçhizat gücüne ek olarak "iman gücü"nü de hesaba katar. Cündî, İslâm fetihlerinin ve gazvelerinin bu olguyu şüpheye yer bırakmayacak şekilde doğruladığını belirtir; Müslümanların düşmanlarından kat kat az sayıda olmalarına rağmen kazandıkları zaferler, Batı'nın tarih yorumunda hesaba katılmayan iman unsurunun belirleyici rolünü ortaya koyar. Bu durum, İslâm tarihinin ancak kendi özgün değerleri ve inanç sistemi çerçevesinde doğru bir şekilde anlaşılabileceğini gösterir (Cündî, 1979, 13-14).

Tarih yorumları, çoğu zaman yorumlayıcının kendi kültürel, dinî ve ideolojik ön kabulleriyle şekillenir. Cündî'ye göre, Batı'nın İslâm tarihi yorumunda açıkça bir fanatizm olgusu gözlemlenmektedir. Bu fanatizm, dinler arası farklılıklardan, Doğu ile Batı arasındaki tarihsel çatışmalardan ve Batı'nın kendisini "medenileştiren beyaz ırk" olarak gören sömürgeci bakış açısından kaynaklanmaktadır. Bu bakış açısı, İslâm ülkelerini "renkli unsurlar" olarak görüp onları derece, yetenek ve yeterlilik açısından daha düşük konumlandırmaktadır. Bu fanatik Batı bakış açısı aracılığıyla yapılan yanlış yorumların başında, "İslâm'ın kılıçla yayıldığı" iddiası gelmektedir. Cündî, bu iddianın geçersiz olduğunu vurgular. Gerçek şudur ki, İslâm kılıcı ancak varlığı tehlikeye girdiğinde, kendisine karşı komplo kuranların girişimlerine karşı koymak amacıyla kendini savunmak için kullanmıştır (Cündî, 1979, 14-15). Bu durum, Batı'nın İslâm tarihine yönelik önyargılı ve çarpıtılmış yorumlarının, kendi tarihsel ve ideolojik arka planından beslendiğini ve İslâm'ın gerçek yayılma dinamiklerini göz ardı ettiğini açıkça ortaya koymaktadır.

İslâm, kendine özgü inancı ve hareket dinamikleriyle, dışarıdan dayatılan teorilerle tam olarak kavranamayacak bir kimliğe sahiptir. Cündî'ye göre, bu nedenle İslâm tarihinin de kendine özgü bir yorumu olmalıdır. Batı'nın İslâm'ın hareketi hakkındaki tüm şüpheleri, İslâm'ın doğası doğru bir şekilde anlaşıldığında ortadan kalkar. İslâm'ın doğası, gerçeklik ile idealizmi, dünya ile ahireti, kalp ile aklı birleştiren bütüncül bir inanç sistemidir. İslâm, esnekliği, geniş ufku ve kapsayıcı çerçeveleri sayesinde farklı medeniyetler ve kültürlerle temel prensipleri üzerinde yüzleşebilme yeteneğine sahiptir. Aynı zamanda, inancını zorla dayatmadan, ibadet özgürlüğü tanıyarak ve ülke halklarına kendilerini yönetme fırsatı vererek açık bir hoşgörü sergiler. İslâm sadece bir din değil, aynı zamanda bir toplum sistemi ve yaşam biçimidir; ibadet bunun sadece bir parçasıdır. İslâm, milletlerin medeniyetlerini ve kültürlerini özümseyebilmiş, onlardan iyi olanı "Tevhid" kavramı çerçevesinde sindirip geliştirmiştir. Bilim ile dini, ahlak

ile siyaseti uzlaştırmış, insanî karakteri ve evrensel eğilimi hareketinin ilk gününden itibaren açıkça göstermiştir. Bu durumu destekleyen en önemli unsurlar ise Kur'an'ın tahrifattan uzak kalması, Resûlullah'ın (s.a.v.) kişiliğinin ve hayatının neredeyse eksiksiz bir şekilde açık olması, aynı şekilde İslâm kahramanlarının kişiliklerinin ve bu tarihin tüm detaylarının bilimsel olarak doğru bir şekilde açık olmasıdır (Cündî, 1979, 15-16).

Tarih boyunca medeniyetlerin yükseliş ve düşüşleri, insanlık serüveninin en çarpıcı kesitlerini oluşturmuştur. Bu serüvende dinler, toplumları bir araya getiren, onlara kimlik kazandıran ve geniş coğrafyalara yayılmalarını sağlayan temel dinamiklerden biri olmuştur. Özellikle bazı inanç sistemleri, sadece manevî bir rehber olmanın ötesine geçerek, siyasî, ekonomik ve kültürel dönüşümlerin de ana aktörü haline gelmiştir. Bu bağlamda, bir medeniyetin gelişimini ve dünya üzerindeki etkilerini anlamak için, onun temel felsefesini ve tarihsel süreç içindeki evrimini bütüncül bir yaklaşımla ele almak büyük önem taşır. Cündî'ye göre İslâm, Arapları birleştirerek onları yarımadalarından çıkarıp yeryüzüne yaymanın temel itici gücü olmuştur. İslâm tarihindeki büyük olaylar, İslâm'ın özgün karakterini değiştirmemiş, aksine dış yapıyı yenileyerek ve dalları yeniden şekillendirerek İslâm çerçevesinde yeniden biçimlendirmiştir. Bu süreçlere körü körüne bir fanatizm değil, aydınlanmış bir ikna ve derin bir iman eşlik etmiştir. İslâm'ın kendisi kapsamlı bir bakış açısına dayandığı için, tarihi ancak kapsamlı ve birbiriyle bağlantılı bir kavram aracılığıyla yorumlanabilir. İslâm tarihi, insanlık tarihiyle sürekli etkileşim içinde olmuş ve insanlığın putlara, Sezar'a, imparatora ve firavuna kölelikten kurtulması gibi geniş çaplı değişimlerde derin etkiler bırakmıştır. İslâm, insanlığı bilim çağına taşıyan deneysel metodu ona hediye etmiştir. Cündî, İslâm tarihinin halkaları birbirine bağlı, tam bir bütün olduğunu ve toplum, ekonomi ve siyaset üzerinde etkili olan tek bir güçten kaynaklandığını belirtir. Hiçbir güç İslâm'ı tamamen yok edemez; ancak onu zayıflatabilir, kriz, işgal veya batılılaşma yoluyla varlığını etkileyebilir. Ancak İslâm, içten yenilenerek gücünü geri kazanma ve zararı defetme yeteneğine sahiptir. Cündî, hiçbir adil tarihçinin İslâm tarihini ve olayların akışı üzerindeki derin etkisini göz ardı ederek insanlık tarihini yazamayacağını vurgular (Cündî, 1979, 16-18).

Günümüz Müslüman gençliğinin tarih bilinçleri ve kimlik arayışları, eğitim metotları ve dış etkiler bağlamında yoğun biçimde tartışılmaktadır. Bu tartışmalarda, Batılılaşma eğilimlerinin ve misyonerlik faaliyetlerinin tarih öğretimi üzerindeki etkileri sıkça gündeme gelir. Cündî'ye göre, modern çağda Müslüman gençliği etkileyen "Batılılaşma" girişimlerinin en tehlikelisi, misyonerlik faaliyetlerinin dayattığı tarih öğretim metodudur. Bu metot, tarihi bir doğa bilimi gibi, yani tümevarım esasına göre öğretmeyi ve araştırmayı teşvik eder. Bu yaklaşım, insanlık tarihinin gelişimini yöneten cebri yasaların olduğuna inanan materyalist felsefeden doğmuştur ve zamanla çürütülmüş, savunucularının tarihi olayları kendi heveslerine göre çarpıttığı ortaya çıkmıştır. Misyonerlik faaliyetleri bu metotta, İslâm tarihine darbe vurmak, olaylarını tahrif etmek ve kahramanlıklarını şüpheye düşürmek için önemli bir silah bulmuştur. Cündî, tarihe doğru bakış açısının hem determinizmi hem de cebriyeyi reddetmesi gerektiğini vurgular. Çünkü insan, tarihin yapıcısıdır; düşünce ve eylem olarak giriştiği her şeyde kendi özgürlüğüne, seçimine ve özel etkisine sahiptir. Eğer insan sadece doğal nedenlerin bir ürünü olsaydı ve olayları dönüştürme rolü olmasaydı, hükmün ve ödül-cezanın anlamı kalmazdı. Tarihin hükmü, ancak insanın özgürlüğünü, seçimini ve imkanları gerçekleştirme inancını kabul ettiğinde var olabilir. Bu insani özgürlük anlamı, tarihteki çabanın özünü özetler ve insanın tarihi yargılayarak pozitif ve olumsuz mirasları ayırmasını sağlar (Cündî, 1979, 18-20).

Misyonerlik faaliyetlerinin ve dış ideolojik etkilerin tarih yazımı üzerindeki etkileri, Müslüman toplumların hafıza ve kimlik inşası açısından kritik öneme sahiptir. Cündî'ye göre, misyonerlik faaliyetlerinin İslâm tarihini materyalist bir yaklaşımla yorumlama çabası bilimsel olarak geçersizdir ve Müslüman gençliğin ruhundaki kahramanlık derslerini yıkmayı hedefler. Bu girişim, tarihin yeni nesillerde rol oynamasını, olaylarla yüzleşme yeteneği kazandırmasını ve

sömürgecilik, Siyonizm ve Marksizm gibi tehlikelere karşı doğru yolu göstermesini engellemeyi amaçlar. Uluslararası Siyonizm de Marksizmin materyalist yorum metodunu benimseyerek tarihi tahrif etme ve zehirli bir şekilde yorumlama girişiminde bulunmuştur. Siyonizm, Batı üniversitelerinde kürsüler ele geçirerek, İslâm ülkelerini işgalini ve Filistin'i kontrol altına almasını meşrulaştırmaya çalışmış, Arap milletinin, tarihinin, konumunun, dininin ve inancının etrafında şüpheler uyandırmayı hedeflemiştir. Ayrıca, Haçlı Seferleri gibi olayları yanıltıcı bir şekilde sunarak Batı'yı Arap ve İslâm halklarına karşı kışkırtmışlardır. Günümüzde de Batı kamuoyunu Araplara karşı seferber etmek için korkuları körüklemeye çalışmaktadırlar. İslâm mezhepleri ve Bâtınî hareketler (Zenciler, Karmatîler, İsmâilîler) hakkındaki yeniden yazım çalışmalarının arkasında da Siyonizm vardır; bu hareketleri adalet savunucuları olarak göstermeye çalışırken, aslında onlar İslâm devletine karşı ayaklanmanın ve onu yıkmanın savunucularıdır. 1942 Biltmore Siyonist Konferansı bu yönelime odaklanmıştır ve günümüzdeki bu tür yayınlar bu stratejinin bir ürünüdür (Cündî, 1979, 20-21).

Tarih kitaplarının ve akademik çalışmaların nasıl yazıldığı, bir toplumun kimlik ve hafıza inşasında belirleyici rol oynar. Cündî'ye göre İslâm tarihinin çarpıtılması, okul kitaplarından akademik çalışmalara kadar geniş bir yelpazede kendini göstermektedir. Portekiz ve İspanyol sömürgeciliğinin ilk misyonerlerini ve elçilerini "coğrafi keşiflerin kahramanları" olarak sunma çabaları, bu çarpıtmanın bir örneğidir. Aynı şekilde, İslâm tarihi kitaplarında Muâviye ile Ali arasındaki anlaşmazlıkların abartılı bir şekilde vurgulanması ve tüm İslâm tarihinin sanki iktidar çatışmalarından ibaretmiş gibi gösterilmesi, Firavunlar tarihinde görülmeyen bir önyargıyı yansıtır. Cündî, bu durumun, bir grup Yahudi ve fanatik Hıristiyan oryantalist tarafından yazılan "İslam Ansiklopedisi" gibi eserlerle de bağlantılı olduğunu belirtir. Bu ansiklopedi, İslâm'a ve Kur'an'a yönelik iftira ve kin dolu suçlamalarla doludur; İslâm'ı Hz. Muhammed'in eseri gibi göstermeye çalışır. Brockelmann ve diğerlerinin yazıları da İslâm'ın önde gelen şahsiyetlerini ve yönetimlerini suçlama, şüphe ve hevesle hedef alarak İslâm tarihini kasıtlı olarak karalamayı amaçlamaktadır. Bu yaklaşımlar, İslâm'ın özgün kimliğini ve tarihsel gerçekliğini göz ardı ederek, Batılı ideolojilerin ve önyargıların bir yansıması olarak ortaya çıkmaktadır (Cündî, 1979, 21-22).

İslâm tarih yazımında dikkat çeken bir husus, oryantalizmin etkisiyle ortaya çıkan ırkçılık eğilimidir. Bu eğilim, yönetici konumundaki Araplar ile yönetilen halklar arasında keskin bir çatışma olduğunu öne sürer. Bazı müsteşrikler, hicri birinci yüzyılı, Arapların fethettiği ülkelerin sakinleriyle yaşadığı kanlı bir çatışma dönemi olarak tasvir etmeye çalışmışlardır. Bu bakış açısı, birçok Arap tarihçiyi de etkilemiş ve Babekîler ile Karmatîler gibi grupların ayaklanmalarını birer özgürlük hareketi olarak yorumlamalarına yol açmıştır. Ancak Cündî'ye göre, bu tür yorumlar modern siyasî düşünceden türetilmiş olup, o dönemin gerçek karakteriyle örtüşmemektedir (Cündî, 1979, 23-24).

CÜNDÎ'YE GÖRE İSLÂM'IN TARİH YORUMUNUN ÖZELLİKLERİ

İslâm'ın tarihe bakış açısı Batı düşüncesinden temelden farklıdır. Bu farklılık hem bireyin konumu hem de tarihsel süreçlerin işleyişi açısından belirginleşir. Cündî'ye göre İslâm'ın tarihe yönelik yorumunun ayırt edici özelliği, yani İslâm tarihine uygulanabilecek tek geçerli metodoloji, Batı düşüncesinin temel kavramlarından farklılaşan önemli özelliklere sahiptir ve dolayısıyla liberal veya Marksist yorumlarla da farklılık gösterir. İslâm'da insan, eylem yapabilen özgür bir iradeye sahiptir ve sorumluluk sahibidir. Bu nedenle, toplumun bedenindeki bir hücre değildir, determinizm veya cebriyetle hükmedilmiş değildir. Bu anlayış, bireyin topluluk içinde yok olduğunu ve bireyin ayrı, kendi başına varlığının bir aldatmaca olduğunu düşünen Batı düşüncesinden farklıdır. Batı düşüncesi, insan ırkını iradesi olmayan

bir yaratıklar yığını olarak görür ve insan yaşamını zamanın tamamen kuşattığı sınırlı bir olgu olarak kabul eder. Bu nedenle, bireyin varlığı önemli değildir. İslâm ise insanı yeryüzünde halifelik konumunda görür. İslâm'da ebedî ile geçici, sabite ile değişken, ruhanî ile maddî, dünyevî ile uhrevî birbirine bağlıdır. İnsanın hayata ve oradaki eylemlerine bakışı ölümden sonrasına, dirilişe ve cezaya, yani bizzat ebediyete uzanır. Bu anlayış, hayatın bir sonu olduğunu ve ondan sonra hiçbir şey olmadığını düşünen, bakış açısı bu sınırlı evren ve sınırlı zamanla münhasır olan Batı düşüncesinden farklıdır. Müslüman, evrenin, varoluşun ve toplumların yasalarını ve kanunlarını yaratan Allah'ın mutlak ve etkin iradesiyle hareket ettiğine inanır. Bu ilahî irade, bu yasaları değiştirmeye ve durdurmaya kadirdir. İnsan iradesi ise Allah'ın iradesi içinde ve ondan kaynaklanan sınırlı bir iradedir ve sorumluluk sahibidir. Toplumu hareket ettirme ve tarihi değiştirme üzerindeki etkisi buradan gelir. Hak Teâlâ, açık bir sebep olmaksızın tarihi değiştirmeye kadirdir. Tarihi olaylar, meydana gelen ve materyalistlerin ancak tesadüf veya ani olay adını vererek açıklayabildikleri birçok büyük değişimle buna şahitlik etmektedir. Tarihin İslâmî yorumu, Allah'ın tarihteki tüm olayların gerçek faili olduğu inancından hareket eder. Kur'an, milletlerin yükselişinin, gelişiminin ve çöküşünün nedenlerini sunmuş, zaferin ve yenilginin, kalıcılığın ve yok oluşun gerçek kaynağını açıklamıştır. Kur'an, bu faktörleri esas olarak ahlaka, Allah'a imana ve takvaya bağlar. Eğer bir medeniyet bu faktörleri korursa devam edebilir, aksi takdirde çöker (Cündî, 1979, 26-28). Cündî, En'âm Sûresi'nin 6. ayetine atıfta bulunarak milletlerin lükse, fesada ve çürümeye sapmaları, ahlak, merhamet ve takvaya dayalı ciddi çalışmalardan yüz çevirmeleri halinde çökeceklerini belirtir. Ona göre milletler bozulduğunda toplumları ve medeniyetleri çöker; hakka geri döndüklerinde ise konumları ve misyonları onlara geri verilir. Müslümanların tüm insanlığa ulaştırmaları gereken evrensel bir mesaj ve emanetleri vardır. Bu nedenle, yaşamın ve gücün nedenlerini özgün kaynağı olan Kur'an'dan aramaları en doğru olanıdır (Cündî, 1979, 29-30).

SONUÇ

Cündî, İslâm tarihinin doğru bir şekilde anlaşılması ve yorumlanması için Batı kaynaklı, tek faktörlü ve indirgemeci tarih yazımı ekollerinin yetersiz olduğunu savunmuştur. Ona göre, İslâm'ın kendine özgü bütüncül karakterinden doğan, maddî ve manevî boyutları birleştiren kapsamlı bir tarih metodolojisi gereklidir. O, liberal, Marksist ve materyalist teorilerin İslâm tarihinin ruhunu, akidesini, manevî ölçülerini ve dönüştürücü iman gücünü kavrayamadığını, bu nedenle İslâm'ı Batılı kategorilere sokma çabalarının onun özgün yapısını bozduğunu belirtir. İslâm tarihinin sadece metodolojik yanlış anlamalarla değil, aynı zamanda kasıtlı bir kültürel istila kampanyasıyla da karşı karşıya olduğunu vurgular. Bu kampanyaların amacı, İslâm tarihini itibarsızlaştırmak, Müslümanların geçmişlerine olan güvenlerini sarsmak ve onları kendi kültürel miraslarından koparmaktır. Cündî'nin önerdiği İslâmî tarih anlayışı çok boyutlu ve kapsamlıdır. Bu yaklaşım, Allah'ın yüce iradesini tarihin nihai yönlendiricisi olarak kabul ederken, insanın etkin iradesini de tarihin akışında önemli bir faktör olarak görür. Maddî faktörlerin yanı sıra ruhanî, ahlakî ve psikolojik faktörlerin etkisini de göz önünde bulundurur ve dünya ile ahiret arasındaki bağlantıyı kurar. Cündî, Batı düşüncesinin sadece Avrupa tarihini evrensel kabul etmesini ve İslâm'ın olağanüstü yayılışını maddi nedenlerle açıklayamamasını eleştirerek, derin imanın tarihteki dönüştürücü gücünün materyalist zihniyet tarafından anlaşılamadığını vurgular.

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TÜRK EDEBİYATINDA ELİF-NÂME GELENEĞİ VE FARKLI BİR TARZ: İSMAİL HAKKI'NIN ELİF-NÂMELERİ

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ÖZ

Divan şiirinde söze güç katmak, anlatımı ilgi çekici kılmak ve edebiyat camiasında hünerlerini göstermek ve ustalığını konuşturmak gayesiyle belirli kurallara uyarak benzetmeler yapmak, sanatlı söyleyişler ortaya koymak, mazmunları yerinde kullanmak ve bu şartlar içinde etkili bir söyleyiş güzelliğine ulaşmak amaçlanmıştır. Şekil özellikleri olarak söz sanatları, harf simgeciliği, ebced hesabı, muvaşşah, elif-nâme gibi birtakım unsurlar hep kullanılmıştır. Elif-nâmeler, Divan ve Halk edebiyatlarında kullanılan ortak manzum ürünler olmuştur. Türk edebiyatında yüzden fazla elif-nâme yazıldığı yapılan çalışmalar sonucunda görülmüştür. Erzurumlu İsmail Hakkı da bu türden eser veren sanatçılardandır. Bu çalışmada elif-nâmeler ile ilgili genel bilgiler verilmiş ve Erzurumlu İsmail Hakkı'nın *Kitâb-ı Gevheriyye'sinde* bulunan elif-nâmelerin hem şekil hem de içerik yönünden özellikleri tanıtılmıştır. İsmail Hakkı'nın elif-nâmelerinin belirgin özellikleri ve divan şiirindeki diğer elif-nâmelerin genel özellikleri sonucunda ikisi arasındaki farklar ortaya çıkarılmıştır.

Anahtar Kelimeler: Divan şiiri, elif-nâme, Erzurumlu İsmail Hakkı, Kitâb-ı Gevheriyye, ebced sistemi, nazım şekli, Osmanlı edebiyatı, elif-nâme geleneği.

THE ELİF-NÂME TRADITION IN TURKISH LITERATURE AND A DIFFERENT STYLE: İSMAİL HAKKI'S ELİF-NÂMELER

ABSTRACT

In Divan poetry, the aim was to enhance the power of expression, make the narration more engaging, showcase literary skill, and demonstrate mastery by adhering to specific rules, employing metaphors, creating artistic expressions, and using literary symbols (*mazmuns*) appropriately—all within the framework of achieving a striking eloquence. In terms of form, literary devices, letter symbolism, the abjad (numerical) system, *muwashshah* poems, and *elif-nâme*s were frequently used. *Elif-nâme*s are poetic works commonly found in both Divan and Folk literature. Studies have shown that more than a hundred *elif-nâme*s were written in Turkish literature. Erzurumlu İsmail Hakkı is one of the poets who produced works in this genre. This study provides general information about *elif-nâme*s and analyzes the *elif-nâme*s found in Erzurumlu İsmail Hakkı's *Kitâb-ı Gevheriyye* in terms of both form and content. The distinctive features of İsmail Hakkı's *elif-nâme*s and the general characteristics of other *elif-nâme*s in Divan poetry are compared to reveal the differences between them.

Keywords: Divan poetry, Elif-nâme, Erzurumlu İsmail Hakkı, Kitâb-ı Gevheriyye, abjad system, poetic form, Ottoman literature, Elif-nâme tradition.

GİRİŞ

Türk edebiyatında Arap alfabesinin benimsenmesinden sonra, bu alfabeye ait harflerin edebi anlamda taşıdığı sembolik değer artmıştır. Özellikle "elif" harfi hem şekli hem de içerdiği anlam itibariyle öne çıkar. Elif; sevgilinin zarif boyunu, âşığın eğilmiş belini, aynı zamanda doğruluğu ve Allah'ın birliğini (tevhid) simgelemek amacıyla kullanılmıştır (Tökel, 2003). Diğer harfler ise sevgilinin fiziksel niteliklerini veya farklı metaforları temsil eden araçlar hâline gelmiştir.

Elif-nâme, mısra veya beyitlerin genellikle başındaki kelimelerin ilk harflerinin alfabetik olarak "elif"ten "ye"ye veya "ye"den "elif"e düzenlenmesi (Güzel, 2009: 247; Tökel, 2003: 145; Gökalp, 2016: 238) olarak tanımlanabilir. "Elif-nâme, Arap alfabesinin ilk harfi olan "elif" ile mektup, kitap anlamlarına gelen ve sonuna geldiği ismi, o ismin anlamını belirten ve ismi Farsça birleşik isim yapan "nâme" kelimesinin vasıf terkibi şeklinde birleşmesiyle meydana gelmiş bir isimdir." (Kaplan, 2022, s. 440).

Elif-nâmeler günümüzde kullanılan şiir sanatı akrostiş diye anılan, mısraların ilk harfleri yukarıdan aşağı okunduğunda bir isim çıkan muvaşşah sanatından doğan bir üründür. İslam ansiklopedisi sözlüğünde, "çift süslemeli gerdanlık; omuzdan koltuk altına kadar uzanan ve iki parçadan oluşan süslü kemer" anlamındaki vişâh kelimesinden türeyen müveşşah kelimesi "iki temel sanat unsurunu taşıyan şiir" demektir (Aydın, s.229-231). Günümüze kadar üzerinde pek çalışılmamış olan elif-nâme türü, yalnızca divan şiirine özgü kalmamakta; halk şiiri ve tasavvuf geleneğiyle de benzer yapılar göstermektedir (Gökalp, 2016, s. 238).

Elif-nâmeler, günümüze kadar çok sayıda örneği olmasına rağmen araştırmacılar tarafından nispeten az incelenmiş türlerden biridir. Bu eserler, içerik ve edebi zevk açısından hem halk şiiri hem tekke-tasavvuf geleneği hem de divan şiiri özelliklerini bir arada taşıma eğilimindedir (Gökalp, 2016; Ataseven, 2020). Divan edebiyatında elif-nâme türü genellikle beyitlerle oluşturulurken, halk şiirinde ise bu yapı dörtlük biçiminde uygulanmıştır. Şairler, bu tür aracılığıyla anlatım gücünü artırma ve edebi yetkinliklerini ortaya koyma amacı gütmüşlerdir (Tökel, 2003).

Elif-nâme türü, İslam kültürünün didaktik ve ahlaki yönlerini yansıtan şiirsel bir form olarak dikkat çeker. Bu eserlerde Arap alfabesinin harfleri hem öğretici hem de tasavvufi içeriklerin aktarımında sembolik bir araç olarak kullanılır (Gökalp, 2016, s. 238; Tökel, 2003, s. 147). Erzurumlu İsmail Hakkı'nın elif-nâmeleri ise yalnızca öğüt veren metinler olmanın ötesinde, Kur'an ayetlerine dayanan anlam derinliği ve manevî yorumlarla örülmüştür (Kaplan, 2022, s. 443). Bu türde genellikle harflerin temsil gücü öne çıkar; her harf, Allah'ın sıfatlarını, peygamberlerin niteliklerini ya da tasavvufi hâlleri çağrıştıran metaforlarla ilişkilendirilir. Böylece hem soyut bir anlatım kurulmakta hem de insanın Tanrı karşısındaki konumunu anlamaya yönelik bir sorgulama sunulmaktadır.

Elif-nâmeler üzerine yapılan sınıflandırma çalışmaları son yıllarda artmıştır. Bu bağlamda Doğan Kaya'nın önerdiği tasnif biçimi, özellikle şiirlerin biçimsel yapısını temel alan bir sistematik sunmaktadır. Kaya'ya göre elif-nâmeler; harflerin beyit başlarında, dörtlük başlarında, dize başlarında ya da beyit sonlarında yer almasına göre gruplandırılabilir. Bu gruplardan ilki, Arap alfabesinin harflerinin beyitlerin başında sıralandığı en yaygın biçimdir. İkinci grupta ise harfler halk şiiri geleneğine uygun olarak dörtlüklerin başında sıralanır. Diğer kategorilerde ise harflerin her bir dize başına getirildiği, beyitlerin sonunda yer aldığı ya da dizenin ortasında kullanıldığı örnekler yer alır (Kaya, 2009, s. 42-45). Bu çalışmada incelenen elif-nâmeler, harflerin beyit sonlarında kullanıldığı dördüncü gruba girmektedir. Erzurumlu İsmail Hakkı'nın *Kitâb-ı Gevheriyye*'sinde yer alan bu şiirlerde, her harf birkaç beyit boyunca

sürdürülmüş ve sonra sıradaki harfe geçilmiştir. Tüm elif-nâmelerin ayrıntılı olarak sunulması mümkün olmadığından yalnızca yapısal özelliklerine yer verilmiştir.

TÜRK EDEBİYATINDA KALEME ALINMIŞ ELİF-NÂME ÖRNEKLERİNİN DEĞERLENDİRİLMESİ AHMET GÖKÇİMEN- TÜRKMEN EDEBİYATINDA ELİF-NÂME

Makale, Türkmen edebiyatındaki elif-nâme geleneğini inceliyor ve çeşitli Türkmen şairlerinin oluşturduğu yedi elif-nâme örneğini bizlere sunuyor. Makalede ele alınan elif-nâmeler, Mahtumkulu, Kemine, Magrupı, Gayıbı, Tahır ve Berdinazar gibi şairlere ait. Bu elif-nâmeler hem dini hem de dünyevi temaları işliyor ve çeşitli nazım şekilleri ve aruz kalıpları kullanılarak yazılmış. Makale, Türkmen edebiyatında elif-nâme geleneğinin varlığını vurgulayarak, bu şiir türünün klasik ve halk şairleri tarafından benimsendiğini gösteriyor. Ayrıca 1920'lerden sonra, Arap alfabesinin değiştirilmesi ve sosyalist rejimin etkisiyle elif-nâme geleneğinin zayıfladığını belirtiyor. (Gökçimen, 2010)

AHMET ÖZGÜR GÜVENÇ-LATİN ALFABESİNE GÖRE ORTAYA KONAN ELİF-NÂMELER ÜZERİNE

Elif-nâme geleneği, Latin alfabesine geçişten sonra da Türkmen âşık tarzı şiirde varlığını sürdürmüştür. Ahmet Özgür Güvenç'in bu makalesi, Latin harfleriyle yazılmış üç âşık şiirini –Âşık Yaşar Reyhani, Silleli Âşık Mansur ve Arguvanlı Âşık Balı'ya ait örnekleri– inceleyerek geleneğin devam ettiğini göstermektedir. Ayrıca Malatyalı Âşık Birfâni'nin "Mektup" adlı şiiri de bu bağlamda değerlendirilmiştir. Makalede, Harf Devrimi sonrasında elif-nâme türündeki şiirlerin yeni alfabeye aktarımı ele alınmakta, âşık tarzı şiirin değişen şartlara nasıl uyum sağladığı vurgulanmaktadır. "Abecename" veya "Alfabename" gibi adlandırmalar önerilse de, "Elif-nâme" isminin tarihsel ve yaygın kullanımı nedeniyle bu konuda net bir değişikliğe gidilmemiştir. (Güvenç, 2013)

AHMET YENİKALE - AHMED KUDDÛSÎ'NİN ELİF-NÂMELERİ VE DİL İÇİ ÇEVİRİLERİ

Bu makalede, 19. yüzyılın önemli mutasavvıf şairlerinden Mar'aşîzâde Ahmed Kuddûsî'nin Divanı'nda yer alan dört elif-nâme incelenmiştir. Öncelikle elif-nâme türü hakkında genel bilgiler verilmiş; tanımı, özellikleri ve Türk edebiyatındaki yeri açıklanmıştır. Kuddûsî'nin elif-nâmeleri şekil ve muhteva yönünden değerlendirilmiş, şiirlerin dil içi çevirileri ile bazı kelime ve ifadelerin anlamları açıklanmıştır. Ayrıca, bir araştırmacının Kuddûsî'nin 16. gazelini yanlışlıkla "Kıbrıslı Kuddûsî"ye atfetmesi, bu çalışmada düzeltilmiştir. Makale, Kuddûsî'nin elif-nâmeleri üzerinden şairin tasavvufi yönü ve edebî kişiliğine dair önemli bilgiler sunmaktadır. (Yenikale, 2020)

AYTEN YILDIRIM XIX. ASRIN BİLİNMEYEN ŞAİRİ VASFÎ VE İKİ ELİF-NÂMESİ

Bu makale, 19. yüzyılın ilk yarısında yaşamış ve tezkirelerde hakkında bilgi bulunmayan Seyyid Hafız Ali Vasfî'nin *Güft-i Vasfî* adlı eserindeki iki elif-nâmeyi incelemektedir. Daha önce bilinmeyen bu elif-nâmeleri tanıtmak ve külliyata katkı sunmak amaçlanmıştır. Vasfî'nin elif-nâmeleri şekil ve muhteva açısından değerlendirilmiş, harflere uygun kelimelerin şiirin içeriğiyle de uyumlu olduğu vurgulanmıştır. Makale, bu eserlerin elif-nâme geleneğine önemli katkılar sağladığını belirtmekte; Vasfî'nin şiirlerinin, diğer elif-nâmelerle benzerlikler taşımasının yanında kendine özgü yönler barındırdığını ortaya koymaktadır. Bu durum, geleneğin zenginliğini ve çeşitliliğini göstermesi açısından dikkate değerdir. (Yıldırım, 2022)

AZİZ KILINÇ-MANA MEDENİYETİNİN BİR MEYVESİ: ELİF-NÂME

Bu makale, Elif-nâme adlı manzume türünü ele almakta; tanımını yaptıktan sonra bu türün Divan, Halk ve Tekke edebiyatlarında görüldüğünü belirtmektedir. Elif-nâmelerin şekilsel özelliklerinin Eski Ahit'teki ağıtlarla ve bazı eski Türk metinleriyle benzerlik gösterdiği ifade edilse de, özünde İslam medeniyetinin vahdet anlayışını yansıttığı vurgulanmıştır. Makalede elif-nâmelerin tasavvufla ilişkisi detaylandırılmış, "elif" harfinin Allah'ın birliğini temsil ettiği ve bu sembolizmin İslam sanatını da etkilediği belirtilmiştir. Şairler arasında Bursalı Fevzi en çok elif-nâme yazan isim olarak, Fakih ise farklı tarzıyla örnek gösterilmiştir. Ayrıca Fuzûlî'nin Divanı'ndan da bir elif-nâme örneğine yer verilmiştir. Sonuç olarak makale, elif-nâmelerin İslam medeniyeti ve tasavvuf anlayışının edebiyattaki yansımaları olduğunu ortaya koymaktadır. (Kılınç, 2022)

BÜŞRA ÇELİK VURAL-EHLÎ'NİN DÜVÂZ-NÂME TEMALI ELİF-NÂME'Sİ

Bu makale, mısra, beyit veya bentlerin baş harflerinin alfabetik sıralandığı şiir türü olan elif-nâmeyi konu almaktadır. Özellikle düvaz-nâme temalı elif-nâmeler ele alınmış ve Ehlî'ye ait bir örnek incelenmiştir. Elif-nâme ile harf mistisizmi arasındaki ilişki açıklanmış, bu türün tanımı, özellikleri ve edebiyattaki yeri üzerinde durulmuştur. İlk örnekler ve gelişim süreci özetlenmiş, Ehlî'nin hayatı ve edebî kişiliği hakkında bilgi verilmiştir. Şiirin Tayyib-zâde Ehlî'ye değil, adı bilinmeyen başka bir Ehlî'ye ait olabileceği ihtimali de dile getirilmiştir. Ehlî'nin elif-nâmesi, şekil ve içerik açısından değerlendirilerek, divan edebiyatında düvaz-nâme temalı elif-nâmeler için yeni bir örnek sunduğu vurgulanmıştır. Makale, bu geleneğin çeşitliliğine dikkat çekerek yeni çalışmalara katkı sağlamayı amaçlamaktadır. (Çelik Vural, 2023)

DİLEK BATİSLAM-KIBRISLI ÂŞIK KENZÎ'NİN ELİF-NÂMELERİ

Bu makale, Kıbrıslı Âşık Kenzî'nin Divanı'ndaki dört elif-nâmeyi biçim ve içerik açısından incelemektedir. Şiirler, "musarra gazel biçiminde semâî" nazım şekliyle ve *Mefâîlün/Mefâîlün/Mefâîlün/Mefâîlün* vezniyle yazılmış olup her biri 15 beyitten oluşmakta, 14. beyit ise tek dizedir. İlk elif-nâme harfleri alfabetik, ikincisi sondan başa sıralanmış, son iki şiirde ise harf sıralamasında sapmalar görülmektedir. Şiirler farklı temalar taşır: ilki Râsim Paşa'yı, ikincisi Gazi 'Ali Hıfzı Paşa'yı, üçüncüsü Celâleddîn'i överken on iki imamı anar, dördüncüsü ise tasavvufî özellik taşır. Kenzî'nin nazım biçimini ustalıkla kullandığı ancak içerik ve anlatımda aynı başarıyı gösteremediği belirtilmiştir. Makale, elif-nâmenin hem divan hem de halk şiirinde önemli ve yetenek isteyen bir tür olduğunu vurgulamakta ve bu alanda daha fazla araştırmaya ihtiyaç olduğunu ifade etmektedir. (Batislam, 2018)

ENES YILDIZ-MUHYÎ'NİN ELİF-NÂME TARZIYLA YAZDIĞI 'ARZ-I HÂLİ

Bu makale, divan şairi Muhyî'nin elif-nâme tarzında yazdığı bir arz-ı hâl şiirini incelemektedir. Şair, müftüye hitap ederek aşk acısına fetva istemekte; bu yönüyle şiir alışılmadık bir konu sunmaktadır. 29 beyitten oluşan şiir, recez bahrinde musammat kaside formunda yazılmıştır. Harfler elif'ten ye'ye doğru sıralanmış, ancak geleneksel elif-nâmelerden farklı olarak anlam yüklenmemiştir. Ayrıca, benzer bir örnek olarak Sehî Bey'in âşka dair fetva isteyen manzumesine de yer verilmiştir. Makale, Muhyî'nin bu şiirinin ilk kez incelendiğini ve arz-ı hâl geleneğine farklı bir boyut kattığını vurgulamaktadır. (Yıldız, 2019)

ERDEM SARIKAYA-XVIII. ASIR ŞAİRLERİNDEN VASFÎ'NİN ELİF-NÂMELERİ

Bu makale, 18. yüzyıl şairi Vasfî'nin iki elif-nâmesini inceleyerek bu şiirlerin biçimsel ve içeriksel özelliklerini analiz etmektedir. Makale, Vasfî'nin daha önce detaylı olarak incelenmemiş iki elif-nâmesini edebiyat dünyasına kazandırmaktadır. Elif-nâme türünün biçimsel ve içeriksel zenginliğini ortaya koyarak bu alanda yapılacak yeni çalışmalara ışık

tutmaktadır. Sonuç olarak, bu makale, Vasfî'nin elif-nâmeleri üzerinden elif-nâme türünün özelliklerini, beşerî ve ilahi aşk temalarını, divan şiiri estetiğini ve tasavvufi düşünceyi ele alarak Türk edebiyatına önemli bir katkı sağlamaktadır. (Sarıkaya, 2021)

FERİDÜN HAKAN ÖZKAN- KAYGUSUZ ABDAL'IN ELİF-NÂMESİ

Bu makale, Kaygusuz Abdal'a atfedilen ve bilinen elif-nâmelerden farklı olarak nesir biçiminde yazılmış bir elif-nâmeyi incelemektedir. Metin, Hurufî felsefesinden etkilenmiş olup Arap alfabesindeki 29 harfe tasavvufi yorumlar getirmektedir. Her harf belirli kavram, kişi veya olaylarla ilişkilendirilmiş, böylece elif-nâme türünün sınırları genişletilmiştir. Çalışma, Kaygusuz Abdal'ın Elif-nâme'si üzerinden tasavvufi düşünceyi ve Hurufî etkisini Türk edebiyatına önemli bir katkı olarak sunmaktadır. (Özkan, 2013)

GÜLŞEN CANDAN- SENÎ ALİ'NİN ELİF-NÂME'Sİ

Bu makale, Senî Ali'nin daha önce bilinmeyen bir Elifnâme'sini inceleyerek, bu şiirin biçimsel ve içeriksel özelliklerini ele almaktadır. Diğer çalışmalarda olduğu gibi bu makalede de önce elif-nâme tanımı yapılmış ardından elif-nâme türünün divan, halk ve tekke edebiyatında farklı konularda yazılmış pek çok örneğe sahip olduğunu belirtmiştir. Daha sonra Senî Ali'nin Elifnâme'sinin biçimsel ve içerik açısından özelliklerine değinilmiştir. Sonuç olarak, bu makale Senî Ali'nin Elifnâme'si üzerinden Elifnâme türünün özelliklerini, tasavvufi düşünceyi ve divan şiirinin estetiğini ele alarak Türk edebiyatına önemli bir katkı sağlamaktadır. (Candan, 2012)

HALİL BATUR- İSTANBUL BÜYÜKŞEHİR BELEDİYESİ ATATÜRK KİTAPLIĞI O. E. 283 NUMARALI MECMUADA BULUNAN BİR ELİFNÂME

Bu makalede, elif-nâmenin yazıldığı İstanbul Büyükşehir Belediyesi Atatürk Kitaplığı'nda bulunan mecmuanın içeriği tanıtılmış, eserin ilmî transkripsiyonu yapılmış ve elif-nâmeler üzerine yapılacak araştırmalara yeni bir katkı sağlanmıştır. Şeyhî'nin elif-nâmesi, hem tasavvufî içerikleri hem de harfleri şiirle estetik bir biçimde birleştirme ustalığı açısından dikkat çekicidir. Bu çalışma, elif-nâme türünün incelenmesine ve bu alandaki edebî mirasın anlaşılmasına önemli bir katkı sunmaktadır. (Batur, 2021)

HASAN KAPLAN-KLASİK TÜRK EDEBİYATINDA ELİF-NÂME GELENEĞİ VE İSMAİL HİKMETÎ'NİN ELİF-NÂMELERİ

Bu makalede Klasik Türk edebiyatındaki elif-nâme geleneği incelenmiş ve bu bağlamda İsmail Hikmetî'nin elif-nâmeleri değerlendirilmiştir. Makalede, İsmail Hikmetî'nin Klasik Türk edebiyatında en fazla elif-nâme yazan ikinci şair olduğu belirtilmiştir. Makalede elif-nâmelerin tanımı ve tarihçesi, elif-nâme türleri ve özellikleri, İsmail Hikmetî'nin hayatı ve eserleri, İsmail Hikmetî'nin şiirlerinde harfler ve elif-nâmelerle olan ilişkisi, Hikmetî'nin elif-nâmelerinin yapısal özellikleri (başlık kullanımı, nazım şekli, birim sayısı, vezin tercihi, konu ve tertip şekli) gibi konulara değinilmiştir. Makalede vurgulanan temel düşünce ise Hikmetî'nin harfler üzerine düşünen, onların din ve kültürdeki yerinden faydalanarak şiirlerinde onlara yer veren önemli bir şair olduğudur. (Kaplan, 2022)

HASAN TAŞ- DELİ BİRĀDER ĠAZĀLÌ [Ö. 1535?]'NİN ELİF-NĀME'Sİ

Bu makale, 16. yüzyıl şairi Deli Birader Gazali'nin elif-nâme'sini incelemektedir. Öncelikle alfabenin tarihçesi ve Türk edebiyatındaki elif-nâme geleneği ele alınmış, Bursalı Feyzi ve Fakih gibi önemli şairlerden bahsedilmiştir. Gazali'nin hayatı, eserleri ve *Miftāhu'l-Hidāye* adlı eseri hakkında bilgi verilmiş; elif-nâmesinin muhammes nazım biçimiyle yazıldığı ve düzen bakımından farklılık gösterdiği vurgulanmıştır. Ayrıca Gazali'nin elif-nâme'sinin Arap harfli metni ve nesir çevirisi makalede sunulmuştur. Çalışmanın amacı, Gazali'nin elif-nâme'sini tanıtarak Türk edebiyatındaki geleneğe katkı sağlamaktır.

HÜSEYİN ÖZCAN- HATAÎ'NİN ELİF-NÂME ŞEKLİNDE YAZDIĞI DÜVAZDEH

Bu makalenin temel amacı, Şah Hatâî'nin Elifnâme şeklinde yazdığı Düvazdeh şiirini incelemektir. Makalede, Elifnâmelerin tanımı, tarihçesi ve türleri hakkında genel bilgiler verildikten sonra, Hatâî'nin şiiri üzerinden Hz. Ali ve Zülfikar'a dikkat çekilmektedir. Şah Hatâî'nin Elifnâme şeklinde yazdığı ve on iki imamı konu alan düvazdehi, bu türün ilginç bir örneği olarak Türk edebiyatına katkı sağlamıştır. Bu makalede elif-nâmelerin tür mü şekil mi olduğu konusunda farklı görüşler olduğu belirtilip elif-nâmenin türden çok şekil olduğu görüşünde karar kılınmıştır. Sonuç olarak makale, Şah Hatâî'nin Elifnâme şeklinde yazdığı Düvazdeh şiirini inceleyerek, Elifnâme geleneği ve Hz. Ali kültü hakkında önemli bilgiler sunmaktadır. (Özcan, 2015)

İSMET ÇETİN – ELİF-NÂMELER VE SEFİL ALİ'NİN BİR ELİF-NÂMESİ

Bu makale, Türk edebiyatında "elif-nâme" olarak adlandırılan şiirlerin tür mü yoksa sadece biçim mi olduğu tartışmasını ele alır. Tarihçe, özellikler ve farklı alfabelerle yazılan örnekler (Fuzulî, Şah Hatâî, Esrar Dede vb.) incelenerek harflerin şiirdeki sembolik ve yapısal anlamları değerlendirilir. Makalenin temel görüşü, elif-nâmelerin edebî tür değil, şekle dayalı bir sanat anlayışı olduğu yönündedir. Ayrıca Arap harfleri dışındaki alfabelerle yazılan benzer şiirler için "abecenâme" gibi yeni terimlerin önerilmesi gündeme getirilir. Sonuçta, çalışma elif-nâme kavramını biçim, tür ve sanat anlayışı açısından yeniden yorumlamaktadır. (Çetin, 1992)

LOKMAN TAŞKESENLİOĞLU – DİVAN EDEBİYATINDA ELİFNÂMELER VE BİLİNMEYEN İKİ ELİFNÂME ÖRNEĞİ: MEMİ CAN SARUHÂNÎ VE ÖMER KARÎBÎ ELİFNAMELERİ

Bu makale, Divan edebiyatındaki elif-nâme geleneğini genel hatlarıyla tanıtarak, daha önce bilinmeyen Memi Can Saruhânî ve Ömer Karîbî'ye ait iki elif-nâme örneğini gün yüzüne çıkarır. Elifnâmelerin tanımı, tarihçesi ve klasik şairlerin örnekleri sunulduktan sonra, bu iki şairin hayatı ve eserleri incelenir. Çalışma, elif-nâmelerin klasik şiirdeki yerini vurgularken, yeni metinlerle alana katkıda bulunur. (Taşkesenlioğlu, 2017)

MEHMET ŞAMİL BAŞ – BİR NA'T VE ELİFNÂME ÖRNEĞİ OLARAK AŞKÎ'NİN DER NA'T-I MESNEVÎ VE SÂHİB-İ MESNEVÎ'Sİ

Bu makale, 19. yüzyıl Mevlevî şairi Aşkî Mustafa Efendi'nin *Der Na't-ı Mesnevî ve Sâhib-i Mesnevî* adlı eserini şekil, tür ve içerik açısından incelemektedir. Eserin transkripsiyonu sunulmuş, elif-nâme geleneği bağlamında Aşkî'nin harf ve nokta sembolizmi üzerinden evvel–âhir kavramlarına yaptığı vurgu değerlendirilmiştir. Çalışma, eserin na't ve elif-nâme geleneğindeki yerini belirlemeye yönelik katkı sağlamaktadır. (Baş, 2024)

MEHMET SADIK ÖZKAN – ADIYAMANLI RIFAT BABA, DÎVÂNI VE ELİFNÂMESİ ÜZERİNE BİR İNCELEME

Bu makale, Adıyamanlı Rıfat Baba'nın hayatı, edebî kişiliği, Dîvânı ve elif-nâmesini mevcut kaynaklar ve sözlü bilgiler ışığında ele almaktadır. Şairin Dîvânı'ndaki elif-nâme detaylı biçimde incelenmiş ve klasik edebiyat geleneği içindeki yeri değerlendirilmiştir. Tek nüsha hâlindeki Dîvân, gelecekteki araştırmalar için önemli bir kaynak olarak sunulmaktadır. (Özkan, 2023)

MERİÇ HARMANCI – ALFABE ÖĞRETİMİNDE DEĞERLER EĞİTİMİ: KAYGUSUZ ABDAL'IN ELİFNÂME ÖRNEĞİ

Makale, Kaygusuz Abdal'ın *Elifnâme* adlı eserini değerler eğitimi bağlamında incelemekte ve harf sembolizmi yoluyla dini, ahlaki ve tasavvufi erdemlerin aktarımını vurgulamaktadır. Doğruluk, merhamet, bilgelik, sabır gibi değerlerin işlendiği eser, hem edebî hem eğitsel açıdan ele alınarak günümüz eğitimine katkı potansiyeliyle değerlendirilmiştir. (Harmancı, 2018)

METİN HAKVERDİOĞLU- GÜMÜŞHACIKÖY CÖNGÜ VE ŞAİRİ BİLİNMEYEN BİR ELİF-NÂME

Bu makale, Amasya Yazma Eser Kütüphanesi'nde bulunan "Gümüşhacıköy Cöngü" adlı eseri tanıtmakta ve içinde yer alan şairi bilinmeyen bir elif-nâme örneğini incelemektedir. Öncelikle Gümüşhacıköy kasabasının tarihçesi ve kültürel önemi ele alınarak, cönkün hangi medreseden geldiği ve içeriği hakkında bilgi verilmektedir. Elif-nâmelerin tanımı ve özellikleri açıklanırken, cönkteki elif-nâme metni ve edebi değeri üzerinde durulmaktadır. Makale, Gümüşhacıköy Cöngü'nün Türk edebiyatı için önemli bir kaynak olduğunu ve özellikle şairi bilinmeyen elif-nâme ile alandaki çalışmalara katkı sağladığını vurgulamaktadır. Ayrıca, cönkün ortaya çıkmasıyla Gümüşhacıköy'ün geçmişte önemli bir kültür ve sanat merkezi olduğuna dair yeni kanıtlar sunulmaktadır.

MUHAMMET SÜMER - ÂŞIK TARZI ŞİİR GELENEĞİNDEKİ ELİF-NÂMELERDE TASAVVUFÎ MOTİFLER

''Âşık Tarzı Şiir Geleneğindeki Elifnâmelerde Tasavvufî Motifler'' adlı yüksek lisans tezi, Türk edebiyatında elif-nâme türünü ve özellikle Âşık Tarzı Şiir Geleneği'ndeki dini-tasavvufi içeriklerini incelemektedir. Tezde, âşıkların gelenek içindeki konumları, hayatları ve tarikatlarla ilişkileri ele alınmış; ardından elif-nâmelerde yer alan tasavvufi motifler tespit edilip değerlendirilmiştir. Ayrıca, elif-nâmelerin tarihçesi, şekil ve içerik özellikleri ile Türk Tasavvuf Edebiyatı ve Âşık Tarzı Şiir Geleneği hakkında genel bilgiler verilmiştir. Çalışmada, Nakşibendî, Halvetî ve Bektaşî tarikatlarına bağlı âşıkların yanı sıra tarikat çevresi belirlenemeyen âşıkların elif-nâmeleri de analiz edilmiştir. (Sümer, 2022)

MUSTAFA DEMİREL- AŞIK PAŞANIN ELİF-NÂMESİ VE DİL ÖZELLİKLERİ

Bu makalenin temel amacı, Âşık Paşa'nın *Garîb-nâme* adlı eserinde yer alan Elif-nâme'nin dil özelliklerini incelemektir. Makalede, öncelikle Âşık Paşa'nın hayatı ve Garîb-nâme hakkında bilgi verilmektedir. Ardından, Elif-nâme'nin yer aldığı Garîb-nâme nüshaları tanıtılıp Elif-nâme'nin tenkitli metninin nasıl oluşturulduğu anlatılmaktadır. Son olarak, Elif-nâme'nin imlâ ve şekil bilgisi özellikleri detaylı bir şekilde ele alınmaktadır. Makale, Âşık Paşa'nın Elif-nâmesi'nin dil özelliklerini detaylı bir şekilde inceleyerek Eski Anadolu Türkçesi döneminin dil özelliklerine ışık tutmaktadır. Ayrıca, Elif-nâme'nin yer aldığı Garîb-nâme nüshalarının tanıtılması ve tenkitli metnin oluşturulmasıyla ilgili bilgiler, bu alandaki çalışmalara önemli bir katkı sağlamaktadır. (Demirel, 1996)

MUVAFFAK EFLATUN - HOCA SAADEDDİN EFENDİ'NİN ELİF-NÂMESİ

Bu makalenin ana konusu, Osmanlı dönemi âlimlerinden Hoca Saadeddin Efendi tarafından yazılmış bir elif-nâmenin incelenmesidir. Makalede, öncelikle elif-nâmenin tanımı ve özellikleri aktarılıp Hoca Saadeddin Efendi'nin hayatı ve eserleri hakkında genel bilgiler verilmekte, ardından Ankara Milli Kütüphanesi'nde bulunan elif-nâmenin transkripsiyonu ve detaylı bir incelemesi sunulmaktadır. Makale, Hoca Saadeddin Efendi'nin elif-nâmesini inceleyerek hem şairin şiir anlayışına hem de dönemin edebiyatına ışık tutmaktadır. Ayrıca, elif-nâme türünün özellikleri ve tarihçesi hakkında da önemli bilgiler sunmaktadır. (Eflatun, 2017)

NİHAT ÖZTOPRAK- BURSALI FEYZİ EFENDİNİN ELİF-NÂMELERİ

Bu makalenin temel amacı, 18. yüzyıl şairi Bursalı Feyzi Efendi'nin elif-nâmelerini tanıtıp, bu eserler hakkında genel bilgi vermektir. Makalede ilk olarak elif-nâme türü hakkında bilgi verilmiş, ardından Bursalı Feyzi Efendi'nin hayatı, sanatı ve eserleri hakkında bilgi verilmiştir. Daha sonra, Feyzi Efendi'nin elif-nâmeleri şekil, muhteva ve sanat bakımından incelenmiştir. Sonuç olarak, makale Bursalı Feyzi Efendi'nin elif-nâmelerini inceleyerek Türk edebiyatındaki

bu az bilinen türe ışık tutmaktadır. Feyzi Efendi'nin elif-nâmeleri, hem şekil hem de muhteva bakımından özgün özellikler taşımaktadır. Makale, bu özellikleri detaylı bir şekilde ele alarak, elif-nâme türünün daha iyi anlaşılmasına katkı sağlamaktadır. (Öztoprak, 2012)

NİLAY KINAY- BİR EDEBÎ TARZ ÖRNEĞİ OLARAK SÂDIK KEMÂLÎ'NİN ELİFNÂMELERİ

Bu makalenin temel amacı, Sâdık Kemâlî'nin elif-nâme örneklerini inceleyerek, bu metinlerin edebi tarz olarak kabul edilip edilemeyeceğini tartışmaktır. Makalede ilk olarak edebi tarz kavramı ve elif-nâme türü hakkında genel bilgiler verilmektedir. Ardından Sâdık Kemâlî'nin hayatı ve edebi kişiliği kısaca tanıtılmakta, sonrasında ise şairin divanında yer alan iki elif-nâme örneği incelenmektedir. Makalede Sâdık Kemâlî'nin elif-nâme örneklerinin, yazılış şekillerine göre edebi tarz olarak kabul edilebileceği sonucuna varılmıştır. Ayrıca elif-nâme türünün Türk edebiyatındaki yeri ve önemi vurgulanmış, genellikle dini-tasavvufi konuların işlendiği bu türün farklı temalarda da yazılabileceği belirtilmiştir. (Kınay, 2013)

NURAN ÖZTÜRK- ELİF-NÂME VE NİDAİ'NİN ELİF-NÂMESİ

Bu makalenin ana konusu, Elif-nâme şiirlerinin tanımı, tarihçesi, özellikleri ve örnekleridir. Makalede, Elif-nâmelerin Türk edebiyatında nasıl ve ne zaman ortaya çıktığı, hangi amaçlarla yazıldığı ve hangi şairler tarafından kaleme alındığı gibi sorulara cevap aranmaktadır. Makalede, 16. yüzyıl şairlerinden Ankaralı Hekim Nidai'nin (1508-1568) "*Genc-i Esrar-ı Ma'ni*" adlı mesnevi kitabında yer alan *"Der Beyan-ı Huruf-ı Tehecci"* başlıklı Elif-nâme örneği incelenmektedir. Makalede ayrıca, Esrar Dede, Ahmed Kuddusi, Şeyh Ahmed Rindi, Derviş Osman, Dertli, Kul Himmet, Ruhsati, Aşık Ömer gibi birçok şairin Elif-nâme örneklerinden bahsedilmektedir. Makale, elif-nâmelerin Türk edebiyatındaki yeri ve önemini vurgulamakta ve bu şiir türünün özelliklerini, tarihçesini ve örneklerini detaylı bir şekilde ele almaktadır. (Öztürk, 2012)

NURGÜL ÖZCAN- RUMELİLİ MURTAZÂ SÜKÛTİ DİVANI'NDAKİ ELİF-NÂMELER

Bu makalenin ana konusu, *Rumelili Murtazâ Sükûtî Divanı'nda* yer alan iki elif-nâmenin şekil ve içerik bakımından incelenmesidir. Makalede öncelikle elif-nâme ve düvâz-nâme türleri hakkında genel bilgiler verilmekte, ardından Murtazâ Sükûtî'nin hayatı ve divanı tanıtılmakta ve son olarak divanında bulunan iki elif-nâme örneği detaylı bir şekilde analiz edilmektedir. Makale, Sükûtî'nin elif-nâmelerini inceleyerek hem şairin hem de dönemin dini-tasavvufi anlayışına ışık tutmaktadır. Ayrıca, elif-nâme ve düvâz-nâme türlerinin özellikleri ve tarihçesi hakkında da önemli bilgiler sunulmaktadır. Sükûtî Divanı'nda 36 adet düvâz-nâme bulunması, Rumeli'deki Sa'diyye tarikatında On İki İmam'a verilen değeri ve bu tarikatın Bektaşilikle ilgisini göstermesi açısından önemlidir. (Özcan, 2019)

ÖZLEM CELEP- HALK ŞİİRİNDE ELİFNÂME SÖYLEME GELENEĞİ VE ELİFNÂMELERDE EĞİTİM UNSURLARI

Bu metin, Halk Şiiri'nde Elif-nâme Söyleme Geleneği ve Elif-nâmelerde Eğitim Unsurları başlıklı bir akademik çalışmanın çeşitli bölümlerinden alıntılardır. Metin, elif-nâme türü hakkında kapsamlı bilgi sunmakta ve bu türün Türk edebiyatındaki yerini ve önemini vurgulamaktadır. Sonuç olarak, bu metin, elif-nâme türünün kapsamlı bir analizini sunmakta ve bu türün hem edebi hem de eğitici yönünü vurgulamaktadır. Elif-nâmeler, Türk kültür ve edebiyatının önemli bir parçası olarak kabul edilmekte ve bu metin, okuyucuların bu türü daha iyi anlamalarına yardımcı olmaktadır. (Celep, 2013)

RAMAZAN ÇELİK- TÜRK EDEBİYATINDA ELİF-NÂMELER VE SEYYİD NEVRUZ'UN ELİF-NÂMESİ

Bu metin, Ramazan Çelik tarafından yazılmış Türk Edebiyatında *Elif-nâmeler ve Seyyid Nevruz'un Elif-nâmesi* adlı akademik bir makaleden alınmıştır. Makalede, elif-nâme türü detaylı bir şekilde incelenmekte, Türk edebiyatındaki örnekleri ve özellikleri ele alınmaktadır. Ayrıca, 19. yüzyıl şairi Seyyid Nevruz'un elif-nâmesi özel olarak analiz edilmekte ve türün genel çerçevesine yerleştirilmektedir. Makalenin sonunda, elif-nâme türünün Türk edebiyatındaki önemi ve zenginliği vurgulanmaktadır. Seyyid Nevruz'un elif-nâmesinin analizi, türün farklı yönlerini anlamak ve değerlendirmek için önemli bir katkı sağlamaktadır. (Çelik, 2022)

RIDVAN ÇETİN-SEYYİD SÜLEYMAN MAHVÎ DİVANI'NDAKİ İKİ ELİF-NAME

Bu makale, Türk edebiyatında elif-nâme türünü ve Seyyid Süleyman *Mahvî Divanı'nda* bulunan iki elif-nâme örneğini incelemektedir. Makalede öncelikle elif-nâme türünün tanımı, tarihçesi ve şekil özellikleri hakkında genel bilgiler verilmekte, ardından Seyyid Süleyman Mahvî'nin hayatı ve sanatı hakkında kısa bir özet sunulmakta ve son olarak da Mahvî'nin Divanı'ndaki iki elif-nâme örneği şekil ve muhteva bakımından detaylı bir şekilde analiz edilmektedir. (Çetin, 2020)

RUKEN KARADUMAN- MELİHÎ VE ELİF-NÂMESİ

Bu metin, Melihî adlı 15. yüzyıl şairinin bir elif-nâmesini incelemektedir. Melihî'nin bilinen bir divanı bulunmamaktadır. Ancak nazire mecmualarında ve çeşitli tezkirelerde bulunan 18 şiiri, döneminin önemli şairlerinden biri olduğunu göstermektedir. Makalede, Melihî'nin elif-nâme biçiminde yazılmış gazeli, modern Türkçeye çevrilerek şekil ve içerik özellikleri açısından incelenmiştir. (Karaduman, 2019)

SADETTİN EĞRİ- ALİ RÛMÎ'NİN ELİF-NÂMELERİNDE ŞAHIS VE ESER İSİMLERİ

Bu makalede, Seyyid Ali Rûmî'nin *Dürrü'l-Fu'âd ve Şeyhu'l-İrşâd* adlı eserinde yer alan elif-nâmeler ve kendi eserlerinin isimlerini sıraladığı beyitler incelenmiştir. Makalede, öncelikle Türk edebiyatında elif-nâme türüne dair genel bilgiler verilmiş ve elif-nâmelerin şekil ve içerik özellikleri açıklanmıştır. Ardından, Seyyid Ali Rûmî'nin hayatı ve eserleri hakkında bilgi verilmiştir. Makalede, Seyyid Ali Rûmî'nin elif-nâmeleri ve kendi eserlerini tanıttığı beyitler aracılığıyla şairin dini ve tasavvufi görüşleri, edebi kişiliği ve yaşadığı dönemin sosyal ve kültürel yapısı hakkında önemli bilgiler sunulmaktadır. (Eğri, 2023)

SADİ GEDİK- BABA RAHÎM MEŞREB'İN ELİF-NÂMELERİ

Bu makale Baba Rahim Meşreb'in Elif-nâmelerini incelemektedir. Makalede, öncelikle Türk edebiyatındaki elif-nâme geleneği hakkında genel bilgiler verilmektedir. Daha sonra Baba Rahim Meşreb'in hayatı ve eserleri hakkında bilgi verilmektedir. Meşreb'in dört elif-nâmesi tespit edilmiştir ve bunlardan üçü Menâkıbnâme'de, biri de Mebde-yi Nûr mesnevisinde yer almaktadır. Makalenin ana konusu olan Meşreb'in dört elif-nâmesi, şekil ve içerik özellikleri açısından incelenmiştir. Makalede, Meşreb'in elif-nâmeleri aracılığıyla Çağatay edebiyatındaki elif-nâme geleneği ve şairin dini-tasavvufi anlayışı hakkında önemli bilgiler sunulmaktadır. (Gedik, 2018)

SEDANUR ÖDEMİŞ - KLÂSİK EDEBİYATIMIZDA ELİF-NÂMELER VE HARF SİMGECİLİĞİ BAĞLAMINDA MUHİBBÎ'NİN DÎVÂNI İLE ELİFNÂMESİ

Bu makale, Muhibbî'nin Divanı'nda yer alan harf simgeciliği ve elif-nâmesi üzerine bir inceleme sunmaktadır. Makalede öncelikle harflere yüklenen anlamlar ve elif-nâme türü

hakkında genel bilgiler verilmekte, ardından klasik Türk şiirinde harf simgeciliği ele alınmakta ve son olarak da Muhibbî'nin hayatı, edebî kişiliği ve Divanı'ndaki harf simgeciliği örnekleri detaylı bir şekilde incelenmektedir. Makalede, Muhibbî'nin Divanı'ndaki harf simgeciliği örnekleri detaylı bir şekilde incelenmektedir. Makale, Muhibbî'nin Divanı'ndaki harf simgeciliği örneklerini inceleyerek, şairin edebî kişiliğini ve dönemin edebî anlayışını anlamak açısından önemli bilgiler sunmaktadır. (Ödemiş, 2023)

ÜZEYİR ASLAN- XVIII. YÜZYIL MUTASAVVIF ŞAİRLERİNDEN FAHRÎ AHMED VE ELİF-NAME ŞERHİ

Bu makalede, 18. yüzyıl mutasavvıf şairlerinden Fahrî Ahmed'in Elif-name Şerhi adlı eseri incelenmektedir. Eser, Fahrî'nin, hakkında bilgi bulunmayan Nesib adlı bir dervişin yazdığı elif-nâmeyi şerh etmesinden oluşmaktadır. Makalede öncelikle elif-name türü hakkında genel bilgiler verilmekte, elif-namelerin tanımı, tarihçesi ve tertip özellikleri açıklanmaktadır. Makalede, Fahrî Ahmed'in Elif-name Şerhi'ni inceleyerek 18. yüzyıl Türk edebiyatındaki elif-name geleneği ve Fahrî Ahmed'in tasavvuf anlayışı hakkında önemli bilgiler sunulmaktadır. (Aslan, 2008)

İSMAİL HAKKI VE KİTAB-I GEVHERİYYE'SİNDE ELİF-NÂMELER

2. a. İsmail Hakkı

İsmail Hakkı ile ilgili kaynaklarda herhangi bir bilgi bulunmamaktadır. Bu yüzden kendisi ve eserleri hakkındaki bilgiler, Erzurumlu İsmail Hakkı ve Kitâb-ı Gevheriyye'si adlı eserden hareketle verilecektir. İsmail Hakkı Kitâb-ı Gevheriyye'de belirttiğine göre Erzurumludur. Sultan Abdülaziz döneminde yaşadığı bilinmektedir. Eserlerindeki bilgilerden hareketle çok fazla ilim tahsili görmediğini, daha çok dinî ilimlere ve tarihe merakı olduğunu, okumalarını daha çok Kur'ân-ı Kerîm, hadis, tefsir ve tarih üzerine gerçekleştirdiğini, Molla Fenârî'den mantık okuduğunu belirtebiliriz. (Ataseven, 2020, s.19-23)

2. b. Şekil Özellikleri

Elif-nâmelerde her harf altışar beyit halinde kullanılır; harfler mısra başında değil, kafiyenin son harfinde yer alır. İlk beyit kendi arasında kafiyelidir, ikinci mısralar ise aynı harfle biter. İsmail Hakkı'nın *Kitab-ı Gevheriyye*'de dört elif-nâme bulunur ve burada harfler dini ve ahlaki anlamlarla ilişkilendirilmiştir. Her harf bir konuyu işlerken, bazen birkaç beyitte devam eden anlam bütünlüğü vardır. Bu yönüyle İsmail Hakkı'nın elif-nâmeleri, diğer elif-nâmelerden farklıdır; harf sıralaması geleneksel gibi tek beyitte bitmez, bazı harfler birden fazla beyitte sürer ve harfler belirli olay veya öğretilere bağlanır.

2. c. Muhteva Özellikleri

Elif-nâmeler, divan, âşık ve tekke şiirlerinde görülen, genellikle dinî-tasavvufî konuları işleyen şiirlerdir. Mesnevi tarzındaki elif-nâmelerde tevhid, naat, methiye ve münâcât gibi temalar; Allah'ın varlığı, yakarışlar ve peygamber ile büyüklerin övgüsü sıkça işlenir (Kaçar, 1997). İsmail Hakkı'nın *Kitab-ı Gevheriyye*'deki elif-nâmeler ise daha çok ahlaki ve fıkhi öğretilerle insanın varoluş sırlarına odaklanır. Eser XIX. yüzyılda yazılmış olup eski Anadolu Türkçesi özellikleri taşır. İncelenen elif-nâme, *Faşlün fī-Beyān-ı Ehli's-Ṣabr 'alā Ḥarfi't-Teheccī* başlığıyla, aruzun hezec bahrinde *Mefā'īlün Mefā'īlün Mefā'īlün Mefā'īlün* kalıbıyla yazılmıştır. Bazı vezin bozuklukları ve aruz kusurları olsa da, eserde biçimden çok muhteva ön plandadır. Her ne kadar şekil açısından estetik kaygı bulunsa da, içerik didaktik ve tasavvufîdir.

İsmail Hakkı'nın *Kitab-ı Gevheriye* adlı eserinde dört elif-nâme bulunmaktadır (Ataseven, 2020). Şairin iyi eğitim almaması ve parlak bir şair olmaması nedeniyle geleneğe tam hakim

olmadığı görülür. İlk elif-nâme, *Faṣlün fī-Beyān-ı Tefsīri'l-ʻĀlem* başlıklı 176 beyitlik kasidedir; 29 harf alfabetik sırayla, genellikle altışar beyit olarak kullanılmış, bazı harflere yedişer beyit ayrılmıştır. İçeriği dini-tasavvufi olup, Allah'ın büyüklüğü, yaratılış ve kulluk görevini işler. İkinci elif-nâme, *Faṣlün fī-Beyān-ı Ẕemmü'd-Dünyā Baḥrü'l Hezec* başlığıyla 145 beyitlik tam bir elifnâme formundadır; harfler alfabetik ve beşer beyit olarak dizilmiştir. Konusu Hz. Peygamber'in dünyaya bakışı ve dünya hırslarından uzak durma öğütleridir. Üçüncü elif-nâme, harflerin sayısı beyitlere göre değişmekte, bazı harfler atlanarak sıralanmaktadır. İçeriği yine dini-tasavvufi temalar çerçevesindedir; insanın nimetlere şükretmesi, günahlardan kaçınması ve ibadetle Allah'a yaklaşması vurgulanır. Dördüncü elif-nâme de benzer şekilde bazı harfler atlanarak ve harfler değişik sayıda beyitte kullanılmıştır. Üçüncü elif-nâme, *Faṣlün fī-Beyān-ı Ehli's-Ṣabr ʻalā Ḥarfi't-Teheccī* başlığıyla 174 beyitlik tam bir elifnâme olup her harf altışar beyitte işlenmiştir. Konusu sabır, tevekkül, ahiret mükafatı ve Allah'ın rahmetidir; insanları sabırlı ve şükürlü olmaya teşvik eder. Genel olarak İsmail Hakkı'nın elif-nâmeleri şekilden çok muhtevaya önem verir ve ağırlıklı olarak dini-tasavvufi temalar işler.

Şiirde hangi harfte hangi kelimelerin kullanıldığına dair aşağıda bir tablo oluşturulmuştur. Harfler eliften başlayarak ye harfine kadar alfabetik olarak sıralanmıştır. Çoğunlukla her harf 7 beyit gitmiştir. Kelimelerde harfler, elif-nâme geleneği çerçevesinde oluşturularak sıralanmış olup anlamdan çok ses ve ahenk bazen de sembolik anlamlar taşıyan bir dizlim haline gelmiştir. Bu tarz yazımlar genellikle edebi maharet göstermek, tasavvufi anlamlar yüklemek ya da öğretici/ezberletici bir amaç taşımak için tercih edilirdi. Şairimiz de bu maksatla kelimeleri ses tekrarlarıyla birlikte kullanmıştır. Her harfin altında o harfle başlayan kelimeler sıralanır. Bazıları anlamlıdır, bazıları vezin ve ahenk için kullanılır. Kelimeler sıklıkla dini, ahlaki, tasavvufi ve mecazi anlamlar taşır. Bazı kelimeler uydurma ya da mecazî görünmektedir. Aynı kelimelerin tekrarı, ahenk ve ritim için yapılmıştır (örneğin: *iblāġ, iblāġ, iblāġ…*). Özellikle "Allāh, Allāh, Allāh" gibi tekrarlar tasavvufi vecdi ve zikri çağrıştırır. "Feyyāż", "Settār", "Ḥabību'llāh" gibi isimler Allah'ın sıfatları ya da peygamberin lakaplarıdır.

