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**Peacebuilding & Sustainable Development
(ICEPSD-25) Abbottabad**



**International Conference on Education for
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(ICEPSD-25) Abbottabad**
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ABSTRACTS BOOK OF
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(ICEPSD-25) Abbottabad
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Editor: Prof. Dr. Muhammad Rafiq
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Conference Fields

1. Humanities & Social Sciences
2. Chemical & Biological Sciences
3. Biotechnology & Bioinformatics
4. Microbiology & Physics
5. Pharmacy, Psychology & Allied Health Sciences
6. Computer & Numerical Sciences



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Table of Contents

1. Conference Fields	3
2. Organizing Body	4
3. Techno-Functional and Sensory impact of Beetroot Pomace Flour in Biscuits	15
4. Enhancing Efficiency and Stability in Perovskite Solar Cells: Pathways to Sustainable Energy Solutions	15
5. Kinetic and Thermodynamic Study of Surface Modified Adsorbent for the Removal of Direct Blue 15 Dye from Aqueous Medium	16
6. Colorimetric Sensing Of Sulfide Using Silver and Zinc Oxide Deposited On Chitosan Nanocomposite	16
7. Bioengineering of Monometallic and bimetallic (Cu/Zn) nanoparticles for Appraisal of structural features and biological activities	17
8. Ultrasonication-Enhanced Composite Flour with Apple Pomace for Functional Bakery Innovation	17
9. Characterization of Lornoxicam nanoparticles using advanced analytical techniques	18
10. Development of Moringa-Bitter gourd Tea and its physicochemical, antioxidant, hypoglycemic activities in alloxan induced diabetic Rabbits	19
11. The Impact of Climate Change on Food Security in Pakistan: Challenges and Opportunities.	19
12. Optimizing Dehydration Techniques for Carrot Pomace Valorization: Enhancing Nutritional Utility and Sustainability	20
13. Exploration of Brca1 and Brca2 Mutations in Gastric Cancer Patients through Next Generation Sequencing: Implications for Diagnosis and Therapy	21
14. Green Synthesis of Silver Nanoparticles Using Plantago Lanceolata Extract: Characterization, Antibacterial Activity against Multidrug-Resistant Bacterial Pathogens	22
15. Managing Diabetes with Novel Drug Discovery: Challenges and Opportunities	22
16. Triptolide increased mitochondrial fission and decreased fusion in rat liver tissue	23
17. Use of protein-polysaccharides based delivery system for improve survival of probiotics	24
18. Prevalence of Conduct Tendencies in Abbottabad and the Interplay of Emotional Regulation, Temperaments, and Callous Unemotional Traits	24
19. Assessment of Unveiling the Antimicrobial Properties of Nano Composite Neodymium Sulphide	25
20. Prevalence of Plasmid-Mediated Quinolone Resistance Genes in E. Coli Isolates From Urinary Tract Infections	26
21. Synthesis and Characterization of Carbon Dots Based Graphene Oxide Nanocomposite for Removal of Methylene Blue and Methyl Orange Dyes	27
22. Targeting MECP2-Driven Deregulation in Rett Syndrome: Epigenetic Therapeutics for X-Linked Neurodevelopment	27
23. Taste Masking Of Ondansetron by Granulation Method	28
24. Impact of Nutrition Knowledge on Diet Quality and Nutritional Status among Pregnant Women in a Tertiary Care Setting in Northern Pakistan	29
25. Effect of Servant Leadership on Employee Performance: The Moderating Role of Effective Communication in Abbottabad Education Sector	29

26. Effect of Training and Development on Employee Turnover Intention and Productivity in Banking Sector of Abbottabad	30
27. Food Addiction: A Review of Neurobiological Mechanisms, Contributing Factors, and Intervention Strategies	30
28. Effect of Storytelling on Consumer Engagement in Abbottabad	31
29. The Influence of Workload Conflict on Job Satisfaction of Employees at Ayub Medical Complex Abbottabad Khyber Pakhtunkhwa	31
30. The Effect of Toxic Organizational Politics on Job Satisfaction of Private School Teachers In Mirpur Abbottabad	32
31. Effect of Brand's On Female Consumer's Buying Behavior in Supply, Abbottabad	32
32. Effects of Job Stress on Employees Performance in Simplexmed Company Abbottabad Khyber Pakhtunkhwa.	32
33. The Effect of Autocratic Leadership Style on Employee Performance	33
34. Effect of Online Shopping On Consumer Buying Behavior in Government Home Economics College, Abbottabad	33
35. The Effect of Laissez-Faire Leadership on the Job Satisfaction of College Teachers in Abbottabad	34
36. The Effect of pricing on consumer buying behavior in Jinnah Abad, Abbottabad	34
37. Barriers to Entry for Women in Entrepreneurship in Abbottabad, Upper Kehal	35
38. Personality Traits and Green Mind Indicators: Investigating the Role of Value Orientation	35
39. Relationship between Mobile Phone Addiction, Delayed Sleep Phase Syndrome and Aggression among Adolescents and Adults	36
40. Correlational study on impulsivity, mind wandering and emotional reactivity among adolescents and emerging adults	36
41. The Social Anxiety and Its Impact on Emotional Regulation, Academic Performance and Social Media Usage Pattern among College Students	37
42. Relationship between Parenting Styles and Maladaptive Cyber Behaviors with Mediating Role of Emotional Regulation; among adolescents and Young Adults	37
43. Examining Imposter Syndrome among Educators in Pakistan: The Role of Childhood Trauma, Gender Role Conflict, and Societal Expectations	38
44. Assigning Gender to English Loanwords in Khattak Dialect of Pashto Language	38
45. Synthesis, Characterization, Antioxidant and Antimicrobial Activity of Organotin (IV) Based Polyvinyl Chloride Composites	39
46. Synthesis and Characterization of Iron-Cerium Oxide Decorated Mxene Nanocomposites for Colorimetric Detection of Dopamine	40
47. Acquisition of Grammatical Gender in Urdu: A Longitudinal Case Study of a Child from 18 to 48 Months Age	40
48. Design, Stability and In-Vivo evaluation of Plant Based W/O emulsions as safer alternatives for Dermatological Disorders	41
49. Antibacterial Efficacy of Ethanollic and Methanolic Extracts of Withania Coagulans against Escherichia Coli Isolated From Labeo Rohita	42

50. Impact of Medicinal Plants Extracts On Shelf Life of Selected Fruits and Vegetables	42
51. Utilizing Context-Aware Fusion for Transformation of 2d Images to 3d Models	43
52. Challenging Toxic Masculinity: A Critical Discourse Analysis of Resistance in Pakistan's Aurat March	43
53. Weaponizing feminism: The white savior syndrome	44
54. Fabrication of Silver Doped Covalent Triazine Framework for the Colorimetric Sensing Of Dopamine	44
55. Synthesis of Titanium Doped Hydroxyapatite Nanocomposite for the Colorimetric Sensing Of Uric Acid	45
56. Sustainable Detoxification of Mycotoxins Using Iron Nanoparticles Synthesized from Waste Rose Petals	46
57. Synthesis of Graphene Oxide Linked Amine Derivative and Their Application for Removal of Congo red And Eriochrome Black T Dyes	46
58. Cross-Influence of Accumulated Metals in Mice Brain: A Comparative Perspective	47
59. Green Synthesis of Iron Oxide Nanoparticles Mediated By Elettaria Cardamomum and Antimicrobial Activity Investigation against Bacteria Causing Mastitis	48
60. Synthesis, characterization (In vitro & In-Vivo) and evaluation of Cefoperazone/Salbactam loaded Chitosan-Sericin-Silver nanocomposites for treatment of chronic infected burn Wounds	48
61. Synthesis of Tungsten Oxide-Poly (Methy Methacrylate) Composites for Efficient Photocatalytic Degradation of Methyl Violet	49
62. Synthesis of Amphoteric Carbon Dots and Their Evaluation as a Drug Carrier	49
63. Synthesis of Zinc Oxide Tungsten Oxide Composites for the Efficient Photocatalytic Degradation of Crystal Violet	50
64. Mindful Consumption in the Age of Social Media and AI: Reclaiming Agency in a Hyper connected World	51
65. Taste Masking Of Ondansetron by Granulation Method	51
66. Integrating Peace Education with ESL Instruction in Pakistan: Systematic Review of Challenges, Opportunities and Future Prospects	52
67. Effect of Academic Performance and Information Technology at College Level in Faisalabad	53
68. Antibacterial Efficacy of Zinc Oxide Nanoparticles Using Tecomella undulata Against E.coli Causing Urinary Tract Infections in Karak	53
69. Integrating Peace Education in Sustainable Agriculture: A Holistic Framework for Rural Resilience	54
70. Determination of Weed Toxicity: Negative Impact on Maize Germination and Young Plants in Sustainable Agriculture Development	54
71. Synthesis, Characterization and Antimicrobial Studies of Thiophene-2- Carbaldehyde Derived Schiff Base Complexes with Copper and Nickel	a
	5
72. Synthesis and Characterization of Thiophene Azomethine and Ferrocene Reinforced Composites of Epoxy Resin	55

73. Triphenylamine based Polyazomethine-ZnO Nanocomposites: Synthesis and Characterization as Potential Antimicrobial Agent	55
74. Synthesis and Spectroscopic Characterization of hydroxy substituted dinitro-triphenylamine as Fluorescent Metal Ion probe	56
75. Effectiveness of Psychoeducation on Healthy Dietary Counseling and Mental Health of University Students: A non-Randomized controlled trial (MIND FUEL Trial)	56
76. Climate-Induced Anxiety and Government Response Perceptions: A Nationwide Study of Pakistani Students	57
77. Psychosocial Distress and Quality of Life among Kohistani Community Affected by Displacement: The Case of Dasu Hydropower Development Project	58
78. A Cross-Sectional Study on Psychological Distress and Associated Factors among University Students in Pakistan	58
79. Silent Killer on Campus: A Qualitative Study of Smoking Behavior, Knowledge, Attitudes, and Perceptions in University Students	59
80. Eating Disorder and Its Contributing Factor to Psychological and Behavioral Challenges: A Cross Sectional Study	59
81. Association of Food Habits on Adolescents' Mental Distress and Quality of Life	60
82. Impact of Lifestyle and Demographic Factors on Diabetes Associated Complications; A Cross-Sectional Study	60
83. Prevalence and Determinants of Mental Health Disorders among Madrassa Students in Tehsil Ghazi, DISTRICT HARIUR	61
84. Surgical Site Infections is the Concerning Issue in Pakistan: A Review Article	62
85. A Cross-Sectional Study on Mental Health and Demographic Factors among Madrassa Students	62
86. The Role of Personal and Institutional Support in Smoking Cessation: A Qualitative Study Among University Students	62
87. Perceptions Regarding Kangaroo Mother Care among Mothers and Barriers to Its Adoption among Healthcare Providers at DHQ Hospital Haripur: A Qualitative Study	63
88. Analyzing the Impact of Project Management Software Usage on Project Performance	64
89. Synthesis of NiO-ZnO Nanocomposite with Improved Size and Stability Control for Efficient Reactive Orange 16 Adsorption	64
90. Computationally Guided Design of ZnO Based Nano adsorbents for Efficient Dye Adsorption	65
91. Sufi Education and Peacebuilding	65
92. Gestures for Peace: Exploring the Role of Nonverbal Communication in Conflict Resolution within ESL Classrooms	66
93. Impact of Heat-drought Climatic Extremes on N Cycling across Various Soil Ecosystems of Lesser Himalaya	66
94. From Space to Soil: Exploring the Variable Linkage among Vegetation Cover, Phosphorous and Cadmium Pools	67
95. Impact of Post-Conflict Social Development Programs on Peace Process – A Case Study of Swat, Pakistan	68

96. Production and Partial Optimization of Keratinase Enzyme from <i>Pseudomonas lactis</i> AF-2	69
97. From Rubble to Resource: Eco-Engineered Photocatalytic Concrete with Recycled Aggregates for Pollutant Degradation	70
98. Biodegradation of Engine Oil by Isolated Bacterial Consortium under Soil Microcosm Experiment	71
99. Fish Scale-Derived Carbon Quantum Dots Doped Magnetic TiO ₂ Photocatalysts: Advancing Environmental Sustainability through Solid Waste Valorization and Wastewater Treatment	71
100. Isolation, Screening and Characterization of Newly Isolated keratinolytic Bacteria from Poultry Farm Soil	72
101. Valorization of Fruit Waste into Functional Nanocomposites for Pollutant Removal: A Sustainable Development Perspective	72
102. Sustainable Nanophotocatalysts from Fish Waste and Metal Oxides for Wastewater Remediation	73
103. Bridging the Gaps: A Critical Review of Environmental Impact Assessment (EIA) Practices in the Construction Sector	73
104. Synthesis and characterization of CoFe ₂ O ₄ nanoparticles for removal of anionic dye from aqueous sample: experimental design, kinetic, isotherm and thermodynamic studies	74
105. Vegetation response to recent trends in climate and land surface temperature changes in Central Khyber Pakhtunkhwa Province, Pakistan	75
106. Manganese sulfate induced behavioral alterations, genotoxicity and histopathological lesions in grass carp (<i>Ctenopharyngodon idella</i>)	75
107. Synthesis of Green Silver Nanoparticles Using Raw Royal Jelly and Its Impact against <i>Fusarium Oxysporum</i> Isolated From Fish	76
108. GC-MS-Based Phytochemical Profiling and Integrated Biological-Computational Analysis of <i>Micromeria biflora</i>	77
109. Sensitivity Analysis of New Mathematical Model for COVID-19	77
110. Inorganic Hybrid Materials for Hydrogen Production	78
111. Impact of Petroleum Crude Oil Exposure on the Gut Microbiota of Pigeons in District Kohat	78
112. Nerium oleander mediated green synthesis of cobalt oxide nanoparticles and their applications in pesticide degradation	79
113. Synthesis and Characterization of Ceria-Doped Hydroxyapatite Nanocomposites for Colorimetric Detection of Mercury via Waste Valorization Approach	80
114. The Pharmacy students' Perception and cognition of Artificial Intelligence; The study of factors and Approaches	80
115. Green Methodological Extraction for Efficient Recovery of High-Value Components from Selected Food Plants and Agro-wastes	81
116. Exploring the Knowledge and attitude of health care professionals regarding artificial intelligence: Implications for the future of healthcare	81
117. Effect of Bee Propolis as a Food Supplement on Proximate Composition and Growth Performance of <i>Labeo Rohita</i>	82
118. Green Synthesis of Zinc Oxid Nanoparticles (Zno) Using <i>Withania Coagulans</i> Extract and Their Antibacterial Potential against <i>Escherichia Coli</i> in Fish	83

119. Colorimetric Sensing Of Uric Acid by Eco-Friendly Cerium Oxide Nanosheets Synthesized By Parallel Flow Precipitation Method	83
120. Ethnomedicinal Plants Used By the Rural Community of District Abbottabad	84
121. Royal Jelly Mediated Silver Nanoparticles and their Antibacterial Study against Selective Fish Pathogens	84
122. Relative Treatment Efficiency Index of <i>Arundo donax</i> for the Treatment of Cd and Pb in Constructed Wetlands	85
123. Nitrogen and Phosphorus Recovery from Bio-digestate using Sawdust	86
124. Mitigating the impacts of NO _x and PM _{2.5} emissions for health risk awareness of associated labor community of Hattar industrial Estate Population, Pakistan	86
125. Integrated Flood Risk Assessment and Mapping by using Analytical Hierarchy Process in Selected Regions of Sindh and Punjab, Pakistan	87
126. Nickel Doped Graphitic Carbon Nitride Nanocomposite As Enhanced Peroxidase-Mimic For The Colorimetric Sensing Of Hydrogen Peroxide	88
127. Biocontrol Potential of Antagonistic Formulation of <i>Trichoderma</i> Spp Originated From Kohat Fields against Phytopathogenic Fungi in Tomato	88
128. Antibacterial Efficacy of Dimethyl Sulfoxide and Methanolic Extracts of <i>Calotropis Procera</i> against <i>Proteus Mirabilis</i> Isolated From Labeo Rohita	89
129. Synthesis and Characterization of Polyazomethine Zinc-Complexes: Impact On The	90
130. Antimicrobial and Redox Potential	90
131. Comparative Gut Microbiota Assessment in Healthy and Infected Common Carp (<i>Cyprinus Carpio</i>)	90
132. Extraction of Oil from <i>Citrus Aurantifolia</i> as Bio-Based Hardner/Additive for Epoxy Resin	91
133. Conjugated Polyazomethine-Ferrocene Composite as Thermally Resistant, Electroactive Coating: Synthesis and Characterization	91
134. Synthesis and Characterization of Iron and Zinc Oxide Co-Doped Hydroxyapatite for Colorimetric Detection of Nitrite Ion	92
135. Biofilm-Associated Antibiotic Resistance in Clinical Isolates of <i>Pseudomonas aeruginosa</i> : Quantitative Analysis and Assessment of Biofilm Disruption Approaches	93
136. Copper Sulfate Induced Genotoxicity in the Erythrocytes of Rohu (<i>Labeo Rohita</i>)	93
137. Synthesis and Characterization of Sulfone-Linked Hyperbranched Polyazomethine	94
138. Ether as Metal Ion Probe	94
139. Synthesis and Characterization of Sulphonamide Linked Schiff base zinc and copper complexes as Potential Antimicrobial Agent	94
140. Molecular Characterization of Multidrug Resistant <i>Klebsiella pneumoniae</i> Isolates from Diabetic Foot Ulcers with Emphasis on Carbapenem Resistance Genes	95
141. Molecular Characterization of <i>MecA</i> and <i>ErmC</i> Genes Harboursing <i>Staphylococcus Aureus</i> and <i>Staphylococcus Saprophyticus</i> Isolated From Patients with Urinary Tract Infections	96
142. Molecular Screening of Antibiotic Resistance Genes (Qnrs and <i>Blactx-M</i>) Among Biofilm-Forming <i>Escherichia Coli</i> and <i>Pseudomonas Aeruginosa</i>	96

143. Synergistic antibacterial effect of <i>Withania coagulans</i> extract and magnesium nitrate nano-particles against multi-drug resistant bacteria	97
144. Characterization of Bioactive Metabolites from Indigenous Soil-Borne Fungi as a Source of Antibacterial Agent	97
145. Green Synthesis of Copper Oxide Nanoparticles Using Snake Plant (<i>Sansevieria trifasciata</i>) Extract and Their Potency against Multidrug-Resistant Bacteria	98
146. Phytochemical Synthesis of Silver Nanoparticles using Spineless Cactus (<i>Opuntia</i> Spp.) and their Antibacterial and Antioxidant Efficacy against Multidrug-Resistant Bacteria	99
147. Metagenomic Analysis of Microbial Community for Structural and Functional Profiling In Locally Processed Moist Snuff Gum Tobacco	100
148. Occurrence and Molecular Profiling of ESBL-Producing Gram-Negative Bacteria Isolated from Cockroaches in Household, Hospital, and Foodservice Environments	101
149. Mutational Analysis of Carbapenem Resistant Genes in Gram-Negative Bacteria Isolated from Clinical Samples	101
150. Sociolinguistics: Study of language and society	102
151. Pipradrol Derivatives; A New Horizon Of Antimycotics.	103
152. Identification of Quality Genotypes among Cross Breeds of Basmati Rice	104
153. Genome-Wide Analysis Of Psbx-Mediated Response To Drought Stress In Maize (<i>Zea Mays</i> L.): Physiological, Biochemical, And Chlorophyll Fluorescence	104
154. Chemical Seed Priming-Mediated Alleviation of Bisphenol A (Bpa) Stress In Wheat: A Morphophysiological and Biochemical Assessment	105
155. Physio-Chemical Response of <i>Pisum Sativum</i> L. To Biological Synthesized Zinc Oxide Nanoparticles Using A Combination Of <i>Mentha Piperita</i> L. And <i>Coriander Sativum</i> L.	105
156. Green Synthesis of Zinc Nanoparticles Using <i>Cassia Absus</i> Leaves Extract: Evaluation Of Their Bio fertilizer And Biopesticidal Potential In Sustainable Farming	106
157. Elucidating the Effects of Salt Stress on Growth, Physiological and Biochemical Traits of <i>Brassica Rapa</i> L. In Rain-Fed Area and Its Mitigation by Foliar Brassinosteroid Spray	106
158. Morpho-Physiological and Biochemical Responses of Chickpea to Cadmium Chloride and Foliar Brassinosteroid Spray under Rain-Fed Conditions	107
159. Characterization of Multidrug Resistance Bacteria Associated With <i>Rhipicephalus</i> (<i>Boophilus</i>) <i>Microplus</i> Ticks Infesting Cattle, Goats, and Sheep in Rural Areas of District Kohat	108
160. Computational and Phytochemical Evaluation of <i>Ifloga Spicata</i> Constituents against Colorectal Cancer Targets	108
161. Assessment and Pharmacist intervention of rational use of cardiovascular drugs in geriatric patients	109
162. Phytochemical profiling and antibacterial potential of <i>ifloga spicata</i> through analytical and computational study	110
163. Bioinformatic Analysis Of Brain Tissue Gene Expression Profile And Therapeutic Drug Target In Alzheimer Disease	110
164. Network Pharmacology-Based Evaluation of <i>Boerhavia Diffusa</i> Phytochemicals and Their Mechanisms against Prostate Cancer Progression and Treatment	111

165. Hydrothermal Synthesis of Copper Aluminate Nanoparticles and Their Antimicrobial Activity	111
166. Exploring English language	112
167. Fabrication of Zirconia and Sulphur Doped Graphitic Carbon Nitride for Colorimetric Sensing Of Cadmium Ion	112
168. Leveraging XAI for the Earliest Possible Detection of Parkinson's Disease	113
169. A Novel Emotion-Aware Captioning Model: Leveraging Vision Transformers for Visual and Sentiment Alignment	113
170. Prevalence and Molecular Characterization of Antibiotic-Resistant Salmonella Typhimurium Isolated From Poultry In North Waziristan, Khyber Pakhtunkhwa, Pakistan	114
171. Synthesis and Characterization of Cerium Oxide Doped Graphene Oxide Nanocomposite for Removal of Methylene Blue and Methyl Orange Dyes from Water	115
172. Antimicrobial Resistance and Susceptibility in Lady Reading Hospital Peshawar	115
173. Synthesis and Characterization Of Graphitic Carbon Nitride Based Nickel Oxide Nanosheets For The Photocatalytic Degradation Of Chlorophenols And Rhodamine B	116
174. Analysis & Design of IT Policy Framework for e-Police Services Innovation in Pakistan using Discrete Choice Modeling Information Security Approaches	117
175. In-Silico Pharmacokinetics Assessment of Liquisolid Compacts Of Clopedogril and Its Comparison with Conventional Tablets	117
176. Synthesis of cerium oxide Nano sheets by parallel flow precipitation method for the detection of nitrite ion in water	118
177. Hamlet tragic flaw: - A study of the prince hamlet downfall through TO BE OR NOT TO BE....	118
178. Genetics Analysis of Male Infertility In Families From District Bannu	119
179. Genetic Analysis Of Pathogenic Variants In Albino Family From District Kohat, Khyber Pakhtunkhwa	119
180. Genetic Study of Polydactyly Family through Linkage Analysis from District Hangu, Khyber Pakhtunkhwa	120
181. Genetic Diversity of Echinococcus Granulosus from Animal Isolates Based On Nadh Dehydrogenase Subunit 5 Gene	121
182. Genetic Characterization Of Cystic Echinococcus Species In Animal Isolates By Using Mitochondrial Cytochrome B Gene	121
183. Analysis Of Echinococcus Granulosus Strains In Animals By Using Nadh Dehydrogenase Subunit 1 Marker In District Kohat	122
184. Molecular Characterization Of Echinococcus Granulosus Through Internal Transcribed Spacer (Its1) Gene In Small Ruminants Of District Kohat	122
185. Molecular Identification and Phylogenetic Analysis of Fish Fauna of River Indus at Khushal Garh, Khyber Pakhtunkhwa	123

Techno-Functional and Sensory impact of Beetroot Pomace Flour in Biscuits

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Food processing by-products represent an untapped reservoir for value addition in functional food development. This study investigates the utilization of beetroot pomace flour (BPF), a fiber- and antioxidant-rich by-product of juice extraction as a functional ingredient in biscuit formulations to enhance nutritional quality and reduce food waste. Biscuits were developed by incorporating BPF at 10%, 15%, and 20% levels, and evaluated for compositional, rheological, physicochemical, and sensory attributes. Incorporation of BPF led to significant increases in fiber, ash, and protein content, indicating enhanced nutritional value. Rheological analysis revealed altered dough consistency and increased water absorption, attributable to the hydrophilic nature of BPF. Post-baking evaluations demonstrated reduced spread ratio and intensified color due to natural beetroot pigments. Among the formulations, biscuits with 10% BPF achieved the highest sensory acceptability across color, aroma, flavor, and texture, indicating an optimal balance between functional enrichment and consumer preference. These findings highlight BPF's potential as a sustainable and functional ingredient in baked products. The study supports the valorization of agro-industrial waste streams and offers a viable approach to developing nutritionally enhanced, eco-conscious bakery products. Further research on shelf-life and storage stability is recommended to support commercialization.

Keywords: Beetroot pomace flour, food waste valorization, functional biscuits, dietary fiber, sensory evaluation, sustainable food innovation

Enhancing Efficiency and Stability in Perovskite Solar Cells: Pathways to Sustainable Energy Solutions

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Perovskite-based solar cells (PSCs), that provide remarkable power conversion efficiencies or PCEs of over 25%, have become a revolutionary innovation in the field of renewable energy. However, issues with environmental resilience and long-term operating stability are impeding their wider use. This study explores the use of sophisticated material engineering and fabrication processes to improve PSC performance. Developing strong encapsulation techniques, enhancing charge transport layers, and optimizing the composition of the perovskite layer are the main goals of the research in order to shield the cells from external influences. By employing these tactics, the research hopes to produce PSCs with increased productivity and longer lifespans, which will increase their viability for use in commercial settings. Among the expected results is the creation of mass-producible, scalable fabrication techniques that will further the development of renewable energy technology. The findings of this study have important significance for sustainable energy solutions in Pakistan and other advanced and developing countries where energy consumption is rising quickly. In the end, this project hopes to provide light on the way to a future with cleaner and more sustainable energy.

Keywords: Renewable energy, sustainable energy solutions, Material Engineering, fabrication techniques, stability improvement, power conversion efficiency, and perovskite solar cells.

Kinetic and Thermodynamic Study of Surface Modified Adsorbent for the Removal of Direct Blue 15 Dye from Aqueous Medium

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The study was to develop economical, highly effective and easy approachable adsorbent for removal of Direct Blue 15 dye from aqueous solution. For this purpose, the adsorption efficiency of surface modified adsorbent prepared from Parthenium hysterophorus plant was evaluated. The surface modified adsorbent was prepared by treating the carbonized samples of the selected plant with Phosphoric acid and Potassium Hydroxide to get the optimized adsorbent. The prepared adsorbent was characterized by Fourier Transform Infrared spectroscopy (FT-IR), Scanning electron microscopy (SEM) and Energy dispersive X-Rays (EDX) and Pore size analyzer for determination of functional group presence, surface structure, elemental analysis and pore size of the adsorbent respectively. Direct Blue 15 solution was prepared in de-ionized water as target adsorbate to determine the adsorption characteristics of the prepared adsorbent. Different conditions like effect of initial concentration, pH, contact time, adsorbent dose and temperature were examined in adsorption process. In the current study, It was observed that adsorption of the selected dye was high at the beginning and then slow down with time reaching to the equilibrium state. Kinetic and thermodynamic study was conducted. The adsorption equilibrium data was described by Langmuir and Freundlich isotherms. The results show that electrostatic interaction was the main cause of adsorption of the selected dye on the surface of the activated carbon.

Keywords: Adsorbent, Direct Blue 15 dye, Adsorption, Kinetic and Thermodynamic study

Colorimetric Sensing Of Sulfide Using Silver and Zinc Oxide Deposited On Chitosan Nanocomposite

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Although sulfide ions (S^{2-}) are important to many living organisms and ecosystems. However, their excess amount is extremely dangerous to both human health and the environment.

Therefore, a highly sensitive and selective analytical platform for S^{2-} detection in complex microenvironments—especially biological systems—has great significance. In this study a new nanocomposite (silver and zinc oxide nanoparticles deposited on chitosan) was synthesized by using a one-step in situ co-precipitation method. The synthesized materials were confirmed using a number of spectroscopic and microscopic methods. In the presence of hydrogen peroxide, Ag-ZnO chitosan changed 3,3',5,5'-tetramethylbenzidine (TMB) into blue oxTMB, S^{2-} significantly reduced the blue solution to colorless, demonstrating high selectivity toward S^{2-} . The optimal colorimetric change was achieved by optimizing a number of parameters, including pH, material

concentration, TMB concentration, hydrogen peroxide concentration, time, and temperature. The optimized experimental parameters were pH 5, 2.5 mg of material concentration, 10 mM TMB concentration, 12 mM H₂O₂ concentration, 5 minutes of incubation time, and 35 °C temperature. The linear range of the suggested sensor is 0.5–168 μ M, and its R² value is 0.99055. The limit of quantification and detection were to be 1 μ M and 0.3 μ M, respectively. The detection of sulfide ions was unaffected by potential interferers, including cobalt chloride, lead acetate, ascorbic acid, lysine, sodium nitrate, mercurous nitrate, and dopamine. It is suggested that the proposed sensor could be a good substitute for on-site and real-time S²⁻ screening.

Key words: Nanozymes, in situ co-precipitation, 3,3',5,5'-tetramethylbenzidine, sulfide ion detection, peroxidase-like activity, characterization.

Bioengineering of Monometallic and bimetallic (Cu/Zn) nanoparticles for Appraisal of structural features and biological activities

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The present study was piloted to evaluate the anticancer, antiliver and cytotoxic potential of monometallic and bimetallic nanoparticles (NPs) of copper (Cu) and zinc (Zn) synthesized via a green route using a mixture of *Allium cepa* (Onion) and *Zingiber officinale* (Ginger) extract. The structural as well as morphological features of these NPs were studied by ultraviolet visible (UV-Vis) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, X-rays diffraction (XRD) analysis, and scanning electron microscopy (SEM). After characterization, the biological activities such as antimicrobial, anti-cancer on breast cell line (MCF-7), antiliver and haemolytic (cytotoxicity) of the synthesized NPs were evaluated. Generally, the Cu/Zn-NPs exhibited better results as compared to the CuNP and ZnNP. Additionally, synergistic effects were examined when co-administered with the anticancer drug doxorubicin on MCF-7 breast cancer cells by using MTT assay test. Cu/Zn-NPs revealed superior anti-cancer activity against MCF-7 cell line than CuNP and ZnNP. Antiliver activity of both monometallic and bimetallic NPs was tested by determining the % of α -amylase inhibition of HepG2 hepatic cell line. Cu/Zn-NPs (50.54% at 100 μ g/mL) exhibited super antiliver efficiency as compared to CuNP (30.10% at 100 μ g/mL) and ZnNP (32.50% at 100 μ g/mL). Likewise, the tested NPs showed a promising antioxidant activity as determined by DPPH radical scavenging assay (63% at 1500 μ g/mL for CuNP, 71% at 1500 μ g/mL for ZnNP and 81% at 1500 μ g/mL for Cu/Zn-NPs). As a result, a significant variation was noted in the biological potential of synthesized NPs, which can be related to their variable chemical profiling, metallic reducing nature, high penetration power and catalytic properties.

Keywords: Bioactive extracts; Cu/Zn-NPs; MTT assay; MCF-7 cell line; Antimicrobial activity.

Ultrasonication-Enhanced Composite Flour with Apple Pomace for Functional Bakery Innovation

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This study explores the functional and nutritional enhancement of composite flour using ultra-sonication, focusing on a blend of wheat (75%), buckwheat (15%), and apple pomace flour (10%). Apple pomace, a fruit processing byproduct, is rich in dietary fiber and antioxidants, offering a sustainable solution to food waste. Ultra-sonication, a green non-thermal technology, was employed to modify the composite flour's physicochemical properties and improve the quality of a model bakery product namely, breadsticks. Three variants were prepared: BW (100% wheat flour), BC (composite flour), and BU (ultra-sonicated composite flour). Comprehensive analysis revealed that ultra-sonication significantly influenced swelling capacity, bulk and tapped densities, flow ability, and solvent retention capacities. BU showed enhanced swelling (2.63 mL/g) and improved farinograph parameters, supporting better dough handling. Although a slight reduction in oil-holding capacity and protein content was observed post-ultra-sonication, the BU variant demonstrated improved hydration, fiber content, and mineral availability. Breadsticks made from ultra-sonicated flour had acceptable sensory scores while offering improved nutritional profiles, particularly in fiber (8.57%) and ash content (1.47%). The study underscores ultra-sonication's potential to valorize food industry by-products like apple pomace into high-value, functional ingredients, promoting sustainability, affordability, and consumer health.

Keywords: Ultra-sonication, apple pomace, composite flour, functional bakery product, food waste valorization, sustainable processing

Characterization of Lornoxicam nanoparticles using advanced analytical techniques

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Background: Lornoxicam belongs to Class II of the Biopharmaceutics Classification System, characterized by low solubility and high permeability. It is a potent analgesic and anti-inflammatory agent used for the treatment of rheumatoid arthritis and osteoarthritis. The poor water solubility of the drug affects its oral absorption that limits its pharmacological effect and bioavailability. The aim of the present study was to characterize the polymeric nanoparticles of lornoxicam formulated by anti-solvent precipitation method using various advanced analytical techniques.

Methods: Dynamic Light Scattering (DLS), Atomic force microscopy (AFM), Fourier transform Infrared (FT-IR), Thermogravimetric differential scanning calorimetry (TGA-DSC) and X-ray powder diffraction (XRPD) techniques were used for the characterization of nanoparticles.

Results: DLS indicated least average particle size (198.7 ± 2.95 nm) with optimum zeta potential (-16.87 ± 1.95 mV) and lesser polydispersity index (0.225 ± 0.01). AFM revealed spherical, smooth shaped and non-aggregated nanoparticles. FT-IR demonstrated drug polymeric encapsulation

while TGA-DSC and XRPD showed thermally stable, pure and semi-crystalline nanoparticles respectively.

Conclusion: Lornoxicam polymeric nanoparticles complied required standards of nano-dimensions, confirmed by various analytical techniques. This ultimately increases oral absorption and therapeutic effect of lornoxicam.

Keywords: Lornoxicam, nanoparticles, Biopharmaceutics Classification System, characterization.

Development of Moringa-Bitter gourd Tea and its physicochemical, antioxidant, hypoglycemic activities in alloxan induced diabetic Rabbits

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One of the most popular vegetables in Pakistan, bitter gourds have a variety of therapeutic uses, including antibacterial, antiviral, anti-inflammatory, anti-obesity and most promptly antidiabetic effects. It contains charantin, moordin, momordicin, polypeptide-p (plant insulin) and glycosides that lower blood sugar by boosting the liver's production of glycogen and use of glucose. Moringa oleifera is regarded as a wonder tree with multifaceted medicinal potential and great culinary value. In the conventional medical system, it has numerous pharmaceutical uses for the treatment of numerous illnesses. Objectives: The goal of this study was to develop a new antidiabetic tea and to assess its nutritional value, antioxidant properties, and hypoglycemic effects in alloxan induced diabetic rabbits. Methodology: In a tunnel dehydrator, bitter gourds were dried at 60 °C and they were powdered by grinding. The antidiabetic tea was made by combining with moringa leaves powdered, green tea and cinnamon. Alloxan-induced diabetic rabbits (n=5) were used to evaluate its hypoglycemic effects (vivo) and its capacity to scavenge the free radical was assessed by DPPH assay (vitro). Results: According to physicochemical examination, the antidiabetic tea contain 22.41% protein, 14.13% fiber, 0.21% fat, 5.61% ash and 5.26% moisture. At 0.2 mg/ml, this tea's % inhibition (DPPH) was 65.96%, higher than BHA's 45.75% at the same concentration. In hypoglycemic studies, using this tea for 28 days at a dose of 100 mg/kgbw/day resulted in a 59.1% decrease in blood glucose levels ($P < 0.05$) in alloxan induced diabetic rabbits. Conclusion: This antidiabetic tea contains vital amino acids which may be a valuable nutritional source and it is a powerful source of natural antioxidants with the strongest radical scavenging activity. Moreover this tea lowers type II diabetes patients' elevated blood glucose levels, which is significant for alternative medicine discovery and diabetic patient diet recommendations.

Key words: antidiabetic tea, physicochemical analysis, DPPH, hypoglycemic effects

The Impact of Climate Change on Food Security in Pakistan: Challenges and Opportunities.

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Climate change poses significant threats to global food security, particularly in developing countries like Pakistan. Agriculture contributes 19.8% to Pakistan's GDP and employs 42.3% of the workforce. Rising temperatures, changing precipitation patterns, and increased frequency

of extreme weather events impact agricultural productivity, food availability, and accessibility. Objective of this study investigates the impact of climate change on food security in Pakistan, identifying vulnerabilities, opportunities, and potential adaptation strategies.

Methodology: A mixed-methods approach was employed, combining:

1. Literature review of existing research on climate change, food security, and agriculture in Pakistan.
2. Analysis of climate-related data (temperature, precipitation, crop yields) and food security indicators (availability, access, utilization).
3. Stakeholder interviews with farmers, policymakers, and experts.

Results: The study reveals:

1. Temperature increase: 0.7°C rise in average temperature since 1960, negatively impacting crop yields (12% decline in wheat yields).
2. Precipitation variability: 15% decline in water availability, affecting agricultural productivity.
3. Food insecurity: 34% of rural population affected, with 21% increase in malnutrition rates.

Conclusion: Climate change poses significant challenges to food security in Pakistan. However, opportunities exist for climate-resilient agriculture, such as:

1. Climate-smart agriculture: Implementing practices like conservation agriculture and crop insurance.
2. Irrigation management: Improving water management practices to reduce crop vulnerability.

Recommendations: To address climate-related food security challenges in Pakistan:

1. Invest in climate-resilient agriculture (allocate 10% of agricultural budget).
2. Enhance irrigation management (increase water storage capacity by 20%).
3. Support policy development (implement climate-resilient agricultural policies).

Keywords: Climate change, food security, agriculture, Pakistan, climate-resilient agriculture, adaptation strategies.

Optimizing Dehydration Techniques for Carrot Pomace Valorization: Enhancing Nutritional Utility and Sustainability

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Carrot (*Daucus carota*) pomace, a nutrient-rich byproduct of juice production, is often discarded, contributing to food waste and environmental challenges. Valorizing this byproduct into functional food ingredients supports Sustainable Development Goals (SDGs) and addresses consumer demand for healthier, eco-conscious alternatives. This study evaluated the impact of three dehydration techniques namely, dehydrator drying, fluidized bed drying (FBD), and oven drying, on the functional, nutritional and physicochemical properties of carrot pomace flour. Key parameters assessed included drying kinetics, color retention, bulk and tapped densities, oil holding capacity, swelling capacity, and total carotenoid content. FBD exhibited the fastest drying rate (0.0335 g/s) and shortest drying time (5357.14 s), indicating its potential for high-throughput industrial use. Oven drying, however, achieved the lowest final moisture content (87.86%) and highest flowability (Carr's Index: 1.70%), making it suitable for applications requiring enhanced

powder handling. The FBD-treated sample had the lowest bulk density (0.3947 g/mL), beneficial for formulations needing better dispersibility or reduced weight. Dehydrator-dried pomace showed superior oil holding capacity (0.54 g/g), relevant for baked goods and meat analogs where moisture retention and mouthfeel are critical. Meanwhile, both FBD and oven-dried flours exhibited excellent swelling capacity, supporting their use in thickeners, gelling agents, and calorie-reduced foods. The findings demonstrate that the optimal drying technique depends on the intended application, and underscore the value of carrot pomace valorization as a sustainable strategy for circular food system innovation.

Keywords: Carrot pomace, food waste valorization, dehydration, functional ingredients, drying kinetics, circular food systems

Exploration of Brca1 and Brca2 Mutations in Gastric Cancer Patients through Next Generation Sequencing: Implications for Diagnosis and Therapy

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Gastric cancer (GC), also termed stomach cancer, stands as a formidable global health challenge, significantly impacting morbidity and mortality rates. It ranks fifth among the most prevalent cancers and is the third leading cause of cancer-related deaths worldwide, underscoring the urgency to delve into its molecular intricacies. The study aims to characterize BRCA1/2 mutations in Pakistani gastric cancer (GC) patients, identifying unique pathogenic variants and evaluating their potential as diagnostic biomarkers, while also exploring therapeutic avenues for personalized treatment strategies. Methodology: In this study, we investigated the role of Breast Cancer gene 1 (BRCA1) and Breast Cancer gene 2 (BRCA2) mutations in Pakistani GC patients and their functional implications using Next-Generation Sequencing (NGS). Results: Through NGS, we identified a total of 19 mutations in BRCA1 and 11 mutations in BRCA2, all with high mutation quality scores. In silico analysis revealed one pathogenic mutation in BRCA1 and one in BRCA2, indicating a potential link to disease development. Notably, two pathogenic mutations (BRCA1 p.Ala1823Ser and BRCA2 p.Gln92fs) were exclusively observed in the Pakistani GC population, suggesting unique genetic markers. Further examination utilizing The Cancer Genome Atlas (TCGA) data confirmed the absence of these mutations in non-Pakistani GC samples, emphasizing their specificity. Sanger sequencing validated these findings. Real Time Quantitative PCR (RT-qPCR) analysis indicated significantly decreased BRCA1/2 gene expression in samples harboring pathogenic mutations, suggesting their potential as biomarkers for GC diagnosis. Immunohistochemistry corroborated this by showing reduced protein expression levels in mutated samples. Enrichment analysis highlighted associations of BRCA1/2 genes with DNA damage response pathways and cancer-related processes. Drug Bank exploration revealed potential therapeutic agents targeting mutated BRCA1/2, such as Cisplatin and Estradiol, offering new avenues for treatment. Conclusion: Our study identifies novel BRCA1/2 mutations specific to Pakistani GC patients, suggesting a distinct genetic susceptibility profile. These findings not only contribute to understanding GC pathogenesis but also hold implications for personalized treatment strategies in this population.

Keywords: BRCA genes, next generation sequencing, diagnosis, treatment

Green Synthesis of Silver Nanoparticles Using *Plantago Lanceolata* Extract: Characterization, Antibacterial Activity against Multidrug-Resistant Bacterial Pathogens

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Nanotechnology has emerged as a transformative discipline, enabling the design characterization, and application of nanoscale materials with unique physicochemical properties. Among these, silver nanoparticles (AgNPs) have garnered significant attention due to their broad-spectrum antimicrobial potential, particularly against multidrug-resistant pathogens. In this study, we report the eco-friendly synthesis of AgNPs using an aqueous extract of *Plantago lanceolata*, a medicinal plant, and evaluate their antibacterial efficacy against clinically significant bacterial strains. The biosynthesis of AgNPs was confirmed through visual observation (dark brown coloration) and UV-Vis spectroscopy, revealing maximum absorption concentration at the range of peak at 400–500 nm. Fourier-transform infrared spectroscopy (FTIR) identified functional groups (O–H, NO₂, C–F, C–I) involved in nanoparticle stabilization. X-ray diffraction (XRD) analysis confirmed the crystalline, face-centered cubic structure of AgNPs, while energy-dispersive X-ray spectroscopy (EDX) verified elemental silver composition. Transmission electron microscopy (TEM) revealed spherical nanoparticles with an average size of 25 nm. The antibacterial activity of biosynthesized AgNPs and *P. lanceolata* extract was assessed against *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Escherichia coli* using broth microdilution and growth inhibition assays. AgNPs exhibited remarkable efficacy, with minimum inhibitory concentrations (MIC) as low as 3.9 µg/mL against all tested pathogens. Notably, *K. pneumoniae* and *E. coli* showed >90% growth inhibition at 1000 µg/mL, while *S. aureus* demonstrated >60% inhibition at 2000 µg/mL. Uncentrifuged nanoparticle solutions in all concentrations nanoparticles i.e 2000 µg/ml, 1000 µg/ml and 500 µg/ml, displayed significant bactericidal activity, suggesting potential synergistic effects from phytoconstituents. These findings highlight the promise of *Plantago lanceolata*-derived AgNPs as a sustainable alternative to conventional antibiotics, particularly in combating resistant infections. Further studies are secured to elucidate mechanistic pathways and in vivo safety profiles.

Keywords: Green synthesis, silver nanoparticles (AgNPs), *Plantago lanceolata*, antibacterial activity, multidrug-resistant (MDR) pathogens, minimum inhibitory concentration (MIC), Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Energy-dispersive X-ray spectroscopy (EDX), Transmission electron microscopy (TEM)

Managing Diabetes with Novel Drug Discovery: Challenges and Opportunities

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Diabetes mellitus (DM), a chronic and progressive metabolic disease of carbohydrate metabolism, certainly remains one of the most debilitating non-communicable health challenges around the globe. The metabolic disorder is generally characterized by elevated blood glucose levels. According to the International Diabetes Federation, 536.6 million individuals worldwide suffered from type 2 diabetes in 2021, making up around 90% of all occurrences of the disease and is predicted to go up to 783.2 million by 2045. DM severely impacts millions of people worldwide and leads to numerous other serious health problems such as kidney diseases, cardiovascular diseases, obesity, blindness and hypertension adding significant cost to the healthcare system. One of the strategies to manage the hyperglycaemic condition in type 2 patients includes the inhibition of digestion and absorption of dietary carbohydrates. In this perspective, α -glucosidase and α -amylase are the two crucial saccharides hydrolyzing enzymes having an impact on the digestion and breakdown of the carbohydrates. The inhibition of these enzymes has culminated in the implementation of robust prevention programmes in the form of developing effective pharmacological agents with favourable impact on the management of T2DM. The current presentation will highlight some of our recent research efforts in the identification of novel inhibitors of these enzymes showing improved efficacy, potency, and reduced adverse effects thus providing possible future therapeutics to address the challenging diabetic complications.

Triptolide increased mitochondrial fission and decreased fusion in rat liver tissue

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Triptolide, is an active ingredient of Chinese herbal plant TWHF. It has various pharmacological activities but it also has multi-organ toxicities i.e. immunotoxicity, nephrotoxicity and hepatotoxicity. Mitochondrial dynamics, a phenomenon controlled by mitochondrial fusion and fission events, plays an important role in mitochondrial quality control and homeostasis mitochondrial fusion involves a combination of outer mitochondrial membrane and inner mitochondrial membrane of adjacent mitochondria. Several proteins involve in the process of mitochondrial fusion i.e. Mfn1 and Mfn2 are involved in outer mitochondrial membrane fusion and Opa1 takes part in inner mitochondrial membrane fusion. Triptolide treatment to female Wistar rat liver tissues did not change the expression of Mfn2 and Opa1 fusion proteins but decreased Mfn1 protein level. Loss of either Mfn1 or Mfn2 causes disturbance in mitochondrial fusion rates and a decrease in mitochondrial length. Mitochondrial fission is characterized by mitochondrial constriction when endoplasmic reticulum encircles mitochondria, followed by the cytosolic shifting of Drp1, protein having GTPase activity, into mitochondria. Although activation of Fis1 fission protein causes mitochondrial fission, its inhibition did not affect either recruitment of Drp1 to mitochondria or mitochondrial fission itself. Exposure of triptolide to rat liver tissues did not show any effect on Fis1 protein level but increased the Drp1 protein level. Taken together, our results showed that triptolide caused an imbalance in mitochondrial dynamics in liver tissues of female wistar rats.

Keywords: Tripterygium wilfordii Hook f. (TWHF), Triptolide, hepatotoxicity, female Wistar rats, Mitochondria

Use of protein-polysaccharides based delivery system for improve survival of probiotics

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Nowadays, consumers are more interested towards the diet and health benefit of a product. Probiotics products are being introduced in the market due to health-boosting effects. Probiotics are living microorganisms that ingested in sufficient quantity; benefit the health of the consumer. They provide certain health benefits by improving immune system and inhibiting the growth of pathogenic bacteria in the human body. The main challenge is the survival and viability of probiotics because they lose their viability during gastric transit and storage. Lactobacillus plantarum is well known probiotic known to date. Currently research focused on the interaction of protein-polysaccharide interaction and their stability under different environmental conditions. This field opens new horizon to study the texture, behavior and microstructure. The aim of current research was to develop protein-polysaccharide based matrix in different combination to improve survival and viability during gastric transit. Therefore, Lactobacillus plantarum (Lp-05) was chosen for microencapsulation with Soy Protein Isolate (SPI) and CMC. T 5 (3% SPI + 1.5% CMC) showed maximum encapsulation efficiency >80% as compared to other combinations. The survival and viability of encapsulated Lactobacillus plantarum (Lp-05) was investigated through their resistance to simulated gastric juice (SGJ), tolerance to bile salt, release profile in simulated intestinal fluid (SIF) and storage stability during 30 days at 4 °C. The survival rate of free and encapsulated probiotic was 10⁴ Log CFU/ml and 10⁹ Log CFU/ml, respectively. The viable count was significantly higher than non-encapsulated probiotics in simulated gastric juice. The complex of protein-polysaccharides based encapsulates showed maximum viability of probiotics as compared to others. So, protein-polysaccharides in combination is one of the effective encapsulating material for targeted delivery of bioactive compounds.

Keywords: probiotic, protein, survival, encapsulation efficiency, storage stability

Prevalence of Conduct Tendencies in Abbottabad and the Interplay of Emotional Regulation, Temperaments, and Callous Unemotional Traits

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This study investigated the prevalence of conduct tendencies and its relationship with emotional regulation among students in Abbottabad, Pakistan. The sample consisted of 300 students who completed questionnaires on conduct disorder, emotional recognition, temperament and character inventory, and callous-unemotional traits. The prevalence of conduct tendencies in the sample was found to be 25.3%, which is higher than expected. There was a negative correlation between emotional regulation and conduct tendencies ($r = -.028$). This indicates that students with lower emotional regulation scores exhibited higher conduct tendencies. Contrary to

expectations, females reported higher conduct tendencies ($M = 44.20$) compared to males ($M = 40.65$) for overall conduct scores. However, males scored higher on aggressive conduct tendencies ($M = 3.6216$) compared to females ($M = 2.3750$), while females scored higher on non-aggressive conduct tendencies ($M = 11.4342$) compared to males ($M = 10.7432$). The study did not find a significant association between conduct disorder tendencies and callous unemotional traits ($r = .099$, $p > .05$). Expressive suppression showed a significant positive correlation with conduct tendencies, suggesting that students who suppress their emotions are more likely to exhibit conduct problems. The study did not find a significant difference in conduct disorder scores between students from single-parent and two-parent households. These findings emphasize the importance of emotional regulation in understanding and addressing conduct problems. Future research can explore the reasons behind the lack of association between CU traits and CD tendencies in this sample, and investigate culturally-sensitive interventions to improve emotional regulation skills in students exhibiting conduct problems.

Keywords: Prevalence of Conduct tendencies, Emotional Regulation, Emotional Recognition, Temperament and Character, Callous Unemotional (CU) Traits, Conduct Disorder (CD) Tendencies, Correlational Analysis, Gender Differences in Conduct, Aggressive Behavior, Non-Aggressive Behavior, Expressive Suppression. Family Structure and Conduct Problems, Psychological Intervention, Cultural Sensitivity

Assessment of Unveiling the Antimicrobial Properties of Nano Composite Neodymium Sulphide

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Antibiotic resistance is a global health crisis with significant implications for public health. The rise of resistant bacteria threatens the effectiveness of standard treatments and can lead to longer hospital stays, higher medical costs, and increased mortality. Excessive use of antibiotics in human medicine and agriculture accelerates resistance. Antibiotic resistance of urinary tract infections (UTIs) is a growing concern. UTIs are commonly caused by bacteria such as *Escherichia coli* (*E. coli*). Resistance can make these infections harder to treat and can lead to more severe health complications. This global health issue, driving the need for novel and effective antimicrobial agents. Nanotechnology offers a promising avenue for developing such agents. Neodymium sulphide (NdS) nano composite has recently emerged as potential candidates due to their unique physical and chemical properties. Understanding the antimicrobial efficacy of NdS nano composites could pave the way for new applications in medical field. The primary objective of this study is to evaluate the antimicrobial properties of NdS nano composite against a range of bacteria (*E. coli* and *S. aureus*). By investigating the antimicrobial activity of these nano composites, the study aims to determine their potential as alternative antimicrobial agents and to understand the mechanisms underlying their activity. Neodymium sulphide nano composites were synthesized using a chemical method. The process parameters, including temperature, concentration, and pH, were optimized to obtain high-quality NdS nanoparticles. Different methods are used to check the antimicrobial activities of nano composite Neodymium sulphide. Methods that are used to check the antimicrobial activities of nano composite are disk diffusion,

MIC, MBC. Disk diffusion is used to evaluate the inhibitory effects of NdS nano composite against Gram-positive bacteria (e.g., *Staphylococcus aureus*), Gram-negative bacteria (e.g., *Escherichia coli*). Maximum zones of *E. coli* is 20mm (compound is effective against the bacteria) and the maximum zone of *S. aureus* is 25mm (compound is effective against the bacteria). The MIC of NdS nano composite is used to quantify their effectiveness against various pathogens. This study revealed that NdS nano composite exhibit significant antimicrobial activity against bacteria. The results showed that NdS effectively inhibit the growth of tested microorganisms. The antimicrobial effect is likely attributed to the high surface area and unique electronic properties of the nano composite, which facilitate interaction with microbial cell membranes and interfere with their metabolic processes. Present study suggest that NdS nano composite have potential as alternative antimicrobial agents and warrant further investigation into their applications in medical field.

Prevalence of Plasmid-Mediated Quinolone Resistance Genes in *E. Coli* Isolates From Urinary Tract Infections

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Urinary tract infections are the second most common infections after the respiratory infections. This infection occurs in all individuals including male, female, children and elderly people but more common in females. About 81% of all UTI has been reported in female. About 12% males and 40% females suffers from symptomatic UTI once during their lifetime. *Escherichia coli* is responsible for 85% community acquired UTIs and up to 50 % hospital acquired UTI. The knowledge about the frequency of uropathogens in males and females their geographical distribution and trends of their Antimicrobial Susceptibility are the important factors for the proper treatment of UTI. The aim of the present study was to determine the prevalence of Uropathogenic *E. coli* in UTI, to check their antibiotic resistance pattern and determining the prevalence of plasmid-mediated quinolone resistance genes in *E. coli* isolates. The bacterial isolates were collected from indoor and outdoor patients admitted in various hospitals of Multan during time period of June 2024 to January 2025. The isolated *E. coli* strains were tested against 17 antibiotics by using Kirby-Bauer Disc Diffusion method and their results were interpreted according to CLSI guidelines. The minimum Inhibitory concentration (MIC) of *E. coli* isolates were studied against 4 different groups of antibiotics. A total of 254 clinical samples from UTI patients were examined and *E. coli* strains were isolated from 131 patients. The prevalence of UTI was found more in the community (72%) as compared to hospitals (28%). Frequency of females infected with UTI was 60 % and males were 40%. Both males and female patients above the age of 55 also showed higher frequency of UTI. Some cases of UTI among the children of age group 8 to 15 years were also reported. Frequency of UTI was higher in warmers months. Colistin, Fosfomycin and nitrofurantoin were found as most effective drugs for treatment of UTI. *E. coli* showed higher resistance rates to quinolones antibiotics. The MIC of *E. coli* was ranged from 32 to 2058 ug/ml against most of the antibiotics. Most of the *E. coli* strains were multidrug resistance. A total of 30 resistance strains of *E. coli* were selected for PCR amplification. About 70% of the quinolone resistance *E. coli* strains harbour's at least one qnr gene. Out of 30 strains,

17 strains were qnrS positive, 11 strains harbors qnr A and 7 strains found positive for qnr B while qep A gene was not found. Qnr S was more prevalent as compared to qnr A and qnr B. These PMQR genes are responsible for resistance against ciprofloxacin and norfloxacin. This study aimed to inform local physicians about the recent trends of antibiotics resistance to effectively contribute in global data to advance the Surveillance programs. It will help to implement the strategies to control the spread of antibiotic resistance and reduce the risk of treatment failures resulting in cost savings for healthcare systems.

Synthesis and Characterization of Carbon Dots Based Graphene Oxide Nanocomposite for Removal of Methylene Blue and Methyl Orange Dyes

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In this study, carbon dots (CDs) and graphene oxide (GO) were effectively synthesized and mixed to form a CDs-GO nanocomposite for the removal of industrial dyes Methylene Blue (MB) and Methyl Orange (MO) from wastewater. CDs were synthesized using a hydrothermal technique with citric acid as the carbon source, while GO was synthesized using a modified Hummers's method. The nanocomposite was made by distributing CDs on GO sheets under controlled circumstances. The effective synthesis and integration of CDs with GO was validated by characterization techniques. Their synthesis was confirmed by UV-Vis spectroscopy, which showed distinctive absorption peaks at about 270 nm for GO and about 350 nm for CDs. Functional groups including hydroxyl (-OH), carbonyl (-C=O), and epoxy (-C-O-C) were detected by FTIR analysis, indicating successful surface modification. CDs were uniformly distributed between GO sheets, increasing surface area and adsorption efficiency, according to SEM imaging. Additionally, SEM verified that the particles' average size falls between 30 and 70 nm. Batch tests were used to assess the CDs-GO nanocomposite's adsorption and degrading efficiency. Under ideal circumstances, the nanocomposite demonstrated a high degree of dye removal effectiveness, degrading MB by about 81% and MO by about 88%. The synergistic interaction between CDs and GO, which results in increased adsorption activity, was credited with the improved performance.