Harfü'l elif	ʻuzma	ilka	merma	nuʻma	iʻta	bilâ-ifha	Şekva		
Ḥarfü'l-bā	Vehhāb	ıṭnāb	iẕhāb	iclāb	aṣḥāb	iʻcāb	Erbāb		
Ḥarfü't-tā	taʻyīnāt	taʻlīmāt	tenʻīmāt	Cennāt	taʻzīzāt	taḫṣīlāt	bi'ẕ-ẕāt		
Ḥarfü'ð-ðā	iḥdāð	iḥdāð	iḥdāð	iḥdāð	iḥdāð	iḥdāð	iḥdāð		
Ḥarfü'l-cīm	iḫrāc	tāc,	muḥtāc	nettāc	behhāc	aç	İsfîdāc		
Ḥarfü'l-ḥā	şerrāḥ	Fettāḥ	ışlāḥ	iflāḥ	ecnāḥ	iḳbāḥ	naṣṣāḥ		
Ḥarfü'l-ḫā	imsāḫ	ıraḫ	ecsām	nussāḫ	Ḥabību'llāh	evsāḫ	ifsāḫ	islāḫ	ḳulaḫ
Ḥarfü'd-dāl	bünyād	aḥfād	ʻubbād	üstād	efrād	irşād			
Ḥarfü'z-zāl	şāẕ	ilzāẕ	şāẕ	şāẕ	şāẕ	şāẕ	şāẕ	istilzāẕ	
Ḥarfü'r-rā	ebrār	aḫyār	iḳrār	inkâr	iḥḳār	Settār	ışrār		

Ḥarfü'z-zā	pervaz	ġammāz	ser-firāz	vāz	az az	şah-bāz	bāz		
Ḥarfü's-sīn	nās	iḥbās	ḥassās	nās	iḳbās	iclās	bilā-ilbās		
Ḥarfü'ş-şın	dehhaş	ġaşşāş	nettāş	ḳardaş	ifḥāş	ifḥāş	naşşāş		
Ḥarfü'ṣ-ṣad	iḫlāṣ	ḫāṣ	ḫallāṣ	raḳḳāṣ	ġavvāṣ	ḥarrāṣ			
Ḥarfü'ż-żād	ı'rāż	ı'vāż	Feyyāż	iġmāż	iḳbāż	Feyyāż			
Ḥarfü'ṭ-ṭā	enmāṭ	eşrāṭ	bī-ıġlāṭ	ifrāṭ	fusṭāṭ	muḥtāṭ	istinbāṭ		
Ḥarfü'ẓ-ẓā	elfāẓ	ıġlāẓ	Ḥuffāẓ	eşvāẓ	va'āż	īḳāẓ			
Ḥarfü'l-'ayn	ifzā'	eşyā'	şeffā'	infā'	ibḳā'	ismā'	żayyā'		
Ḥarfü'l-ġayn	iblāġ	iblāġ	iblāġ	iblāġ	iblāġ	iblāġ			
Ḥarfü'l-fā	'arrāf	elṭāf	ilḥāf	eslaf	aşnāf	vaşşāf	eşḳāf		
Ḥarfü'l-ḳāf	ilḥāḳ	i'tāḳ	iḥrāḳ	iṭbāḳ	infāḳ	müştāḳ	a'nāḳ		
Ḥarfü'l-kāf	idrak	isḥinkāk	Ḍaḥḥāk	ihlāk	işrāk	süllāk	rehhāk		
Ḥarfü'l-lām	ehvāl	irsal	imhāl	derhâl	i'cāl	meyyal			
Ḥarfü'l-mīm	ẓullām	bed-nām	şām	İslām	i'lām	ilhām	ikram		
Ḥarfü'n-nūn	iḥsān	ḫufyān	lem'ān	ferḥān	īmān	iḥsān	imkân		
Ḥarfü'l-vāv	ḳayġu	ḳarşu	ḍarblu	ḥasretlü	sür'atlü	heybetlü	ġayretlü		
Ḥarfü'l-hā	Allāh	Allāh	Allāh	Allāh	āh	rāh			
Ḥarfü'l-lām	İlla	sehlā	ta'līlen	aṣlā	fi'len	tekmīlen	temδīlen		
Ḥarfü'l-yā	ehl-i rāy	'ālī-rāy	bay	vāy	ehl-i rāy	bay	'ālī rāy		

Aşağıda verdiğimiz metin en doğru ve en açık şekilde anlatılmış olup incelediğimiz bu elif-nâme 174 beyitlik bir kasidedir. Tam olması sebebiyle ele aldığımız metinde Arap alfabesindeki 28 harf bir de lâmelif harfi ile sırasıyla altışar beyit yazılmıştır. Beyit sonlarındaki redif ya da kafiyenin son harfleri elif, ba, ta … şeklinde alfabetik sıralanmıştır.

METİN

Faşlün fī-Beyān-ı Ehli's-Ṣabr 'alā Ḥarfi't-Teheccī

Mefā'īlün Mefā'īlün Mefā'īlün Mefā'īlün

Açup ġaflet niḳābını gör imdi ni'met-i 'uẓmā (Harfü'l elif)

Götür dilden ḥicābını ola ḫaşyet aña ilḳā

Didiler şol ekābirler geçen ehl-i meḳābirler

Ḳıyāmet güni ṣābirler bulalar aḳṣa-yı mermā

Anıñ-çün gönderüp Ḳur'ān beyān itdi anı Sübḥān

İdem ṣābirlere iḥsān ḥisāba gelmez ol nu‘mā

Resūl eydür muṣībetler Ḫudādan oldı ni‘metler

Ki ṣābirlere raḥmetler o vech-ile ola i‘ṭā

Buyurdı mü’miniñ ol ẕāt veledi ger olunca māt

Buyura Ḥaḳ o dem bi'ẕ-ẕāt meleklere bilā-iḫfā

Ḳulumuñ ḳalb-i eðmārın pes aldıñız mı ol bārın

Ne didi söyleñ aḫbārın baña eyledi mi şekvā

(…)

TÜRK EDEBİYATINDAKİ ELİF-NÂMELERLE İSMAİL HAKKI’NIN ELİF-NÂMELERİ KARŞILAŞTIRMA

Verilen bütün bilgiler ışığında, elif-nâme geleneğindeki genel örnekler ile Erzurumlu İsmail Hakkı'nın elif-nâmelerinin şekil ve içerik özelliklerini karşılaştıralım:

Elif-nâme geleneğinde şiirler genellikle mısra veya beyitlerin başındaki kelimelerin ilk harflerinin "elif"ten "ye"ye ya da tersine alfabetik sırayla dizilmesiyle oluşur. En yaygın biçimi, harflerin beyit başlarında yer almasıdır, ancak dörtlük başlarında, dizelerin başında, beyit sonlarında veya dize ortalarında da görülebilir. Divan şiirinde daha çok beyitler halinde, halk şiirinde ise dörtlükler halinde uygulanır. Elif-nâmeler farklı nazım şekilleriyle yazılabilir; örneğin musarra gazel biçiminde semâî, musammat kaside, muhammes veya gazel gibi. Vezin olarak ise *Mefâîlün Mefâîlün Mefâîlün Mefâîlün* ya da *müstef'ilün müstef'ilün müstef'ilün müstef'ilün* gibi kalıplar tercih edilir. Harf sıralaması tamamen alfabetik olabileceği gibi bazı harfler atlanabilir veya sondan başa doğru da düzenlenebilir. Elif-nâme, şekle dayalı bir sanat anlayışı olarak görülür ve genellikle edebi türden çok bir biçim ya da tarz olarak değerlendirilir. Nadiren mensur yani düzyazı şeklinde yazılmış örnekler de mevcuttur.

İçerik (Muhteva):

Elif-nâmeler genellikle dinî ve tasavvufî konuları işler ve İslam kültüründe eğitici, ahlaki mesajlar sunar. Konu çeşitliliği bulunsa da ağırlıklı temalar arasında Allah’ın varlığı ve birliği (tevhid), peygamber övgüsü (naat), Allah’a yakarış (münâcât), devrin büyüklerine övgü (methiye), peygamberler, ibadetler, ahiret ve tasavvufi hâllerle ilgili öğütler yer alır. Harfler metaforik olarak kullanılır; örneğin, ‘elif’ harfi Allah’ın birliğini sembolize edebilir. Hurufilik gibi harf mistisizmiyle bağlantılı örnekler de mevcuttur. Ayrıca On İki İmam’ı konu alan düvaz-nâme temalı elif-nâmeler bulunur. Bazı elif-nâmeler ise devlet adamlarını övmek, değerler eğitimi vermek ya da sıra dışı konulara, örneğin aşk acısı için fetva istemek gibi temalara da yer verebilir.

ERZURUMLU İSMAİL HAKKI’NIN ELİF-NÂMELERİ (ŞEKİL VE İÇERİK):

Şekil (Form):

İsmail Hakkı’nın *Kitâb-ı Gevheriyye* adlı eserinde dört elif-nâme bulunmaktadır. Bu elif-nâmelerde en belirgin şekil farkı, harflerin mısra başlarında değil, mısra sonlarında yani kafiyede yer almasıdır; beyit sonlarındaki redif veya kafiyenin son harfleri alfabetik sırayla (elif, ba, ta…) dizilmiştir. Geleneksel elif-nâmelerde her harf genellikle bir beyitte tamamlanırken, İsmail Hakkı’nın elif-nâmelerinde bir harf birkaç beyitte sürmekte ve anlam bütünlüğü bu beyitlerde sağlanmaktadır. İncelenen örneklerde her harf altışar, beşer veya

düzensiz sayıda (3-4) beyitte işlenmiştir. Vezin olarak *Mefā'īlün Mefā'īlün Mefā'īlün Mefā'īlün* kalıbı kullanılmıştır; ancak metinde vezin bozuklukları ve aruz kusurları görülmektedir. Ayrıca bazı elif-nâmelerde alfabedeki belirli harfler atlanmıştır.

İçerik (Muhteva):

İsmail Hakkı'nın elif-nâmeleri dinî-tasavvufî temalar içerir ve didaktik mesajlar sunar. Ancak sadece dini nasihat vermekle kalmayıp, derin tefekkür ve Kur'an tefsiri niteliği taşır. Eserlerinde İslam'ın temel öğretileri, insanın yaratılışı, nimetlerin farkına varılması, ibadetlere yönelme, Allah'ın büyüklüğü, yaratılış düzeni, kulluk görevi, Hz. Peygamber'in dünyaya bakışı, dünya hırslarından uzak durma, sabır, musibetlere metanet, ahiret mükafatı, tevekkül, rahmet, şükür, günahtan sakınma ve ibadetle Allah'a yaklaşma gibi konular ayrıntılı şekilde işlenir. Diğer elif-nâmelere göre tasavvufi derinlikten çok ahlaki ve fıkhi perspektif ön plandadır. Harflerin şekli, sesi ya da temsil ettiği kavramlar üzerinden hikmet dersleri verilir; insanın Allah karşısındaki durumunu anlaması için hikmetli bir dil kullanılır. Bu yönleriyle İsmail Hakkı, elif-nâme geleneğinde hem şekilsel hem de içerik açısından özgün ve didaktik-tefsire dayalı bir yaklaşım sergilemiştir.

SONUÇ

Elif-nâmeler, Divan, Halk ve Tekke edebiyatlarında ortak kullanılan, harfleri sembolleştirerek eğitici, ahlaki ve tasavvufi mesajlar veren manzum metinlerdir. Akrostişe benzeyen yapılarıyla edebî hüner sergilemeyi amaçlarlar. Tür mü yoksa şekil mi oldukları tartışılsa da genellikle şekle dayalı bir sanat anlayışının ürünü kabul edilir ve Türk edebiyatında yüzden fazla elif-nâme yazılmıştır. Bu çalışma, Türk edebiyatındaki elif-nâme eserleriyle ilgili akademik araştırmaları içerik ve şekil açısından ele alıp özetlemiş, ardından Erzurumlu İsmail Hakkı'nın *Kitâb-ı Gevheriyye* adlı eserindeki dört elif-nâmeyi incelemiştir. Sultan Abdülaziz döneminde yaşamış olan İsmail Hakkı'nın daha çok dini ilimlere ilgi duyduğu belirtilmekte; iyi eğitim almaması ve parlak bir şair olmaması, geleneğe tam hâkim olamamasının nedenleri arasında gösterilmektedir. Çalışma, İsmail Hakkı'nın elif-nâmelerinin hem şekil hem de içerik açısından diğer örneklerden farklılıklarını ortaya koymayı hedeflemiştir.

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SECURITIZATION OF WILDFIRES IN THE CONTEXT OF ENVIRONMENTAL SECURITY

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ABSTRACT

After the Cold War, the scope of security studies has expanded. Indeed, the traditional security paradigm, predominantly centered on defense and military considerations, has begun to undergo a transformation under the influence of globalization. Accordingly, threats such as climate change, environmental problems, and pandemics have also been labeled as security issues. In this context, the inclusion of non-military threats beyond traditional concerns has led to the incorporation of new theories into security studies. One of these new theories is the securitization theory produced by the Copenhagen School. Securitization is the process that starts when a securitizing actor, through discourse, articulates a threat to the existence of a referent object. Thus, necessary steps are taken to protect the reference object whose existence is said to be under threat. This is because the securitized issue has been transferred to the private sphere through the discourse of the securitizing actor. For this reason, exceptional measures to protect it are also legitimized. In fact, the securitization of an issue carries a negative connotation. This is because a securitized issue has not been, or cannot be, addressed through ordinary political means. Moreover, securitization grants extraordinary powers to the securitizing actor. In this regard, the ethics of securitization are debatable

The securitization theory is based on the securitization of different sectors. One of these sectors is environmental security. In environmental security, the focus is on the link between the damage suffered by the environment and the security of humans and the biosphere. With the influence of factors such as global warming and climate change, environmental security has become increasingly prominent. One of the greatest threats to environmental security is forest fires. This study examines the securitization of forest fires in the context of environmental security, drawing on examples from different countries. To this end, the connection between environmental security and forest fires is first examined. The article then looks at how securitizing actors present forest fires as a security issue. Finally, it is discussed whether the securitization of forest fires is ethical or not

Keywords: Securitization Theory, Environmental Security, Forest Fires

INTRODUCTION

Following the Cold War, security studies within the discipline of International Relations have expanded in parallel with the developments that have taken place. Accordingly, non-military issues have been included in security studies, in addition to traditional defense-oriented security issues. As a matter of fact, during this process, social and environmental issues, particularly economic and political issues, have begun to appear in security studies (Erdem & Özbek, 2023). One of the security theories that tries to evaluate these issues within the scope of security is the Copenhagen School. The school has three notable approaches: the regional security complex, sectoral analysis, and securitization theory. This study addresses the securitization of forest

fires in the context of environmental security. For this purpose, the study seeks to answer the following questions: Where do forest fires stand within environmental security? In what contexts have forest fires been securitized? Finally, is the securitization of forest fires ethical?

MATERIAL AND METHODS

Collection and preparation

To concretize this study, in addition to articles and books on the subject, online news websites have also been utilized. The majority of these sources were obtained from Boğaziçi University. The collected data were examined through discourse analysis, a method used in securitization theory. Discourse analysis emphasizes the performative aspect of statements. In other words, discourses build action. Discourse analysis of securitization theory focuses on the statements of the securitizing actor. In this context, threats to the existence of the reference object are created through discourses(Emmers,2013). Therefore, according to the discourse analysis of securitization theory, in order for an issue to become a security issue, the securitizing actor must express this through their words

Theoretical Framework

Securitization Theory

Securitization Theory is a theory put forward by researchers from the Copenhagen School. The first person to use this approach was Ole Waever. Waever established this theory in a 1995 study. According to him, in order for an issue to be labeled as a security issue, it must be discursively declared by the securitizing actor. According to this, the securitizing actor declares a threat to the existence of the reference object. In this way, they legitimize the actions they will take to protect the referent object (Wæver, 1995). In the following years, Wæver, together with Barry Buzan, further developed this approach. According to them, the securitization process is a departure from normal political norms. Indeed, the issue of security has become a matter above politics. In this way, the way is opened for extraordinary measures to be taken to eliminate the specified threat(Buzan, et al, 1998). In essence, securitization is a discursive process in which a problem is dramatized and presented as a priority issue(Nyman,2013).

Securitization actually has a negative connotation. In fact, securitizing an issue means that the issue could not be resolved through normal political means. In this context, securitization is a kind of failure of normal politics (Nyman, 2013). If an issue is securitized, the actor who securitizes it can obtain extraordinary powers. That is why it is claimed that securitization disrupts democratization. Because with the securitization, democratic politics can be suspended. An issue that is removed from the political sphere is not ethical. For this reason, it has been stated that securitization is morally wrong(Floyd,2010).

The Threat to Environmental Security: Forest Fires

Kopenhag One of the security sectors mentioned by the Copenhagen School is environmental security. Environmental security is the fight against environmental degradation and the consequences caused by this degradation. Indeed, environmental degradation poses a significant threat both to human safety and to all life on Earth (Graeger, 1996). The effects of these threats were first evaluated within the scope of national security. Later, with global awareness, the cross-border impact of these threats was discussed. As a result, environmental security has been brought to the international agenda.(Atvur&Vural,2022). Indeed,

environmental security has become visible in international relations both in academia and in politics (Dyer, 2001). That is why, after the Cold War, environmental issues have taken their place in security studies under the name of non-traditional threats. Securitization of the environment is the prioritization of environmental issues(Barnett, 2017). Solving environmental problems and raising awareness about the environment are important at this point.

One of the most significant causes of environmental degradation is forest fires. Forest fires destroy millions of acres of forest land and vegetation every year. It also causes human casualties, resource scarcity, and economic damage (Lierop & Moore, 2019). In addition, forest fires also significantly affect the ecosystem. In this context, the plant and animal species that disappear with the fire intensify the threats such as pollution and climate change(Floyd, 2019). On the other hand, forest fires can also affect social phenomena. Indeed, disasters like forest fires have the potential to influence the dynamics of both national and international security. Forest fires have the potential to provoke conflicts among communities while also paving the way for cooperative efforts (Kelman, 2012). For this reason, forest fires can become a subject of security policies. This is particularly meaningful under the frameworks of environmental security and climate change. Because disasters have the power to alter the current status quo. Accordingly, disasters can either displace the ruling powers or strengthen their power(Mandel,2002).

Forest fires are securitized within the scope of environmental security in three contexts. These are national security, human security, and ecological security. Although environmental issues in national security are labeled as a national issue, the state is the main actor here .(Rita,2010). This is because, in the securitization of the environment as a national security issue, the referent object is most often the state. Again, in connection with forest fires, the second pillar of environmental security is formed by an individual-centered approach. In this approach, which puts people at the center, the reference object is the individual. Protecting humans from all types of environmental threats is a priority in this context. On the other hand, approaches that focus on the biosphere provide the most comprehensive example of environmental security. This approach, which focuses on humans and all of nature, concentrates on preserving ecological balance. In short, this approach is about maintaining the functional integrity of the biosphere. In this context, the reference object is not the environment but the ecosystem. As is well known, the environment is based on the distinction between humans and nature. Therefore, the environment is a human construction (Kaya, 2019).

RESULTS AND DISCUSSION

The Securitization of Forest Fires

Have forest fires been taken beyond the bureaucratic ways of policy? Or in other words, have forest fires become a priority issue in security policies? The answer to these questions is controversial. In fact, there is not much specific securitization of forest fires, both in academia and in politics. Even the Paris Climate Agreement signed in 2015 gave very little attention to forests (Paris Agreement, 2015). Despite this, forest fires related to security measures have been linked to issues such as environmental safety and climate change. For example, the United States (US) generally addresses forest fires as a national security issue within the scope of environmental safety and climate change (White, 2020). This situation is clearly evident in US federal reports. In these reports, forest fires, which are listed as one of the threats caused by climate change, have mostly been addressed as a matter of national security. Therefore, the reference object in the US's securitization of wildfires is the state. However, these reports have

paid little attention to the ecological, human, and environmental significance of forest fires (Select Federal Reports, 2015).

The Amazon rainforest plays an important role in maintaining the ecosystem's function. The Brazilian governments, which host the majority of the rainforests within their borders, are controversial in terms of how much they protect this heritage(BBC,2019). Nevertheless, the statements made by officials regarding the containment of forest fires in Brazil are significant. Environment Minister Marina Silva has described Brazil's fight against forest fires using war rhetoric (The Guardian, 2024). Despite this, forest fires in Brazil have not been a priority issue either at the national or humanitarian level(IMCCS,2020). On the other hand, the global effects of forest fires in Brazil have led to the internationalization of the problem. At this point, actors from different countries other than Brazil are trying to play a role in the securitization of forest fires in Brazil. The reference object of these actors is mostly climate change and environmental issues(Munayer, et al. 2025).

The European Union (EU), which is trying to take a leading role in combating climate change and environmental issues, is trying to include forest fires among its priority issues. Because the EU's securitization of forest fires has occurred within the scope of environmental security and climate change. In this regard, the EU has placed forest fires on its agenda in the context of the effects of climate change since the 2000s. In particular, the fact that member states were heavily affected by forest fires in 2018 has been a driving force in the organization's fight against forest fires in the context of environmental security. Accordingly, concrete steps have been taken to take urgent measures against these disasters(Castren,2024).

On the other hand, it should be noted that the state elites, who should be the securitizing actors in the securitization of forest fires, have not been able to properly address this issue. In this context, it is a matter of actors other than the top levels of the state approaching the issue from a broader perspective. For example, Nikola Nikolov, who heads the Southeast Europe and South Caucasus Regional Fire Monitoring Center, claims that forest fires are a significant security issue. In his discourses, Nikolov includes both humans and the entire ecosystem as referent objects (OSCE, 2019).

Is the Securitization of Forest Fires Ethical?

The securitization process grants extraordinary powers to the actors involved in securitization. Therefore, securitization essentially has a negative connotation. Because the securitizing actor may exceed its limits when using these powers. In fact, democratic politics designed by normal politics may be suspended. Such a situation is not always applicable. Even if it were, it would only hold true when democratic values are prioritized above all else. Therefore, if a securitization does not benefit the securitizing actor and the elites, the ethicality of the process becomes debatable. However, if the referent object is a highly valuable entity, such as all of humanity or the ecosystem, the securitization process can be considered ethical (Floyd, 2010). The ethics of securitizing forest fires varies depending on what the reference object is. In securitizing environmental issues, the human and ecological context is considered ethical, except for national security. The reason why the national security context is not considered ethical is as follows: In treating environmental issues as a national matter, people are valued only insofar as they are part of a particular state. The environment is nothing more than a resource pool for national interests. Ultimately, the reference object here is not humanity but the nation-state.

CONCLUSIONS

Forest fires are securitized within the context of environmental security through three different approaches: in terms of national security, within the scope of human security, and through an ecological-focused approach. Since the environment and people are not a priority in national security, it is unethical to treat forest fires as a matter of national security. In contrast, securitizing forest fires within the human and ecological scope is ethical, as it considers individuals and nature as a whole. This is because, in both approaches, the referent objects—that is, those that need protection—are humans, nature, and the environment

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CLADANTHUS MIXTUS ÖZÜTLERİNİN BİYOLOJİK AKTİVİTELERİNİN VE FİTOKİMYASAL İÇERİKLERİNİN ARAŞTIRILMASI

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ÖZET

Tıbbi ve aromatik bitkiler, sahip oldukları ikincil metabolitler sayesinde geleneksel tıptan modern farmakolojiye kadar geniş bir kullanım alanına sahiptir. Bu çalışmada, Asteraceae familyasının önemli türlerinden *Cladanthus mixtus*'un ultrasonik özütleme yöntemi ile elde edilen metanol ve su özütleri, kimyasal kompozisyon, antioksidan kapasite bakımından kapsamlı biçimde değerlendirilmiştir. Öncelikle, özütlerin toplam fenolik ve flavonoid içerikleri spektrofotometrik yöntemlerle belirlenmiş, ardından özütlerin kimyasal içerikleri LC-MS/MS analizi ile karakterize edilmiştir. Antioksidan aktiviteler fosfomolibdenyum, CUPRAC, FRAP, DPPH, ABTS ve Fe(II) şelatlama testleri ile incelenmiştir.

Sonuçlar, metanol özütünün fenolik (70.88 mg GAEs/g özüt) ve flavonoid (46.75 mg REs/g özüt) içerikleri açısından su özütünden (19.77 mg GAEs/g özüt; 6.83 mg REs/g özüt) daha zengin olduğunu göstermiştir. LC-MS/MS analizlerinde metanol özütünde hesperidin (18813 µg/g özüt), klorojenik asit (13696 µg/g özüt) ve hiperosit (1679 µg/g özüt) öne çıkarken; su özütünde apigenin (605 µg/g özüt) ve ferulik asit (268 µg/g özüt) daha yüksek bulunmuştur. Antioksidan testlerde metanol özütü DPPH, ABTS, FRAP ve CUPRAC testlerinde güçlü aktivite sergilemiştir. Su özütü ise Fe(II) şelatlama kapasitesi açısından (IC_{50}: 1.06 mg/mL) daha yüksek bulunmuştur.

Genel olarak, *Cladanthus mixtus* metanol özütü yüksek fenolik/flavonoid içeriğiyle güçlü antioksidan aktivite sergilemekte, su özütü ise metal şelatlama ve BChE inhibisyonunda dikkat çekmektedir. Bu bulgular, bitkinin fonksiyonel gıda ve farmasötik uygulamalarda potansiyel bir doğal kaynak olabileceğini göstermektedir.

Anahtar Kelimeler: *Cladanthus mixtus,* fenolik bileşikler, antioksidan aktivite, hesperidin

EVALUATION OF THE BIOLOGICAL ACTIVITIES AND PHYTOCHEMICAL PROFILE OF *CLADANTHUS MIXTUS* EXTRACTS

ABSTRACT

Medicinal and aromatic plants are widely recognized for their secondary metabolites, which play essential roles in both traditional medicine and modern pharmacology. In this study, the methanolic and aqueous extracts of *Cladanthus mixtus*, a member of the Asteraceae family, were comprehensively evaluated in terms of chemical composition, antioxidant capacity. The total phenolic and flavonoid contents of the extracts were determined spectrophotometrically, and their chemical profiles were characterized by LC-MS/MS analysis. Antioxidant activities were assessed through phosphomolybdenum, CUPRAC, FRAP, DPPH, ABTS, and Fe(II) chelation assays.

The results showed that the methanolic extract was richer in phenolics (70.88 mg GAEs/g extract) and flavonoids (46.75 mg REs/g extract) compared to the aqueous extract (19.77 mg GAEs/g extract and 6.83 mg REs/g özüt, respectively). LC-MS/MS analysis revealed high levels of hesperidin (18813 µg/g extract), chlorogenic acid (13696 µg/g extract), and hyperoside (1679 µg/g extract) in the methanolic extract, while apigenin (605 µg/g extract) and ferulic acid (268 µg/g extract) were more abundant in the aqueous extract. In antioxidant assays, the methanolic extract exhibited strong activities in DPPH, ABTS, FRAP, and CUPRAC tests, whereas the aqueous extract demonstrated superior Fe(II) chelating capacity (IC_{50}: 1.06 mg/mL).

Conversely, the aqueous extract was more effective in inhibiting BChE (IC50: 2.19 mg/mL). In conclusion, the methanolic extract of *C. mixtus*, due to its high phenolic and flavonoid content, demonstrates potent antioxidant properties, while the aqueous extract stands out in metal chelation and BChE inhibition. These findings highlight the potential of *C. mixtus* as a valuable natural source for functional food, phytotherapeutic, and pharmaceutical applications.

Keywords: *Cladanthus mixtus*, phenolic compounds, antioxidant activity, hesperidin

GİRİŞ

Asteraceae familyası, bitki dünyasının en büyük familyalarından biridir ve çok çeşitli türleri içerir. Tür çeşitliliği, geniş bir yelpazede fizyolojik olarak aktif bileşiklerin varlığını düşündürmekte ve bu familyaya ait bitkiler uzun süredir hem geleneksel ilaç hem de gıda olarak kullanılmaları nedeniyle farmasötik ve sağlık amaçlı gıda hammaddesi olma potansiyeli taşımaktadır (Rolnik ve Olas, 2021). Bu familya yaklaşık 1600 cins ve 23.000'den fazla türden oluşmaktadır. Önemli türler arasında pelin otu (*Artemisia absinthium*), civanperçemi (Achillea millefolium), papatya (*Chamaemelum nobile*), marul (*Lactuca sativa*), hindiba (*Cichorium intybus*), enginar (*Cynara cardunculus*), papatya çiçeği (*Bellis perennis*) ve karahindiba (*Taraxacum officinale*) yer almaktadır (Bessada vd., 2015). Asteraceae familyasına ait bitkiler çoğunlukla otsu olmakla birlikte bazı çalı veya yarı çalı formlarında da bulunur (García-Herrera vd., 2014). Uzun ağaçlardan küçük otlara kadar farklı morfolojik yapılara sahiptirler ve genellikle küçük, renkli çiçeklerden oluşan düz salkımlar şeklinde çiçek kümeleri ile karakterize edilirler (Rolnik ve Olas, 2021).

Asteraceae familyasına ait türlerin antimikrobiyal, antioksidan, antifungal, antiinflamatuvar, insektisidal, antikanser, hepatoprotektif ve yara iyileştirici özellikleri birçok çalışma ile gösterilmiş ve bu özellikler insanlarda yürütülen klinik çalışmalarla da doğrulanmıştır (Koc vd., 2015; Rolnik ve Olas, 2021). Hayvan modellerinde elde edilen sonuçlar biyolojik farklılıklar ve deneysel sınırlılıklar nedeniyle doğrudan insanlara uygulanamayabilmekte, bu nedenle klinik çalışmalar büyük önem taşımaktadır (Perel vd., 2007). İnsanlarda yapılan klinik denemeler, bu bitkilerin farklı organlar üzerinde terapötik ve koruyucu etkilerini ortaya koymuştur (Piątkowska vd., 2022; Yoon vd., 2022).

Bu çalışmada, endemik bir tür olan *Cladanthus mixtus* bitkisinin toprak üstü kısımlarından ultrason destekli özütleme yöntemi kullanılarak metanolik ve sulu özütler elde edilmiştir. Elde edilen özütlerin kimyasal profilleri spektrofotometrik ve kromatografik teknikler aracılığıyla belirlenmiştir. Ayrıca, özütlerin antioksidan özellikleri; fosfomolibden, CUPRAC, FRAP, DPPH, ABTS ve demir (II) iyonu şelatlama yöntemleri de dahil olmak üzere çeşitli in vitro testler kullanılarak değerlendirilmiştir.

MATERYAL VE YÖNTEMLER

Bitki materyali

Cladanthus mixtus (L.) Chevall. (sinonim: *Chamaemelum mixtum* (L.) All.) bitkisinin toprak üstü kısımları, Muğla ili Kavaklıdere ilçesi Nebiler yolu yol kenarlarından çiçeklenme zamanlarında (30 Nisan 2023) tarafımızdan daha önceden belirlenmiş koordinatlardan (37° 27' 35" N, 28° 24' 30" E) ve 1050 m yükseltiden toplandı. Örnek, Muğla Sıtkı Koçman Üniversitesi Biyoloji Bölümü Botanik Anabilim Dalı Öğretim Elemanı Öğr. Gör. Dr. Olcay CEYLAN tarafından tekrar teşhis edildi.

. *Özütlerin Hazırlanması*

Toplanan örnekler öncelikle doğrudan güneş ışığı almayan, nem oranının düşük ve hava akımının iyi olduğu bir ortamda kurutuldu. Kurutulmuş örnekler bir blender yardımıyla öğütüldü. Öğütülmüş bitki (10 g) örneği alınarak ultrasonik banyoda 3 saat süreyle metanol ve saf su ile muamele edildi. Metanol ve su özütleri 40 °C'de düşük basınçlı vakum altında konsantre edildi. Elde edilen metanol ve su özütleri, analizler yapılana kadar +4 °C'de muhafaza edildi.

Fitokimyasal Analizler

Toplam Fenolik Bileşik Analizi

Toplam fenolik bileşik içeriğinin tespiti için, örnek çözeltisi (0.25 mL) seyreltilmiş Folin-Ciocalteu reaktifi (1.0 ml, 1:9) ile karıştırılmış ve kuvvetlice çalkalanmıştır. 3 dk sonra Na_2CO_3 çözeltisi (0.75 mL, %1) ilave edildi ve örneğin absorbansı, oda sıcaklığında 2 saat inkübasyondan sonra 760 nm'de okunmuştur. Toplam fenolik bileşik içeriği, gallik asit eşdeğerleri (GAEs) olarak ifade edilmiştir (Zengin vd., 2015).

Toplam Flavonoit Bileşik Analizi

Toplam flavonoit bileşik içeriğinin tespiti için, örnek çözeltisi (1.0 mL), MeOH içerisinde aynı hacimde alüminyum triklorür (%2) ile karıştırılmıştır. Benzer şekilde, örnek çözeltisinin (1.0 ml), $AlCl_3$ içermeyen metanole (1.0 ml) eklenmesiyle bir kör hazırlanmıştır. Örnek ve körün absorbansları oda sıcaklığında 10 dk inkübasyondan sonra 415 nm'de okunmuştur. Körün absorbansı, örneklerinkinden çıkarılmıştır (Zengin vd., 2015). Örneklerin toplam flavonoit bileşik içeriği, rutin eşdeğeri (REs) olarak ifade edilmiştir (mg REs/g örnek).

LC-MS/MS Analizi

Örneklerin fenolik içerikleri daha önde validasyonu yapılmış olan bir yöntemle gerçekleştirildi (Cittan ve Çelik, 2018). Kantitatif analizler için, 6420 Triple Quad kütle spektrometresine sahip Agilent Technologies 1260 Infinity sıvı kromatografi sistemi kullanıldı.

Kromatografik ayırma, Poroshell 120 EC-C18 (100 mm x 4.6 mm I.D., 2.7 µm) kolon ile gerçekleştirildi. Mobil faz olarak %0.1 formik asit/metanol karışımı kullanıldı. Seçilen mobil faz konfigürasyonu, birçok fenolik bileşik için yüksek hassasiyet sağlamıştır. Mobil faz, çözücü A'dan (%0.1, v/v formik asit çözeltisi) ve çözücü B'den (metanol) meydana gelecek şekilde oluşturulmuştur. Gradyan profili şu şekilde ayarlanmıştır: 0. dk %2.0 B çözücüsü, 3. dk %2.0 B çözücüsü, 6. dk %25.0 B çözücüsü, 10. dk %50.0 B çözücüsü, 14. dk %95.0 B çözücüsü, 17. dk %95.0 B ve 17.5 dk %2.0 B çözücüsü. Kolon sıcaklığı 25 °C'de tutuldu. Akış hızı 0.4 ml/dk ve enjeksiyon hacmi 2.0 µl idi (Sarikurkcu vd., 2020). Tandem kütle spektrometresi (MS), bir ESI kaynağı yoluyla LC sistemine entegre edilmiştir. MS'in elektrosprey kaynağı, negatif ve pozitif MRM modunda çalıştırılmış; -3.5, -4 kV (NI modu) ve 3.5, 4 kV (PI modu) kapiler gerilim uygulanmıştır. Kurutucu gaz sıcaklığı ve akış hızı sırasıyla; 300 °C ve 11 L/dk olarak, nebülizor basıncı ise 40 psi olarak ayarlanmıştır.

Örneklerdeki fenolik bileşiklerin pikleri, MRM modunda, orijinal bir standart fenolik türün iyon çiftlerinin monitörize edilmesiyle birlikte alıkonma süreleri karşılaştırılarak tanımlandı.

Antioksidan Aktivite Testleri

Metal ŞelatlamaTesti

Örneklerin Fe^{2+} iyonlarını şelatlama kapasiteleri daha önce literatürde belirtilen yönteme göre belirlenmiştir (Kocak vd., 2016; Zengin vd., 2015). İçerisinde özüt çözeltisi (2.0 ml) bulunan test tüplerine $FeCl_2$ (0.05 mL, 2 mM) çözeltisi ilave edilmiştir. Tepkime ferrozin (0.2 mL, 5 mM) ilavesiyle başlatılmıştır. Karışım çözeltisi karıştırıldıktan sonra oda sıcaklığında 10 dakika inkübasyona bırakılmıştır. Ferrozin yerine metanol (0.2 mL) kullanılarak her bir örnek için kör numune hazırlanmıştır. Daha sonra hem kör hem de örneklerin 562 nm'deki absorbans ölçümleri yapılmıştır. Örneklerin şelatlama kapasiteleri örnekler için ölçülen absorbans değerlerinden her bir örnek için hazırlanan kör karışıma ait absorbans değerleri çıkartılarak etilendiamin tetra asetik asit disodyum (EDTA) tuzu eşdeğer olarak hesaplanmıştır (mg EDTAEs/g örnek).

ABTS Katyon Radikali Süpürüm Testi

Bu testte $ABTS^{\cdot+}$ radikal katyonu, 7.4 mM ABTS çözeltisi ile 2.45 mM potasyum persülfat çözeltisinin tepkimesiyle elde edilmiştir. Bu karışımının 12-16 saat karanlıkta bekletilerek aktif radikal oluşması sağlanmıştır. Deneyden önce ABTS katyon radikal çözeltisi, 734 nm'de absorbansı 1.000±0.020 olacak şekilde metanol ile seyreltilmiştir. Örnek çözeltilerinden 1.0 mL alınmış ve 2.0 mL ABTS çözeltisi ile karıştırılmıştır. Tüpler ağızları kapalı bir biçimde oda sıcaklığında 30 dakika bekletildikten sonra örneklerin 734 nm'deki absorbans ölçümleri yapılmıştır (Zengin vd., 2015). Örneklerin ABTS katyon radikali süpürüm aktiviteleri troloks eşdeğer olarak hesaplanmıştır (mg TEs/g örnek).

DPPH Radikal Süpürüm Testi

Örneklerin serbest radikal giderim aktiviteleri 1,1-difenil-2-pikrilhidrazil (DPPH) serbest radikali kullanılarak belirlenmiştir (Tepe vd., 2011; Zengin vd., 2015). İçerisinde örnek çözeltisi (1.0 mL) bulunan test tüplerine metanolde hazırlanmış DPPH çözeltisi (1.0 ml, 0.4 mM) ilave edilmiştir. Kontrol için test tüpüne özüt yerine 1.0 mL metanol koyulmuştur. Örnekler oda sıcaklığında ve karanlıkta 30 dakika inkübasyona bırakıldıktan sonra 517 nm'deki absorbans ölçümleri yapılmıştır. Örneklerin DPPH radikalini süpürüm aktiviteleri troloks eşdeğer olarak hesaplanmıştır (mg TEs/g örnek).

CUPRAC Testi

Örneklerin Cu^{2+}/Cu^{+} indirgeme potansiyelleri literatürde belirtilen CUPRAC yöntemiyle analiz edilmiştir (Apak vd., 2006). İçerisinde örnek çözeltisi (0.5 mL) bulunan test tüplerine sırasıyla; $CuCl_2$ (1.0 mL, 10 mM), amonyum asetat (1.0 mL, 1 M, pH:7.0) ve neokuproin (1.0 mL, 7.5 mM) çözeltileri eklenmiştir. Tüpler ağızları kapalı bir biçimde oda sıcaklığında karanlıkta 30 dakika bekletildikten sonra 450 nm'deki absorbans ölçümleri yapılmıştır. Örneklerin CUPRAC indirgeme potansiyelleri troloks eşdeğer olarak hesaplanmıştır (mg TEs/g örnek).

FRAP Testi

Örneklerin Fe^{3+}/Fe^{2+} indirgeme potansiyelleri FRAP yöntemiyle belirlenmiştir (Kocak vd., 2016; Zengin vd., 2015). Asetat tamponu (0.3 M, pH: 3.6), 40 mM HCl içinde hazırlanan 2,4,6-tris(2-pyridyl)-s-triazine (TPTZ) (10 mM) ve $FeCl_3$ (20 mM) çözeltilerinin hacimce 10:1:1 oranında karıştırılması ile oluşturulan FRAP reaktifi (2.0 ml), içerisinde örnek çözeltisi (0.1 mL) bulunan test tüplerine eklenmiş ve oda sıcaklığında 30 dakika inkübasyona bırakılmıştır.

Karışımların 593 nm'deki absorbans ölçümleri yapıldı. Örneklerin FRAP indirgeme potansiyelleri troloks eşdeğer olarak hesaplanmıştır (mg TEs/g örnek).

Fosfomolibdenyum Testi

İçerisinde örnek çözeltisi (0.1 mL) bulunan test tüplerine 3.0 ml reaktif çözeltisi (0.6 M sülfürik asit, 28 mM sodyum fosfat ve 4 mM amonyum molibdat) ilave edilmiştir. Test tüpleri 95 °C'de 90 dk inkübe edildikten sonra oda sıcaklığına kadar soğutulmuş ve köre karşı (kör, 3.0 ml reaktif çözelti ve 0.1 mL çözücü içermektedir) 695 nm'deki absorbans ölçümleri yapılmıştır (Zengin vd., 2015). Örneklerin toplam antioksidan kapasiteleri standart troloks eşdeğer (TEs) olarak hesaplanmıştır (mg TEs/g örnek).

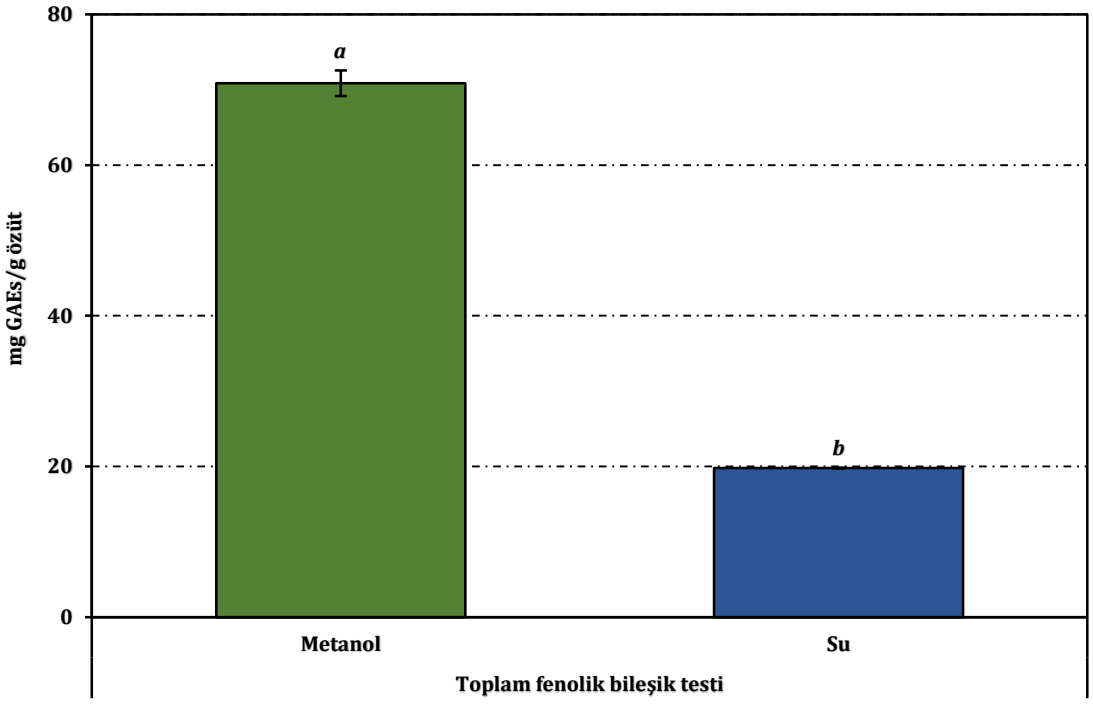
A. *İstatistiksel Analizler*

Çalışmada elde edilen tüm deneysel veriler, IBM SPSS Statistics 22.0 yazılımı kullanılarak analiz edildi. İstatistiksel değerlendirmeler sırasında karşılaştırmalı analizlerde anlamlılık düzeyini belirlemek amacıyla tek yönlü varyans analizi (ANOVA) uygulanmış, gruplar arası farkın kaynağını saptamak üzere ise Tukey'nin çoklu karşılaştırma testi kullanıldı. İki grup arasındaki karşılaştırmalar için bağımsız örneklemler t-testi (Student's t-test) tercih edildi. Tüm testlerde $p<0.05$ değeri istatistiksel olarak anlamlı kabul edildi.

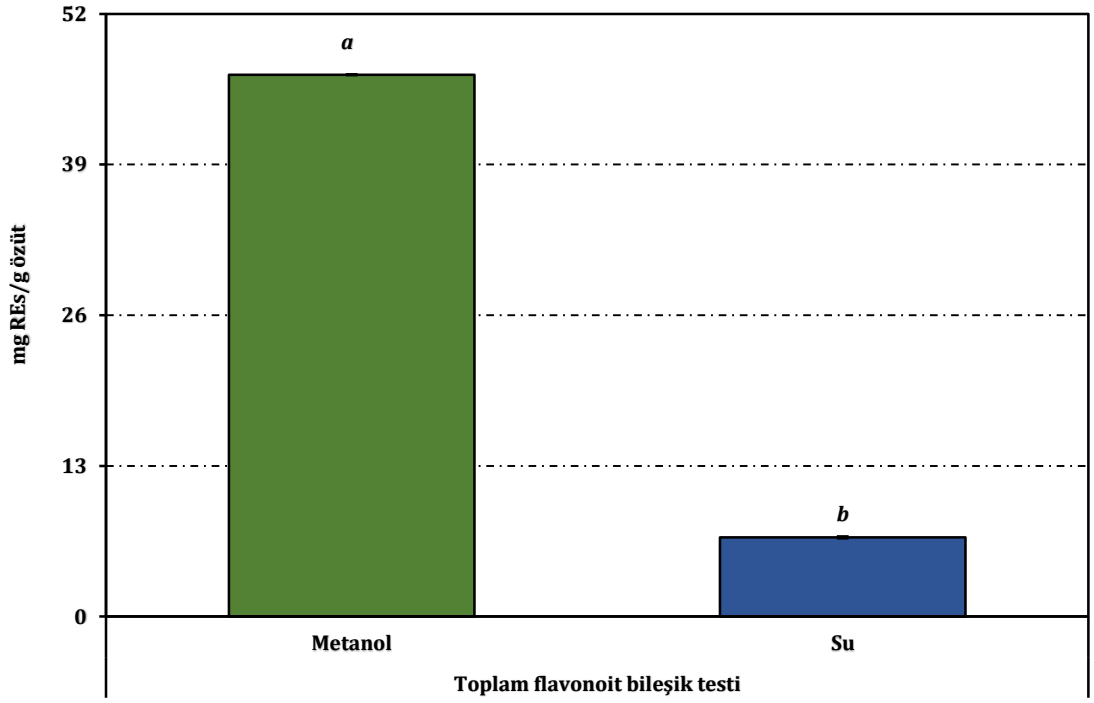
SONUÇLAR VE TARTIŞMA

Doğal tıbbi ve aromatik bitkiler, sahip oldukları zengin fitokimyasal içerikleri sayesinde farmakoloji, gıda endüstrisi ve halk sağlığı alanlarında önemli bir yere sahiptir. Özellikle fenolik bileşikler ve flavonoidler gibi ikincil metabolitler, bitkilerin çevresel streslere karşı korunmasında kritik rol oynarken, insanlar için güçlü antioksidan, antimikrobiyal ve enzim inhibe edici özellikler sergilemektedir. Bu bağlamda, *Cladanthus* cinsine ait türler, Asteraceae familyasının önemli üyeleri arasında yer almakta ve geleneksel tıpta spazmolitik, antiinflamatuvar, analjezik ve sindirim düzenleyici olarak kullanılmaktadır (El Hafidi vd., 2023).

Bu çalışmada, *Cladanthus mixtus*'un metanol ve su özütlerinde toplam fenolik içerik sırasıyla; 70.88 mg GAEs/g özüt ve 19.77 mg GAEs/g özüt (Şekil 1); toplam flavonoid içerik ise, 46.75 mg REs/g özüt ve 6.83 mg REs/g özüt olarak tespit edilmiştir (Şekil 2). Literatürdeki benzer çalışmalar bu sonuçları destekler niteliktedir. Örneğin, El Mihyaoui vd. (2023b) tarafından yapılan çalışmada, *C. mixtus*'un çiçek özütlerinde 30.55 mg GAE/g fenolik ve 26.00 mg QE/g flavonoid bulunmuştur (El Mihyaoui vd., 2023b). Yine El Mihyaoui vd. (2023a) ise farklı organlarda fenolik asitler (özellikle klorojenik asit ve ellagik asit) ile flavonoidlerin (apigenin türevleri, quercetin) baskın olduğunu bildirmiştir (El Mihyaoui vd., 2023a). Bu çalışmadaki fenolik ve flavonoid miktarlarının daha yüksek çıkması, kullanılan ultrasonik özütleme yönteminin ekstraksiyon verimini artırması ile açıklanabilir.



Şekil 1. Özütlerin toplam fenolik içerikleri



Şekil 2. Özütlerin toplam flavonoit içerikleri

Yapılan LC-MS/MS analizlerinde, metanol özütünde hesperidin (18813 µg/g özüt), klorojenik asit (13696 µg/g özüt) ve hiperosit (1679 µg/g özüt) yüksek düzeylerde tespit edilmiştir. Ayrıca apigenin 7-glukosit (26.8 µg/g özüt) ve luteolin (19.3 µg/g özüt) gibi flavonoidler de belirlenmiştir (Tablo 1). Literatürde El Mihyaoui vd. (2023a), *C. mixtus* çiçek özütlerinde klorojenik asidi 1987 µg/g ve apigenin-7-O-glukozidi 1074 µg/g düzeylerinde rapor etmiş (El

Mihyaoui vd., 2023a); Zeroual vd. (2021) ise metanol özütlerinin fenolik ve flavonoidler açısından en zengin fraksiyon olduğunu bildirmiştir (Zeroual vd., 2021).

Tablo 1. Fitokimyasalların özütlerdeki derişimleri

Bileşik Adı	Metanol	Su
Hesperidin	18813±101 ^{a}	7.33±0.24 ^{b}
Klorojenik asit	13696±84 ^{a}	33.6±0.2 ^{b}
Hiperosit	1679±18 ^{a}	1.61±0.05 ^{b}
2,5-Dihidroksibenzoik asit	311±2 ^{a}	82.9±0.1 ^{b}
Protokateşuik asit	307±3 ^{a}	83.0±1.3 ^{b}
Luteolin 7-glukosit	205±2 ^{a}	3.90±0.30 ^{b}
Kafeik asit	187±2	nd
Kuersetin	152±2 ^{a}	3.23±0.07 ^{b}
Gallik asit	66.6±2.1	nd
3-Hidroksibenzoik asit	48.1±0.2 ^{b}	50.6±0.5 ^{a}
4-Hidroksibenzoik asit	48.1±0.6 ^{a}	49.0±0.8 ^{a}
p-Kumartik asit	35.2±0.6 ^{a}	12.2±0.6 ^{b}
Siringik asit	34.0±2.6 ^{a}	10.8±0.1 ^{b}
Pirokatekol	29.0±2.2 ^{a}	11.9±0.8 ^{b}
Apigenin 7-glukosit	26.8±1.9 ^{a}	29.7±0.2 ^{a}
Apigenin	20.3±0.4 ^{b}	605±4 ^{a}
Luteolin	19.3±0.3 ^{b}	35.9±0.7 ^{a}
Eriyodiktiyol	16.7±0.2	nd
Ferulik asit	13.2±0.2 ^{b}	268±6 ^{a}
Vanilin	9.08±0.42 ^{a}	4.24±0.12 ^{b}
2-Hidroksinnamik asit	2.15±0.13 ^{a}	1.66±0.13 ^{b}
3,4-Dihidroksifenilasetik asit	1.72±0.11	nd
Taksifolin	1.22±0.05	nd
(-)-Epikateşin	nd	nd
(+)-Kateşin	nd	nd
Kamferol	nd	nd
Pinoresinol	nd	nd
Rosmarinik asit	nd	nd
Sinapik asit	nd	nd
Verbaskosit	nd	nd

Aynı satırda yer alan ve aynı üst simge (a ve b) ile gösterilen ortalama değerler, %5 anlamlılık düzeyinde Student'in t-testi sonuçlarına göre birbirinden farklı değildir. nd: Belirlenemedi.

Antioksidan aktivite terslerinde, metanol özütü, fosfomolibdenyum, CUPRAC, FRAP, DPPH ve ABTS testlerinde su özütünden belirgin olarak daha yüksek aktivite göstermiştir. DPPH testinde metanol özütü (IC_{50}: 1.81 mg/mL), su özütünden (IC_{50}: 9.63 mg/mL) yaklaşık beş kat güçlü bulunmuştur. Benzer şekilde Zeroual vd. (2021), *C. mixtus*'un metanol özütünün en yüksek radikal süpürme kapasitesine sahip olduğunu (IC_{50}: 55.50 µg/mL) bildirmiştir. El Mihyaoui vd. (2023b) da çiçek özütlerinde DPPH aktivitesini 36.23 mg TE/g, kök özütlerinde ise ABTS aktivitesini 39.49 mg TE/g olarak raporlamış ve antioksidan kapasiteyi fenolik/flavonoid içerikle ilişkilendirmiştir. Bu sonuçlar, bu çalışmada elde edilen bulgularla uyumludur.

Sonuç olarak, *Cladanthus mixtus*'un metanol özütünün yüksek fenolik ve flavonoid içeriği sayesinde güçlü antioksidan ve çok yönlü enzim inhibisyon özelliklerine sahip olduğu, su özütünün ise metal şelatlama açısından öne çıktığı belirlenmiştir. Bu bulgular, bitkinin doğal antioksidan kaynağı olarak değerlendirilebileceğini ve fonksiyonel gıda ile farmasötik uygulamalarda potansiyel kullanım alanlarına sahip olduğunu ortaya koymaktadır.

Tablo 2. Özütlerin antioksidan aktiviteleri

Testler	Metanol	Su	Troloks	EDTA
Fosfomolibdenyum (EC_{50}: mg/mL)	1.29±0.04 ^{b}	2.30±0.05 ^{c}	0.55±0.03 ^{a}	-
CUPRAC indirgeme gücü (EC_{50}: mg/mL)	0.60±0.01 ^{b}	3.69±0.10 ^{c}	0.17±0.01 ^{a}	-
FRAP indirgeme gücü (EC_{50}: mg/mL)	0.34±0.01 ^{b}	1.45±0.10 ^{c}	0.05±0.002 ^{a}	-
DPPH radikal süpürüm (IC_{50}: mg/mL)	1.81±0.03 ^{b}	9.63±0.61 ^{c}	0.23±0.03 ^{a}	-
ABTS radikal katyon süpürüm (IC_{50}: mg/mL)	1.74±0.02 ^{b}	4.67±0.03 ^{c}	0.21±0.03 ^{a}	-
Fe(II) şelatlama (IC_{50}: mg/mL)	1.59±0.04 ^{c}	1.06±0.02 ^{b}	-	0.021±0.002 ^{a}

Aynı satırda yer alan ve aynı üst simge (a, b ve c) ile gösterilen değerler, %5 anlamlılık düzeyinde Tukey'in post hoc testi sonucuna göre anlamlı fark göstermemektedir. EC_{50} (mg/mL), indirgeme gücü ve fosfomolibdenyum testlerinde absorbansın 0.5 olduğu etkin derişimi ifade eder. IC_{50} (mg/mL), DPPH ve ABTS radikallerinin %50'sinin süpürüldüğü ve demir(II)-ferrozin kompleksinin %50 oranında inhibe edildiği derişimi gösterir. EDTA, etilendiamintetraasetik asit (disodyum tuzu). "-", belirlenmemiştir.

Teşekkür

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STACHYS LONGIFLORA BİTKİSİ ÖZÜTLERİNİN ENZİM İNHİBİSYON AKTİVİTELERİNİN İNCELENMESİ

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ÖZET

Bu araştırmada, *Stachys longiflora* bitkisinin farklı özütleme yöntemleriyle (Soxhlet, maserasyon ve ultrasonik destekli özütleme) elde edilen özütlerinin biyolojik aktiviteleri kapsamlı biçimde incelenmiştir. Çalışmanın temel amacı, söz konusu özütlerin özellikle asetilkolinesteraz (AChE), tirozinaz ve α-amilaz gibi biyomedikal açıdan önemli enzimler üzerindeki inhibisyon potansiyelini belirlemektir. Elde edilen sonuçlara göre, özütleme yöntemleri arasında anlamlı farklılıklar gözlenmiştir. Maserasyon yöntemi ile elde edilen özütler, en yüksek AChE inhibisyon aktivitesi (2.00 mg GALAEs/g özüt) sergileyerek dikkat çekmiştir. Soxhlet özütleme yöntemi ise tirozinaz enzimine karşı en güçlü etkiyi (44.41 mg KAEs/g özüt) göstermiştir. Bununla birlikte, α-amilaz inhibisyonunda ultrasonik destekli özütleme (671 mg ACEs/g özüt) öne çıkarak diğer yöntemlerden daha etkili bulunmuştur.

Standart bileşiklerle karşılaştırıldığında (Galantamin, kojik asit ve akarboz), *S. longiflora* özütlerinin inhibisyon gücü nispeten daha düşük olmakla birlikte, belirli enzimlere karşı kayda değer ve istatistiksel olarak anlamlı aktiviteler sergilemiştir. Bu durum, bitkinin fenolik ve flavonoid yapısında bulunabilecek ikincil metabolitlerden kaynaklanabileceğini düşündürmektedir. Ayrıca, çalışmada elde edilen bulgular, *S. longiflora*'nın özellikle nörodejeneratif hastalıklar (Alzheimer gibi) ve metabolik bozukluklar (örneğin diyabet) ile ilişkili patolojik süreçlerde tamamlayıcı tedaviye yönelik doğal inhibitör kaynağı olabileceğini göstermektedir.

Sonuç olarak, bu çalışma *S. longiflora*'nın biyolojik aktivite potansiyelini vurgulamakta ve bitkinin farmasötik araştırmalar ile fonksiyonel gıda geliştirme çalışmalarında değerlendirilebilecek önemli bir aday olduğunu ortaya koymaktadır.

Anahtar Kelimeler: *Stachys longiflora,* enzim inhibisyonu, ekstraksiyon yöntemleri, biyolojik aktivite

INVESTIGATION OF ENZYME INHIBITION ACTIVITIES OF *STACHYS LONGIFLORA* EXTRACTS

ABSTRACT

This study comprehensively investigated the biological activities of *Stachys longiflora* extracts obtained through different extraction methods, namely Soxhlet, maceration, and ultrasound-assisted extraction. The main objective was to evaluate the inhibitory potential of these extracts on biomedically significant enzymes such as acetylcholinesterase (AChE), tyrosinase, and α-amylase. The findings revealed notable variations among the extraction methods. The maceration extract exhibited the highest AChE inhibition (2.00 mg GALAEs/g extract), indicating that this method may preserve active compounds more effectively. In contrast,

Soxhlet extraction yielded the strongest inhibition against tyrosinase (44.41 mg KAEs/g extract), while ultrasound-assisted extraction demonstrated the highest α-amylase inhibition (671 mg ACEs/g extract), highlighting the efficiency of modern extraction techniques in retaining bioactive components.

Although the inhibitory potentials of *S. longiflora* extracts were generally lower compared to standard reference compounds such as galantamine, kojic acid, and acarbose, the extracts still showed statistically significant activity against specific enzymes. These results suggest that the inhibitory effects may be attributed to the presence of phenolic and flavonoid secondary metabolites within the plant. From a biomedical perspective, the findings point to the potential of *S. longiflora* as a natural source of enzyme inhibitors that may contribute to the development of complementary therapeutic strategies, particularly in the management of neurodegenerative diseases such as Alzheimer's and metabolic disorders including diabetes.

In conclusion, this study highlights the promising biological potential of *S. longiflora* and underlines its value as a candidate for further pharmaceutical research and functional food applications. By demonstrating that different extraction methods can significantly influence inhibitory activities, the research also emphasizes the importance of optimizing extraction techniques in future studies.

Keywords: *Stachys longiflora*, enzyme inhibition, extraction methods, biological activity

INTRODUCTION

Plants from the Lamiaceae family have long been utilized in traditional medicine due to their wide range of pharmacological activities, including antioxidant, antimicrobial, and enzyme inhibitory effects (Sarikurkcu vd., 2021; Zengin vd., 2014). The genus *Stachys* comprises more than 270 species, many of which are endemic and display significant biological potential (Kanjevac vd., 2023). Among them, *Stachys longiflora* Boiss. & Bal., a Turkish endemic species, remains underexplored with respect to its phytochemical composition and bioactivity.

Enzyme inhibition studies are of particular interest, as they provide insights into potential therapeutic applications against neurodegenerative disorders, diabetes, and skin-related pathologies (Atanasov vd., 2015). Specifically, acetylcholinesterase (AChE) inhibitors are relevant to Alzheimer's disease management, tyrosinase inhibitors play a key role in dermatological and cosmetic applications, while α-amylase inhibitors are associated with controlling postprandial hyperglycemia (Foddai vd., 2015; Ramalingum ve Mahomoodally, 2014).

The present study aimed to investigate the inhibitory effects of methanol extracts of *S. longiflora* obtained through Soxhlet, maceration, and ultrasound-assisted extraction (UAE) methods on AChE, tyrosinase, and α-amylase enzymes.

Ü MATERIAL AND METHODS

Plant material

The aerial parts of *Stachys longiflora* Boiss. & Balansa were collected during the flowering period on 20 May 2022 from Kızıldere locality, Işıkdere village, Mersin province, Turkey, at an altitude of 200–250 m (36° 52′ 4.8″ N, 34° 33′ 3.6″ E). The botanical identification of the plant was performed by Lecturer Dr. Olcay Ceylan (Department of Biology, Muğla Sıtkı Koçman University).

Preparation of methanolic extracts

Methanol (MeOH) was used as the solvent in the extraction process. Three extraction techniques were employed: the traditional Soxhlet and maceration methods, as well as the modern ultrasound-assisted extraction technique. In each method, 5 g of plant material was used. Soxhlet extraction was carried out using a Soxhlet apparatus. The maceration process was performed by mixing the plant sample in 100 mL of MeOH at room temperature for 24 h at 150 rpm. Ultrasound-assisted extraction was conducted by treating 5 g of plant material with 100 mL of MeOH in an ultrasonic bath at 30 °C. The MeOH extracts obtained from all three techniques were concentrated under reduced pressure. The prepared extracts were stored at +4 °C until further analysis (Sarikurkcu vd., 2020).

Enzyme inhibition activity

Within the scope of enzyme inhibition assays, the inhibitory activities of the methanol extracts against tyrosinase, α-amylase, and acetylcholinesterase (AChE) were evaluated following previously described methods (Kocak vd., 2017; Sarikurkcu vd., 2020; Zengin vd., 2015). The results obtained from the enzyme inhibition assays were expressed as IC50 values (mg/mL), representing the concentration of extract required to inhibit 50% of the enzyme activity. In addition, the results were also expressed in terms of equivalents of positive controls commonly used for each enzyme: galantamine (GALAEs) for AChE, kojic acid (KAEs) for tyrosinase, and acarbose (ACEs) for α-amylase.

α-Amylase inhibition activity

The α-amylase inhibitory activity was assessed using the Caraway-Somogyi iodine/potassium iodide (I/KI) method. The sample solution (25.0 µL) was mixed with the α-amylase solution (50.0 µL) in phosphate buffer (6.0 mM sodium chloride, pH 6.9) in a 96-well microplate and incubated at 37 °C for 10 min. After pre-incubation, the reaction was initiated by adding starch solution (50.0 µL, 0.05%). Similarly, a blank solution was prepared by adding the sample solution to all reaction reagents without the enzyme (α-amylase). The reaction mixture was incubated at 37 °C for 10 min and terminated by adding HCl (25.0 µL, 1.0 M). Subsequently, iodine-potassium iodide solution (100.0 µL) was added. The absorbance values of the sample and blank were measured at 630 nm, and the blank absorbance was subtracted from that of the sample to calculate inhibition.

Cholinesterase inhibition activity

The cholinesterase inhibitory activity was determined using the Ellman method. The sample solution (50.0 µL) was mixed in a 96-well microplate with DTNB (125.0 µL) and AChE solution (25.0 µL) prepared in Tris-HCl buffer (pH 8.0), and incubated at 25 °C for 15 min. The reaction was initiated by adding acetylthiocholine iodide (ATCI, 25.0 µL). A blank was prepared by adding the sample solution to all reaction reagents in the absence of AChE. The absorbance of the sample and blank was measured at 405 nm after 10 min incubation at 25 °C, and the blank value was subtracted from the sample absorbance.

Tyrosinase inhibition activity

Tyrosinase inhibitory activity was measured using a modified dopachrome method with L-DOPA as the substrate. The sample solution (25.0 µL) was mixed with tyrosinase solution (40.0 µL) and phosphate buffer (100.0 µL, pH 6.8) in a 96-well microplate and incubated at 25 °C for 15 min. The reaction was then initiated by the addition of L-DOPA (40.0 µL). Similarly, a blank was prepared by adding the sample solution to all reaction reagents in the absence of the enzyme (tyrosinase). The absorbance values of the sample and blank were measured at 492 nm after 10 min incubation at 25 °C.

Statistical analysis

In order to enhance the scientific reliability of the results, all assays were performed in triplicate. The results were expressed as mean values ± standard deviation (mean ± SD). Tukey's test was applied to determine statistical similarities and differences among the data, and the significance level was set at $\alpha = 0.05$

RESULTS AND DISCUSSION

The enzyme inhibition results revealed significant variations depending on the extraction technique. For AChE inhibition, maceration extract exhibited the strongest effect (IC_{50}: 1.37 mg/mL), followed by UAE (1.53 mg/mL) and Soxhlet (1.59 mg/mL) (Table 1). When expressed as galantamine equivalents, maceration extract achieved the highest inhibition (2.00 mg GALAEs/g extract), as shown in **Figure 1**. Although these values were substantially weaker than the reference galantamine (IC_{50}: 0.003 mg/mL), they indicate moderate potential of *S. longiflora* against cholinesterase-related neurodegeneration. Regarding tyrosinase inhibition, Soxhlet (1.82 mg/mL) and maceration (1.83 mg/mL) extracts demonstrated comparable activity, whereas UAE extract displayed significantly weaker inhibition (2.32 mg/mL) (Table 1). In terms of kojic acid equivalents, Soxhlet and maceration extracts each yielded ~44 mg KAEs/g extract (**Figure 2**). These findings suggest potential applications in hyperpigmentation control and cosmetic formulations. For α-amylase inhibition, UAE extract presented the highest activity (IC_{50}: 1.17 mg/mL), outperforming Soxhlet (1.26 mg/mL) and maceration (1.41 mg/mL). When compared with acarbose (IC_{50}: 0.795 mg/mL), all extracts showed weaker activity (Table m1) but retained considerable inhibitory capacity, particularly the UAE extract, which corresponded to 671 mg ACEs/g extract (**Figure 3**). These results highlight the potential utility of UAE extracts in managing postprandial hyperglycemia.

Overall, although none of the extracts surpassed standard inhibitors, their activities confirm the therapeutic promise of *S. longiflora*. The variation among extraction techniques emphasizes the importance of optimizing methods to maximize enzyme inhibitory potential, in line with earlier reports on other *Stachys* species (Bahadori vd., 2019a; Bahadori vd., 2019b; Sarikurkcu vd., 2016).

B. *Table 1.* ***Enzyme inhibition activities of methanol extracts and standards***

Örnekler	AChE inhibition (IC_{50}: mg/mL)	Tyrosinase inhibition (IC_{50}: mg/mL)	α-Amylase inhibition (IC_{50}: mg/mL)
Soxhlet	1.59 ± 0.06^{c}	1.82 ± 0.02^{b}	1.26 ± 0.01^{c}
Maceration	1.37 ± 0.01^{b}	1.83 ± 0.02^{b}	1.41 ± 0.03^{d}
Ultrasonic-assisted	1.53 ± 0.03^{c}	2.32 ± 0.03^{c}	1.17 ± 0.02^{b}
Galanthamine	0.003 ± 0.0001^{a}	-	-
Kojic acid	-	0.08 ± 0.01^{a}	-
Acarbose	-	-	0.795 ± 0.01^{a}

There is no statistical difference between values marked with the same superscripts in the same column.

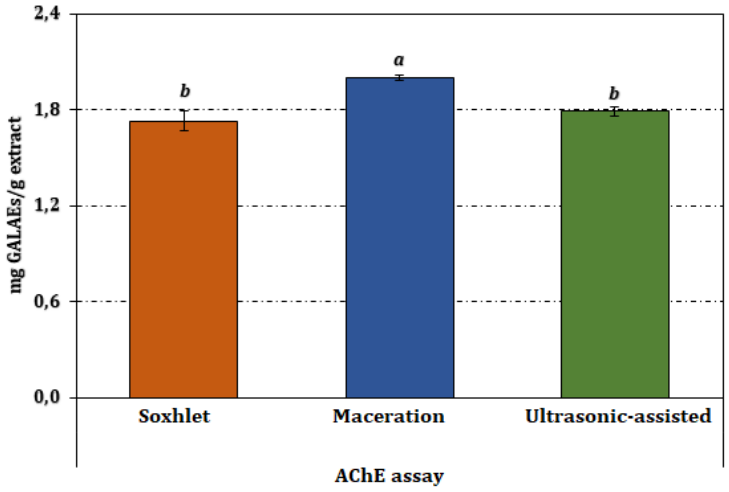

Fig. 1. Acetylcholinesterase inhibition activities of methanol extracts

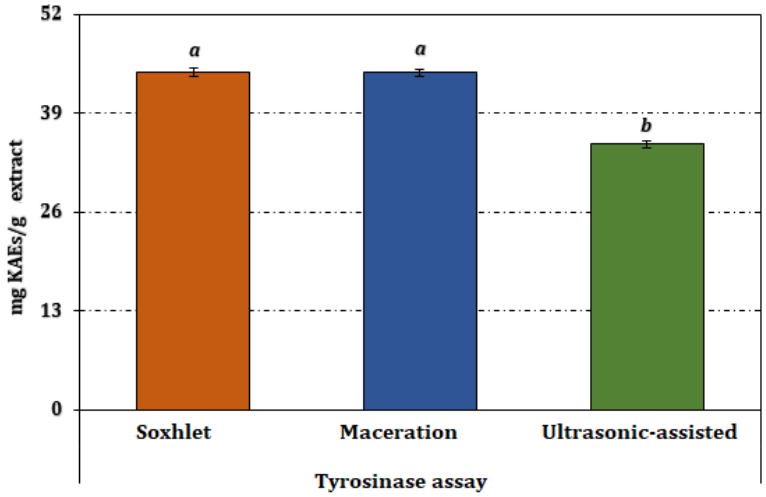

Fig. 2. Tyrosinase inhibition activities of methanol extracts

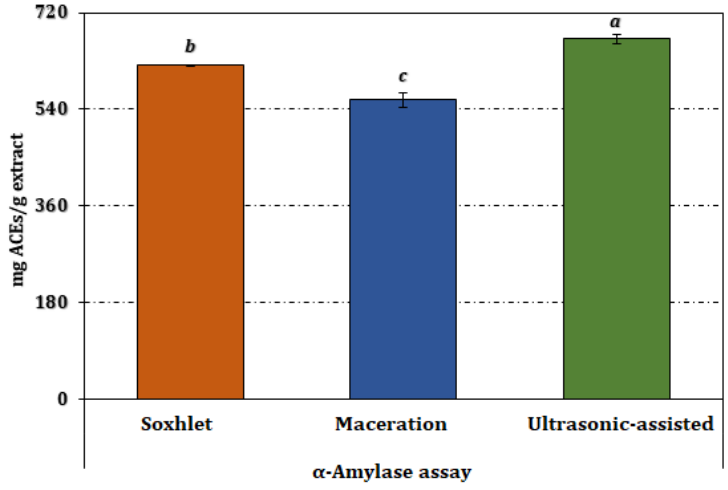

Fig. 3. α-Amylase inhibition activities of methanol extracts

CONCLUSIONS

This study provides the first comprehensive evaluation of the enzyme inhibitory properties of *Stachys longiflora*. The maceration extract showed the strongest inhibition of AChE, Soxhlet and maceration extracts were most effective against tyrosinase, while UAE extract was superior in inhibiting α-amylase. Although less potent than standard drugs, the moderate inhibitory effects of *S. longiflora* extracts underscore their potential as sources of natural bioactive compounds for complementary therapies targeting Alzheimer's disease, diabetes, and dermatological disorders.