Targeting MECP2-Driven Deregulation in Rett Syndrome: Epigenetic Therapeutics for X-Linked Neurodevelopment

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Rett syndrome (RTT) is an X-linked neurodevelopment disorder which predominantly affecting females. It is characterized by the developmental regression leading to intellectual disability, autistic features and motor impairments. It is caused by mutations in methyl-CpG-binding protein 2 (MECP2) located on X-chromosome (Xq28), a gene expression regulating protein found in brain. MECP-2 binds to methylated DNA (5-methylcytosine) to recruit corepressors and histone deacetylases (HDACs). The process modifies chromatin structure and which leads to gene silencing. Rett syndrome occurs when these MECP2 undergo alterations, insertion or deletion of amino acids for example due to nonsense mutation on R168 to R168X which causes partial

inclusion of methyl CpG binding domain and loss of transcriptional repression domain leading to formation of a nonfunctional MECP2 protein. The mutated MECP2 hence can't bind to methylated DNA and recruitment of HDACs or other repressors properly. This mutation suppresses the ability of MECP2 to regulate expressions and gene silencing leading to Rett syndrome. Modern researches have advanced epigenetics therapeutics and treatments to a number of disorders and diseases. Recent advanced therapeutics claim to aim at solutions and therapies to Rett syndrome. Gene therapy (gene replacement) includes introduction of MECP2 gene's functional copy to the patient's neurons. This method includes AAV (adeno-associated virus) vectors that provide a medium to induce gene to the brain. This method has shown reversal of Rett-like symptoms. In read through therapy for nonsense mutations full length MECP2 are formed by suppressing the premature stop codon (R168X). Epigenetic modulation includes introduction of HDAC inhibitors (HDACi) and DNA methylation modulators. HDACi helps MECP2 to rebalance and maintain gene expression and chromatin accessibility while DNA modulators reprograms MCEP2 functions by recovering methylation marks. CRISPR is one of the most advancing techniques in epigenetic therapeutics and molecular biology. CRISPR undergoes base edition which modifies and recovers MECP2 variation in the genome. The developments in epigenetics therapeutics have reshaped the understandings of neurodevelopmental disorders while demonstrating the promising strategies that these X-linked conditions may one day be reversible.

Keywords: R168X, methylated DNA, HDACi, reversal of Rett-like symptoms, epigenetic Modulation

Taste Masking Of Ondansetron by Granulation Method

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The objective of this study was to develop a taste-masked oral formulation of ondansetron hydrochloride using the wet granulation technique with hydroxypropyl methylcellulose (HPMC) and ethyl cellulose (EC) polymers. Three formulations were prepared: F1 (HPMC 3%), F2 (EC 3%), and F3 (HPMC:EC 1:1). Granules were evaluated for flow properties, in vitro drug release in simulated salivary fluid (SSF, pH 6.8), and in vivo taste masking in human volunteers. Flow parameters of F3 showed superior characteristics with Carr's Index of 12.73%, Hausner ratio of 1.15, and angle of repose of 26.3°, indicating excellent flow. In vitro analysis revealed significantly reduced drug release from F3 with only 4.8% release after 3 minutes in SSF, compared to 9.3% and 7.5% for F1 and F2, respectively. In vivo evaluation by a panel of 10 volunteers using a 5-point bitterness scale demonstrated that F3 achieved the best taste masking with an average bitterness score of 0.8 ± 0.4 , significantly lower than F1 (1.8 ± 0.6) and F2 (1.5 ± 0.5). Statistical analysis confirmed these findings ($p < 0.001$). The study concludes that wet granulation using a combination of HPMC and EC offers an effective, scalable solution for taste masking of bitter drugs like ondansetron, improving both patient compliance and manufacturability.

Keywords: Taste masking, Ondansetron hydrochloride, Wet granulation, HPMC, Ethyl cellulose, Flow properties, simulated salivary fluid, Pediatric formulation, Bitterness score, In vitro release

Impact of Nutrition Knowledge on Diet Quality and Nutritional Status among Pregnant Women in a Tertiary Care Setting in Northern Pakistan

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Maternal malnutrition remains a persistent public health issue in low- and middle-income countries, particularly in South Asia, where pregnancy increases the demand for essential nutrients. This study examined the influence of nutrition knowledge on diet quality and nutritional status among pregnant women attending Ayub Medical Complex in Abbottabad, northern Pakistan. A cross-sectional survey of 425 women aged 18–45 collected data on demographics, dietary intake, and health indicators using validated tools, including the Healthy Eating Index-2015 (HEI-2015) and the Global Diet Quality Questionnaire (DQQ). Anthropometric measurements and haemoglobin levels were also recorded. Results revealed that 70.6% of respondents had poor nutrition attitudes, 67.8% were anaemic, and only 5.6% displayed good nutrition knowledge. The dietary quality of the participants revealed poor adherence to the Pakistan Dietary Guidelines 2018. Regression analysis indicated a statistically significant positive relationship between nutrition knowledge and both diet quality and body mass index ($p < 0.05$). Women with greater awareness tended to consume more diverse and nutritionally balanced diets, contributing to better overall health. These findings highlight the urgent need to integrate culturally appropriate nutrition education into antenatal care programs to improve maternal and neonatal outcomes in similar settings.

Keywords: Maternal nutrition, nutrition knowledge, pregnancy, diet quality, anemia

Effect of Servant Leadership on Employee Performance: The Moderating Role of Effective Communication in Abbottabad Education Sector

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The purpose of the study was to examine the effect of servant leadership on employee performance: The moderating role of effective communication. The sample of the study was 350 participants (males=137, females=213) with the age range from 25-40 years was selected from private educational institutes of Abbottabad. The participants completed the research instruments which included servant leadership questionnaire, employee performance questionnaire, and effective communication questionnaire. Data is analyzed using reliability analysis, discriminant validity analysis, measurement model and structural equation model (SEM) in the study. The results of the study indicated that Servant leadership has significant effect on employee performance in the education sector. Additionally, the results also indicated that effective communication moderates the relationship between servant leadership and employee performance in the education sector.

Keywords: Servant Leadership, Employee Performance, Effective Communication, Educational Institution, Structural Equation Model

Effect of Training and Development on Employee Turnover Intention and Productivity in Banking Sector of Abbottabad

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The aim of the study was to examine the effect of training and development on employee productivity and turnover intention within the banking sector in Abbottabad. A purposive sample comprising 270 individuals, aged between 25 and 60 years, was drawn from this sector. The participants completed the research instruments which include training and development, turnover intention and employee productivity questionnaire. The data was subjected to statistical analysis using SPSS, incorporating regression and correlation analysis. The findings of the study demonstrated a statistically significant positive relationship between training and development and employee productivity. Conversely, no significant association was identified between training and development and turnover intention.

Keywords: Training and Development, Employee Productivity, Turnover Intention, Regression Analysis, Correlation Analysis, Abbottabad

Food Addiction: A Review of Neurobiological Mechanisms, Contributing Factors, and Intervention Strategies

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Food addiction is increasingly recognized as a public health issue, characterized by compulsive eating behaviors and a diminished ability to regulate food intake, especially in response to highly processed, hyper-palatable foods. These behaviors resemble substance dependence and are associated with adverse health outcomes. This review synthesizes findings from peer-reviewed literature over the past two decades, selected through systematic searches of databases including PubMed, Scopus, and Web of Science using relevant keywords. The evidence highlights that food addiction is strongly influenced by neurobiological mechanisms, particularly dysregulation in dopaminergic and opioid pathways that reinforce cravings and compulsive consumption. Psychological factors such as stress, emotional eating, and habitual behaviors further contribute to the addictive cycle, while genetic predisposition and gut microbiome imbalances affect individual vulnerability. Several intervention strategies have shown promise, including dietary approaches that emphasize glycaemic control and nutrient-dense meal planning, along with behavioral therapies such as cognitive behavioral therapy (CBT), mindfulness practices, and habit-reversal techniques. The review concludes that food addiction is a complex, multifactorial condition requiring an interdisciplinary approach to prevention and treatment. Integrating neurobiological, psychological, and nutritional insights is essential for developing sustainable strategies to address food addiction and improve population health outcomes.

Keywords: Food Addiction, Neurobiology, Cravings, Dietary Interventions, Behavioral Strategies

Effect of Storytelling on Consumer Engagement in Abbottabad

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This study investigates the effect of storytelling on consumer engagement and purchasing behavior in Mandian, Abbottabad. A sample of 103 consumers was selected using convenience sampling. The research aims to assess whether storytelling as a marketing strategy significantly influences consumer purchasing decisions in comparison to traditional marketing techniques, and to explore the relationship between emotional appeal in storytelling and consumer engagement. Data was collected through a structured questionnaire and analyzed using SPSS. Linear regression was applied to examine the effect of storytelling on purchasing decisions, while Pearson correlation was used to assess the relationship between emotional appeal and engagement. The findings indicate that storytelling has a significant positive impact on consumer purchasing behavior, and that emotional appeal in stories is strongly correlated with higher levels of consumer engagement. These results suggest that emotionally-driven storytelling advertisement can be a powerful marketing tool for businesses seeking to build stronger consumer connections and drive purchasing decisions.

Keywords: Storytelling, Consumer Engagement, Emotional Appeal, Purchasing Decisions, Marketing Strategies.

The Influence of Workload Conflict on Job Satisfaction of Employees at Ayub Medical Complex Abbottabad Khyber Pakhtunkhwa

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This study examines how workload conflict affects job satisfaction among healthcare employees at Ayub Teaching Hospital in Abbottabad, Khyber Pakhtunkhwa (KPK), Pakistan. A total of 103 healthcare workers, including doctors and nurses, participated in the study by completing a structured questionnaire. The study highlights that high workload, unclear job roles, and staff shortages contribute to workplace stress and dissatisfaction. The results suggest that improving workload management, clarifying job responsibilities, and promoting better communication can help reduce conflict and improve job satisfaction in hospitals. The findings showed a significant negative relationship between workload conflict and job satisfaction. As workload conflict increases, employees' job satisfaction decreases. These insights can guide hospital administrators to create healthier and more supportive work environments for healthcare professionals.

Keywords: Workload Conflict, Job Satisfaction, Healthcare Employees, Workplace Stress, Hospital Management

The Effect of Toxic Organizational Politics on Job Satisfaction of Private School Teachers In Mirpur Abbottabad

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This study examines how toxic organizational politics affect job satisfaction among private school teachers in Mirpur Abbottabad. Data was collected from 96 private school teachers using an online questionnaire. This research used SPSS to analyze data with both descriptive and inferential statistics. It examined the relationship between job satisfaction (JS) and task or organizational performance (TOP). The results show that toxic organizational politics lead to higher stress, lower motivation, and burnout, resulting in a negative relationship with job satisfaction and making it harder for teachers to stay engaged and perform well. The findings highlight that teachers exposed to toxic politics are more likely to feel emotionally drained and may consider leaving their jobs. To improve the situation, schools need fair policies, strong leadership, and better support systems to reduce the impact of toxic politics and create a healthier work environment. This study emphasizes the importance of addressing these challenges to improve teacher job satisfaction and retention.

Keywords: Burnout, Turnover intention, Job performance, Teacher morale, Job satisfaction

Effect of Brand's On Female Consumer's Buying Behavior in Supply, Abbottabad

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This study explores the effect of branding on the buying behavior of female consumers in Supply Abbottabad, with a focus on how brand image and brand positioning affect their preferences and decision-making processes. A quantitative research methodology was used, and data was collected through a structured online questionnaire distributed via Google Forms. The sample consisted of 100 female respondents from various demographic backgrounds, primarily urban areas, who provided insights into their attitudes toward branded fashion clothing. Using descriptive statistics and, the study found that branding significantly influences female consumers' buying behavior. The study reveals that brand loyalty among educated female consumers in Supply Abbottabad is driven by consistent messaging, emotional connection, and trust. At the same time, external influences like peer pressure, celebrity endorsements, and social media marketing play a significant role in shaping purchasing decisions. Ethical branding and sustainability have also emerged as important considerations for this demographic.

Keywords: Consumer Buying Behavior, Brand Loyalty, Social Media Marketing, Ethical and Sustainable Branding

Effects of Job Stress on Employees Performance in Simplexmed Company Abbottabad Khyber Pakhtunkhwa.

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This research investigates the effects of job stress on employee performance at Simplex Med, a billing company located in Abbottabad, Khyber Pakhtunkhwa. The study adopted a quantitative research design, utilizing a structured, self-administered questionnaire to collect data from a purposive sample of 108 employees. Data analysis was conducted using SPSS software, applying descriptive statistics, correlation, and regression analysis to interpret the findings. The results revealed a significant negative relationship between job stress and employee performance, suggesting that increased stress levels lead to decreased efficiency and effectiveness among employees. The study emphasizes the importance of implementing effective stress management strategies to enhance employee well-being and overall organizational productivity. These insights can help management foster a healthier work environment and improve operational outcomes.

Keywords: Job Stress, Employee Performance, Workplace Productivity, Organizational Behavior, Stress Management

The Effect of Autocratic Leadership Style on Employee Performance

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This study examines how autocratic leadership style affects employees work at Post Graduate College Mandian Abbottabad. The aim of this research is to see the connection between autocratic leadership and employee performance. The sample of 103 staff members answered structured questionnaires. The data was analyzed using SPSS, with Pearson correlation and regression tests. The results show that there is a strong negative link between autocratic leadership and employee performance. This means that when autocratic leadership increases, employee performance goes down. The regression test shows that autocratic leadership accounts for 72.3% of the changes in employee performance. Although autocratic leadership can help with clear rules and fast decisions, it can lower motivation, creativity, and work performance in colleges. The study suggests that leaders should use a more balanced style to help staff feel more involved and improve results in the institution.

Key Words: Autocratic leadership, Employee performance, Academic institutions, Quantitative research, Regression analysis

Effect of Online Shopping On Consumer Buying Behavior in Government Home Economics College, Abbottabad

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The aim of this study is to examine the effect of online shopping on consumer buying behavior among individuals at Government Home Economics College, Abbottabad. A sample of 109 respondents was selected from online shoppers within the college. Participants completed a

structured questionnaire measuring online shopping behavior and consumer buying tendencies. The data was analyzed using regression and correlation analysis to determine the significance of the relationships among variables. The results of the study indicate that online shopping has a significant effect on consumer buying behavior. Additionally, factors such as security, trust, and convenience significantly influence online purchasing decisions. However, the study also highlights potential drawbacks, such as impulse buying tendencies and difficulties with online returns.

Keywords: Online Shopping, Consumer Buying Behavior, E-Commerce, Digital Marketing, Impulse Buying, Consumer Decision-Making.

The Effect of Laissez-Faire Leadership on the Job Satisfaction of College Teachers in Abbottabad

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This study examines the effect of laissez-faire leadership on job satisfaction among college teachers in Abbottabad. A total of 80 participants were selected through convenience sampling from various colleges in the region. Data was collected using a structured questionnaire that measured perceptions of laissez-faire leadership and levels of job satisfaction. The responses were analyzed using linear regression in SPSS to determine the effect of leadership style on satisfaction levels. The results revealed a significant negative effect of laissez-faire leadership on job satisfaction, indicating that passive leadership practices reduce motivation and workplace fulfillment among teachers. The study highlights the importance of active and supportive leadership in fostering higher levels of job satisfaction in educational institutions.

Keywords: Laissez-faire Leadership, Job Satisfaction, College Teachers, Educational Leadership, Abbottabad.

The Effect of pricing on consumer buying behavior in Jinnah Abad, Abbottabad

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The research aims to evaluate how different pricing strategies influence consumers' psychology and their purchasing decisions. A sample size of 109 participants from Jinnah Abad, Abbottabad, was collected using a structured questionnaire, yielding valid responses that provided valuable insights for analysis. The data was analyzed using SPSS software. Results indicate a positive relationship between pricing and consumer buying behavior. While no significant differences were found in responses based on factors such as age, gender, marital status, education, or monthly income regarding the three pricing strategies (odd pricing, bundle pricing, and discount pricing), a significant difference was noted between genders in responses to the odd pricing strategy.

Keywords: Buying behavior, odd even strategy, bundle strategy, discount strategy, Consumer Psychology.

Barriers to Entry for Women in Entrepreneurship in Abbottabad, Upper Kehal

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This study explores barriers to women entrepreneurship in Upper Kehal, Abbottabad, with a focus on social, cultural, and resource-based challenges. Using a sample of 86 women, data was collected through a structured questionnaire to examine the effect of societal norms, access to resources, and the role of supportive policies in influencing entrepreneurial participation. The results, analyzed using SPSS through descriptive statistics, correlation, and regression analysis, revealed that social and cultural constraints remain the most significant barriers. Additionally, lack of access to capital, training, and networks further limits women ability to start and sustain businesses. Furthermore, the study also emphasizes the need for targeted interventions to overcome gender-specific barriers and promote inclusive economic development.

Keywords: Women Entrepreneurship, Social Barriers, Resource Access, Supportive Policies, economic development.

Personality Traits and Green Mind Indicators: Investigating the Role of Value Orientation

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This study explores the role of Light Triad and Dark Triad personality traits in predicting eco-anxiety in young adults, with a particular focus on the mediating role of value orientation. A convenience sample of 300 participants ($M = 24.3$; $SD = 3.4$) completed four standardized measures: the Light Triad Scale (Kaufman et al., 2019), the Dirty Dozen Scale (Jonason & Webster, 2010), the Hogg Eco-Anxiety Scale (Hogg et al., 2021), and the Short Schwartz Value Survey (Schwartz et al., 2012). Correlational analyses indicated a significant negative association between Light Triad traits—reflecting Kantianism, humanism, and faith in humanity—and eco-anxiety ($r = -.28$, $p < .001$), whereas dark triad traits—comprising Machiavellianism, narcissism, and psychopathy—were positively associated with eco-anxiety ($r = .32$, $p < .001$). Value orientation was inversely related to eco-anxiety ($r = -.20$, $p < .01$), positively correlated with light triad traits ($r = .25$, $p < .001$), and negatively correlated with dark triad traits ($r = -.18$, $p < .01$). Regression analyses revealed that light triad traits predicted lower eco-anxiety ($B = -.036$, $SE = .021$, $\beta = -.099$, $t(298) = -1.72$, $p = .08$, $R^2 = .010$), whereas dark triad traits significantly predicted higher eco-anxiety ($B = .04$, $SE = .015$, $\beta = .218$, $t(298) = 3.20$, $p = .002$, $R^2 = .048$). Mediation analysis using PROCESS Model 4 demonstrated that value orientation significantly mediated the relationship between dark triad traits and eco-anxiety (indirect effect = .01, 95% CI [.004, .023]), but did not mediate the association between light Triad traits and eco-anxiety (indirect effect = $-.008$, 95% CI $[-.019, .001]$). These results highlight divergent psychological mechanisms by which benevolent and malevolent personality dimensions influence ecological distress and suggest that cultivating pro-environmental values may mitigate the adverse effects of dark triad traits while enhancing the protective role of light triad traits.

Keywords: eco-anxiety; Light Triad; Dark Triad; value orientation; mediation; personality traits; climate psychology; young adults

Relationship between Mobile Phone Addiction, Delayed Sleep Phase Syndrome and Aggression among Adolescents and Adults

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This study aimed to explore the relationship between mobile phone addiction, delayed sleep phase syndrome (DSPS), and aggression, and to examine demographic differences (age, gender, and family structure). A quantitative cross-sectional survey design was used. Data were collected from 300 participants through convenience sampling. Informed consent was obtained, and data were gathered using the Smartphone Addiction Scale-Short Version (SAS-SV), the Delayed Sleep Phase Syndrome Scale, and the Reactive-Proactive Aggression Questionnaire (RPQ). The results indicated a significant positive correlation between mobile phone addiction and delayed sleep phase syndrome ($r = .210$, $p < .01$) as well as between mobile phone addiction and aggression ($r = .188$, $p < .01$). Conversely, a negative correlation was observed between delayed sleep phase syndrome and aggression ($r = -.188$, $p < .01$). Findings related to demographic factors showed that adolescents scored significantly higher than adults on mobile phone addiction ($t(298) = 2.167$, $p = .031$), delayed sleep phase syndrome ($t(298) = 2.347$, $p = .020$), and aggression ($t(298) = 1.976$, $p = .049$). Gender comparisons indicated that males scored higher than females on mobile phone addiction ($t(298) = 2.29$, $p = .023$), delayed sleep phase syndrome ($t(298) = 2.16$, $p = .032$), and aggression ($t(298) = 2.50$, $p = .013$). Furthermore, individuals from nuclear families reported greater levels of mobile phone addiction compared to those from joint families ($t(298) = 1.986$, $p = .048$). This study establishes significant associations between mobile phone addiction, delayed sleep phase syndrome, and aggression. The findings underscore the elevated risks associated with mobile phone addiction, particularly among adolescents, males, and individuals from nuclear families. The results suggest an urgent need for interventions aimed at mitigating the adverse effects of mobile phone addiction on sleep and aggression.

Keywords: Mobile phone addiction, Delayed sleep phase syndrome and Aggression.

Correlational study on impulsivity, mind wandering and emotional reactivity among adolescents and emerging adults

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This study aimed to explore the correlation between impulsivity, mind wandering, and emotional reactivity, and to examine demographic differences (age, gender, and family structure). A quantitative cross-sectional survey design was used. Data were collected from 300 participants through convenience sampling. Informed consent was obtained, and data were gathered using the Barratt Impulsiveness Scale Revised (BIS-21), Mind Wandering Questionnaire (MWQ), and Emotion Reactivity Scale (ERS). The results indicated a significant positive correlation between impulsivity, mind wandering and emotional reactivity ($p < .01$). Findings related to

demographic factors showed that adolescents scored significantly higher on mind wandering ($t = 2.11$, $p = .035$), impulsivity ($t = 2.32$, $p = .021$), and emotional reactivity ($t = 3.11$, $p = .002$). Gender comparisons indicated that females scored higher than male on mind wandering ($t = -3.01$, $p = .003$), impulsivity ($t = -1.95$, $p = 0.52$), and male scored higher than female on emotional reactivity ($t = -4.88$, $p = .000$). Furthermore, individuals from nuclear families reported greater levels of impulsivity as compared to those from joint families ($t = 2.981$, $p = .003$). The study highlights the intricate relationships between impulsivity, mind wandering, and emotional reactivity, suggesting interventions targeting these processes could enhance emotional regulation and reduce impulsive behaviors.

Keywords: Impulsivity, Mind Wandering and Emotional Reactivity.

The Social Anxiety and Its Impact on Emotional Regulation, Academic Performance and Social Media Usage Pattern among College Students

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This study explored the impact of social anxiety, emotional regulation, and social media usage on academic performance among college students. With increasing mental health concerns in academic populations, understanding these variables is essential for promoting student wellbeing and success. A total of 300 undergraduate students aged 18 to 25 participated in this descriptive cross-sectional, quantitative study. Data were collected using standardized instruments: the Social Phobia Inventory (SPIN), Emotion Regulation Questionnaire (ERQ), Social Media Use Scale (SMUS), and Academic Performance Scale (APS). Descriptive statistics, Pearson correlations, and multiple regression analyses were conducted using SPSS. The results revealed a significant negative correlation between social anxiety and emotional regulation ($r = .15$, $p < .01$), as well as a modest but significant positive correlation between social anxiety and social media usage ($r = .159$, $p < .01$). However, regression analysis showed that neither social anxiety ($\beta = -.087$, $p = .139$) nor emotional regulation ($\beta = .013$, $p = .818$) significantly predicted academic performance, with the combined model explaining only 0.8% of the variance ($R^2 = .008$). Additionally, social media usage showed no significant relationship with academic outcomes ($r = .023$, $p = .689$). These findings suggest that while social anxiety is linked to emotional regulation.

Relationship between Parenting Styles and Maladaptive Cyber Behaviors with Mediating Role of Emotional Regulation; among adolescents and Young Adults

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This study examined the relationship between perceived parenting styles and maladaptive cyber behaviors—specifically cyber addiction, cyber aggression, and cyber gossiping—among adolescents and young adults in the Pakistani context. A total of 300 participants aged 15 to 35 years ($M = 22.94$, $SD = 3.89$) were recruited using convenient sampling. The Perceived Parenting Style Scale (Reitman et al., 2002), Cyber Addiction Scale (Zhou & Zhou, 2020), Cyber Aggression Scale (Patchin & Hinduja, 2015), and Cyber Gossiping Scale (Farley et al., 2015) were used to assess the relevant constructs. Descriptive statistics showed moderate levels of

cyber addiction ($M = 46.07$, $SD = 8.94$), cyber aggression ($M = 9.01$, $SD = 6.89$), and cyber gossiping ($M = 8.61$, $SD = 6.89$). Correlational analysis revealed that authoritarian and permissive parenting were positively associated with cyber addiction ($r = .25$, $r = .24$) and aggression ($r = .26$, $r = .15$), while authoritative parenting was negatively correlated with aggression ($r = -.13$) and positively associated with adaptive behavior ($r = .35$). Regression analysis confirmed that authoritarian parenting significantly positively predicted cyber aggression ($\beta = .26$) and gossiping ($\beta = .14$), whereas permissive parenting significantly positively predicted cyber addiction ($\beta = .18$). Authoritative parenting negatively predicted aggression ($\beta = -.13$).

Keywords: parenting styles, cyber addiction, cyber aggression, cyber gossiping, Pakistani adolescents, young adults, digital behavior

Examining Imposter Syndrome among Educators in Pakistan: The Role of Childhood Trauma, Gender Role Conflict, and Societal Expectations

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Imposter syndrome (IS) is a universal psychological phenomenon characterized by persistent self-doubt and fear of being exposed as incompetent, irrespective of evident success. It is a critical yet underexplored issue among educators who hold significant responsibility towards shaping the intellectual, emotional, and moral development of children and young adolescents. The education sector in Pakistan, is characterized by high job pressure, a culturally collectivist and gender normative environment. To contribute to the existing literature, this study addresses a timely research topic by examining a complex interplay of these factors and their potential impact on IS in the education sector. We used a sample of educators ($N=300$; male = 150, female =150) with the age range of 25 and 60 through a convenience sampling technique in the region of Khyber Pakhtunkhwa, Pakistan. The results show a moderate significance of IS by intersecting social, cultural, psychological, and development variables. Unmarried educators possessing childhood trauma, GRC, and those who are under high societal pressure reported significantly higher IS as compared to their married counterparts. This highlights the alleviating effect of spousal support within familial validation systems. Additionally, no significant gender differences were found. Furthermore, the results of mediation analyses show that GRC and social expectations particularly mediate the relationship between trauma and IS. It is concluded that there is a need for culturally tailored, trauma informed interventions and public policies that aim to address gender norms to mitigate impostor syndrome feelings among educators in Pakistan's unique sociocultural and economic context.

Keywords: imposter syndrome, childhood trauma, gender role conflict, societal expectations, educational professionals, Pakistan.

Assigning Gender to English Loanwords in Khattak Dialect of Pashto Language

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This thesis attempts to examine the ways and means through which grammatical gender is assigned to English loanwords in Khattak dialect of Pashto language. In terms of gender

assignment, agreement, the portions of speech impacted by it, and gender allocation, there is a significant variance between various languages. Nouns can be categorized into distinct grammatical genders in a variety of ways. Native speakers can determine the gender of a particular noun with the use of the gender assignment rules in a grammatical gender system. This study focuses on the ways the gender is marked for English loanwords borrowed in Khattak dialect of Pashto language and different measures taken or parameters adopted in assigning gender to them. Using Corbett's (1991) model of gender assignment as a framework model, a perceptive and innovative research design that best suited the current and continuing research in the Pakistani setting was created. The categories Corbett uses to categorize the gender assignment system are semantic and formal categories which are further divided into different sub-categories. The nature of the current study is qualitative. Additionally, the study uses a descriptive method of analysis. The findings show that meaning-based cues usually decide gender, followed by sound patterns, while grammatical endings only support what has already been assigned. These results highlight that gender assignment in Pashto follows a clear and consistent pattern, even with borrowed words. The issues of gender assignment, borrowing, code mixing, and gender marking in the Pakistani context gain prominence in this study. With relation to the interaction of English and Pashto, the researcher believes that this research will not only aid in understanding the nature of these processes in Pakistan but will also raise awareness of the need for more research in the area.