Further research, including bioassay-guided fractionation and in vivo validation, is required to isolate the active constituents and confirm their therapeutic efficacy.

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CARRYING OUT THE DROP WEIGHT IMPACT TESTS OF CARBON AND BASALT FIBER REINFORCED POLYMER COMPOSITES

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ABSTRACT

In this study, the low-velocity impact behavior of carbon fiber, basalt fiber, and their hybrid composites was systematically investigated, with special emphasis on a $B_2C_4B_2$ stacking configuration where carbon plies were positioned in the inner region and basalt plies at the outer layers. The composites were subjected to drop-weight impact tests at different energy levels (10, 20, 30, and 40 Joules) to evaluate their damage resistance, energy absorption capacity, and overall structural integrity.

Carbon fiber-reinforced composites exhibited high stiffness and strength, but they were prone to brittle fracture, matrix cracking, and early perforation when exposed to higher impact energies. In contrast, basalt fiber composites displayed superior energy absorption and delayed crack propagation due to the more ductile and compliant nature of basalt fibers. The hybrid laminates revealed a synergistic effect by combining the rigidity of carbon fibers with the toughness of basalt fibers. This hybridization significantly enhanced the overall impact tolerance, effectively delaying perforation and distributing damage more evenly across the laminate thickness. Presence of basalt layers on the outer surfaces contributed to reduced localized fiber breakage and minimized catastrophic failure. The results highlight that an optimized hybrid stacking sequence, such as $B_2C_4B_2$, can provide a balanced mechanical response by ensuring stiffness, damage resistance, and cost-effectiveness. Therefore, hybrid carbon/basalt composites can be considered as promising candidates for structural applications that demand both high performance and improved impact durability under dynamic loading conditions.

Keywords: Carbon fiber; basalt fiber; impact behavior; energy absorbing properties

INTRODUCTION

Polymer composites have been widely used in aerospace, automotive, marine, and defense industries, due to having high specific strength, stiffness, and corrosion resistance (Oladele et al. 2020; Phiri et al. 2024). The success of these materials in structural applications is closely linked not only to their performance under static loads but also to their resistance to dynamic loading such as impact (Pai et al. 2021; Andrew et al. 2019). Low-velocity impact loading, in particular, is a common threat encountered during maintenance activities, transportation errors, or collisions, and can cause serious damage to composite structures (Safri et al. 2014; Kaware et al. 2022). The impact behavior of composite structures varies significantly depending on the fiber type, matrix properties, and fiber sequence (Mulenga et al. 2025). CFRPs are known for their high strength-to-weight ratio and rigidity. However, they exhibit poor interlaminar strength, making them susceptible to sudden breaks under impact loads (Luo et al. 2024; Semitekolos et al. 2025). Hart et al. (2018) highlighted that low-impact events can cause significant internal delamination, leading to reduced compressive strength. Hybrid composite

materials are developed to combine these advantages can offer optimized mechanical performance in terms of both strength and cost properties by leveraging the synergistic effects of different fiber types. Studies have shown that a combination of carbon fiber and glass fiber has been used, with positive results. Regarding this: Ramanan and Rajamurugan (2025) investigated the tensile, flexural and Charpy impact properties of hybrid structures composed of carbon fiber, glass fiber and stainless-steel wire mesh. Dong (2025) investigated the damage modes of glass and carbon fiber reinforced hybrid composites by finite element analysis in terms of fiber alignment and hybridization ratio on flexural behavior. Rajeshkumar et al. (2024) studied the effect of halloysite nano-clay filled carbon/glass hybrid composites on the dynamic mechanical and tribological properties. Huang et al. (2025) examined the impact behavior of composites with hybrid configurations of carbon and glass fibers. It was found that the hybrid combinations exhibited more balanced performance than fiber reinforcements used alone. Dong et al. (2025) examined the impact behavior of carbon and glass fiber reinforced thermoplastic polymer composites. Lei et al. (2023) investigated the low-velocity impact behavior of carbon and glass fiber-reinforced composites and reported that hybrid structures increased impact resistance. The use of glass fibers in conjunction with carbon fibers allowed the damage to spread over a wider area, contributing to more effective dissipation of impact energy. Lv et al. (2025) investigated the behavior and damage mechanisms of carbon, glass, kevlar and basalt fiber reinforced polymers (FRPs) under multi-angle low-velocity impact. Shi et al. (2024) evaluated the low-velocity impact performance of hybrid carbon/glass fiber-reinforced composite tubes according to fiber arrangements. The glass fiber interacted with the carbon fiber, resulting a mechanism that increased energy dissipation and limited fiber damage.

Basalt fibers stand out as an alternative reinforcement material that is naturally derived, environmentally friendly, and exhibits a tougher impact resistance. Studies indicate that basalt fiber can significantly enhance the damage resistance of carbon fiber composites. Rafat et al. (2024) investigated the tensile, flexural, Charpy impact test and water absorption properties of carbon/glass, carbon/basalt and glass/carbon hybrid composites. Wang et al. (2024) investigated the tensile and three-point bending behavior of titanium-based fiber metal laminates reinforced with hybrid carbon and basalt fibers. The findings revealed that incorporating a controlled amount of basalt fibers enhanced the ductility and post-yield behavior of the laminates, while carbon fibers primarily contributed to stiffness and peak load-bearing capacity. It was also observed that the stacking sequence played a pivotal role in governing damage propagation and interfacial synergy. Sun et al. (2024) investigated the effects of different fiber combinations in hybrid composites of basalt and carbon fibers layered composites under ballistic impact. They found that structures containing only carbon fiber offered limited impact resistance, whereas hybrid configurations using basalt and carbon combined both increased energy absorption and limited damage propagation. In particular, arrangements with carbon fibers on the front surface and basalt fibers in the back layers positively impacted the structure's stiffness and post-impact structural integrity. Xu et al. (2024) examined the low-velocity impact behavior of carbon, basalt, and carbon/basalt hybrid composites. They observed that carbon/basalt hybrid structures exhibit more balanced impact response characteristics and absorb damage over a wider area compared to purely reinforced systems. They also noted that the effects of layering sequence and angle parameters on impact resistance are critical for damage distribution and energy absorption performance. Tirillò et al. (2017) found that basalt fibers exhibit advantageous behavior under impulsive loads, demonstrating improved energy dissipation compared to other fiber types in low-velocity impact scenarios Additionally, Bunea et al. (2019) reported that hybrid composites comprising carbon and basalt fibers displayed enhanced impact resistance due to the synergistic effects of both materials, particularly when carbon fibers are placed in the core configuration. However, due to the brittle nature of carbon fibers, their impact resistance can be limited, while basalt

fibers can increase energy absorption at a lower cost. Carbon/basalt hybrid composite structures, by complementing the high strength of carbon with the impact-absorbing capacity of basalt, can provide a more balanced response, particularly to low-velocity impacts.

As seen in literature, the assessment of low-velocity impact features of carbon and basalt fiber-reinforced polymer composites reveals crucial performance indicators, notably energy absorption behavior and damage resistance under stress. Studies have consistently shown that hybrid composites, specifically those combining basalt and carbon fibers, exhibit superior mechanical properties compared to their non-hybrid counterparts. This can be attributed to the complementary characteristics of the two fiber types, where basalt fibers provide ductility and energy absorption capabilities while carbon fibers enhance tensile strength and overall durability. In this study, the low-velocity impact behavior of carbon and basalt fiber-reinforced hybrid composite laminates was systematically investigated. The energy absorption, damage mechanisms, and overall strength performance of composites with different fiber arrangements were comparatively evaluated under impact. The obtained results are intended to contribute to the design of hybrid composites in structural applications requiring impact resistance.

MATERIALS AND METHODS

Manufacturing of the composites

Carbon and basalt plain weaves which have the areal density of 200 g/m^2 were used in this study as seen in Figure 1. Sika epoxy CR80 resin and Sika CH80-2 hardener were used as matrix material. Composite laminates were manufactured as eight layers; $[C]_8$, $[B]_8$ and $[B_2C_4B_2]$ sequences by the vacuum infusion method as 400x400 mm^2 dimensions. After the composites were cured at room conditions for 24 hours, they were subjected to post-curing at 60 ^{0}C for 4 hours. Then, composite plates were cut to sample sizes with a water jet machine. Figure 1 shows the fiber sequences of the laminate composites.

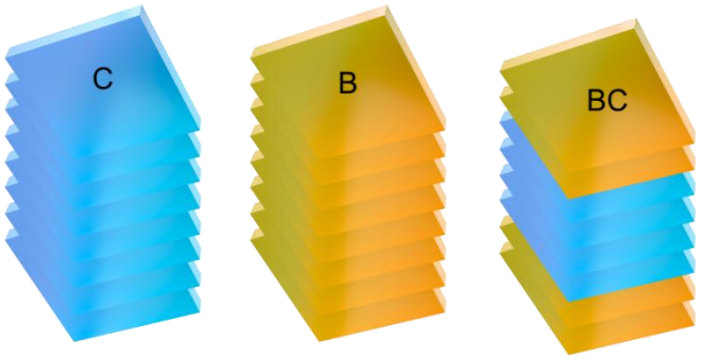

Fig. 1. Fiber sequences of the laminate composites

Impact tests

Low-speed impact tests were performed on the Instron Ceast 9350 testing machine. The striking tip is made of steel with a hemispherical geometry, 20 mm in diameter and 5.5 kg in weight. The samples are held on their upper and lower surfaces by circular fixtures with an inner diameter of 40 mm and an outer diameter of 60 mm. Three different impact energies were studied as 10, 20, 30 and 40 J.

RESULTS AND DISCUSSIONS

Figure 2 shows the force-time and energy-time curves of the composites under 10 Joule impact energy. It is seen that the load carrying abilities of hybrid composites increase by basalt fibers on the carbon fibers. Sudden load drops occur due to the brittleness of the carbon fibers on the front surfaces. Due to the brittle structure of the thermoset resin, cracking occurs in the matrix under impact loading and immediately afterwards, fibers break occurred (Gómez-del Río et al., 2005) In the composite consisting only of basalt fibers, due to the flexible structure of the fibers, energy absorption occurs by moving the striker between the layers and forcing the fibers to stretching. Curves of all composites return to the starting point, called the closed curve under 10J impact energy. This shows that the striker made the rebound in all composites (Viscusi et al., 2020). It was observed that the absorbed energy increases over time upon impact, and after a certain point, the curve flattens and reaches saturation under 10 J.

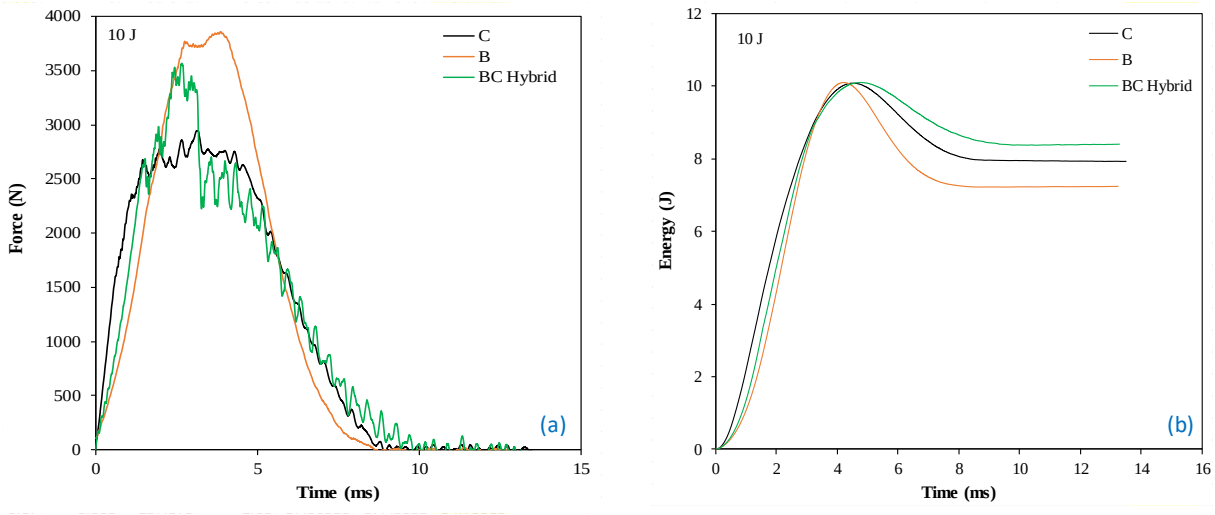

Fig. 2. (a) Force-time and (b) energy-time curves of the composites at 10 joule impact energy

Figure 3 shows the force-time and energy-time curves of the composites under 20 and 30 Joule impact energies. The oscillations in the curves of hybrid composites attract attention because the increase in the number of rigid layers may causes more fiber breaks during impact as seen in literature (Luo et al. 2024; Semitekolos et al. 2025), perforation is observed in carbon fiber composites at 30J impact energy. This shows that the fibers in composites break at 30J and the load-carrying ability of the composite decreases. The ductile basalt fibers at the outer side have a synergistic effect by showing stretching behavior and absorb the impact load. As the impact energy level increases, the penetration limit is approached and the laminate damage effects are reflected in the curves as seen in the literature (Francesconi et al., 2023; Liu et al., 2000). It is seen that carbon fiber and hybrid composites are approaching the penetration limit as the impact energy increases to 20J. It is observed that when the impact energy increases to 30J, composites other than basalt fiber undergo perforation. In this case, the fibers are completely broken and their load carrying ability is completely eliminated. Impact energy increasing caused the contact force an increase. Particularly at the 30J impact energy level, indicates that the sample has perforated and its load-carrying capacity has been completely lost. In contrast, in basalt fiber-containing samples, the energy-time curve exhibits a lower slope and a longer-lasting upward trend. This demonstrates that the ductile structure of fibers allows them to dissipate and absorb impact energy more effectively, making the structure more resistant to perforation as seen in literature (Siddiqui et al., 2023). In basalt-carbon hybrid composites, the

characteristic properties of both fiber types are combined. Basalt fibers on the front surface provide ductility, while carbon fibers on the inter surface exhibit stiffness.

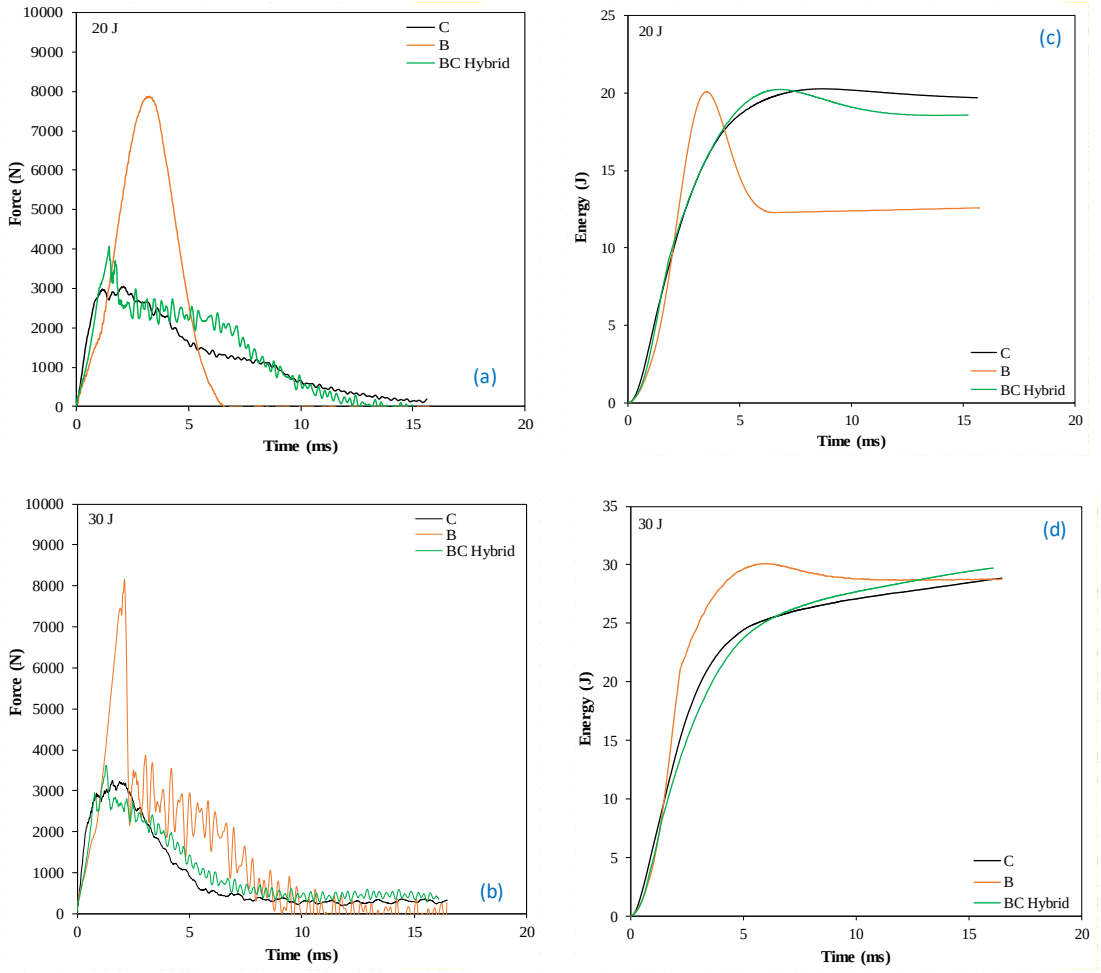

Fig. 3. Energy-time curves of the composites at 20 and 30 Joule impact energies

Figure 4 shows the cross-section views of damage modes at 20 and 30 Joules. At 20 J, carbon fiber-reinforced composites experience sudden fiber fractures and delamination due to their brittle structure, leading to a decrease in load-carrying capacity. In basalt fiber composites, however, due to their ductile fiber behavior, the damage spreads over a wider area and they distribute the impact load. At 30 J, carbon fiber composites completely perforate, while basalt fiber composites, thanks to their higher energy absorption, such as fiber pull out as seen in Figure 4. In hybrid composites, although the carbon layers begin to fracture, the limited number of basalt plies becomes insufficient to provide full protection at higher energy levels.

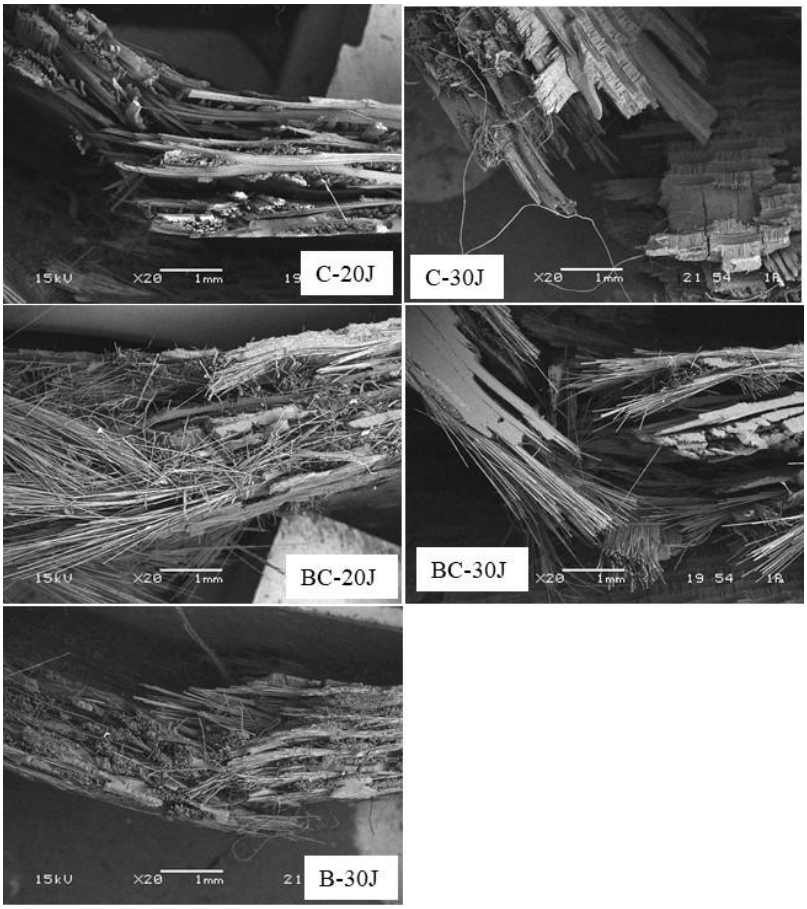

Fig. 4. Cross section views of the damage modes of the composites at 20 and 30 Joules

Figure 5 shows the force-time and energy-time curves of the basalt and basalt/carbon hybrid composites at 40 Joule impact energy. Sudden force drops are observed in both the B and BC hybrid curves. This indicates sudden fiber rupture and, consequently, loss of fiber load-carrying capacity. The high force fluctuations suggest that the structure is undergoing cracking, fiber breakage, and potential delamination (Li et al., 2024; Daouache et al., 2025). In the energy-time curves, the trend begins steeper and reaches a saturation point earlier. This indicates that composite material was complete perforated (Zike et al., 2011).

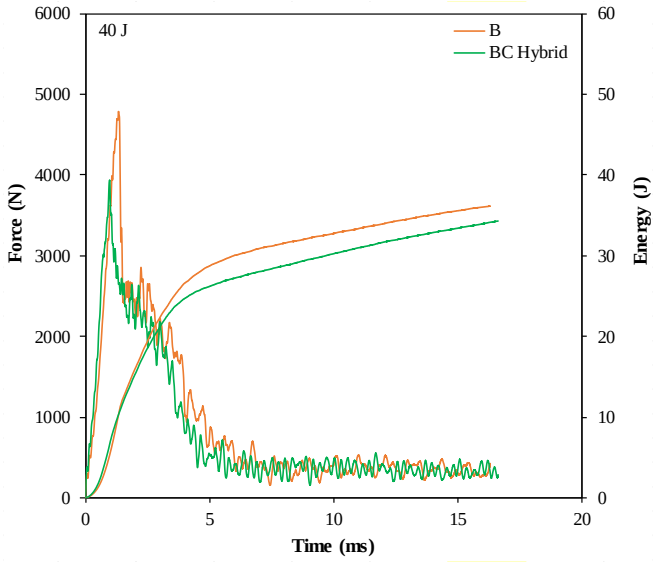

Fig. 5. Force-time and energy time curves of the basalt and basalt/carbon hybrid composites at 40 Joule impact energy

Figure 6 shows the cross-section views of damage modes of basalt and basalt/carbon composites at 40 Joule. At this highest energy level, complete perforation occurs in both structures. The ductile properties of the fibers are prominent in the basalt composites, and fiber pull-out is clearly observed. In hybrid composites, the carbon layers fracture and lose their load-carrying capacity, while the basalt layers attempt to dissipate the impact load but are unable to prevent perforation.

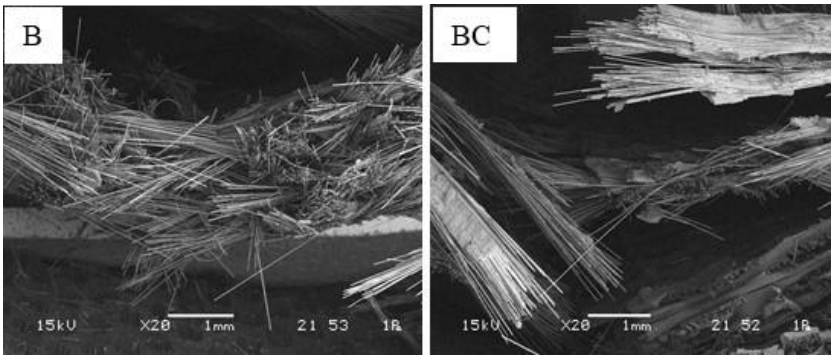

Fig. 6. Cross-section views of the damage modes of B and BC composites at 40 Joule

Table 1 shows the drop weight impact characteristics of the composites. As seen in Table 1, damage severity show that carbon fiber-reinforced composites reach full perforation with increasing impact energy, while basalt fiber composites limit damage by absorbing energy more dispersedly thanks to their ductile structure. Hybrid composites, on the other hand, combine both extremes in a balanced manner, providing advantages in both structural rigidity and energy absorption. In terms of absorbed energy, basalt and hybrid composites exhibited significantly higher energy absorption capacities than carbon fiber composites. Particularly at the 10 J and 20 J levels, the hybrid structure absorbed more energy than carbon fiber composites and exhibited a more durable structure with a lower damage degree. At high energy levels such as 30 J and 40 J, carbon and hybrid structures were perforated, but hybrid composites were able to maintain their structural integrity to some extent by providing higher energy absorption.

Absorbed energy and elastic energy are two fundamental parameters used to understand the energy behavior of a material under impact in low-velocity impact tests. Absorbed energy is the amount of energy absorbed by a material during impact, causing permanent deformations as a result of damage mechanisms. It is the portion of the total impact energy that cannot be elastically recovered. On the other hand, elastic energy, is the energy a material recovers by elastic deformation during impact. This energy is the energy released by the material as it returns to its original state after impact (Han et al. 2024; Mahesh 2024). In low velocity impact, high elastic energy is expected to ensure the structure maintains its function after impact, minimizes permanent deformation and damage, and exhibits reversible elastic behavior (Khashaba 2024; Yao et al. 2025). From the data in the table, it can be seen that when a controlled layer design is made, economical components with high mechanical properties can be produced.

Table 1. Drop weight impact characteristics of the composites

Impact energy	Laminate type	Impact velocity ($m.s^{-1}$)	Residual velocity ($m.s^{-1}$)	Absorbed energy (J)	Elastic energy (J)	Damage degree
10 J	C	1.89	-0.82	7.93	2.07	0.79
	B	1.89	-0.95	7.23	2.77	0.72
	BC	1.89	-0.72	8.39	1.61	0.84
20 J	C	2.68	-0.39	19.72	0.23	0.98
	B	2.68	-1.55	12.52	7.48	0.62
	BC	2.68	-0.73	18.57	1.43	0.92
30 J	C	3.28	0.86	Perforation	0	1.00
	B	3.28	-0.60	28.75	1.25	0.95
	BC	3.28	0.63	Perforation	0	1.00
40 J	B	3.79	1.36	Perforation	0	1.00
	BC	3.79	1.62	Perforation	0	1.00

CONCLUSIONS

In this study, carbon, basalt and basalt/carbon fiber hybrid composites were manufactured and the effects hybridization on the low-velocity impact behavior were experimentally investigated.

- Carbon fiber reinforced composites demonstrated higher stiffness but exhibited sudden failure behavior under impact due to their brittle nature, resulting in early perforation, particularly at 30 J impact energy. In contrast, basalt fiber reinforced composites showed more gradual energy absorption and better resistance to perforation, attributed to the ductile behavior of basalt fibers which allows for progressive deformation and damage distribution.
- Hybrid composites, exhibited a synergistic performance by combining the high rigidity of carbon fibers and the ductility of basalt fibers. This configuration resulted in improved energy absorption capacity and delayed failure, as evidenced by the more stable and extended energy-time curves and the presence of more distributed damage zones than carbon fiber composites.
- The incorporation of cost-effective basalt fibers into hybrid laminates thus presents a promising approach for the development of damage-tolerant, lightweight, and affordable composite structures.

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ng properties

EVALUATION OF TENSILE PROPERTIES OF CARBON/BASALT FIBER HYBRID EPOXY COMPOSITES SUBJECTED TO HYGROTHERMAL AGING

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ABSTRACT

In this study, the tensile behavior of carbon/basalt fiber hybrid reinforced polymer matrix composites was comprehensively investigated under the influence of hot water aging. The specimens were immersed in distilled water at 60 °C for a prolonged period of 120 days in order to simulate hygrothermal conditions and to evaluate the long-term degradation mechanisms on the mechanical performance of the composites. Such exposure is known to induce plasticization of the polymer matrix, microcracking, and fiber-matrix interfacial weakening, which can substantially alter the load transfer efficiency within the composite system.

The hybrid design was selected to effectively combine the high stiffness and strength of carbon fibers with the relatively ductile and energy-absorbing characteristics of basalt fibers, thereby producing a more balanced and damage-tolerant mechanical response. Effect of fiber stacking sequence on tensile performance was systematically examined by employing different layer configurations of carbon and basalt fabrics. Experimental observations revealed that fiber orientation and layer alignment strongly influenced both the ultimate tensile strength and the failure mechanisms, particularly when the material was subjected to hygrothermal degradation.

Overall, the results indicate that hybrid fiber reinforcement can mitigate the detrimental effects of water absorption and thermal exposure, providing an optimal balance between stiffness, deformability, and durability. These findings highlight the potential of carbon/basalt hybrid composites for structural applications where high mechanical performance must be maintained under harsh environmental conditions.

Keywords: Hybrid composites, hygrothermal aging, tensile properties, damage behavior

INTRODUCTION

Carbon fiber reinforced composite materials are widely used in aerospace vehicles, and these components are subjected to various environmental effects such as temperature, humidity, etc. throughout their working lives. These effects play an important role in the mechanical integrity of composite materials. In this regard, Moreno et al. (2019) examined the effects of thermal aging on impact behavior of carbon fiber composites by subjecting them to temperatures between 190 and 210 °C for 10 and 20 days. Short-term aging below the glass transition temperature positively affected impact performance by increasing the adhesion between the matrix and fiber. However, at temperatures above the glass transition temperature, degradation occurred in the matrix, causing the gap between the fiber and matrix to open, and reducing the impact strength of the composites. Yorseng et al. (2022) produced bamboo/basalt/carbon hybrid composites using epoxy and bio epoxy resin and subjected them to thermal conditioning at 120 °C under 100% humidity conditions for 144 h and studied their mechanical properties.

Khashaba and Othman (2017) studied the impact behavior of carbon fiber composites under different temperatures, including room temperature, 50 and 75 °C. Hong et al. (2022) studied Quasi-static tensile, bending and shear tests by exposing carbon fiber/epoxy composite tensile specimens to thermal effects from room temperature to 260 ^{0}C for different durations ranging from 1 to 72 hours. Hawileh et al. (2015) produced carbon, glass, and carbon/glass hybrid composite laminates by heating them to different temperatures between 25 ^{0}C and 30 ^{0}C (45 minutes) and allowing them to cool, then subjecting them to tensile tests. They investigated the changes in tensile strength and modulus of elasticity due to temperature effects. Rathore et al. (2017) performed flexural tests of glass fiber, carbon fiber and glass/carbon epoxy hybrid composites at temperatures of 70 °C, 90 °C and 110 °C. Patnaik et al. (2020) carried out mechanical tests of graphene nano-doped carbon fiber woven epoxy composites under cryogenic environment. Tai et al. (1999) applied thermal fatigue cycles to carbon fiber/peek composites in the range of -60 and +60 °C. Mosallam et al. (2021) investigated the changes in mechanical properties of carbon fiber composites by applying 50 thermal cycles between -31 and +71 °C and ultraviolet radiation for 750 hours. Guo et al. (2022) subjected carbon fiber composites to cryo-thermal cycling tests (-196 ^{0}C) and studied the effects of cycle number and duration on unidirectional and orthotropic samples. Sorrentino et al. (2017) studied the effect of test temperature on the mechanical properties of polyethylene 2,6-naphthalate thermoplastic matrix-based composites. They conducted bending and impact tests at temperatures of 20, 60, and 100 °C using carbon, twaron, vectran, and basalt fibers. Farsani et al. (2013) investigated the hardness and impact strength behavior of basalt, carbon and basalt/carbon phenolic hybrid composites by applying 5-30 thermal fatigue cycles between -30 and 222 °C, with each cycle lasting 6 minutes. Lei et al. (2022) applied various freeze-thaw cycles to carbon fiber/PA6 composites. Freeze-thaw cycles in dry conditions improved mechanical properties by eliminating thermal stresses. Mortas et al. (2014) applied HCL and NaOH solutions to carbon fiber and kevlar epoxy composites and studied the concentration effect of the solutions, the effect of solution exposure time and the effects of solution temperature parameters on the impact performance of the composites. Hossain et al. (2014) studied the low-velocity impact behavior of carbon fiber/epoxy composites and nano clay-added carbon fiber/epoxy composites subjected to seawater corrosion. LeBlanc et al. (2021) investigated the effects of water saturation test and ambient temperature values of 20 °C, 5 °C and -2 °C on the mechanical behavior of the composites on carbon and glass fiber epoxy composites.

The literature demonstrates that thermal effects play a vital role in the mechanical performance of composite materials. In this study, carbon/basalt fiber hybrid composites were stored in pure water at 60°C for 120 days and tensile tests were performed to evaluate the effects of fiber alignment and hybridization ratio on mechanical properties.

MATERIALS AND METHODS

Manufacturing of the composites

In this study, woven carbon fiber with an areal density of 200 g/m² and woven basalt fiber with an areal density of 200 g/m² were used. Sika brand CR 80 epoxy resin and CH 80-2 epoxy hardener were used as matrix materials. Composite laminates were produced in eight layers using a vacuum infusion system, using C_4B_4, $C_2B_4C_2$, and $B_2C_4B_2$ fiber sequences as shown in Figure 1a. Tensile test coupons were cut according to ASTM D3039 standard. Specimen sizes are consisted of 250 mm X 25 mm length and width dimensions, respectively. Tests were conducted at a test speed of 2 mm/min. Aluminum tabs were attached to the ends of the sample jaws to prevent damage to the contact surfaces during the test.

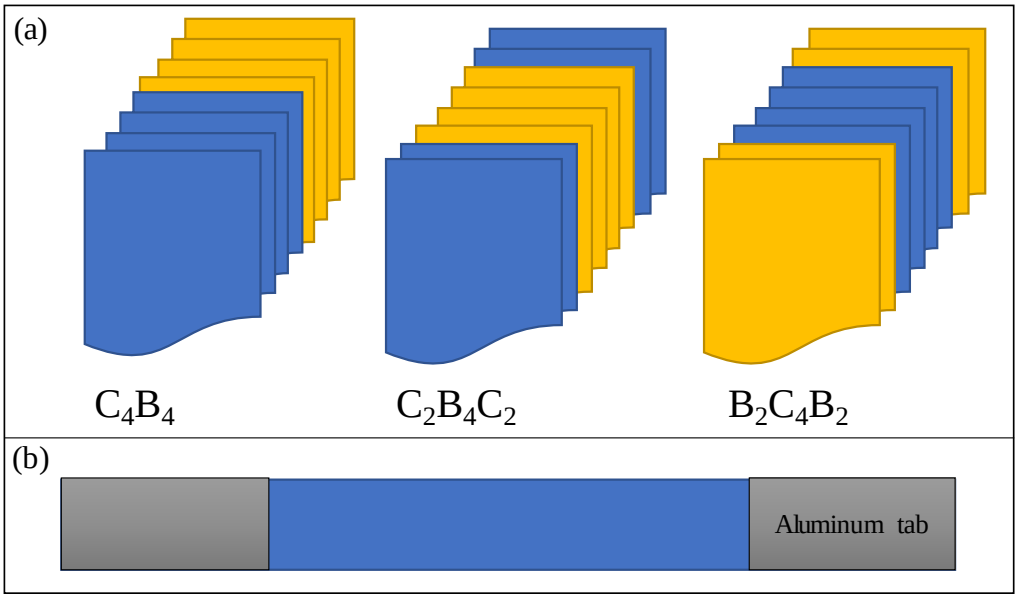

Fig. 1. (a) Fiber sequences and (b) schematic representation of test coupon

Aging procedure

Samples were held in a hand-made hot water aging chamber shown in Figure 2, 60 °C for 120 days to examine the hygrothermal behavior of the composites.

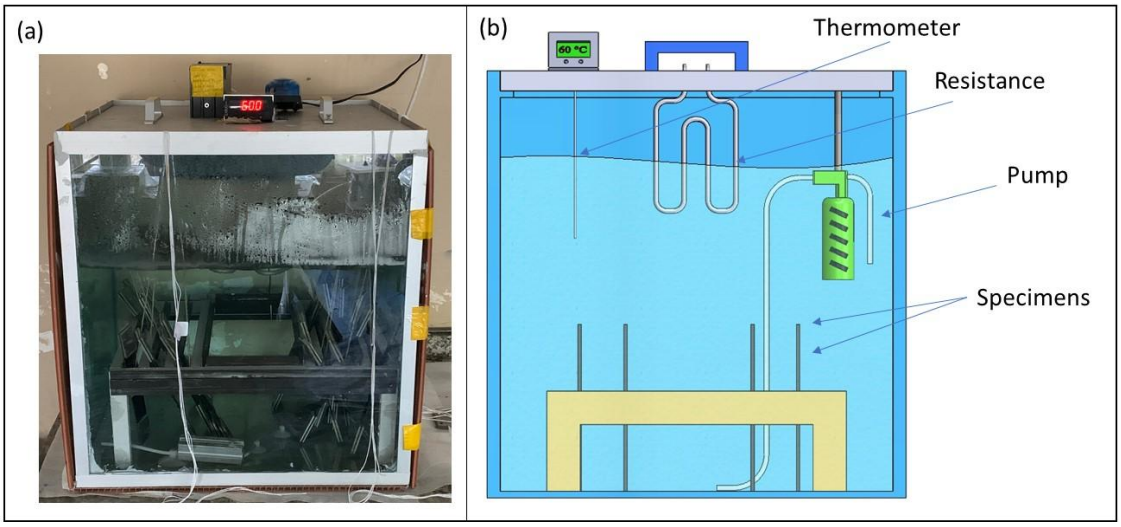

Fig. 2. (a) Handmade hygrothermal aging cabin, (b) Schematic representation of the components

RESULTS AND DISCUSSIONS

Figures 3 and 4 show the tensile test results of the unaged hybrid composites Fiber sequence plays a significant role in load distribution in hybrid composites. One of the most important reasons for this is the different elastic modulus of carbon and basalt fibers. Under tensile loads, the lower ductility of carbon fiber and the greater flexibility of basalt fiber can lead to stress incompatibility, leading to premature fracture. Examining the tensile test curves of hybrid composites clearly demonstrates the influence of fiber combinations on mechanical behavior. Composites with carbon fibers at the front surface (C_4B_4) exhibit high elastic modulus than $B_2C_4B_2$ resulting in a stiff structure. However, fracture in these composites is generally more

brittle and occurs abruptly. In contrast, although basalt fibers at the outer surfaces exhibit lower elastic modulus, their higher deformation capacity suggests that these structures are more ductile. While carbon fibers offer superior tensile strength, basalt fibers are more advantageous in terms of ductility. This demonstrates that basalt fibers can absorb greater deformation and exhibit more elastic behavior before fracture. On the other hand, in hybrid structures with carbon fibers at the center, the load is effectively distributed between the two fibers, resulting in higher tensile strengths than other hybrid structures. Furthermore, due to the brittle nature of carbon fibers, the outer layer can be damaged more rapidly. A similar situation has been observed in the literature (Jesthi et al. 2019; Jesthi et al. 2019).

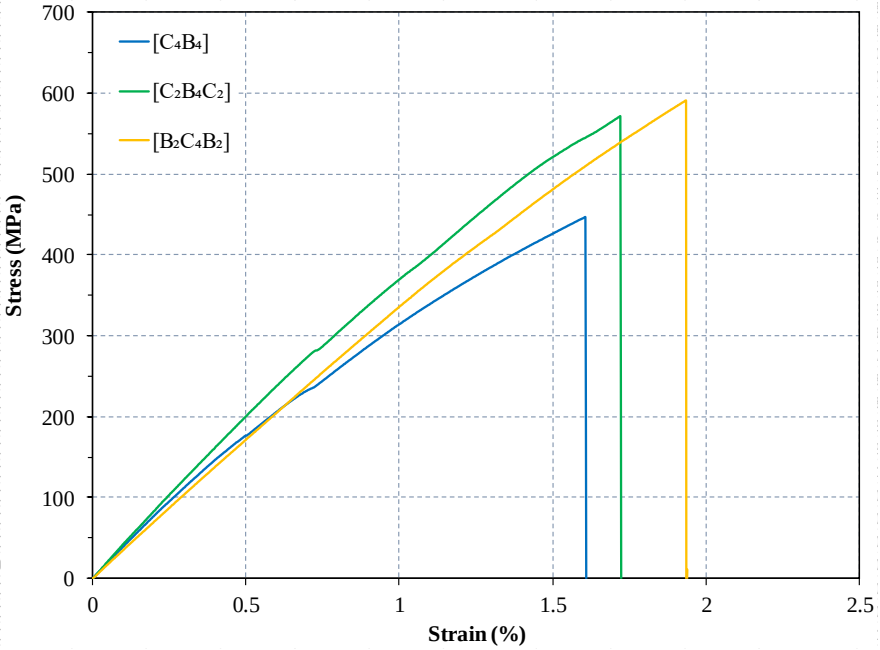

Fig. 3. Tensile curves of the unaged hybrid composites

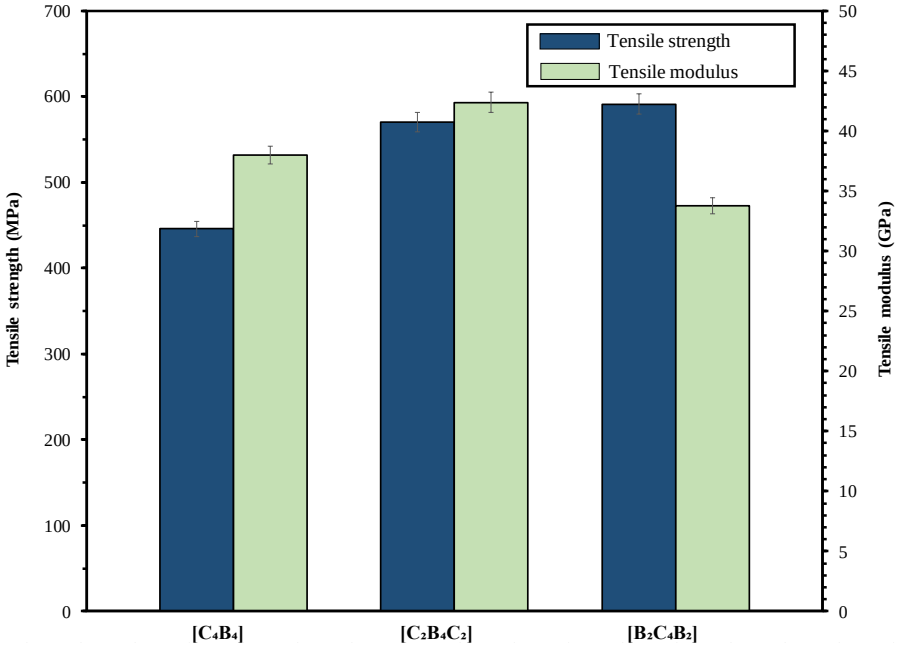

Fig. 4. Tensile strength and tensile modulus of the unaged hybrid composites

Figures 5 and 6 show data obtained from tensile tests on hybrid composite samples aged by exposure to water for 120 days at 60°C. A decrease in tensile strength and elastic modulus

values was observed in all configurations after aging. This can be explained by plasticization of the epoxy matrix due to hot water, microstructural deterioration at the fiber-matrix interface resulting from water absorption, and weakening of interfacial bonds (Krauklis et al. 2023; Soykok et al. 2013). Structures with basalt fibers on the outer surface, in particular, experience greater strength loss, revealing their proneness to water absorption.

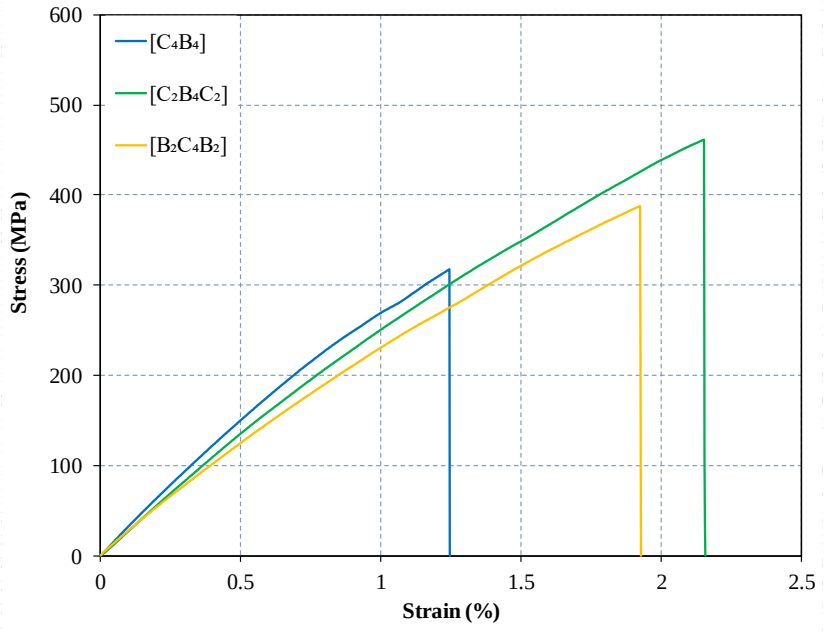

Fig. 5. Tensile curves of the hygrothermal aged hybrid composites

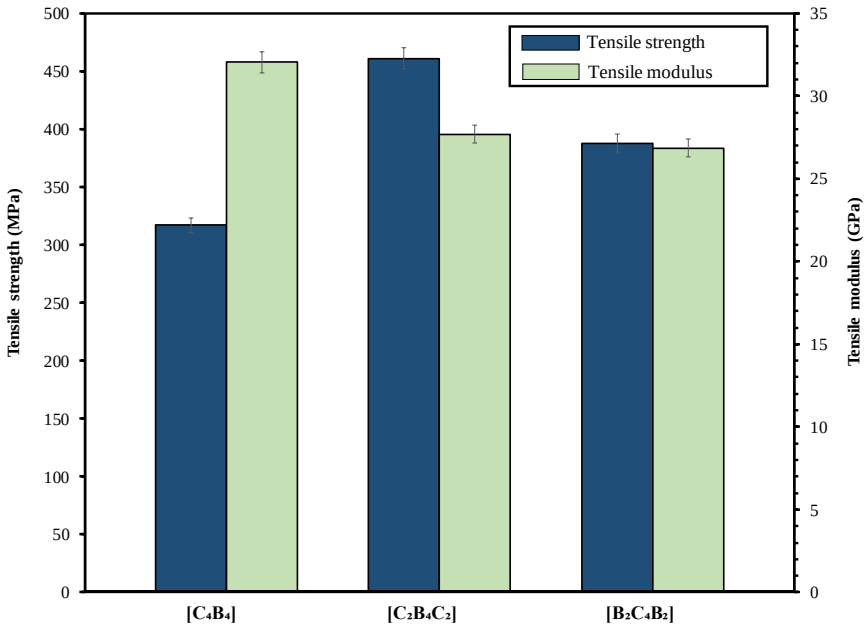

Fig. 6. Tensile strength and tensile modulus of the aged hybrid composites

When evaluating the influence of hydrothermal aging on the tensile properties of the hybrid composite configurations, a significant reduction in mechanical performance was observed across all specimens. Specifically, the C_4B_4 configuration exhibited a 28.92% decrease in tensile strength, whereas the $C_2B_4C_2$ and $B_2C_4B_2$ configurations showed reductions of 18.56% and 34.57%, respectively. These results indicate that the placement of basalt fibers on the outer surfaces, as in $B_2C_4B_2$, makes the composite more susceptible to water ingress and interfacial degradation, leading to greater strength deterioration. In terms of elastic modulus, a similar

trend was observed: the C_4B_4 composite demonstrated a reduction of 15.78%, the $C_2B_4C_2$ configuration exhibited the highest decline at 34.64%, and the $B_2C_4B_2$ structure showed a 20.50% decrease. These reductions can be attributed to microcrack formation at the fiber–matrix interface, and weakened interfacial bonding due to prolonged water exposure at elevated temperature (Amara et al. 2005; Chowdhury et al. 2005). The varying degrees of degradation across the different hybrid configurations underscore the critical role of fiber stacking sequence in behavior of moisture resistance and mechanical properties under hygrothermal conditions.

Figure 7 shows the damage surfaces of unaged hybrid composites after tensile testing. When examining the post-tensile damage surfaces of unaged hybrid composites (Figure 7), the combined use of carbon and basalt fibers with different elastic moduli resulted in tensile mismatches at the fiber-matrix interfaces. This mismatch results in typical failure modes such as fiber-matrix separation and interlayer delamination. Studies such as Hawileh et al. (2015) and Rathore et al. (2017) have similarly noted that in hybrid composites using carbon and glass fibers, load transfer difficulties are experienced, particularly between fibers with different thermal expansion coefficients and elastic moduli, leading to interface weakness.

Specimen	Front	Rear	Cross section
C_4B_4			

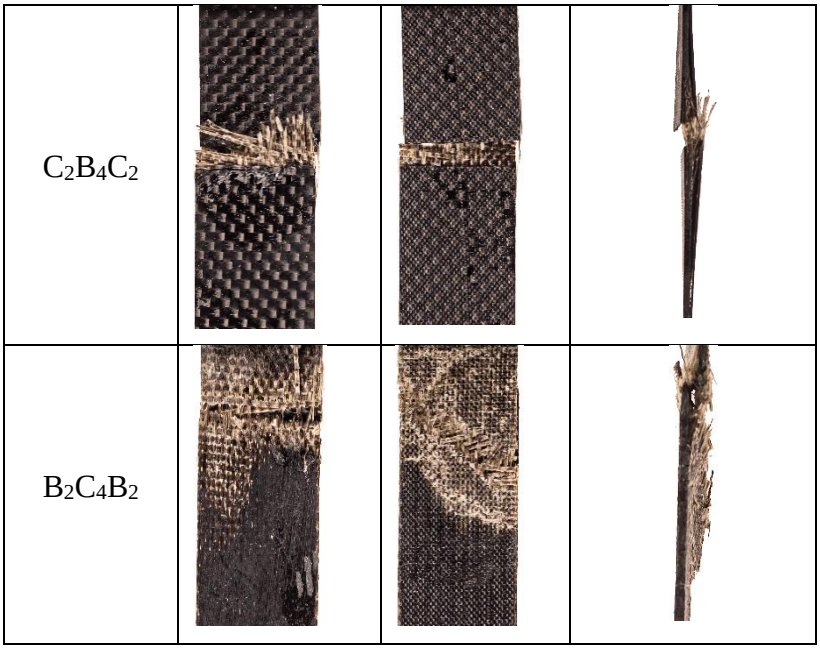

Fig. 7. Tensile failures of unaged carbon/basalt hybrid composites

Figure 8 shows the damage surfaces of the same configurations after tensile testing at 60°C for 120 days in hot pure water. Damage images of aged samples demonstrate that prolonged exposure to hot water has a significant degradative effect on the composite structures. The mechanical integrity of the composites is significantly compromised, particularly through effects such as matrix plasticity, weakening of fiber-matrix bonds, and microcrack formation. Similar situation has been seen in the literature. For example, LeBlanc et al. (2021), in experiments examining carbon and glass fiber-reinforced epoxy composites under water saturation and low temperature, observed increased bond failure and delamination at the interface. Similarly, Hossain et al. (2014) reported that carbon fiber composites exposed to seawater developed more severe damage after low-velocity impacts, and that aging, in particular, compromised interface integrity and reduced mechanical performance. The presence of carbon fibers on the exterior of the C_4B_4 and $C_2B_4C_2$ configuration exacerbated brittle fracture behavior after aging. This confirms that carbon fibers, due to their high stiffness, are more vulnerable to environmental influences in the outer layer and more prone to interface separation, as observed by Guo et al. (2022) in carbon fiber composites subjected to cryothermal cycling. The presence of basalt fibers in the exterior layers of the $B_2C_4B_2$ configuration increased water absorption, making the structure more susceptible to strength loss. This supports the observation by Eslami-Farsani et al. (2013) that basalt fibers tend to retain more water after thermal cycling in basalt and carbon-reinforced phenolic composites, which accelerates interfacial damage.

Specimen	Front	Rear	Cross section
C_4B_4			

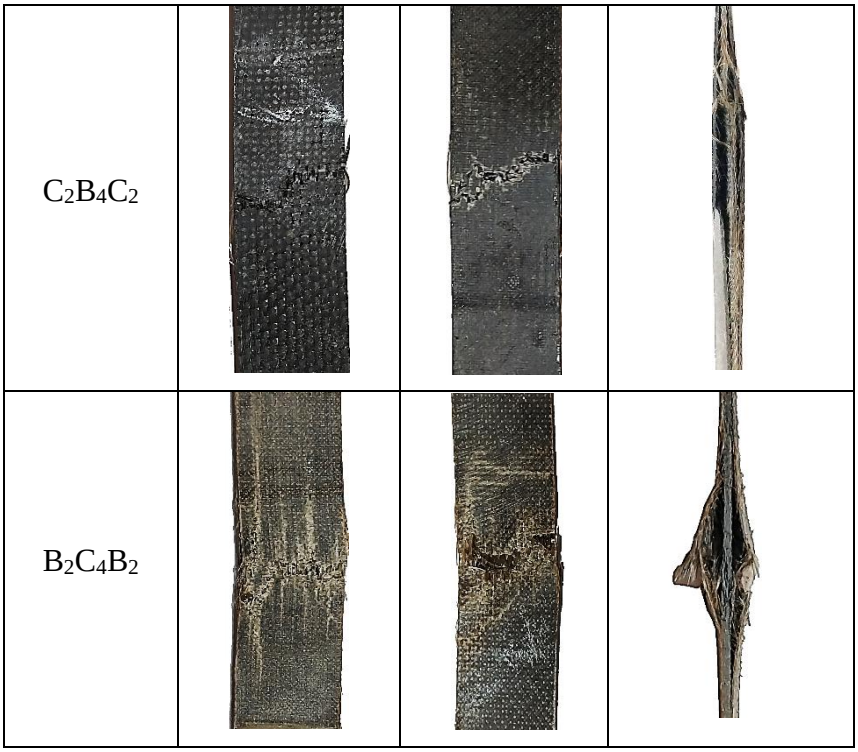

Fig. 8. Tensile failures of aged carbon/basalt hybrid composites

CONCLUSIONS

In this study, the mechanical performance of carbon/basalt fiber reinforced hybrid composites were investigated under hygrothermal aging conditions. The results indicate that fiber stacking sequence plays a critical role in determining tensile strength, stiffness, and failure behavior. These points can be listed as follows:

- Stacking sequence had a decisive influence on tensile behavior. In the unaged condition, composites with carbon fibers placed in the center exhibited the highest tensile strength due to more efficient load sharing, whereas with carbon fibers on the outer layers provided the highest stiffness.
- Hygrothermal aging significantly reduced tensile strength and elastic modulus in all composite configurations due to matrix plasticization, water absorption, and interfacial degradation.
- The $B_2C_4B_2$ laminate exhibited the highest strength reduction, indicating the vulnerability of basalt fibers on the outer surface to moisture ingress. Otherwise, the $C_2B_4C_2$ configuration, with carbon and basalt fibers arranged symmetrically, showed better retention of mechanical properties due to more balanced load distribution.
- In the unaged specimens, delamination and fiber pull-out occurred due to stiffness differences between carbon and basalt fibers, whereas in the aged specimens, hot water exposure caused matrix softening and bond degradation, leading to stronger interfacial separation.

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TANISAL PATOLOJIDE İMMÜNOHISTOKIMYANIN KULLANIMI: GÜNCEL BIYOBELIRTEÇLER VE YÜKSEK DUYARLILIKLI TANI YÖNTEMLERI

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Özet

Antijen-antikor etkileşimine dayalı güçlü bir analiz yöntemler bütünü olan immünohistokimya, histopatolojik tanı süreçlerinde hücre ve doku düzeyinde belirli proteinlerin saptanmasını sağlar. Spesifik proteinlerin başarıyla saptanması, kanser türlerinin doğru teşhis ve tedavisinde son derece önemlidir. Moleküler patoloji ile histolojik morfolojiyi entegre edebilen immünohistokimyasal yöntemler sayesinde hem tanı koymada hem de hastalığın biyolojik davranışını öngörmede başarılı sonuçlar elde edilebilir. Ayrıca, prognostik değerlendirmelerde ve hedefe yönelik tedavi stratejilerinin belirlenmesinde de önemli rol oynar. Günümüzde immünohistokimyasal teknikler; konvansiyonel tümör sınıflandırmasından, kişiselleştirilmiş tıp uygulamalarında prediktif biyobelirteçlerin değerlendirilmesine kadar geniş bir yelpazede kullanılmaktadır. Antikor teknolojilerindeki gelişmeler sayesinde rekombinant monoklonal ve tavşan kaynaklı antikorların üretiminde, immünohistokimyasal verilerin duyarlılığında ve özgüllüğünde ilerlemeler meydana gelmiştir. Multiplex immüno histokimya sistemleri kullanılarak aynı doku örneğinde çoklu biyobelirteçler eşzamanlı olarak değerlendirilebilmektedir. Bu sayede tümör mikroçevresi, bağışıklık hücre popülasyonları ve terapötik hedefler daha ayrıntılı olarak analiz edilebilmektedir. Dijital patolojik yöntemler ve yapay zekâ algoritmaları immünohistokimya analizlerine entegre edilerek, subjektif değerlendirmelerin önüne geçilmiştir. Böylece olabilecek hatalar en aza indirgenerek daha objektif, tekrarlanabilir ve kantitatif sonuçlar elde etmek mümkün hale gelmiştir. Modern immünohistokimya uygulamaları otomatik boyama sistemleri ve kalite kontrol protokolleri ile desteklenerek, karşılaştırılabilir tanı verileri elde edilmektedir. Rutin tanısal işlemleri kolaylaştıran bu süreç sayesinde, immün kontrol noktası inhibitörleri, hedefli ajanlar ve füzyon inhibitörleri gibi modern tedavilere uygun hasta seçimi başarıyla gerçekleştirilebilmektedir. Bu çalışma, immünohistokimyanın teknik altyapısında ve klinik uygulamalarında yaşanan güncel gelişmeleri disiplinler arası bir perspektif ile ele almayı amaçlamaktadır. Ayrıca, yeni nesil antikor teknolojileri, multiplexleme stratejileri, dijital analiz sistemleri ve yapay zekâ destekli patoloji uygulamalarının yanı sıra, gelecekte immüno histokimya'nin moleküler biyoloji ve transkriptomikle entegrasyon potansiyelini de kapsamlı bir şekilde irdelemektedir. Sunulan çalışmada, immünohistokimyanın tanısal patolojide kullanımı ve yeni tanı yöntemleri hakkında bilgi sunmak amaçlanmıştır.

Anahtar Kelimeler: İmmonuhistokimya, tanısal patoloji, biyobelirteçler, antikor teknolojileri.

THE USE OF IMMUNOHISTOCHEMSITRY IN DIAGNOSTIC PATHOLOGY: CURRENT BIOMARKERS AND HIGH-SENSITIVITY DIAGNOSTIC METHODS

Abstract

Immunohistochemistry, a powerful analytical method based on antigen-antibody interactions, enables the detection of specific proteins at the cellular and tissue levels in histopathological diagnostic processes. The successful identification of specific proteins is crucial for the accurate diagnosis and treatment of various cancer types. Immunohistochemical methods that integrate molecular pathology and histological morphology can yield successful results both in diagnosis and in predicting the biological behavior of the disease. They also play a crucial role in prognostic assessments and the development of targeted treatment strategies. Currently, immunohistochemical techniques are used in a wide range of applications, from conventional tumor classification to the evaluation of predictive biomarkers in personalized medicine. Advances in antibody technologies have led to improvements in the sensitivity and specificity of immunohistochemical data, including the production of recombinant monoclonal and rabbit-derived antibodies. Multiplex immunohistochemistry systems allow for the simultaneous assessment of multiple biomarkers in the same tissue sample. This allows for more detailed analysis of the tumor microenvironment, immune cell populations, and therapeutic targets. By integrating digital pathological methods and artificial intelligence algorithms into immunohistochemistry analyses, subjective assessments have been eliminated. This minimizes potential errors and enables more objective, reproducible, and quantitative results. Modern immunohistochemistry applications are supported by automated staining systems and quality control protocols, yielding comparable diagnostic data. This process, which simplifies routine diagnostic procedures, enables successful patient selection for modern therapies such as immune checkpoint inhibitors, targeted agents, and fusion inhibitors. This study aims to examine current developments in the technical infrastructure and clinical applications of immunohistochemistry from an interdisciplinary perspective. It also comprehensively examines next-generation antibody technologies, multiplexing strategies, digital analysis systems, and AI-assisted pathology applications, as well as the potential for future integration of immunohistochemistry with molecular biology and transcriptomics. The presented study aims to provide information about the use of immunohistochemistry in diagnostic pathology and new diagnostic methods.

Keywords: Immunohistochemistry, diagnostic pathology, biomarkers, antibody technologies.

Giriş

Modern patolojinin temel taşlarından biri olan immünohistokimya; prognostik ve prediktif amaçlarla yaygın olarak kullanılan bir disiplindir (Mahajan 2016). 1940'da immünolojik yöntemlerin histolojik örneklere uyarlanmasıyla temelleri atılan bu yöntem; gelişen antikor üretim teknolojileri, boyama yöntemleri ve analiz uygulamalarının yardımıyla günümüzdeki ileri haline ulaşmıştır. Temel olarak antijen-antikor etkileşimine dayalı olan İmmünohistokimya, belirli bir proteinin doku kesitindeki yerini saptama esasına dayanmaktadır. Bu yöntemle hem hücresel hem de subhücresel seviyede hedef proteinler gösterilerek hastalığın patobiyolojisi hakkında doğrudan bilgi sağlanır. Günümüzde immüno histokimya sadece tümörlerin histolojik açıdan sınıflandırılmasında değil, aynı zamanda kanser alt tiplerinin tanımlanması, moleküler hedeflerin belirlenmesi, immün yanıt profillerinin oluşturulması ve tedaviye yönelik kararlara yön verilmesi gibi pek çok alanda kullanılmaktadır.

Akciğer ve meme kanseri, lenfomalar, nöroendokrin ve gastrointestinal sistem tümörlerinde immüno histokimya'nin önemi giderek artmaktadır. Pd-l1, Her2, Ki-67, Cd20 ve P53 gibi biyobelirteçler, bu anlamda en sık kullanılan proteinlerdendir (Lin ve Chen, 2014).

Teknolojik ilerlemelere bağlı olarak, immünohistokimyanın uygulama alanları da genişlemiştir. Rekombinant antikorlar, poliklonal ve klasik monoklonal antikorlara kıyasla daha özgül ve stabil olup, analitik doğruluğu yüksektir. Bunun yanında, multi biyobelirteçlerin aynı kesitte eşzamanlı olarak analizine izin veren multiplex immünohistokimya teknikleri sayesinde, tümör heterojenitesinin ve bağışıklık mikroçevresinin daha derinlemesine incelenmesi mümkündür (Glenn 2007). Bu gelişmeler ışığında kişiselleştirilmiş tedavi yaklaşımlarının önünü açan prediktif patoloji, immünohistokimyasal yöntemlerle daha güçlü bir temele kavuşmuştur. Bu makalede immünohistokimyanın tarihsel gelişimi ve teknik altyapısı, günümüzdeki uygulama alanları ve teknolojik yenilikleri kapsamlı olarak ele almayı amaçlamaktadır. Ayrıca yapay zekâ destekli analizler, dijital patoloji, otomatik boyama sistemleri, moleküler patoloji ile entegrasyon ve kalite kontrol uygulamaları gibi çağdaş başlıklar da ele alınmıştır.

C. *2. Yeni antikor gelişimi ve validasyon*

İmmünohistokimyada kullanılan antikorların özgül, standart ve duyarlı olması, yöntemin başarısını doğrudan etkiler. Poliklonal ve fare monoklonal antikorları geleneksel yöntemler olup çapraz reaktivite, düşük yeniden üretilebilirlik ve hedef dışı bağlanma gibi sınırlılıkları vardır. Bu gibi problemler yeni nesil antikor teknolojilerinin geliştirilmesini teşvik etmiş olup bu kapsamda tavşan monoklonal antikorlar, rekombinant antikorlar ve sentezlenmiş fragment antikor teknolojileri son yıllarda öne çıkmaktadır (Roskams 2002).

Genetik mühendisliği teknikleri kullanılarak üretilen rekombinant antikorlar, in vitro ortamda üretilir ve istenilen epitopa yüksek özgüllükle bağlanacak yapıda tasarlanabilirler. Bu özellikleri nedeniyle bilhassa düşük ekspresyonlu hedef proteinlerin tanımlanmasında klasik antikorlardan çok daha üstün performans sergileyebilirler. Benzer şekilde, memeli hücrelerinde daha zengin epitop tanıma profiline sahip olan tavşan monoklonal antikorları, özellikle onkolojik biyobelirteçlerin tanımlanmasında yaygın olarak tercih edilir (Chapel 2020).

İmmünohistokimyada kullanımına sunulmadan önce antikorlar çeşitli validasyon süreçlerinden geçirilir. Antikorun belirli bir hedef antijene özgü olarak bağlandığını ve doğru sonuçlar verdiğini kanıtlayan sistematik testler bütünü olan Validasyon sürecinde bazı temel teknikler kullanılır (Ruiz ve ark 2005).

- **Western blot**: Hedef proteinin moleküler ağırlığındaki spesifik bağlanmayı test eder.
- **Peptid inhibisyon testi**: Antikorun bağlandığı epitope özgüllüğünü teyit eder.
- **Knockout doku kullanımı**: Hedef proteini eksprese etmeyen hücre veya dokularda antikorun bağlanmaması beklenir.
- **İn situ hibridizasyon karşılaştırması**: Protein düzeyi ile RNA ekspresyonunun korelasyonunu değerlendirir.
- **Doku mikrodizileri**: Çok sayıda doku örneğinde aynı anda antikor performansını ölçmeye olanak tanır.

Günümüzde Uluslararası Antikor Validasyon Çalışma Grubu tarafından validasyon süreçlerini standart hale getirebilmek için yeni kriterler geliştirilmiştir. Bu kriterlerin amacı, klinik uygulamalarda kullanılması hedeflenen antikorların güvenilirliğini artırmak ve sonuçların laboratuarlar arasında karşılaştırılabilirliğini sağlamaktır (Kohale ve ark., 2023). Bbiyoinformatik destekli antijen-antikor modelleme sistemleri ve yapay zekâ tabanlı

algoritmalar sayesinde antikorların in silico validasyonu mümkün hale gelmiştir. Biyosensör temelli tespit sistemleri, nanoteknoloji destekli antikor sentezi ve kimyasal modifikasyon teknikleri sayesinde antikorların duyarlılığı ve doku içi penetrasyon kabiliyeti artırmaktadır. Bütün bu gelişmeler, immünohistokimyanın tanı gücünü artırmakla birlikte, aynı zamanda prediktif ve prognostik biyobelirteçlerin daha hassas değerlendirilmesine imkan vermektedir. Bu sayede, kişiselleştirilmiş tıbbın gereksinim duyduğu moleküler doğruluk düzeyine ulaşma yolunda immünohistokimya önemli bir araç haline gelmektedir.

D. *3. Multiplex immünohistokimya*

Multiplex immünohistokimya yöntemi sayesinde, aynı doku kesitinde birden fazla antijenin eşzamanlı görüntülenmesi mümkündür. Geleneksel immünohistokimyada her kesitte tek bir antijen gösterilirken, bu yöntem sayesinde çok sayıda biyobelirteçin floresan ya da kromojenik sistemlerle etiketlenme yoluyla birlikte analizi mümkündür (Mebratie ve Dagnaw, 2024). Tümör mikroçevresinde immün yanıtın ayrıntılı olarak incelenmesinde çok değerli bilgiler sağlayan bu teknik, hem renk ayrışması hem de sinyal amplifikasyonu konusunda yüksek verimlilik sağlamaktadır. Bu yöntem kullanılarak elde edilen veriler, mekansal biyoloji alanında yeni perspektifler kazandırmaktadır.

E. *4. Dijital patoloji ve yapay zekâ destekli analizler*

Dijital patoloji, preparatların tam alan tarayıcılarla dijital ortama aktarılmasıyla sağlanan görüntüler aracılığıyla patolojik analizlerin bilgisayar destekli yapılmasına imkan verir. Bu dijitalleşme süreci sayesinde, immünohistokimya analizlerinde otomatik sayımlardan boyama yoğunluğu tayinine kadar pek çok nicel değerlendirme yapay zekâ algoritmalarıyla desteklenmektedir (Sheffield, 2016). Makine öğrenmesi ve derin öğrenme modelleri, pd-l1 skorlamasından ki-67 indeks hesaplamasından kadar çok sayıda biyobelirtecin yorumlanmasında katkı sunabilir. Yapay zekâ teknikleri, görüntülerdeki varyasyonları azaltarak standart hale getirdiği gibi yorum farklılığını da azaltır.

F. *5. Klinik uygulamalarda prediktif biyobelirteçler*

Hastaların tedaviye yanıt verip vermeyeceğini öngörmede kullanılan biyomoleküler göstergelere Prediktif biyobelirteçler adı verilir. Bu belirteçlerin saptanmasında temel yöntemlerden olan immünohistokimya, kişiselleştirilmiş tedavi kararlarını yönlendirmede de tercih edilir. Günümüzde onkolojide kullanılan pek çok hedefe yönelik ajan, bu biyobelirteçlerin varlığına bağlı olarak uygulanmaktadır (McCluggage ve Young, 2005). Bu amaçla, immünohistokimya ile değerlendirilen başlıca prediktif biyobelirteçler şunlardır:

- **Her2 (Human Epidermal Growth Factor Receptor 2)**: Meme ve mide kanserlerinde Her2 aşırı ekspresyonu, trastuzumab gibi Her2 hedefli tedavilere uygunluk açısından belirleyici bir yöntemdir. Skorlama sistemiyle standardize edilen Her2 değerlendirmesi tedavi planlamasında doğrudan rol oynamaktadır (Tuffaha ve ark., 2017).
- **Pd-L1 (Programmed Death-Ligand 1)**: Pembrolizumab ve nivolumab gibi immün kontrol noktası inhibitörleri için kullanılan önemli bir biyobelirteç olan Pd-L1 boyama skorları, farklı klonlarla yapılan, tümör hücreleri veya tümörle ilişkili immün hücrelerdeki ekspresyon düzeyine göre belirlenir (Bonacho, 2020).
- **Alk, Ros1, Ntrk füzyonları**: Akciğer kanseri gibi solid tümörlerde görülen bu gen füzyonları, immünohistokimyasal yöntemlerle belirlenebilmekte ve hedefe yönelik olarak tirozin kinaz inhibitörü tedavileri için kullanılmaktadır.
- **Mismatch repair proteinleri (Mlh1, Msh2, Msh6, Pms2)**: DNA bozuklukları ve mikrosatellit instabilitesiyle ilişkili bu proteinlerin eksikliği, kolorektal kanserlerde immünoterapiye yanıtı öngörmede ve Lynch sendromu taramasında kullanılabilir.

Birden fazla sayıda biyobelirtecin aynı anda değerlendirilebildiği multiplex immünohistokimya sistemler kullanılarak, hem tümörlerin moleküler heterojenitesi hem de bağışıklık mikroçevresi hakkında kapsamlı bilgiler elde edilebilir. İmmünohistokimyanın dijital patoloji platformları ile entegrasyonu sayesinde, Pd-l1 ve Ki-67 gibi biyobelirteçlerin daha objektif olarak değerlendirilmesi mümkündür (Taylor ve ark., 2013). Gün geçtikçe gelişen yapay zekâ destekli analiz sistemleri sayesinde prediktif biyobelirteçler değerlendirilebilir ve gözlemci varyasyonları azalır. Bu durum; sonuçların güvenilirliğini ve klinik geçerliliğini artıran önemli bir faktördür. İmmünohistokimya sadece bir tanı yöntemi değil, kişiselleştirilmiş tıbbın temel bileşenlerinden birisi haline gelmiştir.

G. *6. Otomasyon ve kalite kontrol*

İmmünohistokimyasal süreçler, gelişen teknolojiyle birlikte tam otomatik sistemler tarafından otonom olarak yürütülebilmektedir. Bu sistemler, hem boyama protokollerini standart hale getirirken hem de reaktif tüketimini azaltarak verimliliği artırır (Gown, 2016). Leica bond, ventana benchmark ve dako omnis gibi sistemler; başta otomatik antijen geri kazanımı, antikor inkübasyonu, yıkama ve kromojen gibi uygulamaları yüksek hassasiyetle yürütebilir. İmmünohistokimyanın doğruluğu açısından hayati önem taşıyan kalite kontrol sistemleri arasında Nordiqc, UK Neqas ve Cap gelmektedir. Bu sistemler sayesinde hem laboratuvarların iç ve dış kalite kontrolleri sağlanmakta hem de çalışmalar standart hale gelmektedir (Kim, 2016).

H. *7. Geleceğe yönelik perspektifler*

Teknolojik ve biyolojik yeniliklere paralel olarak önümüzdeki yıllarda immünohistokimyanın daha da gelişmesi beklenmektedir. Yüksek çözünürlüklü görüntüleme sistemleriyle yapay zekâ destekli algoritmalarla birleşmesi sayesinde immünohistokimyasal analizlerin klinik tanı, prognostik değerlendirme ve tedavi kararlarına entegrasyonunu kolaylaştıracaktır. Yakın gelecekte, dijital patoloji altyapılarının yaygınlaşması sonucunda immünohistokimyasal sonuçların uzaktan erişimle yorumlanması ve bulut tabanlı yapay zekâ sistemleriyle analizi mümkün hale gelecektir (Oumarou ve ark., 2022). Bununla birlikte transkriptomik, proteomik ve metabolomik verilerin birlikte kullanımı sayesinde immünohistokimyasal yöntemlerle elde edilen verilerin biyolojik anlamı derinleşerek kişisel tıbbın yeni boyutları ortaya çıkacaktır. İmmünohistokimya ile eşzamanlı olarak spatial transcriptomics ya da RNA in situ hibridizasyon gibi teknolojilerle entegrasyonu, tümör mikroçevresinin protein yapısının ve genetik düzeyinin ayrıntılı olarak analizini mümkün kılacaktır (Fedchenko ve Reifenrath, 2014). Tamamen otomatikleştirilmiş boyama ve analiz sistemlerinin de gelecekte daha yaygın hale gelmesi beklenmektedir. Bu sistemlerin insan hatalarını azaltması, analiz sürelerini kısaltması, laboratuvarlar arası farklılıkları gidermesi ve akıllı kit olarak bilinen bireyselleştirilmiş tedaviye uygun biyobelirteç panellerinin gelişmesi beklenmektedir (Sukswai ve Khoury, 2019). Klinik uygulamalarda prediktif biyobelirteçlerin öneminin artması, immünohistokimyanınn kişiselleştirilmiş tıp konusunun merkezi konumunu güçlendirmektedir. Her2, Pd-L1, Alk ve Mismatch repair proteinleri gibi belirteçler immünohistokimyasal yöntemlerle etkin bir şekilde tespit edilebilir ve tedavi stratejileri hastaya özel olarak şekillendirilebilir. Bu sayede hastalar hem hatalı tedavilerden korunmuş olur hem de yan etkileri azaltmış olan daha etkin yöntemlerle tedavi edilebilir (Paner, 2008). Yapay zekâ destekli görüntü analizleri sayesinde insan kaynaklı hataların en aza indirgenmesi ve verilerin klinik yorumumun derinleşmesi mümkündür. Buna ek olarak, etik ve regülasyon alanında ortaya çıkacak yeni gereksinimler, standartların oluşturulması ve hasta verilerinin güvenliği açısından kritik önem taşımaktadır.

. Sonuç

Günümüzde immünohistokimya alanındaki yenilikler, klasik histopatolojinin önüne geçmiş, kişisel tanı ve tedavi yaklaşımlarının moleküler düzeyde temelini oluşturmuştur. Gelecekte, immünohistokimyanın multidisiplinerle birlikte gelişmeye devam ederek, klinik uygulamalarda daha geniş bir kullanım alanına erişeceği ve hastalar için daha etkin, güvenli ve hedefe yönelik tedavi seçenekleri sunacağı muhtemeldir. İmmünohistokimya alanında yaşanan gelişimlerin temel bilimsel araştırmalara ve klinik pratiğe önemli katkılar sağlayarak, modern tıbbın vazgeçilmez bir bileşeni olmayı sürdürmesi beklenmektedir.

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HİSTOLOJİDE ZEBRA BALIĞI (DANİO RERİO): UYGULAMALAR, AVANTAJLAR VE GELECEK PERSPEKTİFLERİ

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ÖZET

Son yıllarda Zebra balığı (*Danio rerio*) özellikle histolojik, biyolojik ve tıbbi araştırmalarda model organizma olarak önemli bir yer edinmiştir. Bu organizmanın kullanımının artmasında etkili olan en önemli faktörler arasında embriyonik gelişiminin hızlı olması, embriyoların şeffaf ve mikroskobik gözleme elverişli olmasıdır. Ayrıca yüksek doğurganlığa sahip olan bu türün laboratuvar bakımı kolaydır ve genetik olarak memelilere yüksek oranda benzerlik gösterir. Zebra balığı insan genomunun yaklaşık %70'ini ve hastalıklarla ilişkili genlerin %84'ünü taşımasından dolayı insanlarda görülen pek çok hastalık için model olarak kullanılabilir. Histolojik çalışmalarda zebra balığı; organ gelişimi, kanser oluşumu, rejenerasyon kapasitesi ve toksik madde etkileri gibi pek çok biyolojik sürecin anlaşılmasına katkı sağlar. Zebra balığı ile özellikle karaciğer, kalp, böbrek, retina ve sinir sistemi gibi dokuların gelişimi ve hastalıkları modellenebilir. Bu türün kalp rejenerasyonundaki doğal yeteneği yüksek olup, birçok omurgalı bu özelliğe sahip değildir. Bu nedenle, bilhassa rejeneratif tıp alanında yeni tedavi stratejilerinin geliştirilmesine imkan tanır. Transgenik zebra balığı hatları kanser çalışmalarında kullanılarak insan tümör hücreleri histopatolojik açıdan incelenebilir. Bu sayede melanoma, lösemi ve hepatokarsinom gibi hastalıklar moleküler düzeyde araştırılabilir. Toksikoloji alanında ise farmasötik bileşiklerin ve çevresel kirleticilerin dokulara etkileri; histokimyasal, immünohistokimyasal ve moleküler düzeyde incelenebilmektedir. Karakteristik özelliklerinden dolayı zebra balığı, histoloji, çevre sağlığı, biyoloji ve ilaç geliştirme çalışmalarında etik açıdan daha az sınırlayıcı ve ekonomik yönden daha uygun bir alternatif sunmaktadır. Hematoksilen-Eozin boyama, özel histokimyasallar, immünohistokimyasal ve elektron mikroskobu gibi histolojik yöntemler zebra balığında başarıyla uygulanabildiği için, bu tür modern histoloji araştırmalarının vazgeçilmez bir modeli haline gelmiştir. Sunulan araştırmada, zebra balığının kullanım alanları, avantajları ve histoloji bilimi açısından önemi literatür desteğiyle kapsamlı olarak ele alınmıştır.

Anahtar Kelimeler: Zebra balığı, histoloji, çevre sağlığı, kanser

ZEBRAFISH (DANIO RERIO) IN HISTOLOGY: APPLICATIONS, ADVANTAGES, AND FUTURE PERSPECTIVES

ABSTRACT

In recent years, the zebrafish (Danio rerio) has gained significant prominence as a model organism, particularly in histological, biological, and medical research. The main factors contributing to the increasing use of this organism include its rapid embryonic development and the transparency of its embryos, which makes them highly suitable for microscopic observation. Additionally, this species is highly fertile, easy to maintain in laboratory settings,

and shows a high degree of genetic similarity to mammals. The zebrafish shares approximately 70% of the human genome and 84% of human disease-related genes, making it a valuable model for studying numerous human diseases. In histological studies, zebrafish contribute significantly to the understanding of various biological processes, including organ development, cancer formation, regenerative capacity, and the effects of toxic substances. Zebrafish are particularly useful for modeling the development and diseases of tissues such as the liver, heart, kidney, retina, and nervous system. This species possesses a remarkable natural ability to regenerate heart tissue, a trait not commonly found in other vertebrates. Therefore, it offers promising opportunities for the development of new therapeutic strategies, especially in the field of regenerative medicine. Transgenic zebrafish lines are employed in cancer research, allowing the histopathological examination of human tumor cells. Through this, diseases such as melanoma, leukemia, and hepatocarcinoma can be investigated at the molecular level. In the field of toxicology, the effects of pharmaceutical compounds and environmental pollutants on tissues can be studied using histochemical, immunohistochemical, and molecular techniques. For these reasons, zebrafish present a less ethically restrictive and more cost-effective alternative for histology, environmental health, biology, and drug development studies. As histological methods such as Hematoxylin-Eosin staining, special histochemicals, immunohistochemistry, and electron microscopy can be successfully applied to zebrafish, this species has become an indispensable model in modern histological research. This study comprehensively discusses the applications, advantages, and importance of zebrafish in histology, supported by relevant literature.

Keywords: Zebrafish, histology, environmental health, cancer

Giriş

Dokuların mikroskobik düzeyde inceleyen histoloji bilimi; hücreler arası organizasyonu, doku tiplerinin özelliklerini, fizyolojik ya da patolojik süreçlerin etkilerini anlamayı amaçlar. Modern histoloji, morfolojik tanımlamaları içermekle birlikte, hücre düzeyinde moleküler değişimleri, gen ekspresyon modellerini ve rejeneratif özellikler de bu bilimin araştırma alanında yer alır. Bu nedenle model organizma kullanımı; doku ve organların gelişiminde ve hastalık süreçlerinin tanımlanmasında vazgeçilmez bir yöntemdir.

Özellikle son yirmi yılda omurgalı model organizmalar arasında öne çıkan Zebra balığı (*Danio rerio*); histoloji, genetik ve gelişimsel biyoloji alanlarında sıkça kullanılmaktadır (Bertrand 2008). Bu durumun temelinde; zebra balığının sağladığı bazı biyolojik ve teknik avantajlar yer almaktadır. Şeffaf embriyoları olan bu tür canlı doku ve hücre hareketlerinin doğrudan gözlemlenebilmesine imkan verir. Ayrıca, dış döllenmeye dayalı hızlı embriyo gelişimi, genetik manipülasyona imkan vermesi, bakım maliyetinin ucuz ve nesil süresinin kısa olması, bu canlıyı laboratuvar araştırmaları için ideal bir seçenek haline getirmiştir. Bunun yanında, insan genlerinin büyük bir kısmının zebra balığında da bulunması, bu canlıyı translasyonel araştırmalarda da değerli hale getirmiştir (Howe et al., 2013).

Histolojide zebra balığı ile yapılan çalışmalar; organ gelişimi, doku rejenerasyonu, hastalık modelleme, ilaç tarama ve toksikolojik analizler gibi çok çeşitli alanların temelini oluşturmaktadır (Hwang 2013). Bu sayede karaciğer, kalp, böbrek, göz ve sinir sistemi gibi doku ve organların gelişim süreçleri detaylı bir şekilde takip edilebilir. Ayrıca immünohistokimya, elektron mikroskobu ve in situ hibridizasyon gibi ileri teknikler kullanılarak bu süreçler moleküler düzeyde analiz edilebilir. Kalp ve retina gibi dokular başta olmak üzere rejeneratif kapasitesi yüksek olan zebra balığı bu yönüyle rejeneratif tıp araştırmalarında umut verici bir model olarak karşımıza çıkmaktadır (Kimmel 2013).

Sunulan çalışmanın amacı, histolojik çalışmalarda bir model organizma olarak kullanılan zebra balığının önemini ve kullanım alanını kapsamlı olarak ele almaktır. Kanser modellemesinden toksikolojiye, gelişimsel biyolojiden rejeneratif tıbba kadar geniş uygulama alanları sayesinde zebra balığı bir model organizma olmasının yanında, histopatolojik analizler için güçlü bir araçtır. Bu çalışmada, zebra balığı ile yapılan güncel histolojik araştırmalara, teknik yaklaşımlara ve gelecekteki potansiyel kullanım alanlarına yer verilmiştir.

Zebra Balığının Histolojik Model Olarak Özellikleri

Zebra balığı, birçok biyolojik ve teknik özelliklere sahip olduğu için histolojik araştırmalarda yaygın olarak tercih edilen bir model organizmadır. Bu özellikleri, araştırma sürecini kolaylaştırdığı gibi elde edilen verilerin güvenilirliğini ve insan fizyolojisine uyarlanabilirliğini de artırır.

Şeffaf Embriyolar ve Gelişimsel İzlenebilirlik

Zebra balığının embriyoları ve larvaları doğal olarak şeffaf oldukları için gelişim süreci herhangi bir müdahaleye gerek kalmaksızın gözlemlenebilir. Optik netlik yöntemiyle mikroorganizmalar, floresan etiketleme yöntemi ile organogenez ve hücre hareketlerini doğrudan izlemek mümkündür (Patton ve Zon, 2001). Şeffaf özellik sayesinde canlı embriyodaki hücre bölünmesini, migrasyonu, doku katmanlaşması gibi histolojik olayları gerçek zamanlı olarak gözlemlemek mümkündür.

Hızlı Gelişim ve Düşük Maliyet

Döllenmeyi takip eden ilk 24 saatte Zebra balığının major organ sistemlerinin çoğu oluşmaya başlar. Beşinci gün serbest yüzebilen ve fonksiyonel organları olan larvalar oluşur. Bu hızlı gelişim döngüsü sayesinde, kısa sürede çok fazla histolojik veri elde edilebilir. Bakım ve üretim maliyetleri küçük boyutları ve birlikte yaşama eğilimleri nedeniyle memeli model organizmalara kıyasla çok daha düşüktür.

Genetik Manipülasyon Kolaylığı

Transgenik hatların kolayca üretilebildiği Zebra balığında; TALENs, CRISPR/Cas9 ve morpholino antisens oligonükleotid gibi teknikler sayesinde genetik düzenlemeler de yapılabilir. Bu yöntemle spesifik genlerin histolojik düzeyde neden oldukları etkiler detaylı olarak incelenebilir. Ayrıca, floresan proteinlerle etiketlenmiş transgenik hatlar yardımıyla doku-spesifik ekspresyon modelleri meydana getirilebilir (Howe 2013)

Histolojik Çalışmalarda Kullanım Alanları

Zebra balığı, sistem biyolojisi ve patoloji alanında yer alan çalışmalarda histolojik model olarak yaygın şekilde kullanılmaktadır. Bu bağlamda; organ gelişimi, hastalık modellemeleri, doku onarımı ve toksisite analizleri ele alınmaktadır.

Organ Gelişimi ve Diferansiyasyonu

Zebra balığında embriyonik gelişimin tüm evrelerini detaylı olarak izlemek mümkündür. Histolojik kesitlerde gastrointestinal sistem, sinir sistemi, böbrek, karaciğer, kalp ve retina gibi temel organlar ve sistemler yüksek çözünürlükle incelenebilir (Poss 2002). Özellikle pronefros, karaciğerin lobülasyon yapısı ve merkezi sinir sisteminin morfogenezi zebra balığında oldukça belirgin olduğu için zebra balığı gelişimsel histolojinin kritik bir modeli olarak bilinmektedir.

Doku Rejenerasyonu

Zebra balığını eşsiz bir araştırma modeli haline getiren en önemli özelliği hiç şüphesiz rejeneratif yeteneğidir. Omurilik, kalp, retina ve yüzgeç gibi organlar zarar gördüğünde, zebra

balığı eşsiz rejenerasyon yeteneği sayesinde bu dokuları işlevsel biçimde yeniden oluşturabilir. Histolojik inceleme yöntemleri kullanılarak hücre proliferasyonu, farklılaşması ve matris yeniden yapılanma süreçleri detaylı olarak incelenebilir (Ruyra ve ark 2015). İnsanlarda rejenerasyonun sınırlı olduğu organlarda önemi son derece fazla olan bu çalışmalar, potansiyel tedavi stratejilerinin geliştirilmesini destekler.

Kanser Modelleme

Çeşitli kanser tiplerinin genetik modelleri Zebra balığında oluşturulabilir. Mesela BRAF mutasyonları içeren hatlar, melanom modellemesinde tercih edilirken, KRAS mutasyonları pankreatik kanser çalışmalarında kullanılabilir (Westerfield 2000). Histolojik analizlerle tümör yapısı ve invazyon derinliği, ayrıca anjiyogenez ve metastaz potansiyeli de değerlendirilebilir. Ayrıca, ilaç tarama çalışmalarında histolojik düzeyde tümör yanıtını değerlendirilebilir.

Toksikolojik Testler

Çevresel toksikoloji ve ilaç güvenliği değerlendirme çalışmalarında Zebra balığı çoğunlukla tercih edilen bir modeldir. Solungaç, karaciğer, gastrointestinal kanal ve böbrek dokularında meydana gelen hücre nekrozu, vakuolizasyon, inflamasyon, fibrozis gibi histopatolojik değişimler kantitatif ve kalitatif olarak değerlendirilebilir (Seomoon ve ark., 2025). Uluslararası toksikoloji kılavuzlarında embriyo toksisite testleri geçerli bir yöntem olarak kabul edilmektedir.

Histolojik Teknikler ve Uygulama Örnekleri

Klasik ve ileri düzey histolojik yöntemlerin tamamı Zebra balığında başarıyla uygulanabilir.

Rutin Boyama Yöntemleri

Zebra balığı dokularında dokuları boyamak, hücre yoğunluğu ve patolojik değişiklikleri değerlendirebilmek için tercih edilen temel yöntemlerden birisi Hematoksilen-Eozin (H&E) boyasıdır. Ayrıca, Periodic Acid–Schiff (PAS), Masson Trichrome, Oil Red O ve Alcian Blue gibi özel boyamalar kullanılarak mukus salgısı, lipid birikimi ve bağ dokusu yapısı gibi yapıların da analizi mümkündür.

İmmünohistokimya ve In Situ Hibridizasyon

Protein düzeyinde ekspresyon analizleri için immünohistokimyasal yöntemler kullanılırken, mRNA düzeyinde hedef gen analizleri için in situ hibridizasyon teknikleri tercih edilir (Hill 2005). Anti-PCNA, anti-Ki67, anti-cleaved caspase-3 gibi belirteçler hücresel aktivitelerde izlenebilir (Ulucan ve ark., 2019).

Elektron Mikroskopisi

Zebra balığındaki mitokondri, endoplazmik retikulum, desmozomlar gibi hücre içi yapıların elektron mikroskobuyla analizi mümkündür. Bu yöntemle membran bütünlüğü, hücre-hücre bağlantıları ve hücresel dejenerasyon süreçleri rahatlıkla izlenebilir ve değişimler kayıt altına alınabilir.

Klinik Araştırmalara Katkıları

Zebra balığı temel bilimlerin vazgeçilmezi olmasının yanında hastalık modelleme, klinik patoloji ve tedavi stratejileri geliştirme gibi süreçlerde de tercih edilir.

- **Kardiyovasküler Hastalıklar**: Kardiyomiyosit proliferasyonu ve kalp rejenerasyonunu kapsayan çalışmalar, miyokard infarktüsünden sonraki iyileşme sürecinin anlaşılmasına katkı sağlaması bakımından önemlidir.

- **Nörodejeneratif Hastalıklar**: Alzheimer ve Parkinson hastalığı gibi nöropatolojik süreçler Zebra balığında modellenebildiği için glial yanıtlar, protein agregasyonu ve nöronal ölüm histolojik yöntemlerle incelenebilir (Bandmann ve Burton, 2010).
- **Metabolik Hastalıklar**: Zebra balığında; diyabet, obezite ve NAFLD gibi hastalıkların sonucu olarak karaciğerde meydana gelen yağlanmayı, fibrozisi ve inflamasyonu modellemek mümkündür.
- **Kanser Tedavisi**: Tümör regresyonunu ve tedaviye yanıtı Zebra balığı kullanılarak histolojik açıdan olarak değerlendirmek mümkün olmakla birlikte, bu sayede çok sayıda birey üzerinde hızlı taramalar ve tekrarlar yapmak mümkündür (Amatruda 2002).

Etik ve Yasal Açılar

Etik kurallar açısından Zebra balığı, birçok ülkede memeliler kadar sıkı düzenlemelere tabi olmasa da canlı kullanımı içeren tüm çalışmalar gibi etik kurul onayı gerektirir. Avrupa Birliği'nin 2010/63/EU raporuna göre deney hayvanı olarak tanımlanan Zebra balığı, hayvan refahı ilkeleri çerçevesinde kullanılmalıdır. Bu nedenle Zebra balığı ile histolojik çalışmalar planlanırken etik protokol tasarımı, uygun anestezi ve ötenazi yöntemleri diğer canlılarda olduğu gibi dikkate alınmalıdır (Canedo 2022).

Sonuç ve Gelecek Perspektifi

Histolojik analizlere uygunluğu, optik açıdan izlenebilir gelişime sahip olması, genetik esnekliği ve yüksek üreme kapasitesi nedeniyle Zebra balığı histolojik araştırmalarda öncü bir model organizma olarak öne çıkmaktadır. Histolojik yönden sağladığı avantajlar nedeniye bu canlı organizma, hem gelişimsel biyoloji hem de toksikoloji, kanser, rejeneratif tıp ve hastalık modellemelerinin vazgeçilmezidir. Yakın gelecekte zebra balığı modelinin canlı görüntüleme, genetik mühendisliği sistemleri ve üç boyutlu histolojik analiz teknikleri sayesinde kullanımının giderek artması muhtemeldir.

Kaynakça

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KURŞUNSUZ p-n HOMOEKLEM $FASnI_3$ TABANLI PEROVSKİT GÜNEŞ HÜCRELERİNİN PERFORMANS ANALİZİ

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ÖZET

Perovskit güneş hücrelerindeki (PSC'ler) homoeklemler, aynı perovskit malzeme içinde hem p tipi hem de n tipi bölgelerin oluşturulduğu ve böylece yük taşıyıcı ayrımı ve taşınmasının iyileştirildiği yenilikçi ve umut verici bir tasarımı temsil eder. Bu konfigürasyon, arayüz kafes uyumsuzluklarını ortadan kaldırır ve heteroeklemlere kıyasla kusur oluşumunu en aza indirir. Emici katmana bir homoeklem eklemek, verimliliği büyük ölçüde artırır, rekombinasyon kayıplarını azaltır ve daha basit üretim sağlayarak potansiyel maliyet ve kararlılık avantajları sunar. Bu araştırma, p-n homoeklem mimarisini kullanan ve hem n tipi hem de p tipi emici katmanlar olarak formamidinyum kalay iyodür ($FASnI_3$) kullanan kurşunsuz bir perovskit güneş hücresinin (PSC) sayısal simülasyonunu sunmaktadır. Cihaz konfigürasyonu ($FTO/TiO_2/n\text{-}FASnI_3/p\text{-}FASnI_3/CuI/Au$), optoelektronik performansını değerlendirmek için SCAPS-1D kullanılarak modellenmiştir. Amaç, toksik kurşun içermeyen, çevre dostu, verimli ve kararlı bir PSC geliştirmek ve aynı zamanda homoeklemlerin yük ayrımı ve arayüz kararlılığındaki işlevini incelemektir. Optimize edilmiş cihaz, %26,27 güç dönüşüm verimliliği (*PCE*), 29,56 mA/cm² kısa devre akım yoğunluğu (J_{sc}), 1,048 V açık devre voltajı (V_{oc}) ve %84,8 dolum faktörü (*FF*) sergilemiştir. Bulgular, homoeklem bazlı kalay perovskitlerin sürdürülebilir ve yüksek performanslı kurşunsuz güneş enerjisi teknolojileri için umut verici bir yol sunduğunu doğrulamaktadır.

Anahtar Kelimeler: Kurşunsuz perovskitler, Formamidinyum kalay iyodür, Homoeklemler, Güneş pilleri

PERFORMANCE ANALYSIS OF LEAD-FREE p-n HOMOJUNCTION $FASnI_3$-BASED PEROVSKITE SOLAR CELLS

ABSTRACT

Homojunctions in perovskite solar cells (PSCs) signify an innovative and promising design where both p-type and n-type regions are created within the same perovskite material, thereby improving charge carrier separation and transport. This configuration eliminates interfacial lattice mismatches and minimizes defect formation in comparison to heterojunctions. Incorporating a homojunction within the absorber layer greatly enhances efficiency, decreases recombination losses, and facilitates simpler fabrication, offering potential cost and stability benefits. This research presents a numerical simulation of a lead-free perovskite solar cell (PSC) utilizing a p-n homojunction architecture, employing formamidinium tin iodide ($FASnI_3$) as both n-type and p-type absorber layers. The device configuration (FTO/TiO_2/n-$FASnI_3$/p-$FASnI_3$/CuI/Au) was modeled using SCAPS-1D to evaluate its optoelectronic performance. The objective was to develop an eco-friendly, efficient, and stable PSC devoid of toxic lead, while also examining the function of homojunctions in charge separation and interface stability. The optimized device attained a power conversion efficiency *(PCE*) of 26.27%, with a short-circuit current density (J_{sc}) of 29.56 mA/cm², an open-circuit voltage (V_{oc}) of 1.048 V, and a fill factor (*FF*) of 84.8%. The findings affirm that homojunction-based tin perovskites represent a promising avenue for sustainable and high-performing lead-free solar technologies.

Keywords: Lead free perovskites; Formamidinium tin iodide; Homojunctions; Solar cells

INTRODUCTION

Perovskite solar cells (PSCs) have garnered significant interest over the last ten years due to their impressive efficiency, low production costs, and adjustable optoelectronic characteristics. Nevertheless, most high-efficiency PSCs utilize lead (Pb)-based materials, such as methylammonium lead iodide ($MAPbI_3$), which raises issues regarding environmental toxicity and long-term durability (Polimante et al. 2025).

Tin-based perovskites, including formamidinium tin iodide ($FASnI_3$), have surfaced as a non-toxic substitute that offers similar optical properties and an appropriate bandgap (~1.41 eV). However, these materials are susceptible to oxidation (Sn^{2+} to Sn^{4+}), exhibit high intrinsic defect densities, and demonstrate poor air stability. To mitigate these challenges, innovative device architectures and interface engineering are essential (Miglani et al. 2025).

One promising strategy is the p-n homojunction, where the absorber layer consists of the same semiconductor configured for both n-type and p-type doping (Wei et al. 2024). This configuration minimizes lattice mismatch, enhances band alignment, and improves carrier selectivity at the interface. In this study, we simulate a lead-free PSC architecture utilizing a homojunction of $FASnI_3$ positioned between TiO_2 and CuI transport layers.

DEVICE STRUCTURE AND SIMULATION APPROACH

In this study, a theoretical model of a solar cell is developed, examining the factors that can influence the performance of solar cells, and enhancing and optimizing that performance. The numerical simulation tool SCAPS-1D, commonly employed to investigate the physical processes within solar cells, is utilized in this research. The SCAPS-1D software was developed by Burgelman (Burgelman et al. 2000) and is founded on the Shockley-Read-Hall

recombination statistics, which consider the Poisson equation (Equation (1)), the continuity equation for holes (Equation (2)), and the continuity equation for electrons (Equation (3)).

$$\frac{d^2}{dx^2}\psi(x) = -\frac{q}{\varepsilon_0\varepsilon_r}(p(x) - n(x) + N_D - N_A + p_t(x) - n_t(x)) \quad (1)$$

$$\frac{dp}{dt} = -\frac{dJ_p}{dx} - R_p + G_p \quad (2)$$

$$\frac{dn}{dt} = -\frac{dJ_n}{dx} - R_n + G_n \quad (3)$$

where $\psi(x)$, p, n, q, $\varepsilon_0, \varepsilon_r$, $N_D, N_A, p_t(x), n_t(x)$, J_p, J_n, $G_p(G_n)$, and $R_p(R_n)$ are the electrostatic potential, holes, and electron concertation, permittivity of free space, relative permittivity, donor and acceptor charge impurity, the trapped holes and electron densities, current hole densities, current electron densities, generation, and recombination rate of hole (electron), respectively.

Therefore, SCAPS-1D can compute the performance parameters of prescribed solar devices, such as open-circuit voltage (V_{oc}), current density (J_{sc}), fill factor (*FF*), power conversion efficiency (*PCE*), and quantum efficiency (*QE*), using the equations while taking boundary circumstances into account. The simulation parameters for the FTO, ETL, HTL and absorber are listed in Table 1. The work function of back electrode Au was taken as 5.1 eV. The design configuration of single junction (SJ) and homojunction (HJ) perovskite solar cells is FTO / TiO_2 (ETL) / n-$FASnI_3$ / CuI (HTL) / Au and FTO / TiO_2 (ETL) / n-$FASnI_3$ / p-$FASnI_3$ / CuI (HTL) / Au, respectively.

Table 1. The material parameters utilized in the simulation program.

Parameters	FTO	TiO_2	$FASnI_3$	CuI
Thickness [μm]	0.5	0.05	0.45	0.1
Band gap [eV]	3.5	3.2	1.41	2.98
Electron affinity [eV]	4	3.9	4	2.1
Dielectric permittivity	9	9	8.2	6.5
CB effective density of states [cm^{-3}]	$2.2x10^{18}$	$2x10^{18}$	$1x10^{18}$	$2.8x10^{19}$
VB effective density of states [cm^{-3}]	$2.2x10^{18}$	$1.8x10^{19}$	$1x10^{18}$	$1x10^{19}$
Electron thermal velocity [cm/s]	$1x10^{7}$	$1x10^{7}$	$1x10^{7}$	$1x10^{7}$
Hole thermal velocity [cm/s]	$1x10^{7}$	$1x10^{7}$	$1x10^{7}$	$1x10^{7}$
Electron mobility [$cm^2\ Vs^{-1}$]	20	20	22	$1.69x10^{-4}$
Hole mobility [$cm^2\ Vs^{-1}$]	10	10	22	$1.69x10^{-4}$
Donor density [cm^{-3}]	$1x10^{15}$	$9x10^{16}$	0	0
Acceptor density [cm^{-3}]	0	0	$7x10^{16}$	$1x10^{18}$
Bulk defect density [cm^{-3}]	$1x10^{18}$	$1x10^{15}$	$1x10^{14}$	$1x10^{15}$

RESULTS AND DISCUSSION

The band structures featuring SJ and HJ devices are illustrated in Fig. 1, where alterations in the band diagram are solely attributed to the presence of p-$FASnI_3$, while other layers remain

constant. Given that the processes of electron and hole extraction significantly influence device performance, proper band alignment is essential for enhancing this performance. Typically, the excitons generated by light illumination are transferred from the perovskite absorber layer to both the ETL and HTL. To optimize the electron extraction process, the ETL must possess a higher electron affinity compared to the absorber, while the HTL's ionization energy should be lower than that of the absorber layer to expedite the hole extraction process. In the absence of illumination, the device exhibits a single Fermi level; however, upon illumination, this Fermi level divides into two quasi-Fermi levels, one corresponding to the electrons and the other to the holes.

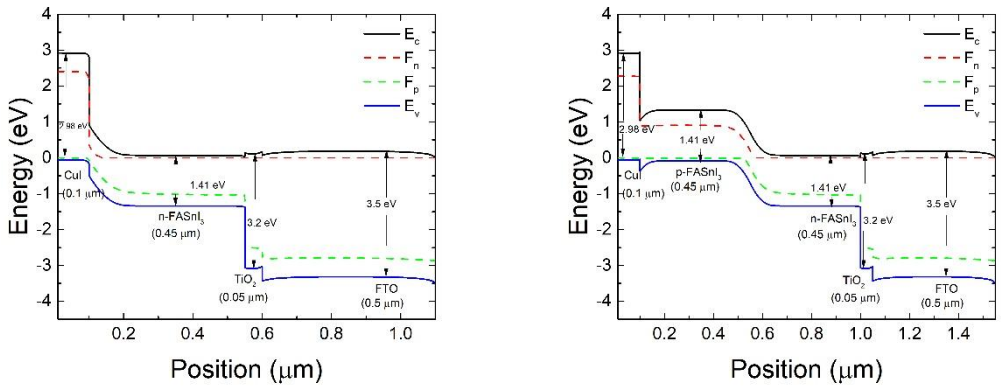

Fig. 1. Energy band diagram of **(a)** the SJ and **(b)** the HJ devices

Compared to band alignment of the SJ device (Fig. 1a), the band alignment of the HJ device (Fig. 1b) confirms a favorable energy profile for efficient charge transport in the device. The downward slope from TiO_2 to n-type $FASnI_3$ facilitates electron flow toward the electron transport layer, ensuring minimal resistance. Simultaneously, the upward slope from p-type $FASnI_3$ to CuI promotes effective hole extraction. Crucially, the presence of a homojunction between n- and p-type $FASnI_3$ results in smooth band bending across the absorber layer. This not only strengthens the internal electric field but also significantly reduces carrier recombination losses, thereby improving overall device performance.

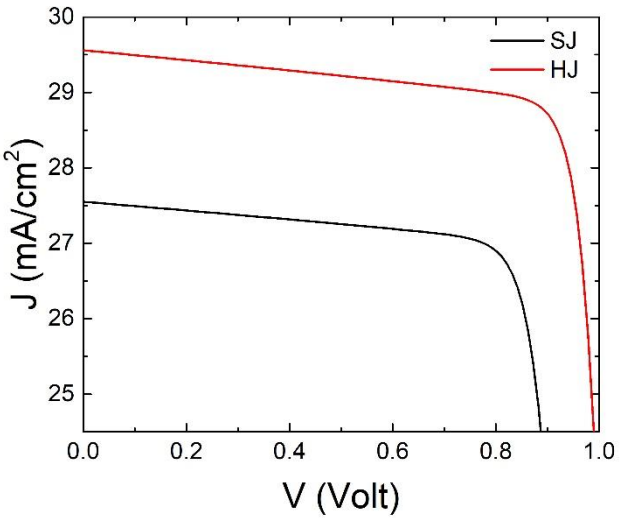

Fig. 2. Current density-voltage curve of the SJ and the HJ devices

A graphical depiction illustrating the variation of current density in relation to different voltage ranges from 0 V to 1.1 V is presented in Fig. 2. The ultimate J-V curve for the device featuring the structure FTO / TiO_2 (ETL) / n-$FASnI_3$ / p-$FASnI_3$ / CuI (HTL) / Au is generated based on the optimal outcomes from the previous analysis. It is obvious that the HJ device outperforms the SJ device (Table 1). Following the final optimization, the performance metrics of the device, including *PCE*, V_{oc}, J_{sc}, and *FF*, achieved values of 26.27 %, 1.048 V, 29.56 mA/cm^2, and 0.848, respectively. This performance is encouraging for a lead-free structure and demonstrates the benefit of using a homojunction to suppress interface recombination (Jafri et al. 2024).

Table 2. The photovoltaic parameters for the SJ and the HJ devices

Junction	V_{oc} (V)	J_{sc} (mA/cm^2)	*FF* (%)	*PCE* (%)
SJ	0.986	27.55	0.821	22.30
HJ	1.048	29.56	0.848	26.27

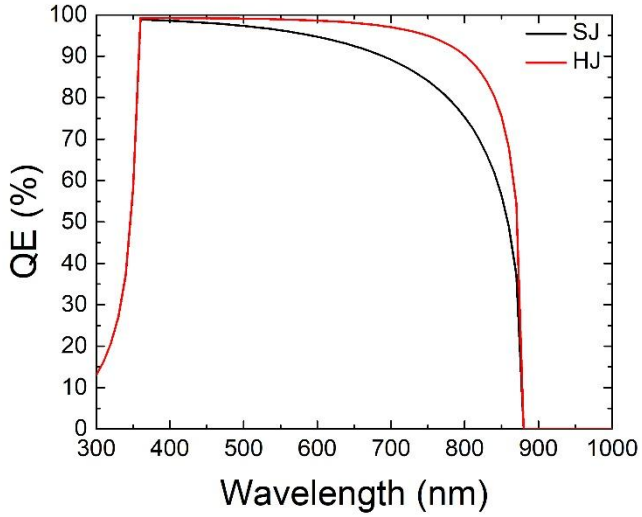

Fig. 3. Quantum efficiency of the SJ and the HJ devices

When a solar cell is exposed to various wavelengths of light, its quantum efficiency (QE) serves as a measure for determining the extent to which photons are converted into current within the device. The ability of a device to produce photocurrent is commonly evaluated through quantum efficiency (Ajayakumar et al. 2025). The quantum efficiency curve for both the SJ and HJ device is illustrated in Fig. 3, which depicts the relationship between wavelength and QE. It has been demonstrated that the HJ device performs exceptionally well within the wavelength ranges of 400 nm to 900 nm.

CONCLUSION

This work demonstrates the potential of a lead-free p-n homojunction perovskite solar cell based on $FASnI_3$ using SCAPS-1D simulation. The device achieves a respectable PCE of 26.27%, with good current output and fill factor. The findings verify that homojunction reduces interface mismatch and enhances charge separation. The design offers a scalable, environmentally benign alternative to Pb-based PSCs. As a future work, tandem integration with wide bandgap perovskites or CIGS can be realized.

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PEROVSKİT FOTOVOLTAİKLERDE YEŞİL ALTERNATİFLER: $CsPbI_3$ İÇİN KURŞUNSUZ BİR İKAME MADDE OLARAK $CsGeI_3$'ÜN DEĞERLENDİRİLMESİ

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ÖZET

İnorganik perovskit güneş pilleri (PSC'ler), üstün termal kararlılıkları ve uzun vadeli çalışma potansiyelleri nedeniyle ilgi görmektedir. Bunlar arasında, sezyum kurşun iyodür (CsPbI3) gibi tamamen inorganik kurşun halojenür perovskitleri, dikkate değer optoelektronik özellikler ve cihaz verimlilikleri göstermiştir. Ancak, kurşunla ilişkili doğal toksisite ve çevresel tehlikeler, alternatif B-bölgesi metal katyonlarının araştırılmasını teşvik etmektedir. Perovskit kafesle uyumlu ve daha az toksik olan Germanyum (Ge), kurşunun potansiyel bir ikamesi olarak ortaya çıkmaktadır. Bu çalışma, SCAPS-1D yazılımı aracılığıyla tek boyutlu sayısal simülasyonlar kullanılarak düzlemsel bir güneş pili konfigürasyonunda $CsPbI_3$ ve $CsGeI_3$ perovskit soğuruculanının karşılaştırmalı bir incelemesini sunmaktadır. Akım-gerilim (J-V) karakteristikleri, harici kuantum verimliliği (EQE) ve fotojenerasyon hızı profilleri dahil olmak üzere temel çıktı parametreleri, B-bölgesi ikamesinin cihaz performansı üzerindeki etkisini değerlendirmek için analiz edilmiştir. Simülasyonlarımız, Ge bazlı $CsGeI_3$'ün, üstün ışık emilimi ve uygun yük taşıma özellikleri sayesinde, güç dönüşüm verimliliği açısından Pb bazlı $CsPbI_3$'ten daha iyi performans gösterdiğini ortaya koymaktadır. Bulgular, Pb bazlı perovskitlerin hem potansiyelini hem de mevcut sınırlamalarını vurgulamakta ve fotovoltaik potansiyellerini artırmak için malzeme düzeyinde stratejilere ışık tutmaktadır.

Anahtar Kelimeler: Perovskitler, CsPbI3, CsGeI3, Güneş hücreleri.

GREEN ALTERNATIVES IN PEROVSKITE PHOTOVOLTAICS: EVALUATING $CsGeI_3$ AS A LEAD-FREE SUBSTITUTE FOR $CsPbI_3$

ABSTRACT

Inorganic perovskite solar cells (PSCs) are gaining attention due to their superior thermal stability and potential for long-term operation. Among them, all-inorganic lead halide perovskites such as cesium lead iodide ($CsPbI_3$) have demonstrated remarkable optoelectronic properties and device efficiencies. However, the inherent toxicity and environmental hazards associated with lead motivate the search for alternative B-site metal cations. Germanium (Ge), being less toxic and compatible with the perovskite lattice, emerges as a potential substitute for lead. This study presents a comparative investigation of $CsPbI_3$ and $CsGeI_3$ perovskite absorbers in a planar solar cell configuration using one-dimensional numerical simulations via the SCAPS-1D software. Key output parameters including current-voltage (J-V) characteristics, external quantum efficiency (EQE), and photogeneration rate profiles were analyzed to assess the impact of B-site substitution on device performance. Our simulations reveal that Ge-based $CsGeI_3$ outperforms Pb-based $CsPbI_3$ in terms of power conversion efficiency, largely due to its superior light absorption and favorable charge transport properties. The findings highlight both the promise and current limitations of Pb-based perovskites and offer insight into material-level strategies for enhancing their photovoltaic potential.

Keywords: Perovskites; $CsPbI_3$; $CsGeI_3$; Solar cells

INTRODUCTION

Perovskite solar cells have experienced an exponential rise in efficiency, surpassing 25% within a decade, placing them at the forefront of next-generation photovoltaic technologies (Zhang et al. 2024). The perovskite crystal structure (ABX_3) offers a flexible platform for compositional engineering, where the A-site is typically occupied by an organic (e.g., methylammonium) or inorganic (e.g., Cs^+) cation, the B-site by a metal such as Pb^{2+} or Ge^{2+}, and the X-site by a halide ion.

Despite the impressive performance of hybrid organic-inorganic perovskites, issues related to moisture sensitivity and thermal instability persist. In contrast, all-inorganic perovskites, particularly those based on cesium (Cs), demonstrate enhanced structural stability under ambient conditions, making them promising candidates for commercial photovoltaic deployment (Gao et al. 2024).

$CsPbI_3$ has emerged as one of the most investigated all-inorganic perovskites due to its optimal bandgap (~1.73 eV), high absorption coefficient, and favorable carrier mobility (Shen et al. 2024). However, its reliance on toxic lead poses environmental concerns and regulatory barriers. To address these, researchers have explored alternative B-site substitutions. Germanium (Ge), a group IV element, has a similar ionic radius and can form perovskite structures such as $CsGeI_3$, which are non-toxic and potentially more sustainable (Panjikaran et al. 2024).

Nonetheless, the intrinsic properties of $CsGeI_3$, such as its bandgap, defect density, and stability under ambient conditions, remain less well understood. In this study, we aim to systematically compare the photovoltaic performance of $CsPbI_3$ and $CsGeI_3$ using numerical simulations. SCAPS-1D software was employed to simulate device structures, allowing us to isolate the effect of B-site substitution on key performance metrics under identical architectural and operating conditions.

METHODOLOGY

DEVICE STRUCTURE AND ARCHITECTURE

Both devices are modeled using a planar heterojunction structure with the following configuration:FTO (Front contact) / TiO_2 (Electron Transport Layer) / $CsPbI_3$ or $CsGeI_3$ (Absorber Layer) / MoO_3 (Hole Transport Layer) / Au (Back contact). This architecture is commonly adopted in experimental perovskite solar cell research due to its simplicity and effectiveness in evaluating material performance.

SCAPS-1D SIMULATION PARAMETERS

SCAPS-1D, developed by the University of Ghent, is a widely used tool for simulating thin-film solar cell behavior. The software numerically solves the Poisson and continuity equations to simulate device performance under illumination (Burgelman et al. 2000). The key simulation parameters used for both devices included an absorber layer thickness of 500 nm, an operating temperature of 300 K, front and back contact work functions selected to ensure ohmic behavior, defect densities and carrier mobilities derived from experimentally reported values in the literature, and band alignment adjustments made according to the known differences in bandgap and electron affinity between the Pb- and Ge-based perovskites. Material-specific properties such as bandgap, absorption coefficient, relative permittivity, and effective densities of states were tuned for each absorber material to reflect realistic performance (Miah et al. 2023; Shen et al. 2023).

PERFORMANCE METRICS

Three primary metrics were extracted from the simulations to evaluate device performance: the current-voltage (J-V) characteristics, which include key parameters such as open-circuit voltage (V_{oc}), short-circuit current density (J_{sc}), fill factor (FF), and overall power conversion efficiency (PCE); the external quantum efficiency (EQE), which represents the device's spectral response across the visible light range and reflects its capacity to convert incident photons into charge carriers; and the photogeneration rate, which provides the spatial distribution of electron-hole pair generation within the absorber layer under illumination. Together, these parameters offer complementary insights into the influence of B-site substitution on both the optical absorption behavior and electronic transport properties of the perovskite solar cells.

RESULTS AND DISCUSSION

CURRENT–VOLTAGE (J-V) CHARACTERISTICS

The J-V characteristics clearly show a performance advantage for the $CsGeI_3$-based device (Fig. 1). It demonstrated a higher V_{oc}, J_{sc}, and FF, leading to an overall higher PCE (Table 1). These improvements are attributed to the superior intrinsic carrier lifetime and mobility in $CsGeI_3$ as well as more favorable band alignment with the adjacent charge transport layers. The lower performance of $CsPbI_3$ can be attributed to several factors: a slightly lower bandgap, higher recombination rates due to defect levels introduced by Pb oxidation, and less effective carrier transport.

Table 1. The photovoltaic parameters for the devices with absorber layer of $CsPbI_3$ and $CsGeI_3$.

Absorber layer	V_{oc} (V)	J_{sc} (mA/cm^2)	*FF* (%)	*PCE* (%)
$CsPbI_3$	1.333	18.32	0.833	20.36
$CsGeI_3$	1.314	22.06	0.862	24.98

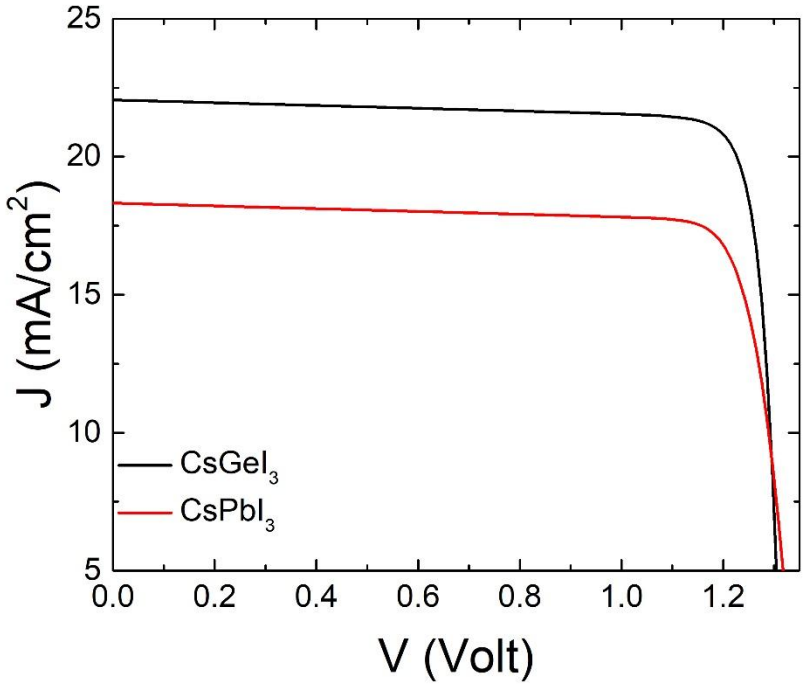

Fig. 1. Current density-voltage curve of the devices with absorber layer of $CsPbI_3$ and $CsGeI_3$.

EXTERNAL QUANTUM EFFICIENCY (EQE)

The EQE spectra (Fig. 2) reveals that $CsGeI_3$ possesses a broader and more intense spectral response, especially in the 400-700 nm region, which corresponds to visible light absorption. This aligns with its high absorption coefficient and optimal bandgap for solar harvesting. $CsPbI_3$ showed a narrower EQE response, particularly lacking in the red region (700-800 nm), which could explain its lower J_{sc} values. This suggests that $CsPbI_3$ may require bandgap tuning (e.g., halide mixing or strain engineering) to improve light absorption.

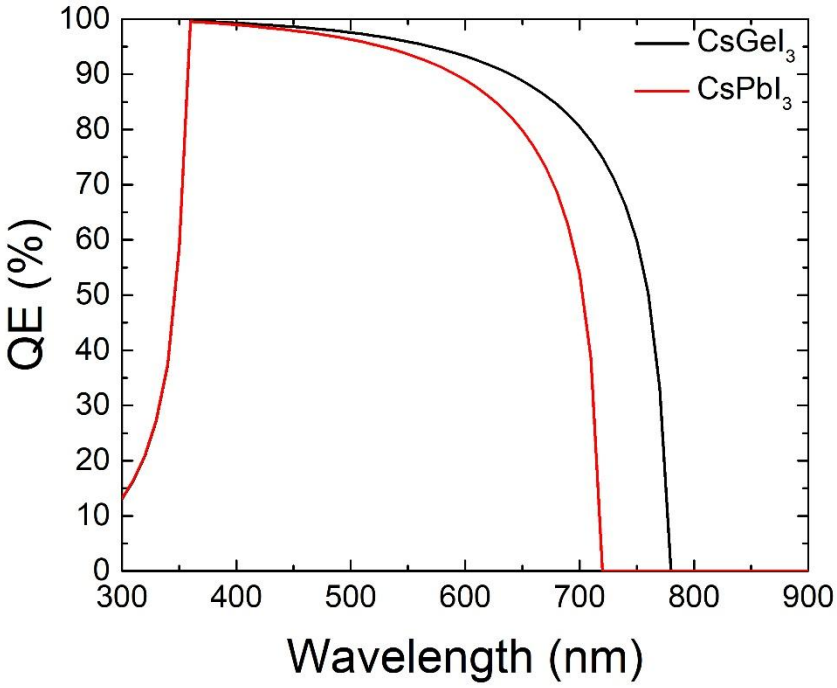

Fig. 2. Quantum efficiency of the devices with absorber layer of $CsPbI_3$ and $CsGeI_3$.

PHOTOGENERATION RATE

The spatial generation rate profiles indicated that $CsGeI_3$ facilitated a higher rate of photogeneration near the front interface of the absorber. This is advantageous for minimizing recombination losses and maximizing charge extraction. In contrast, $CsPbI_3$ exhibited a lower and more uniform generation profile across the absorber, indicating suboptimal absorption and weaker carrier separation.

In addition, the recombination profile indicated that $CsPbI_3$ suffered from higher trap-assisted recombination, likely due to intrinsic instability of Pb^{2+} and associated defect states.

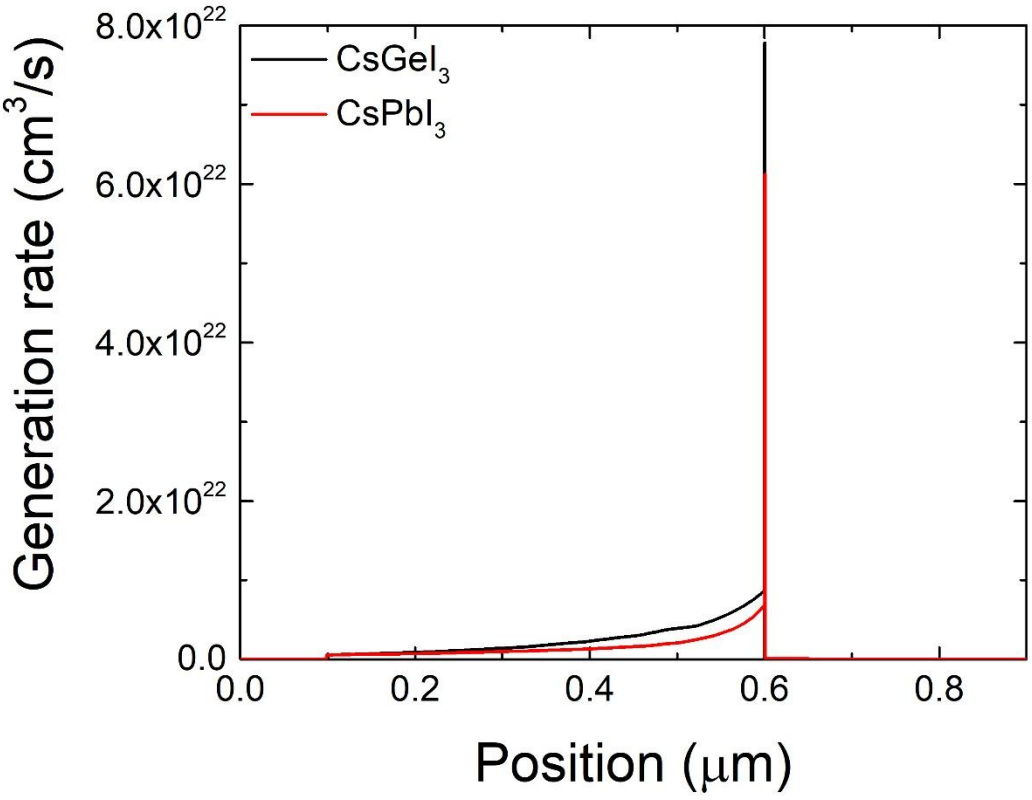

Fig. 3. Generation rate vs position graph of the devices with absorber layer of $CsPbI_3$ and $CsGeI_3$.

CONCLUSION

This study presents a comparative numerical investigation of two all-inorganic perovskite absorber materials ($CsPbI_3$ and $CsGeI_3$) focusing on the impact of B-site metal substitution on device performance. The simulations demonstrate that $CsGeI_3$ offers superior photovoltaic performance, driven by its higher absorption, favorable band alignment, and efficient carrier transport properties.

$CsGeI_3$ presents a compelling alternative due to its reduced toxicity and comparable structure since its photovoltaic output remains promising under standard simulation conditions. Limitations such as a narrower absorption range, higher defect-mediated recombination, and potential stability issues under illumination must be addressed through material and device engineering strategies.

Future work should explore the incorporation of Ge-based perovskites in mixed-composition or layered architectures, interface passivation techniques, and doping strategies to enhance performance and mitigate intrinsic weaknesses. The insights from this study reinforce the critical role of B-site engineering in the continued development of stable, efficient, and environmentally responsible perovskite solar cells.

ACKNOWLEDGEMENTS

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POLITICAL PARTICIPATION AND MARGINALIZATION OF INDIGENOUS PEOPLE: A CASE STUDY ON THE SANTAL COMMUNITY IN BANGLADESH

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Abstract

The political participation of indigenous people is important to ensure fair and inclusive elections, which remain critical in Bangladesh. In this study, we examine the issues and opportunities that hinder the political participation and persistent marginalization of the Santan community in Bangladesh. This research employs a qualitative case study methodology that examines both the historical context and the present circumstances of the Santal community. Data have been gathered from secondary sources, interviews, and field observations to analyze constitutional guarantees and international commitments to safeguard their rights. Our findings reveal the challenges like limited representation in decision-making bodies, land dispossession, socio-economic exclusion, and formal and informal political processes. This study contributes to safeguarding indigenous rights, governance, and social justice relating to Sustainable Development Goal (SDGs) 10(Reduced Inequalities) and 16 (Peace, Justice, and Strong Institutions). Finally, we have formulated a sustainable solution for achieving strong policies and governance practices to ensure meaningful political participation of the Santal community in Bangladesh.

Keywords

Indigenous Community, The Santal Community, Political Participation, Bangladesh

POSTBİYOTİK UYGULAMASININ *ECHİNOCOCCUS GRANULOSUS* PROTOSKOLEKSLERİNİN CANLILIĞINA ETKİSİ

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ÖZET

Bir sestod olan *Echinococcus granulosus*'un larval formları, insanlarda başta karaciğer ve akciğerler olmak üzere çeşitli doku ve organlara yerleşerek kistik ekinokokkozis (KE) hastalığına neden olmaktadır. KE için ana tedavi seçeneği cerrahi olup kemoterapi cerrahiye önemli bir yardımcı olarak kullanılmaktadır. Ancak benzimidazol karbamat grubu ve mevcut skolisidal ajanlar, tedavide beklenen düzeyde olumlu sonuçlar vermemektedir. Bu çalışma, *Pediococcus acidilactici* bakterilerinden elde edilen postbiyotiğin *E. granulosus* protoskolekslerinin canlılığı üzerindeki etkisini incelemeyi amaçlamaktadır. Araştırma kapsamında, De Man Rogosa & Sharp (MRS) broth kültüründe çoğaltılan *P. acidilactici* bakterilerinden postbiyotik elde edilmiştir. Taze postbiyotik, suda çözündükten sonra 25, 50, 75 ve 100 mg/mL konsantrasyonlarında hazırlanmış ve her bir konsantrasyondan 100 µL alınarak, 100 µL protoskoleks (yaklaşık 10^5 hücre/ml) süspansiyonu içeren mikrotitre plaklarındaki kuyucuklara eklenmiştir. Protoskoleks canlılıkları, 15, 30, 60, 120 ve 240. dakikalarda %0,1'lik eozin boyası kullanılarak ışık mikroskobunda incelenmiştir. İnceleme sonucunda, 60. dakikada 100 mg/mL konsantrasyonunda ve 240. dakikada 75 mg/mL konsantrasyonunda %100 inhibisyon gözlemlenmiştir. Ayrıca, 240. dakikada 50 mg/mL konsantrasyonunda %80,95 ve 25 mg/mL konsantrasyonunda %61,90 inhibisyon tespit edilmiştir. Sonuç olarak, bu ön değerlendirme çalışması, *P. acidilactici* bakterilerinden elde edilen postbiyotiğin *E. granulosus* protoskolekslerinin canlılığını inhibe ettiğini ve bu konuda daha kapsamlı araştırmalar yapılması gerektiğini ortaya koymaktadır.

Anahtar kelimeler: Hidatik kist, protoskoleks, postbiyotik, tedavi

THE EFFECT OF POSTBIOTIC TREATMENT ON THE VIABILITY OF *ECHINOCOCCUS GRANULOSUS* PROTOSCOLECES

The larval forms of *Echinococcus granulosus*, a cestode, settle in various human tissues or organs, primarily in the liver and lungs, and cause cystic echinococcosis (CE). The main treatment option for CE is surgery, with chemotherapy serving as an important adjunctive treatment. However, the benzimidazole carbamate group and currently available scolicidal agents have not produced the expected positive outcomes in treatment of CE. This study investigated the effect of postbiotics obtained from *Pediococcus acidilactici* on the viability of *E. granulosus* protoscoleces. For this study, postbiotics were obtained from *P. acidilactici*

bacteria cultured in De Man Rogosa & Sharp (MRS) broth. The postbiotic was freshly prepared, dissolved in water, and prepared at concentrations of 25, 50, 75, and 100 mg/mL. Then, 100 µL of each concentration was added to the wells of microtiter plates containing 100 µL of protoscolex suspension (approximately 10^5 cells/mL). At the 15th, 30th, 60th, 120th, and 240th min, the viability of the protoscoleces was examined under a light microscope using 0.1% eosin stain. The results showed 100% inhibition at the 60th minute with the 100 mg/mL concentration, and at the 240th minute with the 75 and 100 mg/mL concentrations. In addition, at the 240th minute, 80.95% inhibition was observed at 50 mg/mL, and 61.90% inhibition was observed at 25 mg/mL. In conclusion, in this preliminary evaluation study, we determined that the postbiotic obtained from *P. acidilactici* inhibits the viability of *E. granulosus* protoscoleces. Comprehensive studies on this topic are required.

Keywords: Hydatid cyst, protoscolex, postbiotic, treatment

EDUCATION FOR SUSTAINABLE DEVELOPMENT FOR A SAFER FUTURE

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Abstract:

Sustainable development is a concept defined by the World Commission on Environment and Development in 1987 as development that meets the needs of the present without compromising the ability of future generations to meet their own needs, having three essential pillars: economic, social and ecological. The Sustainable Development Goals (SDGs), established by the United Nations through the 2030 Agenda, represent a global framework for action and international cooperation, targeting issues such as poverty, hunger, health, education, gender equality, access to clean energy and environmental protection.

Education for sustainable development aims to develop skills and knowledge to understand and promote sustainable practices, thus ensuring a safer future for younger generations.

Education for sustainable development also trains citizens who are able to act in harmony with nature, promote equality and contribute to a productive and healthy lifestyle. It integrates essential topics such as climate change, poverty, sustainable consumption and human rights into existing curricula, with the aim of providing the knowledge and skills needed to understand and address global challenges, thus contributing to a safer and more balanced future.

"Education is the most powerful weapon which you can use to change the world", said Nelson Mandela, a basic tool in achieving a sustainable future. Therefore, the process of sustainable development must begin in the earliest forms of education in which their mentors on the path of learning (educators, teachers, professors) are involved, adapting the educational offer to categories of children, youth and adults, depending on their specific needs and abilities.

Within the Universities it is necessary to develop courses on sustainable development, to be taught within the profile faculties and not only, to develop appropriate educational materials, to create a simulation system by organizing competitions, conferences, etc. Education for and in the spirit of sustainable development must challenge society, to adopt new behaviors and measures to ensure a decent future. This makes room for new approaches, based on values, critical thinking and analysis.

Keywords: education, sustainable development, sustainable practices

EU STRUCTURAL FUNDS AND REGIONAL POLICY

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Abstract:

The European Structural and Investment Funds are financial instruments, managed by the European Commission, whose purpose is to provide support at a structural level. Financial support from the ESI funds is intended, in principle, for the less developed regions, to strengthen economic and social cohesion in the European Union.

The aim of these funds is to create more jobs, ensure a strong European economy and a healthy environment. The EU is committed to creating more and better jobs and a society conducive to social inclusion. These objectives have formed the core of the Europe 2020 Strategy.

The European Structural Funds, as demonstrated by the experience of the Member States that joined in the 1980s (the cohesion states, Spain, Portugal, Greece and Ireland), have had a strong impact on the economies of the European Union to which they have been transferred. More than that, the way in which they were absorbed and their different distribution according to destination, for the development of infrastructure, human capital or directly for economic actions, produced a distinct impact in each of the Member States receiving the funds.

The need to promote balanced development by reducing disparities between different regions and supporting the least developed in catching up was observed even in the preamble of the Treaty of Rome (1957). The foundations of the European Social Fund and the European Investment Bank were laid. Other instruments were created over time, concomitant with the construction of Europe and the increase in the number of new Member States. Thus, in 1962, when a consensus was reached on the development of a common agricultural policy, the European Agricultural Guidance and Guarantee Fund (EAGGF) was created. In 1964 it was divided into two main sections - one for Guidance and the other for Guarantee - which contribute to the implementation of a policy supported by agricultural reforms and the promotion of new forms of rural development. As a result of globalization, the regions of the world, and implicitly those of the EU, are in a permanent competition in which all material, human and informational resources are involved, which differentiates them in qualitative, quantitative and structural aspects.

Thus, at the European Union level, a program was initiated to reduce disparities between regions and EU member states, in terms of the level of development and quality of life, known as EU cohesion policy. Regional policy, through structural funds, contributes to improving the living standards of the EU population by increasing public funds intended for the reconstruction, maintenance or construction of competitive infrastructures, in accordance with European environmental standards. Also, SMEs are established and supported during the first years of existence in areas in economic decline, information systems, new facilities in the fields of education, health, and even leisure.

Keywords: structural funds, regional development, regional disparities

REGULATING E-COMMERCE BUSINESSES: CHALLENGES, OPPORTUNOTIES, AND THE PATH TO EFFECTIVE GOVERNANCE

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Abstract

Electronic commerce (e-commerce) has emerged as a pivotal force in the global digital economy, driven by the rapid proliferation of internet usage and technological advancements. This transformative sector has expanded access to global markets, reduced operational costs, and enhanced customer experiences, particularly in developing economies. However, its rapid growth has introduced complex regulatory challenges, necessitating robust frameworks to govern digital transactions. This study analyzes the regulatory landscape of e-commerce, identifying key challenges and opportunities in shaping effective governance. Major challenges include safeguarding data privacy, combating online fraud, protecting consumer rights, enforcing intellectual property rights, and addressing cross-border legal conflicts. Issues such as taxation, digital creator rights, and personal data management further complicate regulatory efforts. Through a comprehensive review of national and international regulations, this paper highlights opportunities to strengthen e-commerce governance, including enhancing market competitiveness, fostering innovation, and promoting global market integration. By implementing smart, technology-driven regulations and fostering international cooperation, a balance can be achieved between ensuring security, protecting consumer rights, and supporting sustainable e-commerce growth. The findings underscore that well-designed regulatory frameworks, leveraging technologies like block chain and Regulatory Technology (RegTech), can create a secure, transparent, and equitable e-commerce ecosystem, paving the way for its long-term development.

Keywords: e-commerce, regulation, digital economy, data privacy, consumer protection, cybersecurity, intellectual property, cross-border trade, RegTech, innovation, global markets, taxation, online fraud, regulatory framework.

Introduction

Electronic commerce, as a cornerstone of the digital economy, has profoundly transformed global commercial processes and consumption patterns. By transcending traditional trade boundaries, e-commerce has created extensive opportunities for businesses, governments, and consumers. According to the United Nations Conference on Trade and Development (UNCTAD), the global e-commerce market reached a value of $26.7 trillion in 2019, underscoring its pivotal role in the world economy (UNCTAD, 2020). However, alongside its rapid growth, e-commerce has introduced novel regulatory challenges stemming from its unique characteristics, including its cross-border nature, reliance on data, rapid technological advancements, and varying legal frameworks across jurisdictions. These features pose significant obstacles for governments and regulatory bodies in harmonizing national and international laws, safeguarding consumer rights, and ensuring fair competition.

A critical challenge in regulating e-commerce is data privacy. E-commerce platforms collect vast amounts of sensitive user data, including personal information, purchase preferences, location, and search histories, which hold significant economic value and influence consumer

behavior and business decisions. Consequently, establishing robust legal frameworks to protect these data and prevent misuse is a pressing concern. Regulations such as the European Union's General Data Protection Regulation (GDPR) and similar laws in other jurisdictions have been enacted to address this issue, yet achieving global enforcement and harmonization remains a formidable challenge (European Commission, 2020).

Cybersecurity threats constitute another major regulatory hurdle in e-commerce. The digital environment is a fertile ground for various cybercrimes, including online fraud, identity theft, unauthorized payments, and cyberattacks. These threats not only harm consumers but also undermine the reputation and credibility of businesses. Effective regulation and oversight of cybersecurity in e-commerce are therefore essential. International organizations must enhance cooperation to identify and counter these threats effectively.

Moreover, the market dominance of major e-commerce platforms such as Amazon, Alibaba, and eBay raises concerns about monopolistic practices and anti-competitive behaviors. These platforms, which control significant market shares, can influence pricing, competition, and consumer choices. By acting as both sellers and intermediaries, they may prioritize their own products in search results and advertisements, thereby restricting competition. Competition authorities, such as the U.S. Federal Trade Commission (FTC) and the European Commission, are actively investigating these anti-competitive practices and striving to enforce antitrust laws effectively (European Commission, 2020).

Consumer rights represent another critical dimension of e-commerce regulation. Consumers frequently encounter issues such as misleading product descriptions, delivery errors, and complex return policies. These challenges are exacerbated in cross-border transactions, where resolving disputes becomes particularly difficult due to jurisdictional differences. While international frameworks, such as UNCITRAL's Model Law on Electronic Commerce, provide guidelines for consumer protection, the absence of a globally coordinated dispute resolution system remains a significant barrier (UNCITRAL, 2017).

Despite these challenges, e-commerce also presents opportunities to enhance regulatory frameworks. Emerging technologies such as block chain and Regulatory Technology (RegTech) offer significant potential to increase transparency and efficiency in oversight. Block chain, as a decentralized ledger, enables secure and transparent transaction recording, which can help detect fraud and build trust in online markets. Similarly, RegTech leverages big data and artificial intelligence to enable real-time monitoring and prevent violations (Arner et al., 2017).

This article aims to explore the challenges and opportunities in regulating e-commerce and propose a comprehensive framework for achieving effective governance. It emphasizes how innovative technologies and international cooperation can support the growth of e-commerce while protecting consumers and promoting fair competition.

Key Challenges in E-Commerce Regulation

Electronic commerce, despite its significant contributions to economic and social progress, presents complex regulatory challenges that necessitate innovative approaches to governance. These challenges arise from the unique characteristics of e-commerce, including its cross-border nature, reliance on data, rapid technological evolution, and jurisdictional disparities. The primary challenges include data privacy and protection, cybersecurity and online fraud, market dominance and monopolistic practices, consumer rights, and cross-border legal conflicts. Each of these challenges is examined in detail below.

Data Privacy and Protection

Data privacy and the protection of personal information represent one of the most significant regulatory challenges in e-commerce, as platforms collect extensive sensitive user data—such as banking details, purchase histories, location data, and personal preferences—for commercial purposes like service personalization. Misuse or exposure of these data to security breaches can lead to identity theft, financial fraud, or diminished consumer trust (Zarsky, 2016). Ensuring the security of this information is both essential and complex due to the cross-border and dynamic nature of e-commerce.

A key challenge is the significant variation in legal approaches across jurisdictions. For instance, the European Union's General Data Protection Regulation (GDPR) emphasizes explicit user consent and extensive individual rights, such as access, correction, and deletion of data, whereas the United States adopts a more fragmented approach through laws like the California Consumer Privacy Act (CCPA), which relies on an opt-out model. These differences complicate uniform consumer protection and increase compliance costs for multinational companies (Chander & Sun, 2021). In developing countries, where technical infrastructure and enforcement capacities are often limited, implementing these regulations faces additional hurdles. For example, in Indonesia, the absence of comprehensive data protection laws and fragmented regulations heightens cybersecurity risks and undermines oversight (UNCTAD, 2020; European Commission, 2020).

Managing consumer consent and data minimization poses another challenge. E-commerce platforms collect vast amounts of data for personalized services, but ensuring informed consent and limiting data collection to essential purposes is technically and legally complex. Consumers are often unaware of how their data are processed or shared, leading to distrust and a privacy paradox, where individual's express concerns but continue sharing data for transactional convenience. Research indicates that privacy breaches in e-commerce can significantly erode consumer trust, negatively impacting participation rates and the industry's sustainable growth (Zarsky, 2016).

Data security and breach prevention are also critical issues. Data breaches, identity theft, and non-compliance with evolving regulations like GDPR and CCPA highlight the inherent vulnerabilities of e-commerce systems. These challenges necessitate advanced technologies, such as block chain and artificial intelligence, to enhance security (UNCTAD, 2021). Cross-border data transfers and third-party sharing further complicate compliance, as differing jurisdictional laws can restrict data flows, forcing companies to balance commercial objectives with privacy obligations. In developing nations, limited resources for enforcement exacerbate these issues, rendering oversight inefficient (European Commission, 2020). Additional operational challenges include data retention policies, employee access controls, staff training, and evolving consumer expectations. Smaller firms often struggle with the high costs of compliance, which can stifle innovation. Effective enforcement of regulations like GDPR faces obstacles such as inconsistent compliance, lack of robust control groups for impact assessment, and unintended effects on competition and innovation. Addressing these challenges requires robust regulatory systems, international coordination, and consumer education to enhance awareness and strengthen data protection in e-commerce (UNCTAD, 2020).