Keywords: Gender, Grammatical Gender Assignment, Gender Marking, Agreement, Amount and Place of Marking, Loanwords, Gender Assignment System, Semantic System, Formal System, Code mixing, English, Khattak dialect of Pashto.

Synthesis, Characterization, Antioxidant and Antimicrobial Activity of Organotin (IV) Based Polyvinyl Chloride Composites

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Organotin (IV) complexes are a class of organometallic compounds known for their promising biological activities, including antimicrobial, antioxidant, and anticancer effects. In this study, organotin (IV) complexes were synthesized using oxygen and nitrogen donor ligands and their structural features were investigated using FT-IR, UV-Visible and NMR spectroscopy. These characterized complexes were then incorporated into polyvinyl chloride (PVC) through solvent casting to prepare bioactive composites. The antioxidant potential of the composites was evaluated using the DPPH radical scavenging assay, while antimicrobial activity was tested against selected bacterial and fungal strains using agar diffusion, MIC, and MBC methods. The organotin (IV) based PVC composites showed significant inhibition zones against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Aspergillus Niger* indicating strong antimicrobial properties. The prepared composites demonstrated enhanced biological activity due to the synergistic interaction between the organotin (IV) complexes and the PVC matrix. This study provides a simple and effective approach to develop functional PVC-based materials with improved antimicrobial and antioxidant performance for potential use in healthcare and industrial applications.

Keywords: Organotin (IV) complexes, PVC composites, antimicrobial activity, antioxidant, DPPH assay, MIC, MBC.

Synthesis and Characterization of Iron-Cerium Oxide Decorated Mxene Nanocomposites for Colorimetric Detection of Dopamine

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Dopamine is one of the most important neurotransmitters, playing a crucial role in the renal, cardiovascular, and central nervous systems. However, abnormal levels of dopamine can cause serious health complications including Parkinson's disease, schizophrenia, and cardiovascular diseases, making its accurate detection essential for clinical diagnosis and monitoring. In the present work, iron-cerium oxide decorated MXene (Fe-CeO₂/MXene) nanocomposites were synthesized through an in-situ hydrothermal method and characterized using various analytical techniques such as FTIR, elemental mapping, EDX, SEM, TEM, XRD, and XPS. The synthesized Fe-CeO₂/MXene nanocomposites were successfully applied for the colorimetric detection of dopamine in blood samples. The Fe-CeO₂/MXene nanocomposites demonstrated excellent peroxidase-like activity analogous to horseradish peroxidase (HRP), effectively catalyzing the H₂O₂-dependent oxidation of 3,3',5,5'-tetramethylbenzidine (TMB) to yield a distinct blue-green colored product. The blue-green color of the reaction system disappeared rapidly and proportionally with increasing dopamine concentration, providing a visual detection mechanism. To achieve optimal sensor performance, various experimental parameters were systematically optimized including nanozyme amount, pH, TMB concentration, H₂O₂ concentration, incubation time, temperature, and dopamine concentration. The proposed colorimetric sensor exhibited a wide linear range of 1-117 µM with very low limits of detection (0.29 µM) and quantification (0.97 µM), and correlation coefficient (R²) of 0.99667. The sensor demonstrated rapid response kinetics with a short response time of 3 minutes at physiological temperature and showed sensitivity and selectivity towards dopamine over other interfering substances. The proposed sensor has potential applications for dopamine detection in physiological samples such as blood and urine.

Keywords: Dopamine Detection, Fe-CeO₂/MXene Nanocomposites, Colorimetric Sensor, Nanozyme Activity, Peroxidase mimetic activity

Acquisition of Grammatical Gender in Urdu: A Longitudinal Case Study of a Child from 18 to 48 Months Age

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This study explores the acquisition of grammatical gender in Urdu as a first language through a longitudinal case study of a child, observed between the ages of 18 and 48 months. The research aims to examine error patterns, the approximate time required for accurate acquisition, and the

cognitive stages involved in the mastery of gender rules. The study builds upon the theory of Universal Grammar, which posits that children possess an innate linguistic mechanism that facilitates the rapid internalization of syntactic and morphological rules. Despite consistent exposure to correct gender usage in input, children tend to make systematic errors before reaching full mastery of the adult grammatical system. These errors are not arbitrary but reflect the child's own developing grammar. The study finds that comprehension of gender structures emerges before productive use and that multiple incorrect attempts often precede stable acquisition. The complexity of the gender assignment system, the quality of available linguistic cues, and interactions with other grammatical features significantly influence the pace of acquisition. Although English has been extensively studied in first language research, relatively little is known about the acquisition of Urdu grammar, especially gender, despite its rich morphological structure. The findings from this research are expected to support language educators and curriculum developers in designing more effective English language teaching materials for Urdu-speaking learners by accounting for cross-linguistic transfer from a highly gendered language to one that lacks grammatical gender.

Keywords: Grammatical Gender, Urdu, First Language Acquisition, Morphological Development, Language Transfer.

Design, Stability and In-Vivo evaluation of Plant Based W/O emulsions as safer alternatives for Dermatological Disorders

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Dermatological disorders, often chronic and debilitating, are frequently managed with synthetic corticosteroids that carry risks of long-term adverse effects. This study aimed to develop and non-invasively evaluate topical creams incorporating ethanolic extracts of *Curcuma longa*, *Ocimum sanctum*, and *Matricaria chamomilla* for their antioxidant, antimicrobial, and skin-modulating properties. Phytochemical analysis confirmed the presence of beneficial compounds. All three plant extracts exhibited significant antioxidant activity (DPPH scavenging: *O. sanctum* 91.09%, *C. longa* 81.98%, *M. chamomilla* 72.63%) and antimicrobial activity against *Staphylococcus aureus* (zones of inhibition: *C. longa* 15.86 mm, *O. sanctum* 13.60 mm, *M. chamomilla* 10.60 mm). The developed water-in-oil (W/O) emulsions demonstrated excellent physical and chemical stability over 90 days across various temperature conditions (8°C, 25°C, 40°C, 40°C+75% RH), maintaining consistent pH and pseudoplastic flow. Non-invasive in-vivo evaluation on human volunteers revealed promising dermatological benefits: all three plant-based formulations significantly reduced skin melanin (up to -12.24% for *C. longa*), indicating potential for hyperpigmentation treatment. *C. longa* and *O. sanctum* significantly reduced skin erythema (up to -12.24% for *C. longa*). All three significantly increased skin hydration (up to 106.57% for *C. longa*). *O. sanctum* and *M. chamomilla* significantly improved skin elasticity (up to 10.18% for *M. chamomilla*). *C. longa* and *O. sanctum* significantly reduced skin sebum (up to 72.12% for *C. longa*). These findings collectively support the therapeutic potential of these plant

extracts in dermatological formulations, offering safer, effective alternatives for managing various skin disorders, including eczema and hyperpigmentation.

Keywords: Antioxidant, Antimicrobial, Non-invasive in-vivo evaluation, Eczema, Skin Disorders

Antibacterial Efficacy of Ethanolic and Methanolic Extracts of *Withania Coagulans* against *Escherichia Coli* Isolated From *Labeo Rohita*

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The present study was conducted to assess the antibacterial potential of methanolic and ethanolic extracts of *Withania coagulans* (commonly known as Shapyanga) against *Escherichia coli* isolated from the gut and muscle tissues of *Labeo rohita*. Ten samples were collected and subjected to standard microbiological techniques including 10-fold serial dilution, Gram staining, and selective culturing. Two dominant bacterial isolates were identified and biochemically characterized through oxidase, catalase, coagulase, motility, indole, Triple Sugar Iron (TSI), and Phenol Red Glucose Fermentation Test (PRGFT). Sample 1 exhibited a classic *E. coli* profile: Gram-negative, oxidase-negative, catalase-positive, indole-positive, motile, and capable of fermenting glucose with gas production, without H₂S in TSI, supporting its identification as *E. coli*. In contrast, Sample 2 was Gram-negative but oxidase-positive, indole-negative, non-motile, catalase-negative, and H₂S-producing, suggesting it was not *E. coli* and potentially a member of *Pseudomonas*, *Aeromonas*, or *Proteus* genera. Antibacterial efficacy of *W. coagulans* extracts was evaluated using the agar well diffusion method at three concentrations (2 mg/mL, 4 mg/mL, and 6 mg/mL). Among methanolic extracts, M6 showed the highest zone of inhibition (14.00 ± 0.1 mm), followed by M4 (12.33 ± 0.57 mm) and M2 (10.33 ± 0.57 mm). Ethanolic extracts showed similar trends, with E6 (13.50 ± 0.58 mm), E4 (12.80 ± 0.82 mm), and E2 (9.50 ± 0.58 mm). The activity of both extract types increased with concentration, indicating a dose dependent antibacterial effect. Statistical comparisons revealed no significant differences between M2 and E2 ($p = 0.828036$), or M2 and E4 ($p = 0.609277$), showing comparable efficacy of the extracts at lower concentrations. These findings demonstrate that *Withania coagulans* possesses strong antibacterial properties against *E. coli*, particularly at higher concentrations, and could serve as a promising plant based alternative to antibiotics in aquaculture to combat bacterial infections, reduce antimicrobial resistance, and support sustainable fish farming practices.

Impact of Medicinal Plants Extracts On Shelf Life of Selected Fruits and Vegetables

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Fruits and vegetables play a fundamental role in a balanced diet, promoting overall health and well-being. Fruits and vegetables undergo post-harvest spoilage because of their delicate nature

resulting in economic loss. To improve the shelf life of fruits and vegetables, medicinal plant extracts are very promising in enhancing the shelf life. In present study, medicinal plants (*ziziphus mauritiana*, *canna glauca*) aqueous extracts were prepared by Soxhlet extraction followed by phytochemical investigation, antimicrobial activity and applied as edible coating to check the efficacy in extending shelf life of fruit and vegetables such as peaches, guavas, tomatoes and round gourds. Dipping method was used for the coating of fruits and vegetables in triplicates as reported in literature. Daily observation of coated fruit and vegetable was done to monitor colour texture firmness changes and sign of microbial attack recorded for two months at room temperature. The result showed the presence of flavonoids, phenols, alkaloids, saponins, tannins, carbohydrates and diterpenes and high content of total flavonoids and phenolics content (TFC and TPC) in plant extracts. The result showed that edible coating with plant extracts prevented the fruits and vegetables from microbial attack and deterioration due to its antibacterial and antifungal properties. Edible coating with plant extract treated fruits and vegetables had the maximum shelf life in contrast to all other treatments including the control. In conclusion these plant extracts are effective in extending the shelf life of fruits and vegetables.

Keywords: Medicinal plant, Edible coating, phytochemical investigation, Antimicrobial activity, Shelf life.

Utilizing Context-Aware Fusion for Transformation of 2d Images to 3d Models

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The improvement of DNN optimized the bounds for the estimation of the 3D shapes using images of several objects. Despite several approaches that demonstrate real-world application possibilities, they continue to fall short of extracting the detail-level reconstruction that input images often contain. Using DL techniques to execute the recovery of object shape from images, previous works (like 3D-R2N2) implement RNN to singularly parse feature maps from each provided image, creating a sequential synthesis. However, reconstructing images with set orders is a problem most RNN-based models face, producing wildly divergent results despite consistent inputs. From early input the important features of images are often forgotten due to the loss of the RNN with respect to long-term memory. Proposing a framework that can reconstruct objects for single as well as multi view, we address these issues with VoxFusion. Each image can be provided to a custom encoder-decoder which constructs a coarse estimate of the 3D volume which then undergoes further processing. They are then cleverly selected to integrate multiple context-conscious fusion modules from all coarse volumes and reconstruct the fused volumes. For the correction of wrongly recovered components, a refiner is used and then it produces the final output. Our model is compared with SOTA methods in accuracy and efficiency, and the experimental results show that it performs favorably on the ShapeNet, Pix3D, and Things3D benchmarks.

Challenging Toxic Masculinity: A Critical Discourse Analysis of Resistance in Pakistan's Aurat March

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The Aurat March is a contemporary feminist movement in Pakistan that has, over the past five years, acted as a catalyst for socio-political change. It provides a powerful platform for women's solidarity and challenges entrenched gender norms through public activism. This movement has evolved into a nationwide phenomenon marked by collective action, creative expression, and pointed feminist critique—particularly through its lingual and visual culture in slogans. This study examines how the Aurat March challenges dominant toxic masculine discourse by analyzing 50 visual materials (posters, banners, and postcards) collected from marches held between 2018 and 2023. The analysis is guided by Norman Fairclough's three-dimensional model of Critical Discourse Analysis (CDA), which allows for a socio-linguistic reading of the visual and verbal elements of protest material. By foregrounding feminist resistance embedded in language and imagery, this research highlights how visual discourse becomes a site of contestation against patriarchy in contemporary Pakistan.

Keywords: Aurat March, Toxic Masculinity, Critical Discourse Analysis, Feminist Discourse, Fairclough, Protest slogans

Weaponizing feminism: The white savior syndrome

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For centuries, there has been an ongoing debate regarding how white individuals serve as a protective barrier for people of color. White people have crafted policies for non-white populations under the pretext of protection, often framed as a defense against terrorism, a war on terror, the promotion of civilization, and the safeguarding of women of color. My presentation argues that these actions are primarily motivated by the West's own interests. I will examine feminist narratives and how they have been manipulated when it comes to justifying violence and warfare. I will do that by highlighting the prominent narratives propagated by the West in response to political instability by using the example of the recent escalation between Israel and Iran as a case study.

Keywords: Iran, Feminism, West, Terrorism.

Fabrication of Silver Doped Covalent Triazine Framework for the Colorimetric Sensing Of Dopamine

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Dopamine (DA) is one of the most important neurotransmitters that take part in several body functions, and its detection, which is very crucial towards the early diagnosis and monitoring of neurological conditions, mainly Parkinson and Schizophrenia must be accurate and fast. This paper describes the preparation and use of a Ag-CTF its use to selectively detect dopamine using a colorimetric probe. Highly thermally-stable covalent triazine structures with a tunable porosity

and long-range conjugation CTFs were very well synthesized utilizing polymerization procedure and silver doping to broaden the optical and electronic properties of these CTFs. Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Scanning electron microscopy (SEM), transmission electron microscopy (TEM), Energy-dispersive X-ray spectroscopy (EDX) and UVvis spectroscopy were used to describe the Ag-CTFs in a detailed manner. The Ag-CTF turned visibility and measurable color changing from pale yellow to dark orange when incubated with an appropriate amount of dopamine due to the redox reaction between the silver ions in the Ag CTFs and the dopamine molecule. The sensor exhibited a fast response time (minutes), high specificity to typical interfering materials (including ascorbic acid, uric acid, and glucose), and the low detection limit of the micro-molar level. The proposed colorimetric sensing mechanism 2 is that the bleaching of dopamine-to-dopamine quinone is aided by silver ions, and the altered surface plasmon properties of the Ag-CTFs will occur. In addition, the sensor proved to be stable, repeatable and it has a prospect of real-time monitoring of the biological and environmental situations. The paper shows the potential in silver-doped covalent organic frameworks as a robust platform to create minimally expensive, portable, and very sensitive colorimetric dopamine sensors.

Keywords: Dicyanobenzene, Zinc Chloride, HCl, NaBH₄, AgNO₃, colorimetric determination of Dopamine

Synthesis of Titanium Doped Hydroxyapatite Nanocomposite for the Colorimetric Sensing Of Uric Acid

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Uric acid and its role as a metabolic waste product, uric acid has been proposed to be an important molecule with multiple functions in human physiology and pathophysiology and may be linked to human diseases beyond nephrolithiasis and gout. In the present work, titanium doped hydroxyapatite nanocomposite were synthesized through calcinations method. The hydroxyapatite (HAp), was used as a template for titanium nanocomposite synthesis because they providing surface area for chemical reactions and also the have catalytic nature which is needed for sensing uric acid. From Fish bones HAp were synthesized, followed by doping with titanium metal salt through calcination. The synthesized nanocomposite was used for the colorimetric detection of uric acid. To characterize the synthesized nanocomposite different characterization techniques, were used such as FTIR, SEM, TGA, EDX and XRD. In the presence of H₂O₂ and titanium doped hydroxyapatite nanocomposite TMB can be oxidize to blue green color. Based on this phenomenon, titanium doped hydroxyapatite nanocomposite based colorimetric sensor was prepared for the detection of uric acid. To achieve the best possible results, various parameter were optimized such as the amount capping titanium doped hydroxyapatite nanocomposite, H₂O₂, pH, TMB, and uric acid. The proposed sensor shows a wide linear range from 1-99 μ M, a low detection limit of 0.29 μ M, a low quantification limit of 0.96 μ M, and an R² of 0.99, the developed sensor shows a high sensitivity and selectivity towards uric acid. The proposed sensor gives a quick response within 1 minute. The proposed sensor has been

successfully applied to arthritis patient's blood serum samples for uric acid detection with a visible colorimetric change.

Keywords: titanium doped hydroxyapatite nanocomposite, TMB, uric acid, colorimetric sensor.

Sustainable Detoxification of Mycotoxins Using Iron Nanoparticles Synthesized from Waste Rose Petals

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Nanotechnology offers innovative solutions across various fields, including medicine, agriculture, and environmental remediation. One promising application is the detoxification of mycotoxins-harmful fungal metabolites that pose serious risks to food and feed safety. This study presents a green synthesis approach for producing iron nanoparticles (FeNPs) using aqueous extracts from waste rose petals. Among the three iron salt precursors tested, ferrous sulfate heptahydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) yielded the most efficient synthesis. The synthesized FeNPs were characterized using UV-Visible spectroscopy, X-ray diffraction (XRD), and Fourier Transform Infrared (FTIR) spectroscopy to confirm their formation and structural properties. These nanoparticles were then applied for the detoxification of aflatoxin, with removal efficiency evaluated through High-Performance Liquid Chromatography (HPLC). The FeNPs achieved a maximum aflatoxin removal of 86.35%. In addition, rose petal extracts and their flavonoid fractions were tested against aflatoxin, ochratoxin, and fumonisin. HPLC analysis revealed that both the crude extract and flavonoids showed substantial detoxification potential, particularly against aflatoxin. This study demonstrates that plant-based iron nanoparticles, along with botanical extracts, provide an eco-friendly, cost-effective strategy for mitigating mycotoxin contamination in animal feed and agricultural commodities.

Keywords: Biogenic synthesis, nanoparticles, Rose petals, mycotoxins, detoxification.

Synthesis of Graphene Oxide Linked Amine Derivative and Their Application for Removal of Congo red And Eriochrome Black T Dyes

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In this study, amine functionalized graphene oxide (GO) was synthesized and evaluated for the removal of toxic dyes, Congo Red (CR) and Eriochrome Black T (EBT), from waste water. GO was synthesized using the modified hummers' method, followed by functionalization with ethylenediamine (EDA) to enhance its adsorption properties. The successful synthesis and functionalization of GO were confirmed through characterization techniques. Fourier Transform Infrared spectroscopy (FTIR) identified the presence of amine groups ($-\text{NH}_2$) and oxygen-containing functional groups ($-\text{OH}$, $\text{C}=\text{O}$), while X-ray diffraction (XRD) revealed changes in crystallinity post-functionalization. Scanning Electron Microscopy (SEM) demonstrated the uniform dispersion of amine groups on the GO surface, and Thermogravimetric Analysis (TGA)

confirmed the thermal stability of the nanocomposites. Batch adsorption experiments were conducted to assess the efficiency of amine-functionalized GO under varying conditions of PH, contact time, initial dye concentration, and adsorbent dosage. The results indicated high removal efficiencies for both CR and EBT, attributed to the enhanced electrostatic interactions between the amine groups and the anionic dyes. Adsorption Kinetics and isotherms were analyzed using Langmuir and Freundlich models, providing insights into the adsorption mechanism and capacity. The study highlights the potential of amine-functionalized GO as an effective adsorbent for the removal of hazardous dyes from industrial wastewater, offering a sustainable solution for environmental remediation.

Cross-Influence of Accumulated Metals in Mice Brain: A Comparative Perspective

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Heavy metals including lead, aluminum, and copper are ubiquitous environmental pollutants known to cause neurotoxicity. Although individual toxicities have been extensively studied, limited data exist on the combined accumulation and interactions of these metals in target tissues. Objectives: This study aimed to quantify and compare the accumulation of lead, aluminum, and copper in the brain and blood of BALB/c mice following sub-chronic exposure to each metal alone and in combination. Methods: Twenty-five male BALB/c mice were randomly divided into five groups (n=5 per group): control, copper-only, aluminum-only, lead-only, and combination exposure. Animals received 300 ppm of each metal (or their combination) via drinking water for 40 days. Metal concentrations in brain and blood samples were measured using atomic absorption spectrophotometry. Statistical comparisons were performed with one-way ANOVA and Tukey's post hoc test. Results: All metal exposed groups showed significant increases in tissue metal concentrations compared to controls ($p < 0.001$). The combination group exhibited the highest levels of accumulation for all three metals. In brain tissue, mean concentrations reached $5.85 \pm 0.34 \mu\text{g/g}$ (lead), $6.28 \pm 0.29 \mu\text{g/g}$ (aluminum), and $5.24 \pm 0.31 \mu\text{g/g}$ (copper), significantly exceeding single-metal exposures ($p < 0.01$). Lead was preferentially retained in blood (brain/blood ratio < 1), whereas aluminum and copper predominantly accumulated in the brain (brain/blood ratios > 1). The results suggested that lead positively affect the accumulation of copper in brain and vice versa whereas the aluminum concentration remain constant. Conclusions: Sub-chronic exposure to multiple metals results in additive or synergistic accumulation in both blood and brain, raising concerns about heightened neurotoxic risk. These findings emphasize the importance of revising regulatory standards to account for mixture toxicity. Future studies integrating behavioral assessments and oxidative stress biomarkers are recommended to clarify the functional implications of combined metal exposure.

Keywords: Aluminum, lead, copper, atomic absorption spectrophotometer, metal accumulation

Green Synthesis of Iron Oxide Nanoparticles Mediated By Elettaria Cardamomum and Antimicrobial Activity Investigation against Bacteria Causing Mastitis

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Nanotechnology is a field of science and engineering that focuses on materials with dimensions on the scale of 100 nanometers or smaller. As nanotechnology advances, nanoparticles exhibit unique characteristics compared to bulk materials. The present study described the synthesis of iron oxide nanoparticles through eco-friendly green process using (Elettaria cardamomum) extract and their antibacterial activity. The green synthesized iron oxide nanoparticles were characterized by Fourier-transform infrared (FTIR) spectroscopy, X-ray Diffraction (XRD) and, Scanning Electron Microscopy (SEM). With the use of a UV-VIS spectrophotometer, the optical characteristics of iron oxide nanoparticles revealed an absorbance peak at 410nm. FTIR studies confirm the presence of bio molecules and metal oxides such as iron oxide nanoparticles. The green synthesized nanoparticle from Elettaria cardamomum exhibited strong antibacterial activity against the Staphylococcus aureus. The iron oxide NPs which was obtained from Elettaria cardamomum have good zone of inhibition against Staphylococcus aureus which could be used as a potential antibacterial agent against bacterial disease.

Keywords: Elettaria cardamomum, Iron Oxide Nanoparticles, Green Synthesis, Antibacterial Activity, Mastitis, FTIR, SEM, XRD

Synthesis, characterization (In vitro & In-Vivo) and evaluation of Cefoperazone/Salbactam loaded Chitosan-Sericin-Silver nanocomposites for treatment of chronic infected burn Wounds

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Background: Antibacterial resistance and cost burden associated with the management of chronic infected burn wounds.

Objective: Synthesis and dual in-vitro & in-vivo characterization of Cefoperazone (CPZ)/Salbactam (SBT)-loaded chitosan-Sericin-Silver nanocomposite (CSSN) films via solution casting technique for efficacious management of chronic infected burn wounds.

Method: CPZ and SBT-loaded CSSN were successfully synthesized by in-situ method followed by composite films preparation via solution casting technique. In-vitro characterizations included drug release, swelling studies, morphological (SEM), spectral (FTIR), structural (XRD) and spectroscopic analysis. The composite films were characterized for in-vitro antibacterial activity against the selected strains of Staphylococcus aureus and Pseudomonas aeruginosa along with in-vivo burn wound healing assessment (rat wound models) through wound closure and histopathological analysis.

Results: Morphological analysis confirmed the presence of randomly oriented, spherical or pseudo-spherical shaped silver nanoparticles upon close magnification. The analysis of colloidal composite solution via cold stage SEM technique clearly indicated the spherical morphology of nanoparticles. The FT-IR spectrum clearly revealed spectral bands corresponding to chitosan and

sericin together with presence of dual intermolecular and intra-molecular hydrogen bonds among both the biopolymers. Further, the in-situ synthesis of silver nanoparticles presented no remarkable effect on spectral pattern of the composite films. Dual unloaded and drug loaded nanocomposite films presented broad peaks with reduced diffraction peaks intensities suggesting low crystallinity or highly amorphous form of the nano-composites. In-vitro drug release analysis indicated no initial burst release pattern with sustained release pattern providing approximately > 90% release within 24 h. Nanocomposite films presented efficacious antibacterial activity against all the tested strains however comparatively better antibacterial efficacy was indicated by the drug loaded films against *S. aureus*. Accelerated wound repair capabilities corresponding to rapid wound closure (in comparison to control groups) and epidermal regeneration, neovascularization, granular tissue reformation, collagen reorganization, folliculitis and sebaceous glands formation was noticed during histopathological analysis.

Conclusion: In current report CPZ and SBT-loaded CSSN were developed as promising antibacterial wound dressing material for accelerated healing of chronic infected burn wounds.

Keywords: Antibacterial, chitosan, Sericin, Nanocomposite, wound repair.

Synthesis of Tungsten Oxide-Poly (Methyl Methacrylate) Composites for Efficient Photocatalytic Degradation of Methyl Violet

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The escalating challenge of water pollution, particularly from synthetic dyes in industrial effluents, demands innovative and effective treatment technologies. This study explores the synthesis and application of tungsten oxide-poly (methyl methacrylate) (WO_3 -PMMA) composites for the photocatalytic degradation of methyl violet, a common water pollutant. Tungsten oxide nanoparticles were synthesized via an acid co-precipitation method and subsequently incorporated into a PMMA matrix at varying concentrations (0.1%, 1%, 3%) to enhance the composite's photocatalytic performance. The prepared composites were characterized using techniques such as SEM, FTIR, EDX, UV-Vis spectroscopy, and XRD to investigate their structural, morphological, and optical properties. The photocatalytic efficiency was evaluated under sunlight exposure, with optimization studies conducted to determine the effects of parameters such as pH, dye concentration, exposure time, and catalyst loading. The findings are expected to provide insight into the development of low-cost, efficient, and stable composite materials for sustainable wastewater treatment.

Keywords: poly methyl methacrylate (PMMA), Tungsten oxide (WO_3), HCl, Chloroform, dye degradation.

Synthesis of Amphoteric Carbon Dots and Their Evaluation as a Drug Carrier

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Carbon dots (CDs) are a novel class of carbon nanomaterials with unique physical and chemical properties. Their ease of surface modification, low toxicity, and high biocompatibility make them valuable in various applications, including chemical analysis, biological imaging, disease diagnosis and therapy. Amphoteric CDs, possess both hydrophilic and lipophilic properties, which make them an ideal carrier for different drugs. Depending upon the surrounding environment, CDs can both increase and decrease the solubility of the drug. AgSD is used topically and by complexation with CDs, its transdermal absorption will decrease, making the drug available on skin for a longer time and will enhance its therapeutic output. While DAC loaded CDs are expected to release the drug in acidic environment (lower pH) of GIT at relatively higher rate due to molecular interactions. The hydrothermal method were used to synthesize CDs from organic substances like lactic acid and glycine at 180°C for 6 hours and their properties were characterized through UV-visible spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), and Fourier transform infrared (FTIR) spectroscopy. The UV-visible spectra showed a strong absorption peak at 280 nm, confirming the formation of CDs. XRD analysis revealed an amorphous structure, while SEM images displayed spherical nanoparticles. FTIR spectroscopy identified functional groups such as C-N, C=O, -OH, -COOH, and -NH₂ on the surface of the CDs, which facilitated drug loading. The drug-loading capacity of the CDs was evaluated by encapsulating Silver sulfadiazine and Daclatasvir. The drug-loading efficiency was found to be 93% for silver sulfadiazine and 88% for daclatasvir at a 1:3 drug-to-CD ratio. Drug release from CDs was evaluated by intrinsic dissolution testing. It was observed that DAC exhibited enhanced release in acidic conditions, such as those present in the gastrointestinal tract, while AgSD, when complexed with CDs, showed reduced skin absorption and prolonged topical activity. This approach provided a novel method to fine-tune drug solubility and release rates, ultimately improving drug efficacy and safety. The findings contributed to the growing field of Nano carrier-based drug delivery by offering insights into the potential of amphoteric CDs to modulate drug dissolution behavior.