Cybersecurity and Online Fraud

Cybersecurity and online fraud are critical challenges in e-commerce regulation, driven by the sector's cross-border and dynamic nature. Cyber threats, including ransomware, distributed denial-of-service (DDoS) attacks, payment fraud, and phishing, disrupt online commerce and

compromise sensitive information, such as banking and identity data, thereby eroding consumer trust and damaging platform reputations (Liu et al., 2022). These threats are evolving rapidly, with cybercriminals leveraging advanced technologies like artificial intelligence and machine learning for sophisticated attacks combining phishing, malware, and social engineering, necessitating dynamic and coordinated regulatory responses.

A primary challenge is the lack of harmonized cybersecurity regulations globally. For instance, the European Union's GDPR and the United States' Payment Card Industry Data Security Standard (PCI DSS) adopt differing approaches, complicating uniform compliance for multinational firms. These inconsistencies increase compliance costs and create regulatory gaps exploited by cybercriminals (Chander & Sun, 2021). In developing countries, limited technical infrastructure and enforcement capacity further hinder oversight, amplifying risks of fraud, such as payment scams through insecure gateways (UNCTAD, 2020).

The high costs of implementing advanced cybersecurity measures pose a significant barrier, particularly for small and medium-sized enterprises (SMEs), which often lack resources for tools like intrusion detection systems or advanced encryption, leaving them vulnerable to breaches and attacks (Liu et al., 2022). Human factors also contribute significantly, with studies indicating that 80% of cyber incidents stem from human errors, such as clicking phishing links or neglecting security protocols, underscoring the need for ongoing training for employees and consumers (Liu et al., 2022). Additionally, reliance on third-party vendors and Internet of Things (IoT) devices introduces vulnerabilities, as these devices often lack adequate security and can serve as entry points for DDoS attacks.

Addressing these threats requires stringent cybersecurity policies and enhanced international cooperation. The Organisation for Economic Co-operation and Development (OECD) emphasizes the need for global cybersecurity standards and collaborative efforts, such as threat intelligence sharing, to mitigate fraud and breaches (OECD, 2019). However, implementation faces challenges, including complex legal requirements and the need for continuous updates to counter emerging threats like deepfakes and fraud-as-a-service (ENISA., 2023). Limited organizational preparedness, particularly in developing countries, and global coordination gaps further hinder effective regulation. A multifaceted approach, integrating AI-driven fraud detection, consumer education, and international policy alignment, is essential to bolster cybersecurity and reduce online fraud.

Market Dominance and Monopolistic Practices

The e-commerce market is increasingly dominated by a few major platforms, such as Amazon, Alibaba, and eBay, which wield significant influence over online commerce by acting simultaneously as sellers and intermediaries. These platforms leverage economies of scale, access to vast datasets, and control over digital infrastructure to create high barriers to entry for new competitors, fostering monopolistic tendencies and anti-competitive behaviors, such as self-preferencing and using third-party seller data to compete against them (Khan, 2017). For instance, Amazon, which controlled approximately 50% of the U.S. e-commerce market in 2020, has faced allegations of using independent sellers' data to develop competing products and prioritizing its own offerings in search results (European Commission, 2020).

Such anti-competitive practices not only restrict market competition but also limit consumer choices and stifle innovation. The dominance of large platforms disadvantages small and medium-sized enterprises (SMEs) and startups, which lack comparable financial and infrastructural resources, potentially leading to higher prices and reduced service quality for consumers in the long term (Gupta et al., 2023). Additionally, the lack of transparency in these

platforms' proprietary ranking and advertising algorithms undermines trust among sellers and consumers while complicating regulatory oversight due to technical complexities (Khan, 2017). In India, for example, Amazon and Flipkart have faced accusations of anti-competitive practices, such as offering exclusive discounts and favoring affiliated sellers (Reuters, 2024, September 13).

Regulatory inconsistencies across jurisdictions further exacerbate this challenge. The European Union's Digital Markets Act (DMA) aims to curb the power of dominant platforms (gatekeepers) by imposing stricter rules on anti-competitive behavior, while the United States relies primarily on case-by-case antitrust litigation led by the Federal Trade Commission (FTC). These divergent approaches hinder global coordination, allowing large platforms to exploit regulatory gaps in jurisdictions with weaker frameworks, particularly in developing countries like Brazil and India (European Commission, 2020; UNCTAD, 2020). These regions often lack robust regulatory infrastructure to address anti-competitive practices, intensifying monopolistic tendencies. Regulating this domain requires balancing the promotion of competition with the preservation of innovation. Overly stringent regulations may stifle technological advancements, while insufficient oversight perpetuates monopolistic practices (Chander & Sun, 2021). International organizations advocate for global standards to regulate dominant platforms, but cultural, economic, and legal differences across countries complicate their implementation. Furthermore, vertical integrations, such as acquisitions of logistics or technology firms by major platforms, strengthen their market power and make oversight more challenging (Chander & Sun, 2021). Flexible, transparent, and harmonized regulatory frameworks, coupled with international cooperation and enhanced regulatory capacity in developing countries, are essential to foster fair competition, protect consumers, and promote innovation in the e-commerce ecosystem (UNCTAD, 2020).

Consumer Rights in E-Commerce

Consumer rights constitute a critical and complex aspect of e-commerce regulation, exacerbated by the sector's cross-border and digital nature. A primary challenge is the information asymmetry between consumers and e-commerce platforms, leading to issues such as misleading product descriptions, discrepancies between advertised and delivered products, complex return policies, and delivery errors (UNCTAD, 2020). These issues erode consumer trust, particularly in cross-border transactions, where dispute resolution is often time-consuming and costly.

Enforcing consumer protection laws globally presents another significant challenge. While regulations like the EU's Consumer Rights Directive (CRD) and India's Consumer Protection Act 2019 mandate transparency in product information, a 14-day withdrawal right, and effective complaint handling, many developing countries lack up-to-date legal frameworks or enforcement capabilities to uphold these standards (UNCTAD, 2021). In regions like Africa and parts of Asia, outdated consumer protection laws often fail to address the complexities of digital commerce, resulting in low trust and a high volume of unresolved disputes (UNCTAD, 2020). The absence of a globally coordinated dispute resolution system further intensifies this challenge (UNCITRAL, 2017).

Dispute resolution in e-commerce is hindered by its digital and cross-border nature. Traditional mechanisms, such as courts, are costly and time-consuming for consumers, and online dispute resolution (ODR) platforms, while promising, remain underdeveloped in many regions. Although platforms like Concilianet in Mexico achieve a 96% settlement rate, many countries lack comparable systems, limiting consumers' access to remedies (Lianos et al, 2019).

Additionally, online fraud, such as non-delivery of goods or counterfeit products, further undermines consumer confidence and highlights the need for robust regulatory mechanisms (Gupta et al., 2023). In India, for example, the E-Daakhil portal handled approximately 9,800 complaints by November 2021, but many consumers abandon claims due to legal complexities (Economic Times, 2024).

Legal inconsistencies across jurisdictions also pose a significant barrier. While the EU enforces stringent standards through GDPR and CRD, countries like Pakistan or Nigeria often have fragmented or ineffective regulatory frameworks, enabling large platforms to exploit legal gaps. International frameworks, such as those proposed by UNCITRAL and the World Trade Organization (WTO), aim to support consumer rights, but the lack of global enforcement remains a critical obstacle (UNCITRAL, 2017). Moreover, low consumer awareness of rights and the technical complexity of digital platforms, such as dynamic pricing algorithms or intricate terms of service, limit informed decision-making (Chander & Sun, 2021). Regulators face the challenge of balancing strict consumer protections with industry innovation. The OECD emphasizes the importance of consumer education, enhanced ODR systems, and international cooperation to create cohesive regulatory frameworks that bolster consumer trust and ensure the sustainability of the e-commerce ecosystem (UNCTAD, 2020; OECD, 2016a).

Cross-Border Challenges and Legal Conflicts

The inherently cross-border nature of e-commerce, enabling transactions across jurisdictions without geographical constraints, introduces significant regulatory challenges related to legal conflicts. Fundamental questions, such as which country's laws should govern an online transaction or which court has jurisdiction over disputes, often remain unresolved, creating legal and operational complexities (WTO, 2021). These inconsistencies, rooted in differing national regulatory frameworks, hinder effective law enforcement and undermine trust among businesses and consumers in the digital ecosystem (UNCTAD, 2020).

A key challenge is the variation in national laws concerning taxation, intellectual property rights, and e-commerce standards. For instance, digital service taxes in countries like France and the UK differ from traditional tax regimes elsewhere, complicating compliance for multinational firms (Chander & Sun, 2021). In intellectual property, discrepancies in patent and trademark regulations across jurisdictions make it difficult to enforce protections against counterfeit goods in cross-border e-commerce (WTO, 2021). These inconsistencies are particularly pronounced in developing countries, such as Pakistan or Nigeria, where weak regulatory infrastructure allows large platforms to exploit legal gaps.

Cross-border dispute resolution is further complicated by jurisdictional disparities. Determining legal authority in transactions involving parties in different countries is challenging due to variations in legal systems and judicial procedures (UNCITRAL, 2017). Traditional court-based mechanisms are costly and slow, and while online dispute resolution (ODR) platforms offer potential solutions, their development remains limited, particularly in developing regions.

International organizations like the WTO and UNCITRAL are working to establish harmonized frameworks for e-commerce regulation and cross-border data flows, but progress is slow. The WTO's Joint Statement Initiative on E-commerce, involving over 80 countries, seeks to develop common rules for data flows and digital trade, but economic, political, and cultural differences impede comprehensive agreements (WTO, 2021). Regional agreements, such as the Regional Comprehensive Economic Partnership (RCEP), have made strides toward harmonization, but issues like data localization remain contentious (Chander & Sun, 2021). For

instance, countries like China enforce data localization policies, conflicting with principles of free data flows and complicating global coordination (UNCTAD, 2020).

Technical complexities in e-commerce further hinder cross-border regulation. Traditional legal concepts, such as “offer” and “acceptance” in electronic contracts, are often misaligned with modern technologies like the internet’s end-to-end principle, leading to ambiguous legal interpretations. Regulators must balance the need for cohesive regulations with the preservation of innovation, as overly restrictive rules may stifle industry growth, while lax oversight allows exploitation of legal gaps (Chander & Sun, 2021). International cooperation, strengthened ODR systems, and adoption of global standards, such as UNCITRAL’s Model Law on Electronic Transactions, are critical to reducing legal conflicts and fostering a secure and equitable e-commerce environment (UNCTAD, 2020; OECD, 2021).

Opportunities in E-Commerce Regulation

While e-commerce presents numerous regulatory challenges, it also offers significant opportunities to enhance governance by leveraging emerging technologies and fostering international cooperation. This section explores key opportunities, including increased transparency and traceability, the adoption of Regulatory Technology (RegTech), the use of big data analytics, and strengthened international collaboration.

Enhancing Transparency and Traceability

One of the most significant opportunities in e-commerce regulation is the potential to enhance transparency and traceability in commercial processes, thereby improving consumer trust, supply chain efficiency, and regulatory oversight. Technologies such as block chain, a decentralized ledger, enable secure and immutable transaction records, preventing data manipulation and increasing transparency across supply chains (Tapscott & Tapscott, 2016). For instance, in the food industry, block chain can identify the source of contamination within seconds, compared to weeks required by traditional methods, reducing fraud and enhancing consumer confidence in cross-border e-commerce (Gupta et al., 2023). Companies like Walmart have implemented block chain to track agricultural products, improving consumer safety and reducing regulatory costs (UNCTAD, 2020).

Complementary technologies, such as the Internet of Things (IoT) and artificial intelligence (AI), further amplify transparency. IoT enables real-time data collection from supply chains, while AI analyzes these data to detect anomalies or fraud (Liu et al., 2022). In the Asia-Pacific region, these technologies have improved logistics transparency and reduced delivery times (Spherical Insights, 2025). However, challenges such as high implementation costs for small and medium-sized enterprises (SMEs) and limited digital infrastructure in developing countries, like Pakistan, hinder widespread adoption.

Adoption of Regulatory Technology (RegTech)

The emergence of Regulatory Technology (RegTech) offers transformative opportunities for efficient and scalable oversight. By leveraging AI, natural language processing (NLP), and big data analytics, RegTech enables real-time monitoring of e-commerce platforms, ensuring compliance with regulations on data privacy, anti-money laundering (AML), and consumer protection (Arner et al., 2017). For example, AI and NLP can analyze digital contracts or platform policies to identify regulatory violations, significantly reducing the time and cost of manual oversight. RegTech also facilitates proactive risk management by detecting financial risks, fraud, and non-compliance before they escalate (Arner et al., 2017).

Leveraging Big Data for Evidence-Based Policymaking

The vast data generated by e-commerce platforms presents a valuable opportunity for improving regulatory policymaking. By analyzing these data, regulators can identify market trends, consumer behaviors, and issues such as fraud or product discrepancies, enabling the design of evidence-based policies aligned with market needs (UNCTAD, 2020). For instance, big data analytics can detect unusual purchasing patterns or suspicious activities, allowing regulators to develop targeted policies to protect consumers and businesses (Liu et al., 2022). This data-driven approach enhances regulatory decision-making, making policies more flexible and effective.

Strengthening International Collaboration

Strengthening international collaboration to establish global standards and harmonized regulatory frameworks is a critical opportunity. Organizations like the World Trade Organization (WTO) and UNCITRAL, through initiatives such as the WTO's Joint Statement Initiative on E-commerce involving over 80 countries, aim to create common rules for data flows, consumer protection, and cybersecurity (WTO, 2021). Such collaborations can reduce cross-border legal conflicts and enhance coordination among jurisdictions. For example, agreements like the Regional Comprehensive Economic Partnership (RCEP) promote standardized protocols for tracking and verifying product authenticity, mitigating issues like counterfeiting and intellectual property violations (Chander & Sun, 2021). Frameworks like UNCITRAL's Model Law on Electronic Transactions and online dispute resolution (ODR) systems can streamline regulatory processes and improve access to remedies in cross-border transactions (UNCITRAL, 2017).

However, exploiting these opportunities faces challenges. High implementation costs for technologies like block chain and RegTech limit adoption by SMEs, while inadequate digital infrastructure in developing countries, such as Pakistan, restricts scalability. Cultural, economic, and political differences among countries also complicate international coordination (OECD, 2021). To overcome these barriers, regulators must adopt flexible, technology-driven policies, invest in digital infrastructure, and enhance training for businesses and consumers. This approach, combined with international cooperation, can create a secure, transparent, and equitable e-commerce ecosystem, fostering consumer trust and market sustainability (UNCTAD, 2020).

Path to Effective Governance in E-Commerce Regulation

Achieving effective governance in e-commerce requires a multifaceted approach that supports rapid innovation while protecting consumer rights, promoting fair competition, and ensuring data security. Given the cross-border and dynamic nature of e-commerce, regulation must be flexible, technology-driven, and aligned with market needs. This section proposes a practical framework to address regulatory challenges (e.g., legal conflicts, monopolistic practices, cybersecurity, and consumer rights) and leverage opportunities (e.g., transparency, RegTech, and big data analytics). The framework encompasses smart regulation, international cooperation, industry self-regulation, consumer empowerment, and widespread adoption of emerging technologies.

Smart and Risk-Based Regulation

Smart, risk-based regulation is a cornerstone of effective e-commerce governance. Rather than applying uniform rules to all market players, regulators should tailor regulations based on the risk and impact of platforms. Large platforms like Amazon and Alibaba, which manage vast data volumes and pose greater risks to competition and privacy, should face stricter oversight, while SMEs can benefit from more flexible regulations (Arner et al., 2017). This approach reduces unnecessary regulatory burdens on startups, fostering innovation while curbing abuses by dominant platforms (Khan, 2017). For instance, the EU's Digital Markets Act (DMA) imposes stringent rules on gatekeeper platforms to prevent anti-competitive practices like self-preferencing (European Commission, 2020).

Strengthening International Cooperation and Regulatory Harmonization

Cross-border challenges, such as conflicting laws on privacy, taxation, and consumer rights, necessitate enhanced international cooperation and regulatory harmonization. Disparities between frameworks like the EU's GDPR and the U.S.'s CCPA increase compliance costs and complicate enforcement in cross-border transactions (Chander & Sun, 2021). International agreements, such as the RCEP and the WTO's Joint Statement Initiative on E-commerce, can establish common standards for data flows, consumer protection, and cybersecurity, supporting developing countries in strengthening their regulatory infrastructure (WTO, 2021). The APEC Cross-Border Privacy Rules (CBPR) system, for example, facilitates data protection harmonization, boosting trust in cross-border transactions.

Promoting Industry Self-Regulation and Standards

Industry self-regulation and the development of voluntary standards offer an effective approach to reduce regulatory pressure and enhance compliance. Instead of relying solely on governmental oversight, the e-commerce industry can establish codes of conduct and standards for issues like transparent digital marketing, targeted advertising, and consumer dispute resolution (OECD, 2020). For example, the ISO B2C e-commerce standard can guide platforms in improving algorithm transparency and return policies, enhancing consumer trust (Gupta et al., 2023). Successful examples, such as Mexico's Concilianet ODR platform with a 96% settlement rate, demonstrate the potential of industry-led initiatives (Lianos et al, 2019).

Investing in Digital Literacy and Consumer Empowerment

Empowering consumers through enhanced digital literacy is critical for effective governance. Consumers must be aware of their online rights, including withdrawal rights, data protection, and fraud detection. Governments and civil society should invest in digital literacy programs and tools like ODR platforms to enable consumers to pursue complaints efficiently (OECD, 2021). For instance, India's E-Daakhil portal handled approximately 9,800 complaints by November 2021, but low consumer awareness limits its effectiveness (Economic Times, 2024). Education on topics like privacy management and phishing prevention can boost consumer confidence and reduce online fraud (Liu et al., 2022).

Widespread Adoption of Emerging Technologies (RegTech and SupTech)

Broad adoption of Regulatory Technology (RegTech) and Supervisory Technology (SupTech) offers unprecedented opportunities to enhance regulatory efficiency. RegTech, leveraging AI, NLP, and big data analytics, enables real-time monitoring and compliance with privacy, AML, and consumer protection laws (Arner et al., 2017). SupTech supports regulators in predicting financial risks and violations through data analysis (Cambridge SupTech Lab, 2024). Block chain enhances supply chain transparency and reduces fraud, while AI detects suspicious transaction patterns (Tapscott & Tapscott, 2016). However, high implementation costs for SMEs and limited digital infrastructure in developing countries, like Pakistan, restrict scalability.

To achieve effective governance, regulators must integrate these strategies. Principle-based policies, such as UNCITRAL's Model Law, provide flexibility to adapt to technological changes, while international cooperation and digital infrastructure investments enhance coordination and efficiency (UNCITRAL, 2017). This framework addresses regulatory challenges and leverages technological and collaborative opportunities, fostering a secure, transparent, and competitive e-commerce ecosystem (UNCTAD, 2020).

CONCLUSION

Electronic commerce (e-commerce) has emerged as a transformative force in the digital economy, offering unprecedented opportunities for businesses, consumers, and governments. Its rapid growth has expanded access to global markets, reduced operational costs, and enhanced customer experiences, particularly in developing economies (UNCTAD, 2020). However, the unique characteristics of e-commerce—its cross-border nature, reliance on data, and rapid technological evolution—present complex challenges, including data privacy protection, cybersecurity threats, market dominance by large platforms, consumer rights, and cross-border legal conflicts (Chander & Sun, 2021). If not addressed effectively, these challenges can erode consumer trust, restrict fair competition, and threaten the sustainable growth of the industry.

Despite these challenges, e-commerce offers significant opportunities to enhance regulatory frameworks. Emerging technologies, such as block chain, enable transparency and traceability in supply chains, fostering consumer trust and reducing fraud, such as counterfeit goods (Tapscott & Tapscott, 2016). Regulatory Technology (RegTech) and Supervisory Technology (SupTech), leveraging artificial intelligence and big data analytics, facilitate real-time monitoring and compliance with data privacy, anti-money laundering, and consumer protection regulations (Arner et al., 2017). Additionally, big data analytics empower regulators to design evidence-based policies aligned with market needs, enhancing regulatory efficiency (Liu et al., 2022). International cooperation, through initiatives like the WTO's Joint Statement Initiative on E-commerce and regional agreements like the RCEP, can mitigate legal conflicts and establish global standards for data flows, consumer protection, and cybersecurity (WTO, 2021; Chander & Sun, 2021).

The proposed framework for effective governance—encompassing smart, risk-based regulation, strengthened international cooperation, industry self-regulation, consumer empowerment through digital literacy, and widespread adoption of emerging technologies—offers a balanced approach to support innovation while safeguarding consumer rights and fair competition (OECD, 2016b). This framework requires investments in digital infrastructure, training for businesses and consumers, and international coordination through frameworks like

UNCITRAL's Model Law to create a secure, transparent, and competitive e-commerce ecosystem (UNCITRAL, 2017).

In conclusion, effective e-commerce regulation not only addresses existing challenges but also leverages technological and collaborative opportunities to foster sustainable industry growth. Flexible, technology-driven policies, coupled with enhanced regulatory capacity in developing countries, can bolster consumer trust, promote fair competition, and support innovation. This study demonstrates that comprehensive and harmonized regulations, underpinned by advanced technologies and global cooperation, can position e-commerce as a driving force in the digital economy, contributing to sustainable economic and social development while ensuring security and transparency.

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MULTIDRUG RESISTANT GRAM- POSSITIVE COCCI BACTERIA ISOLATED FROM FOMITES IN SELECTED HEALTH CARE CENTRES IN IBARAPA EAST LOCAL GOVERNMENT, OYO STATE, NIGERIA.

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Fomites can potentially harbor and transmit infectious or contagious pathogens thus contributing to the widespread of hospital-acquired infections and antibiotics resistance bacteria. These infections and antibiotic resistance are responsible for increased morbidity, mortality and high cost of treatment expenses due to extended stays in hospitals. The study was designed to determine the antibiotics susceptibility patterns of Gram- positive cocci isolated from fomites in selected health care centres in Ibarapa East Local Government, Oyo state, Nigeria.

A cross sectional study was carried out by which 108 swab samples were collected from bed railings, door handles, bed covers and benches of four health care centres. Bacteria were isolated and identified using standard microbiological techniques. The Gram positive cocci bacteria were subjected to antibiotics susceptibility testing against Erythromycin, Vancomycin, Chloramphenicol, Gentamycin, Ciprofloxacin, Co-trimethaxazole and cefoxitin using the Kirby Bauer disc diffusion method. Data were analysed using descriptive statistics.

The isolates obtained from the samples were (39 Bed covers, 31 Bed railings, 26 Door handles, 22 Benches and 21 side pans) Out of which 47 (32.2%) were identified as Gram positive cocci. The antibiotics susceptibility pattern of these isolates showed that 51.1, 55.3 and 70.2% were resistant to erythromycin, cotrimethaxazole, and vancomycin, respectively, while 48.9% were multidrug resistant having shown resistance to more than three different classes of antibiotics.

The inanimate surfaces of the studied hospitals harbor multidrug resistant bacteria which established the fact that nosocomial infections persist within our healthcare setting and proves that fomites are possible vehicles of infection transmission. Hence, proper and regular disinfection of inanimate surfaces should be enhanced within the health care settings to curtail the menace of nosocomial infections.

Keywords: Nosocomial infection, Gram-positive cocci, Antibiotic resistance, Fomites, Health care setting.

EFFICIENCY EMPOWERMENT OF SOLAR ENERGY STORAGE SYSTEMS USING ARTIFICIAL INTELLIGENCE

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Abstract:

Solar energy is a vital renewable resource, but its intermittent nature limits efficient utilization without reliable storage systems. Energy storage systems (ESS), particularly batteries, ensure continuity of supply, though conventional management methods often face challenges such as inefficient energy dispatch, inaccurate state-of-charge estimation, and battery degradation. Artificial Intelligence (AI) offers advanced solutions to these challenges by enabling precise forecasting of solar irradiance and load demand, optimizing charging and discharging cycles, and predicting battery health for extended lifespan. AI-driven control systems further enhance operational efficiency through real-time decision-making, cost-effective energy arbitrage, and seamless integration with the grid. By applying machine learning and deep learning models, solar energy storage systems achieve higher efficiency, reduced energy losses, and improved system resilience. This study emphasizes the role of AI in empowering the efficiency, reliability, and sustainability of solar energy storage, establishing it as a key enabler in advancing smart and sustainable energy infrastructures.

Keywords: Energy Storage System, Artificial Intelligence, Sustainable Approach.

High lights:

- AI improves solar forecasting accuracy by 10–20%, enabling efficient energy scheduling.
- ML and RL optimize battery health and real-time control, boosting system efficiency.
- AI accelerates HESS design and materials discovery for sustainable storage solutions.

Abbreviation:

AI	artificial intelligence	P2P	peer-to-peer
ANNs	artificial neural networks	PCMs	phase change materials
DL	deep learning	PV	photovoltaic
DQN	deep q-networks	RL	reinforcement learning
ESS	energy storage systems	RUL	remaining useful life
HESSs	hybrid energy storage systems	SoC	state-of-charge
k-NN	k-nearest neighbors	SoH	state-of-health
LSTM	long short-term memory	SVMs	support vector machines
ML	machine learning	V2G	vehicle-to-grid

Introduction:

The global demand for clean, sustainable, and efficient energy solutions has increased drastically over the past two decades due to rising concerns over climate change, depletion of fossil fuels, and environmental degradation. Among the various renewable energy sources, solar energy has emerged as one of the most promising and widely utilized resources because of its abundance, accessibility, and declining costs of photovoltaic (PV) technology. However, solar power generation is inherently intermittent and variable, primarily depending on weather conditions, day–night cycles, and seasonal variations. This intermittent nature creates a mismatch between supply and demand, limiting the large-scale adoption of solar power in modern energy systems. To overcome these challenges, the integration of energy storage systems (ESS) has become essential, as they ensure continuous power supply, grid stability, and effective utilization of harvested solar energy.

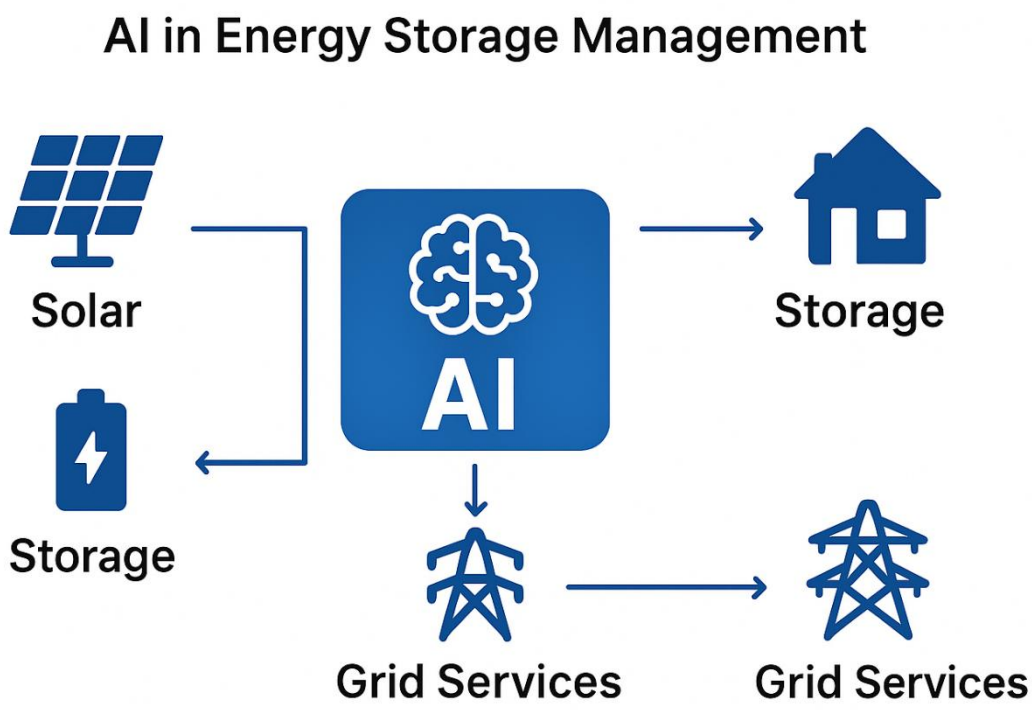

Fig. 1 Energy Storage Management with Artificial Intelligence

Despite these advancements, challenges remain in terms of scalability, computational requirements, data privacy, and cybersecurity risks associated with AI-enabled systems. Moreover, the reliability of AI predictions depends on the quality and availability of data, which may be limited in certain geographical or infrastructural contexts. Therefore, further research is required to develop robust, adaptive, and secure AI models tailored to diverse energy environments.

In summary, the convergence of solar energy storage and Artificial Intelligence represents a critical step toward achieving sustainable, efficient, and resilient energy infrastructures. By overcoming the limitations of conventional storage management, AI empowers solar energy systems with enhanced forecasting, optimized operations, extended asset life, and cost savings. This not only accelerates the transition toward clean energy but also strengthens the resilience of power systems against variability and uncertainty. The focus of this research is to explore

how AI can empower efficiency in solar energy storage systems and to highlight the emerging opportunities, applications, and challenges in this rapidly evolving domain.

Literature Review:

Significant research over recent years underscores the transformative potential of **Artificial Intelligence (AI)**—particularly **machine learning (ML)** and **deep learning (DL)**—in enhancing the efficiency, reliability, and intelligence of **solar energy storage systems (ESS)**.

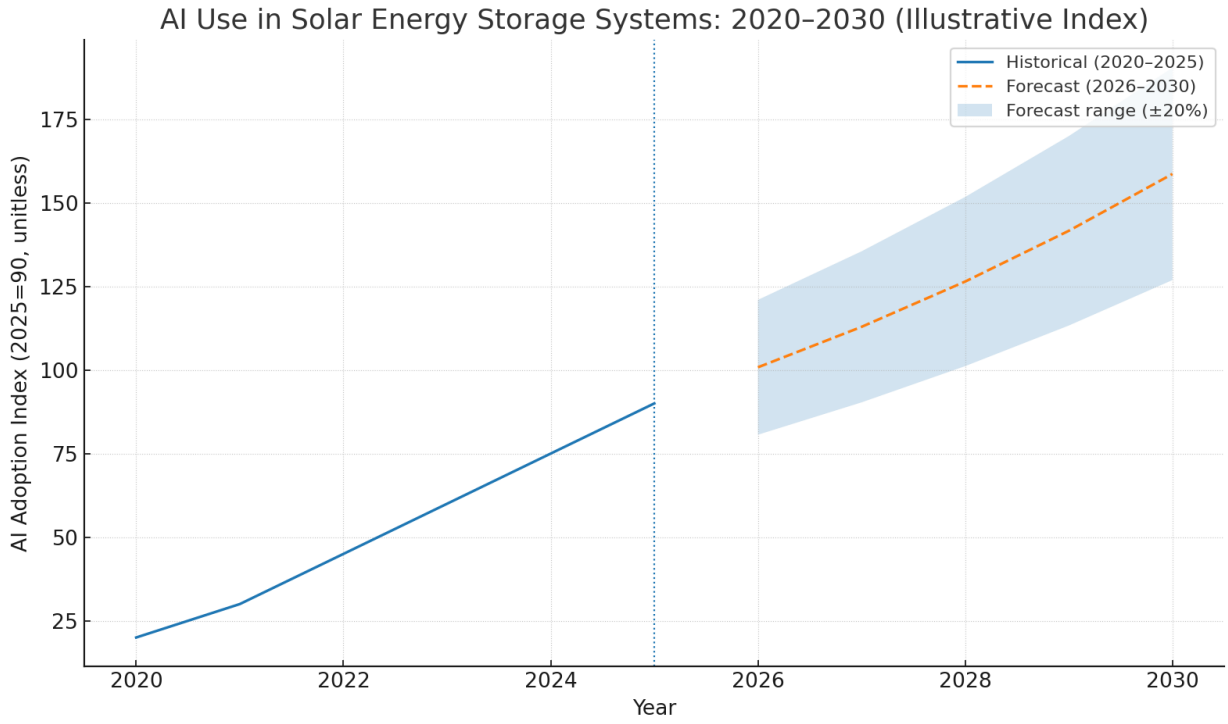

Fig. 2 Use of AI in solar energy storage system in last five years and upcoming five years

Forecasting Solar Irradiance and Power Output

Accurate prediction of solar irradiance and photovoltaic (PV) output is foundational for optimizing ESS operations. A comprehensive review confirms that classical ML models—including Artificial Neural Networks (ANNs), Support Vector Machines (SVMs), k-Nearest Neighbors (k-NN), and advanced DL architectures—have been widely employed in solar irradiance forecasting. Among these, ANNs often deliver the most reliable performance, with Long Short-Term Memory (LSTM) networks and wavelet–LSTM hybrids further improving multi-scale prediction accuracy and robustnes. Similarly, ensemble methods combining ANNs with variables like irradiance, temperature, humidity, and cloud cover further enhance PV power forecasting accuracy [1].

Battery Health Monitoring, Prognostics, and SOC/SOH Estimation

In battery management, ML models are increasingly applied to estimate **state-of-charge (SoC)**, **state-of-health (SoH)**, and predict **remaining useful life (RUL)**. For instance, diverse techniques—ranging from extreme learning machines and convolutional neural networks with transfer learning to hybrid frameworks combining fiber sensors—have shown effectiveness in real-time capacity and degradation prediction for lithium-ion batteries [2]. ML's application

extends to prognostics based on coarse field data, enabling accurate lifespan estimation for off-grid solar battery systems.

Intelligent Control: Reinforcement Learning for Storage Dispatch

Reinforcement learning (RL), especially using Deep Q-Networks (DQN), offers powerful means to manage ESS without requiring statistical assumptions on energy generation or price patterns. A study demonstrated that DQN agents can learn near-optimal real-time control strategies—deciding when to charge or discharge—based on reward-based learning, achieving efficient energy dispatch even in stochastic environments [3]. Broader reviews also highlight RL's potential for optimizing **hybrid energy storage systems (HESSs)**, particularly in EV applications where dynamic, adaptive energy management is crucial [4].

Hybrid Energy Storage Systems (HESS) & Emerging AI Directions

Hybrid systems—integrating batteries with supercapacitors or flow batteries—offer enhanced performance by leveraging complementary strengths. A recent study emphasizes AI-driven control strategies to manage such HESS configurations, advocating scalable, cybersecure designs aligned with lifecycle, environmental, and policy considerations [5].

Materials Discovery & Thermal Storage Optimization

Beyond control and forecasting, ML enables breakthroughs in energy-storage material development. It accelerates discovery through predicting crystal structures and electrochemical properties—key for batteries—thus expanding the design space for advanced materials [6]. In thermal energy storage, particularly using phase change materials (PCMs), ANN and SVM models have been applied to predict dynamic behavior and thermal performance, albeit with challenges in generalization to unseen conditions [7].

S. No.	Area	Study (year)	Methods	Data/Setup	Key finding
1	Solar forecasting	*Advances in Short-Term Solar Forecasting* (2024) [8]	ML & DL review (ANN/LSTM/Ensembles)	Short-term PV & irradiance	DL methods now dominate short-term PV forecasts; guidance on model selection & metrics.
2	Solar forecasting	*Evaluation of Solar Radiation Prediction Models Using AI* (2025) [9]	LSTM, Bi-LSTM	Train/test split with MAE/RMSE /R^2	LSTM/Bi-LSTM outperform classical baselines for radiation prediction.
3	Solar forecasting	*Investigating the Power of LSTM-Based Models in Solar Energy Forecasting* (2023) [10]	LSTM, hybrid LSTM	Time-series PV datasets	Hybrid LSTM variants improve accuracy over plain LSTM.

4	Solar forecasting	*Short-Term PV Power Forecasting Models* (2023) [11]	ANN/SVM/Ensembles	Smart-grid day-ahead use	Practical guidance for short-term PV in operations/markets.
5	Solar forecasting	*Ultra-Short-Term PV Forecasting via Ensemble Learning* (2025) [12]	Stacking/Ensembles	Minute-level PV	Ensemble learners boost ultra-short-term accuracy for control.
6	Solar forecasting	*Comprehensive Review on Ensemble Solar Power Forecasting* (2023) [13]	Competitive & cooperative ensembles	Multi-site PV	Ensemble diversity (data/parameters) consistently improves forecasts.
7	Battery dispatch	*Deep RL for Economic Battery Dispatch* (2025) [14]	DRL (survey)	Market operations	DRL emerges as a strong tool for arbitrage & scheduling with uncertainties.
8	Battery dispatch	*Economic Battery Storage Dispatch with DRL + Demonstrations* (2025)	SAC + learning from demos	Year-long hourly episodes	Adding demonstrations stabilizes long-horizon DRL training.
9	Microgrid control	*DRL for Microgrid Cost Optimization* (2024) [15]	Soft-Actor-Critic (SAC)	Microgrid with BESS	SAC reduces operating cost under stochastic demand/prices.
10	Grid services	*RL-ADN Library for ESS Dispatch in ADN* (2024)	DRL toolkit	Active distribution networks	Open-source RL library accelerates ESS-dispatch research/benchmarks.

The integration of Artificial Intelligence (AI) into solar energy storage systems has shown remarkable improvements in energy efficiency, system reliability, and adaptive control when compared to conventional methods. The findings across existing research highlight that AI techniques significantly outperform rule-based and physics-only models in areas of solar forecasting, battery health estimation, and real-time energy dispatch.

Solar Forecasting Efficiency: AI-based forecasting models, particularly Artificial Neural Networks (ANN), Support Vector Machines (SVM), and Deep Learning architectures, have

been shown to reduce prediction errors by **10–20%** compared to statistical models (Das et al., 2021). Accurate forecasting ensures that energy storage units are optimally charged during high irradiance periods and discharged during demand peaks, reducing energy wastage and enhancing grid stability. Ensemble learning approaches further improve robustness by combining multiple predictive models, making them suitable for real-world deployment.

Battery State-of-Charge (SoC) and State-of-Health (SoH) Estimation: Machine learning-based prognostic methods enable highly accurate SoC and SoH estimation with error margins of less than **3–5%** (Li et al., 2024). Hybrid sensor-aided AI models combine electrochemical measurements with data-driven predictions, providing more reliable insights into battery degradation. This advancement extends battery life and lowers maintenance costs, addressing one of the most critical challenges in energy storage management.

Real-time Energy Storage System (ESS) Control: Reinforcement learning (RL) approaches, especially Deep Q-Networks (DQN), have demonstrated effectiveness in optimizing real-time charge–discharge decisions (Wang & Chen, 2019). These methods adapt to fluctuating energy demands and generation, ensuring minimal reliance on the grid during peak hours. Compared to static scheduling, RL-based systems enhance operational efficiency by **8–12%**, highlighting their potential for autonomous energy management.

Hybrid Energy Storage Systems (HESS): AI has also been applied to optimize the operation of hybrid battery–supercapacitor systems. Multi-objective optimization algorithms balance factors such as efficiency, cost, and device lifetime. Research shows that AI-optimized HESS can improve energy utilization efficiency by up to **15%** compared to conventional rule-based systems (Zhang & Liu, 2022). Such advancements are vital for applications requiring both high energy density and fast response times, including electric vehicles and smart grids.

AI in Materials Discovery for Next-Generation Batteries: Machine learning models are increasingly being used to accelerate materials discovery for high-performance batteries. Instead of relying solely on time-consuming experimental trials, ML algorithms can predict material properties and screen thousands of electrode and electrolyte candidates within weeks. This approach has already reduced development cycles by several years (Chen & Zhao, 2024), paving the way for advanced lithium-ion and solid-state storage technologies.

Phase Change Material (PCM)-based Storage: For thermal energy storage, AI-based models predict the thermal performance of Phase Change Materials (PCM). While such models provide insights into heat storage and release dynamics, limitations exist due to non-linear behavior under varying climatic conditions. Nevertheless, ML-assisted PCM forecasting offers promising directions for improving passive solar storage systems in buildings (Kumar & Singh, 2024).

Discussion

The reviewed studies consistently demonstrate that AI empowers solar energy storage systems by enabling predictive, adaptive, and intelligent management. However, several challenges remain:

- **Data dependency:** Most AI models require large datasets, which may not be available in all regions.
- **Cybersecurity risks:** As storage systems become more interconnected, risks of cyberattacks on AI-driven control systems increase.
- **Generalizability:** Models trained in specific climates may underperform in different geographical conditions.

- **Computational complexity:** Advanced models like deep reinforcement learning require significant processing power, limiting their scalability.

Despite these limitations, AI-driven solar energy storage solutions provide a clear pathway toward achieving higher efficiency, cost-effectiveness, and long-term sustainability. The results indicate that future research should focus on hybrid AI approaches, robust datasets, and secure, scalable deployment strategies to ensure global adoption.

Conclusion and Future Scope:

Artificial Intelligence (AI) has emerged as a transformative tool for enhancing the efficiency, reliability, and sustainability of solar energy storage systems. By enabling accurate forecasting of solar power generation, AI supports better scheduling and utilization of energy resources. It also optimizes battery charging–discharging cycles while ensuring effective state-of-charge and state-of-health monitoring, thereby extending battery life and reducing operational costs. Furthermore, AI-driven decision-making facilitates seamless integration of storage systems with the grid, minimizing energy losses and improving overall system performance. Collectively, these advancements position AI as a critical enabler for making solar energy storage more cost-effective, adaptive, and future-ready.

Looking ahead, future research should focus on developing hybrid AI models that combine machine learning, deep learning, and reinforcement learning for more robust and adaptive energy management. Additionally, addressing challenges related to data availability, cybersecurity, and large-scale deployment will be essential to fully realize the potential of AI in next-generation solar energy storage systems.

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ECO-CONSCIOUS CHROMATIC ENHANCEMENT OF SILK SUBSTRATES WITH PHYTO-DERIVED CHROMOPHORES: A COMPREHENSIVE EVALUATION OF CHROMATIC STRENGTH, FASTNESS CHARACTERISTICS, AND ANTIMICROBIAL EFFICACY FOR SUSTAINABLE TEXTILE ENGINEERING

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ABSTRACT

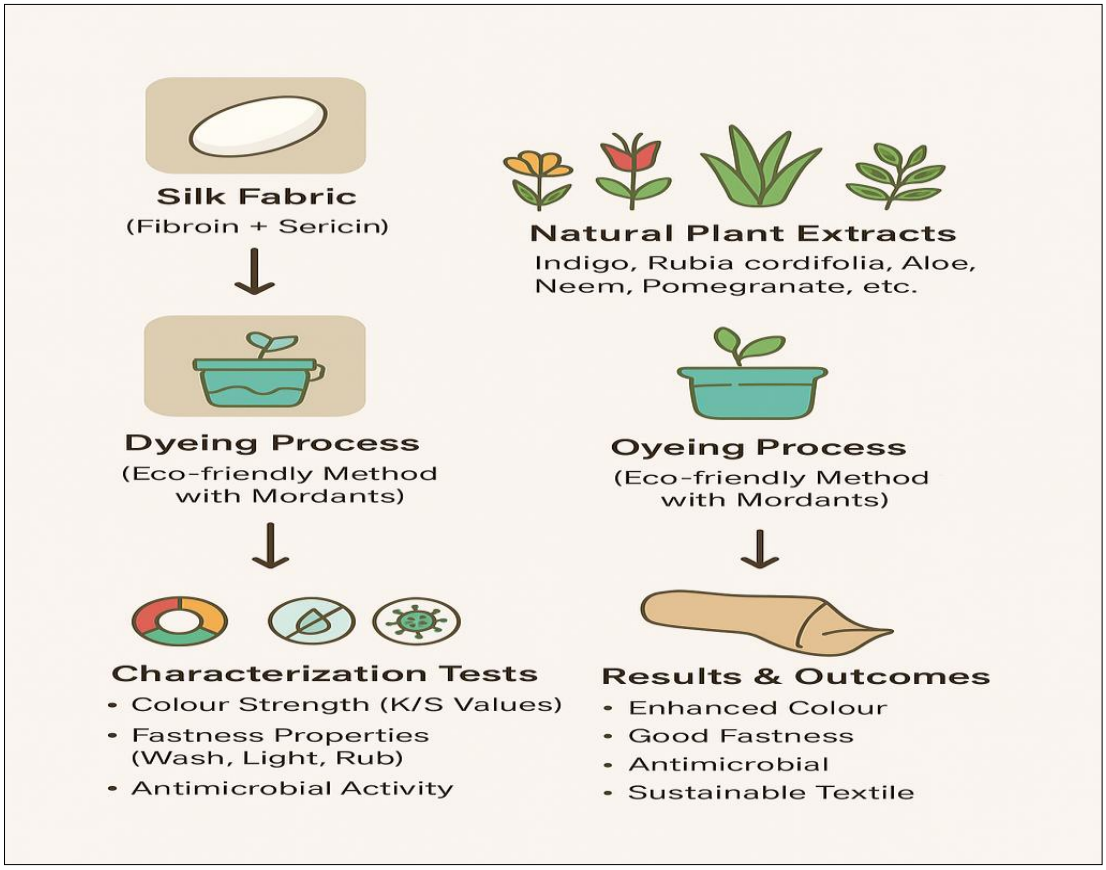
Silk, a natural protein fibre synthesized by silkworms, is secreted through the silk gland, which includes three distinct regions. The posterior gland, about 15 cm long with ~500 secretory cells, produces fibroin, the primary structural protein of silk. The middle gland (~7 cm, ~300 secretory cells) synthesizes sericin, the binding protein that cements fibroin filaments. The anterior gland (~2 cm, ~250 cells) acts as a duct without secretory function. Raw silk, therefore, contains mainly of fibroin (≈75%) and sericin (≈25%), along with minor impurities such as fats, waxes, salts, and colouring matter.

In recent years, natural dyes have gained rehabilitated prominence in textile finishing due to their eco-friendly nature, non-toxicity, and aesthetic appeal. Unlike synthetic dyes, natural colorants help maintain ecological balance and reduce allergic reactions. They are sourced from plants (e.g., indigo), animals (e.g., cochineal), and minerals (e.g., ochre). In this study, selected natural sources—*Berberis vulgaris*, *Bixa orellana*, *Terminalia chebula*, *Punica granatum*, *Allium cepa*, *Citrus paradisi*, *Indigofera tinctoria*, *Rubia cordifolia*, *Pterocarpus santalinus*, *Vitex negundo*, *Emblica officinalis*, *Aloe barbadensis*, and *Azadirachta indica*—were pragmatic to silk fabrics. The dyed samples were appraised for colour strength (K/S values), fastness properties, and antimicrobial activity.

The consequences designate promising dye uptake and performance, suggesting that natural dyes can serve as sustainable alternatives for silk coloration while simultaneously enhancing functional properties. This work highlights the potential for further exploration of natural bio-based dyes in eco-textile applications.

Keywords: Silk fabric, Natural dyes**,** Eco-friendly textiles**,** Fibroin and sericin**,** Plant-based dyes**,** Antimicrobial activity**,** Fastness properties**,** Colour strength**,** Sustainable dyeing**,** Herbal colorant

Graphical Abstract



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ORMAN YANGINLARININ AHŞAP ÖZELLİKLERİ ÜZERİNDEKİ ETKİSİNİN DEĞERLENDİRİLMESİ: BİR İNCELEME

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ÖZET

İklim değişikliğinin etkisiyle orman yangınlarının sıklığı artmakta, bu durum ağaçlar ve odun kalitesi üzerinde önemli etkiler yaratmaktadır. Yangınlar, ağaçlarda, özellikle meşe türlerinde, su potansiyeli ve stoma iletkenliği gibi fizyolojik süreçlerde anlık ve ikincil değişikliklere neden olurken, prolin ve toplam karbonhidrat konsantrasyonlarını (TKK) düşürmektedir. Yangın sonrası kuraklık koşulları, ağaçların hayatta kalma oranını azaltarak böceklere karşı hassasiyetlerini artırabilir.

Yangından zarar görmüş ağaçlarda odun çürümesi ve mavi lekelenme gibi önemli bozulmalar gözlemlenir; bu bozulmalar ilk yılda minimal düzeydeyken, ikinci yıldan itibaren yaygınlaşır. Poria asiatica gibi kahverengi çürük mantarları ve diğer odun çürüten mantarlar, yangın yaralarının fırsatçı istilacıları olup, çürüme genellikle nem tutulumunun yüksek olduğu gövdenin alt kısımlarında yoğunlaşır. Yangın sonrası ağaçlar, özellikle kabuk böcekleri ve odun delici böcekler tarafından yapılan saldırılara karşı oldukça hassastır. Odun delici böcekler dumana çekilir ve %30'a varan önemli ekonomik kayıplara neden olabilir. Ağır taç hasarı olan ağaçlarda böcek saldırıları ölüm oranını önemli ölçüde artırır. Ladin ve sarıçam gibi türler yangına karşı daha az direnç gösterirken, karaçam ve Douglas köknarı gibi kalın kabuklu türler daha dirençlidir. Meşe türleri ise, kalın kabukları ve yeniden sürgün verme yetenekleri sayesinde yangına toleranslı özelliklere sahiptir.

Yangın hasarı nedeniyle kereste değeri ve hacim kayıpları, yara izleri küçükse veya ağaçlar yangından sonraki beş yıl içinde hasat edilirse düşük olabilir. Ancak, yangın hasarı belirli eşikleri (örneğin 50 cm yükseklik veya %20'den fazla taban çevresi hasarı) aşarsa, değer kaybı zamanla artar. Akustik tomografi ve rezistografi gibi modern teknikler, yangından etkilenen ağaçlarda iç odun kalitesini ve çürümeyi değerlendirmek için kullanılır ve yangın sonrası bile çeşitli çürüme aşamalarını ortaya çıkarır. Kurtarılan odun, taze ise orta ve düşük kaliteli ürünler için uygun olabilir, ancak kömürleşme ve çürüme kullanımı sınırlayabilir.

Anahtar Kelimeler: Orman yangınları, Odun kalitesi, Böcek saldırıları, Mantar enfeksiyonları

ASSESSMENT OF THE EFFECT OF FOREST FIRES ON WOOD PROPERTIES: A REVIEW

ABSTRACT

The frequency of forest fires is increasing due to climate change, significantly impacting trees and wood quality. Fires cause immediate and secondary changes in tree physiology, such as water potential and stomatal conductivity, especially in oak species, while decreasing proline and total carbohydrate concentrations (TCC). Post-fire drought can reduce tree survival and increase susceptibility to insects.

Wood decay and blue staining are significant deteriorations in fire-damaged trees, minimal initially but widespread from the second year. Brown rot fungi like *Poria asiatica* are opportunistic invaders of fire wounds, with decay often concentrated in lower, moister trunk parts. Trees are highly susceptible to bark beetle and wood borer attacks post-fire. Wood borers are attracted to smoke and can cause up to 30% significant economic losses. Severe crown damage increases insect-related mortality. Spruce and Scots pine show less fire resistance, while thick-barked species like black pine and Douglas fir are more resistant. Oaks are fire-tolerant due to their thick bark and resprouting ability.

Lumber value and volume losses are low if fire scars are small or trees are harvested within five years. However, losses increase over time if damage exceeds thresholds (e.g. 50 cm height, >20% basal circumference). Acoustic tomography and resistography are modern techniques used to assess internal wood quality and decay in fire-affected trees, revealing various decay stages post-fire. Fresh salvaged wood suits medium to low-quality products, but charring and decay can limit usage.

Key words: Forest fires, Wood quality, Insect attacks, Fungal infections

INTRODUCTION

Forest ecosystems worldwide are constantly shaped by a myriad of natural phenomena, among which forest fires stand out as a primary disturbance agent (Attiwil, 1994; Trabaud, 1994; Bond and Van Wilgen, 1996). Beyond their immediate devastating effects, wildfires initiate a cascade of physical, chemical, and biological changes in trees and wood, altering their fundamental properties. These alterations can significantly compromise the structural integrity and economic value of timber, posing substantial challenges for forest managers and the timber industry (Marttila et al., 2024). The rising incidence of severe wildfires, partly attributed to climate change, underscores the urgency of comprehending these impacts for sustainable forest management and resource allocation (Flannigan et al., 2005; Roshani et al., 2022).

The wood of fire-damaged trees undergoes various forms of degradation, including discoloration, cracking, reduced mechanical strength, and increased vulnerability to insect infestation and fungal decay. These changes are not uniform; they vary depending on factors such as fire intensity, tree species, bark thickness, and the time elapsed since the fire event (Marttila et al., 2024; Musat, 2024; DeNitto et al., 2000). This paper aims to provide a comprehensive review of the current scientific understanding regarding the effects of forest fires on the durability, physical, and mechanical properties of wood, drawing upon various studies conducted across different regions and tree species. By synthesizing these findings, we highlight the mechanisms of deterioration and their implications for wood utilization.

MATERIAL AND METHODS

This review synthesizes findings from multiple studies employing diverse methodologies to assess the impact of forest fires on wood properties across various tree species and geographical locations. The primary focus areas included physical and mechanical properties, as well as biological and abiotic degradation mechanisms.

Study Areas and Tree Species

Studies were conducted in various regions, including Kalajoki, Finland (Marttila et al., 2024); Düzce, Türkiye (Kabaoğlu et al., 2023); Missouri, USA (Marschall et al., 2014); Gorj County, Romania (Musat, 2024); and several locations across the Western United States (e.g., Eastern

Washington, Southern Oregon, Northern California, Intermountain West, Northern Rocky Mountains, Central Idaho) (DeNitto et al., 2000). A wide range of tree species were investigated, predominantly conifers and hardwoods known to inhabit fire-prone ecosystems. *Coniferous* species included Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris)* (Marttila et al., 2024), Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), western larch (*Larix occidentalis*), and grand fir (*Abies grandis*) (DeNitto et al., 2000). Hardwood species comprised various oaks (*Quercus velutina, Q. rubra, Q. coccinea, Q. cerris, Q. pubescens*) (Marschall et al., 2014; Kabaoğlu et al., 2023) and European beech (*Fagus sylvatica* L.) (Musat, 2024).

Assessment of Wood Properties

Physical and Mechanical Properties

• ***Sampling and Specimen Preparation:*** Studies often involved sampling burned trees and corresponding unburned reference trees. For instance, in Finland, eight burned trees and four reference trees per species (Norway spruce and Scots pine) were sampled. From these, 4-meter logs were cut into 60 cm blocks, representing butt, middle, and top logs, for subsequent physical and mechanical tests (Marttila et al., 2024). For red oak in Missouri, 88 butt logs from harvested trees were used, with analyses considering value loss to the individual butt log (Marschall et al., 2014).

• ***Density:*** Air-dry density (kg/m³) was determined for each specimen following ISO standard 13061-2 (ISO 13061-2:2014; Marttila et al., 2024). Basic density was also determined using the oven-dry method (Marttila et al., 2024).

• ***Moisture Content/Gradient:*** Moisture content (%) was measured after mechanical tests. Moisture gradient was assessed by cutting cubes (20 × 20 × 20 mm) from battens sawn radially from cross-sectional slices, with measurements taken from bark towards the pith (Marttila et al., 2024).

• ***Color:*** Wood color (CIE Lab* coordinates) was measured using a portable spectrophotometer, adhering to ISO/CIE 11664-4 (ISO/CIE 11664-4:2019; Marttila et al., 2024). Color difference (ΔE*ab) was calculated (Marttila et al., 2024).

• ***Modulus of Elasticity (MOE) and Modulus of Rupture (MOR):*** These properties were determined using a three-point bending test in the tangential direction according to ISO standards 13061-4 and 13061-3, respectively (ISO 13061-4:2014; ISO 13061-3:2014; Marttila et al., 2024). Flexural stress (σf) and strain (εf) were also calculated according to ISO 178 (ISO 178:2019; Marttila et al., 2024).

• ***Brinell Hardness (HB):*** HB (N/mm²) was measured using a universal material testing machine, following CEN-EN 1534:2020 (CEN-EN 1534:2020; Marttila et al., 2024).

• ***Data Analysis:*** Linear mixed-effect models (LMMs) were frequently employed to analyze variability in mechanical properties, moisture gradient, and color, considering fixed effects such as fire damage class, height class, radial position, and density, as well as random effects of tree and stand (Marttila et al., 2024).

Durability and Degradation Assessment

• ***Visual Inspection and Time-Series Studies:*** Many studies involved annual examinations of fire-killed or fire-damaged trees over several years to track the progression of blue stain, decay, and insect infestation. This included assessing external signs like weather checking and bark sloughing (DeNitto et al., 2000). For Missouri red oak, fire-scar residence time (R-time) was

calculated by subtracting the calendar year of fire injury from the year of harvest (Marschall et al., 2014).

• ***Fungal Isolation and Identification:*** Fungi responsible for blue stain and various forms of decay (white rot, brown rot) were identified from wood samples, often cultured on 2% malt extract media. *Basidiomycete* fungi were identified in accordance with methods and keys published by Nobles (1965) and Stalpers (1979) (Littke and Gara, 1986). Enzymatic capabilities of fungi were identified to characterize them as white or brown rots (Littke and Gara, 1986).

• ***Insect Activity Monitoring:*** Observations included the presence and density of bark beetles (e.g., Douglas-fir beetle, spruce beetle, pine engraver beetle) and wood borers (e.g., ambrosia beetles, flatheaded borers, roundheaded borers) (DeNitto et al., 2000; McHugh and Kolb, 2003).

• ***Physiological Changes in Living Trees:*** For oak species in Düzce, seasonal measurements were taken on leaf and shoot samples to determine xylem water potential, stomatal conductivity (in the field), and carbohydrate concentration and proline content (in the laboratory) to understand fire-induced stress responses (Kabaoğlu et al., 2023).

• ***Non-destructive and Semi-destructive Testing:*** For assessing internal wood quality in standing trees, particularly beech, methods included the Arbotom Rinntech sound tomograph (at 50 and 100 cm above ground) and IML Resi F-500S resistograph (measuring drilling resistance). Sound wave speeds were categorized to interpret wood quality (Musat, 2024).

• ***Laboratory Fungal Competition Studies:*** Experiments were conducted on burnt and unburnt Scots pine and Norway spruce wood discs, sterilized and inoculated with common wood-decaying fungi (e.g., *Antrodia sinuosa, Fomitopsis pinicola, Gloeophyllum sepiarium*) to assess competitive outcomes and the role of heat-induced chemical modifications (Edman and Eriksson, 2016).

Fire Reaction Performance

• ***Charring for Fire Resistance:*** Ladin (spruce) wood boards were charred using specific equipment. Modified wood prototypes were tested for reaction to fire using cone calorimeter (small-scale) and single burning item (SBI) (large-scale) methods, classified according to EN 13501-1:2018 (EN 13501-1:2018; Buksans et al., 2021). Different flame retardants were also applied and tested (Buksans et al., 2021).

RESULTS AND DISCUSSION

Results

Physical Properties

• ***Density:*** Burned Norway spruce sapwood in butt logs showed a slight decrease in air-dry density (446.5–448.9 kg/m³) compared to reference trees (474.8 kg/m³). Conversely, burned Scots pine sapwood in butt logs had a higher density (581.3–585.4 kg/m³) than reference trees (527.7 kg/m³) (Marttila et al., 2024).

• ***Moisture Content/Gradient:*** A decrease in moisture content was observed in spruce wood after fire. For both Norway spruce and Scots pine, the fire damage class was a significant factor influencing the moisture gradient in spruce, but not in pine (Marttila et al., 2024).

• ***Color:*** A noticeable darkening of sapwood occurred in both Norway spruce and Scots pine. In spruce, radial position and its interaction with fire damage class significantly affected all

CIE Lab* color coordinates, while in pine, height class was a significant factor for all color coordinates (Marttila et al., 2024).

• ***Weather Checking/Cracking:*** Cracks are common in the upper bolts of trees and on hot, dry, or windy sites. Douglas-fir showed weathering checks, especially in younger, thinner-barked trees and on dry, windy sites. Ponderosa pine also showed cracking, with significant increases in volume affected by cracks from year 3 to 4 post-fire (DeNitto et al., 2000).

Mechanical Properties

• ***Modulus of Elasticity (MOE):*** Burned Norway spruce sapwood butt logs showed lower MOE (8.0–8.5 GPa) compared to reference trees (10.4 GPa). For Scots pine, burned sapwood butt logs displayed higher MOE (11.6–12.3 GPa) than reference trees (10.6 GPa). Fire damage class was not a significant factor for MOE in spruce (Marttila et al., 2024).

• ***Modulus of Rupture (MOR):*** In Scots pine, the fire damage class was a significant factor for MOR, with burned wood having a lower MOR than reference wood. In spruce, top logs exhibited lower MOR than butt or middle logs (Marttila et al., 2024).

• ***Brinell Hardness (HB):*** Fire damage positively affected HB in Norway spruce, resulting in a small increase. In Scots pine, radial position and its interaction with density were significant for HB. Density had a positive effect on HB in both species (Marttila et al., 2024).

• ***Flexural Strain:*** Spruce generally showed a decrease in strain towards the top of the tree, while pine had the lowest values mostly in the middle logs. Pine showed higher strain values on average than spruce in middle and top logs across all groups (Marttila et al., 2024).

• ***Tomography and Resistography (Beech):*** Tomograms revealed a high amplitude in sound speeds (e.g., 59 m/s to 3673 m/s), indicating varying degrees of degradation. Some trees exhibited healthy wood, while others showed low sound speeds and internal structural modifications, particularly at the trunk base or at 100 cm above ground. These affected areas were often in a north-northwest direction. Trees with micro-hollows nearby were more affected. Resistograms confirmed areas of completely destroyed wood structure and advanced decay, even when tomograms might indicate higher speeds due to tangential sound travel in healthy areas. Red heartwood in beech exhibited much higher hardness. Mechanical resistance varied greatly by section, with significant reductions observed in several trees (Musat, 2024).

Durability and Degradation

• ***Blue Stain:*** Blue stain, a discoloration in sapwood caused by non-decaying fungi, is commonly vectored by bark. Sapwood of pines is often completely blue-stained within a year of death, while Douglas-fir sapwood showed minimal blue stain after 2 years. Ponderosa pine and lodgepole pine were 70% and 90% stained at one year dead, respectively (DeNitto et al., 2000).

• ***Decay (Fungi):*** Decay, primarily caused by fungi breaking down wood cell walls, leads to significant strength loss. Douglas-fir was largely unaffected by decay after 2 years, with significant decay appearing after 3 years. Ponderosa pine showed significant decay in the lower bole after 5 years (DeNitto et al., 2000). Brown rot species like *P. asiatica* are significant in heart-rot columns, being opportunistic invaders of fire wounds and outcompeting white-rot fungi (Littke and Gara, 1986). *Tyromyces palustris* was the most prolific decay fungus in fire-killed conifers, decaying both sapwood and heartwood (DeNitto et al., 2000).

• ***Weathering:*** After tree death, moisture loss leads to wood drying, shrinking, and developing cracks, which act as entry points for decay fungi (DeNitto et al., 2000).

• ***Insect Infestation:*** Fire-damaged trees are highly attractive to bark beetles and wood borers (DeNitto et al., 2000; McHugh and Kolb, 2003). Outbreaks of Douglas-fir beetle, spruce bark beetle, and pine engraver beetle were documented following wildfires. Douglas-fir, western larch, and ponderosa pine were particularly susceptible to Douglas-fir beetle attacks if more than half of the bole circumference was charred. Many larger diameter trees predicted to survive fire were subsequently killed by Douglas-fir beetles (DeNitto et al., 2000). Lodgepole pine and subalpine fir were extensively killed by a combination of fire injury and bark beetle attacks (DeNitto et al., 2000; Ryan and Ammann, 1996). Ponderosa pine can be attacked by western pine beetles (*Dendroctonus brevicomis*) or red turpentine beetles, while severely weakened western larch may be infested by wood borers. Engelmann spruce and subalpine fir were found to be susceptible to spruce beetle and western balsam bark beetle attacks, respectively, especially after root damage and windthrow (DeNitto et al., 2000).

• ***Fungal Competition in Burnt Wood:*** Laboratory studies demonstrated that burnt and charred wood altered competitive outcomes among wood-decaying fungi. The competitive ability of fungi either increased, decreased, or remained unaffected, depending on the fungal species and competitor identity. This change is primarily attributed to chemical modifications and degradation of wood polymers (e.g., hemicellulose degradation at temperatures as low as 180°C) rather than differences in wood moisture content (Edman and Eriksson, 2016).

Physiological Responses (Oak Trees)

• ***Water Potential and Stomatal Conductivity:*** High fire intensity led to lower water potential and stomatal conductivity in oak leaves, while low intensity showed intermediate values. Control trees had the highest water potential and stomatal conductivity (Kabaoğlu et al., 2023).

• ***Carbohydrate and Proline Content:*** High fire intensity resulted in lower carbohydrate concentration but higher proline content. Control trees had the highest carbohydrate concentration and lowest proline (Kabaoğlu et al., 2023).

Fire Reaction Performance (Charred Wood)

• ***Charring improves the reaction to fire performance of wood (Buksans et al., 2021).*** Charred wood products exhibited significantly higher smoke production (2.5 to 3 times increase in Total Smoke Production over 600 seconds), leading to a change in smoke index classification from s1 to s2. Flame retardants can enhance the fire performance of charred wood, but they must be fixed to the char layer (Buksans et al., 2021).

Discussion

Forest fires, as powerful ecological forces, instigate a complex series of changes in wood properties that impact both its structural integrity and its susceptibility to degradation. The intensity and duration of fire, coupled with species-specific characteristics like bark thickness and crown architecture, determine the extent of initial damage and subsequent deterioration (Marttila et al., 2024; Musat, 2024; DeNitto et al., 2000).

Mechanisms of Degradation: Fungi, Insects, and Weathering Post-fire wood degradation is a multifaceted process involving biotic agents (fungi and insects) and abiotic factors (weathering). These agents often interact synergistically, accelerating the deterioration rate (DeNitto et al., 2000; Edman and Eriksson, 2016).

• ***Fungal Activity:*** Fungi play a crucial role in wood decay. Blue stain fungi, typically non-decaying, cause discoloration in sapwood and are often vectored by bark beetles (DeNitto et al., 2000). While they do not directly weaken wood, they reduce its aesthetic and commercial value. Decay fungi, including white rot and brown rot species, actively break down wood cell walls, leading to significant strength loss (DeNitto et al., 2000). Brown rotters like *P. asiatica*

are particularly aggressive in fire wounds, outcompeting white rot fungi and causing substantial heart rot (Littke and Gara, 1986). The rapid degradation of wood by decay fungi is often facilitated by insect activity, which creates entry points and vectors fungal spores (DeNitto et al., 2000). Laboratory studies confirm that thermal modification from fire can alter the competitive dynamics among wood-decaying fungi, largely due to chemical changes in the wood like hemicellulose degradation, making it more or less amenable to certain fungal species (Edman and Eriksson, 2016).

• ***Insect Infestation:*** Fire-damaged trees, especially those weakened but not killed outright, become highly vulnerable to mass attacks by bark beetles (e.g., Douglas-fir beetle, spruce bark beetle, pine engraver beetle) and wood borers (DeNitto et al., 2000; McHugh and Kolb, 2003). These insects exploit stressed hosts, often leading to widespread tree mortality even in trees initially predicted to survive the fire (DeNitto et al., 2000). Insect infestations also contribute to wood deterioration by boring galleries and introducing decay fungi. The timing of fire and subsequent beetle flights is critical; fires occurring when beetles are in their adult stage can lead to immediate and widespread infestations (DeNitto et al., 2000; Gibson et al., 1999).

• ***Weathering:*** After a tree dies, moisture loss causes the wood to dry, shrink, and crack. These "weather checks" provide additional entry points for fungi and can significantly reduce the strength of the affected timber (DeNitto et al., 2000).

Physical and Mechanical Property Changes: Forest fires induce significant changes in the physical and mechanical properties of wood, affecting its usability (Marttila et al., 2024).

• ***Density and Moisture:*** While some studies report slight decreases in density in certain species like Norway spruce, others note increases in Scots pine sapwood, possibly due to charring effects or rapid drying (Marttila et al., 2024). A general decrease in moisture content in spruce after fire is consistent with heat exposure (Marttila et al., 2024).

• ***Color:*** The darkening of sapwood in both spruce and pine is a consistent observation, primarily due to the heat effects and the spread of char and soot. This discoloration can significantly reduce the aesthetic value of the wood, limiting its use in certain applications (Marttila et al., 2024).

• ***Mechanical Strength:*** Changes in mechanical properties like MOE, MOR, and HB are often subtle immediately after fire but can become more pronounced over time as degradation progresses (Marttila et al., 2024). While minor increases in Brinell hardness in spruce were noted, a decrease in MOR in pine suggests species-specific responses to fire stress. The strong correlation between density and mechanical properties highlights the fundamental role of wood structure in its response to fire (Marttila et al., 2024). Structural differences between mature sapwood and juvenile heartwood are relevant in this context, as they exhibit different responses to fire-induced damage (Zobel and Sprague, 1998; Moore and Cown, 2017).

• ***Non-Destructive Assessment:*** Techniques like sonic tomography and resistography prove valuable in identifying internal defects and decay in standing fire-damaged trees, providing insights into the extent of structural compromise (Musat, 2024). These methods are crucial for guiding salvage decisions and evaluating residual wood quality, especially for valuable trees (Musat, 2024; Gendvilas et al., 2024; Downes et al., 2022). The detection of areas with low sound speeds and internal modifications correlates with advanced stages of decay, even if external signs are minimal (Musat, 2024).

Physiological Stress and Economic Implications: Physiological studies on oak species demonstrate that high fire intensity negatively impacts water potential, stomatal conductivity, and carbohydrate reserves, while increasing proline content—a common stress indicator. Such physiological stress weakens the tree, making it more susceptible to further biotic attacks and

ultimately affecting wood growth and quality indirectly (Kabaoğlu et al., 2023; Bär et al., 2019).

Economically, fire-damaged wood often needs to be salvaged quickly to prevent further deterioration. While salvaged timber can still be used for middle-quality and lower-quality wood products, the presence of char and soot can limit its usage, especially for spruce, due to processing challenges and aesthetic concerns (Marttila et al., 2024; Barkley, 2020). Charring as a surface modification technique can improve fire resistance, but it often increases smoke production and requires proper flame retardant application to maintain desired fire performance classifications (Buksans et al., 2021).

CONCLUSION

Forest fires exert complex and significant impacts on the durability, physical, and mechanical properties of wood. The immediate effects include charring, discoloration, and physiological stress in living trees. Over time, fire-damaged wood becomes highly susceptible to rapid deterioration driven by a synergistic action of wood-decaying fungi, bark beetles, wood borers, and weathering processes. Key findings indicate:

• ***Physical Properties:*** Changes in density can be variable (Marttila et al., 2024), but a noticeable darkening of sapwood is common in both conifers and hardwoods. Moisture content generally decreases, contributing to cracking (Marttila et al., 2024; DeNitto et al., 2000).

• ***Mechanical Properties:*** While some mechanical properties like Brinell hardness may show minor increases in certain species, others, such as Modulus of Rupture, can decrease, particularly in species like pine (Marttila et al., 2024). Non-destructive methods are crucial for assessing the extent of internal decay and structural compromise (Musat, 2024).

• ***Durability:*** Fire dramatically reduces wood durability by attracting insect pests and creating entry points for fungi (DeNitto et al., 2000; Littke and Gara, 1986). Blue stain and various forms of decay (white and brown rot) rapidly progress in fire-killed timber (DeNitto et al., 2000). Laboratory studies highlight that the chemical alterations caused by charring modify competitive outcomes among wood-decaying fungi (Edman and Eriksson, 2016).

• ***Overall Impact:*** The combined effects of fire-induced stress, insect infestation, and fungal decay lead to substantial economic losses by reducing timber value and necessitating rapid salvage operations for low to medium-grade products (Marttila et al., 2024; Marschall et al., 2014).

Understanding these intricate post-fire mechanisms is essential for developing effective strategies for forest resilience, optimizing salvage harvesting, and ensuring the sustainable utilization of wood resources in a world facing increasingly frequent and intense wildfires. Future research should further explore the specific chemical modifications in wood at different decay stages post-fire and their precise influence on fungal interactions, ideally under diverse field conditions. Additionally, ongoing development and application of non-destructive assessment technologies will be vital for accurately and efficiently evaluating wood quality in affected stands.

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LİMON YAĞININ MİKROENKAPSÜLASYONU VE ODUN ÇÜRÜTEN MANTARLARA KARŞI İNHİBİTİF ETKİSİ

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ÖZET

Bu çalışma, odun çürümesine neden olan beyaz çürüklük mantarı *Trametes versicolor* 'a karşı limon uçucu yağının (LEO) antifungal etkinliğini artırmayı amaçlamış ve bunun için mikroenkapsülasyon tekniği kullanılmıştır. Doğal bir yapı malzemesi olan odun, *Trametes versicolor* gibi odun çürüten mantarların biyolojik bozunumuna karşı hassastır. Geleneksel odun koruyucular çoğu zaman toksik ağır metaller içerdiğinden çevresel ve sağlık açısından endişe yaratmakta, bu da limon yağı gibi uçucu yağlar dâhil olmak üzere doğal biyositlere olan ilgiyi artırmaktadır. Ancak uçucu yağlar yüksek uçuculukları ve ışık, oksijen, ısı gibi çevresel faktörlere duyarlılıkları nedeniyle doğrudan kullanımda sınırlamalara sahiptir. Mikroenkapsülasyon yöntemi, yağın stabilitesini artırarak buharlaşmayı azaltır, kontrollü salınım sağlar ve böylece antifungal etkinliği artırır.

Bu araştırmada, limon yağı melamin-üre-formaldehit (MUF) polimer kabuk içinde enkapsüle edilmiştir. Oluşan mikrokapsüllerin yüzey morfolojisi Taramalı Elektron Mikroskobu (SEM) ile incelenmiş, kapsüllerin genellikle küresel şekilli, hafif pürüzlü yüzeyli ve farklı boyutlarda oldukları belirlenmiştir. Mikroenkapsüle limon yağının antifungal etkinliği, %1 ve %5 konsantrasyonlarda Patates Dekstroz Agar (PDA) besiyeri üzerinde *Trametes versicolor'*a karşı test edilmiştir. Mikroenkapsüle limon yağı %1 konsantrasyonda %27, %5 konsantrasyonda ise %100 inhibisyon göstermiştir. Karşılaştırma amacıyla saf limon yağının doğrudan uygulanması aynı konsantrasyonlarda sırasıyla %11 ve %44 inhibisyon sağlamıştır.

Elde edilen sonuçlar, mikroenkapsüle limon yağının saf formuna göre üstün antifungal aktiviteye sahip olduğunu ortaya koymaktadır. Ayrıca limon yağı ile MUF kabuk materyali arasında sinerjik bir etkinin bulunduğu ve bunun biyolojik aktivitenin artmasına önemli ölçüde katkı sağladığı düşünülmektedir. Bu çalışma, mikroenkapsülasyonun limon yağının biyosidal özelliklerini geliştirmede etkili bir yöntem olduğunu göstermekte ve odun yüzeylerinde mantar gelişimine karşı koruyucu ajan geliştirilmesi için umut verici bir strateji sunmaktadır.

Anahtar Kelimeler: Limon yağı, Mikroenkapsülasyon, Antifungal aktivite, *Trametes versicolor*, Odun koruma

MICROENCAPSULATION OF LEMON OIL AND ITS INHIBITORY EFFECT AGAINST WOOD-DECAYING FUNGI

ABSTRACT

This study aimed to enhance the antifungal efficacy of lemon essential oil (LEO) against Trametes versicolor, a white-rot fungus responsible for wood decay, by employing a microencapsulation technique. Wood, despite being a natural building material, is susceptible to biological degradation by wood-decaying fungi such as Trametes versicolor. Traditional wood preservatives often contain toxic heavy metals, raising environmental and health

concerns, which has increased interest in natural biocides like essential oils. However, essential oils, including lemon oil, have limitations due to their high volatility and sensitivity to environmental factors like light, oxygen, and heat, restricting their direct application. Microencapsulation overcomes these limitations by enhancing the oil's stability, reducing evaporation, and enabling controlled release, thereby improving its antifungal activity.

In this research, lemon oil was successfully encapsulated within a melamine-urea-formaldehyde (MUF) polymeric shell. The surface morphology of the resulting microcapsules was characterized by Scanning Electron Microscopy (SEM), revealing them to be generally spherical with slightly rough surfaces and varying sizes. The antifungal effectiveness of the microcapsules was tested against Trametes versicolor on Potato Dextrose Agar (PDA) medium at concentrations of 1% and 5%. Microencapsulated lemon oil showed an inhibition rate of 27% at 1% concentration and a remarkable 100% inhibition at 5% concentration. In comparison, direct application of pure lemon oil at the same concentrations yielded inhibition rates of 11% and 44% respectively.

These results demonstrate that microencapsulated lemon oil exhibits superior antifungal activity compared to its unencapsulated form. Furthermore, according to the findings, it is thought that there is a synergistic effect between the lemon oil and the MUF shell material, which significantly contributes to the enhanced bioactivity. This study concludes that microencapsulation successfully improves the biocidal properties of lemon oil, offering a promising strategy for developing protective agents against fungal growth on wooden surfaces.

Keywords: Lemon oil, Microencapsulation, Antifungal activity, *Trametes versicolor*, Wood protection.

INTRODUCTION

Wood, as a natural and sustainable building material, offers numerous aesthetic and environmental advantages. However, it is inherently susceptible to biological degradation by wood-decaying fungi, particularly white-rot fungi like *Trametes versicolor,* which poses significant challenges to its durability and structural integrity (Broda, 2020; Khademibami ve Bobadilha, 2022). This decay process involves the enzymatic breakdown of lignin and cellulose, weakening the wood's mechanical properties (Khademibami ve Bobadilha, 2022).. Conventional wood preservatives often contain toxic heavy metals, leading to serious environmental and health concerns, which has accelerated the search for safer, natural alternatives (Broda, 2020).

In this context, essential oils (EOs) have emerged as promising compounds due to their antimicrobial and antifungal properties, acting as natural biocides. Lemon essential oil (*Citrus limon*), for example, has demonstrated significant antifungal activity, with its main components including *limonene, β-pinene*, and *citral*. These compounds are known to inhibit fungal growth by disrupting microbial cell membranes (Antonelli et al., 2020). Despite their potential, the direct application of EOs is limited by their high volatility and sensitivity to environmental conditions such as light, oxygen, and heat, which can lead to rapid degradation of their active components (Turek ve Stintzing, 2013).

To mitigate these limitations, microencapsulation techniques have been developed. Microencapsulation involves enclosing essential oils within a protective polymeric shell, thereby increasing their stability, reducing evaporation, and enabling a controlled release of the active compounds (Turek ve Stintzing, 2013). Various studies have shown that microencapsulation can significantly enhance the antifungal efficacy of essential oils. For instance, encapsulated oregano and marjoram oils in polycaprolactone (PCL) nanoparticles

exhibited stronger antifungal activity than their unencapsulated forms (Kang et al. 2025). Similarly, melamin-formaldehyde microcapsules containing lavender and tea tree oils provided effective inhibition against *Aspergillus fumigatus* spores, highlighting the potential of encapsulated EOs in wood preservation (Kang et al. 2025). Recent work on lemon essential oil nanoemulsions has also shown efficacy in suppressing *Phomopsis* infection in kiwi, by promoting reactive oxygen species accumulation and enhancing antioxidant enzyme activity in the host plant (Antonelli et al., 2020). It has also been noted that nanoformulations of essential oils exhibit antifungal mechanisms by altering cell membrane permeability and disrupting intracellular pH balance (Antonelli et al., 2020).

Building upon this background, the present study aimed to enhance the antifungal activity of lemon essential oil by encapsulating it within a melamine-urea-formaldehyde (MUF) based polymer shell. The findings indicate a synergistic interaction between the lemon oil and the capsule matrix, suggesting that encapsulated systems can be effectively utilized as low-health-risk, environmentally friendly, and long-lasting wood protection alternatives compared to traditional preservatives.

MATERIAL AND METHODS

This study involved extensive preliminary trials with various core-to-shell ratios, reaction temperatures, stirring speeds, and the presence or absence of surfactants for the encapsulation of lemon oil. The materials and methods described below represent the production stages that yielded the "best result," determined by the quality of microcapsule images obtained via SEM. The inhibition tests were then conducted using these optimized microcapsules.

Materials

Arifoğlu brand lemon oil was used as the core material in microcapsule production. It was obtained from lemon peels using the distillation method. Melamine Urea Formaldehyde (MUF) was used as the shell material and was obtained using the chemicals listed in Table 1.

Table 1. Chemicals used in MUF production and their properties

Melamine	Urea	Formaldehyde	Triethanolamine
Color: White	Color: White	Purity: 37%	"
Purity: 99.8%	Total Nitrogen: 46% by mass	Stabilization: min 10% methanol	Melting Point: 21°C
Moisture: 0.02%	pH: 9.1	Melting Point < -15°C	Boiling Point: 360°C
pH: 8.1	Biuret: 0.92%	Boiling Point: 93-96°C	Density: 1.12-1.16 g/cm³
Melting Point: 350-355°C			Diethanolamine: ≤10.8%
Density: 800 kg/m³			Water: ≤0.2%

Tween 80 (Polyoxyethylene Sorbitan Monooleate), used as a surfactant, was supplied by Tekkim Kimya san.tic.ltd.şti. Acetic acid was used as a 20% solution supplied by Tekkim Kimya san.tic.ltd.şti. Sodium hydroxide was used as a 20% solution supplied by Tekkim Kimya san.tic.ltd.şti.

Method

MUF pre-polymer production:

14.8 g of urea, 15.5 g of melamine, and 60 ml of formaldehyde were added to 60 ml of pure water and mixed. The pH was adjusted to 8-9 with triethanolamine, then the temperature was raised to 70 °C and the mixture was stirred until it became transparent (Figure 1).

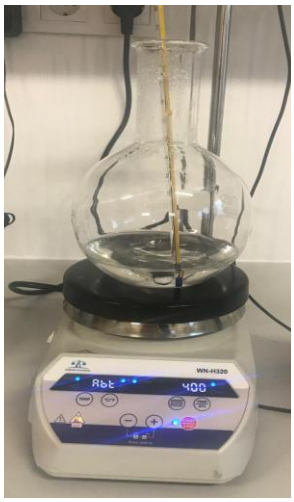

Fig. 1. Preparation of MUF prepolymer

The transparent mixture was cooled to 25 °C and 375 g of pure water was added to the mixture to obtain a 10% MUF prepolymer.

Microcapsule production:

5 ml of Tween 80 was added to 45 ml of water and mixed at 1000 rpm, and the pH of the mixture was adjusted to 4-4.5 with acetic acid. Twelve grams of this mixture was taken and mixed with 6.5 g of lemon oil in a 250 ml flask at 40 °C at 1000 rpm for 20 minutes. Then, 32 g of MUF pre-polymer was added to this mixture and mixed at the same temperature and 1200 rpm for 40 minutes. The temperature was raised to 65°C to initiate the reaction. At this temperature, stirring continued at the same speed for 2 hours. At the end of 2 hours, the mixture was cooled to 25°C and its pH was adjusted to between 7 and 9 using a 20% sodium hydroxide solution. The resulting mixture was filtered and left to dry at room temperature.

Scanning Electron Microscopy (SEM) Analysis

The surface morphology of the microcapsules was examined by scanning electron microscopy (SEM). Analyses were performed using a Carl Zeiss Ultra Plus Gemini FESEM instrument located at the Karabük University Materials Research and Development Laboratory. Powdered samples were gently dispersed onto a grid covered with adhesive tape and subsequently coated with gold using a Quorum Q150R-ES sputter coater, following the procedure typically applied to insulating materials. After coating, SEM analyses were conducted, and representative micrographs of selected regions were captured.

Inhibition Test

The antifungal activity of the microcapsules was evaluated against Trametes versicolor, a white-rot fungus belonging to the Basidiomycetes. Potato dextrose agar (PDA; Merck, Darmstadt, Germany) was used as the growth medium. The medium was prepared by dissolving 39 g of PDA in 1 L of distilled water under continuous stirring until complete dissolution (Figure 2). Aliquots of 30 mL PDA were poured into sterile Petri dishes, to which either lemon oil-containing microcapsules or pure lemon oil were added at concentrations corresponding to 1% and 5% (v/v) of the PDA volume. Fungal inoculation was carried out at the center of each Petri dish, and three replicates were prepared for each treatment. Incubation was conducted at 25 ± 1 °C and 70 ± 2% relative humidity. The assay was terminated when the mycelia in the control dishes (without any biocidal agents) reached the edges of the plates, typically after 7–8 days.

Fig. 2. **Preparation of culture media and pouring into Petri dishes**

Additionally, to assess the localized inhibitory effect, microcapsule powder was placed at a single spot on the PDA surface in one Petri dish, while pure lemon oil was dropped onto another, followed by fungal inoculation. The objective was to determine whether distinct inhibition zones would form around the treated areas during fungal growth.

Calculation of Inhibition Rate

At the end of the test, the colony diameter of the mycelium was measured, and the inhibition rate was calculated using the following equation:

$$I\ (\%) = \frac{C - T}{C} 100$$

where I represent the inhibition rate (%), C is the colony diameter (cm) in the control Petri dishes, and T is the colony diameter (cm) in Petri dishes containing biocidal agents

(microcapsules or pure lemon oil). According to Terzi et al. (2016), an inhibition rate greater than 20% was considered evidence of fungal growth inhibition.

RESULTS AND DISCUSSION

In this study, lemon essential oil was encapsulated using the microencapsulation method, aiming to enhance its antifungal activity against Trametes versicolor, a common wood-decaying fungus. Both the structural properties and the biological activity of the microcapsules were evaluated. The images obtained from scanning electron microscopy (SEM) analysis of the microcapsules are presented in Figure 3.

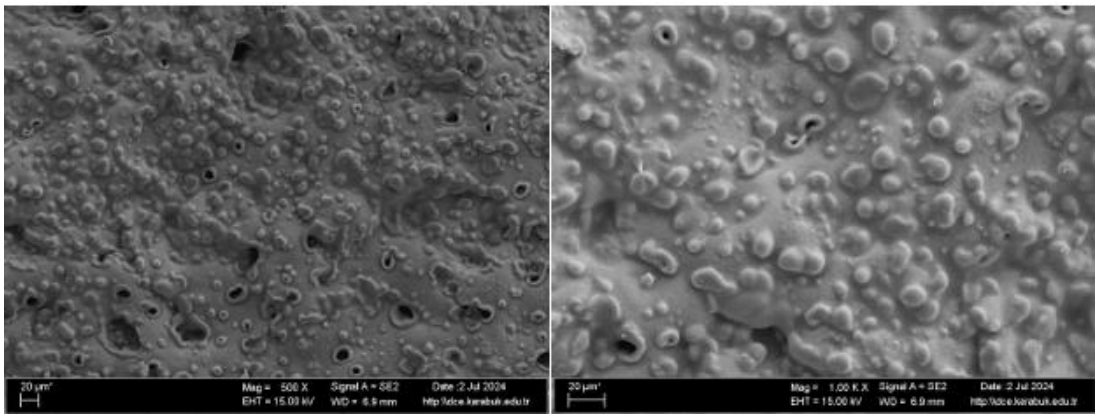

Fig. 3. ***SEM micrographs of the obtained microcapsules at 500X and 1.00 KX magnifications***

The surface morphology and shape of the microcapsules were analyzed using SEM. The images revealed that the microcapsules were mostly spherical in form; however, some surface irregularities and structural deformations, likely originating from the drying process, were observed. The variation in capsule sizes suggests that production parameters such as mixing speed, temperature, and pH have significant effects on capsule quality. These findings are consistent with those of Mejri et al. (2022), who reported that optimizing microencapsulation processes leads to more homogeneous capsule structures.

As a result of the inhibition test, the fungal growth in the culture media containing microcapsules and lemon oil at two different concentrations (1% and 5%) is shown in Figures 4 and 5.

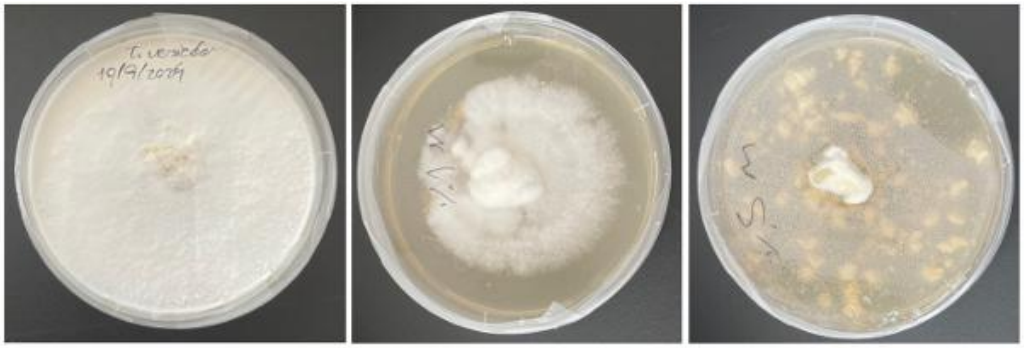

Fig. 4. **Control; culture medium containing 1% microcapsules; culture medium containing 5% microcapsules**

The antifungal activity of both pure and microencapsulated lemon essential oil was evaluated against Trametes versicolor grown on agar medium. The results were as follows:

- 1% microcapsules achieved 27% inhibition.
- 5% microcapsules achieved 100% inhibition.
- 1% pure lemon oil achieved 11% inhibition.
- 5% pure lemon oil achieved 44% inhibition.

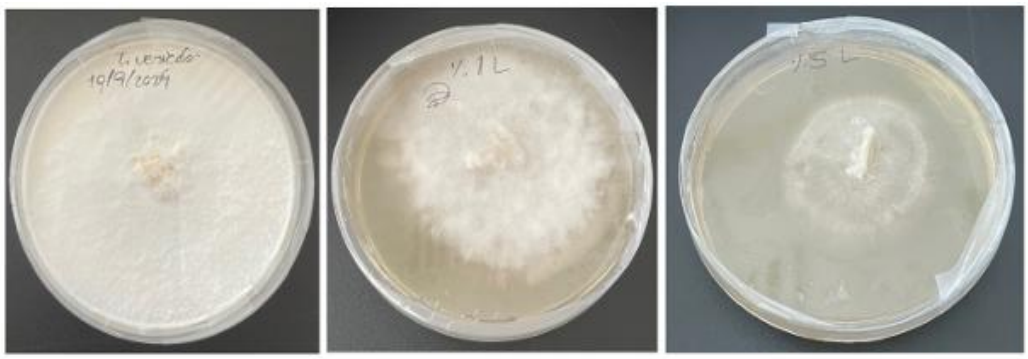

Fig. 5. Control; culture medium containing 1% lemon oil; culture medium containing 5% lemon oil

As shown in Figure 6, fungal growth in the Petri dishes could also be visually assessed. Distinct inhibition zones were observed in the regions where microcapsule powder or lemon oil had been applied. This indicates that lemon oil is effective in reducing fungal growth, and that the encapsulated form did not reduce its effectiveness, potentially creating a synergistic effect with the shell material (MUF).

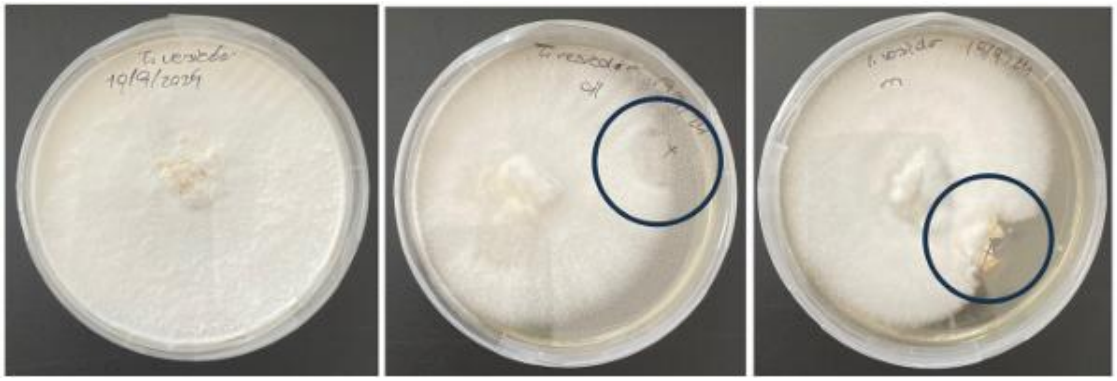

Fig. 6. Control; culture medium with lemon oil applied to a marked area; culture medium with microcapsule powder applied to a marked area

It is evident that the microcapsule form exhibited stronger antifungal activity compared to pure oil. In particular, the 5% microcapsule treatment completely inhibited fungal growth (100% inhibition), demonstrating the high efficacy of the method. These findings are consistent with the results of Zhang et al. (2023, 2024), who reported that microencapsulation enhances the stability and efficacy of essential oils in fungal control.

The results of this study align with previous research demonstrating that microencapsulation enhances the antifungal properties of essential oils. For example, Azmi et al. (2022) showed that lemon oil-based nanoemulsions were effective against various fungal species. The data obtained here indicate that microencapsulation protects the active compounds in lemon oil from environmental degradation and enables prolonged, controlled release, thereby maintaining its efficacy. These characteristics highlight the potential practical benefits of the method, especially in wood protection applications.

The findings demonstrate that microencapsulation not only preserves the activity of lemon essential oil but also enhances its biological effectiveness against wood-decaying fungi. However, the observed irregularities in capsule structures suggest that further optimization of production parameters (mixing speed, pH, temperature, etc.) would be beneficial. Additionally, this study focused only on a single fungal species. Future studies investigating the effects of microencapsulated lemon oil against other fungal species and microbial threats will be important to reveal its potential applications in different fields.

CONCLUSIONS

This study has successfully demonstrated that the antifungal activity of lemon essential oil against Trametes versicolor, a common wood-decaying fungus, can be enhanced through microencapsulation. The microencapsulation process protected the essential oil from environmental degradation, preserved the structure of its biologically active compounds, and enabled their controlled and prolonged release. As a result, the encapsulated lemon oil exhibited greater antifungal efficacy compared to its pure form. In particular, the higher inhibition values obtained at elevated concentrations further support the role of microencapsulation in improving the bioprotective properties of essential oils. This inhibitory effect even surpassed that of pure lemon oil alone, which may be attributed to a possible synergistic interaction between lemon oil and the shell material, MUF.

Structural analyses of the microcapsules revealed variations in capsule size and morphology. These differences were likely related to production parameters such as mixing speed and pH. Future studies focusing on the systematic optimization of these parameters could result in more homogeneous capsule structures, thereby improving application performance.

Further research is also needed to investigate the mechanism of action of the microcapsules. Their antifungal activity against different fungal species, as well as their potential effects on wood-degrading insects, should be explored. Moreover, the incorporation of the produced microcapsules into surface treatment formulations (e.g., varnishes, paints) may provide an effective approach to wood surface protection.

Based on the findings of this study, several recommendations for future research can be made. Firstly, microencapsulation parameters such as temperature, pH, and mixing speed should be systematically optimized to achieve more uniform capsule size and surface properties, thereby further enhancing the biological activity of the essential oil. Secondly, since this study only evaluated the effect against T. versicolor, testing the antifungal performance of encapsulated lemon oil against other wood-decaying fungi and microbial threats would broaden the applicability of the method.

From a practical perspective, it is recommended that the promising laboratory results be validated under real environmental conditions. Field studies would allow the assessment of the protective performance of microencapsulated lemon oil under external factors such as moisture, temperature, and sunlight exposure. Additionally, the potential synergistic effects of combining such natural biocides with other natural antifungal agents or coating systems should

be investigated. Indeed, previous studies by Zhang et al. (2023) and Pudžiuvelytė et al. (2022) have shown that essential oils exhibit enhanced antimicrobial efficacy when combined with other compounds.

Finally, the continued evaluation of health and environmental safety aspects of essential oils as biocides is of great importance. Comprehensive studies on the cytotoxic and ecotoxic effects of microencapsulated formulations will provide valuable guidance for the sustainable and safe use of these natural compounds in wood protection and beyond.

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A CRITICAL STYLISTICS STUDY OF DISSENT IN SOYINKA'S 'MADMEN AND SPECIALISTS'

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Abstract

This study explores a critical stylistics analysis of dissent in Wole Soyinka's 'Madmen and Specialists', employing Jeffries' (2010) Critical Stylistics as the sole theoretical framework. Soyinka's play, set in the aftermath of the Nigerian Civil War, illustrates a bleak allegory of moral disintegration, authoritarian abuse, and the corrosion of human values. Dissent, open and silent, emerges as a thematic and linguistic construct, critiquing oppressive authority and questioning the complicity of the oppressed. With the aid of Jeffries' toolkit, particularly the textual-conceptual functions such as naming and describing, representing actions/events/states, equating and contrasting, and representing speech and thought, the analysis examines how linguistic choices embodying resistance and defiance. Data were derived through close reading of the play's dialogues, focusing on exchanges between Bero, the authoritarian ex-military doctor, and other characters who embody fragmented opposition. Findings reveal that Soyinka's dissent is constructed through ironic naming, metaphorical descriptions that destabilise authority, and the strategic representation of speech as fragmented, hesitant, or sarcastically exaggerated. Contrasts between madness and reason, as well as between silence and speech, are also central in portraying resistance as both a linguistic and psychological act. The study argues that Soyinka's stylistic crafting of dissent goes beyond mere political commentary. It offers a layered critique of postwar disillusionment and the human condition under tyranny. By applying Jeffries' framework, this paper contributes to the growing body of research on African drama through the lens of critical stylistics, demonstrating how linguistic form shapes ideological resistance in literary discourse.

Keywords: *authoritarianism, verbal irony, ideological framing, post-conflict discourse, moral erosion.*

SILENCES AND OMISSIONS: WHAT IS LEFT UNSAID ABOUT AGRICULTURE IN TINUBU'S 2025 BUDGET SPEECH

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Abstract

Agriculture remains pivotal to Nigeria's development discourse, and President Tinubu's 2025 budget presentation foregrounds such interventions as fertilizer support, irrigation projects, and Bank of Agriculture recapitalisation. That notwithstanding, critical attention is needed to explore what was left unsaid in relation to in relation to critical issues of insecurity, climate change, and structural barriers that still undermine productivity. This study employs ***Critical Stylistics*** *(Jeffries, 2010; Jeffries & Walker, 2019), paying attention to textual-conceptual functions like naming, foregrounding, backgrounding, and exclusion. The framework underscores how omissions in political texts construct ideological meanings, making pronounced certain realities while silencing others. A qualitative critical stylistic analysis was employed to the agricultural aspects of Tinubu's 2025 budget speech. Data were sourced from the official transcript presented at the National Assembly. Key categories of analysis involved lexical representation of farmers, recurrent themes, and absent issues relevant to agricultural development. Findings reveal that while the speech emphasised financial allocations, fertilizer distribution, and mechanisation, systematically, it omitted references to farmer–herder conflicts, climate resilience strategies, and rural infrastructural deficits. Such silences signal a sense of optimism under the Renewed Hope Agenda, that just budgetary allocations are enough to secure food sufficiency, while deflecting attention from deep structural challenges. The study submits that omissions in Tinubu's 2025 agricultural discourse perform ideological work by legitimising government efforts and suppressing attention to persistent crises. Thus, critical stylistics exposes the persuasive power of silence in political communication.*

Keywords*: discourse, ideology, foregrounding, representation, persuasion*

EFFECT OF FOLIAR SPRAY OF ZINC ON GROWTH AND YIELD OF KNOLKHOL

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Abstract

An experiment was conducted to examine how foliar spray of Zn affects the growth and yield of knolkhol in field conditions. The experiment was carried out from December 2024 to February 2025 at the Horticulture farm of Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200. A Randomized Complete Block Design was employed for the experiment, which included one factor consisting of five levels of zinc foliar application: Zn_0= Control, Zn_1= 50 ppm, Zn_2= 100 ppm, Zn_3= 150 ppm, and Zn_4= 200 ppm. The results show that the morphological attributes and reproductive components, along with yield, were significantly affected among the treatments. The highest measurements achieved were plant height (39.18 cm), number of leaves per plant (15.6), leaf length (38.00 cm), leaf width (14.46 cm), weight of the knob (254.80 g), diameter of the knob (8.19 cm), perimeter of the knob (27.23 cm), root weight (13.31 cm), total plant weight (457.80 g), dry matter content of leaf (9.80 %), dry matter content of knob (6.25 %), yield per plot (2.29 kg), and yield per hectare (38.27 t/ha) respectively for the Zn_2 treatment, whereas the lowest values were recorded from the control. Thus, it can be concluded that 100 ppm Zn foliar spray resulted in improved growth and yield performance of knolkhol.

Keywords: knolkhol yield improvement, Zn foliar application, Growth and morphology, Randomized Complete Block Design (RCBD)

A NEW HYBRID METHOD FOR MORE ACCURATE SSVEP TARGET IDENTIFICATION

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Abstract

SSVEPs are brain signals used in technologies that let people control devices with their minds. While current signal-decoding methods have their uses, they often struggle with speed and accuracy. This research introduces a new, more effective approach called **eCCA-SSCOR**, which combines two different decoding techniques to improve performance.

The new eCCA-SSCOR approach combines two established techniques, extended Canonical Correlation Analysis (eCCA) and the Sum of Squared Correlations (SSCOR), to create a more effective solution. We tested this method on a public dataset «**Benchmark Dataset**» containing 40 frequency targets from 35 subjects, and found it significantly outperformed four leading techniques (CCA, FBCCA, eCCA, and SSCOR) in both accuracy and information transfer rate (ITR). With just 5 seconds of data, the system achieved **98.60%** accuracy, and with only 1 second of data, it reached an impressive **238.66** bits per minute ITR. These results show that eCCA-SSCOR is a promising method for making offline BCI applications more reliable and efficient.

Keywords: Brain-computer interface (BCI), ElectroEncephaloGram (EEG), Steady-state visual evoked potential (SSVEP), Canonical correlation analysis (CCA), Extended CCA (eCCA), Sum of squared correlation (SSCOR).

BRICS-T ÜLKELERİNDE ENERJİ TÜKETİMİ VE EKONOMİK BÜYÜMENİN SU AYAK İZİ ÜZERİNDEKİ ETKİLERİ

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ÖZET

Su ayak izi, bir mal veya hizmetin üretim sürecinde, tedarik zincirinin tüm aşamalarında kullanılan toplam tatlı su miktarını ölçen temel bir göstergedir. Sürdürülebilir kalkınma hedefleri ve etkin su yönetimi politikaları açısından su ayak izi analizleri, ekonomik faaliyetlerin çevresel maliyetlerinin değerlendirilmesine ve su kaynaklarının uzun vadeli korunmasına yönelik önemli bir araç niteliği taşımaktadır. Bu çalışmanın temel amacı, 2000–2022 dönemi için BRICS-T ülkelerinde (Brezilya, Rusya, Hindistan, Çin, Güney Afrika ve Türkiye) su ayak izi, ekonomik büyüme ve enerji tüketimi arasındaki ilişkileri panel veri yöntemi ile incelemektir. Analiz bulguları, enerji tüketiminin su ayak izi üzerinde negatif ve istatistiksel olarak anlamlı bir etkiye sahip olduğunu ortaya koymaktadır. Elde edilen sonuçlar, enerji tüketiminde meydana gelen %1'lik bir artışın, su ayak izinde yaklaşık %0,26 oranında bir azalmaya yol açtığını göstermektedir. Bununla birlikte, ekonomik büyümenin etkisi doğrusal bir eğilim göstermemekte; düşük gelir seviyelerinde büyüme, su ayak izinin azalmasına katkıda bulunurken, belirli bir gelir düzeyinin aşılmasının ardından büyümenin artışı su ayak izinde yeniden yükselişe neden olmaktadır.

Anahtar Kelimeler: Su Ayak İzi, Ekonomik Büyüme, Enerji Tüketimi

THE EFFECTS OF ENERGY CONSUMPTION AND ECONOMIC GROWTH ON WATER FOOTPRINT IN BRICS-T COUNTRIES

ABSTRACT

The water footprint is a key indicator that measures the total amount of freshwater used in the production process of a good or service at all stages of the supply chain. In light of sustainable development goals and effective water management policies, water footprint analyses are an important tool for assessing the environmental costs of economic activities and for the long-term protection of water resources. The primary objective of this study is to examine the relationships between water footprint, economic growth, and energy consumption in BRICS-T countries (Brazil, Russia, India, China, South Africa, and Turke) for the period 2000–2022 using panel data. The analysis findings reveal that energy consumption has a negative and statistically significant impact on the water footprint. The results indicate that a 1% increase in energy consumption leads to a reduction in the water footprint of approximately 0.26%. However, the effect of economic growth is not linear; at low income levels, growth contributes to a reduction in the water footprint, while after a certain income level is exceeded, increasing growth leads to a resurgence in the water footprint.

Keywords: Water Footprint, Economic Growth, Energy Consumption

KAMUSAL ALANIN YENİDEN OKUNMASI: DE-WESTERNİZASYON EKSENİNDE DOĞU VE BATI LİTERATÜRÜNE ELEŞTİREL BİR BAKIŞ

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ÖZET

Kamusal alan kavramı, iletişim, medya ve siyaset çalışmalarında sıklıkla Batı merkezli bir perspektifle ele alınmaktadır. Bu çalışma, Habermasçı burjuva kamusallığı modelinin ötesine geçerek, Doğu toplumlarındaki kamusal alan deneyimlerini (Osmanlı ve Türkiye örnekleri özelinde) Batıdışılaşma (de-westernizasyon) çerçevesinde yeniden okumayı amaçlamaktadır. Karşılaştırmalı literatür analizine dayanan araştırmada, Doğu ve Batı'daki kamusal alan dinamiklerinin benzerlik ve farklarının belirlenmesine odaklanılmıştır. Söz konusu yöntemle Doğu ve Batı'daki kamusal alan dinamiklerinin tarihsel, toplumsal ve epistemolojik kökenleri incelenmekte ve Batılı kavramların evrensellik iddiasının sınırları tartışılmaktadır. Bulgulara göre Doğu ve Batı arasındaki tarihsel ve yapısal ayrım, kamusal alan kavramının evrensel değil, bağlamsal bir niteliğe sahip olduğunu göstermektedir. Bu nedenle Batı'da geliştirilen teorik çerçevelerin Doğu toplumlarına doğrudan uygulanması, analitik olarak sınırlı kalmakta ve yerel özgünlükleri göz ardı etmektedir. Doğu toplumlarının kamusal alan deneyimini anlayabilmek için tarihsel bağlamı dikkate alan, yerel toplumsal yapıyı gözeten ve farklı kamusallık biçimlerini kapsayan çoğulcu bir yaklaşım gereklidir.

Anahtar Kelimeler: Kamusal alan, Doğu, Batı, de-westernizasyon, medya, iletişim

REREADING THE PUBLIC SPHERE: A CRITICAL VIEW OF EASTERN AND WESTERN LITERATURE ON THE AXIS OF DE-WESTERNIZATION

ABSTRACT

The concept of the public sphere is often approached from a Western-centric perspective in communication, media, and political studies. This study aims to go beyond the Habermasian model of bourgeois publicity and re-read the experiences of public sphere in Eastern societies (specifically the Ottoman and Turkish examples) within the framework of de-Westernization. Based on comparative literature analysis, the research focuses on identifying similarities and differences in the dynamics of the public sphere in the East and West. This method examines the historical, social, and epistemological roots of the public sphere dynamics in the East and West, and discusses the limits of Western concepts' claims of universality. The findings suggest that the historical and structural distinction between the East and West indicates that the concept of the public sphere is contextual, not universal. Therefore, the direct application of theoretical frameworks developed in the West to Eastern societies is analytically limited and ignores local specificities. Understanding the public sphere experience of Eastern societies requires a pluralistic approach that considers historical context, considers local social structures, and encompasses diverse forms of publicity.

Keywords: Public sphere, East, West, de-westernization, media, communication

INTRODUCTION

West and East represent not only geographical directions but also two distinct worldviews engaged in a historical rivalry. In his work "The West and the Rest: Discourse and Power," Stuart Hall (Hall, 1992), while asking, "What and where is the West?", argues that the West is not actually a geographical definition but a historical construct, an idea, and that this concept serves an ideological function. Historical processes, economic developments, and social structures are central to Western identity and Western discourse. Other societies, on the other hand, are considered the rest.

The term de-westernization is used to refer to all discourses and actions that oppose the West's hegemonic stance. De-westernization is a concept that generally includes the effort of "other" societies to purify themselves from the social, cultural, scientific, economic and conceptual hegemony of the West. Glück (2018) expresses this purification effort with a demand for a review of power relations. According to Glück, who defines de-westernization as a criticism of predominantly European-American ethnocentrism in knowledge production, de-westernization creates an inequality at this point as the production and dissemination of global academic knowledge moves from the West to the East. The power relations in the production and distribution of knowledge require reconsideration.

In addition to the West's hegemony over the rest of the world, there is also its academic hegemony that needs to be discussed. Many of the concepts used especially in the field of social sciences have been transferred directly from the West to the literature. It is a matter of debate to what extent it is healthy, appropriate and scientific to try to understand and explain the sociological structure of Turkey, for example, by examining the concepts put forward about the cultural, historical, economic, social etc. lives of Western societies. In this sense, the academic de-westernization of concepts plays a significant role, especially in the social sciences, in the effort to understand and make sense of each society's unique structure.

At this point, de-Westernization of concepts should not be understood as a complete rejection of valuable, useful, and scientifically significant studies from the West, nor should these values be ignored. On the contrary, it is crucial for the reliability of scientific knowledge that the hegemony of Westernized concepts be replaced by diversity. The development of studies and concepts specific to non-Western societies' own sociological structures, and the global acceptance of these studies, will contribute to the diversity of the scientific world.

MEDYA VE İLETİŞİM ÇALIŞMALARINDA BATILILAŞMA VE BATIDIŞILAŞMA

Batılılaşma, Batılı olmayan toplumların Batı kültürel, politik, ekonomik ve sosyal normlarını benimsemesini ifade eder; bu, çoğunlukla küreselleşme, sömürgecilik ve medya etkisinin bir sonucu olarak ortaya çıkar (Waisbord ve Mellado, 2014). Batılılaşma, Batılı olmayan toplumların Batı ideolojilerini, kurumlarını ve kültürel uygulamalarını benimseme sürecini tanımlar (Iwabuchi, 2010). Tarihsel olarak sömürgecilik ve küreselleşmeyle bağlantılı olan Batılılaşma, dünya çapında yönetişimi, eğitimi ve medya sistemlerini etkilemiştir. Akademide Batılılaşma, genellikle alternatif bakış açılarını marjinalleştirerek, Anglo-Amerikan teorilerinin ve metodolojilerinin ayrıcalıklı kılınmasıyla ortaya çıkmaktadır (Glück, 2018). Batı düşüncesinin sosyal bilimlerdeki hakimiyeti, Avrupalı ve Amerikalı akademisyenlerin daha

sonra evrenselleştirilen temel teoriler oluşturmasıyla sömürge döneminde ortaya çıkmıştır (Amin vd., 2000).

Bu teoriler genellikle Batı dışı bağlamları göz ardı ederek Avrupa merkezli bir dünya görüşünü güçlendirmiştir. Medya ve iletişim çalışmaları Batılılaşmadan büyük ölçüde etkilenmiştir ve erken dönem araştırmaları Amerikan ve Avrupa medya modellerine odaklanmıştır (Waisbord ve Mellado, 2014). Gündem belirleme ve kamusal alan gibi teoriler Batı bağlamlarında geliştirilmiştir ancak genellikle uyarlanmadan küresel olarak uygulanmıştır (Demeter vd., 2022). Bu yaklaşım, yerel medya uygulamalarını göz ardı ederek Batı karşıtı bakış açılarının dahil edilmesini savunan bir hareket olan Batı karşıtı çağrılara yol açmıştır (Waisbord, 2022).

Medya ve iletişim çalışmalarında Batılılaşmanın özellikleri şöyle sıralanabilir:

1. Teorik Hakimiyet – Batı teorileri (örn. Habermas'ın kamusal alanı, McLuhan'ın küresel köyü) medya çalışmalarının merkezinde yer almış ve sıklıkla yerel çerçeveleri gölgelemiştir (Glück, 2018).
2. Metodolojik Önyargı – Batı araştırmalarında tercih edilen nicel ve ampirik yöntemlere öncelik verilmişken, Batılı olmayan bilim insanlarının nitel ve kültürel olarak özgül yaklaşımları marjinalleştirilmiştir (Wang, 2011).
3. Medya Emperyalizmi – Batılı medya içeriğinin (örn. Hollywood filmleri, Batılı haber ajansları) küresel yayılımı kültürel hegemonyayı güçlendirmiş ve dünya çapında medya tüketim modellerini şekillendirmiştir (Iwabuchi, 2010).
4. Akademik Yayıncılık Farklılıkları – Batılı dergiler iletişim araştırmalarına hakimdir ve bu da Batılı olmayan bilim insanlarının tanınmasını zorlaştırmaktadır (Demeter vd., 2022).

Medya ve iletişim çalışmalarında Batılılaşma, araştırma metodolojilerini, teorik çerçeveleri ve akademik söylemleri şekillendiren baskın bir paradigma olmuştur. Ancak, bilim insanları bu baskınlığı giderek daha fazla eleştirerek, çeşitli bakış açılarını desteklemek için Batılılaşmanın ortadan kaldırılmasını savunmaktadır. Batıdışılaşma Batı paradigmalarının sosyal bilimlerdeki egemenliğine meydan okuyan, Batılı olmayan teorilerin, metodolojilerin ve bakış açılarının dahil edilmesini savunan entelektüel ve akademik hareketi ifade etmektedir (Wang, 2011). Akademideki Avrupamerkezciliğin bir eleştirisi olarak ortaya çıkan Batıdışılaşma, özellikle Batı çerçevelerinin tarihsel olarak evrenselleştirildiği medya ve iletişim çalışmalarında bilgi üretiminin sömürgeciliğini ortadan kaldırmayı amaçlamaktadır (Waisbord ve Mellado, 2014).

Batıdışılaşma, küresel akademide Batı düşüncesinin hegemonyasına karşı eleştirel bir yanıt olup, çeşitli epistemolojileri tanıma ve bütünleştirme ihtiyacını vurgulamaktadır (Glück, 2018). Batı teorilerinin evrensel olarak uygulanabilir olduğu varsayımını sorgulayarak ve bunun yerine yerel kültürleri, tarihleri ve medya uygulamalarını yansıtan bağlam-özgü araştırmaları teşvik etmektedir (Iwabuchi, 2010). Wang'a (2010) göre, Batıdışılaşma yalnızca Batılı akademik çalışmaları reddetmekle ilgili değildir, aynı zamanda akademik söylemi marjinal sesleri de içerecek şekilde yeniden dengelemekle ilgilidir.

Batıdışılaşmanın kökenleri, Batı akademisinin Batı dışı bilgi sistemlerini nasıl marjinalleştirdiğini ortaya koyan 20. yüzyılın sonlarındaki sömürge sonrası eleştirilere kadar uzatmak mümkündür (Amin vd., 2000). Edward Said ve Gayatri Spivak gibi akademisyenler, Batı teorilerinin Batı dışı gerçeklikleri sıklıkla yanlış temsil ettiğini veya görmezden geldiğini savunarak sosyal bilimlerdeki önyargıları açığa çıkarmaya çalışmıştır (Wang, 2011). Bu eleştiri, bilgi üretiminin artık Anglo-Amerikan kurumları tarafından tekelleştirilmeyeceği epistemik çoğulculuk çağrılarını içermektedir (Demeter vd., 2022).

Medya ve iletişim çalışmaları alanındaki Batıdışılaşma hareketi genel olarak şu amaçları taşımaktadır: Küresel anlatıları şekillendiren Batı medya konglomeralarının hakimiyetini eleştirmek (Iwabuchi, 2010), yerel medya modellerini içeren araştırmaları teşvik etmek (Glück, 2018) ve akademik yayıncılıkta batı dışı araştırmacıların yetersiz temsilini ele almak (Demeter v.d, 2022).

Waisbord (2022), Batılılaşmanın yalnızca bakış açılarını çeşitlendirmekle kalmayıp aynı zamanda iletişim çalışmalarındaki temel soruları, yalnızca Batı'ya ilişkin kaygıları değil, küresel kaygıları da yansıtacak şekilde yeniden tanımlaması gerektiğini savunmaktadır.

Medya ve iletişim çalışmalarında Batıdışılaşmanın genel çerçevesini şu yaklaşımlar oluşturmaktadır:

1. Epistemolojik Çoğulculuk – Afrika, Asya, Latin Amerika ve Yerli iletişim modellerini de kapsayacak şekilde Avrupamerkezli teorilerin ötesine geçmek (Wang, 2011).

2. Metodolojik Kapsayıcılık – Yerel bağlamlarla uyumlu nitel, etnografik ve katılımcı yaklaşımlara değer vermek (Glück, 2018).

3. Eleştirel Medya Politik Ekonomisi – Küresel güç yapılarının Batı ötesindeki medya sistemlerini nasıl etkilediğini incelemek (Amin vd., 2000).

4. Akademik Yayıncılığı Sömürgecilikten Kurtarmak – Batı dışı akademik çalışmalara öncelik veren dergileri ve konferansları teşvik etmek (Demeter vd., 2022).

Batı Toplumlarında Kamusal Alan Kavramının Gelişimi

İletişim çalışmaları çerçevesinde bolca araştırılan, tartışılan konulardan biri olan kamusal alan kavramı, içerik ve tanımlamaları ile Batılı düşünürlerin dağarcığından ve Batı toplumlarının sosyolojik yapısından ortaya çıkmıştır.

Tarihi Antik Yunan dönemine kadar uzanan kamusal alan düşüncesinin (Çalışkan, 2014) kavramsallaştırılması Alman sosyolog Jurgen Habermas tarafından "Kamusallığın Yapısal Dönüşümü" isimli eserinde yapılmıştır. Habermas'ın yanı sıra Hannah Arendt, Richard Sennett, Nancy Fraser, Michael Warner gibi pek çok Batı'lı düşünür kamusallık, kamusal alan kavramları ile ilgili çeşitli teoriler üzerinde durmuştur.

"Kamusallığın Yapısal Dönüşümü" adlı eserinde Habermas (2021:59), kamu, kamusallık ve kamusal alan gibi kavramlara değinerek bu kavramların tanımlamalarını yapmıştır. Ona göre kamu kelimesi etimolojik olarak Almanca'da geçmiş zamandan bu yana kullanılan kamusal

sıfatından gelmektedir. Fakat bu sıfat 18. yüzyıl itibariyle 'publicité' ve 'publicity' kelimelerinden ilham alınarak kullanılmaya başlanmıştır.

Habermas, kamusal alanı, kamu çıkarını ilgilendiren konularda özel kişilerin konuşma ve tartışma alanı olarak tanımlamaktadır (Goodsell, 2003). Habermas'a göre kamusal alan kavramı öncelikle toplumsal hayat için kamuoyunun oluşturulabildiği ve herkesin ulaşabildiği bir alandır. Vatandaşların, çoğunluğun yararına ilişkin konularda toplanma, kendilerini ifade etme, düşündüklerini yayınlama özgürlüğününe sahip olduklarında kamusallık sağlanabilmektedir (Habermas, 2004).

Verstraeten, Habermas'ın kamusal alan düşüncesinden yola çıkarak kamusal alanı tanımlayan birkaç öğeyi sıralamıştır. Verstraeten'e (2014:245-246) göre kamusal alanın çok sayıda insanın erişimine açık olan ve içinde çok çeşitli toplumsal deneyimlerin ifade edilebildiği ve paylaşılabildiği bir forumu gerekli kılmaktadır. Diğer yandan farklı görüşlerin rasyonel tartışma ortamında karşı karşıya gelen kamusal alanda rasyonel siyasal tercihin mümkün olabilmesi için alternatif seçim olanağının olması gerekmektedir. Bu noktada medyanın da vatandaşlara geniş yorum çerçevesi sunarak neyi seçip neyi seçmediklerini farkında olması noktasında destek sunmalıdır. Son olarak kamusal alanın başat görevi, iktidar politikalarını eleştirel ve sistemli şekilde denetlemektir.

Hanada (Hanada, 2006:613) kamusal alanın zamanın ekonomik, politik, kültürel ve teknolojik şartlara göre değişen dinamik yapısını vurgulayarak bu alanı bireylerin sosyal statülerine bakılmaksızın bir araya geldiği iktidarın eleştirilip sorgulanabileceği bir alan olarak görmektedir.

Arendt, kamusal alan kavramının kullanımını Antik Yunan dönemine kadar götürür. Bunu ise eylem, bir aradalık ve konuşmak terimlerini şaşırtıcı bir şekilde birleştirerek ve bir mantığa oturtarak anlatır. Ona göre eylem; insan toplumu dışında tahayyülü mümkün olmayan tek insani etkinliktir. Eylem ile bir arada/birlikte olmak arasında özel bir ilişki kurarken bu ilişkinin insanın "toplumsal hayvan", "siyasal hayvan" olarak tanımlanmasına yol açtığını vurgulamaktadır. Tam burada Arendt, Antik Yunan düşüncesine göre insanın siyasal örgütlenme kapasitesinin, merkezinde ev ve aile ortamına doğrudan bir karşıtlık oluşturduğunu söyler. Kent devletlerinin doğuşu ile insanın özel yaşamının yanında ikinci bir yaşam tarzını (bios politikos) elde ettiğini söyler. Artık her yurttaş iki varoluş düzenine aittir ve yaşamında özel alan ile kamusal alan arasında keskin bir ayrım ortaya çıkmıştır. Arendt, kamusal alanı, bireylerin birlikte görünür hâle geldiği, özgürlüğün ve çoğulculuğun ortaya çıktığı bir "eylem" sahnesi olarak görür. Arendt'in tanımında kamusal alan, bireyin kim olduğunun değil, ne yaptığının önemli olduğu bir zemindir (Arendt, 2021:57-61).

Fraser, "Rethinking the Public Sphere: A Contribution to the Critique of Actually Existing Democracy"adlı çalışmasında Habermas'ın kamusal alan kavramını sorgulamış, eleştirmiş ve feminist bir bakış açısıyla alternatif kamusal alan teorisi sunmuştur. Nancy Fraser'ın kamusal alan tanımlamasında prensip olarak devletin, iktidarın eleştirildiği söylemler üretilmektedir. Bu yanıyla kamusal alan kavramını devletten arındırmaktadır. Kamusal alandan ve kamusal alana katılımdan bahsederken Fraser, kamusal alanı sadece burjuvazinin oluşturduğu liberal bir alan ve kavram olmadığını söyleyerek Habermas'ı eleştirmiştir. Habermas'ın liberal ve burjuva

olmayan, diğer (rakip) kamusal alanları incelemeyi ihmal ettiğinin ifade etmiştir. Fraser Habermas'ın mülkiyetçi, eril ve burjuvazi ile sınırlı olduğunu iddia ettiği kamusal alanın kadınları, işçileri, milliyetçi grupları, köylüleri ve diğer marjinal grupları dışarıda bıraktığını, dikkate almadığını vurgularken bu grupların da aslında karşıt kamusal alanlar yarattığını savunmuştur. Fraser'ın bahsettiği bir diğer önemli köşetaşı ise çoklu kamusal alan nosyonudur. Normatif bakış açışıyla idealize edilmiş tek bir kamusal alan kavramına sıkışmak yerine toplumdaki tüm kişi ve grupları kapayan çoklu kamusal alanların varlığını savunmuştur (Fraser, 1990).

Fraser, Habermas'ın kamusal alan kavramsallaştırmasının, kadınları ve mülk sahibi olmayan sınıfları dışladığı için, yalnızca ayrıcalıklı erkeklerin yönetişim becerilerini uygulayabilecekleri bir alan olarak işlev gördüğünü eklemiştir. Bu nedenle, eşit derecede güçlü, açık veya ayrıcalıklı olmayan ve kolektif kimlikleri ve çıkarları dile getiren çoklu kamusal alanlar mevcuttur. Bununla birlikte, tüm bu farklı seslere kulak veren bir kamusal alan veya hükümet hiçbir zaman var olmamıştır. (Papacharissi, 2002:11). Bir başka deyişle Fraser (1990), Habermas'ın ideal kamusal alan kavramsallaştırmasını eleştirerek, bu alanın hiçbir zaman gerçekten kapsayıcı olmadığını, aksine kadınları, etnik grupları ve alt sınıfları dışlayan bir alan olduğunu savunmuştur. Bu eleştiriden hareketle Fraser, toplumda farklı kimliklerin ve çıkar gruplarının kendilerini ifade edebileceği çoğul kamusal alanların varlığını savunur. Ancak, tüm bu farklı sesleri gerçek anlamda içerebilen bir kamusal alan veya yönetim mekanizmasının tarihsel olarak hiç var olmadığını belirtmiştir.

Michael Warner ise kamuya daha farklı bir perspektiften bakmaktadır. Ona göre kamu, söylemin kendisinden başka hiçbir şey tarafından organize edilmeyen bir söylem alanıdır yani *ototeliktir*. Yani amacı kendisi olan bir nosyondur. Warner'a göre kamu, pratik yaşamda halkın kendisi olarak olarak ortaya çıkmaktadır. Ancak ona göre kamu aslında kişilerin bir araya gelerek oluşturduğu sayısal bir toplam değildir. Kamunun oluşabilmesi için örgütlenme ve söylemsel olarak vear olabilmek gerekmektedir. Ayrıca Warner'e göre kamuyu devlet haricinde bir şeyin organize etmesi gerekmektedir. (Warner, 1958:49-51).

Kamusal İnsanın Çöküşü eserinde ise Sennett (2013), 18. yüzyıl Londra ve Paris şehirlerindeki kamu ve kamusallığı incelediğini ifade etmiştir. Sennett kamusal yaşam ile sahne ve sokak arasındaki bağa dikkat çekmiştir. One göre kamusallığın ön plan çıktığı sokak ve sahneler özellikle kitabında da incelediği Paris ve Londra gibi büyük şehirlerdir. Bu alanlar yabancıların birbirleriyle etkileşime girdiği alanlar olarak kamusallığı oluşturma niteliğine sahiptir. 18. yüzyıl kamusal alanını bir sahne insanını ise bir aktör olarak tanımlayan Senett, kamusal alanın içinin boşaldığını ve kamusal yaşamın artık çöktüğünü bu çöküşün ise kapitalist, seküler, kentli kültürün oluşmasıyla başladığını söylemiştir. Ona göre dengesiz bir kişisel yaşam ve içi boşalmış kamusal alan bu çöküşün belirtilerindendir. Bu modern kent kültürü, ifade edici yaşantının ve kamusal insan kimliğinin yerine daha kişisel, daha sahici ve tüm öğeleriyle değerlendirildiğinde çok daha boş olan yeni bir yaşamı koymaktadır. Sennett, kamusal alandaki değişimleri incelerken 18. yüzyılın sonunda ulusal sanayi kapitalizminin yükselmesiyle birlikte kamusal ve özel olana dair düşüncelerde temel bir değişimin başladığını ifade etmiştir (Sennett, 2002:31-32)

DOĞU TOPLUMLARINDA KAMUSALLIK

Doğu toplumlarında (bu çalışma, doğu toplumu, batının dışında kalan diğer tüm toplumların içinde özel olarak Türkiye (geçmişte Osmanlı) toplumunu ele alacaktır) batıdaki gibi bir burjuvazi veya kamusal alan oluşumundan bahsedilememektedir. Ekonomik, toplumsal, kültürel, teknolojik ve gündelik yaşam biçimlerine varana kadar farklılık arz eden ayrı toplumlar doğal olarak farklı süreçlerden geçmektedirler.

Kırlı, Osmanlı kahvehanelerini inceleyerek kamuoyu ve kamusal alanın nasıl işlediğinin izini sürdüğü çalışmasında özellikle Habermas'ın Kamusal Alanın Yapısal Dönüşümü eserinden sonra kamu ve kamuoyu terimlerinin demokrasi ve vatandaşlık kavramlarının gelişimiyle bağlantılı bir anlam edinmeye başladığını söylemektedir. Kırlı'ya göre göre Habermas'ın ifade ettiği şekliyle devlet ve kamuoyu arasıdaki ilişki özü itibariyle antagonistiktir. Habermas'tan etkilenen özellike 18. yüzyıl Fransız tarihçileri, kamuoyunun etkili bir güç olarak 18. yüzyılın ikinci yarısında okuma yazma oranlarının yükseldiği, basının geliştiği ve insanların siyaset hakkında giderek bilinçlendiği Batı Avrupa'da ortaya çıktığına dair neredeyse hemfikir olduklarını iddia etmektedir. Onlara göre siyasal bilincin gelişerek statükonun reform ya da devrimle dönüştürmesi bu antagonistik ilişkiden kaynaklanmaktadır. Terim, 18. yüzyıl Avrupa'sında okur yazar bir toplumun doğuşuyla sıkıca ilişkilendirildiğinden, Osmanlı toplumunda kamuoyunun varlığı tıpkı dünyanın geri kalan kısmındakiler gibi dolaylı olarak yok sayılmıştır. (Kırlı, 2018:113-114).

Doğu dünyasında büyük çapta egemenliğe sahip Osmanlı İmparatorluğu'nda Habermas'ın Batı toplumları için konuşurken ifade ettiği gibi mevcut egemenliğin karşısına dikilip bu egemenliği değiştirmeye yönelik amaçları olan bir burjuvadan söz edilememektedir. Bu noktada geçmişte Osmanlı, günümüzde Türkiye toplumunun yapısını incelemek gerekmektedir.

Doğu ve Batı Ayrımının Kökeni: Feodalizmden Kapitalizme Geçiş

Esasen sadece kavramlar açısından değil tamamıyla bir toplumsal, zihinsel farklılıkların olduğu iki dünyadan bahsetmek mümkündür. Yerdelen'e göre Doğu ile Batı arasındaki farklılık öncelikle zihniyet temellidir. Tarihsel olarak geçmişe gittikçe Doğu ile Batı'nın buluştuğu, günümüze doğru yaklaştıkça ise ayrıştığı bilinmektedir. Yerdelen bu ayrışmanın 16. Yüzyılda başladığını iddia etmektedir. Bu yüzyılı dünya tarihi açısından bir dönüm noktası varsaymakla birlikte 16 yüzyılda ticaretin temellerinin belirlendiğini, Batı ve Kuzey Avrupa'nın da temel zihniyet dğişikliklerine uğrayarak yapısal dönüşüm sürecine girdiğini söylemektedir. Yerdelen'e göre 16. yüzyıldan bu yana Doğu toplumları pek çok alanda geride kalırken, Batı toplumları tersine yükselişe sürecine girmiştir. Böylelikle Doğu ile Batı arasındaki farklılıklar artmıştır. 16. yüzyıla iki toplum da ataerkil ve otoriter yapıdayken bu tarihten sonra özellikle batı Avrupa'da çok yönlü ve köklü değişimler meydana gelmiştir. Bu köklü değişimlerin başında feodalizmin çöküşü ve mutlak merkezi devletlerin oluşumu gelmiştir. Bu köklü politik değişimleri kapitalizme bağlayan Yerdelen'e göre kapitalizm ile modern toplum yapısı oluşmaya başlamış bu da ekonomik, sosyal ve kültürel ve sınıfsal değişim ve gelişimleri de beraberinde getirmiştir. Böylece yeni bir zihniyet modeli meydan gelmiştir. Yerdelen bu değişimi yönetsel ve düşünsel bir devrim olarak tanımlamıştır (Yerdelen, 2016:256).

Amerikan Sosyolog Immanuel Wallerstein, temelde toplumsal değişimi açıkladığı "Modern Dünya Sistemi" kuramında yine 16. yüzyıla büyük önem atfeder. Kapitalist dünya ekonomisinin başlangıcı olduğunu ifade ettiği bu zaman diliminde Avrupa'nın özellikle ekonomik olarak farklılaşmaya gittiğini be bu farklılaşmanın da politik durumun değişimiyle olduğunu öne sürmüştür.

Wallerstein'a göre 16. Yüzyıldan önce Batı Avrupa'da feodalizm hakimdi. Bu dönemdeki demografik ve ticari genişleme feodalizmi çeşitli krizlere sürüklemiştir. Feodalizmin bu krizi yaşamasının başlıca sebebi tarım üretiminin düşüşü, yönetici sınıfının genişlemesi ve feodal ekonominin dopal sınırlarına ulaşmasıdır. Diğer öne çıkan faktör ise Avrupa'nın iklim koşullarıdaki değişimin üretkenliği azaltıp salgın hastalıkları çoğatmasıdır. Dolayısıyla Avrupa ekonomik olarak büyümek için doğal olarak kapitalist dünya ekonomisine geçiş yapmak için yol almıştır. Dolayısıyla Wallerstein'a göre kapitalist dünya ekonomisi feodalizmden gelişmiştir (Kaya, 2005:49-50).

Yerdelen, aynı zaman diliminde Doğu'daki ekonomik hayatta, bir pazar sürecinin henüz yaşanmadığını vurgulamaktadır. Doğu toplumlarında devlet, özgürlüğü koruyan ve yeri geldiğinde kısıtlayan bir yapıdır. Egemen (padişah), ülkeyi dini değerleri ile yönetmektedir dolayısıyla laik bir düzen henüz söz konusu değildir. Feodal sistemin hala sürmekte olduğu bu toplumlar feodal sistemle devam ederken Avrupa toplumları 17. ve 18. yüzyıl modernitesinin yol açtığı Aydınlanma ve Sanayi Devrimi ile Doğu'dan farklılaşmaya başlamıştır (Yerdelen, 2016:257).

Doğu ve Batı dünyasının ekonomik gelişmeler ve şartlar karşılaştırıldığında Batı toplumlarının farklı bir işleyişe geçtiği Doğu'nun ise aynı şartlarda devam ettiği görülmektedir. Üretim şekli değişiminin toplumsal yaşamda ve ilişkilerde meydana getirdiği değişimler de yine Doğu ve Batı'da aynı olmamıştır. Batı toplumlarında feodalite çözülüp burjuva kamusu doğarken Doğu'daki (Osmanlı özelinde örnek verilecek olursa) patrimonyal yapı kamusal alanın bireylere bırakmadan devlet eliyle oluşturulmuş bir kamusal alan yaratmıştır.

Özbek'in (2004:14) bahsettiği üzere Habermas (Kamusal Alanın Yapısal Dönüşümü) ve Negth-Kluge'nin (Kamusal Alan ve Tecrübe) yazmış olduğu kitaplar bu kavram aynı koşulların ve aynı ulusal sınırların birer ürünüdür (Özbek, 2004:14). Kavramların ortaya çıktığı ulusal sınırlar Özbek'in de bahsettiği üzere belirli sınırlar içerisindedir. Belirli toplumların içinde yaşayan bireyler tarafından incenelenerek ve gözlemlenerek ortaya çıkan bu kavramların aynı koşulları yaşamayan toplumlar için için aynı şekliyle kullanılması sağlıklı ve yerinde tespitler yapmayı engellemektedir.

Doğu'nun Toplumsal Yapısına Dair Yaklaşımlar

Sosyal bilimler alanında özellikle bilim üretmede Batı'nın hakimiyeti söz konusu olduğu bilinen bir durumdur. Bilim üretmenin yanında bilimsel kavramlar de yine Batı toplumları temel alınarak bu toplumlardaki gelişmeler, değişimler ve dönüşümler gözlemlenerek ortaya konulmuştur.

Batının bilimsel ve akademik baskınlığının yanı sıra Doğu toplumları da incelenmiş, gözlemlenmiştir. Doğuyu inceleyip Doğu toplumları hakkında fikir üreten yine birçok "Batılı"

düşünür olmuştur. Bunlardan bazıları Karl Marx ve Max Weber'dir. Marx ve Weber doğu toplummlarının toplumsal, siyasal, ekonomik, kültürel boyuttaki yaşayışlarını incelemişlerdir.

Sunar, bu iki Alman düşünür'ün incelemelerini ve düşüncelerini Batı'nın kendisini Doğu üzerinden tanımlaması girişimlerinin bir parçası olarak görmektedir. Hatta sadece bu konu için değil tüm sosyoloji bilimi için bu iddiayı dile getirmektedir. (Sunar, 2010) Sosyoloji biliminin bu kadar sığ bir temele oturtulmasını doğru bulmamakla birlikte Doğu toplulukları ile ilgili Batılı düşünürlerin inceleme ve kavramlarının günümüzde dahi kabul görüyor olması ve bu kavramların üzerinden doğrulama veya yanlışlama yapılıyor olması da yadsınamaz bir gerçekliktir.

Sunar, toplum tipleri ve bu toplumların yönetim biçimlerini sınıflandırıken Montesquieu'den yararlanmaktadır. Despotizmi Doğu'nun yönetim karakteri olarak gören Montesquieu yönetim biçimlerini iklim ve coğrafi şartlara göre değerlendirmiştir. Montesquieu'nün toplum tipini yansıtan başlıca üç yönetim şekli olan Cumhuriyet (aristokrasi ve demokrasi de dâhil), saltanat ve despotizm ayrımını dile getirmektedir. Ona göre soğuk iklimler ve küçük devletler cumhuriyet ile yönetilirken nüfus arttıkça cumhuriyet idaresinin işlemesi mümkün değildir. Buna karşın despotizm de sıcak iklimlerde, büyük devletlerde ve doğal ve mükemmel varlığına ulaştığı Doğu'nun geniş topraklarında ortaya çıkmakta ve korkuya dayanmaktadır. Ilıman iklimin hâkim olduğu Avrupa'da ise orta boy devletlerde şerefe dayanan saltanat görülmektedir (Sunar, 2010:42-43).

Montesquieu'den önce yaşayan ve Doğu toplumuna doğan bir İslam alimi olarak tanınan ve bir sosyolog olarak kabul edilen İbn Haldun da Montesquieu'nün düşüncelerine benzer gözlemler yaparak bu gözlemlerini Mukaddime adlı eserinde dile getirmiştir. Doğu toplumlarıyla bir arada yaşamış ve bilimsel çalışmalarının yanında yönetimsel kademelerde de aktif olarak bulunmuş biri olarak İbn Haldun da Doğu kültürünün genel yönetim yapısının otoriter ve hatta despot bir tarzı benimsediğini yazmıştır. (Haldun, 2007).

Divitçioğlu'nun (1981:21) yer verdiği yazışmalarda Doğu toplumlarında özel mülkiyet, klasik feodalizm ve kamusallık kavramları ele alınmıştır. Bu yazışmalarda doğu toplumlarının üretim tarzının kaynağını özel mülkiyetin yokluğuna bağlayan ikili, özel mülkiyetin yokluğunu ise iklim ve sulama zorluklarına dayandırmaktadır. Dolayısıyla zorlu iklimlerin topraklarını sulamak buralardan verim elde etmek özel kişilerin yapabileceği boyutta bir iş değildir. Bu sebeple toprağın işlenmesi, yönetimi gibi işler devletin yapması gereken kamu işleridir.

"Asya üretim tarzında toprak üzerinde bireysel mülkiyet yoksa, mülkiyet kime aittir? Marx ve Engels'e göre, mülksahibi kamu hizmetlerini yerine getiren üstün otoritedir, dedik. Nitekim, «temel Asya şekillerinin birçoğunda, küçük topluluklar üzerindeki birleştirici birim, üstün ve biricik mülksahibi» olmaktadır. Anlaşılacağı gibi, birleştirici birim deyimi ile kastedilen üstün ve biricik otorite devlettir. Bu topluluklarda «ceberrut (despot) bir sürü toplulukların babası gibi gözükür ve hepsinin birliğini sağlar. Bununla beraber, hemen işaret edelim ki, burada kullanılan ceberrut terimi tesadüfidir. Çünkü Marx'a göre, birleştirici birim, yani devlet, ceberrut olabileceği gibi, demokrat da olabilir. Asya toplumlarmda devlet toprağın mülkiyetine sahip olsa bile, «gerçek topluluklar (toprağın) tasarruf hakkına sahiptirler». Fakat yine de

«aslında birey tek başına mülksüzdür». Böyle olunca, Asya üretim tarzında mülksahibi olan sadece devlettir" (Divitçioğlu,1981).

Öztürk'e göre (2010:73-74) Marx'ın doğu toplumlarını anlatırken fazla geliştirmediği bir kavram olan AÜT (Asya Tipi Üretim), özellikle 16. yy'a kadar Osmanlı toplum yapısına uygundur. AÜT tezine göre otarşik (kendi kendine yeterli olan) köy birimleri, merkezden yalıtılmış bir şekilde varlığını sürdürmektedir. Merkez ile köyler arasındaki ilişki vergilerin alınması ve askeri görevler ile sınırlı kalmaktadır. Toprağın özel mülkiyeti söz konusu değildir. Patrimonyal Bürokrasi yaklaşımı Weber'in doğu toplumlarına atfen kullandığı bir başka kavramdır. Bu kavramın Türkiye'deki en önemli temsilcisi Şerif Mardin'dir.

Şerif Mardin'e göre Batı'da Orta Çağ toplumunu ayırdeden patrimonyalizm ve feodalizm ilkelerinden Türkiye'de en ağır basan ilke patrimonyalizm olmuştur. Hatta Osmanlı da kuruluşundan az sonra patrimonyal bürokrasiyi benimsemiştir. Mardin, bu toplumlarda padişahın "uyruklarınının babası" niteliğinde olduğunu ve hükümdarın tebaasının refahından şahsen sorumlu olduğu bir yönetim sistemi söz konusudur. Hükümdar ile tebaa arasında hiçbir feodal yetki girmemiştir (Mardin, 1983:106-109). Mardin'e göre Türkiye'de ve genel olarak Doğu'daki toplum yapısının en belirgin özelliği baba ve oğul ilişkisini anımsatacak bir ilişkinin siyasal iktidar ve geniş toplum kesimleri arasında da var olmasıdır. Saraydaki 'Sultan baba' yönettiği tebaasına sevgi, şefkat ve merhamet gösterecek; tebaa ise sultan babalarının bu şefkat ve merhametine üreterek ve sorgulamayarak nail olacaklardır (Öztürk, 2010:74). Yani feoadalizmde hükümdar ile köylü sınıfı arasında çeşitli özerk otoriteler bulunurken Osmanlı'nın dahil olduğu patrimonyal sistemde bu özerk otoritelerden söz edilememektedir. Hükümdar yönettiği kesime direkt olarak hükmetmekte. Doğu toplumlarının bu 'baba-oğul' ilişki yapısı bu toplumların yönetim biçimini feodal yapıdan ayırmaktadır.