Keywords: Carbon dots, drug carrier, daclatasvir (DAC), silver sulfadiazine (AgSD), intrinsic dissolution testing, Drug release, Nano carrier, amphoteric CDs.

Synthesis of Zinc Oxide Tungsten Oxide Composites for the Efficient Photocatalytic Degradation of Crystal Violet

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The increasing discharge of untreated industrial effluents into water bodies, particularly from the textile and tanning industries, has led to significant environmental and health concerns. Conventional wastewater treatment methods are often ineffective in removing persistent dyes such as Crystal Violet. This study focuses on the synthesis and application of zinc oxide (ZnO) and tungsten oxide (WO₃) nanocomposites for the photocatalytic degradation of Crystal Violet dye under sunlight. ZnO nanoparticles, known for their high photo activity and wide band gap, and WO₃ nanoparticles, recognized for their strong visible-light absorption and stability, were synthesized using chemical methods. The nanocomposites were prepared via an ultrasonic dispersion technique in varying ratios (1:1, 1:3, and 1:5) and subsequently characterized using

UV-Vis spectroscopy, SEM, XRD, FTIR, and EDX analysis. Photocatalytic activity was evaluated by monitoring the degradation of Crystal Violet under solar irradiation. Optimization of parameters such as dye concentration, catalyst dosage, pH, and contact time was also performed. The incorporation of WO₃ into ZnO is anticipated to reduce the band gap and enhance the photocatalytic efficiency, offering a promising approach for sustainable dye degradation in wastewater treatment.

Keywords: Zinc oxide (ZnO), Tungsten oxide (WO₃), Nanocomposites, ultrasonic dispersion, photocatalytic dye degradation.

Mindful Consumption in the Age of Social Media and AI: Reclaiming Agency in a Hyper connected World

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In an era shaped by algorithm-driven content, targeted advertising, and AI-generated recommendations, consumer behavior is no longer solely a matter of choice, it is increasingly a product of influence. This paper explores the concept of mindful consumption as a conscious counter-response to the persuasive design of digital platforms powered by artificial intelligence. Drawing from interdisciplinary research in digital ethics, behavioral psychology, and media studies, the study examines how social media and AI technologies shape desires, distract attention, and promote overconsumption, both materially and cognitively (Zuboff, 2019; Harris, 2019). The current research proposes a framework for cultivating digital mindfulness that emphasizes self-awareness, ethical engagement, and critical filtering of content. It highlights real-world examples and emerging initiatives that empower individuals to regain control over their consumption habits, promote digital well-being, and foster sustainable lifestyles. Ultimately, this paper calls for a cultural shift—from passive scrolling to purposeful interaction—where users become intentional participants rather than manipulated consumers in the digital ecosystem. Beyond individual responsibility, the paper also examines the structural dimensions of mindful consumption, emphasizing the role of platform design, corporate accountability, and public policy in shaping digital environments. It argues that fostering intentional consumption requires not only user awareness but also systemic interventions—such as transparent algorithms, ethical design standards, and digital literacy initiatives—that prioritize human agency over engagement metrics. By advocating for a collaborative effort among technologists, policymakers, educators, and consumers, the research underscores the need for a more equitable and humane digital infrastructure that supports rather than undermines mindful engagement.

Keywords: Mindful consumption, Age of AI, digital platforms, digital mindfulness.

Taste Masking Of Ondansetron by Granulation Method

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The objective of this study was to develop taste-masked granule formulations of ondansetron hydrochloride using the wet granulation technique, focusing on optimizing flow properties and palatability. Total 8 eight formulations were prepared of which three formulations—F2 (HPMC), F5 (EC), and F8 (combination of HPMC, EC, and Primogel) were optimized and evaluated. These formulations were assessed for flow properties, drug release in simulated salivary fluid (SSF, pH 6.8), and in vivo bitterness by a human panel. Among the tested samples, formulation F8 demonstrated superior taste masking, with drug release below the taste threshold (3.12–6.25 µg/mL) and a significantly reduced bitterness score of 0.67 ± 0.5 on a 4-point scale, compared to 1.67 ± 0.6 and 1.33 ± 0.7 for F2 and F5, respectively. FTIR, DSC, and XRD analyses confirmed drug excipient compatibility and partial amorphization in F8, supporting effective entrapment within the polymeric matrix. Flowability assessments showed acceptable Carr's Index (<15%), Hausner's ratio (~1.2), and angle of repose (<30°) for all formulations, indicating suitability for further processing. This study concludes that wet granulation using a combination of HPMC, EC, and a disintegrant (Primogel) offers an effective, scalable, and pharmaceutically acceptable strategy for taste masking of ondansetron hydrochloride, especially for pediatric applications.

Keywords: Taste masking, Ondansetron hydrochloride, Wet granulation, HPMC, Ethyl cellulose, Flow properties, simulated salivary fluid, Pediatric formulation, Bitterness score, Invitro release.

Integrating Peace Education with ESL Instruction in Pakistan: Systematic Review of Challenges, Opportunities and Future Prospects

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Pakistan is known for rich ethnic, cultural, political, linguistic and regional diversity. The rising socio-political tensions, religious extremism, climate crises and ethnic divisions in Pakistan underscore the urgent need for peace education across educational institutions. English as a Second Language (ESL) is widely implemented across Pakistan's curricula. It presents a unique opportunity to integrate peace education principles into mainstream pedagogy. Exploring the intersection of peace education and ESL instruction in Pakistan, this systematic literature review aims to evaluate the potential ESL learning and the cultivation of peace-oriented attitudes, values, and behaviors. Present study is a systematic review of journal articles, government reports, and NGO publications presented between 2010 and 2025, focusing on empirical and theoretical works addressing peace education in connection with ESL instruction in Pakistani context. Findings reveal that limited content is available on integration of peace education with ESL pedagogy as both peace education and ESL instruction are being developed independently. However, the review identifies several promising strategies having potential to breed peace education coupled with ESL instruction. The inclusion of critical pedagogy, culturally responsive teaching, and narrative-based ESL instruction can foster peaceful dialogue, intercultural understanding and social cohesion. The review also highlights systemic challenges such as curriculum rigidity, limited teacher training, political sensitivities, and linguistic hierarchies that potentially obstruct integration. Recommendations are provided for policymakers, educators, and curriculum developers to adopt inclusive frameworks that integrate peace values with ESL instruction without compromising objectives for linguistic proficiency. Emphasizing the synergies

between ESL instruction and peace building, this review is an attempt to contribute to the broader discourse on education for peace and sustainable development. It also highlights the need for future research and implementation strategies in multilingual conflict-affected societies.

Keywords: peace education, ESL instruction, ESL pedagogy, second language, Curriculum

Effect of Academic Performance and Information Technology at College Level in Faisalabad

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Information technology and academic performance are the two main component of students' learning and academic achievement. Academic performance is the essential part of the students' learning level as well as information technology also play a important role in students' academic achievement. This research examines the dynamic relationship between information technology (IT) and academic performance among college students. Academic performance serves as a fundamental measure of students' learning outcomes and intellectual development. In the contemporary educational landscape, information technology has emerged as a transformative force, significantly enhancing the quality of teaching, learning, and assessment practices. The integration of IT within academic institutions enables more effective knowledge delivery, streamlined access to educational resources, and improved methods for learning evaluation. Tools such as digital assessments, learning management systems, and online collaboration platforms offer students more flexibility and autonomy in managing their studies. As a result, educational environments that incorporate information technology often experience a positive impact on student engagement, retention, and academic success. This descriptive, survey-based study focused on two academic departments within a college. 110 students were selected through simple random sampling technique. Data were collected through a structured questionnaire containing 44 items. The questionnaire was developed and validated with input from the researcher and their academic supervisor to ensure reliability and content validity.

Keywords: Academic performance, Information Technology, Students' achievement

Antibacterial Efficacy of Zinc Oxide Nanoparticles Using Tecomella undulata Against E.coli Causing Urinary Tract Infections in Karak

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This study evaluates the antibacterial efficacy of zinc oxide nanoparticles (ZnO NPs) synthesized using Tecomella undulata against Escherichia coli strains responsible for urinary tract infections (UTIs). Urinary tract infection (UTI) is one of the most common bacterial infections in the world, which is associated with high morbidity and healthcare costs. The formation of ZnO NPs was analyzed by UV-drs, FTIR, and XRD techniques, revealing particles with sizes ranging from 20 to 50 nm. The results show that the isolated E. coli bacteria were the most susceptible, with a 28.67±0.58 mm zone of inhibition at 10 mg/mL ZnO NP. The use of plant-based synthesis, such

as with *T. undulata*, offers an eco-friendly approach and may enhance the biocompatibility and effectiveness of the nanoparticles. The findings suggest that ZnO NPs synthesized with *T. undulata* may exhibit antibacterial activity against *E. coli* in UTIs, particularly in regions with high rates of antibiotic resistance. Further in vitro and in vivo studies are recommended to confirm their safety and clinical applicability in the management of urinary tract infections.

Keywords: urinary tract infection, zinc oxide nanoparticles, zone of inhibition, minimum inhibitory concentration, antibacterial activity.

Integrating Peace Education in Sustainable Agriculture: A Holistic Framework for Rural Resilience

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The intersection of peace education and sustainable agricultural development presents a critical pathway for addressing global challenges such as food insecurity, rural conflict, and environmental degradation. This paper explores the central theme of Integrating Peace Education and Sustainability in Agricultural Learning Systems, emphasizing the need for interdisciplinary and inclusive educational frameworks. It discusses innovative curriculum models that merge agriculture, environmental science, and peace studies, with a focus on experiential learning for rural youth and farming communities. The role of agricultural extension is analyzed as a strategic instrument for community cohesion and conflict resolution, particularly through participatory and community-based approaches. The paper also investigates the contribution of education to climate resilience in rural settings by promoting climate-smart agricultural practices and enhancing adaptive capacities. Gender equity and social inclusion are highlighted as essential pillars for sustainable peace, advocating for policies and programs that empower women and marginalized populations. Moreover, youth engagement is framed as a vital component in fostering rural innovation and entrepreneurship for peaceful development. In the context of digital transformation, the study examines the role of knowledge-based agriculture, ICTs, and AI in advancing peace-oriented agricultural education. Lastly, it underscores the importance of preserving indigenous knowledge systems and promoting culturally rooted approaches to sustainable land management. Collectively, these sub-themes provide a comprehensive foundation for reimagining agricultural education as a driver of peace and sustainability.

Determination of Weed Toxicity: Negative Impact on Maize Germination and Young Plants in Sustainable Agriculture Development

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Many weeds, along with their leftover parts, can stop crops from growing by releasing harmful chemicals into the soil. This study tested how ten different weeds affect maize (corn) growth. The experiment was done in a lab at Gomal University's Agronomy Department in Pakistan. Researchers used pots in a controlled setup, mixing fresh and dried weed material (100 grams each) with clean soil to see their effects on maize seeds and young plants. The results showed that all weeds—whether fresh or dried—reduced maize seed sprouting, shoot length, and root

growth. However, one weed, Senji (*Melilotus indica*), actually helped maize shoots and roots grow better compared to the others. Other weeds like Pohli, Aak, Jangli palak, Bhathu, Lehli, Gajarbooti, Deela grass, Jangli jai, and Billi booti had harmful effects on maize germination and early growth. In conclusion, most weeds hurt maize seed sprouting, but after breaking down, Senji improved maize seedling growth.

Keywords: Allelopathy, Phyto-amendments, Phytotoxicity, weed biomass, Zea maize

Synthesis, Characterization and Antimicrobial Studies of Thiophene-2- Carbaldehyde Derived Schiff Base Complexes with Copper and Nickel

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A series of copper and nickel complexes (A-D) have been synthesized from two types of schiff bases derived from the condensation reaction of thiophene-2-carbaldehyde with diamine: (4,4'-oxydianiline (1) and 4,4'-diaminodiphenyl sulfone (2)). Schiff bases and their metal complexes (AD) were characterized and confirmed by CHN elemental and spectral analysis. Antimicrobial activity of the newly synthesized complexes have been evaluated against bacterial strains such as *E. coli*, *S. aureus*, and *B. subtilis*, showed good to excellent results against the tested bacterial strains. The copper complexes showed significant antibacterial activity, with inhibition zones ranging from 14–18 mm, while the nickel complexes exhibited moderate activity, ranging from 10–14 mm. These results suggest that copper-based Schiff base complexes possess stronger antibacterial potential compared to their nickel analogues.

Synthesis and Characterization of Thiophene Azomethine and Ferrocene Reinforced Composites of Epoxy Resin

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This study reports the synthesis and characterization of ferrocene-reinforced epoxy composites using diglycidyl ether of bisphenol-A (DGEBA) cured with 4,4'-oxydianiline (ODA). A Schiff base (azomethine) was synthesized from thiophene-2-carbaldehyde and 4,4'-oxydianiline and used as an additive (1–10%) in the epoxy matrix. Ferrocene was added in varying amounts (1–5%) to enhance electroactivity. The composites were characterized using FTIR and XRD to confirm structural interactions and filler dispersion. Thermal behavior was analyzed via TGA, showing improved stability with higher ferrocene content. Electrochemical properties were assessed by cyclic voltammetry, confirming redox activity. Antimicrobial studies showed good inhibition of microbial growth, especially with both ferrocene and thiophene–azomethine. Overall, the study presents multifunctional epoxy composites with enhanced thermal resistance, antimicrobial activity, and electrochemical performance.

Triphenylamine based Polyazomethine-ZnO Nanocomposites: Synthesis and Characterization as Potential Antimicrobial Agent

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The alarming rise of antibiotic-resistant pathogens has accelerated the search for advanced antimicrobial materials with broad-spectrum efficacy and environmental safety. In this context, zinc oxide (ZnO) nanoparticles have gained significant attention for their inherent antimicrobial properties. This study explores the development of innovative polyazomethine-ZnO nanocomposites synthesized using a triphenylamine (TPA)-based diamine, which offers a three-dimensional, electron-rich architecture. The unique three-dimensional and electron-rich structure of TPA enhances ZnO dispersion, addressing common drawbacks such as poor solubility and limited processability. A series of nanocomposites with varying ZnO loadings were successfully synthesized and systematically characterized using UV/Vis spectroscopy, FTIR, XRD, SEM, and thermal analysis. The results revealed that thermal stability decreased slightly with increased ZnO content. However, all synthesized nanocomposites exhibited potent antibacterial and antifungal activity against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans*, and *Aspergillus Niger*. Notably, antimicrobial performance improved consistently with higher ZnO concentrations. These findings underscore the potential of TPA-based polyazomethine/ZnO nanocomposites as multifunctional materials for next-generation biomedical applications and antimicrobial surface coatings.

Synthesis and Spectroscopic Characterization of hydroxy substituted dinitro-triphenylamine as Fluorescent Metal Ion probe

Saima Noreen

In this study a hydroxy-substituted triphenylamine-based dinitro derivative dinitro-4-hydroxytriphenylamine (1) was successfully prepared via cesium fluoride-assisted nucleophilic arylation. The compound's chemical structure was confirmed by FTIR, ^1H NMR spectroscopic analyses. UV-Visible and PL spectroscopic techniques were used for analysis of photophysical properties of the synthesized compound. UV/VIS spectral analysis of the 1 in solution exhibited absorption in the range $\lambda_{\text{emiss}} = 250 \text{ nm}$ and 300 nm . A $10 \mu\text{M}$ solution of the synthesized compound in DMSO was titrated with aqueous Pb^{2+} , Cu^{2+} and Fe^{2+} solutions to evaluate its potential as a metal-ion probe. The results revealed strong interactions with these heavy metal ions in aqueous media. Additionally, batch adsorption experiments in the solid state were performed for various heavy metal ions, and the quantities adsorbed were quantified using atomic absorption spectrometry. Adsorption data for Cu^{2+} , Pb^{2+} , and Fe^{2+} fit the Freundlich isotherm model exceptionally well, with regression coefficients (R^2) ranging between (0.8106-0.9574), indicating favorable multilayer adsorption behavior. These findings suggest that this fluorescent adsorbent holds promise as a dual-function material for both metal-ion sensing and removal in future environmental applications.

Effectiveness of Psychoeducation on Healthy Dietary Counseling and Mental Health of University Students: A non-Randomized controlled trial (MIND FUEL Trial)

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There is strong epidemiological evidence suggesting that poor dietary habits are significantly associated with psychological distress, including symptoms of depression, anxiety, and stress.

This study aims to evaluate the impact of psychoeducation and nutrition counseling on mental health by assessing the efficacy of combined nutritional and psychoeducational interventions in improving psychological well-being and related physical health indicators, including anthropometric measurements such as Body Mass Index (BMI), body fat percentage, muscle mass percentage, and body water percentage. The University of Haripur Centre for Counselling and Social Wellbeing (UOH-CCSW) in Khyber Pakhtunkhwa, Pakistan, conducted an interventional trial in September 2023, recruiting 120 individuals from the university. Data collection tools included the Depression, Anxiety, and Stress Scale (DASS-21), the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS), the Rosenberg Self-Esteem Scale, a Diet Quality Questionnaire, and anthropometric measurements were taken by using the Beurer BF70 device. The intervention consisted of six expert-led sessions, followed by a three-month follow-up, addressing various psychological and nutritional issues. Data were analyzed using SPSS version 22.0. The study included 117 participants across three intervention arms and a control group, primarily aged 18–25 years. Most were undergraduates, unmarried, and from urban areas, with varied physical activity, sleep, and dietary habits. Psychoeducation and healthy dietary counseling interventions showed significant improvements in mental health, diet quality, and changes in anthropometric measurements. Psychoeducation combined with healthy dietary counseling resulted in significant improvements ($p\text{-value} < 0.05$) in mental health diet quality, and anthropometric measurement showed a synergistic effect. Intervention showed a significant reduction of psychological distress and improved wellbeing in university students. Healthy dietary counseling and psychoeducation is a successful strategy for promoting a balanced diet and mental well-being.

Keywords: Depression, anxiety, stress, self-esteem, wellbeing, body weight, body fat, body muscle, psychoeducation, healthy dietary counseling.

Climate-Induced Anxiety and Government Response Perceptions: A Nationwide Study of Pakistani Students

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Globally, young people are becoming more susceptible to climate anxiety and a negative perception of governance. To find out how common climate fear is among Pakistani university students and how they feel about the government's reaction. 5090 undergraduate students from 164 public and private universities across Pakistan's tropical, desert, temperate, continental, and polar zones provided data for this cross-sectional study, which used a quantitative methodology. A questionnaire that was based on The Lancet survey questions and encompassed sociodemographic data, climate anxiety, and government perception was used to gather data online. Convenient sampling methods were used. Information Descriptive statistics and Pearson's correlation were among the statistical tests. The prevalence of climate anxiety was 60%, with emotional responses including sadness, helplessness, and anger. 69.5% of participants expressed dissatisfaction with government replies, with betrayal scores higher than reassurance scores. Compared to students in other regions, those in the polar and continental zones

showed more mental distress and functional difficulties. Pakistani university students suffer from a high rate of climate anxiety, which is made worse by their discontent with the government's climate solutions. To combat climate anxiety, create psychological support networks, enact specific climate legislation, and encourage government and university cooperation.

Keywords: Climate change, Climate anxiety, university students, government perceptions, mental health

Psychosocial Distress and Quality of Life among Kohistani Community Affected by Displacement: The Case of Dasu Hydropower Development Project

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Development-induced displacement (DID) frequently causes significant social and psychological issues for the impacted populations. The aim of this study was to determine the prevalence and severity of psychological distress, mental well-being, and quality of life of the community affected by the Dasu Hydropower Project Upper Kohistan. A cross-sectional study of 365 displaced adult's was undertaken in the Dasu project area in district of Upper Kohistan, between March and May 2023. The WHOQOL-BREF, Depression, Anxiety, Stress Scale (DASS-21), and The Warwick-Edinburgh Mental Wellbeing Scale were used to collect data, which was then analyzed to determine association between psychological distress, quality of life and sociodemographic characteristics. The study found high levels of psychological distress, with 45.5% of participants reporting depression, 22.5% anxiety, and 60.0% stress. In the physical and psychological domains, most participants reported moderate to good well-being. However, 43.8% had poor social relationships, and 38.9% experienced a low-environmental quality of life which was assessed through WHOQOL -BREF. Low income and occupation were significant socio-demographic factors influencing psychological distress and quality of life, with lower-income individuals reporting higher levels of distress and lower quality of life across all dimensions, indicating a negative relationship between distress and well-being. The Dasu Hydropower-induced displacement adversely affected mental health and well-being. Further research is needed to explore long-term impacts and contributing factors.

Keywords: Project -induced displacement, psychological distress, Dasu Hydropower, Quality of life, DASS-21, Mental well-being

A Cross-Sectional Study on Psychological Distress and Associated Factors among University Students in Pakistan

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This study investigates the prevalence and associated factors of mental health conditions specifically depression, anxiety, and stress—among university students in Haripur, Pakistan. A total of 402 students were randomly selected between April and June 2023. Data were gathered using a structured questionnaire containing socio-demographic variables and the validated Depression, Anxiety, and Stress Scale (DASS-21). Descriptive statistics and logistic regression were applied to identify significant associations. The results revealed a high prevalence of psychological distress: 72.2% experienced depression, 82.1% anxiety, and 60.8% stress. Depression was significantly linked to shorter daytime sleep, lack of physical activity, and drug addiction. Anxiety was more common among female students but lower among those taking supplements or engaging in exercise. Stress was notably higher in females, individuals with a family history of illness, and current smokers. The findings point to an urgent need for mental health support and preventive initiatives within academic settings. Interventions targeting lifestyle factors and early screening could help reduce psychological burden among students.

Keywords: depression, anxiety, stress, university students, psychological distress, mental health

Silent Killer on Campus: A Qualitative Study of Smoking Behavior, Knowledge, Attitudes, and Perceptions in University Students

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One of the primary preventable causes of death in the globe is still smoking. Due to social and emotional factors, university students—especially young males—are becoming more and more vulnerable. Many people consider smoking to be more of a social norm than a dangerous addiction, even though they are aware of the health consequences. This qualitative study investigated the knowledge, attitudes, and perceptions of male students at University of Haripur regarding tobacco use, as well as the factors that contribute to smoking initiation and continuation. Snowball sampling and convenience sampling were used to choose a total of 20 participants. Self-structured interviews were used to gather data, and NVivo software was used for theme analysis. The results showed that students' smoking addictions are maintained in a substantial way by emotional stress, peer pressure, cultural acceptance, and a lack of targeted quitting support. Participants showed a basic understanding of the risks of smoking, but many underestimated how addictive it is. The study comes to the conclusion that addressing smoking in university settings requires behavioral interventions targeted to the social environment of young adults as well as culturally sensitive education.

Keywords: university students, smoking behavior, qualitative study, attitudes, perceptions, addiction

Eating Disorder and Its Contributing Factor to Psychological and Behavioral Challenges: A Cross Sectional Study

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This study looks at the eating disorder and its contributing factor to psychological and challenges faced by university students aged between 18 to 26 , were surveyed to find out how many of them struggle with eating problems, psychological problems and how these problems affect the behavior and their quality of life. The survey used well known tools to measure these issues. Results showed that half of the students dealing with some form of eating disorder. 68.9% students dealing with eating disorder due to psychological factors, 62.3% students quality of life affect due to eating disorder, 79.4% eating disorder occur due to living conditions of students. 77.1% eating disorder occur due to factors that influence the eating habit the most. Eating disorder occur due to other reasons such as stress, emotional state, peer influence, family habits and body image concerns and the main role that social media that is the main factor in contributing eating disorder. Students who were less stressed are generally have better quality of life and less chances of eating disorder. These results showed university students need academic support and strategies to cope with stress.

Keywords: eating disorder, mental health, quality of life, university students.

Association of Food Habits on Adolescents' Mental Distress and Quality of Life

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The study explores how the eating habits of school students in Haripur, Khyber Pakhtunkhwa, Pakistan, relate to their mental health and overall well-being. The research aimed to understand how the food choices of adolescents affect their mental health, specifically levels of stress, anxiety, and depression, and their overall quality of life. Researchers surveyed students from government higher secondary schools in Haripur between March and May 2023. They used three questionnaires: one to assess eating habits, another to measure mental health (focusing on depression, anxiety, and stress), and a third to evaluate quality of life. A significant number of students experienced mental health issues, 92.4% reported stress, 76.8% had anxiety, and 86.6% suffered from depression. Students were categorized based on their eating habits: 36% had poor eating habits, 35% had moderate habits, and 29% had good eating habits. There was a strong link between poor eating habits and higher levels of mental distress. The study concluded that unhealthy eating habits are associated with increased psychological distress and a lower quality of life among adolescents. It suggests that improving students' diets and creating a supportive school environment could help enhance their mental health and overall well-being. In essence, the research highlights the importance of healthy eating for the mental and emotional health of school-aged children. Adolescents, Eating Habits, Depression, Anxiety, Stress, Quality of Life, Mental Health, Pakistan, Cross-Sectional Study, School-based Study

Keywords: Adolescents, Eating Habits, Depression, Anxiety, Stress, Quality of Life, Mental Health, Pakistan, Cross-Sectional Study, School-based Study

Impact of Lifestyle and Demographic Factors on Diabetes Associated Complications; A Cross-Sectional Study

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Diabetes Mellitus (DM) is a leading cause of death and morbidity worldwide, with a rising prevalence among adults. This study aims to assess and evaluate the impact of lifestyle and demographic factors that exacerbate diabetic complications. The objective is to provide insights into how lifestyle modifications can mitigate these complications and improve patient outcomes. A cross-sectional study was conducted among adult diabetic patients in Lahore, Pakistan. The target population included patients visiting Medical OPDs and Diabetic Care centers. Participants aged 20 to 70 years, diagnosed with type 2 Diabetes Mellitus, were included. Data were collected through face-to-face interviews using a self-structured questionnaire, and anthropometric measurements (weight, height) were recorded. SPSS version 20.0 was used for data analysis the study sample consisted of 370 participants, with 189 (51.1%) females and 181 (48.9%) males. Descriptive statistics showed a standard deviation of 0.501 and a variance of 0.251 for gender distribution. Among the respondents, 167 were classified as normal weight, 110 as overweight, and 33 as obese. Patients with better knowledge of lifestyle impacts on diabetes complications were less affected by these complications. The findings highlight the importance of educating diabetic patients about the impact of a sedentary lifestyle on their health. Regular screening by skilled health professionals is essential for the early detection and management of diabetic complications. This study underscores the need for lifestyle interventions to improve patient outcomes.

Keywords: Diabetes Mellitus, Obese Scale, Aggression, Neuropathy, complications, Screening, Eating Habits

Prevalence and Determinants of Mental Health Disorders among Madrassa Students in Tehsil Ghazi, DISTRICT HARIJUR

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This study investigates the mental health conditions and associated demographic factors among Madrassa students in Tehsil Ghazi, Pakistan. A total of 67 male students, aged between 14 to 24 years, participated in the study. Mental health assessments were conducted using standardized tools to measure depression, anxiety, stress, and happiness levels. The findings revealed that 66.1% of the students exhibited some form of depression, 50.7% reported anxiety, and 62.7% experienced stress. In terms of happiness, 50.7% were happy, 44.8% moderately happy, and 4.5% unhappy. Depression was significantly associated with education level and general health condition ($p < 0.05$). Anxiety showed significant links with education level ($p = 0.002$), while stress was significantly associated with health status and living conditions ($p < 0.05$). Happiness was influenced by age, health condition, living condition, and access to health facilities. Correlation and regression analyses indicated that better general self-assessment (GSA) scores were positively linked with happiness and negatively with depression and anxiety. These results highlight the urgent need for targeted mental health support and well-being programs within the Madrassa education system in Tehsil Ghazi.

Keywords: Mental health, Depression, Anxiety, Stress, Happiness, madrassa students, Tehsil Ghazi

Surgical Site Infections is the Concerning Issue in Pakistan: A Review Article

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Surgical Site Infections (SSIs) pose a major challenge in healthcare, particularly in low and middle income countries (LMICs) like Pakistan. This review examines the incidence, prevalence, risk factors, and role of medical devices in SSIs through a comprehensive literature analysis. Studies comparing povidone-iodine (PI) and chlorhexidine gluconate (CHG) for skin antisepsis, normothermia, sterile surgical attire, and negative pressure wound therapy were evaluated. SSI rates in LMICs range from 8-30%, significantly higher than 1-4% in high-income countries. Key risk factors include patient conditions (e.g., malnutrition, immunosuppression), surgical issues (e.g., contamination, inadequate sterilization), and physiological factors (e.g., postoperative hypoxia). Alcohol-based CHG preparations outperform PI in efficacy. Maintaining normothermia, using disposable medical equipment, and ensuring proper sterilization help lower SSI rates. Preventive measures include training on CHG application, mandatory use of disposable sterile drapes and gowns, compliance with AST and AORN surgical attire guidelines, and ongoing perioperative staff education. Adopting comprehensive strategies, including CHG with alcohol-based solutions, normothermia, negative pressure wound therapy, and robust training programs, is critical for reducing SSIs in LMICs, enhancing patient outcomes and healthcare sustainability.