Osmanlı toplum yapısını açıklayan bir diğer yaklaşım ise Behice Boran'ın Merkezi Foedalite Yaklaşımı'dır. Bu yaklaşım, Osmanlı toplum yapısının bazı farklılıklarına rağmen Batı feodalitesinden büsbütün kopuk olmadığını savunur. Boran'a göre batıdaki feodalite ile Osmanlı İmparatorluğu "feodal tip" toplumun iki değişik örneğidir. Batı ve doğu feodalizmi ise mahallilik ve merkezilik kavramlarıyla ayırmıştır. (Boran, 1962). Boran'a göre her iki üretim tarzı da toprağa dayalıdır. Toprakta üretim yapan serfler ile Osmanlı'daki reaya arasında önemli benzerlikler bulunmaktadır. Her ikisi de toprağı bırakıp gidemez, az da olsa özel mülkiyet hakkına sahiptir (Öztürk, 2010:75).

Doğu toplumlarının yönetim biçim ve anlayışlarına genel olarak bakıldığında bireyin değil devletin ön planda olduğu aşkın bir devlet anlayışının söz konusu olduğu ifade edilmebilir. Bu bilgiler ışığında doğu toplumlarında kamusallığın, kamusal alanın ve kamu anlayışının da batıdan farklı bir yol izlediği kanısına varılabilir. Doğu'nun iklimsel, coğrafi, insani ve kültürel yapısının farklılaştırdığı yönetim ve üretim biçimleri bu kavramların da farklı anlaşılmasına ve farklı bir şekilde yaşanmasına yol açtığı söylenebilir.

Doğu Toplumlarında Kamusal Alanın Dinamikleri

Batı toplumlarının incelenmesi ile içi doldurulan kamusal alan kavramı doğu toplumlarında da aynı konsept çerçevesinde kullanılagelmiştir. Habermas'ın İngiltere, Almanya ve Fransa'nın 18 yy. sonları, 19 yy. başlarındaki gelişmelerin tarihsel bağlamından yola çıkarak oluşturduğu burjuva kamusunun ideal tipini tanımlayan araştırmada geçen kamu, kamusallık ve kamusal alan kavramları kendisinin de belirttiği üzere Avrupa'nın sadece belirli toplumlarından yola çıkılarak tanımlanmıştır. Yine kendisinin belirttiği üzere "burjuva kamusu" kavramını belli bir çağa özgü bir kategori olarak tanımlamaktadır (Habermas, 2021:9-11).

Habermas belli bir çağa özgü bir kategori olarak sunduğu 'burjuva kamusu'nun gelişim döneminden (Orta Çağ'ın son dönemleri) kopartılamayacağını ve bir genellemeyle herhangi bir tarihsel durumdaki biçimsel açıdan aynı olan yapılar bütününe aktarılamayacağını da özellikle belirtmiştir (Habermas, 2021:10). Habermas'ın bu söyleminden yola çıkarak söz konusu kavramların toplumların kültürel, siyasal, ekonomik özelliklerine ve bulunulan döneme göre anlam kazandığını söylemek mümkündür. Örneğin Habermas'ın bu kavramı ele aldığı dönemin Avrupa'sındaki toplumda buurjuva kamusu kavramından söz edilebilirken doğu toplumlarında (Osmanlı devleti özelinde) böyle bir yapıdan söz edilememektedir.

Toplumu incelerken, toplumsal bir olay veya durumu tanımlarken kullanılan bu westernize kavramlar, derinlemesine bakıldığında içinde bulunduğumuz toplumu tam olarak tanımlamamaktadır. Bu noktada kamu, kamusallık, kamusal alan gibi kavramların doğu toplumlarında nasıl tanımlandığı, nasıl deneyimlendiği gibi fark yaratan konulara değinmek yerinde olacaktır.

Öztürk (2005), kamusal alan kavramının "rasyonel-eleştirel" olması gerektiği vurgusunun yine Batılı düşünürler tarafından eleştirildiğini ifade etmiştir. Habermas'ın getirdiği ve sınırlı olduğu vurgulanan bu anlayışın ötekini ve ötekinin söylemini dışladığını vurgulayan bu düşünürlere göre ötekinin söylemi genellikle rasyonel-eleştirel değil, estetik-duygusal bir söylemdir. Metafor, şiir, tiyatro, retoriği de içinde barındıran estetik-duygusal söylemler iletişimin farklı şekillerini içermektedir (Öztürk, 2005:99).

Narmanlıoğlu'na göre batı ve doğu kamusallığı arasındaki en önemli fark devrim yapabilme gücüdür. Batı kamuoyu kamusal alanda devrim yaparken doğu toplumlarında sistem değiştirecek bir dinamik yoktur. Sistemi değiştirme potansiyeline sahip medya ise devlet eliyle kamuya girmiştir. Kamusal alan kamuya bırakılmamıştır ve devlet her alandadır (Narmanlıoğlu, 2020). Devletin her alanda olması konusu geçmişten süregelen bir despot, ceberrut, baba-oğul ilişkisini anımsatan bir siyasal yapı kamusal alan yapısını ve kamusallık deneyiminin de farklılaştırmıştır.

Sadece Batı toplumlarının incelenerek bu çerçevede tanımalanan kamusal alan tanımlamaları eksik kalmaktadır. Benzer biçimde Alemdar (2018), Batı'dan aktarılan modellerin Türkiye'nin özgün toplumsal yapısını ve tarihsel deneyimlerini açıklamakta yetersiz kaldığını, bu nedenle yerli bir teorik açılımın gerekliliğini vurgulamaktadır. Kamusal alan tartışmalarında olduğu gibi, iletişim disiplininin geneli de Batı-merkezli kavramsallaştırmaların gölgesinde kalmaktadırBatı uygarlıklarının dışında dünyanın çeşitli yerlerinde çeşitli kültürlerin birçok

farklı tarzda kamusallık, kamusal alan ve kamu nosyonlarının deneyimlendiği göz ardı edilmemelidir. Dolayısıyla doğu kültürlerinde deneyimlenen kendine has bir kamusallıktan söz edilebilir. Öztürk'ün (2005) aktardığı üzere batının rasyonel kamusallığına karşın doğu toplumları estetik-duygusal kamusallığı deneyimlemiştir.

Öztürk'e göre Osmanlı'da ancak 19. yüzyılın ortalarında "kamuoyu" kavramından söz edilmeye başlanmıştır. Bu tarihe kadar İstanbul'da çeşitli fikir ve görüşler özellikle kahve ve camilerden yayılmıştır. Bu anlamda etkili bir haberleşme ağından söz edilebilmektedir. (Öztürk, 2020:87).

"Türkiye'de devlet-toplum ilişkileri üzerine yazan çoğu sosyal bilimci, Osmanlı dönemine uzanan bir merkez-çevre anlayışı üzerinde durmuştur. Bu görüşe göre ara yapıların zayıflığı nedeniyle devlet-toplum ilişkileri katı sınırlarla birbirinden ayrılmış; bürokratik geleneğe sahip "ceberrut devlet" toplumu sürekli olarak denetlemek istemiştir" (Akt.,Öztürk, 2020:38-39).

Yıldırım, Türkiye'deki kamu anlayışının 'devlet' etrafında şekillendiğini vurgulamaktadır. Bu doğrultuda kamusal alan da devlet idaresi ile aynı anlama gelmektedir. Ona göre kamunun devletle özdeşleşmesi ve anlamının daralması Cumhuriyet Türkiyesi ile başlamıştır. Cumhuriyetin ilk yıllarının devlet anlayışını "aşkın" olarak tanımlayan Yıldırım, ulus yaratma çabasının homojenliği zorunlu kıldığı bu yıllarda siyasi erkin kamusal alanda mutlak bir güç olarak devreye girdiğini ifade etmektedir. Özellikle erken Cumhuriyet dönemindeki homojenleşme çabası sonucunda siyasal erkin kamusal alanı ele geçirdiğine ve devletin kamusal olarak tanımladığı parametreler dışındaki farklılıkların kamusal alanda yer almadığını ifade etmektedir (Yıldırım, 2015).

Yıldırım'ın bahsettiği aşkın devlet yapısını Çaha'nın 'Aşkın Devletten Sivil Topluma' adlı eseri aşkın devlet yapısının sivil toplumla ilişkisini incelediği eserinde görülmektedir. Çaha, 'devlet ebed' düşüncesinin Türk siyasal kültüründeki en merkezi temayı oluşturmasının doğal olarak birey, topluluk, sosyal grup, insan hak ve hürriyetleri gibi kavramlarını önemli ölçüde arka plana ittiğini ve devlet düşüncesinin bu kadar içselleştirmiş bir toplumda sivil toplum oluşmasının oldukça güç olduğunu ifade etmektedir (Çaha, 2007). Çaha'nın bahsettiği sivil toplum esasında kamusal alan ve kamusallık nosyonlarından farklı değildir. Çünkü ancak kamusallığın olduğu ve doğru işlediği durumlarda sivil toplumdan bahsedilebilir. Yıldırım ve Çaha'nın söylemlerinden yola çıkarak bir Doğu toplumu olarak nitelendirilebilecek Osmanlı ve Türkiye toplumları incelemelerinde Narmanlıoğlu'nun da (2020) bahsettiği üzere kamusal alan kamuya bırakılmamış aşkın olan devlet yapısıyla kamu ve kamusallık özdeşleşmiştir.

Bu durumun güncel yansımalarını Alternatif Bilişim Derneği'nin yayınlarında da görmek mümkündür. Bu yayınlardan birinde Dirini (2023), Türkiye'nin zaman zaman uyguladığı bant daraltma, erişim engeli ve içerik çıkartma gibi uygulamaların, kamusal alan oluşumuna ve komuoyunun enformasyon alma hakkına bir engel olduğunu vurgulamıştır. Bu vurgudan hareketle kamusal alana ve kamuoyu oluşturacak potansiyeldeki sosyal medya platformlarına uygulanmaya çalışılan devlet kontrolünü görmek mümkündür.

Osmanlı'da ise kamusal alanın başat mekanlarından biri olan kahvehanelerin daimi denetim, gözetim ve hatta kapatılması gibi devlet mekanizmasının gücünü kullandığı örnekler mevcuttur. Öztürk'e (2020:30) göre kahvehaneler Osmanlı'da ortaya çıktıkları andan itibaren otoritenin her daim kontrol altında tutmaya çalıştığı, zaman zaman hafiye bulundurduğu ve bazı dönemlerde kapatıldığı kamusal mekanlar olmuştur.

Köroğlu'na göre Türkiye'de gündelik dilde, kamusal alan dendiğinde ilk akla gelen devlet ve devletin temsil edildiği alanlardır. Köroğlu'nun incelediği Liberal Kamu alanı Modeli ve Agonistik Kamu Alanı Modeli gibi westernize kamusal alan tanımlamalarında devlete dışarıda bir rol verilirken Türkiye'de kamusal alan, gündelik hayatta devletle özdeş bir kavram olarak değerlendirilmektedir. Devletin kamusal alanın kurucu öğesi olarak kabul edildiği böyle bir anlayış gerek siyasal irade gerekse bazı entelektüel yaklaşımlarca da benimsenmektedir. Böylece kamusal alan tartışmaları güç, iktidar ilişkileri ve yasaklar bağlamında gündeme gelmektedir. Köroğlu'na göre devletin denetimindeki kamusal alan, Batı'da yaşanan ve oranın yönetim ve toplumsal yapısına binaen ortaya konmuş hiçbir modele uymamaktadır (Köroğlu & Köroğlu, 2013:927-929).

YÖNTEM

Karşılaştırmalı literatür analizi, tema, kavram, yöntem gibi farklılıkları ortaya çıkarmak için yapılan bir araştırma türüdür. De Zepetnek (1998), karşılaştırmalı literatür analizini, metinler, kültürler ve ideolojiler arasındaki ilişkilere odaklanan bir yöntem olarak tanımlamaktadır. Günümüzde karşılaştırmalı literatür analizi dijital beşeri bilimler, sömürge sonrası çalışmalar ve ulusötesicilik gibi yeni eğilimleri kapsamaktadır. Literatür karşılaştırmalarını daha geniş sosyo-politik ve tarihsel çerçeveler içinde değerlendirmek gerekmektedir (Domínguez vd 2014). Bu nedenle literatürde kullanılanılan kavramların sosyo-politik ve tarihsel süreç içerisinde nasıl ortaya çıktığının araştırılması ve nasıl geliştiğinin karşılıklı olarak değerlendirilmesi gerekmektedir. Bu çalışmada da medya ve iletişim çalışmaları alanında sıkça kullanılan kamusal alan kavramının Batı ve Doğu'nun farklı sosyo-politik ve tarihsel süreç içerisinde kazandığı anlamın karşılaştırmalı bir okuması yapılmıştır

SONUÇ VE TARTIŞMA

Bu çalışmada, kamusal alan kavramının Batı merkezli kökenleriyle birlikte, Doğu toplumlarında nasıl farklılaştığı ve farklı deneyimlendiği incelenmiştir. Habermas'ın tanımladığı burjuva kamusu ve rasyonel-eleştirel kamusal alan anlayışı, tarihsel olarak belirli bir zaman ve mekâna –özellikle 18. ve 19. yüzyıl Avrupa'sına– özgü bir formasyonun ürünüdür. Bu bağlamda, Batı dışı toplumlarda aynı yapının birebir karşılığının olmaması doğaldır. Doğu toplumlarının tarihsel, siyasal ve kültürel gelişim çizgisi göz önünde bulundurulduğunda, kamusal alanın işleyişi ve içeriği farklılaşmaktadır.

Doğu toplumlarında kamusal alan, genellikle devletin gölgesinde şekillenmiş; kamusallık, çoğu zaman sivil inisiyatiften çok siyasal otoritenin belirlediği sınırlar içinde deneyimlenmiştir. Bu bağlamda, Osmanlı ve Türkiye örneğinde görüldüğü üzere, kamu kavramı devletle özdeşleşmiş, kamusal alan ise bireylerin özgürce fikir alışverişinde bulunabildiği özerk bir zemin olmaktan çok, siyasal erkin belirlediği bir sahneye dönüşmüştür.

Doğu ve Batı toplumları arasındaki bu yapısal ayrımın kökenleri ise yalnızca kültürel değil, aynı zamanda ekonomik ve düşünsel temellere dayanmaktadır. 16. yüzyıldan itibaren Batı Avrupa'da yaşanan feodalizmin çözülüşü, merkezi devletlerin kurulması, kapitalizmin doğuşu ve Aydınlanma ile birlikte gelişen modernleşme süreci, toplumsal yapıda ve kamusal alanda büyük dönüşümler yaratmıştır. Aynı dönemde Doğu toplumlarında benzer bir dönüşüm yaşanmamış, devlet-toplum ilişkisi daha hiyerarşik, otoriter ve geleneksel bir yapıda devam etmiştir.

Bu tarihsel ve yapısal ayrım, kamusal alan kavramının evrensel değil, bağlamsal bir niteliğe sahip olduğunu açıkça ortaya koymaktadır. Bu nedenle Batı'da geliştirilen teorik çerçevelerin Doğu toplumlarına doğrudan uygulanması, analitik olarak sınırlı kalmakta ve yerel özgünlükleri göz ardı etmektedir. Doğu toplumlarının kamusal alan deneyimini anlayabilmek için tarihsel bağlamı dikkate alan, yerel toplumsal yapıyı gözeten ve farklı kamusallık biçimlerini kapsayan çoğulcu bir yaklaşım gereklidir. Bu değerlendirme, Alemdar'ın (2018) Türkiye'de iletişim disiplininin özgün bir epistemoloji geliştirmesi gerektiğine dair tespitleriyle örtüşmektedir. Dolayısıyla hem kamusal alan literatüründe hem de genel iletişim çalışmalarında Batıdışılaşma, yalnızca eleştirel bir yaklaşım değil, aynı zamanda yeni bir bilgi üretim paradigması olarak ele alınmalıdır.

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MURGUL KABACA VADİSİNDEN ELDE EDİLEN ORMAN ÇİÇEK BALLARINDA YILLARA BAĞLI KALİTE PARAMETRELERİNİN İNCELENMESİ

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ÖZET

Arıcılık faaliyetleri, küresel ölçekte tarımsal üretimin temel bileşenlerinden biri olup, ekosistemlerin sürdürülebilirliği açısından hayati bir öneme sahiptir. Türkiye, zengin bitki çeşitliliği, farklı floristik bölgeleri ve uzun vejetasyon süresine sahip bitki örtüsü ve farklı iklim koşulları sayesinde arıcılık faaliyetleri için oldukça elverişli bir ülkedir. Bu benzersiz ekolojik koşullar kaliteli ve yüksek saflıkta bal üretimi açısından değerlendirilmesi gereken önemli fırsatlar sunmaktadır. Bal, insanlık tarihi boyunca hem gıda hem de sağlık amaçlı kullanılan değerli bir ürün olmuştur. Tarımsal üretimin modern bileşenlerle gerçekleştirildiği ülkeler için bal ek bir katma değer oluşturmaktadır. Balın kimyasal bileşeni, fiziksel özellikleri ve biyoaktif aktif kapasitesi büyük ölçüde üretim bölgesinin floristik yapısı, rakımı ve iklim koşulları gibi çevresel faktörlerden etkilenmektedir. Ayrıca bu faktörler aynı zamanda balın kalite parametrelerinin belirlenmesinde de kritik rol oynamaktadır. Balın kalite kriterlerini karşılamasının ötesinde daha yüksek değerler sunması, hem pazar değerini hem de tüketici

güvenini artıran en önemli unsurlardan biridir. Bu nedenle, balın satışa sunulmadan önce kalite parametrelerinin belirlenmesi büyük önem taşımaktadır. Doğu Karadeniz bölgesi, çiçek balı üretiminde önde gelen alanlardan biridir. Lokasyon olarak seçilen Murgul ilçesi, zengin floristik çeşitliliği ve farklı rakım seviyeleri sayesinde çiçek balı üretimi için elverişli bir bölge olarak öne çıkmaktadır. Kabaca bölgesi vadi özellikleri sergilemesi ve çevresinden görece izole edilmiş olması nedeniyle doğal bitki örtüsü ve orman altı çiçekleri açısından çeşitlilik sunması nedeniyle örnekleme alanı olarak seçilmiştir. Vadinin belirlenen istasyonundan seçilen ballarda Türk Gıda Kodeksi Bal Tebliğinde belirtilen kalite parametrelerinin yıllara göre değişimi incelenmiştir. Çalışmada 2022, 2023, 2024 ve 2025 yıllarında temin edilen çiçek ballarında prolin, diastaz, nem, elektriksel iletkenlik ve HMF analizleri gerçekleştirilmiştir. Bu analizlerle, balın kalite profili hakkında bilgi sağlanması yıllık ve iklimsel değişimlerin bal kalitesine etkilerinin incelenmesi amaçlanmıştır. Ayrıca, elde edilen bulgular, coğrafi işaretli bal üretimi ve markalaşma potansiyelinin değerlendirilmesinde de katkı sunacağı düşünülmektedir.

Anahtar Kelimeler: Kabaca, kalite, Murgul, orman çiçek balı, yıllık değişim

INVESTIGATION OF YEARS-DEPENDENT QUALITY PARAMETERS IN FOREST FLOWER HONEYS OBTAINED FROM THE MURGUL KABACA VALLEY

Beekeeping activities are one of the fundamental parts of agricultural production on a global scale and are of vital importance for the sustainability of ecosystems. Türkiye, with its rich plant diversity, distinct floristic regions, long vegetation period, and diverse climatic conditions, is a highly favorable country for beekeeping activities. These unique ecological conditions offer significant opportunities for the production of high-quality and high-pure honey. Honey has been a valuable product used for both food and health purposes throughout human history. For countries where agricultural production is carried out with modern practices, honey represents an additional source of added value. The chemical composition, physical properties, and bioactive capacity of honey are largely influenced by environmental factors such as the floristic structure, altitude, and climatic conditions of the production area. Moreover, these factors play a critical role in determining the quality parameters of honey. Meeting quality standards and even exceeding them is one of the most important factors that increase both the market value of honey and consumer confidence. Therefore, determining the quality parameters of honey before marketing is of great importance. The Eastern Black Sea region is among the leading areas in flower honey production. Murgul district, selected as the study location, stands out as a suitable area for flower honey production due to its rich floristic diversity and different altitude levels. The Kabaca region was selected as the sampling area due to its valley characteristics and is relatively isolated from its surroundings, which offering rich diversity in natural vegetation and forest understory flowers. The honey samples collected from the designated station of the valley were examined for annual variations in the quality parameters specified in the Turkish Food Codex Honey Communiqué. In this study, proline, diastase, moisture, electrical conductivity, and HMF analyses were conducted on flower honeys samples obtained in 2022, 2023, 2024, and 2025. These analyses aim to provide insights into the quality profile of honey and to evaluate the effects of annual and climatic variations on honey quality. Furthermore, the findings are expected to contribute to the assessment of geographical indication potential and branding opportunities in honey production.

Keywords: Murgul, Kabaca, forest flower honey, quality, annual variation

GİRİŞ

Türk Gıda Kodeksi Bal Tebliği (Tebliğ No: 2020/7)'ye göre bal; bitki nektarlarının, bitkilerin canlı kısımlarından salgılanan maddelerin veya bu kısımlar üzerinde yaşayan bitki emici böceklerin (*Hemiptera*) salgılarının bal arıları tarafından toplanıp, arıların kendi enzimleriyle işlenerek yapısında değişiklik meydana getirdiği, su oranı azaltılarak peteklerde olgunlaştırılan ve doğal olarak kristalleşebilen bir ürün olarak tanımlanmaktadır. Tebliğe göre bal çeşitleri, kaynağına göre iki grupta incelenmektedir: Çiçek balı, bitki nektarından elde edilen bal; salgı balı ise bitkilerin özsuyundan veya bitki üzerinde yaşayan emici böceklerin salgılarından üretilen bal olarak belirtilmiştir. Üretim yöntemi ve piyasaya sunuluş şekline göre ballar; petekli bal, doğal petekli bal, kara kovan balı, süzme bal, petekli süzme bal, sızma bal, pres bal ve filtre edilmiş bal şeklinde sınıflandırılmaktadır. Tebliğde ayrıca, piyasada satışa sunulacak veya gıda maddelerinde bileşen olarak kullanılacak balların sahip olması gereken nitelikler ve standartlar da açıklanmıştır (TGK, 2020).

Bu çalışmanın amacı, Murgul Kabaca Vadisi'nden elde edilen Kabaca orman çiçek balında yıllara göre meydana gelen değişimleri çeşitli analizler yoluyla incelemektir. Bu kapsamda 2022, 2023, 2024 ve 2025 yıllarında bal örnekleri toplanmış ve prolin, diastaz, nem, iletkenlik ve HMF analizleri gerçekleştirilmiştir. Bu analizler sonucunda yıllara göre balın kalite profiline ait veriler elde edilmiş ve balda meydana gelen değişimlerin bal kalitesi üzerindeki etkileri değerlendirilmiştir.

Bal

Bal, antik çağlardan bu yana yalnızca bir tatlandırıcı olarak değil, besin değeri, insan sağlığına katkıları ve tedavi edici özellikleriyle de öne çıkan doğal bir üründür (Seraglio S. vd., 2019). Dioscorides'in kayıtlarına göre, balın enfekte yaraların tedavisinde kullanımı en az 2000 yıl öncesine dayanmaktadır (Silici S., 2019). Bal, bal arıları (*Apis mellifera*) tarafından bitkilerin nektarı ve bal özünden üretilir ve işlenir. Ağırlıklı olarak glukoz ve fruktoz gibi karbonhidratlar içermesinin yanı sıra amino asitler, organik asitler, enzimler, vitaminler ve mineraller gibi önemli bileşenleri de bünyesinde barındırır; ayrıca sahip olduğu belirgin antioksidan aktivite sayesinde birçok gıda ürününde yaygın olarak kullanılmaktadır (Yücel Y. ve Sultanoğlu P., 2013; Ferreiro M. vd., 2018). Balın kimyasal bileşimi, arıların nektar topladığı bitki türleri, çevresel koşullar, uygulanan işlem basamakları ve depolama şartlarına bağlı olarak değişkenlik göstermektedir (Mendes E. vd., 1998). Botanik ve coğrafi köken, hasat sırasındaki hava durumu ve bölgenin iklim koşulları da balın kalitesini ve özelliklerini etkileyen önemli faktörler arasında yer almaktadır (Escuredo O., ve Seijo M. C. 2019). Dünya genelinde yaklaşık 320 farklı çiçek kaynağına dayanan bal çeşitleri bulunmaktadır; bu çeşitler balın tadı, rengi ve kokusu gibi özelliklerini, arının bal aldığı çiçek ve bitkilerin farklı sıvı içeriklerine bağlı olarak kazanmaktadır. Ayrıca bal çeşitleri, sıcaklık, yağış, mevsimsel ve iklimsel değişiklikler açısından da sınıflandırılmaktadır (Meo S. vd., 2017).

Balın Sınıflandırılması

Türk Gıda Kodeksi Bal Tebliği'ne göre bal, hem kaynağına hem de üretim veya satış şekline göre farklı kategorilere ayrılmaktadır (TGK, 2020).

Kaynağa dayalı sınıflandırma:

- **Çiçek balı:** Arıların çeşitli bitki nektarlarını toplamasıyla elde edilen baldır. Örnekler arasında ıhlamur, yonca, kekik ve funda balları yer alır.
- **Salgı balı:** Bitkilerin canlı dokularından veya bu dokular üzerinde yaşayan Hemiptera türü böceklerin salgılarından üretilen ballardır; çam ve yaprak balı buna örnektir.

Üretim ve pazarlama biçimine göre sınıflandırma:

- **Doğal petekli bal:** Modern kovanlarda, temel petek kullanılmadan, arılar tarafından peteğiyle birlikte üretilen baldır.
- **Fırıncılık balı:** Yabancı tat veya kokuya sahip, fermantasyon başlamış ya da yüksek ısıya maruz kalmış bal olup, endüstriyel işlemlerde veya diğer gıda ürünlerinde bileşen olarak kullanılır.
- **Petekli bal:** Arılar tarafından yapılmış veya temel petekten hazırlanmış peteklerin gözlerinde depolanmış ve büyük kısmı sırlanmış baldır.
- **Süzme bal:** Sırları alınmış ve yavrusuz peteklerden santrifüj yöntemiyle elde edilen baldır.
- **Petekli süzme bal:** Süzme bal içerisine petek parçalarının katılmasıyla hazırlanan baldır.
- **Pres balı:** Yavrusuz peteklerin doğrudan veya 45 °C'yi geçmeyecek şekilde ısıtılarak preslenmesiyle elde edilir.
- **Sızma bal:** Süzme bal işlemi sırasında sırlardan ve balı alınmış peteklerden sızdırılarak toplanan baldır.
- **Filtre edilmiş bal:** Filtrasyon sırasında polen içeriği büyük ölçüde azalmış bal türüdür.

Bal Standardı

Bal, bitki nektarlarının veya bitkilerden/bitki emici böceklerden elde edilen salgıların arılar tarafından toplanıp işlenmesiyle oluşan, su içeriği azaltılmış ve petekte olgunlaştırılmış doğal bir üründür. Doğal bir ürün olduğu için hiçbir madde eklenemez veya çıkarılamaz (European Commission Honey). Türk Gıda Kodeksi (TGK) Bal Tebliği'ne (2020) göre balların sahip olması gereken temel özellikleri belirlemiş olup, bunlardan bazıları Tablo 1'de gösterilmiştir.

Tablo 1. TGK'ya göre balların özellikleri

Özellikler	Çiçek Balı	Salgı Balı	Çiçek ve Salgı Balı Karışımı	Fırıncılık Balı
Nem (en fazla) %	20	20	20	20
Sakkaroz (en fazla) g/100g	5	5	5	5
Fruktoz+Glikoz (en az) g/100g	60	45	45	-
Fruktoz/Glikoz	0,9-1,4	1,0-1,4	1,0-1,4	-
Suda çözünmeyen madde (en fazla) g/100g	0,1	0,1	0,1	0,1
Serbest asitlik (en fazla) meq/kg	50	50	50	80
Elektrik iletkenliği mS/cm	En fazla 0,8	En fazla 0,8	En fazla 0,8	En fazla 0,8
Diastaz sayısı (en az)	8	8	8	-
HMF (en fazla) mg/kg	40	40	40	-
Prolin miktarı (en az) mg/kg	300	300	300	180

Balın İnsan Sağlığı Açısından Önemi

Bal, hem doğal hem de yaygın olarak tüketilen bir ürün olarak, uzun yıllardır çeşitli sağlık yararlarıyla bilinmektedir. Sadece besleyici bir tatlandırıcı olmanın ötesinde, tedavi edici özellikler taşıyan fonksiyonel bir gıdadır. Araştırmalar, balın içerdiği antioksidanlar, fenolik asitler ve flavonoidler gibi biyolojik açıdan aktif bileşenler sayesinde insan sağlığını desteklediğini göstermektedir. İnsan sağlığı açısından balın rolü aşağıda özetlenmiştir.

Besleyici ve tedavi edici özellikler (Scepankova, vd. 2017).

Antioksidan ve Antimikrobiyal Aktiviteler (Scepankova, vd. 2017).

Glisemik Düzenlemedeki Rolü (Ajibola, vd. 2012).

Anti-inflamatuar ve Yaraların İyileşmesi (Ajibola, vd. 2015).

Antik Mısır'dan Hindistan'a kadar, hastalıkların önlenmesinde kullanılan bal, sağlık üzerindeki faydalı etkileri sayesinde değer görmüştür. Bu geleneksel uygulamalar, günümüz bilimsel araştırmalarıyla doğrulanmakta ve balın tarih boyunca taşıdığı önemi ortaya koymaktadır (Cortés, vd. 2011; Crittenden, 2011).

MATERYAL VE METOT

Materyal

Bu çalışmada kullanılan bal örnekleri, uzun yıllardır arıcılığın yapıldığı, dış etkenlerden büyük ölçüde izole konumuyla dikkat çeken ve zengin bitki çeşitliliğine sahip Artvin'in Murgul İlçesi Kabaca Vadisindeki yerel bal üreticilerinden temin edilmiştir; nem, elektriksel iletkenlik, prolin, diastaz ve HMF analizleri yapılarak kalite parametreleri açısından incelenmiştir. Ballar, her biri 200 g olacak şekilde cam kavanozlarda muhafaza edilmiş şekilde, 2022, 2023, 2024 ve 2025 yıllarındaki sağım dönemlerinde, yaklaşık 1020 m rakımdaki aynı lokasyondan toplanmıştır. Analizler yapılana kadar örnekler, kapaklı kavanozlarda 25 °C'de saklanmıştır. Elde edilen bal numunelerinin analizleri, toplandıkları yıl içerisinde gerçekleştirilmiştir. Çalışmada kullanılan tüm kimyasal maddeler ise Sigma Aldrich ve Isolab firmalarından temin edilmiştir.

Şekil 1. Murgul Kabaca Vadisi ve bal temin edilen kovanlar

Cihaz Adı	**Cihaz Markası**
Refraktometre	: Anton Paar Abbemat 3200
pH ve İletkenlik Ölçer	: Mettler Toledo S220
Su Banyocu	: Weightlab / Wf-SBC30
Santrifüj Cihazı	: Hermle / Z-36 HK
Spektrofotometre	: Agilent Carry 3500
HPLC	: Shimadzu

Metot

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Türk Standartları Enstitüsü TS 13366/2008 – Balda Elektrik İletkenliği Tayini

Türk Standartları Enstitüsü TS 13357/2008 – Balda Prolin Muhtevasının Tayini

Türk Standartları Enstitüsü TS 13364/2008 – Balda Diastaz Aktivitesi Tayini

Türk Standartları Enstitüsü TS 13356/2008 – Balda HMF Tayini

BULGULAR VE TARTIŞMA

- Nem (%)

Balda nem oranı, ürünün **stabilitesi ve raf ömrü** açısından en kritik kalite parametrelerinden biridir. Yüksek nem içeriği, balda **fermantasyon riskine** yol açabilmektedir. Bu nedenle Gıda Kodeksinde nem oranı için maksimum sınır %20 olarak belirlenmiştir. Çalışmamızda incelenen bal örneklerinin nem değerleri %15,7 ile %19,8 arasında değişmiş, dört yıllık ortalama ise %17,25 olarak bulunmuştur. Bu sonuçlar mevzuatta belirtilen limitin altında olup balların mikrobiyal açıdan stabil olduğunu göstermektedir. Özellikle 2023 yılı örneklerinde nem oranının %19,8 ile sınır değere oldukça yakın bulunmasının, o yılki iklim koşulları ve balın olgunlaşma sürecinden kaynaklanmış olabileceği söylenebilir. Diğer yıllarda ölçülen daha düşük nem değerleri ise ürünün raf ömrü açısından daha güvenli olduğunu ortaya koymaktadır.

- Elektriksel İletkenlik (mS/cm)

Elektriksel iletkenlik, balın botanik kökenini ayırt etmede kullanılan önemli parametrelerden biridir. Türk Gıda Kodeksi'ne göre, elektriksel iletkenlik değeri 0,8 mS/cm'nin altında olan ballar çiçek balı olarak sınıflandırılmaktadır. Ayrıca mineral içeriği ve balın kimyasal kompozisyonu da iletkenlik üzerinde etkilidir. Çalışmamızda elektriksel iletkenlik değerleri 0,630–0,705 mS/cm arasında değişmiş ve ortalama 0,667 mS/cm bulunmuştur. Bu sonuçlar bal örneklerinin çiçek balı olduğunu ve mineral içeriklerinin standart değerlerle uyumlu olduğunu göstermektedir. Yıllar arasında gözlenen küçük farklılıklar, flora çeşitliliği ve çevresel koşullardaki değişimlerden kaynaklanabilir.

- Prolin (mg/kg)

Prolin miktarı, balın olgunluk düzeyini ve arı kaynaklı katkısını gösteren en önemli biyokimyasal parametrelerden biridir. Ayrıca, prolin içeriği bala dışarıdan herhangi bir katkı yapılıp yapılmadığını belirlemede de önemli bir kriter olarak kullanılmaktadır. Türk Gıda Kodeksi'ne göre balda prolin miktarının en az 300 mg/kg olması gerekmektedir. Çalışmamızda prolin değerleri 341–385 mg/kg arasında değişmiş ve ortalama 359,5 mg/kg olarak tespit edilmiştir. Elde edilen tüm sonuçların mevzuatta belirtilen minimum değerin üzerinde olduğu görülmektedir. Özellikle 2025 yılına ait örneklerde en yüksek prolin miktarına ulaşılması, o dönemdeki flora çeşitliliği ve arıların beslenme davranışlarıyla ilişkili olabilir. Bu bulgular, Murgul Kabaca Vadisi balının doğal yapısını güçlü bir şekilde ortaya koymaktadır.

- Diastaz Aktivitesi

Diastaz enzimi, balda doğal olarak bulunan ve ürünün tazeliğini ile ısıl işleme maruz kalıp kalmadığını belirlemede kullanılan önemli bir kalite parametresidir. Diastaz aktivitesinin düşük olması, balın ya ısıl işlem gördüğünü ya da uzun süreli depolama sonucunda enzim aktivitesinin azaldığını göstermektedir. Türk Gıda Kodeksi'nde minimum diastaz sayısı 8 olarak belirlenmiştir. Çalışmamızda; diastaz sayısı 19,75–25,43 arasında değişmiş ve ortalama 22,49 olarak tespit edilmiştir. Bu değerler, incelenen örneklerin taze ve yüksek enzim

aktivitesine sahip olduğunu ortaya koymaktadır. Özellikle 2024 yılına ait örneklerde en yüksek diastaz sayısının belirlenmesi, balın güçlü biyolojik aktiviteye sahip olduğunun da bir göstergesi olabilir. Yıllar arasında gözlenen farklılıkların ise flora çeşitliliği ve çevresel koşullardan kaynaklandığı düşünülmektedir.

- HMF (mg/kg)

Hidroksimetilfurfural (HMF), balda saklama koşulları ve uygulanan ısıl işlemler sonucunda oluşan bir bozunma ürünüdür. Bu nedenle HMF miktarı, balın tazeliğini ve ısıl işleme tabi tutulup tutulmadığını gösteren en kritik kalite parametrelerinden biridir. Türk Gıda Kodeksine göre balda HMF miktarı 40 mg/kg'ı geçmemelidir. Çalışmamızda HMF değerleri 0–1,13 mg/kg arasında değişmiş, ortalama 0,45 mg/kg olarak bulunmuştur. Bu değerler, mevzuatta belirtilen sınırın oldukça altında olup örneklerin taze, uygun koşullarda depolanmış ve ısıl işlem görmemiş olduğunu göstermektedir. Özellikle 2022 ve 2025 yıllarında HMF'nin hiç tespit edilmemesi, balların uygun koşullarda depolanıp ısıl işlem görmediğini ve Murgul Kabaca Vadisi ballarının depolama ile işleme süreçlerinde doğal kalitesini koruduğunu göstermektedir.

Tablo 2. Yapılan analizlerin sonuçları

Sağım Dönemi	Yapılan Analizler				
	Nem	**Elektriksel İletkenlik**	**Prolin**	**Diastaz**	**HMF**
2022	17,2	0,705	341	19,75	0
2023	19,8	0,630	353	20,57	1,13
2024	16,3	0,667	359	25,43	0,7
2025	15,7	0,665	385	24,19	0
Dört yılın ortalaması	17,25	0,667	359,5	22,49	0,45
Standart sapma	1,8083	0,0306	18,5741	2,7525	0,5566

SONUÇ

Murgul Kabaca Vadisi orman çiçek ballarına ait 2022–2025 yılları arasındaki analiz sonuçları ile Temmuz ve Ağustos aylarına ait veriler birlikte değerlendirildiğinde, balın kalite standartlarını ve doğal karakterini koruduğu görülmektedir. Nem, iletkenlik, prolin, diastaz ve HMF parametrelerinin yıllar boyunca benzer düzeylerde seyretmesi, ürünün doğal süreçlerle üretildiğini ve geleneksel arıcılık yöntemlerinin sürdürüldüğünü göstermektedir. Elde edilen bulgular, Kabaca Vadisi çiçek balının kimyasal açıdan istikrarlı, güvenilir ve kaliteli bir profile sahip olduğunu ortaya koymaktadır. Ayrıca, tüm parametrelerin yıllar boyunca birbirine yakın değerler göstermesi, bölgenin kendine özgü flora çeşitliliğini ve ekolojik koşullarının bala karakter kattığını göstermektedir. Bu özellikler, ürünün botanik ve coğrafi açıdan karakterizasyonu için sağlam bir bilimsel temel sunmakta, aynı zamanda coğrafi işaret tescili açısından değerini artırmaktadır. Böylece Murgul Kabaca Vadisi balları, hem bilimsel hem de ekonomik açıdan güçlü bir potansiyele sahip, özgün ve değerli bir doğal ürün olarak konumlandırılabilir.

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"THE EVOLVING LANDSCAPE OF INTERNATIONAL FINANCIAL REGULATION"

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Contemporary international finance raises important questions about whether, and how, it might be overseen by national governments and international institutions. Inasmuch as global financial stability is a global public good, there is a normative case for governance structures to try to achieve this goal—whether they take the form of interstate cooperation or international institutions. This, however, does not mean that national states will necessarily be willing or able to work together to provide this global public good, as the incentives to free-ride are enormous. Nonetheless, the past 25 years do indicate that there has been some movement toward the provision of such global public goods as financial harmonization and a semblance of global lender-of-last-resort facilities. The record is spotty, but the trend appears to be in the direction of more global governance of global finance

Keywords: International finance, global governance, international externalities, monetary cooperation

PRODUCTION AND CHARACTERIZATION OF CARBON NANOTUBES FROM BIOCHAR UNDER MICROWAVE IRRADIATION

Faisal Nazir

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF PHILOSOPHY

PHYSICS

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ABSTRACT

Carbon nanotubes (CNTs) are widely used in a variety of fields to produce a diversity of products, including hydrogen storage systems, and field emitters. In the proposed study, CNTs synthesized via biochar under the microwave irradiation method. In this method, the combination of charcoal and ferrocene are used to synthesize CNTs from the biochar approach. Biochar samples for CNTs synthesis are made from pyrolyzed agro-industrial waste such as rapeseed cake, hazelnut hulls, wheat straw, and oat hulls at different temperatures. The biochar was produced from agro-industrial biomass. During experiments, 100g of biomass was placed in a microwave reactor. The samples were pyrolyzed at 400 °C to 600°C. SEM analysis was used to confirm the morphology of CNTs. SEM micrographs revealed the perfect structure of multiwall carbon nanotubes, while interlayers spacing was changed due to variation of catalysts and measured about 0.34nm. Further, the optical properties were examined by UV-visible spectroscopy. In the UV, one band is clear at 240 nm region due to resonance of nanotubes pi(π) electrons of carbon nanotubes. XRD was used to analyze the glassy structure of prepared CNTs under microwave revealed that the creation and growth of CNTs were mostly influenced by microwave irradiation and the ferrocene catalyst. The structure of CNTs was developed under microwave heating and in the presence of ferrocene catalyst. To research how nitrogen impurities adhere to CNTs, FTIR experiments were conducted in the 400–4000 cm^{-1} range. The sample's FTIR spectra exhibit prominent peaks that correspond to C-H and C=C, respectively.

TRANSFORMING AL-DUBATI HOUSE INTO A HERITAGE VILLA IN JORDAN

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Abstract

This paper explores the adaptive reuse of Al-Dubati House in Jordan as a heritage villa. The study emphasizes the significance of preserving historical architecture while promoting cultural tourism and community engagement. Adaptive reuse of historical buildings not only safeguards cultural identity but also contributes to sustainable urban development.

Jordan is renowned for its rich historical and cultural heritage, reflected in its architecture and urban landscapes. Among these heritage assets, Al-Dubati House represents a vital example of traditional Jordanian architecture. The building embodies historical construction techniques, social values, and cultural narratives of its era. Preserving such structures is essential for maintaining the collective memory and identity of the local community.

Heritage preservation ensures the continuation of cultural identity and historical knowledge. By transforming Al-Dubati House into a heritage villa, the project serves as a platform for cultural exhibitions, educational programs, and tourism activities. Authentic restoration using traditional materials and techniques maintains the architectural integrity, allowing visitors to experience Jordan's historical environment in a genuine manner.

Adaptive reuse offers a sustainable alternative to demolition. Repurposing historical buildings reduces environmental impact, optimizes land use, and preserves urban heritage. Additionally, heritage villas provide economic opportunities for local artisans and entrepreneurs, fostering community participation and cultural engagement.

Al-Dubati House, located in [specific location if available], exemplifies the potential of heritage adaptive reuse in Jordan. Restoration focuses on structural stabilization, preservation of original decorative elements, and integration of modern functionalities to support public access and cultural events. This model demonstrates how historical preservation and contemporary use can coexist effectively.

Transforming Al-Dubati House into a heritage villa not only preserves a significant architectural monument but also strengthens cultural identity and promotes sustainable development. Such projects serve as benchmarks for similar initiatives across Jordan, highlighting the importance of adaptive reuse in maintaining historical continuity while meeting modern societal needs.

Keywords: Adaptive Reuse, Heritage Preservation, Jordanian Architecture, Cultural Tourism, Sustainable Development, Al-Dubati House

REVOLUTIONIZING DROUGHT TOLERANCE IN STAPLE CROPS: INTEGRATING CRISPR-CAS9 WITH TRADITIONAL PLANT BREEDING TECHNIQUES FOR CLIMATE-RESILIENT AGRICULTURE

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Introduction:

Drought is among the most important contributors to global food insecurity, particularly in dryland areas that rely on rainfall to grow most of their staple crops. We now need to breed crop varieties that can endure longer dry spells while maintaining yield and nutritional quality due to climate change exacerbating this phenomenon. Conventional breeding has made inroads improving drought tolerance but is a slow process and constrained by genetic base. CRISPR-Cas9 gene-editing technology heralds an exciting new opportunity to quickly develop drought-resistant crops through targeted modulation of genes involved in stress tolerance. For long, the words" CRISPR-Cas9" and" climate-resilient staple crops" have been part of research, however recently this study investigates the combination of CRISPR-Cas9 with traditional plant breeding methods to combine climate resiliency into essential crops as a step to sustainable agricultural practices in drought-prone regions.

Objective:

This study aims to test the hypothesis that synergism is likely between CRISPR-Cas9 gene-editing and traditional breeding approaches to develop drought-tolerant crops, such as wheat, maize and rice. This study seeks to identify molecular pathways involved in drought tolerance and speed the breeding process for high-yielding drought-resistant crops.

Method:

It uses a combination of CRISPR-Cas9 and crossbreeding. Using CRISPR technology, mutations that promote water retention, root establishment, and stress response were targeted in specific genes involved in drought resistance in maize, wheat, and rice. At the same time, conventional breeding crossed plants that had the desired traits. The performance of the genetically edited and traditionally bred plants was compared with respect to their growth rate, water use efficiency, yield, and physiological stress markers while these plants were grown under controlled drought stress conditions.

Results:

Initial analysis shows that the drought tolerance of these CRISPR crops is greatly increased compared with natural varieties. The plants, with CRISPR edits, exhibited deeper roots, greater capacity for water retention, and higher yield in a drought setting. Additionally, the hybrid breeding strategy sped up the creation of drought-resistant varieties, shortening the time frame needed for finding desirable characteristics. These edited crops stably expressed across multiple generations without significant off-target effects, indicating the precision of CRISPR-Cas9 technology.

Conclusion:

Combination of classical plant breeding with CRISPR-cas9 is a promising approach for drought-resilient staple crops. It not only improves drought resistance, but it is a more rapid and efficient way to make climate resilient crop varieties. These results could ultimately transform breeding programs for drought tolerance that achieve food security and sustainability in climate-challenged parts of the world.

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ÖZET

Tarihi zenginlikler arasında ifade edilebilecek olan mimari yapılar, anıtlar ve diğer eserler çeşitli dönemlerde gerçekleştirilen restorasyon çalışmaları sayesinde günümüze kadar ulaşabilmiştir. Ancak kültürel miras yalnızca bunlardan ibaret değildir. Müzik gibi sözlü gelenek yoluyla aktarılan soyut kültürel değerler de toplumların hafızasının vazgeçilmez parçalarıdır. Geleneksel veya anonim ezgilerin sesli kayda alınıp, notasının yazılması anlamına gelen derleme çalışmaları sayesinde, yazılı kayıt ve görsel belgelerden yoksun bu tür müzikal miraslar, unutulma tehlikesinden kurtarılmaktadır. Bu nedenle, sözlü geleneğin en önemli taşıyıcısı olan müzik, yalnızca icra edilerek değil; sistematik biçimde derlenerek, kaydedilerek ve arşivlenerek sağlıklı bir şekilde gelecek kuşaklara aktarılabilir. Derleme çalışmaları, bu bağlamda, müzik kültürünü korumanın "restorasyon" işlevini üstlenmektedir. Muzaffer Sarısözen ve ekip arkadaşları tarafından 1937-1953 yılları arasında devlet desteğiyle "Derleme Gezileri" düzenlenmiştir. Bu derlemeler müzik tarihimiz açısından önemli bir yer tutmaktadır ve Sarısözen'in derlediği eser sayısı binlerle ifade edilmektedir. "TRT Yurttan Sesler Koroları" ile Türk Halk Müziği'nin modern anlamda icrası ve günümüze intikali bu derleme çalışmaları sayesinde olmuştur. 1925 yılında çıkarılan kanunla tekke ve zâviyelerin kapatılması sonucu yüzyıllara dayanan Tasavvuf kültürü ve musikisi kaybolma tehdidiyle yüzyüze kalmıştır. Bu sıkıntılı süreçte Safer Dal tamamen kişisel gayretiyle tekkelerde okunan kadim eserlerin bazılarını ehil kişilerden zahmetli gayretler sonucunda toplamayı başarmıştır. 1940'lı yıllardan 90'lı yıllara kadar yaklaşık 50 sene Tekke Musikisini derleyen Safer Dal yüzlerce eseri kaybolmaktan kurtarmıştır. Çalışmaları bununla sınırlı olmayan Dal'ın literatürde dokuz ilahi bestesi bulunmaktadır. Ayrıca yetmiş dokuz nutku farklı besteciler tarafından bestelenmiştir. Bununla birlikte yaşadığı dönemdeki bestekar ve musikişinasları Tasavvuf Müziği formlarında beste yapmaya teşvik ederek sayısız eser ortaya çıkmasına vesile olmuştur. Böylelikle kaybolma tehlikesi yaşayan Türk Tasavvuf Müziğini kendisi ve teşvik ettiği Türk Müziği sanatçılarıyla ihya ve inşa ederek günümüze ulaşmasını sağlamıştır. Sonuç olarak konuyla ilgili yapılan literatür taramasında Muzaffer Sarısözen'in derleme çalışmaları hakkında pek çok araştırmaya ulaşılırken Safer Dal'ın derleme çalışmaları ve tasavvuf müziğine olan katkıları hakkında iki yüksek lisans tezi haricinde araştırmaya rastlanmamıştır. Geçtiğimiz yüzyılın önemli müzik olaylarından biri olan Safer Dal'ın derleme çalışmaları müzik araştırmacıları ve müzikoloji çevresinde daha geniş kapsamda değerlendirilebilir. Araştırmacılara yönelik öneriler kapsamında Safer Dal'ın derlediği eserlerin tasnif çalışmaları yapılabilir.

Anahtar Kelimeler: Dini Müzik, Türk Tasavvuf Müziği, Tekke Musikisi, Safer Dal

MUZAFFER SARISÖZEN OF TURKISH SUFI MUSIC: SAFER DAL

ABSTRACT

Architectural structures, monuments, and other works that can be considered among historical riches have survived to the present day thanks to various restoration efforts carried out across different periods. However, cultural heritage is not limited to these tangible assets. Intangible cultural values transmitted through oral tradition, such as music, are also indispensable components of the collective memory of societies. Musical heritages of this kind, which lack written records or visual documentation, face the risk of being forgotten unless efforts are made to preserve them through compilation activities—that is, the systematic collection of traditional or anonymous melodies from the field and their transcription into notation through sound recording. For this reason, music, as the most significant carrier of oral tradition, can be transmitted to future generations in a sustainable manner not only through performance but also by being systematically compiled, documented, and archived. In this context, compilation studies assume a "restorative" function in the preservation of musical culture. Between 1937 and 1953, Muzaffer Sarısözen and his colleagues organized "Compilation Expeditions" with state support. These compilations occupy an important place in the history of Turkish music, and the number of works collected by Sarısözen is counted in the thousands. Thanks to these efforts, Turkish Folk Music has been transmitted to the present day and performed in a modern sense through the "TRT Yurttan Sesler Choirs." However, following the closure of dervish lodges (*tekke*) and convents (*zâviye*) by law in 1925, the centuries-old tradition of Sufi culture and music faced the threat of disappearance. During this challenging period, Safer Dal, relying solely on his personal initiative, managed—through arduous efforts—to collect some of the ancient works once performed in lodges directly from competent sources. From the 1940s until the 1990s, for nearly fifty years, Dal compiled Sufi music and rescued hundreds of works from oblivion. His contributions were not limited to this endeavor: the literature records nine hymns (*ilahi*) composed by him, while seventy-nine devotional poems (*nutuk*) were set to music by various composers. Moreover, he encouraged composers and musicians of his time to create works in Sufi musical forms, leading to the production of numerous compositions. In this way, Turkish Sufi Music, which was under threat of extinction, was revitalized and reconstructed through his own efforts and through the artists he inspired, ensuring its survival to the present day. A review of the relevant literature reveals that while numerous studies have been conducted on the compilation works of Muzaffer Sarısözen, only two master's theses have been identified regarding Safer Dal's compilations and his contributions to Sufi music. Safer Dal's compilation efforts, which stand as one of the significant musical undertakings of the last century, merit broader evaluation within the fields of music research and musicology. As a recommendation for future researchers, classification studies of the works compiled by Safer Dal could be undertaken.

Keywords: Religious Music, Turkish Sufi Music, Tekke Music, Safer Dal

ÜLKELERİN BÜYÜME STRATEJİLERİNDE ULUSLARARASI TİCARETİN ÖNEMİ: ÇİN, GÜNEY KORE VE TÜRKİYE ÖRNEĞİ

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ÖZET

Bu çalışma ile ülkelerin ekonomik büyüme stratejilerinde uluslararası ticaretin konumu, kuramsal olarak ele alınmakta ve Çin, Güney Kore ile Türkiye örnekleri karşılaştırmalı olarak incelenerek büyüme stratejilerinde ticaretin öneminin tespit edilmesi amaçlanmıştır. Çalışmanın teorik temeli, klasik ve neoklasik ticaret kuramlarıyla başlayarak, dışa açıklık ve ihracata dayalı büyüme stratejilerinin gelişmekte olan ekonomiler açısından nasıl bir kalkınma dinamiği yarattığını tartışmaktadır. Literatürdeki bulgular, uluslararası ticaretin ekonomik büyüme üzerinde sadece doğrudan mal ve hizmet değişimi yoluyla değil; aynı zamanda teknoloji transferi, sermaye birikimi, işgücü verimliliği ve sanayi politikalarının etkinliği gibi dolaylı kanallarla da belirleyici olduğunu ortaya koymaktadır. Çin'in uzun vadeli planlamaya dayalı dışa açık politikaları, teknoloji geliştirme yatırımları, yabancı yatırımlarından yararlanarak verimlilik artışı ve ihracata dayalı sanayileşme modeli; Güney Kore'nin başlangıçta devlet destekli işletmeler aracılığıyla ihracat merkezli kalkınma stratejisi ile teknoloji yoğun sektörlerde rekabet avantajı sağlaması başarılı örnekler olarak öne çıkmaktadır. Türkiye açısından ise, ihracata dayalı büyüme girişimleri ekonomik gelişmeye katkı sunmakla birlikte, yapısal reform eksiklikleri, makroekonomik dalgalanmalar ve teknoloji yoğun üretime yeterince yönelimin olmayışı, uluslararası ticaretin büyüme üzerindeki etkilerini sınırlı kılmaktadır. Bulgular, uluslararası ticaretin ekonomik büyüme stratejilerinde merkezi bir unsur olduğunu, ancak sürdürülebilir kalkınma için dış ticaret politikalarının sanayi stratejileri, inovasyon ve teknoloji yatırımlarıyla bütünleşmesi gerektiğini göstermektedir.

THE IMPORTANCE OF INTERNATIONAL TRADE IN COUNTRIES' GROWTH STRATEGIES: THE EXAMPLE OF CHINA, SOUTH KOREA AND TÜRKİYE

ABSTRACT

This study theoretically examines the role of international trade in the economic growth strategies of countries and aims to determine the importance of trade in growth strategies by comparatively examining the examples of China, South Korea and Türkiye. Beginning with classical and neoclassical trade theories, the study discusses how openness to trade and export-led growth strategies can create a dynamic of development for developing economies. Literature reviews reveal that international trade influences economic growth through the direct exchange of goods and services, as well as through indirect channels such as technology transfer, capital accumulation, labour productivity and the effectiveness of industrial policies. Notable examples of successful strategies include China's long-term planning-based open policies, technology development investments, and export-driven industrialisation model, as well as South Korea's initial state-supported export-oriented development strategy through state-supported enterprises, which enabled it to gain a competitive advantage in technology-intensive sectors. However, while Turkey's export-driven growth initiatives contribute to

economic development, deficiencies in structural reform, macroeconomic fluctuations and an insufficient focus on technology-intensive production limit the impact of international trade on growth. The findings indicate that international trade is a central element in economic growth strategies.

GİRİŞ

Sistemli bir teori temelinde uluslararası ticaret ile ekonomik büyüme arasındaki ilişki ilk olarak Adam Smith tarafından ele alınmıştır. Klasik ve neoklasik ticaret teorileri uluslararası ticaretin karşılaştırmalı üstünlüklere bağlı olarak refah artışına katkıda bulunduğunu öne sürmüştür. Ancak klasik teorilerin gerçekleşen ticareti yeterince açıklayamaması sonucu yeni bakış açılarını içeren teoriler gelişmeye başlamıştır. Bu teorileri inceleyen çoğu ampirik çalışma uluslararası ticaretin büyüme üzerindeki olumlu etkilerinin olduğunu göstermiştir (Karluk, 2013, s. 9; Sun & Heshmati, 2010, s. 4).

Gelişmekte olan ülkeler perspektifinden bakıldığında, uluslararası ticaretin ekonomik kalkınma üzerindeki etkisi daha da belirginleşmektedir. Gelişmekte olan ülkeler için ihracat odaklı politikalar sayesinde küresel pazarlara entegrasyon ve dışa açılma adımları ekonomik gelişmenin temel unsurları olarak değerlendirilmiştir. Uluslararası ticaret sadece döviz kazandırıcı bir işlem olmanın ötesinde teknoloji transferi, verimlilik artışı, üretim yapısının gelişmesi ve ülke içinde kaynak ihtiyacının azaltılması gibi çeşitli kanallar vasıtasıyla büyümeyi destekleyen çok yönlü bir dizi etki doğurmaktadır.

Ülkeler, uluslararası ticaret açısından kendi yapısal özelliklerine ve mevcut konjonktürel yapıya uygun yollar izleyerek farklı politikalar geliştirmektedir. Bu bağlamda, ülkelerin büyüme stratejilerinde uluslararası ticaretin nasıl konumlandığı, ekonomik kalkınma süreçlerini anlamak açısından kritik öneme sahiptir. Özellikle Doğu Asya ülkeleri örneklerinde olduğu gibi ihracat odaklı büyüme stratejileri sayesinde uzun vadede sürdürülebilir kalkınma hedeflerine ulaşmanın mümkün olabildiği görülmüştür. Nitekim Güney Kore, 1960'lı yıllardan itibaren uygulamaya koyduğu ihracata dayalı sanayileşme politikaları ile kısa sürede düşük gelirli bir ekonomiden yüksek teknolojili ürünlerin üretildiği, rekabetçi bir ekonomi haline dönüşmüştür. Çin ise 1978 sonrası dönemde dışa açılma politikaları ile küresel ticaret sistemine entegre olmuş, bu süreci kamu yatırımları ve doğrudan yabancı yatırımların teşviki gibi stratejik adımlarla desteklemiştir. 1980 sonrası Türkiye ihracata dayalı büyüme stratejileri ve dışa açılma adımları ile ekonomik büyümeyi desteklemeyi amaçlayan politikalar geliştirmiştir. Ancak Türkiye ekonomisinin üretim yapısı, dış ticaret açığı sorunları, ekonominin yapısal kırılganlıkları bu politikaların etkilerini sınırlayıcı bir rol oynamıştır.

Bu çalışma ile farklı kalkınma aşamalarında ve farklı kurumsal yapılara sahip Çin, Güney Kore ve Türkiye'nin ekonomik gelişim süreçleri ve büyüme stratejilerinde uluslararası ticaretin yeri ele alınacaktır. Betimsel analizle, söz konusu ülkelerin ticaret politikaları yoluyla büyümeye nasıl katkı sağladığı, hangi stratejilerin daha etkili olduğunu tespit etmek amaçlanmıştır. Ayrıca Türkiye'nin mevcut pozisyonunu güçlendirmek için yürütülmesi gereken politikalar değerlendirilecektir.

KAVRAMSAL ÇERÇEVE

Ekonomik, sosyal, çevresel ve politik yapı gibi farklı alanları etkileyen küreselleşme dünyadaki pek çok ülke tarafından uzun yıllardır deneyimlenmiştir. Araştırmacılar tarafından farklı dönemler olarak ele alınan küreselleşme, özellikle 2. Dünya Savaşı'nı takip eden yıllarda etkisini arttırmış, 1980'li yıllardan sonra yüksek bir ivme kazanmıştır. Ticari küreselleşme başta mal ve hizmet ticaretlerindeki artışı, sermayenin serbest dolaşımını ve ticareti engelleyici dolaylı ve dolaysız bariyerlerin azalması olarak ifade edilebilir.

Dünya ticaretinin serbestleşmesi ve gelişmesi adına gerçekleştirilen süreçlerde kilit rol oynayan Gümrük Tarifeleri ve Ticaret Genel Anlaşması (GATT), 1947 yılında 23 üye ile yürürlüğe girmiş, 1995 yılında Dünya Ticaret Örgütü (DTÖ) olarak yeniden yapılandırılmıştır (Crowley, 2003, s. 42). 2025 yılı itibariyle 166 üyesiyle dünya ticaretinin %98'ini oluşturan önemli bir yapı olarak ülkeler arasında gerçekleşen ticaretin sorunsuz bir şekilde sürdürülmesi adına görevler üstlenmiştir (WTO, 2025). Dünya ekonomisinin küreselleşme sürecinde GATT'ın gelişim süreçlerine paralel olarak kurulan Uluslararası Para Fonu (IMF), Dünya Bankası (DB) ve OECD gibi kurum ve kuruluşlar da etkin roller almıştır (Aytekin, 2013, s. 128). Ekonomik küreselleşmenin; sermaye hareketliliği, finansal serbestlik, işgücü piyasaları ve dış ticaret olmak üzere farklı alanlarda önemli etkileri olmuştur.

Ekonomistlerin büyük kısmı ticaretin serbestleşmesi sonucu açık ekonomi politikaları uygulayan ve ihracata dayalı büyümeyi destekleyen ülkelerin diğer ülkelerden daha hızlı büyüdüğünü kabul etmişlerdir (Zahonogo, 2016, s. 42). İhracatın dış ticaret çarpanı yaratması, döviz kazandırıcı işlem olması, ölçek ekonomisi yoluyla maliyetleri düşürmesini destekleyerek büyümeye katkı sağlamasının yanı sıra dışa açıklığın bir başka boyutu olan ithalatın, üretim süreçlerinde eksikliği hissedilen üretim faktörlerinin teminini sağlaması aracılığıyla büyümeyi teşvik edici bir boyutu bulunmaktadır (Özcan ve Özçelebi, 2013, s. 2). İhracat sayesinde elde edilen döviz, sermaye malı ve ara malı ithalatının seviyelerinin artmasına olanak tanıyarak üretim hacmini arttırıcı etkiler yaratabilmektedir (Awokuse, 2003, s. 128). Ayrıca yurt içi üretkenlik büyümesinin çoğunlukla yurt içi inovasyondan ziyade yabancı inovasyonla ilişkili olduğuna dair kanıtların olması, ticaretin teknoloji transferi vasıtasıyla büyüme üzerindeki önemli etkilerinden bir diğeri olmaktadır (Baldwin, Braconier, & Forslid, 2005, s. 945).

Ülkelerin büyüme teorileri açısından ihracatın önemi uzun yıllardır tartışılmış olsa da ihracat ve büyüme ilişkisinin ampirik olarak incelenmesi 20. yy. sonlarına doğru gerçekleşmeye başlamıştır. Türkiye'nin içinde olduğu bazı gelişmekte olan ülkelerin ithal ikameci politikalarının büyüme konusunda yeterli başarı elde edememesine karşın ihracata dayalı büyüme stratejileri uygulayan bazı Asya ülkelerinin büyüme oranlarının yüksek olması ilginin bu alana kaymasında önemli bir rol oynamıştır (Kösekahyaoğlu ve Şentürk, 2006, s. 25). 1980'lerden itibaren gelişmekte olan pek çok ülke dış ticaret odaklı büyüme stratejilerini izleyerek ticareti ve sermaye akışlarını serbestleştirerek, küresel ekonominin dinamiklerine entegre olmaya çalışmıştır. Bazı ülkeler yüksek ve kalıcı ekonomik büyüme oranlarına ulaşmış ve yaşam standartlarını iyileştirmişken, Latin Amerika ülkeleri gibi gelişmekte olan bazı ekonomiler düşük ekonomik büyüme oranlarıyla yeterince başarı elde edememişlerdir (Carrasco & Tovar-García, 2021, s. 920).

ÜLKE ÖRNEKLERİ

Gelişmekte olan ülkelerin 1980'lerde ve 1990'larda ekonomilerini dış ticarete ve yatırıma açma kararı dünya ekonomisi açısından önemli bir dönüm noktası olmuştur. Dünyanın en kalabalık iki ülkesi olan Çin ve Hindistan'ın ekonomilerinde liberalleşme adımları ve dışa açılma süreçleri kendi başlarına kayda değer gelişmelerin başında gelmiştir. Benzer şekilde bu dönemlerde Latin Amerika'dan Güneydoğu Asya'ya kadar birçok ülke ticaret engellerini azaltmaya ve küresel ticarete katılımlarını artırmaya başlamıştır. Bu kararlar dünya ekonomisini kökten yeniden şekillendirmiş ve dünya çapında yoksulluk ve eşitsizlikte çarpıcı bir azalmanın gerçekleşmesine katkıda bulunmuştur (Irwin, 2025, s. 1). Bu çalışmada yakın dönemlerde benzer dış ticaret politikaları izleyen Çin, Güney Kore ve Türkiye örnekleri incelenerek ortak noktalar ve farklılıklar tespit edilmeye çalışılmıştır.

Çin

Dünyanın en büyük yüzölçümüne sahip 3. ülkesi ve en kalabalık 2. ülkesi konumundaki Çin, doğal kaynaklar açısından zengin, geniş tarımsal alana sahip, enerji ihtiyacının büyük kısmını ülke içinden çıkan kömürle karşılamasına karşın önemli bir petrol ithalatçısı konumundadır. 1990'ların başından itibaren yıllık yaklaşık %6 oranında büyüme kaydederek dünya ekonomisinin %38'ini oluşturan dünyanın en büyük 2. ülkesi olan Çin, en fazla dış ticaret fazlası veren ülkelerden birisi olmuştur (Ticaret Bakanlığı, 2025a). Çin'in dünya ekonomisi ve ticaretindeki önemli konumu, 1970'lerin sonunda başlayan ekonomik yapıdaki dönüşümle mümkün olabilmiştir.

1950'lerden itibaren Sovyetler Birliğinin izlediği yöntemle planlı ekonomik üretim yapısını tercih eden Çin, 1978 yılından itibaren liberal politikalar izlemeye başlamıştır. Çin Komünist Partisi'nin 1966-1976 yılları arasında uyguladığı başarısız kültür devrimi, planlı ekonomik sistemin verimsizliği ve yönetilmesinin güçlüğü, tüketicilerin temel yaşam malzemelerine erişiminde bile önemli aksaklıklar yaşaması ve liberal sistemi benimseyen komşu ülkelerin daha başarılı büyüme performansları sergilemesi, Çin hükümetini yeni bir ekonomik yapılanmaya doğru itmiştir (Chow, 2004, s. 128). Bu atılımlar sayesinde tarımsal üretkenlikte önemli artışlar yaşanırken, imalat ve hizmet sektörleri çok daha hızlı büyüdüğü için tarımın payı azalmış, fazla işgücünün büyük bir kısmı, özellikle kırsal işletmeler olmak üzere tarım dışı sektörler tarafından istihdam edilmiştir (Fan, Zhang, & Robinson, 1999, s. 7). Bu büyüme Çin'in ortalama olarak her sekiz yılda bir GSYİH'sini ikiye katlamasını sağlayarak, tahmini 800 milyon insanın yoksulluktan kurtulmasına yardımcı olmuştur (Morrison, 2013, s. 1).

Çin'in ekonomik büyüme başarısı, 1970'lerin sonlarında Xiaoping Deng tarafından başlatılan bir dizi reformdan sonra ortaya çıkmıştır. Bu reformlar, Çin'de zaten gizli olan bir ekonomik gücü serbest bırakmıştır (Anyanwu, 2014, s. 483). Yapısal değişikliklerle 1978 yılından yaklaşık 2020'li yılların başına kadar 9,5% büyüme oranları ile dünyanın en hızlı büyüyen ekonomisi konumuna yerleşmiştir. Çin'in bu başarısının arkasındaki itici güçlerden birisi doğrudan yabancı yatırımlar olmuştur (Zhang, 2001, s. 680; Morrison, 2013, s. 2). Ancak 90'lı yılların sonuna kadar Çin hala piyasa ekonomisi olmaktan uzak, mülkiyet haklarının güvensiz olduğu bir ülke konumundaydı. Bu dönemde üretimin yaklaşık %70'i devlet işletmeleri tarafından gerçekleştirilmiştir. Ancak 2000'li yılların başından itibaren önemli doğrudan yatırımlar çekmeyi başarmıştır. Bu yatırımlar teknoloji transferi için bir kanal oluşturmuş ve ihracatın artışında önemli bir rol oynamıştır (Bramall, 2009, s. 376).

Çin'in ticaret ve yatırım reformları ve teşvikleri, doğrudan yabancı yatırımlarda önemli artışları beraberinde getirmiştir. Yabancı yatırımlı işletmeler Çin'in endüstriyel çıktısının önemli bir bölümünü oluşturmaktadır. Bu seviye 1990'daki %2,3'ten 2003'te %35,9'luk bir zirveye yükselmiş, ancak zaman içerisinde düşüş göstermiştir. Yabancı sermaye yatırımları, 2005 yılında zirvedeyken Çin ihracatının %58,3'ünü, ithalatının ise %59,7'sini oluşturarak rekor kırmış, ancak bu seviyeler daha sonra düşerek 2018 yılında sırasıyla %41,7 ve %43,7'ye gerilemiştir (Morrison, 2013, s. 14).

Büyümenin arkasındaki itici güçlerden birisi yapısal değişim olmuştur. Kaynakların verimsiz sektörlerden daha verimli sektörlere aktarılması Çin'in büyümesinin yaklaşık %20'lik kısmını oluşturmuştur. Sektörel üretkenliğin artması, büyümenin %40'lık kısmını açıklarken, sermaye artışı yaklaşık %25, işgücü artışı büyümenin yaklaşık %15'lik kısmını oluşturmaktadır (Fan, Zhang, & Robinson, 2003, s. 374). Ekonomik büyümenin önemli itici güçlerinden bir diğeri maliye politikaları olmuştur (Qin, Cagas, Quising, & He, 2006, s. 772). Araştırmacılar ayrıca Çin'in hızlı büyümesinin arkasında yerel ve yabancı yatırımlarla gerçekleşen sermaye yatırımları ile hızlı üretkenlik artışı olduğunu dile getirmektedirler.

Çin'in dünya ekonomisine artan entegrasyonuna ilişkin bu verilerden genellikle üç sonuç çıkarılmıştır. Bunlar; Çin'in reform hareketleri sonrası dış ticaret ve doğrudan yabancı yatırımların ekonomik büyümenin motoru olduğu, Çin'in büyümesinin dünya emtia fiyatlarında artışa neden olduğu ve Çin'in düşük vasıflı işlerde imalat sektöründe işsizliğe neden olduğu şeklinde özetlenebilir (Bramall, 2009, s. 361). Çin'in reform hareketleri kırsal kolektif işletmelere, aile çiftliklerine, küçük özel işletmelere ve yabancı yatırımcılara ve tüccarlara kâr teşvikleri getirerek ekonomik verimliliği artırmıştır. 1978 ve 1992 yılları arasında, devlete ait işletmelerin çıktısı ulusal çıktının %56'sından %40'ına düşerken, kolektif işletmelerin payı %42'den %50'ye ve özel işletmelerin ve ortak girişimlerin payı ise %2'den %10'a çıkmıştır. Reformlar kırsalda mülkiyet haklarını genişletmiş ve kırsal alanlarda küçük tarım dışı işletme kurma süreçlerini hızlandırmıştır. 1978 yılında her beş Çinliden dördü tarımda çalışıyorken; 1994'e gelindiğinde, sadece ikide bire gerilemiştir (Hu & Khan, 1997, s. 4-5).