Keywords: Incidence, Prevalence, SSI, AMR, CHG, Medical device, AORN, Pakistan

A Cross-Sectional Study on Mental Health and Demographic Factors among Madrassa Students

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This study looks at the mental health of madrassa students in Haripur, Pakistan. A total of 185 students, aged 14 to 29, were surveyed to find out how many of them struggle with depression, anxiety, and stress, and how happy they feel in general. The survey used well-known tools to measure these issues. Results showed that more than half of the students were dealing with some form of mental stress: 58.4% had signs of depression, 63.2% had anxiety, and 50.8% felt stressed. About 49% were moderately happy, 40% were happy, and 12% felt unhappy. Mental health was affected by things like gender, education level, living conditions, and how easy it was to access help or support. Students who were in better health or felt more confident in themselves were generally happier and less stressed. These results show that Madrassa students need better mental health support and simple ways to deal with daily stress.

Keywords: depression, anxiety, stress, madrassa, student mental health, happiness

The Role of Personal and Institutional Support in Smoking Cessation: A Qualitative Study Among University Students

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Smoking is a leading cause of preventable mortality. According to the World Health Organization (WHO), tobacco smoking kills one in every ten people globally (about 5 million fatalities per year). In Pakistan, the prevalence of tobacco smoking is estimated to be 36% for men and 9% for women. The smoking prevalence among young individuals, particularly university students, is 15%, with male smokers accounting for the vast majority. This qualitative study investigated institutional and individual smoking cessation assistance measures among University of Haripur students. A total of 41 students were interviewed, comprising 23 smokers (chosen by purposive snowball sampling) and 18 non-smokers (picked by convenience sampling). Smokers use action-oriented techniques including self-motivation, stress management, and gradual reduction, according to a thematic analysis conducted with NVivo. Nonsmokers place a strong emphasis on knowledge, peer pressure, and smoke-free surroundings as means of prevention and control. Support from the university, such as peer-led initiatives and counseling, became a common goal. The results emphasize the necessity for focused institutional and personal interventions by highlighting a complimentary but different perspective between the two groups.

Keywords: University students, individual tactics, institutional support, smoking cessation

Perceptions Regarding Kangaroo Mother Care among Mothers and Barriers to Its Adoption among Healthcare Providers at DHQ Hospital Haripur: A Qualitative Study

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Kangaroo Mother Care (KMC) is a globally recommended practice that involves early, continuous skin-to-skin contact and exclusive breastfeeding to improve neonatal outcomes. In Pakistan, where the burden of preterm births remains high, the effective implementation of KMC is critical. This qualitative study explored perceptions and experiences of KMC among mothers and identified barriers to its adoption among healthcare providers at the WHO-supported KMC unit in DHQ Hospital Haripur. A total of 34 participants were included: 22 mothers of preterm infants and 12 NICU healthcare providers selected through purposive sampling. Data were collected through in-depth and semi-structured interviews and analyzed thematically using NVivo. The findings revealed that mothers generally had positive emotional and physical responses to KMC, citing improved bonding and breastfeeding. However, efficient KMC delivery was hindered by obstacles such as a lack of infrastructure, a lack of family awareness, unclear institutional guidelines, and a staffing shortage. The provision of proper accommodations for mothers, community awareness campaigns, frequent audits, and the assignment of specialized KMC personnel are among the recommendations. In order to guarantee long-term KMC implementation in healthcare settings, the study highlights the necessity of coordinated policy and structural support.

Keywords: Kangaroo Mother Care, neonatal care, qualitative research, maternal perception, healthcare system, barriers

Analyzing the Impact of Project Management Software Usage on Project Performance

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This study was conducted to analyze the impact of project management software usage on project performance. The main purpose of study is to investigate and explain the importance of software usage in project processes. The objective of the study is to determine how the project management software is assisting the project managers for planning and monitoring the projects and the degree of satisfaction among project personals for the output generated. The study is purely quantitative; Purposive sampling technique along with snowball sampling technique was used for selection of sample population and the data have been presented in the form of figures, tables and graph. The sample of 33 respondent's form different developmental organizations of KPK was selected for the study. Questionnaire was developed for gathering primary data and was uploaded online as a Google Form. The URL of the questionnaire was then sent to the targeted population. The analysis for the study was drawn using SPSS in the form of graphs, tables and the correlation regression tests representing and indicating use of PM Software and its impacts on project performance. The results concluded from this study shows that the organizations which follow the project management standards for the planning of the project are using software more and the outputs drawn from the answers of the respondents indicated that the use of software makes it easy to plan and monitor the project and helps in generating high productivity in less time, consuming less energy and resources. The respondents were satisfied with the quality of output they obtain through the software as it meets their expectations and fulfill the daily work requirements, providing reliable information.

Synthesis of NiO-ZnO Nanocomposite with Improved Size and Stability Control for Efficient Reactive Orange 16 Adsorption

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NiO-ZnO composite nanoparticles are synthesized and optimized for effective adsorption of reactive orange 16 dye. The initial focus was to decrease the size and enhance the stability of nanoparticles for which the optimization was achieved by adjusting synthetic parameters such as concentration of precursor salts, pH, temperature, and the time of reagent addition. UV-Vis, FTIR spectroscopy, hydrodynamic size and zeta potential through dynamic light scattering, XRD pattern, and Brunauer-Emmett-Teller (BET) were performed to observe the formation and optimization. All spectroscopic techniques and XRD diffraction pattern confirmed successful synthesis of composite nanoparticles. The optimized synthetic conditions are observed at a concentration ratio of 50:50 with highest stability, smaller hydrodynamic radius (R_{hyd}) size is achieved at higher pH, while better control over size distribution and enhanced stability is attained at higher temperatures. The smallest size with highest stability is achieved with a reagent addition time of 5 minutes. These nanoparticles are also compared to the physical mix of nanoparticles, where UV-Vis spectroscopy differentiated their spectra. Later a large quantity

of these optimized NiO-ZnO composite nanoparticles was synthesized and removal of reactive orange 16 dye was observed from an aqueous solution. The effect of contact time, initial dye concentration, pH, and temperature was studied by batch adsorption experiments to examine the adsorption process, followed by adsorption isotherms and adsorption kinetics. The Langmuir model was observed for adsorption process and the experimental data fitted the first-order kinetic model.

Keywords: Hydrodynamic size; Composite NiO-ZnO; Reactive Orange 16; Adsorption Isotherms; Adsorption Kinetics

Computationally Guided Design of ZnO Based Nano adsorbents for Efficient Dye Adsorption

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Environmental sustainability has emerged as a critical global concern, demanding innovative solutions to preserve natural resources and minimize ecological degradation. Industrial dyes pollution has adversely affected aquatic health, which degrade the quality of aquatic life. This study focuses on the treatment of detrimental RB15 dye with the help of RSM (Response Surface Methodology) driven Graphene Quantum Dot (GQD)/Zinc Oxide (ZnO) namely GQD/ZnO nanoparticle synthesis. RSM driven synthesized Nano adsorbent were employed for dye removal using RSM and manual optimized application conditions where resource consumption, adsorption efficiency as well as optimized conditions were compared. Central Composite Design (CCD) of RSM was used to design the experimental synthesis of ZnO and GQDs/ZnO nano adsorbent. In the latter, 1, 2 and 3% of GQDs were added to constant dose of ZnO and variable calcination temperature, i.e., 300, 400, 500 °C. Results confirm pH 9 and 550 °C as optimum conditions of ZnO synthesis. Moreover 1% GQD loading and 300 °C were confirmed as optimum conditions for 1%GQD/ZnO-300 nano hybrid. The Optimum conditions were found as 30 mg/L dye, dose of 1 mg/L GQDs/ZnO, pH 4 and 30 minutes of equilibrium time. Overall RSM driven synthesis and adsorption application conditions ranked it as a better strategy for RB15 removal than manually optimized condition. Characterization studies revealed nano rod like structure and carboxylic, hydroxyl, nitrate and carbonyl groups present on the surface of 1%GQD/ZnO-300 nano hybrid. 1%GQD/ZnO-300 nano hybrid loses its adsorption efficiency by 65% until 5th cycle and main peaks shifts were observed. It is concluded that RSM driven synthesis and adsorption conditions optimization is better with respect to resource utility and high adsorption efficiency for RB15 dye removal.

Sufi Education and Peacebuilding

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Sufi education, a special form of education, grounded in the mystical tradition of Islam, offers deep knowledge and a profound approach to peacebuilding through emphasizing on ethical conduct, inner transformation, and universal love. There is a need to explore spiritual practices and pedagogical methods to promote humanitarian values such as tolerance, forgiveness, and respect for humanity. Through promoting these values peaceful individuals can be fostered to promote peaceful communities. Drawing on historical examples and contemporary applications, the study highlights the relevance of Sufi traditions in countering extremism and modern global terrorism, fostering intercultural dialogue, and contributing to global peace efforts. The paper also addresses current challenges faced by Sufi institutions and offers recommendations for integrating Sufi principles into modern peacebuilding initiatives.

Keywords: Sufism, Peacebuilding, Pedagogical, Tolerance, Interfaith Dialogue

Gestures for Peace: Exploring the Role of Nonverbal Communication in Conflict Resolution within ESL Classrooms

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In linguistically and culturally diverse ESL classrooms across Pakistan, nonverbal communication, such as gestures, facial expressions, and tone, plays a crucial yet often overlooked role in shaping student-teacher interactions. This study explores how teachers' use of paralanguage influences classroom dynamics and contributes to either conflict or inclusion among male and female students in both public and private universities. Using a mixed-methods approach, data were collected through structured questionnaires distributed to 200 undergraduate ESL students across Punjab and Khyber Pakhtunkhwa. The responses were analyzed through the lens of Systemic Functional Linguistics (interpersonal Meta function) and supported by Critical Discourse Analysis. Preliminary findings suggest that negative paralanguage (e.g., pointing, abrupt tone) often correlates with decreased student engagement and heightened tension. In contrast, inclusive nonverbal behaviors, such as open gestures and calm expressions, were associated with increased participation and emotional safety, especially among female learners. The study highlights the potential of mindful nonverbal communication to support peace-oriented pedagogies in ESL contexts and encourages further research into its role in fostering respectful and inclusive classroom environments.

Keywords: paralanguage, peacebuilding, ESL education, nonverbal communication, gender inclusion, teacher-student interaction

Impact of Heat-drought Climatic Extremes on N Cycling across Various Soil Ecosystems of Lesser Himalaya

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Soil ecosystems despite of providing a range of services are under enormous pressure of human perturbations and predicted climatic extremes. Microbial communities' integral in driving soil ecosystem functions respond differently to such extreme events hence estimating their

resistance and resilience is crucial to understand the impact on soil services. This study investigated the effect of heat-drought and rewetting patterns (uneven precipitation regimes) across various soil ecosystems (arable, grassland, forest) in lower Himalaya. Nitrification potential (PNA) and relative distribution of inorganic N species (NH_4 , NO_3) along with the contribution of involved functional guilds were studied through a microcosm experiment. Resistance and resilience were quantified by comparing with control, the response to drought and recovery over time, respectively. Results revealed high nitrification potential as well as soil mineral nitrogen for arable as compared to forest and grassland. Interestingly, the impact of drought was pronounced for forest soil which showed relatively low resistance and collapsed for studied parameters post drought. Rewetting levels caused a significant but variable impact with a sudden increase in soil NH_4 while reduction in NO_3 and nitrification. Forest soil rich in organic matter showed high resilience and recovered the PNA and soil mineral nitrogen to the initial levels which might also be associated to the functional redundancy of corresponding guilds. Further analysis revealed strong relations between the organic matter and PNA mainly in the forest soil whereas NH_4 was the main driver for PNA in arable and grassland. Droughts affected the specific function – PNA more strongly than the broad scale process - NH_4 release while heavy rewetting caused a sudden increase in soil mineral nitrogen which may subsequently impact the N losses to surrounding environment. Results demonstrated the unprecedented impact of heat-drought and uneven precipitation in variably perturbed soil ecosystems. The study also underlines the ecological relevance of N cycling processes in view of predicted N_2O budget under changing climate across various soil ecosystem of lower Himalaya.

Keywords: climate changes, forest soils, (de)nitrification, droughts, N_2O , extreme events

From Space to Soil: Exploring the Variable Linkage among Vegetation Cover, Phosphorous and Cadmium Pools

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This study explores the relationship between vegetation cover, soil nutrients, and contaminants using satellite imagery and geospatial analysis in the study area. Vegetation cover was assessed using the Normalized Difference Vegetation Index (NDVI) derived from satellite images for both spring and autumn seasons. Soil samples were analyzed to determine levels of available and total phosphorus (as essential nutrients) and cadmium (as a contaminant). The results indicated a general decline in NDVI, available phosphorus, and total phosphorus during the autumn season compared to spring. When categorized by land cover types such as forest and shrub land, a trend of increasing correlation between NDVI and phosphorus levels was observed, suggesting a potential vegetation-specific interaction with soil nutrients. In addition, cadmium levels were monitored to assess potential contamination risks, providing an environmental context to the nutrient analysis. These findings contribute to understanding the combined effects of soil nutrients and contaminants on vegetation health and can support future ecological management and land-use planning.

Keywords: NDVI, Phosphorus, Cadmium Contamination, Vegetation Cover, Geospatial Analysis

Impact of Post-Conflict Social Development Programs on Peace Process – A Case Study of Swat, Pakistan

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This research thesis examines the impact of post-conflict social development programs on the peace process in Swat, Pakistan, which experienced severe militant insurgency from 2007 to 2009. Using a mixed-methods approach, the study evaluates initiatives such as the School Rehabilitation and Reconstruction Program, Vocational Training Centers for Women, Healthcare Enhancement Program, Economic Revitalization Program for Men, and the Sabaoon Program for youth rehabilitation. Guided by Galtung's Peace Theory, Lederach's Peacebuilding Framework, Conflict Transformation Theory, and the Development and Peacebuilding Nexus, the research offers a multidimensional analysis of social development and sustainable peace. The research involved 80 respondents from diverse backgrounds: 46 from Charbagh, 34 from Barikot, 17 from urban areas, 18 from rural areas, 10 from conflict-affected zones, 10 economically disadvantaged individuals, 10 from cultural communities, 7 government officials, and 8 NGO representatives. The division between Charbagh and Barikot was intentional, as these two areas were significantly affected by the insurgency but displayed distinct socio-economic and cultural characteristics. Charbagh, with a higher concentration of respondents, was a strategic focal point for development programs due to its infrastructural and social vulnerability, whereas Barikot offered insights into post-conflict recovery in a more culturally conservative area. This distribution allowed for a comprehensive comparison of the programs' impact across different communities and socio-economic settings. Findings show that social development programs significantly contributed to Swat's physical and social reconstruction. Educational initiatives increased school enrollment and improved academic performance, providing long-term societal benefits. Vocational training for women enhanced economic participation and empowerment, promoting gender equality and financial independence. Healthcare programs improved medical service availability and quality, leading to better health outcomes and community well-being. Economic revitalization for men boosted local employment and business opportunities, fostering economic stability and resilience. Sabaoon Program effectively deracialized and reintegrated youth, reducing tensions and enhancing social cohesion. Despite these successes, challenges such as uneven program implementation, cultural sensitivities, and persistent socio-economic disparities were identified. These issues highlight the need for culturally sensitive, community-driven approaches involving local stakeholders. The research stresses the importance of continuously adapting development strategies to the evolving socio-political dynamics in post-conflict recovery. This study contributes to the understanding of post-conflict recovery by providing empirical evidence and theoretical insights into how social development initiatives foster sustainable peace. It offers practical recommendations for policymakers and development practitioners, emphasizing the need for integrated, context-specific strategies that combine educational, economic, healthcare, and social cohesion initiatives to achieve long-term stability and peace. The research underscores the interconnectedness of development sectors and their collective impact on peacebuilding, providing a framework for effective post-conflict development programs adaptable to similar contexts worldwide.

Keywords: Peacebuilding, Sustainable peace, Cultural sensitivities, Rehabilitation, Reconstruction.

Fluorescent Carbon Quantum Dots-Decorated TiO₂ Nanocomposites for Efficient Photocatalytic Removal of Reactive Black 5

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This study investigated the photocatalytic degradation of model pollutant Ramazol Black 5 (RB₅) textile dye under visible light irradiation using various CQD-sensitized titanium dioxide (TiO₂) nanocomposites. Fish scales were used as a carbon precursor to produce carbon quantum dots, which were intended to be used as sensitizers to improve the effectiveness of titania and as efficient photo catalysts for water pollutant degradation. Carbon quantum dots have a variety of uses, including drug delivery, bio imaging, gas detection, and catalysis. The study emphasizes the long-term viability and efficacy of employing fish scales as a carbon source, providing a feasible solution to wastewater pollution and assisting with waste management in fisheries. This novel method has the potential to considerably improve the photocatalytic activity of carbon quantum dot/TiO₂ nanocomposites, lowering their negative environmental impact. Different CQDs/TiO₂ with 1%, 2%, 5%, 10%, 20% and 30% wt% loading at a calcination temperature of 300°C. Key findings indicate that the RB₅ photo-degradation efficiency increases with longer irradiation times, achieving complete removal (100%) in 60 minutes. The effectiveness of degradation diminishes with higher initial dye concentrations, with 100% removal efficiency at 10 mg/L, decreasing to 44.64% at 200 mg/L. The photocatalytic activity significantly improves with increased doses of the 2CQD-T-3 photo catalyst, achieving over 100% efficiency at doses of 1.5nmg/mL and higher. The reaction solution pH also plays a crucial role, with optimal decolorization efficiency observed at acidic pH levels of 2, 4, and 6, while alkaline conditions (pH 10) result in a marked reduction in efficiency to around 70%. These findings highlight the potential of CQDs/TiO₂ composites as effective, eco-friendly, and recyclable materials for wastewater treatment applications, providing insights into optimizing synthesis and operational parameters for enhanced photocatalytic performance.

Keywords: Fluorescent Carbon Quantum Dots; Sensitized titanium dioxide; Wastewater; Photo catalyst

Production and Partial Optimization of Keratinase Enzyme from *Pseudomonas lactis* AF-2

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The increasing global population and its increasing nutritional demands have led to an expansion in various industries including poultry, livestock, and slaughterhouse activities, resulting in the production of large amount of keratinous waste materials including feathers, horns, wool, hooves etc. The accumulation of these non-biodegradable keratinous wastes poses a significant threat to ecological stability. Conventional disposal methods, such as burning and landfilling, restrict the capacity of soil microorganisms to decompose the waste material. Therefore, the present study aims to utilize *Pseudomonas lactis* AF-2, isolated from poultry contaminated soil, to produce and partially optimize the keratinase enzyme. The effects of temperature, pH, nitrogen source, and substrate type on keratinase production were evaluated. The highest enzyme activity (70.6 U/mL) was found with feather meal, whereas the lowest activity (6.34 U/mL) was recorded with skim milk. The maximum keratinase production of 95.29 U/mL was observed at pH 8.0 using chicken feather substrate, while the optimum temperature is 28°C, which shows maximum enzyme production of 73.35 U/mL. Similarly, organic nitrogen sources significantly enhanced enzyme synthesis compared to inorganic nitrogen sources. Under these optimum conditions, the study demonstrates that *Pseudomonas lactis* AF-2 can effectively produce keratinase, offering an environmental friendly approach to managing chicken feather waste and producing valuable enzymes for industrial applications.

Keywords: Keratinase enzyme, Optimization, *Pseudomonas Lactis* Af-2, Feather Meal

From Rubble to Resource: Eco-Engineered Photocatalytic Concrete with Recycled Aggregates for Pollutant Degradation

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The depletion of natural resources and the growing burden of construction waste necessitate sustainable alternatives for building materials and environmental remediation. This study explores the development of photocatalytic concrete using recycled aggregates combined with titanium dioxide (TiO₂) and graphene quantum dots (GQD) to achieve a dual objective: resource conservation and wastewater treatment. The photocatalytic properties of TiO₂ enable the degradation of organic pollutants, such as dyes and microbes, under light irradiation, while the incorporation of GQD enhances visible-light activity by narrowing the band gap of TiO₂. Recycled aggregates replace conventional natural aggregates, reducing the environmental footprint and promoting circular economy principles. In this work, different molar ratios of GQD (1–25 mol%) were integrated into TiO₂ and annealed at three calcination temperatures (300°C, 400°C, 500°C) to optimize photocatalytic performance. The 15 mol% GQD/TiO₂ composite embedded in concrete demonstrated the highest degradation efficiency for Reactive Black 5 (RB5) dye within 60 minutes of irradiation. Statistical optimization using Response Surface Methodology (RSM)

and ANOVA analysis confirmed significant correlations among variables ($p < 0.05$), indicating strong model reliability. The findings highlight the potential of GQD-modified TiO_2 photocatalytic concrete using recycled aggregates as a sustainable, green infrastructure solution for water treatment and pollution mitigation. This approach not only enhances wastewater treatment efficiency but also contributes to the conservation of natural resources through waste valorization in construction materials.

Biodegradation of Engine Oil by Isolated Bacterial Consortium under Soil Microcosm Experiment

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Petroleum hydrocarbon contamination, particularly from used engine oil, poses a serious threat to soil health and environmental quality due to its toxicity and persistence. This study investigates the biodegradation potential of a bacterial consortium comprising *Pseudomonas oleovorans* and *Enterobacter* spp. under controlled soil microcosm conditions. A completely randomized block design with three replicates per treatment was implemented. Each treatment consisted of 50 g of soil artificially contaminated with 3% and 5% (v/v) engine oil and inoculated with either individual strains or a 1:1 bacterial consortium. Microcosms were incubated at 37°C for 21 days, and hydrocarbon degradation was quantified at 7-day intervals using UV-Visible spectrophotometry. The results demonstrated superior biodegradation efficiency by the consortium, achieving up to 90% and 96% degradation at 3% and 5% oil concentrations, respectively. In comparison, *Pseudomonas oleovorans* achieved 65%–68% degradation, while *Enterobacter* spp. achieved 69%–72%. The enhanced performance of the consortium suggests synergistic metabolic activity, enabling more effective breakdown of complex hydrocarbon mixtures. These findings highlight the potential of indigenous microbial consortia as effective bioremediation agents for petroleum-contaminated soils, offering a low-cost and environmentally sustainable alternative to conventional remediation strategies.

Keywords: Engine oil, Biodegradation, *Pseudomonas oleovorans*, *Enterobacter*, Soil Microcosm

Fish Scale-Derived Carbon Quantum Dots Doped Magnetic TiO_2 Photocatalysts: Advancing Environmental Sustainability through Solid Waste Valorization and Wastewater Treatment

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The increasing amount of fish-processing waste and ongoing water pollution pose significant environmental issues. Converting this bio-waste into high-performance nanomaterials provides an eco-friendly approach that combines waste reduction with water treatment. This review emphasizes recent advancements in the production of carbon quantum dots (CQDs) from fish scales, along with their use in conjunction with magnetic TiO_2 photocatalysts for wastewater treatment. CQDs derived from biomass possess distinctive optical characteristics and adjustable band structures, allowing for effective photocatalysis using visible light. When integrated with

magnetic TiO₂, these hybrid systems show enhanced charge separation, increased light absorption, and remarkable recyclability, ensuring their practical use. The review covers green synthesis methods, structural design, photocatalytic processes, and performance enhancement, while also addressing challenges related to scalability and stability. Future perspectives for improving environmental sustainability through bio-waste valorization and innovative photocatalytic technologies are discussed as well.

Keywords: Carbon Quantum Dots, TiO₂, Photo catalysis, Solid Waste Management, fish scales, Wastewater Treatment

Isolation, Screening and Characterization of Newly Isolated keratinolytic Bacteria from Poultry Farm Soil

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The poultry business contributes significantly to the global income. It generates a lot of trash, including chicken feathers. Soil microorganisms' ability to degrade trash is hindered by conventional disposal techniques like burning and landfilling along with other garbage. Therefore, the objective of this work was to identify and isolate bacterial strains that produce keratinase and are able to break down chicken feather waste. Isolated, 7 strains were screened, and their feather degrading ability on feather meal agar plates and skimmed milk agar media. Two strains; AF2 and AF7 shows keratinolytic activity that reveal the keratinase enzyme on feather meal agar and skimmed milk agar media. Among all, the two strains AF2 and AF7, showed largest zone of hydrolysis that show maximum enzymatic activity. The identified bacterial strains AF2 and AF7 showed 99% similarity to *Pseudomonas lactis* and 98% to *Mammaliicoccus lentus* respectively. The bacterial isolates AF2 and AF7 degraded 73 % and 63% of the chicken feather meal in 7 days of incubation. Therefore, these bacterial strains have a greater potential to be used for the biotechnological waste management and value-added product manufacturing from keratinous waste.

Keywords: Feather meal, Bacterial Isolate, Keratinase, *Pseudomonas lactis* AF- *Mammaliicoccus lentus* AF7

Valorization of Fruit Waste into Functional Nanocomposites for Pollutant Removal: A Sustainable Development Perspective

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The rapid accumulation of fruit waste from agricultural and food processing industries poses a significant environmental challenge yet offers an untapped opportunity for sustainable resource recovery. This review explores the valorization of fruit waste such as peels, seeds, and pomace as a green and cost-effective route for synthesizing functional nanomaterials, including mono, bi, and trimetallic nanoparticles. Rich in natural reducing and stabilizing agents, fruit waste extracts enable environmentally benign nanoparticle synthesis without the use of hazardous chemicals. Bimetallic and trimetallic composites, such as Au-Ag, Fe-Cu, and Au-Ag-Pt, exhibit enhanced

catalytic and photocatalytic properties due to synergistic metal interactions. The synthesized nanoparticles are characterized using advanced techniques like UV/Vis spectroscopy, FTIR, XRD, TEM, and zeta potential analysis, confirming their structural, morphological, and colloidal stability. A particular focus is placed on their application in the removal of environmental pollutants, especially synthetic dyes and pharmaceutical contaminants, through adsorption and advanced oxidation processes. The integration of fruit waste valorization into nanotechnology supports several United Nations Sustainable Development Goals (SDGs), including SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), and SDG 9 (Industry, Innovation, and Infrastructure). The review concludes by highlighting the current limitations, such as scalability and environmental safety, and recommends future directions to bridge research and industrial implementation. Overall, fruit waste-based nanomaterials represent a promising avenue for advancing circular economy practices and sustainable environmental remediation technologies.

Keywords: Fruit waste valorization, Green synthesis, Bimetallic and Trimetallic nanocomposite, Dye degradation, Sustainable development goals (SDGs).

Sustainable Nanophotocatalysts from Fish Waste and Metal Oxides for Wastewater Remediation

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Zinc oxide nanoparticles (ZnO NPs) are promising semiconductor photocatalysts due to their high efficiency, low energy consumption, and non-toxic nature in treating wastewater containing organic dyes. However, their wide band gap (3.37 eV), rapid electron–hole recombination rate, and instability under visible light limit their practical applications. To address these limitations, ZnO NPs were modified through coupling with p-type magnetic semiconductor cobalt oxide and sensitization with carbon quantum dots (CQDs). CQDs were synthesized via hydrothermal treatment of fish scales, while ZnO NPs were produced using a simple calcination method. Co₃O₄ NPs were prepared through a co-precipitation process. The nanocomposites with specific weight ratios of CQDs/ZnO and Co₃O₄/ZnO were fabricated using solvothermal and hydrothermal methods, respectively. These composites exhibited the photocatalytic degradation of RB 5 dye by 85%. Analysis using the Langmuir isotherm model and pseudo-second-order (PSO) kinetics indicated that dye adsorption followed a monolayer chemisorption mechanism. The generation of hydroxyl radicals, holes, and electrons contributed to dye degradation, with electrons playing the dominant role. Future research should focus on optimizing the balance between nanoparticle stability and surface activity to improve pollutant interaction in wastewater treatment.

Bridging the Gaps: A Critical Review of Environmental Impact Assessment (EIA) Practices in the Construction Sector

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Environmental Impact Assessment (EIA) serves as a key component of sustainable development, particularly within the construction sector where ecological and social risks are high. Despite being mandatory in many countries, EIA practices in construction often fall short due to regulatory gaps, inconsistent implementation, and lack of technical integration. This review critically examines the current situation of EIA application in the construction industry, highlighting both strengths, such as structured frameworks and emerging technological tools and weaknesses, including deficient stakeholder engagement, inadequate post-construction monitoring, and limited integration of climate change adaptation. Sector-specific challenges are explored in detail, particularly the impacts of rapid urbanization, neglect of cumulative effects, and the failure to apply lifecycle thinking. Drawing from global case examples, including successful models like the Netherlands nature-inclusive construction policies and failure cases from Brazil Amazon development, this paper proposes a comprehensive set of reforms. These include strengthening governance, enhancing technical and institutional capacity, ensuring meaningful public participation, integrating climate resilience, and embedding lifecycle sustainability into EIA processes. Ultimately, bridging these gaps is vital to align construction practices with global environmental commitments such as the SDGs, the Paris Agreement, and national green growth agendas.

Keyword: Environmental Impact Assessment (EIA), Sustainable Construction, Climate Resilience, Urban Infrastructure Planning, Cumulative Environmental Impacts, Stakeholder Participation

Synthesis and characterization of CoFe_2O_4 nanoparticles for removal of anionic dye from aqueous sample: experimental design, kinetic, isotherm and thermodynamic studies

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Indiscriminate disposal of dye-loaded wastewater into aquatic ecosystems is a major contributor to water pollution, primarily due to the toxic and carcinogenic effects of synthetic dyes. To address this issue, studies have increasingly focused on the removal of dyes from wastewater using nanotechnology. In this study, cobalt ferrite (CoFe_2O_4) nanoparticles were successfully synthesized via the co-precipitation method and employed as adsorbents for the removal of Reactive Orange 16 (RO16) dye from aqueous solutions through batch adsorption. Adsorption parameters such as pH, contact time, adsorbent dose, and initial dye concentration were optimized. Maximum dye removal of 90% was achieved under optimal conditions: pH 4, adsorbent dose of 2 mg, temperature 318 K, and 60 minutes contact time. Thermodynamic parameters indicated that the adsorption process was spontaneous and endothermic in nature, with ΔG ranging from -8.6 to -12.6 kJ/mol, $\Delta H = 51$ kJ/mol, and $\Delta S = 0.2$ kJ/K·mol. Among the tested isotherm models, the Freundlich model best fitted the equilibrium data ($R^2 = 0.995$), suggesting multilayer adsorption on a heterogeneous surface. Kinetic data were well described by the pseudo-second-order model, indicating chemisorption as the rate-limiting step. The synthesized CoFe_2O_4 nanoparticles were environmentally safe, as confirmed by non-phytotoxic effects in tomato seed germination tests. Their magnetic properties allowed easy recovery with

a handheld magnet, and they retained 76% removal efficiency after five reuse cycles. These results underscore their potential as cost-effective, reusable, and eco-friendly adsorbents for dye removal.

Keywords: CoFe₂O₄, RO16 dye, co-precipitation, regeneration, toxicity study.

Vegetation response to recent trends in climate and land surface temperature changes in Central Khyber Pakhtunkhwa Province, Pakistan

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Meteorological parameters and land surface temperature (LST) affect energy balance by altering vegetation. In the current study, we explored trends and the relationship between the normalized difference vegetation index (NDVI), LST, and meteorological parameters (i.e., precipitation and air temperature) using Moderate Resolution Imaging Spectroradiometer (MODIS) and Google Earth engine data from 2009 through 2022. Annual mean images for LST, NDVI, and meteorological parameters were prepared from monthly data. The results of the study showed significant changes such as the mean annual LST increased from 29 °C to 33 °C, while the mean annual NDVI decreased from 0.6 to 0.5 from 2009 through 2022. The air temperature also increased from 21 °C to 22 °C, while precipitation decreased from 680 mm to 656 mm during the same period. The results of NDVI for different land use and land cover (LULC) types showed that the built-up area has the lowest NDVI as compared with other LULC classes. The correlation analysis between NDVI and LST showed a statistically negative relationship with a correlation coefficient (r) value of -0.06 for the study period. Furthermore, NDVI and air temperature have a negative correlation with a r value of -0.002. Precipitation and LST also showed a negative correlation (r=-0.191). Our study results indicated that vegetation would further decrease with the decrease in rainfall and an increase in air temperature, which helps detect NDVI changes associated with the effect of climate and LULC changes. The current study findings are important for sustainable land use planning to minimize the consequences of climate and LULC changes, which will affect vegetation and LST in the study area.

Keywords: Land Surface Temperature, Normalize Vegetation Indices, Land Use Land Cover Changes, Moderate Resolution Imaging Spectroradiometer

Manganese sulfate induced behavioral alterations, genotoxicity and histopathological lesions in grass carp (*Ctenopharyngodon idella*)

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Manganese sulfate (MnSO₄) is an industrial and agricultural compound whose environmental consequences, especially within aquatic habitats, are a growing concern. This investigation was designed to characterize the toxicological profile of MnSO₄ in juvenile grass carp (*Ctenopharyngodon idella*), an economically important freshwater fish. The study assessed its effects on behavior, genetic integrity, and tissue histology. Over 96 hours period, replicate groups of fish (total n=120) were exposed to sublethal concentrations of MnSO₄ (0, 3.51, 3.60, and 3.71

mg/L). Behavioral endpoints, including locomotor activity and feeding patterns were quantified, revealing significant dose-dependent impairments such as diminished swimming velocity ($p < 0.05$) and feeding efficiency ($p < 0.01$). Genotoxic potential was evaluated in erythrocytes, where the micronucleus test indicated a marked increase in micronuclei formation at higher concentrations (1.0 and 2.0 mg/L, $p < 0.001$). Furthermore, histopathological analysis of gills and skin tissues showed pronounced pathological changes, including epithelial lifting in gills, vacuolation and necrosis in skin tissue. These findings collectively illustrate that $MnSO_4$ induces a cascade of toxic effects, compromising the behavior, genome, and tissue integrity of grass carp. The study emphasizes the critical need for regulating manganese-based pollutants to preserve the stability of aquatic ecosystems.

Keywords: Manganese Sulphate, ctenopharyngodon Idella, Genotoxicity, Histopathology, Behavioral alteration.

Synthesis of Green Silver Nanoparticles Using Raw Royal Jelly and Its Impact against *Fusarium Oxysporum* Isolated From Fish

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Aquaculture is a key contributor to global food security; however, it faces significant challenges from fungal pathogens such as *Fusarium oxysporum*, which causes skin and systemic infections in fish and leads to major economic losses. The excessive use of antifungal drugs has resulted in the emergence of drug-resistant fungal strains, necessitating the development of environmentally friendly alternatives. In this study, silver nanoparticles (AgNPs) were synthesized via a green approach using raw royal jelly obtained from KUST Model Bee Farm. Characterization of the synthesized AgNPs revealed a UV-visible surface plasmon resonance (SPR) peak at 430 nm, confirming nanoparticle formation. FTIR analysis detected functional groups responsible for nanoparticle stabilization, XRD patterns indicated a face-centered cubic crystalline structure, and SEM images showed spherical AgNPs with sizes ranging from 25 to 50 nm. The antifungal activity of the royal jelly-derived AgNPs was tested against *F. oxysporum* isolated from infected Cyprinidae fish using the agar well diffusion method. Results demonstrated a concentration-dependent antifungal effect, with inhibition zones measuring 13 mm at 1 mM, 18 mm at 2 mM, and 23 mm at 3 mM AgNP concentration. Corresponding percent fungal growth inhibition values were 45%, 68%, and 87%, respectively. These findings confirm the potent antifungal activity of green-synthesized AgNPs, particularly at higher concentrations. The royal jelly-mediated AgNPs represent an effective and eco-friendly antifungal agent suitable for controlling resistant fungal pathogens in aquaculture. It is recommended that future studies include in vivo evaluations in aquaculture models, analysis of the mechanism of action on fungal cell walls and membranes, and thorough toxicological and environmental safety assessments to support potential commercial application.

Keywords: Aquaculture, *Fusarium oxysporum*, Silver nanoparticles, Royal jelly, Green Synthesis, Antifungal activity, Drug resistance

GC-MS-Based Phytochemical Profiling and Integrated Biological-Computational Analysis of *Micromeria biflora*

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The methanolic extract of *Micromeria biflora* and its solvent-partitioned fractions (n-hexane, chloroform, and ethyl acetate) were subjected to GC-MS analysis, leading to the identification of 74 compounds. Among the fractions, the ethyl acetate extract exhibited the highest radical scavenging activity in the ABTS assay (86.21%) and the strongest reducing power in the FRAP assay (85 mg AAE/g). Conversely, the methanolic extract demonstrated superior scavenging efficacy in the DPPH assay (93.30%). Upon in vitro evaluation of antidiabetic activity, the chloroform extract exhibited the most potent inhibitory effects against α -glucosidase ($80.67 \pm 0.61\%$) and α -amylase ($75.15 \pm 0.11\%$) at 1000 $\mu\text{g/mL}$. Consistently, in vivo studies confirmed its superior antihyperglycemic efficacy, which closely paralleled the therapeutic performance of the standard drug glibenclamide. Antimicrobial activity was evaluated through minimum inhibitory concentration (MIC) determination, where the n-hexane fraction exhibited the most pronounced antibacterial effect (MIC: 0.39–0.78 mg/mL). Molecular docking studies targeting penicillin-binding protein 5 (PBP5) of *Escherichia coli* and sterol 14- α -demethylase (CYP51B) of *Candida albicans* revealed notable binding affinities for key compounds, including 3,5,6,12-tetrahydroxyergostan-25-yl acetate, ferruginol, and 3-ethyl-3-hydroxyandrostane-17-one. Additionally, density functional theory (DFT) calculations further identified 3,5,6,12-tetrahydroxyergostan-25-yl acetate as possessing high chemical reactivity and polarity, supported by a low HOMO–LUMO energy gap (6.99 eV), elevated dipole moment (5.63 D), and minimum total energy (–1623.64 Eh). Structural optimization confirmed geometries devoid of steric hindrance, corroborating the docking outcomes. These integrated phytochemical, biological, and computational findings underscore the therapeutic promise of *Micromeria biflora*, validating its ethnopharmacological relevance and potential as a source of bioactive agents.

Keywords: *Micromeria biflora*, GC-MS, antioxidant activities, antidiabetic activities, antimicrobial activities, molecular docking studies, DFT analysis.

Sensitivity Analysis of New Mathematical Model for COVID-19

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In this study, we present a new mathematical model to analyze the transmission dynamics of the COVID-19 outbreak, with a particular focus on parameter sensitivity. The model is qualitatively investigated using stability theory of differential equations. The basic reproduction number, a key epidemic threshold, is derived from the dominant eigenvalue of the next-generation matrix. Conditions for the global asymptotic stability of the disease-free equilibrium are established. Using real COVID-19 incidence data from Pakistan, collected between July 1 and August 14, 2020, we estimate the model parameters through data fitting techniques. A detailed sensitivity analysis is then conducted to identify the most influential parameters affecting the model outcomes. Our results show that the transmission rate (β) exhibits the highest sensitivity, while the recovery rate (γ) is the least sensitive parameter. Numerical simulations are performed to explore the behavior

of the state variables under varying parameter values. In addition, the dependence of the basic reproduction number on key parameters is illustrated through contour plots, providing further biological insights into the epidemic dynamics.

Inorganic Hybrid Materials for Hydrogen Production

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Water splitting, a promising energy conversion technology, has gained attention for producing clean hydrogen fuel. The process involves two crucial reactions, namely the hydrogen evolution reaction (HER) and the oxygen evolution reaction (OER), necessitating cost-effective catalysts. Non-precious-metal catalysts, especially those derived from metal-organic frameworks (MOFs), show potential applications due to their high specific surface area (SSA) and efficient synergistic interactions. Thus, developing MOF-derived catalysts are crucial for advancing commercial water-splitting applications. This presentation will include the significance of electrochemical water splitting for hydrogen production and the synthesis of some innovative materials for this purpose. For instance, a novel core-shell structure is prepared, wherein MOFs serve as the core material with dispersed Ni and NiTe nanoparticles. Combining MOFs and NiTe in a core-shell configuration offers several synergistic and surface interface effects, leading to exceptional bifunctional activity for HER and the oxygen evolution reaction OER. A few other examples of the current work will be presented. By addressing the challenges of environmental pollution and energy sustainability, this research has the potential to be a valuable opportunity for the advancement of economically viable, efficient, and low over potential electro catalysts that facilitate the overall process of water splitting along with wastewater treatment. Biography Dr. Manzar Sohail is Professor of Inorganic / Analytical Chemistry at the Department of Chemistry, NUST, and Islamabad. Dr. Manzar Sohail obtained his PhD at Monash University, Australia in October 2009. During his postdoctoral appointments, he worked at the Nano chemistry Research Institute, Curtin University and the University of the Sunshine Coast, Australia. His main research focus and interest is fabrication of electrochemical sensors, synthesis of new inorganic materials and surface characterization techniques. Since April 2014, he is Research Scientist at Center of Excellence in Nanotechnology, King Fahd University of Petroleum and Minerals, Saudi Arabia. Dr. Manzar completed several industrial research projects. He has 7 US patents and over 115 international journal publications. He developed a prototype sensor for Calibration Free nitrate sensing which is currently being used by Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia.

Impact of Petroleum Crude Oil Exposure on the Gut Microbiota of Pigeons in District Kohat

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Petroleum crude oil contamination is a major environmental issue, especially in industrial regions where it poses substantial risks to local biodiversity. Birds such as *Columba livia* (Rock Pigeon) are

key components of urban ecosystems and are particularly vulnerable to pollutants due to their frequent exposure and close interaction with contaminated environments. Crude oil exposure has been associated with disruptions in gut microbiota, which can lead to impaired digestion, weakened immune responses, altered metabolism, and loss of physiological homeostasis. This study aims to assess the impact of petroleum crude oil on the gut health of *C. livia* in District Kohat, Pakistan. A region affected by significant petroleum-related activity. Fecal samples were collected from pigeons inhabiting areas with varying levels of petroleum pollution. The bacterial composition of the gut microbiota was analysed through 16S rRNA gene sequencing, specifically focusing on the identification and relative abundance of key bacterial groups: *Escherichia coli*, *Salmonella* sp., and *Enterobacter* sp. Enzyme assays were conducted to evaluate β -glucuronidase and urease activities, which serve as indicators of microbial metabolic function and intestinal health. Additionally, Gas Chromatography–Mass Spectrometry (GC-MS) was used for metabolomics profiling to quantify short-chain fatty acids (SCFAs) and amino acids, offering further insight into functional alterations in the gut environment. The study provides a comprehensive analysis of how chronic exposure to petroleum hydrocarbons can lead to microbial dysbiosis and metabolic disturbances in urban bird populations. Findings are expected to enhance understanding of pollutant-induced health risks in avian species and contribute to the development of targeted conservation and pollution mitigation strategies in industrial ecosystems.

Nerium oleander mediated green synthesis of cobalt oxide nanoparticles and their applications in pesticide degradation

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This study presents the successful green synthesis of cobalt oxide (Co_3O_4) nanoparticles using *Nerium oleander* leaf extract and evaluates their photocatalytic potential in degrading two commonly used pesticides: pendimethalin and acetamiprid. The Co_3O_4 nanoparticles were synthesized through an eco-friendly route involving green method, confirmed by UV-Visible spectroscopy. The synthesized nanoparticles were characterized by FTIR, SEM, EDX, and XRD techniques, revealing spherical morphology, crystalline nature and functional groups responsible for reduction and stabilization. Photocatalytic degradation experiments demonstrated that 1 mg of Co_3O_4 nanoparticles could degrade up to 87% of pendimethalin and 79% of acetamiprid within 90 minutes under optimal conditions (pH 7, 30°C, and light exposure). Optimization of nanoparticle dose, pH, and reaction time showed that higher doses improved degradation up to a saturation point beyond which no significant increase occurred. The toxicity of nanoparticles was assessed using a brine shrimp lethality assay. Results indicated that the mortality rate of *Artemia nauplii* exposed to untreated nanoparticles was above 70%, whereas mortality significantly dropped to 23% ($\text{LC}_{50} > 10 \text{ mg/mL}$) when exposed to the nanoparticle-treated degradation products. These findings confirm the reduced toxicity of the treated samples. The study concludes that Co_3O_4 nanoparticles synthesized via green chemistry offer an efficient and

environmentally safe approach for pesticide remediation and have potential applications in environmental cleanup strategies.

Keywords: Green synthesis, Cobalt oxide nanoparticles, Photocatalytic degradation

Synthesis and Characterization of Ceria-Doped Hydroxyapatite Nanocomposites for Colorimetric Detection of Mercury via Waste Valorization Approach

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Mercury (Hg^{2+}) contamination poses a critical threat to ecosystems and human health due to its extreme toxicity, bioaccumulation, and persistence in the environment. Developing a low-cost, eco-friendly, and sensitive platform for its detection is essential for environmental monitoring. This study reports the synthesis of cerium-doped hydroxyapatite (Ce-HAp) nanocomposites through a sustainable waste valorization approach utilizing fish scale-derived calcium sources as HAp precursors. This approach addresses fishery waste disposal issues while contributing to circular bio economy by transforming waste into functional nanomaterials. The nanocomposites were synthesized using a calcination method, followed by doping with cerium ions ($\text{Ce}^{3+}/\text{Ce}^{4+}$) to enhance its optical and sensing properties. The structural, morphological, and compositional characteristics of the Ce-HAp nanocomposites were investigated using XRD, FTIR, SEM, EDX, and UV–Visible spectroscopy. For sensing applications, the Ce-HAp nanocomposites were tested for colorimetric detection of mercury ions in aqueous media using 3,3',5,5'-tetramethylbenzidine (TMB) as a chromogenic substrate. Upon interaction with Hg^{2+} ions, a distinct color change from colorless to blue was observed, due to the catalytic reaction between Ce-HAp nanocomposites and TMB. This reaction enables visual detection and UV-vis based quantification of mercury, showing high selectivity and sensitivity with a very low detection limit. The study highlights the dual benefit of sustainable nanomaterial synthesis from waste and the development of a simple, rapid, and cost-effective platform for mercury detection. The Ce-HAp nanocomposites show promising potential in environmental monitoring and wastewater assessment, particularly in low-resource settings. This work reinforces the importance of waste-to-resource strategies in advanced functional material development for environmental applications.

Keywords: Mercury, Ce-HAp Nanocomposites, Colorimetric Sensor, TMB

The Pharmacy students' Perception and cognition of Artificial Intelligence; The study of factors and Approaches

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Background: The present study was conducted to analyze the undergraduate Pharmacy students understanding and utilization of artificial intelligence (AI) in their studies.

Methods: An online survey was conducted with 1st year to final year pharmacy students at two different Universities of Karachi, Pakistan, assessing their AI knowledge, perception and literacy regarding its appropriate use. Data were analyzed descriptively by SPSS version 25.

Results: A total of 312 students participated, belongs to age bracket of 18-24 years, majority of them were resident of district east and spoke Urdu language. Among them 23% proficient in computer literacy and 46.2% students always use computer for their learning. 12% got proper training for artificial Intelligence. Over 56.4% strongly agreed that AI will affect the job opportunities. More than fifty percent of the participants felt that the health care facilities in Pakistanis are not synchronize with the upcoming challenges of AI, and the students of medical and allied health sciences should focus to learn the AI tools and technology.

Conclusion: Healthcare challenges concerning manpower and limited resources may be resolved by the methodical application of AI in Pakistan's healthcare system. One helpful first step is to include AI and machine learning-related topics in medical curricula.

Green Methodological Extraction for Efficient Recovery of High-Value Components from Selected Food Plants and Agro-wastes

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Extraction of high-value components (functional components) such as phenolics and lipids from various plant materials is a challenging task. Traditionally, high-value components have been extracted using organic solvent-based methods, however, most of such approaches have limitations due to process and food safety concerns. Ongoing efforts are focused on developing new, safer, and more environmentally friendly techniques for producing clean label ingredients for the development of functional food and nutraceutical products. This lecture focuses on the applications of green extractions such as ultrasound-assisted extraction (UAE), enzyme-assisted extraction (EAE), supercritical fluid extraction (SFE), subcritical water extraction (SWE), and plant milking technology (PMT). Main focus is given on methodological developments pertaining to the extraction of polyphenols, lipids, and essential oils from a range of food plants and agro-wastes using green extraction techniques. Advanced chromatographic techniques, including GC-MS and LC-MS, have been used to characterize the recovered bioactive components. Significant improvement in the nutraceutical prospects of the bioactive extracts have been noticed relative to the controls. Overall, optimized UAE, EAE, EA-SFE were found to be quite effective for the efficient recovery of phenolics from olives, jujube fruit, pomegranate peel, black tea residue, balsam apple, mulberry leaves and Capparis fruits, where applicable. Field-emission scanning electron microscopy (FE-SEM) revealed significant changes in the ultrastructure of the leftover materials, indicating that the given pre-treatments had effectively hydrolyzed and broken down the cell walls, improving the recovery of bioactives. The currently devised green approaches can be applicable for the efficient extraction of functional bioactive from a variety of food plant materials.

Keywords: Plant phenolics, antioxidant potential, essential oils, functional lipids, optimized green extraction, plant milking technology

Exploring the Knowledge and attitude of health care professionals regarding artificial intelligence: Implications for the future of healthcare

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Background: Artificial intelligence (AI) holds immense potential to revolutionize various sectors of the economy, including healthcare, by serving as a catalyst for innovation. In recent times, AI has garnered significant attention for healthcare professionals in decision-making processes, thereby reshaping the landscape of the healthcare industry. The current research aimed to evaluate the health care professional's knowledge and attitudes regarding the implication of AI in clinical practice.

Methodology: This study employed a cross-sectional research design utilizing an online survey approach. A convenient sampling technique was employed, involving 315 participants from diverse healthcare backgrounds, including medical doctors, pharmacists, physiotherapists, and nurses. Descriptive statistics was used to examine quantitative data via the SPSS 27.0 version. Chi-square test was utilized to compare the association between variables, with significance set at a level of less than 0.05 and 95% confidence intervals applied to the findings.

Results: The findings indicate that a majority of respondents with substantial knowledge of AI fall within the 20-30 age group, with pharmacists demonstrating a higher level of AI knowledge compared to other healthcare professionals. Interestingly, while 17.6% of pharmacists express firm beliefs that AI may replace them, over 30% of nurses share similar concerns. The chi-square analysis provided further insights into the general responses of healthcare professionals regarding various aspects of AI in healthcare. While significant associations were observed for some statements, such as the belief that AI could replace participants' jobs (p-value =0.014).

Conclusion: The study highlights a prevailing apprehension among respondents regarding the extensive use of AI in the medical profession, with a significant proportion expressing concerns that surpass even those associated with nuclear weapons. Despite this apprehension, 60% of respondents emphasize the critical importance of AI tools in healthcare. It is evident that while there exists a fear surrounding the potential replacement of humans by AI, there is also a recognition of the invaluable contribution that AI can make to the field of healthcare.

Effect of Bee Propolis as a Food Supplement on Proximate Composition and Growth Performance of Labeo Rohita

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Background: Propolis, a bioactive resinous substance collected by honeybees, is recognized for its antimicrobial, antioxidant, and growth-enhancing properties. The study aimed to elucidate the profitable operational attributes of bee propolis and validate how it can be used as a nutritional supplement to enhance the proximate composition and growth performance of Labeo rohita.

Method: Juvenile L. rohita were fed diets containing varying concentrations of bee propolis over a 45-day feeding trial. Growth performance metrics, including weight gain, specific growth rate (SGR), and feed conversion ratio (FCR), were assessed, along with proximate composition parameters such as moisture, crude protein, lipid, and ash content.

Result: The results revealed significant improvements in growth and feed efficiency in treatment groups receiving propolis compared to the control group (G0; no propolis supplementation). Notably, fish in the G1 group (0.5 g propolis/250g feed) exhibited a marked increase in crude protein content (71.30%) and a reduction in lipid content (16.47%) relative to the control group (55.25% protein and 20.20% lipid), indicating enhanced nutritional quality.

Conclusion: These findings demonstrate the efficacy of bee propolis as a natural growth promoter and functional feed additive, offering a sustainable and health-oriented alternative to synthetic compounds in aquaculture. The inclusion of propolis in aquafeeds may contribute to improved fish health, growth performance, and product quality, thereby supporting environmentally responsible aquaculture practices.

Keywords: Labeo rohita, Propolis, Proximate Composition, Growth Performance, Aquaculture Nutrition

Green Synthesis of Zinc Oxide Nanoparticles (ZnO) Using Withania Coagulans Extract and Their Antibacterial Potential against Escherichia Coli in Fish

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The growing threat of multidrug-resistant (MDR) bacteria in aquaculture demands eco-friendly alternatives to conventional antibiotics. This study focused on the green synthesis of zinc oxide nanoparticles (ZnO NPs) using *Withania coagulans* extract and evaluated their antibacterial potential against *Escherichia coli* isolated from *Labeo rohita*. *W. coagulans*, a medicinal plant rich in bioactive compounds, were collected from the Kohat region and used to prepare aqueous leaf extract for nanoparticle synthesis. ZnO NPs were synthesized by mixing zinc acetate solution with plant extract under controlled heating and stirring conditions. The resulting nanoparticles were characterized using UV-Vis spectroscopy, FTIR, XRD, SEM, EDX, and DLS analyses, confirming their structural and functional properties. *E. coli* was isolated from skin swabs of *L. rohita* collected from fish farms and natural waters, and identified using selective media and biochemical tests. Antibacterial activity of the synthesized ZnO NPs was assessed through the well diffusion method, which showed significant inhibition zones against *E. coli*. The results highlighted the potential of green synthesized ZnO NPs as effective antibacterial agents, supporting sustainable aquaculture practices and offering a promising alternative to conventional antibiotics to combat AMR in fish pathogens.

Keywords: Green synthesis, Zinc oxide nanoparticles, *Withania coagulans*, *Escherichia coli*, *Labeo rohita*, Antibacterial activity, Aquaculture, Antimicrobial resistance.

Colorimetric Sensing Of Uric Acid by Eco-Friendly Cerium Oxide Nanosheets Synthesized By Parallel Flow Precipitation Method

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This study demonstrates a novel approach to synthesizing eco-friendly cerium oxide nanosheets using a parallel flow precipitation method, leveraging their enzyme-mimicking activities for

colorimetric sensing of uric acid. The synthesized nanosheets were thoroughly characterized using various techniques to confirm their morphology, structure, and optical properties. The cerium oxide nanosheets exhibited excellent oxidase-mimicking activity, catalyzing the oxidation of colorless substrates to produce a colored product. This property was exploited to develop a sensitive and selective colorimetric sensor for uric acid detection. The sensor's performance was evaluated in terms of linearity, detection limit, and selectivity. The results demonstrated a promising potential for practical applications in biomedical research and disease diagnosis, particularly for conditions associated with abnormal uric acid levels. The eco-friendly synthesis method and the sensor's high sensitivity make it an attractive option for further development.

Keywords: Cerium oxide nanosheets, colorimetric sensing, uric acid, parallel flow precipitation method.

Ethnomedicinal Plants Used By the Rural Community of District Abbottabad

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The traditional knowledge of medicinal plants plays a vital role in primary healthcare for rural communities, particularly in regions where modern medical services are limited. This study explores the ethnomedicinal practices and plant-based remedies used by the rural population of District Abbottabad, Khyber Pakhtunkhwa, Pakistan. Through field surveys, interviews with local healers, and discussions with community elders, data were collected on the types of medicinal plants used, their local names, parts utilized, methods of preparation, and ailments treated. The findings reveal a rich diversity of ethnomedicinal flora, with over 60 plant species documented, belonging to various families such as Lamiaceae, Asteraceae, and Fabaceae. In this study Asteraceae is the most commonly used family among the people. *Berberis lycium* shows the highest Rfc value of 0.58 and the highest use values were represented by *Berberis lycium*, *Mentha royleana*, *Plantago major*, *Lactuca serriola* which is 0.042. Among different life forms herbs are most commonly present in these areas. Commonly treated conditions include digestive disorders, respiratory problems, skin infections, and fever. The study highlights the critical role of indigenous knowledge in healthcare and the need for its preservation amidst growing environmental and cultural changes. Furthermore, the documentation of these practices provides a foundation for future pharmacological research and conservation strategies.