1990'ların başından itibaren ekonomik kısıtlamaları önemli ölçüde azaltmış, piyasa ekonomisine doğru geçişi hızlandırmıştır. 1990'ların sonlarına doğru KİT'lerdeki karlılık oranlarının düşük olması dolayısıyla başta küçük işletmeler özelleştirilmeye başlanmıştır (Saray ve Gökdemir, 2007, s. 665-666). 2000'li yılların başından itibaren piyasaya entegrasyonunu daha derin hale getirerek Dünya Ticaret Örgütü'ne katılmış, gümrük tariflerini indirmiş ve Çin'e karşı uygulanan tekstil kotaları kaldırılmıştır. Bu gelişmelerle beraber Çin, büyük ithalat ve ihracat hacimlerine ulaşmıştır. (Gündal, 2015, s. 64). Çin'in dış ticaret hacmi GSYH'den daha hızlı artış göstermiştir. Araştırmacılar 1990'ların ortalarından itibaren Çin'in ihracat kompozisyonunun genel olarak daha gelişmiş ülkelerin uzmanlık alanına ait ürünler olduğunu fark etmişlerdir (Jarreau & Poncet, 2012, s. 281). Schott (2008), Çin'in ihracat sepeti ile OECD'nin sepetini karşılaştırdığında örtüşmenin oldukça yüksek olduğunu bulmuştur. Doğrudan yabancı yatırımlar vasıtasıyla teknoloji transferi sağlayan sektörlerde verimlilik oranlarının artması da dış ticaretteki bu olumlu gidişatın nedenlerinden birisi olmuştur (Gündal, 2015, s. 64). Dış ticaretteki önemli belirleyicilerden birisi de döviz kuru olmuştur. 1994 yılına kadar döviz kuru sabit kalmış, 1994 yılında yerli parasını devalüe ederek ihracatta rekabet gücünü arttırmayı başarmıştır (Saray ve Gökdemir, 2007, s. 669). Çin'in bugüne kadar sergilediği hızlı büyüme ve kalkınma sürecinin arkasında önemli ekonomik yapısal dönüşümle beraber başta ucuz işgücünün varlığı dolayısıyla ülkeye gelen yabancı yatırımlar tetikleyici olmuştur. Bununla beraber uyumlu bir dış ticaret politikası ve dünya ticaretine entegre olma girişimleri, işgücü verimliğinin artışı ve uygulanan döviz kuru rejimi Çin'i dünyanın en büyük ihracatçısı ve ekonomilerinden biri haline gelmesini sağlamıştır.

Çin'deki düşük ücretler yatırımcılar için cezbedici bir fırsat sunmuştur. 1990 yılında ortalama Çinli bir işçi aylık 55 $ kazanırken, Meksikalı bir işçi 221 $ kazanmış, 2018 yılında sırasıyla 990 $ ve 383 $ olmuştur. Yükselen işçi ücretleri yatırımcıların karşılaştığı en büyük zorluklardan biri olarak kabul edilmiştir (Morrison, 2013, s. 13). Çin'in büyüme oranları bir süre için tahmin edilen değerlerin üstünde veya altında gerçekleşse de Çin'in de yakınsama yasasından etkileneceği düşünülmektedir. Bu nedenle, Çin'in kişi başına düşen büyüme oranının yakın bir gelecekte yılda yaklaşık %3-4 aralığına düşmesinin muhtemel senaryolardan birisi olacağı tahmin edilmektedir. Buna rağmen kişi başına düşen milli gelirde %3-4'lük bir büyüme, orta gelirden yüksek gelir statüsüne geçiş için 2-3 on yıl boyunca sürdürüldüğünde yeterlidir. Dolayısıyla, bu gerçekçi büyüme oranları yakın tarihli deneyimlerin çok altında olsa da Çin'in büyüme serüveni büyük bir başarı olarak kabul edilmektedir (Barro, 2016, s. 18). 2025 yılının ilk çeyreğindeki %5,4 büyüme rakamları ile 2025 yılının toplam büyüme tahminin %4,7 ve 2026 yılının %4,3 olması yakınsama yasasını destekler niteliktedir. Ayrıca 2024 yılında toplam ihracatının yaklaşık %13'lük kısmını oluşturan ABD ile yaşanan ticari

gerilimden dolayı yüksek tarife uygulamaları büyümenin önündeki önemli engellerden biri olacağı tahmin edilmektedir (OECD, 2025, s. 132).

Güney Kore

Doğal kaynaklar açısından oldukça fakir olan ülke sanayide kullanılan çoğu maddeye sahip olmayıp, enerji ihtiyacının neredeyse tamamını ithal etmektedir. Dünyanın ilk 20 ekonomisinden biri olmayı başaran Güney Kore GSYH'sinin, 2026 yılında 2 trilyon dolara ulaşması beklenmektedir (Ticaret Bakanlığı, 2025b). Güney Kore günümüzdeki gelişmiş ülke konumuna erişmeden, 2. Dünya savaşı döneminde, Afrika ülkeleri ile benzer yoksulluk çeken bir ülke konumda olmuştur. 1950 ve 1953 yılları arasında 4 yıllık Kore Savaşı durumu daha dramatik ve umutsuz bir hale getirmiştir. 1960'ların başında başlayan tam ölçekli hükümet liderliğindeki sanayi hamlesinden sonra, Kore'nin kişi başına düşen geliri 1960 yılından 2005 yılına 12 kattan fazla artarak $13 bin üzerine (Chung-hae & Chen, 2007, s. 5), 2025 yılında ise $33 bin üzerine çıkmıştır (WB, 2025).

Güney Kore kuruluşunun ardından tarımsal arazi reformu gerçekleştirerek, gelecekteki ekonomik kalkınma için çok önemli olacak girişimci orta sınıfın yükselişinin temellerini atmayı arazi ve gelir dağılımını iyileştirmeyi amaçlamıştır (Tassinari, vd., 2019, s. 224). 1962'ye kadar, büyük miktarda dış yardımla desteklenen Güney Kore, 1963'te doğal kaynak eksikliğini ve iç pazara bağımlı kalmamayı amaçlayan dışa dönük, ihracata yönelik bir stratejiye geçmiştir. Ekonomik kalkınma çabalarına ithal ikameci sanayileşme stratejisiyle başlayan kalkınma adımları bu stratejinin sınırlılığını fark eden hükümetin düşük döviz kurlarını koruyarak ve teşvikleri arttırarak ihracat yönelik sanayileşme stratejisine geçerek son bulmuştur (Kim & Heo, 2017, s. 24).

Bu stratejiyi gerçekleştirmek için ilk beş yıllık kalkınma planını hayata geçirmiş dışa bağımsız kalkınabilmek için temel endüstrilere yardım sağlanmış ve ekonomik kalkınma için kritik öneme sahip olan sosyal ve ekonomik altyapının iyileştirilmesine yatırım yapılmıştır. İlk ekonomik kalkınma planı 1967'de tamamlandıktan sonra, ikinci beş yıllık kalkınma planının temel konusu ihracatı artırmak üzerine kurgulanmıştır. Sermaye ve ileri teknoloji eksikliği nedeniyle, hükümet başlangıçta ihracat için emek yoğun hafif endüstrileri teşvik etmiştir (Heo, Jeon, Kim, & Kim, 2008, s. 6). İkinci kalkınma planındaki elektronik endüstri hedeflerinin başarıya ulaşabilmesi için özel sektör (Samsung), hükümet (Kore Telekomünikasyon Şirketi) ve bir araştırma ajansı (Kore Bilim ve Teknoloji Enstitüsü) iş birliği yapmıştır (Macroeconomic Policy, 2021, s. 24).

1970'lerde ihracatın bileşimini ağır ve kimyasal endüstriler lehine yeniden yapılandırırken, 1980'lerde ihracat stratejisi, hafif endüstrilerdeki teknolojik yeniliğe odaklanan yatırımlarla tekrar güncellenmiştir. Dördüncü ulusal kalkınma planı (1977-81) petrokimyasallara, nükleer enerjiye ve gemi yapımına öncelik vermiş daha sonra, devlet şirketleri Korean Oil Corporation ve Korea Pacific Chemical Corporation ile Gulf Oil gibi yabancı şirketler arasında ortak girişimler kurmuştur. 1990'lardan bu yana, yüksek katma değerli, bilgi ve teknoloji yoğun endüstrilere yoğunlaşmıştır (Zang & Baimbridge, 2012, s. 362; Macroeconomic Policy, 2021, s. 24).

1960'larda tarım, GSYİH'nın %36'sını oluşturuyorken, 2000'lerin başına doğru tarım ve balıkçılık yalnızca %9'unu oluşturmuştur. Güney Kore'nin 1960'larda en büyük ihracatı demir cevheri ve tungsten gibi birincil ürünler olmuşken, 1970'ler ve 1980'lerde tekstil ve konfeksiyon gibi emek yoğun hafif sanayi mallarına geçiş yaşanmıştır. 1990'lara gelindiğinde sermaye yoğun elektronik ürünler ve bilgisayar ile ilgili ürünler başı çekmeye başlamıştır (Kim & Heo, 2017, s. 20).

1999 yılında hükümet inovasyon odaklı Kore Bilgi Tabanlı Ekonomi Ana Planı, ismini verdiği önlemleriyle yeni bir aşama başlatmıştır. Planın temel amacı özellikle bilgi iletişim teknolojilerinde yenilikçilik ve araştırma kapasitelerini güçlendirmek olmuştur. Diğer yandan Güney Kore'nin uluslararası pazarlardaki ihracatı arttırabilmek için 2000'li yıllar boyunca ABD ve Avrupa Birliği de dahil olmak üzere birçok önemli ticaret ortağıyla çok sayıda ikili anlaşma imzalamış olması ekonomik başarının önemli unsurlarından birisi olmuştur (Tassinari, vd., 2019, s. 229).

İnsan kaynaklarının geliştirilmesinin ekonomik kalkınmada hayati önem taşıdığını fark eden hükümet, bilgi odaklı refaha, eğitim ve öğretime yoğun yatırım yaparak, erişilebilir ve modern bilgi altyapısı geliştirerek, inovasyonu artırmak için yoğun araştırma ve geliştirme (Ar-ge) kullanarak, ekonomik teşviklere odaklanarak ve bilgi odaklı yatırımları artırmaya elverişli bir politika uygulayarak önemli bir başarıya ulaşmıştır (Kim & Heo, 2017, s. 26; Asongu, 2017, s. 212).

Güney Kore hükümetinin aldığı önemli risklerden birisi uluslararası performanslarına göre özel şirketlere uluslararası piyasalardan topladığı sermaye ile ucuza kredi kullandırması olmuştur. Samsung, Hyundai, Daewoo ve Lucky-Goldstar (LG) şirketleri özel şirketler olmasına rağmen devlet işletmeleri gibi davranarak devletin garanti ettiği kredileri güvence altına almak için yoğun çaba sarf etmişlerdir. Hükümetin bu adımlarıyla beraber 4 şirket bütün ülkedeki satışların yarısını gerçekleştirmiştir (Macroeconomic Policy, 2021, s. 26). Hükümet ve özel şirketler arasında gerçekleşen bu başarılı ilişki, kamu kurumlarının sübvansiyonları şirketlerin ekonomik performanslarını periyodik olarak raporlaması ile mümkün olabilmiştir. Bu sübvansiyonlarla güçlenen şirketler belirli bir süre sonra riskli araştırma projeleri dahi üstlenebilecek yeterli mali kaynağa ve eğitimli işgücüne sahip bir yapıya ulaşmıştır (Tassinari, vd., 2019, s. 225-227). Güney Kore ekonomisinin bu başarılı kalkınma ivmesini yakalamasındaki temel etkenler, ihracata yönelik ve merkezi hükümet öncülüğündeki sanayileşme, 1960'larda hafif sanayiden 1980'lerde ağır sanayiye ve 1990'ların sonlarından itibaren yüksek teknoloji sanayine geçişteki başarılı sanayi yeniden yapılanması ve insan sermayesine, sanayi, bilim ve teknoloji kabiliyetlerine yapılan yüksek yatırım olarak sıralanabilir (Jung, 2011, s. 455).

Türkiye

Cumhuriyetin ilanından önce İzmir İktisat Kongresi ile başlayan konjektürel olarak değişen Türkiye'nin ekonomik tarihi 1923-1929 yılları arasında liberal politikaların, 1930-1950 arası ılımlı bir devletçilik politikasının, 1950-1960 arası tekrardan liberal politikaların uygulandığı süreçlerden geçmiştir (Çelebi, 2002). İzmir İktisat Kongresi ile başlayan milli sanayileşme hamlesi 1950-1960 yıllarında devam ettirilmiş ancak bu dönemde özel sektörün ve dış yardımların öne çıktığı bir dönem olmuştur (Özsoylu, 2013, s. 93). 1920'li yılların sonunda gelirin yaklaşık %50'si tarımsal üretim kaynaklı olmuştur. 1950'li yıllara kadar tarımın payı neredeyse aynı kalmıştır. Türkiye1929 yılına kadar dış ticaret açığı vermiş ancak gerçekleşen politika değişikliği ile 1946 yılına kadar (1938 hariç) dış ticaret fazlası vermeye başlamıştır (Parasız, 2003).

1950'li yıllarda yaşanan ekonomik sorunların ardından 1960'lı yılların başında yaşanan askeri darbe ile ekonomide planlı ekonomiye geçilmiştir. Bu dönemde ihracatın teşvikinin yanı sıra ilk olarak iç talebin dikkate alındığı bir dış ticaret politikası güdülmüş ve ithalat kota ve liberasyon esasıyla yürütülmüştür (Parasız, 2003, s. 210). 1970'li yılların sonuna doğru başta ekonomi alanında yaşanan olumsuz gelişmeler sonrasın 24 Ocak 1980 tarihinde alınan kararlar ile Türkiye'de ithal ikameci dış ticaret politikası terk edilmiş ve dünya ile ekonomik entegrasyon adımları atılmaya başlanmıştır (Karaçor ve Alptekin, 2006, s. 308).

1970'lerde yaşanan yüksek enflasyon ve döviz darboğazını aşma ile küresel ekonomiye entegre olma girişimleri sonrası alınan 24 Ocak Kararları ile sıkı para politikası uygulanmış, reel faiz pozitif hale getirilmiş, mal ve hizmet fiyatları, dış ticaret ve döviz kuru süreç içinde piyasa koşullarına bırakılmış, yabancı sermayenin ülkeye çekilmesi için çaba sarf edilmiştir (Bayrak ve Kanca, 2013, s. 3). 1983 ve 1984 yıllarında yaşanan hükümet değişikliği ile 24 Ocak Kararlarını destekleyici kararlar alınmış (Kılınç Savrul, Özel, ve Kılıç, 2013, s. 70), 1980'li yılların sonuna kadar aşamalı olarak liberalleşme adımları sürmüş, tarımın ihracattaki payı düşmüş, sanayi ürünlerinin payı ise artış göstermiştir (Toprak ve Çatalbaş, 2019, s. 227).

Türkiye ve Avrupa Birliği arasında alınan karar sonrası Türkiye, 1996 yılında Gümrük Birliğine girmiştir. Bu adım dar anlamda Türkiye'nin ihracatını olumlu anlamda etkilemiştir. 1980'li yıllardan itibaren farklı dönemlerde on üç türde ihracatı teşvik edici girişimlerde bulunulmuş, ancak bu uygulamalar her zaman amaca hizmet etmemiş hayali ihracat gibi farklı hukuka aykırı durumları ortaya çıkarmıştır (Kepenek, 2017, s. 304-339). 1990'lı yıllarda yaşanan siyasi istikrarsızlık ve yüksek faiz, düşük kur ve ucuz işgücü gibi ekonomiyi daha kırılgan hale getiren kısa vadeli politikalardan dolayı yaşanan olumsuzluklar uzun vadede uygulanmaya çalışılan politikaların başarısız olmasıyla sonuçlanmış, küresel ekonomiye entegre olma çabaları istenilen düzeye taşınamamıştır (Meçik & Afşar, 2014, s. 5; Acar, 2008, s. 30). 1990'lı yıllar yüksek enflasyon ve işsizlik oranlarının yaşandığı dönemler olmuştur. 2001 yılında yaşanan krizin ardından ekonomi %9 oranında küçülmüş, enflasyon oranı, işsizlik ve borç stoğu artış göstermiştir. 2002 yılında başlayan yeni ekonomi programları sayesinde enflasyon oranlarında 2008 yılında ABD'de yaşanan krize kadar önemli bir iyileşme görülmüştür. 2009 yılında küçülen ekonomi, 2010 yılı itibariyle toparlanma sürecine girmiştir (Mazlum, 2020, s. 56-57). 2002 yılında başlayan istikrar programlarıyla beraber dış ticaret hacminde de önemli artışlar yaşanmıştır. Ancak Türkiye ekonomisi 1946 yılından itibaren uyguladığı farklı politikalara rağmen önemli dış ticaret açıkları vermiştir. 1980-2020 yılları arası ihracatın ithalatı karşılama oranı yaklaşık %60 olmuştur (Orkunoğlu Şahin, 2002, s. 86).

Kronik hale gelen dış ticaret açıklarının arkasında yapısal problemler yatmaktadır (Sungur, 2015, s. 265). İhracatın yüksek oranda ithal girdiyle yapılması, döviz kurunda beklenmeyen ve yüksek hareketlilik, katma değeri yüksek veya teknolojik ürün ihracatının yeterli düzeyde olmaması, verimliliğin ve yurtiçi tasarrufların düşük olması dış ticaret açığının arkasındaki yapısal nedenlerin başında gelmektedir (Meçik ve Afşar, 2014, s. 20; Orkunoğlu Şahin, 2002, s. 97). Türkiye yaklaşık 50 yıldır orta gelir seviyesinde kalmış ve üst gelir grubuna çıkmayı başaramamıştır (Alkan ve Ümit, 2018, s. 98). Yüksek katma değerli ürün üretiminde rekabet gücü elde edilmesi için nitelikli işgücünün ve uzmanlaşmanın arttırılması ve ulusal tasarrufların arttırılması gerekmektedir (Bayar, 2016, s. 75; Alkan ve Ümit, 2018, s. 111). Rekabet gücünün önemli belirleyicilerinden bir diğeri olan Türkiye'nin Ar-ge harcamalarının Güney Kore, Çin ve pek çok Avrupa Birliği ülkesinin gerisinde kalması, bunun yerine makine ve teknoloji ithalatıyla kalkınma çabası istenilen düzeyde gelişmenin önündeki engellerdendir. Ayrıca kurumlaşmanın yeterince sağlanamaması ekonomik ve toplumsal gelişmenin önündeki engellerden bir diğeri olmuştur (Kepenek, 2017, s. 552).

ÜLKELERE AİT DIŞ TİCARET VERİLERİ

1970-2024 yılları arasında Çin, Güney Kore ve Türkiye'nin ihracat verileri Tablo 1'de gösterilmiştir. Tablonun son satırında 1970-2024 yıllarını kapsayan 55 dönemin ortalaması hesaplanmıştır. 1970 yılında henüz üç ülkede yurtdışıyla entegre olma çabalarına girişmeden önce Çin'in ihracat hacmi Kore'nin yaklaşık 3, Türkiye'nin 4 katı olarak gerçekleşmiştir. Çin'in, 1970 yılından 1999 yılına kadar ihracat hacmi yaklaşık 8500%, Güney Kore'nin yaklaşık 18000%, Türkiye'nin yaklaşık 4400% oranında artış göstermiştir. 2000 yılından 2024 yılına kadar Çin'in ihracat hacmi yaklaşık 1400%, Güney Kore'nin yaklaşık 400%,

Türkiye'nin yaklaşık 900% oranında artış göstermiştir. İlgili dönem boyunca Çin toplam ihracatını kümülatif olarak 1554 kat, Güney Kore 805 kat ve Türkiye 437 kat arttırmıştır. Çin 6 dönem hariç toplam ihracatını istikrarlı bir şekilde arttırmayı sürdürmüşken Güney Kore 8 dönem ve Türkiye 10 dönem hariç toplam ihracatını arttırmıştır.

Çin'in ihracat hacminde en yüksek oransal artış (59%) 1973 yılında, en yüksek hacim artışı (726 milyar $) 2021 yılında, oransal (16%) ve hacim olarak en yüksek miktardaki küçülme (228 milyar $) ise 2009 yılında "Mortgage Krizi" olarak anılan dönemde gerçekleşmiştir. Güney Kore'nin ihracat hacminde en yüksek oransal artış (98%) 1973 yılında, en yüksek hacim artışı (132 milyar $) 2021 yılında, oransal olarak en yüksek küçülme (14%) 2009 yılında ve hacim olarak en yüksek miktardaki küçülme (62 milyar $) ise 2019 yılında gerçekleşmiştir. Türkiye'nin ihracat hacminde en yüksek oransal artış (62%) 1981 yılında, en yüksek hacim artışı (56 milyar $) 2021 yılında, oransal (23%) ve hacim olarak en yüksek miktardaki küçülme (30 milyar $) ise 2009 yılında gerçekleşmiştir. Üç ülkenin ihracat hacmindeki en önemli düşüşün 2009 yılında olduğu görülmektedir. 2009 yılında ABD merkezli yaşanan finansman krizi ülke dış ticaretlerini önemli ölçüde olumsuz etkilemiştir. Üç ülkenin ihracat hacminde yaşanan en yüksek artış ise COVID-19 sonrası dönemde gerçekleşmiştir.

2019 yılının son aylarında Çin'de ortaya çıkan COVID-19 pandemisinin kısa süre içerisinde tüm dünyaya yayılması sonrası 2020 yılında ülke ekonomileri ve dış ticaretleri negatif yönde etkilenmiştir. Çin'de çıkmış olmasına rağmen 2020 yılında Çin ihracatında 4% büyüme gerçekleşmiş, Kore ve Türkiye ihracatlarında sırasıyla 5% ve %6 küçülme gerçekleşmiştir. Bu dönemin ardından 2021 yılında hızlı bir toparlanma süreci gerçekleşmiş, üç ülkede de ihracat miktarının en yüksek olduğu yıl 2024 olmuştur.

1970-2024 yılları arasında Çin, Güney Kore ve Türkiye'nin ithalat verileri Tablo 2'de gösterilmiştir. Tablonun son satırında 1970-2024 yıllarını kapsayan 55 dönemin ortalaması hesaplanmıştır. 1970 yılında henüz üç ülkede yurtdışıyla entegre olma çabalarına girişmeden önce Çin ve Güney Kore yaklaşık 2 milyar $, Türkiye yaklaşık 1 milyar $ civarında ithalat gerçekleştirmiştir. Çin ve Güney Kore'nin en yüksek oranda ithalat artışı (83% ve 68%) ihracata paralel olarak 1973 yılında, Türkiye'nin (81%) 1974 yılında gerçekleşmiştir. Üç ülkenin ithalat miktarları ihracata paralel olarak artış göstermiştir. 2009 yılında yaşanan krizin etkileri ithalat miktarlarına da yansımış üç ülkenin ithalatında önemli düşüşler yaşanmıştır. Pandemi sonrası toparlanma sürecinde üç ülkenin ithalat miktarları 2022 yılında en yüksek noktaya ulaştıktan sonra gerilemiştir.

1970-2024 yılları arasında Çin, Güney Kore ve Türkiye'nin dış ticaret dengesine ilişkin veriler Tablo 3'de gösterilmiştir. Çin, 1970 yılından 1993 yılına kadar bazı dönemlerde ticaret fazlası verirken bazı dönemlerde dış ticaret açığı vermiştir. 1994 yılında başlayarak düzenli olarak dış ticaret fazlası vermiş, 2024 yılında 988 milyar $ fazla vererek tarihindeki en yüksek dış ticaret fazlasına ulaşmıştır. Güney Kore 1970 yılından 1997 yılına kadar çoğu dönemde dış ticaret açığı vermiş, 1998 yılından itibaren 2008, 2022 ve 2023 yılları dış ticaret fazlası vermiştir. Dış ticaret fazlasının en yüksek miktara ulaştığı dönem ise 95 milyar $ ile 2017 yılı olmuştur. İncelenen dönemler içinde Türkiye'nin kronik bir biçimde dış ticaret açığı verdiği, açığın 2022 yılında en yüksek düzeye ulaşarak 109 milyar $ olarak gerçekleştiği ve 2011 ile 2023 yıllarında da 100 milyar $ üzerinde açık verdiği görülmektedir.

SONUÇ

Bu çalışma kapsamında elde edilen bulgular, uluslararası ticaretin ülkelerin büyüme stratejilerinde merkezi bir konuma sahip olduğunu ortaya koymuştur. Ancak incelenen örneklerden elde edilen bulgular ışığında, dışa açıklık ve ihracata dayalı politikaların tek başına yeterli olmadığı; sürdürülebilir kalkınmanın kapsamlı sanayi stratejileri, teknoloji yatırımları ve kurumsal kapasiteyle bütünleştiğinde mümkün olabileceği anlaşılmaktadır. Bu bağlamda, uluslararası ticaretin yalnızca mal ve hizmet değişimini kolaylaştıran bir süreç olmadığı, aynı zamanda yapısal dönüşümü hızlandıran ve uzun vadeli büyüme için stratejik bir araç olduğu tespit edilmiştir.

Çin ve Güney Kore örnekleri, bu sürecin nasıl başarılı bir şekilde yönetilebileceğini ortaya koymaktadır. Çin, uzun vadeli planlama ve devlet destekli sanayi politikaları sayesinde dışa açıklığı teknoloji geliştirme ve üretim kapasitesinin artırılması ile bütünleştirmiştir. Bu sayede ülke, küresel piyasalarda rekabet üstünlüğü elde ederek yüksek ve istikrarlı büyüme oranları yakalamıştır. Benzer şekilde Güney Kore, ihracata dayalı sanayileşme stratejisini Ar-ge yatırımları, inovasyon politikaları ve eğitim yoluyla destekleyerek küresel ekonomide üst sıralara yükselmiştir.

Türkiye bağlamında ise ihracata dayalı politikaların büyümeye katkı sunduğu görülmekle birlikte, yapısal reformların yetersizliği, makroekonomik dalgalanmalar ve yüksek katma değerli üretimin yeterince artış göstermemesi, bu katkının uzun vadeli sürdürülebilirliğini sınırlamıştır. Bu durum, dış ticaretin ekonomik performansa etkisinin yalnızca dışa açılma derecesiyle değil, aynı zamanda üretim yapısının niteliği ve stratejik yönelimlerle de şekillendiğini göstermektedir. Sonuç olarak, uluslararası ticaretin ekonomik büyüme stratejilerinde etkili bir biçimde değerlendirilebilmesi için temel unsurlar; sanayi politikalarının güçlendirilmesiyle yüksek katma değerli sektörlere yönelim ve teknoloji odaklı üretim kapasitesinin artırılması, kısa vadeli dalgalanmalara karşı dirençli ve istikrarlı kalkınma modellerinin oluşturulması, eğitim, Ar-ge ve nitelikli işgücüne yapılan yatırımların artırılması, politikaların sürekliliğini güvence altına alacak güçlü bir kurumsal çerçevenin oluşturulması şeklinde sıralanabilir. Bu çerçevede, uluslararası ticaretin ekonomik büyümeye katkısının, yalnızca ihracat hacminin artışıyla değil, aynı zamanda yapısal dönüşümü destekleyen, teknoloji ve inovasyona dayalı uzun vadeli kalkınma vizyonuyla bütünleştiğinde kalıcı ve sürdürülebilir olabileceğini göstermiştir.

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Ekler

Tablo 1 ***1970-2024 Yılları Arası İthalat Verileri ve Artış Oranları (Milyar $)***

Ülke	Çin		Güney Kore		Türkiye			Çin		Güney Kore		Türkiye	
Yıl	İhr.	Artış	İhr.	Artış	İhr.	Artış	Yıl	İhr.	Artış	İhr.	Artış	İhr.	Artış
1970	2,3	-	0,8	-	0,6	-	**1998**	183,7	*-1%*	132,3	*3%*	26,9	*-2%*
1971	2,8	*21%*	1,1	*28%*	0,7	*15%*	**1999**	194,9	*6%*	143,7	*9%*	26,6	*-1%*
1972	3,7	*33%*	1,6	*52%*	0,9	*31%*	**2000**	249,2	*28%*	172,3	*20%*	27,8	*4%*
1973	5,9	*59%*	3,2	*98%*	1,3	*49%*	**2001**	266,1	*7%*	150,4	*-13%*	31,3	*13%*
1974	7,1	*21%*	4,5	*39%*	1,5	*16%*	**2002**	325,6	*22%*	162,5	*8%*	36,1	*15%*

1975	7,7	*8%*	4,9	*11%*	1,4	*-9%*	**2003**	438,2	*35%*	193,8	*19%*	47,3	*31%*
1976	6,9	*-10%*	7,7	*56%*	2,0	*40%*	**2004**	593,3	*35%*	253,8	*31%*	63,2	*34%*
1977	7,5	*8%*	10,0	*30%*	1,8	*-11%*	**2005**	762,0	*28%*	284,4	*12%*	73,5	*16%*
1978	10,0	*32%*	12,7	*27%*	2,3	*31%*	**2006**	969,0	*27%*	326,1	*15%*	85,5	*16%*
1979	13,6	*37%*	15,1	*18%*	2,3	*-1%*	**2007**	1220,1	*26%*	371,6	*14%*	107,3	*25%*
1980	18,1	*33%*	17,5	*16%*	2,9	*29%*	**2008**	1432,6	*17%*	422,0	*14%*	132,0	*23%*
1981	22,0	*22%*	21,3	*21%*	4,7	*62%*	**2009**	1204,1	*-16%*	363,5	*-14%*	102,1	*-23%*
1982	22,3	*1%*	21,9	*3%*	5,7	*22%*	**2010**	1580,7	*31%*	466,4	*28%*	113,9	*11%*
1983	22,2	*0%*	24,4	*12%*	5,7	*0%*	**2011**	1898,4	*20%*	556,5	*19%*	134,9	*18%*
1984	26,1	*18%*	29,2	*20%*	7,1	*25%*	**2012**	2048,7	*8%*	548,1	*-2%*	152,5	*13%*
1985	27,4	*5%*	30,3	*4%*	8,0	*12%*	**2013**	2209,0	*8%*	559,6	*2%*	161,5	*6%*
1986	30,9	*13%*	34,7	*15%*	7,5	*-6%*	**2014**	2342,3	*6%*	573,1	*2%*	166,5	*3%*
1987	39,4	*27%*	47,3	*36%*	10,2	*37%*	**2015**	2273,5	*-3%*	526,8	*-8%*	151,0	*-9%*
1988	47,5	*20%*	60,7	*28%*	11,7	*14%*	**2016**	2097,5	*-8%*	495,4	*-6%*	149,2	*-1%*
1989	52,5	*11%*	62,4	*3%*	11,6	*0%*	**2017**	2263,3	*8%*	573,7	*16%*	164,5	*10%*
1990	62,1	*18%*	65,0	*4%*	13,0	*11%*	**2018**	2486,7	*10%*	604,9	*5%*	177,2	*8%*
1991	71,9	*16%*	71,9	*11%*	13,6	*5%*	**2019**	2499,5	*1%*	542,2	*-10%*	180,8	*2%*
1992	84,9	*18%*	76,6	*7%*	14,7	*8%*	**2020**	2590,0	*4%*	512,5	*-5%*	169,6	*-6%*
1993	91,7	*8%*	82,2	*7%*	15,3	*4%*	**2021**	3316,0	*28%*	644,4	*26%*	225,2	*33%*
1994	121,0	*32%*	96,0	*17%*	18,1	*18%*	**2022**	3544,4	*7%*	683,6	*6%*	254,2	*13%*

1995	148,8	*23%*	125,1	*30%*	21,6	*19%*	**2023**	3379,2	*-5%*	632,2	*-8%*	255,6	*1%*
1996	151,0	*2%*	129,7	*4%*	23,2	*8%*	**2024**	3575,5	*6%*	683,7	*8%*	261,9	*2%*
1997	182,8	*21%*	136,2	*5%*	26,3	*13%*	**Ort.**		***15%***		***15%***		***13%***

Kaynak: (IMF, 2025)

Tablo 2 ***1970-2024 Yılları Arası İthalat Verileri ve Artış Oranları (Milyar $)***

Ülke	Çin		Güney Kore		Türkiye		Ülke	Çin		Güney Kore		Türkiye	
Yıl	İth.	Artış	İth.	Artış	İth.	Artış	Yıl	İth.	Artış	İth.	Artış	İth.	Artış
1970	2,3	-	2,0	-	0,9	-	**1998**	140,2	*-1%*	93,3	*-35%*	45,9	*-5%*
1971	2,1	*-7%*	2,4	*21%*	1,2	*24%*	**1999**	165,7	*18%*	119,8	*28%*	40,2	*-12%*
1972	2,9	*34%*	2,5	*5%*	1,6	*33%*	**2000**	225,1	*36%*	160,5	*34%*	54,5	*35%*
1973	5,2	*83%*	4,2	*68%*	2,1	*33%*	**2001**	243,6	*8%*	141,1	*-12%*	41,4	*-24%*
1974	7,8	*50%*	6,9	*62%*	3,8	*81%*	**2002**	295,2	*21%*	152,1	*8%*	51,6	*25%*
1975	7,9	*2%*	7,3	*6%*	4,7	*25%*	**2003**	412,8	*40%*	178,8	*18%*	69,3	*34%*
1976	6,7	*-16%*	8,8	*21%*	5,1	*8%*	**2004**	561,2	*36%*	224,5	*26%*	97,5	*41%*
1977	7,1	*7%*	10,8	*23%*	5,8	*13%*	**2005**	660,2	*18%*	261,2	*16%*	116,8	*20%*
1978	11,1	*56%*	15,0	*38%*	4,6	*-21%*	**2006**	791,8	*20%*	308,6	*18%*	139,6	*20%*
1979	15,6	*40%*	20,3	*36%*	5,1	*10%*	**2007**	956,5	*21%*	356,1	*15%*	170,1	*22%*
1980	19,9	*28%*	22,3	*10%*	7,9	*56%*	**2008**	1133,2	*18%*	435,3	*22%*	202,0	*19%*
1981	22,0	*10%*	26,1	*17%*	8,9	*13%*	**2009**	1006,5	*-11%*	323,1	*-26%*	140,9	*-30%*
1982	19,3	*-12%*	24,3	*-7%*	8,8	*-1%*	**2010**	1397,1	*39%*	425,2	*32%*	185,5	*32%*
1983	21,4	*11%*	26,2	*8%*	9,2	*4%*	**2011**	1744,7	*25%*	524,4	*23%*	240,8	*30%*
1984	27,4	*28%*	30,6	*17%*	10,8	*16%*	**2012**	1819,9	*4%*	519,6	*-1%*	236,5	*-2%*
1985	42,3	*54%*	31,1	*2%*	11,3	*5%*	**2013**	1951,6	*7%*	515,6	*-1%*	260,8	*10%*
1986	42,9	*2%*	31,6	*1%*	11,1	*-2%*	**2014**	1959,2	*0%*	525,6	*2%*	251,1	*-4%*

1987	43,2	*1%*	41,0	*30%*	14,2	*27%*	**2015**	1679,6	*-14%*	436,5	*-17%*	213,6	*-15%*
1988	55,3	*28%*	51,8	*26%*	14,3	*1%*	**2016**	1587,9	*-5%*	406,2	*-7%*	202,2	*-5%*
1989	59,1	*7%*	61,5	*19%*	15,8	*10%*	**2017**	1843,8	*16%*	478,5	*18%*	238,7	*18%*
1990	53,3	*-10%*	69,8	*14%*	22,3	*41%*	**2018**	2135,8	*16%*	535,2	*12%*	231,2	*-3%*
1991	63,8	*20%*	81,5	*17%*	21,0	*-6%*	**2019**	2078,4	*-3%*	503,3	*-6%*	210,3	*-9%*
1992	80,6	*26%*	81,8	*0%*	22,9	*9%*	**2020**	2066,0	*-1%*	467,6	*-7%*	219,5	*4%*
1993	104,0	*29%*	83,8	*2%*	29,4	*29%*	**2021**	2679,4	*30%*	615,1	*32%*	271,4	*24%*
1994	115,6	*11%*	102,3	*22%*	23,3	*-21%*	**2022**	2706,5	*1%*	731,4	*19%*	363,7	*34%*
1995	132,1	*14%*	135,1	*32%*	35,7	*53%*	**2023**	2556,4	*-6%*	642,6	*-12%*	362,0	*0%*
1996	138,8	*5%*	150,3	*11%*	43,6	*22%*	**2024**	2587,3	*1%*	632,1	*-2%*	344,0	*-5%*
1997	142,4	*3%*	144,6	*-4%*	48,6	*11%*	**Ort.**		***16%***		***13%***		***14%***

Kaynak: (IMF, 2025)

Tablo 3 ***1970-2024 Yılları Arası Dış Ticaret Dengesi (Milyar $)***

Ülke	Çin	Güney Kore	Türkiye	Ülke	Çin	Güney Kore	Türkiye
1970	0,03	-1,15	-0,36	**1998**	43,48	39,03	-19,04
1971	0,65	-1,33	-0,49	**1999**	29,23	23,93	-13,64
1972	0,84	-0,90	-0,68	**2000**	24,11	11,79	-26,73
1973	0,67	-1,02	-0,77	**2001**	22,55	9,34	-10,07
1974	-0,68	-2,39	-2,25	**2002**	30,43	10,35	-15,50
1975	-0,24	-2,33	-3,34	**2003**	25,47	14,99	-22,09
1976	0,28	-1,06	-3,17	**2004**	32,10	29,38	-34,37
1977	0,37	-0,76	-4,04	**2005**	101,72	23,18	-43,30
1978	-1,18	-2,25	-2,31	**2006**	177,16	17,52	-54,04
1979	-2,01	-5,28	-2,81	**2007**	263,59	15,53	-62,79
1980	-1,84	-4,78	-5,00	**2008**	299,46	-13,27	-69,94
1981	-0,01	-4,86	-4,23	**2009**	197,62	40,45	-38,79
1982	3,04	-2,40	-3,10	**2010**	183,61	41,17	-71,66
1983	0,84	-1,75	-3,51	**2011**	153,72	32,14	-105,93
1984	-1,27	-1,39	-3,62	**2012**	228,86	28,50	-84,08
1985	-14,90	-0,85	-3,39	**2013**	257,40	44,09	-99,34
1986	-11,96	3,13	-3,65	**2014**	383,06	47,52	-84,64
1987	-3,78	6,26	-3,97	**2015**	593,90	90,26	-62,64
1988	-7,75	8,89	-2,67	**2016**	509,65	89,23	-52,94
1989	-6,60	0,91	-4,17	**2017**	419,55	95,22	-74,22
1990	8,75	-4,83	-9,34	**2018**	350,94	69,66	-53,98
1991	8,12	-9,66	-7,45	**2019**	421,07	38,89	-29,51
1992	4,36	-5,14	-8,16	**2020**	523,99	44,87	-49,88
1993	-12,22	-1,56	-14,09	**2021**	636,61	29,31	-46,21
1994	5,39	-6,33	-5,16	**2022**	837,93	-47,79	-109,54
1995	16,70	-10,06	-14,11	**2023**	822,77	-10,35	-106,34
1996	12,22	-20,62	-20,38	**2024**	988,16	51,59	-82,17
1997	40,42	-8,45	-22,30				

Kaynak: (IMF verileri kullanılarak hazırlanmıştır.)

WHAT GOVERNANCE OF THE BLUE ECONOMY IN AFRICA?

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Abstract - King Mohammed VI's message at the "Africa for the Ocean" summit, held in Nice, France, from June 9 to 13, 2025, called for redefining Africa's maritime role and integrating its ocean policies into a vision of sustainable development at the continental, sub-regional, and national levels. This message provided an opportunity to address the governance of the blue economy in Africa. Therefore, it is timely to take stock after a decade of implementation of the AIM 2050, the founding element of the maritimization of the African continent. This analysis aims to highlight the progress made as well as the pitfalls that hinder the establishment of optimal governance for the development of an inclusive blue economy in Africa. The African Union, the keystone of this governance, is called upon to strengthen its institutions to embed, in coordination with its member states, the components of the Blue Economy in all value chains of the BE sectors. The Regional Economic Communities (RECs), after successful experiences in regions of Africa, are called upon to operationalize blue policies in harmonization with the states that compose them while adopting a participatory approach at the common level. Ultimately, the governance of the blue economy in Africa requires redoubled efforts at the political, institutional, legal, infrastructural, scientific and technical levels within the framework of a structured and interconnected global approach.

Keywords: Blue Economy, AIM 2050 Strategy, African Union, Regional Economic Communities (RECs), CEMZA, ZECLAF.

WHO IS A JOURNALIST IN A CHANGING NIGERIA? NAVIGATING ETHICS, INFLUENCE AND RESPONSIBILTY IN THE DIGITAL AGE'.

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Abstract

The question of who qualifies as a journalist in Nigeria has become increasingly complex in the digital age, where traditional newsrooms now share space with bloggers, citizen reporters, and social media influencers. This paper interrogates the evolving boundaries of journalism in a rapidly changing Nigerian media environment, examining how ethical standards, professional influence, and responsibility are being negotiated in a landscape shaped by technology and democratized content production. Drawing on theoretical and empirical perspectives, the study highlights the tension between professional gatekeeping and the participatory nature of digital platforms, The paper argues that while digital technologies expand the space for expression, they also raise urgent questions about ethical responsibility, misinformation, and the sustainability of journalism as a profession. Ultimately, the study contends that defining who a journalist is in contemporary Nigeria requires moving beyond institutional affiliation to a framework rooted in ethics, responsibility, and public interest.

Keywords: Journalist, Ethics, Influence, Responsibility, Digital Age.

INTRODUCTION

The question of who qualifies as a journalist has become increasingly complex in Nigeria's rapidly changing media environment. Traditionally, journalism in the country was defined by professional training, membership in professional bodies, and employment in established newsrooms. In the same vein,, a journalist was seen as a trained professional working within established media organizations, responsible for gathering, verifying, and disseminating information to the public. These criteria provided clear boundaries that distinguished journalists from other communicators in society. However, the advent of digital technologies, particularly the rise of social media platforms, has disrupted these boundaries. Bloggers, influencers, citizen reporters, and online commentators now produce and circulate news to mass audiences, often with speed and reach that rival mainstream media. This shift has raised debates about credibility, ethics, and responsibility in contemporary Nigerian journalism.

The situation is further complicated by Nigeria's political and socio-economic context, where journalism has historically played a central role in nation-building, democratic struggles, and public accountability. In this landscape, traditional standards of objectivity, accuracy, and fairness are increasingly challenged by the pressures of instant news, commercial interests, and political influence. The result is an evolving media ecology where questions of ethics and responsibility must be re-examined.

This paper explores the redefinition of journalism in today's Nigeria focusing on how ethics, influence, and responsibility shape the profession within the digital space. It interrogates the blurred line between professional journalists and other content creators, examines the

implications for public trust and democracy, and argues that journalism in Nigeria must be evaluated less by platform or title and more by adherence to ethical and professional standards.

LITERATURE REVIEW

Who is a Journalist in Today's Nigeria?

The definition of a journalist has long been contested within media and communication scholarship. Classical theories often locate journalism within professional frameworks where formal training, adherence to ethical codes, and institutional affiliation mark out the boundaries of the profession (McNair, 2009). In the Nigerian context, journalism historically aligned with nationalist struggles and democratic advocacy, positioning journalists as both chroniclers and actors in the public sphere (Oso, 2012). This normative understanding rested on values such as objectivity, truth-telling, and responsibility to the public interest.

Traditionally, a journalist is one who collects, processes, and disseminates information for public consumption. In Nigeria, however, this identity is increasingly blurred due to the rise of citizen journalism and social media, where individuals without professional training also publish news (Okoro & Diri, 2020). Thus, the question challenges us to rethink who qualifies as a journalist in today's society.

A journalist is not only a news reporter but also a **public watchdog**, holding government and powerful institutions accountable. Professionalism now demands not just reporting, but also obtain **digital literacy, multimedia skills, and critical thinking** to navigate misinformation and fast-paced news cycles (Adeyanju, 2020). In the digital space, journalists compete with bloggers, influencers, and content creators, making it more difficult to distinguish trained professionals from unregulated voices. Understanding who qualifies as a journalist in Nigeria's digital age requires an engagement with theories that explain media practice, ethics, and social responsibility. Three frameworks are particularly relevant: gatekeeping theory, social responsibility theory, and the public sphere concept.

Gatekeeping Theory

Gatekeeping was first articulated by Lewin (1947) and later expanded by Shoemaker and Vos (2009). It emphasizes the role of journalists and editors in selecting, shaping, and disseminating information. In the Nigerian context, traditional newsrooms historically acted as gatekeepers, ensuring that only verified and socially relevant information reached the public. However, digital platforms have eroded this function. Today, bloggers, influencers, and citizen journalists tend to bypass traditional editorial structures, challenging the monopoly of professional journalists over information flows. This raises critical questions about authority, credibility, and the legitimacy of those who perform journalistic roles without institutional oversight.

Social Responsibility Theory

The social responsibility theory of the press profounded by Siebert, Peterson, & Schramm in 1956 argues that media freedom must be balanced by a duty to the public stressing thatj Journalists are expected to serve as watchdogs, provide accurate information, and promote democratic values. In Nigeria, this framework resonates with the normative role journalism has played in anti-colonial struggles, democratic transitions, and governance accountability. However, mIn the digital age, the challenge lies in extending responsibility beyond established journalists to include new information actors. Therefore, the theory provides a benchmark for

assessing whether bloggers, influencers, and digital media practitioners uphold values of fairness, accuracy, and accountability in their communication practices.

The Public Sphere

Habermas's (1989) concept of the public sphere underscores the role of communication in enabling democratic deliberation. Journalism serves as a central institution within this sphere by facilitating informed debate. In Nigeria, the press has historically functioned as a site of contestation where political, cultural, and social issues are debated. Social media now expands the public sphere, offering new avenues for participation, but also introducing noise, misinformation, and polarization. This framework helps explain how digital actors who perform journalistic functions contribute to or undermine the democratic role of journalism.

These theories provide a lens for analyzing the changing identity of the journalist in Nigeria. Gatekeeping theory highlights the shifting boundaries of information control, social responsibility theory foregrounds ethics and accountability, while the public sphere concept situates journalism within democratic practice.

3. **Navigating Ethics**

Nigerian journalists must uphold ethical standards such as **accuracy, objectivity, fairness, and truthfulness** despite pressures of speed and sensationalism online (Nigerian Press Council, 1998). The digital space often prioritizes clicks, likes, and trending content over facts, making ethical reporting more challenging. Issues such as **fake news, plagiarism, invasion of privacy, and biased reporting** demand strict adherence to the Nigerian Code of Ethics for Journalists and international standards (Okoro & Dunu, 2018). **Journalism ethics emphasize truth, fairness, and accountability. However, in the digital era, speed and competition often clash with accuracy, making ethical navigation difficult (Oso, 2012).** Studies highlight how misinformation, fake news, and sensationalism proliferate online, raising questions about the ethical responsibilities of those who claim the title of journalist (Ibraheem & Garba, 2020). **Also, Nigerian journalists face pressure from political actors, media owners, and online audiences, which complicates adherence to professional codes.**

a) *4.* ***Influence of Digital Media***

Social media platforms like Twitter (X), Facebook, and WhatsApp have become major sources of news. Journalists now operate in an environment where information spreads faster than traditional gatekeeping processes (Iosifidis, 2011). This democratization of information allows for broader participation but also **amplifies propaganda, hate speech, and misinformation**. Journalists are pressured to maintain credibility while competing with unverified citizen-generated content (Chiluwa & Adegoke, 2013). Journalists influence public opinion and hold power to set the national agenda. Social media amplifies this influence but also creates risks of misinformation and sensationalism (Ojebode, 2019).

b) *5.* ***Responsibility in the Digital Age***

Responsibility is a recurring theme in scholarship on journalism and democracy. The social responsibility theory of the press (Siebert et al., 1956) provides a useful lens for examining the Nigerian context, where journalists are expected to inform, educate, and hold power accountable. Recent studies, however, suggest that responsibility in the digital age must extend beyond professional journalists to include citizen reporters, influencers, and other information actors (Allan, 2013). This perspective emphasizes that the defining feature of journalism in

contemporary Nigeria may not be professional status but a commitment to ethical standards and responsibility toward the public.

Moreover, Journalists carry the responsibility of being **truth bearers** in a society where falsehoods can spread within minutes. They must fact-check, provide context, and counter misinformation, especially during elections, conflicts, or national crises (Akinfeleye, 2011). Beyond informing, they have a **civic duty** to educate, foster national unity, and promote democratic values (Ojebode, 2013). The responsibility also extends to **digital security and data protection**, safeguarding sources and ensuring ethical use of user-generated content (Okoro & Dunu, 2018). Beyond reporting, journalists have a duty to society to strengthen democracy, promote accountability, and foster development (Okoro & Diri, 2020). In Nigeria, responsibility also means resisting censorship, propaganda, and political manipulation while serving the public interest. Nigerian journalists must therefore use their platforms responsibly to maintain credibility.

Defining a Journalist in the Digital Age

The digital revolution has redefined journalism. Online platforms, mobile reporting, and interactive media have created opportunities but also blurred the line between professional and amateur reporting (Udeze, 2021). Nigerian journalists must embrace these tools while safeguarding credibility and public trust.

The digital age has changed the traditional definition of a journalist, particularly in Nigeria, where online platforms have enabled many to claim the title (Vasist & Krishnan, 2024). The ease of disseminating information online has led to a rise in citizen journalism, challenging the professionalism and ethical standards of traditional journalism. Determining who qualifies as a journalist becomes crucial in upholding ethical standards and ensuring credible information dissemination. Journalistic privilege, which protects the anonymity of sources, adds another layer of complexity, requiring a clear definition of a journalist to balance freedom of expression with national security concerns (Ibbi, 2016).

A Changing Nigeria

Nigeria is undergoing socio-political and technological transformations. Issues such as insecurity, corruption, youth activism (e.g., #EndSARS protests), and rapid digitization affect journalism (Udeze, 2021). Journalists must adapt to these changes to remain relevant and effective in informing the public.

In a changing Nigeria, journalists navigate a complex landscape of ethics, influence, and responsibility, significantly shaped by the digital age. The advent of the internet and social media has transformed journalism, presenting both opportunities and challenges for professionals in Nigeria.

A journalist is traditionally regarded as an individual who gathers, verifies, interprets, and disseminates information to the public through various media channels. In Nigeria's changing media landscape, this role has expanded significantly due to technological innovations, socio-political realities, and the influence of digital communication platforms. **Today, journalists are not only gatekeepers of information but also mediators of truth in a society where misinformation spreads rapidly** (Oso, 2012).

The influence of journalists has also increased with digital tools. Social media platforms like Twitter, Facebook, and WhatsApp allow journalists to reach vast audiences instantly. However, this influence comes with the responsibility to avoid sensationalism and to fact-check content before publication (Udeze, 2021). In Nigeria, where issues of governance, corruption, and

insecurity dominate public discourse, journalists play a vital role in shaping democratic accountability while maintaining professional independence.

Ultimately, being a journalist in Nigeria today means balancing traditional journalistic values with new digital realities. A journalist is not just a conveyor of news but a custodian of public trust, tasked with promoting informed citizenship while upholding ethical standards in the face of technological disruption and socio-political pressures.

Ethical Challenges in the Digital Sphere

Several ethical issues confront journalists in Nigeria's digital age. **Fake news and misinformation proliferate online, posing a significant threat to accurate reporting and public trust** (Vasist & Krishnan, 2024). The speed and reach of digital media can exacerbate the spread of false information, making it imperative for journalists to verify information meticulously (Vasist & Krishnan, 2024). Additionally, **the erosion of journalistic ethics in the post-truth era, fueled by biased reporting, further complicates the ethical landscape** (Flew, 2019). Maintaining authenticity, accountability, and autonomy becomes essential for journalists to retain credibility in this environment (Cheng & Zhang, 2023).

Influence and Responsibility

The convergence of media has amplified the influence of journalists, demanding a heightened sense of responsibility. With the ability to reach vast audiences through various digital platforms, journalists must be mindful of the potential impact of their reporting on public opinion and social discourse (Omoera & Uwalaka, 2023). This influence necessitates adherence to ethical guidelines, ensuring unbiased, accurate, and responsible dissemination of information (Vimalkumar et al., 2020). Corporate digital responsibility also plays a role, requiring digital platforms to address the spread of false information (Flew, 2019).

Navigating the Digital Divide

Despite the growing influence of digital media, a significant digital divide persists in Nigeria. Many individuals lack access to mobile phones or can only use basic applications, limiting their access to information and participation in digital discourse. This divide can exacerbate inequalities and hinder the reach of journalistic content to all segments of society. **Journalists must consider this divide and strive to reach diverse audiences through various channels, ensuring that information is accessible to all** (Audrian & Sergiu, 2023).

In the digital age, Nigerian journalists must navigate complex ethical challenges. Issues such as fake news, unverified online content, clickbait, and political propaganda threaten the credibility of journalism.

Ethical responsibility requires journalists to adhere to accuracy, fairness, balance, and accountability regardless of the platform used (Okoro & Diri, 2020). Moreover, journalists are expected to distinguish between professional reporting and citizen journalism, which often lacks editorial oversight.

In this evolving media landscape, **digital skills are increasingly important for journalists These skills encompass not only the ability to use digital tools but also critical inquiry, cybersecurity awareness, and ethical responsibility** (Zostant & Chataut, 2023).

Furthermore, **corporate governance models play a crucial role in shaping the digitalization level and digital capabilities of media organizations.** Transparency and accountability, driven by effective corporate governance, are essential for building trust and maintaining ethical standards in the digital age (Herrmann, 2023).

Corporate Social Responsibility (CSR) is also relevant for journalists in Nigeria. CSR involves ethical practices and reputation management, influencing how media organizations interact with stakeholders and address social and ethical concerns. **Embracing Corporate Digital Responsibility (CDR) ensures that digital technologies are used ethically and that potential negative impacts are mitigated** (Yassin & Beckmann, 2024). **CDR includes unbiased data handling, privacy protection, and responsible innovation, all of which are vital for maintaining public trust and promoting positive social outcomes** (Khalilzadeh et al., 2024).

Conclusion

In conclusion, the identity of a journalist in a changing Nigeria is being redefined by the demands of the digital age. In a changing Nigeria, a journalist is more than a news reporter; they are an **ethical communicator, digital navigator, and responsible influencer**.

The digital age presents opportunities for wider reach and impact, but it also brings challenges of misinformation, ethical dilemmas, and political interference. To remain relevant and credible, journalists must uphold professionalism, embrace technology responsibly, and remain committed to their role as guardians of truth and democracy. .

For Nigeria, this calls for a reimagined approach to media regulation, professional training, and public engagement. Rather than excluding digital actors, frameworks should integrate them into conversations about responsibility while reinforcing standards that protect the public from misinformation and manipulation. The challenge is not merely to preserve journalism as it once was, but to nurture it in ways that meet the demands of a complex, digital society. Ultimately, who qualifies as a journalist in Nigeria will be determined not by labels but by the consistent practice of ethics, influence exercised responsibly, and commitment to the public good.

Recommendations

To navigate the challenges and opportunities of the digital age, journalists in Nigeria should:

1. Uphold ethical standards by prioritizing accuracy, impartiality, and accountability (Vimalkumar et al., 2020).

2. Develop strong digital skills to effectively use online tools and platforms (Zostant & Chataut, 2023).

3. Combat fake news and misinformation through fact checking, rigorous verification and responsible reporting (Vasist & Krishnan, 2024).

4. Promote media literacy to empower citizens to critically evaluate online information (Winkler et al., 2023).

5. Advocate for policies that bridge the digital divide and ensure equitable access to information (Adrian & Sergiu, 2023).

6. Embrace Corporate Digital Responsibility to foster ethical and sustainable digital practices (Yassin & Beckmann, 2024).

7. Engage in continuous self-reflection and professional development to adapt to the evolving media landscape (Theodorio et al., 2024).

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YAPAY ZEKA ÇAĞINDA TASARIM EĞİTİMİNİN YENİDEN DÜŞÜNÜLMESİ: "BİR TASARIM FAKÜLTESİ TASARIMI/ÖNERİSİ"

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ÖZET

Manfred Buhr ve Alfred Kosing'in yazıp hazırladığı *Bilimsel Felsefe Sözlüğü'*nde (1999), yer alan tasarım tanımı üzerinden var olan tasarım eğitimi tartışmaya açılarak güncel eksikler saptanacak ve gelecek projeksiyonu yapılacak. Bu tanıma göre tasarım "*Nesnel gerçeğin merkezi sinir sistemi aracılığıyla oluşan bir yansıma biçimi... Tasarım, çeşitli özellikleri ve bağlamlılıklarıyla ele alınan eşyaların (şeylerin), bir bütünlük ortaya koyan duyumsal imgesidir; ancak algıdan farklı olarak, tasarım, belirli bir anda duyu organlarına etki yapan eşyaların o anda ve doğrudan doğruya beliren bir imgesi olmayıp, daha önce algılanmış olan eşyanın yeniden üretilen algısal imgesidir.*" (s.403). Tanımın bu kısmından kısaca şu anlaşılmaktadır: Tasarım, bilgisine sahip olduğumuz şeyin (nesne, olgu ya da duygunun) gördüğümüz "**o anki yeni hali**" ve "**o anın kurduğu iletişim**" ile imgeleşmeye başlayan durum, görünüm, işlev ya da ruhtur. Bu tanımla güncel yapay zekâ tartışmaları birleştiğinde yeni bir tasarım eğitimi ve bu eğitimin oluşacağı fakülte kurgusu artık kaçınılmaz hale gelmiştir. Ayrıca sektör ihtiyacı ve yetişen öğrenci sayısı arasındaki orantısız gelişim ile bu öğrencilerin seçimi, eğitimi ve istihdamı gibi durumlar da fakülte önerisi ile tartışmaya dahil edilecektir. Bu çalışmada tasarım ve eğitim gibi soyut kavramların güncel karşılıklarına odaklanabilmeyi olanaklı hale getiren Kavramsal Araştırma Yöntemi kullanılmıştır. Böylece tasarım eğitiminin sorgulandığı ve gelecek kurgusunun oluşturulduğu kavramsal bir araştırma/tartışma sürdürülebilmiştir.

Anahtar Kelimeler: "Tasarım", "Tasarım Kavrayışı", "Tasarım Eğitimi"

RETHINKING DESIGN EDUCATION IN THE AGE OF ARTIFICIAL INTELLIGENCE: "A DESIGN FOR A FACULTY OF DESIGN/PROPOSAL"

ABSTRACT

Based on the definition of design found in the *Scientific Philosophy Dictionary* (1999), written and prepared by Manfred Buhr and Alfred Kosing, the existing state of design education will be opened for discussion, current deficiencies will be identified, and a future projection will be made.

According to this definition, design is "A form of reflection of objective reality created through the central nervous system... Design is the sensory image of things (objects), considered with their various characteristics and contexts, that presents a whole; however, unlike perception, design is not an image of things that appears at that moment and directly affects the sense organs at a specific moment, but rather the reproduced perceptual image of what has been previously perceived" (p.403).

From this part of the definition, the following can be briefly understood: Design is the state, appearance, function, or spirit that begins to become an image through the "new state of that moment" and the "communication established by that moment" of something (an object, phenomenon, or feeling) of which we have knowledge.

When this definition is combined with current artificial intelligence debates, a new model for design education and the structure of a faculty where this education will take place have become inevitable. Furthermore, issues such as the disproportionate development between industry needs and the number of graduating students, as well as the selection, education, and employment of these students, will be included in the discussion through the faculty proposal.

In this study, the Conceptual Research Method has been employed, which makes it possible to focus on the contemporary meanings of abstract concepts such as design and education. Thus, a conceptual investigation/discussion in which design education is questioned and its future is envisioned has been sustained.

Keywords: "Design," "Conception of Design," "Design Education"

İÇERİK TABANLI (TF-IDF) BENZER ÜRÜN ÖNERİLERİ: B2B ECZANE PAZARYERİ İÇİN MAKİNE ÖĞRENMESİ TABANLI ÖNERİ SİSTEMİ UYGULAMASI

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ÖZET

Bu araştırmanın konusu, eczacılara yönelik bir B2B pazaryerinde ürün detay sayfasını desteklemek üzere içerik tabanlı "Benzer Ürünler" modülünün tasarlanması ve değerlendirilmesidir; kapsam, 61.177 ürünlük katalogdan alınan örneklem üzerinde yalnızca metin ve temel ürün özniteliklerine (ürün adı, kategori/marka kimlikleri) dayalı bir yaklaşımın pratik uygulanabilirliğini sınamayı içermektedir. Bu çalışma, etkileşim verisi olmadan da makul maliyetle ve az veri gereksinimiyle işe yarar öneriler üretilebileceğini gösterir. Hedefimiz, ürün adlarından çıkan metin temsilleriyle güvenilir benzer ürünler önermek ve canlı A/B denemelerine geçmeden önce kullanılabilecek pratik bir çevrim dışı doğrulama adımı ortaya koymaktır. Yöntem olarak Türkçe metin ön-işleme (küçültme, ölçü/birim maskeleme, temel durak sözcük temizliği) uygulanmış; TF-IDF (1–2-gram) ile metin vektörleri çıkarılmış ve kosinüs benzerliği ile her ürün için Top-10 aday öneri üretilmiştir; puanlama, ileride sağlanacak marka/kategori adlarıyla zenginleşecek şekilde kurgulanmıştır. Değerlendirmede tıklama/etiket verisi olmadığından Kategori Tutarlılığı (CC@K), Marka Tutarlılığı (MC@K) ve birleşik Hybrid@K metrikleri kullanılmış; 1.500 ürünlük örneklemde CC@5 ≈ 0,74 ve CC@10 ≈ 0,63 elde edilerek yalnızca ürün adlarına dayalı yaklaşımın güçlü kategori-içi tutarlılık sağladığı gösterilmiştir. Çalışma, B2B eczane pazaryeri bağlamında hızlı devreye alınabilir, soğuk başlangıca kısmen dayanıklı ve veri erişimi kısıtlı ortamlarda dahi etkili olabilen bir içerik tabanlı öneri prototipi sunmakta; gelecek çalışmalarda marka/kategori isim eşleştirmelerinin entegrasyonu, uzman puanlamasıyla insan temelli doğrulama ve anlamsal gömme (ör. Sentence-BERT) karşılaştırmalarının eklenmesi planlanmaktadır.

Anahtar Kelimeler: Öneri Sistemleri; TF-IDF; Kosinüs Benzerliği; B2B E-Ticaret; Eczane Pazaryeri

CONTENT-BASED (TF-IDF) SIMILAR PRODUCT RECOMMENDATIONS: MACHINE LEARNING-BASED RECOMMENDATION SYSTEM APPLICATION FOR B2B PHARMACY MARKETPLACE

ABSTRACT

The subject of this study is the design and evaluation of a content-based “Similar Products” module to enhance product detail pages in a B2B marketplace dedicated to pharmacists, with the scope limited to assessing the practical applicability of a text-driven approach using only product names and basic attributes (category and brand identifiers) on a catalog of 61,177 products. This study demonstrates that it's possible to generate useful recommendations without interaction data at a reasonable cost and with minimal data requirements. Our goal is to reliably recommend similar products using text representations of product names and to provide a practical offline validation step before moving to live A/B experiments.The methodology involved preprocessing Turkish product names (lowercasing, masking units/measures, stopword removal), extracting text vectors using TF-IDF (1–2-gram), and computing cosine similarity to retrieve the Top-10 candidate recommendations per product, with a scoring scheme designed to be further enriched through brand and category mappings. In the absence of user interaction data, evaluation relied on Category Consistency (CC@K), Brand Consistency (MC@K), and Hybrid@K metrics; on a 1,500-product sample, results showed CC@5 ≈ 0.74 and CC@10 ≈ 0.63, indicating strong intra-category coherence even when using product names alone. In conclusion, the study presents a deployable prototype that is partially resistant to the cold-start problem and effective under limited data access conditions in the context of a B2B pharmacy marketplace, with future work planned to incorporate brand/category name mappings, expert-based human evaluation, and semantic embedding comparisons (e.g., Sentence-BERT).

Keywords: Recommender Systems; TF-IDF; Cosine Similarity; B2B E-Commerce; Pharmacy Marketplace

TOURISTIC TRAILS ALONG ZARQA RIVER IN THE SOUTH LEVANT – JORDAN

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Abstract

The Zarqa River has a long-standing history shaped by numerous civilizations across the ages. From the Stone Ages up to the modern periods, human settlement along the river valley has shown remarkable continuity without interruption throughout historical epochs. Given the significance and diversity of these civilizations, and the growing need to safeguard the cultural heritage of the Zarqa Valley in the face of rapid urbanization and investment activities in the region, the creation of a clear and well-organized touristic trail is of urgent importance.

This project aims to establish a structured visitor loop that connects the diverse archaeological and heritage sites along the valley, allowing visitors to explore the succession of civilizations that once thrived there. It also emphasizes the development of an analytical and remedial master plan for the region, serving as a scholarly reference for researchers and specialists in archaeology and tourism. Such a plan will enhance the economic value of the area and is expected to yield multiple positive outcomes, both direct and indirect, particularly by promoting tourism in Zarqa Governorate and linking it with the governorates of Jerash and Amman. This will elevate Zarqa's tourism product and improve visitor services, thereby contributing to comprehensive development.

Zarqa Governorate, with its river, represents one of the most historically significant valleys in Jordan. Along its banks, many civilizations left behind architectural and cultural remains that are still visible today. The valley hosts numerous archaeological sites dating from successive periods, including the Stone, Bronze, Iron, Classical, and Islamic eras. Its richness in tangible heritage makes it a vital cultural corridor deserving of a dedicated tourist trail that highlights the grandeur and historical depth of this ancient valley.

Beyond heritage preservation, such a trail will generate significant tourism revenues, which in turn will have a positive impact on the local community by fostering direct contributions to socio-economic development. Recent archaeological excavations have uncovered new, significant sites that require documentation and inclusion within the visitor circuit, and even integration into the training curricula of tourist guides in Jordan. Academic publications on Zarqa's heritage and archaeological sites have also increased, emphasizing the urgency of disseminating such valuable knowledge locally, given that much of it results from substantial efforts by local and foreign missions.

Furthermore, the proposed trail will highlight Zarqa's appearance in ancient maps, such as the Roman Peutinger Map, and will also encompass the geological history of the governorate. This aligns with the diverse forms of tourism that Zarqa can offer, including environmental, cultural, religious, and recreational tourism. All of these factors necessitate decisive action to address the severe shortage of structured tourism initiatives in Jordan's second-largest city, which, despite its large population and distinctive climate diversity, has long remained marginal in tourism development. Implementing such studies and projects in practice will unlock the potential of Zarqa's cultural and natural resources for sustainable benefit.

Key words: Tourism, Trails, Development, Cultural tourism, Natural Tourism, Jordan

IDENTIFICATION OF FUNGI RESPONSIBLE FOR THE DECOMPOSITION OF SOIL ORGANIC MATTER

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Abstract

The study was aimed to isolate, identify and determine the percentage of fungi species present in contaminated soil samples from Waste-contaminated soil and Mechanic workshop or garage within Katsina State, Katsina city. Soil samples were obtained from two different locations within Katsina metropolis and twenty-five gram of samples were added to two hundred and twenty-five milliliter of distilled water and one milliliter of each was added to nine milliliter of distilled water to give a tenfold serial dilution of which was made up to (10-6) dilution for the isolation and identification of fungi. One milliliter aliquot of 10-5 and 10-6of each sample was spread on surface of prepared Potato Dextrose Agar (PDA) and incubated at room temperature for 3 to 7 days for the isolation of fungi. Nine species of fungi were isolated from the soil samples and then characterized macroscopically and microscopically. The fungi were Saccharomyces cerevisiae, Candida albicans, Aspergillus niger, Aspergillus terreus, Aspergillus flavus, Penicillium chrysogenum, Fusarium spp., Rhizopus spp, and Mucor spp. The fungal counts ranged from 5.5 $\times 10^{-6}$(cfu/ml) to 102 $\times 10^{-5}$(cfu/ml). The percentage occurrence amongst the fungal isolates from the two places was higher in Waste-contaminated soil with 58.3% and lower in Mechanic garage or workshop with 48.6% this variation occur as a result of direct released of hydrocarbons that are toxic to the living organisms (particularly microorganisms and Plants) present in the soil, while these fungi in Waste disposal area soil are involved in the degradation of complex organic compounds which increases the soil health and quality. Therefore, these complex organic compounds-degrading microbes are abundant in soil and can be applied for bioremediation of soils contaminated with recalcitrant compounds and petroleum products.

Keywords: Fungi, complex organic compounds, decomposition.

ADVANCED OXIDATION PROCESSES FOR EFFICIENT AZO DYE DEGRADATION: EXPERIMENTAL AND TOXICITY INSIGHTS

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Abstract

Background: Aquatic environments today face contamination from various compounds originating from industrial wastewater. Advanced oxidation processes (AOPs) are one of the very efficacious solutions for the degradation and mineralization of refractory contaminants from industrial wastewater such as the hazardous Ponceau S dye (PS).

Methods: In this novel experimental work, the PS degradation with the Fenton-like process was inspected. The Full Factorial Design (FFD) was applied to study the effect of operating parameters on the PS degradation efficiency. Molecular docking was investigated to study the PS's toxicity, mutagenicity and carcinogenic effect.

Significant Findings: The statistical optimization demonstrated a coefficient R^2 of 0.9638. The underlying reasons of each factor's effect on the PS degradation were comprehensively discussed. The optimal conditions established by the experimental design were as follows: the initial dosage of cobalt ions at 0.12 mM, PS dosage at 0.06 mM, and initial H_2O_2 dosage at 1 mM. At optimum conductions, the expected PS degradation was 20.14%.

Ponceau S docked effectively with all five targets, showing the strongest and cleanest binding to CDK8. AKT and PR had strong but slightly less favorable interactions. Hydrophobic and electrostatic forces played a major role in ligand stabilization.

Keywords: Ponceau S; Fenton-like process; Industrial wastewater; molecular docking; full factorial design; Toxicity

EFFECTS OF DIRECT SEEDING ON THE PHYSIOLOGICAL PARAMETERS OF SOFT WHEAT (TRITICUM SATIVUM L., VARIETY AÏN ABID)

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Abstract:

The issue of cereal production in Algeria raises three main determining factors: climate, soil, and agronomy. While rainfall is the main factor affecting cereal production, agronomic practices and their effects on soil are far from negligible.

In the literature, there is a barely concealed reluctance to use direct seeding in semi-arid regions due to low rainfall and low soil organic matter content. On the contrary, conventional plowing is seen as a factor in the reduction of soil organic matter and therefore in the steady destruction of biodiversity.

It is in relation to this dialectic that the present work fits in, which addresses the study of the behavior of soft wheat grown under two cultivation methods: direct seeding (DS) and conventional plowing (CP).

Keywords: Direct seeding, Conventional plowing, Physiological parameters, Soft wheat, Algeria.

FORMULATION AND EVALUATION CLITORIA TERNATEA LINN. ALCOHOLIC EXTRACT ANTIPIGMENT CREAM

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Abstract:

Hyperpigmentation is a common dermatological condition caused by excess melanin production. Conventional treatments often have side effects, prompting the need for safer, plant-based alternatives. *Clitoria ternatea* Linn., commonly known as butterfly pea, is a medicinal plant rich in flavonoids, anthocyanins, and antioxidants known to exhibit skin-lightening and anti-tyrosinase activity. An ethanolic extract of *Clitoria ternatea* flowers was prepared using maceration. The extract was incorporated into a cream base in varying concentrations. The formulations were subjected to physicochemical evaluation including pH, spreadability, viscosity, and stability studies under different conditions. The antipigment activity was evaluated through in vitro tyrosinase inhibition assay and preliminary skin compatibility tests. This study aims to formulate and evaluate a topical antipigment cream containing the alcoholic extract of *Clitoria ternatea* Linn., assessing its physicochemical properties, stability, and efficacy in reducing pigmentation.

Key words:

 Clitoria ternatea Linn ,Antipigment cream**,**Hyperpigmentation**,**Ethanolic extract**,**Tyrosinase inhibition**,**Herbal cosmetics**,** Skin depigmentation**,** Phytochemicals**,**Flavonoids .