Royal Jelly Mediated Silver Nanoparticles and their Antibacterial Study against Selective Fish Pathogens

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Nanoscale engineered materials are at the forefront of innovative antimicrobial strategies. In this study, silver nanoparticles (AgNPs) were synthesized via an eco-friendly, royal jelly-mediated green synthesis method, utilizing royal jelly as both a reducing and capping agent. The formation

of AgNPs was confirmed by UV–Visible spectroscopy, showing a characteristic surface plasmon resonance peak at ~430 nm. X-ray diffraction (XRD) analysis revealed four distinct peaks, confirming the crystalline nature of the silver. Fourier transform infrared (FTIR) spectroscopy indicated the presence of functional groups from royal jelly biomolecules involved in the reduction and stabilization of nanoparticles. Scanning electron microscopy (SEM) showed that the AgNPs possessed varied morphologies. The antibacterial efficacy of the synthesized AgNPs was tested in vitro against three common Gram-negative bacterial pathogens in aquaculture: *Escherichia coli*, *Klebsiella pneumoniae*, and *Aeromonas hydrophila*. Results demonstrated strong, dose-dependent antibacterial activity. At 20 mg/mL, AgNPs inhibited *E. coli*, *K. pneumoniae*, and *A. hydrophila* with mean zones of inhibition of 34.5 mm, 32.5 mm, and 19.0 mm, respectively. Increasing the concentration to 25 mg/mL resulted in larger inhibition zones: 38.5 mm for *E. coli*, 37.5 mm for *K. pneumoniae*, and 24.0 mm for *A. hydrophila*. The highest antibacterial activity was observed at 30 mg/mL, with inhibition zones reaching 41.0 mm (*E. coli*), 40.5 mm (*K. pneumoniae*), and 29.0 mm (*A. hydrophila*). All results were statistically significant ($p < 0.05$). These findings underscore the significant potential of royal jelly-mediated AgNPs as sustainable antimicrobial agents in aquaculture. Their high efficacy, especially against *E. coli* and *K. pneumoniae*, combined with a green synthesis process devoid of toxic chemicals, supports their role in reducing dependence on conventional antibiotics and combating antibiotic resistance. This study adds to the growing evidence supporting biogenic nano-materials as effective and eco-friendly alternatives for managing bacterial infections in aquatic animal health.

Keywords: Royal jelly, silver nanoparticles, aquaculture, antibacterial activity, *Aeromonas hydrophila*, *Escherichia coli*, *Klebsiella pneumoniae*

Relative Treatment Efficiency Index of *Arundo donax* for the Treatment of Cd and Pb in Constructed Wetlands

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Relative treatment efficiency index (RTEI) is used to identify the efficiency of the treatment by plant itself. Greater RTEI indicates greater efficiency of plant to remediate the heavy metals from the contaminated medium. In this study, *Arundo donax* were used to evaluate its efficiency in removing heavy metals like lead (Pb) and cadmium (Cd) in constructed wetlands. *Arundo donax* was grown in experimental buckets filled with synthetic wastewater along with the heavy metals concentration of 1 and 3mg/L of cadmium and lead. The experiment was conducted for 21 days in order to evaluate the potential of *Arundo donax* for removal of cadmium and lead. The overall results showed that the greater removal was observed at 3mg/L of cadmium followed by 1mg/L of cadmium, 3mg/L and 1mg/L of lead respectively. The highest RTEI value was 0.89 with 91% removal of cadmium 3mg/L after 21 days of experiment. The accumulation of heavy metals in plant parts were measured in range of 34.1mg/kg to 328.1mg/kg for Cd 1 and 3mg/L, and 19mg/kg to 153.6mg/kg for Pb 1 and 3mg/L. It is also revealed that the highest accumulation of heavy metals were observed in roots than leaves and stems. Bioconcentration Factor (BCF) was also greater than the Translocation Factor (TC), which indicates that *Arundo donax* exhibits a greater capacity for phytostabilization compared to phytoextraction. Water quality parameters

were also observed through the experiment with maximum removal of COD on 21st day of experiment for Cd 1mg/L i.e. 220mg/L with 70% removal and EC was 210.3 g/cm with 70.4% removal followed by Cd 3mg/L, Pb 1mg/L and Pb 3mg/L. This research gave a better understanding for the *Arundo donax* potential of remediating Cd and Pb in constructed wetlands.

Nitrogen and Phosphorus Recovery from Bio-digestate using Sawdust

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This increasing world population introduces a notable challenge to the agricultural mechanisms, which makes implementation of effective and viable methods of handling nutrients important. Use of digestate, a byproduct obtained by the process of anaerobic digestion, along with one of the biomass residues, the sawdust residue, which is readily available hence presents a possible solution to reducing the reliance on synthetic fertilizers. The aim of the current research was to analyse the possible use of digestate and sawdust residue as a potential source of slow-release fertilizer. The methodology followed in this study included obtaining some samples of digestate in an anaerobic digester and obtaining sawdust in a local furniture store. Analysis of the moisture content, total organic carbon, pH, ammonium nitrogen, nitrate nitrogen and orthophosphates were conducted with the established procedures. Further, there was the extraction of fibres with the sawdust residue after which nutrients of the digestate were loaded onto the extracted fibres. The results were positive as they showed a trend of the gradual release of nutrients of the fiber based superabsorbent material (FBSM) which was acquired out of the residual sawdust. This study assessed bio-digestate, FBSM, and FBSM-NP for moisture content (90.2%, 10.71%, 9.58%), TOC (0.13, 0.06, 0.08 ppm), and pH (7.8, 7, 7.64). A 30-day soil release analysis showed FBSM-NP gradually increased nitrate from 2.42 to 25.79 ppm, ammonium from 5.29 to 9.74 ppm, and phosphorus from 3.35 to 15.84 ppm, confirming its role as an efficient slow-release fertilizer. Additionally, effective recovery of nutrients back to the pile of the sawdust residue shows effectiveness of this method in nutrient management. Within the most generalization terms, the use of a combination of digestate and sawdust residue shows a promise of a good alternative to synthetic fertilizers, which will be an effective solution to the nutrients management and a sustainable treatment of the concerns caused by the increasing world population. Further research and adoption of this methodology in the agriculture system can contribute immensely to achievement of sustainable and ecologically healthy approaches to nutrient-management practices.

Mitigating the impacts of NO_x and PM_{2.5} emissions for health risk awareness of associated labor community of Hattar industrial Estate Population, Pakistan

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This study has been focused on examining the fluctuations in indoors and outdoors air quality monitoring of pollutants of health concern. For indoor NO_x concentration three distinct industrial units, namely food, oil, and steel were selected at Hattar industrial Estate (HIE) KPK, situated in an economic and development zone of Pakistan. The data of NO_x and PM_{2.5} was collected

through NO_x meter and portable dust Trak. The collected NO_x data was utilized to assess the distribution trend at Hattar and correlation between NO_x exposure and disease prevalence of Hattar Industrial Estate population by calculating the relative risk (RR) and the attributable proportion risk (APR) of diseases associated with NO_x exposure in HIE. The overall NO_x concentration at Hattar Industrial Estate exceeded the permissible limits devised by US- EPA and WHO guidelines. For indoor NO_x concentration maximum nitrogen dioxide (NO₂) was noticed at the steel industry reached 388.92 ppb (731.86 µg/m³), and maximum nitric oxide (NO) was noticed in the steel industry reached up to 600 ppb (736.44 µg/m³) which was alarming high concentration of nitric oxide as compared to permissible concentration of nitrogen oxide 53 ppb (100 µg/m³) while the maximum and minimum PM_{2.5} conc. was observed at 38.82 µg/m³, and 22.36 µg/m³ in steel and food industries, respectively. For outdoor concentration, diesel vehicles produce high concentrations of NO_x e.g., four-wheel trucks (239.44 ppm NO₂ and 103 ppm NO 443.71 ppm) as compared to petrol and natural gas-powered vehicles. The findings had been communicated to the stakeholders of Hattar to encourage the adoption of low-emission techniques and alternative fuels to contribute the development process to cope with health hazards, ensure the trainings to prioritize the safety of workers and educating the stakeholder as wells and contributing towards well-being of nearby communities to achieve the 3rd and 4th sustainable development goals.

Keywords: NO_x pollution, Traffic emissions, Industrial emissions, distribution trend, health risk

Integrated Flood Risk Assessment and Mapping by using Analytical Hierarchy Process in Selected Regions of Sindh and Punjab, Pakistan

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In Pakistan, floods are one of the most common and destructive natural catastrophes, having a major impact on infrastructure, the environment, and human life. The purpose of this study was to use the Analytical Hierarchy Process (AHP) in conjunction with Geographic Information Systems (GIS) and remote sensing data to perform an integrated flood risk assessment in flood prone districts of Sindh (Larkana, Sukkur, and Ghotki) and Punjab (Dera Ghazi Khan (DG Khan) and Rajanpur). Maps of flood vulnerability, hazard, and risk were developed by combining socioeconomic and physical elements in this study. Seven factors were used to evaluate flood hazard and three factors were used to evaluate flood vulnerability. The AHP approach was used to assign weights to these characteristics, and the largest weights in their respective categories were assigned to elevation (34%) and population density (58%). The study present that population density (58%) was the main factor contributing to flood vulnerability, elevation (34%), distance from the river (25%), and slope (18%) were the most important flood hazard factors. These results demonstrate that flood risk is mostly determined by topographical, hydrological and demographic factors in the chosen districts of Sindh and Punjab. GIS tool was used to do spatial analysis after all criteria of hazard, vulnerability and risk were standardized into five classes: very low, low, moderate, high, and very high. The findings show that a significant portion of the study area is in a moderate (~39%) to high (~54%) risk of flooding, especially in low-lying, heavily inhabited areas close to important rivers. A comprehensive visual representation of

spatial flood exposure is provided by the final flood risk map, which is produced by integrating the hazard and vulnerability maps. This map shows that the regions of Larkana are highly affected, followed by Sukkur, Rajanpur, Ghotki and DG Khan. By identifying flood-prone areas, our research will help policymakers, urban planners, and disaster risk management agencies to make more informed judgments about future mitigation and adaptation measures.

Nickel Doped Graphitic Carbon Nitride Nanocomposite As Enhanced Peroxidase-Mimic For The Colorimetric Sensing Of Hydrogen Peroxide

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In the present work Nickel doped graphitic carbon nitride nanocomposite (Ni@g-C₃N₄NCs) were synthesized through pyrolysis process for the colorimetric sensing of hydrogen peroxide. Hydrogen peroxide the end product of various metabolic processes, such as peroxisomal oxidation pathways. It is one of the most common biological reactive oxygen species that can greatly affect tissues and cells. In human body the detection of hydrogen peroxides with peculiar sensitivity and selectivity. Graphitic carbon having characteristic properties of conductivity. The FTIR, spectroscopy and XRD analysis showed the characteristic peaks assigned to Ni@g-C₃N₄NCs. SEM analysis shows round shaped morphology and EDX showed strong band for Ni@g-C₃N₄NCs. TGA analysis showed maximum degradation at 340 °C for the prepared Nanocomposite. The functionalized Ni@g-C₃N₄NCs was used in sensing of hydrogen peroxide. Different reaction conditions have been optimized to find the optimal performance of Ni@g-C₃N₄NCs such as; (a) pH (b) amount of Ni@g-C₃N₄NCs (c) time of incubation; (d) TMB and (e) hydrogen peroxide. The response time of the proposed sensor for hydrogen peroxide detection was only 1.5 minutes with a visible colorimetric change from colorless to blue green color. The proposed sensor showed a wide linear range (1-109 µM), low limit of detection 0.29 µM, and limit of quantification 0.99 µM with an R² value of 0.9991. The Ni@g-C₃N₄NCs assembly exhibits no reactivity towards folic acid, urea, ascorbic acid, Ca⁺² and K⁺ and used to quantify hydrogen peroxide in blood serum sample of hyper tension patient.

Keywords: Ni@g-C₃N₄NCs, TMB, H₂O₂, Colorimetric sensor

Biocontrol Potential of Antagonistic Formulation of Trichoderma Spp Originated From Kohat Fields against Phytopathogenic Fungi in Tomato

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Background: Fusarium oxysporum is a notorious infection causing fungi in tomato plants causing vascular wilt. The synthetic fungicides are traditionally used to overcome the disease; however, they have residual effects on environment. Therefore, alternative biocontrol methods are required to overcome pathogenic attack on plants. The present study is planned to design

different formulations of the putative biocontrol *Trichoderma* strains and analyze their efficiency against the selected fungal pathogens of tomato.

Methods: Previously identified *Trichoderma* strains i.e., *T. afroharzianum* ISO-02, *T. bevicrassum* ISO-03 and phyto-pathogenic fungi such as *Fusarium oxysporum* were collected from the Agricultural Microbiology laboratory of KUST. Different formulations such as powder, liquid-oil based and granular were prepared and evaluate their efficacy using in vivo assays with tomato as plant host. Disease incidence and severity rate were collected at 35 day of the experiment.

Results: Result demonstrated that among different formulation of selected *Trichoderma* spp, *T. afroharzianum* ISO-02 based powder and granular formulation showed strong suppression of *Fusarium oxysporum* in tomato plants and also enhance root and shoot development as compared to liquid-oil based formulation.

Conclusion: These finding highlighted that *T. afroharzianum* ISO-02 based powder and granular bio-control formulation offer sustainable and eco-friendly approach.

Keywords: *Trichoderma afroharzianum*, *Trichoderma bevicrassum*, *Fusarium oxysporum*, Severity rate.

Antibacterial Efficacy of Dimethyl Sulfoxide and Methanolic Extracts of *Calotropis Procera* against *Proteus Mirabilis* Isolated From Labeo Rohita

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The present study was conducted to assess the antibacterial potential of dimethyl sulfoxide and methanolic extracts of *Calotropis procera* (commonly known as Sodom apple) against *Proteus mirabilis* isolated from the gut, skin, intestine and muscle tissues of *Labeo rohita*. One infected fish sample was collected and subjected to standard microbiological techniques, including 10-fold serial dilution. One dominant bacterial isolate was identified and biochemically characterized through Gram staining, VP, Indole, Triple Sugar Iron (TSI), Urease, and Ornithine decarboxylase tests. The Ornithine decarboxylase test, which is a specific test for identifying *Proteus mirabilis*, was also performed. Sample 1 exhibited a classic *Proteus mirabilis* profile, supporting its identification as *P. mirabilis*. The antibacterial efficacy of *Calotropis procera* extracts was evaluated to determine their potential against *Proteus mirabilis*. The results showed that the methanolic extract exhibited higher antibacterial activity compared to the DMSO extract, indicating its stronger inhibitory effect on bacterial growth. This suggests that methanol is more efficient in extracting bioactive compounds responsible for antibacterial activity from *C. procera*. The enhanced activity of the methanolic extract may be attributed to the higher solubility of phenolic, alkaloid, and flavonoid compounds in methanol, which are known for their antimicrobial properties. These findings highlight the potential of *C. procera* methanolic extract as an effective, natural alternative to conventional antibiotics for controlling *P. mirabilis* infections, especially in aquaculture systems, where sustainable and eco-friendly disease management strategies are required.

Synthesis and Characterization of Polyazomethine Zinc-Complexes: Impact On The Antimicrobial and Redox Potential

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This research focuses on the Synthesis and characterization of polyazomethine zinc complex with different redox potential and antimicrobial applications were carried out in the present study. Polyazomethines were synthesized by condensation of equimolar amounts of 4,4-diaminodiphenylmethane, 4,4-diaminodiphenyl ether, 4,4-diaminodiphenyl sulfone and p-phenylenediamine with p-phthalaldehyde in methanol under reflux, which were being monitored by TLC. Polyazomethine zinc complex was synthesized by adding zinc chloride in the above-mentioned reaction mixture under similar conditions. The synthesized polymers were characterized by Fourier Transform Infrared Spectroscopy (FTIR). FTIR of the polymers exhibited typical azomethine (C=N) stretching peaks in the region of 1615–1625 cm^{-1} , aromatic C–H bending at 830–850 cm^{-1} and new Zn–N and Zn–O coordination band in the region of 420–480 cm^{-1} . X-ray Diffraction (XRD) patterns of the polymers were semi-crystalline to amorphous. Thermal behavior of the polymers was studied by Thermogravimetric Analysis (TGA) and it was found that the thermal stability of the polymers improved after the introduction of zinc. Cyclic Voltammetry (CV) results also revealed different redox characteristics. Antimicrobial studies revealed that the inhibitory effects of the corresponding zinc polymers were improved compared to parent polymers. These results may find potential applications in antimicrobial as well as in advanced energy materials.

Keywords: Polyazomethine, Schiff base, Zinc complex, FTIR, Antimicrobial activity, Redox potential, Thermal stability, cyclic voltammetry.

Comparative Gut Microbiota Assessment in Healthy and Infected Common Carp (Cyprinus Carpio)

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The gut microbiota plays a critical role in the health, immunity, and disease resistance of aquatic organisms. This study aimed to comparatively profile the gut microbial communities of healthy and pathogen-infected common carp (*Cyprinus carpio*) to explore microbial alterations associated with disease onset. Gut samples were collected from clinically healthy and visibly infected individuals, followed by DNA extraction and 16S rRNA gene sequencing to characterize bacterial diversity and composition. Morphological and biochemical tests will be conducted to characterize isolates, while antibiotic susceptibility patterns will be evaluated using the Kirby-Bauer disc diffusion method and MIC/MBC assessments according to CLSI (2025) guidelines. Molecular identification will be performed via 16S rRNA gene amplification and sequencing, with phylogenetic analysis conducted using MEGA 11 software. The results revealed significant differences in microbial community structure between healthy and infected fish. Healthy carp exhibited a diverse and balanced microbiota dominated by beneficial genera such as *Lactobacillus*, *Bacillus*, and *Cetobacterium*. In contrast, infected individuals showed a marked

decrease in microbial diversity and an overrepresentation of opportunistic pathogens including *Aeromonas*, *Pseudomonas*, and *Vibrio*. Alpha and beta diversity analyses confirmed the dysbiosis in infected fish. These findings highlight the potential of gut microbiota as biomarkers for fish health status and provide insights for developing microbiome-based strategies for disease management in aquaculture.

Keywords: Gut microbiota, *Cyprinus carpio*, DNA extraction, 16S rRNA, MIC, MBC

Extraction of Oil from *Citrus Aurantifolia* as Bio-Based Hardner/Additive for Epoxy Resin

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The present research task encompasses the extraction of essential oil from waste peel of *Citrus Aurantifolia*, and its use as additive for the epoxy resin and ascorbic acid polymer network as antimicrobial coatings. The essential oil was extracted from peel via hydrodistillation method, where for the first time the peel oil acted as bacteriostatic agent, for end use in long-term antibacterial coating. The epoxy resin, DGEBA (diglycidyl ether of bis-phenol-A with $n = 0.03$) cured thermally with ascorbic acid/vitamin C as bio based curing agent to obtain polymer networks. A series of polymer networks were then prepared by using various percentage of extracted essential oil by in-situ polymerization technology. The impact of the percentage of additive/essential oil upon the thermal, antimicrobial, mechanical and processability of the polymeric products have been evaluated. The thermal analysis (thermogravimetric analysis (TGA), differential scanning calorimetry (DSC)) revealed that the synthesized products are thermally stable up to 360 °C. The processability of polymers in common organic solvent is due to the ascorbic acid and essential oil component, widen their use in various application, especially as coatings. Their antibacterial and antifungal characteristics against variety of strains (*Bacillus velezensis*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Aspergillus Niger*, *Aspergillus parasiticus*, *Candida albicans*), showed their effectiveness as antimicrobial coatings. The polymer P3 (DGEBA + Ascorbic Acid + 1mL NMP + 2mL essential oil) show best result against all the antimicrobial strains.

Conjugated Polyazomethine-Ferrocene Composite as Thermally Resistant, Electroactive Coating: Synthesis and Characterization

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In this study, conjugated polyazomethine-ferrocene composites were synthesized and characterized as thermally resistant coatings with electroactive properties. Two polyazomethines were prepared as precursors via Schiff base condensation reaction of equimolar 4,4-diaminodiphenyl ether and 4,4-diaminodiphenylmethane in ethanol, which were monitored until complete monomer consumption. The corresponding organometallic additive, ferrocene, was doped into the polymer at 1–5 mol% via a sonication-assisted method in dimethyl sulfoxide (DMSO) for a fixed time followed by centrifugation and filtration. Fourier Transform Infrared Spectroscopy (FTIR) showed azomethine (C=N) stretching at $\sim 1620\text{ cm}^{-1}$ and typical C–H and C–

C vibrations of ferrocene, which confirmed the successful doping of the organometallic additive into the polymer. X-ray Diffraction (XRD) showed semi-crystalline behaviors with altered packing of the polymer upon doping of the organometallic additive, ferrocene. Thermogravimetric Analysis (TGA) showed improved thermal stability of the ferrocene-doped composites compared to the pristine polyazomethines. Differential Scanning Calorimetry (DSC) showed improved thermal transition profiles of the ferrocene-doped composites. Cyclic Voltammetry (CV) of the composites in DMSO/acetonitrile solutions showed well-resolved and reversible redox peaks of the ferrocene moieties in the electrochemical interface, which were assigned to improved redox activity and electrochemical stability of the composites as well as improved electron transfer characteristics. The composites with up to 5 mol% of ferrocene doping showed improved redox activity and conductivity without significant decrease in film-forming ability. This work demonstrated the potential of the polyazomethine–ferrocene composites as promising candidates for electroactive coatings with combined thermal and redox behaviors.

Keywords: Polyazomethine, Ferrocene composite, Schiff base, Electroactive coating, Thermal stability, cyclic voltammetry, FTIR, XRD.

Synthesis and Characterization of Iron and Zinc Oxide Co-Doped Hydroxyapatite for Colorimetric Detection of Nitrite Ion

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Nitrite (NO_2^-) ions are considered to be type A inorganic contaminants in drinking water and have proven to be of a great threat to human health. Nitrite ions, upon interaction with proteins, act as important precursors for the generation of highly carcinogenic N-nitrosamines. Excessive consumption of nitrites can lead to a number of medical issues such as esophageal cancer, infant methemoglobinemia (blue baby syndrome), spontaneous abortion, and birth defects in the central nervous system. In the present work, Hydroxyapatite (HAp) co-doped with iron (Fe) and zinc (Zn) oxide nanoparticles was synthesized and characterized with various techniques such as FTIR, XRD, SEM and EDX. The synthesized nanocomposite was used for the colorimetric detection of nitrite ions (NO_2^-). The incorporation of Fe and Zn into the HAp enhanced its catalytic activity, facilitating the oxidation of a chromogenic substrate in the presence of nitrite ions. Due to the catalytic nature of HAp owing to the acidic and basic moieties within the structure, it was used as a template for iron and zinc oxide co-doped hydroxyapatite (Fe@ZnOHAp) synthesis. This approach provides an active as well as large surface area for the sensing of nitrite ion. The $\text{HAp@Fe}_2\text{O}_3$ demonstrated inherent peroxidase-like activity in the presence of 3,3,5,5-tetramethylbenzidine (TMB) oxidized with the assistance of H_2O_2 . It resulted in the color changing to blue-green, and after the addition of nitrite ion, the color changed to green, resulting in the reduction of TMB. To achieve the best response of the developed sensor various parameters were optimized such as amount of Fe@ZnOHAp , concentration of H_2O_2 , TMB, pH, time, and nitrite ion. The designed sensor show high sensitivity for the detection of nitrite ion with wide linear range (2-150 μM), low limit of detection 0.3 μM , low limit of quantification (0.98

μM). The developed sensing platform was successfully applied for the detection of nitrite in real samples.

Keywords: Hydroxyapatite, iron and zinc oxide, nitrite, colorimetric biosensor, peroxidase-like activity.

Biofilm-Associated Antibiotic Resistance in Clinical Isolates of *Pseudomonas aeruginosa*: Quantitative Analysis and Assessment of Biofilm Disruption Approaches

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Pseudomonas aeruginosa, a highly invasive nosocomial pathogen, exacerbates the worldwide antimicrobial resistance (AMR) emergency by means of biofilms organized microbial aggregates immersed in extracellular polymeric substance (EPS), such as alginate, Pel polysaccharides, and extracellular DNA rendering up to 1000-fold resistance to antibiotics. These biofilms impede infection treatment such as ventilator-associated pneumonia and catheter-associated bloodstream infections, which present important clinical challenges. This research explores the intersection between biofilm development and antibiotic resistance in *P. aeruginosa* clinical isolates, seeking to measure resistance patterns and initiate new disruption strategies. Using standard tests disk diffusion, broth microdilution, and crystal violet staining it measures biofilm formation in relation to resistance to key antibiotics (ceftazidime, ciprofloxacin, meropenem, amikacin). The effectiveness of novel disruption agents, such as chelating molecules (EDTA), plant-based antimicrobials is assessed through biomass reduction and colony forming unit counting. Sophisticated methods, like Fourier Transform Infrared Spectroscopy (FTIR) and Gas Chromatography-Mass Spectrometry (GC-MS), decode EPS structure and quorum sensing mediated resistance mechanisms. Through filling knowledge gaps in biofilm-mediated AMR, this research aims to shine light on molecular drivers of resistance and design intervention accordingly. The results seek to support infection control and antimicrobial stewardship, in fulfillment of Sustainable Development Goal 3 in fighting AMR through advanced therapeutic approach to *P. aeruginosa* infections.

Keywords: *Pseudomonas aeruginosa*, nosocomial pathogen, antimicrobial resistance (AMR), biofilms, extracellular polymeric substance (EPS), alginate, Pel polysaccharides

Copper Sulfate Induced Genotoxicity in the Erythrocytes of Rohu (Labeo Rohita)

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Copper sulfate (CuSO₄), widely used in agriculture, aquaculture, and industry, is a known environmental contaminant with potential genotoxic effects on aquatic organisms. This study aimed to evaluate the genotoxic impact of CuSO₄ exposure on *Labeo rohita* (rohu), a commercially important freshwater fish species. Juvenile fish were exposed to sublethal concentrations of CuSO₄ (0.0, 0.5, 1.0, and 1.5 mg/L) for 96 hours under controlled laboratory conditions. Peripheral blood samples were analyzed using the micronucleus (MN) assay and other nuclear abnormality tests to assess genotoxicity. Results revealed a statistically significant,

concentration-dependent increase in micronuclei frequency ($p < 0.001$), along with other nuclear deformities such as binucleated cells, nuclear buds, and lobed nuclei in exposed groups compared to controls. These findings clearly demonstrate that CuSO_4 induces chromosomal damage and nuclear instability in *L. rohita* erythrocytes, raising concerns about its ecotoxicological implications. The study highlights the necessity of regulating copper-based compounds to minimize genotoxic risks in freshwater ecosystems.

Keywords: Copper sulfate, *Labeo rohita*, erythrocytes, genotoxicity, micronucleus assay, nuclear abnormalities, aquatic toxicology

Synthesis and Characterization of Sulfone-Linked Hyperbranched Polyazomethine Ether as Metal Ion Probe

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A sulfone-linked hyper branched polyazomethine ether (P) was successfully obtained via curing of tetra functional resin, tetra glyceryl diamino diphenyl methane (TGDDM) with sulfone azomethine based phenolic (M). The curing agent M, was synthesized via condensation of 4,4'-diaminodiphenyl sulfone and o-hydroxy benzaldehyde in 50mL of ethanol. The chemical structures of both the sulfone based phenolic precursor and the resulting hyperbranched polyazomethine ether were confirmed through Fourier Transform Infrared (FTIR) spectroscopy and CHN elemental analysis. Thermal properties were systematically investigated by Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC), revealing high thermal stability and a well-defined glass transition behavior of hyper branched polyazomethine ether. X-ray Diffraction (XRD) analysis revealed the semicrystalline nature of the synthesized material. Mechanical properties, including tensile strength and modulus, were evaluated to determine the material's structural performance. To evaluate its potential as a metal ion probe, adsorption studies were conducted using atomic absorption spectrometry to estimate the amount of heavy metal ions adsorbed on the surface of the adsorbent. The Langmuir and Freundlich isotherm models were used to further explore the adsorption behavior of the synthesized adsorbent. The adsorption of Ni^{2+} , Cu^{2+} , Pb^{2+} , and Fe^{2+} ions onto the synthesized compound was best described by the Freundlich isotherm model, with regression coefficient (R^2) values ranging from 0.471 - 0.9904, This indicates a favorable adsorption process occurring on a heterogeneous surface, with significant affinity between the metal ions and the active sites of the synthesized hyper branched polyazomethine ether. The results demonstrated favorable adsorption behavior, indicating the material's suitability for metal ion detection and removal applications. The combined thermal, mechanical, and adsorption properties highlight the potential of this hyper branched polyazomethine ether for advanced environmental remediation and high-performance material applications.

Synthesis and Characterization of Sulphonamide Linked Schiff base zinc and copper complexes as Potential Antimicrobial Agent

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A series of sulphonamide linked schiff base zinc and copper complexes (1-6) were synthesized via condensation of sulphonamide with o/p-hydroxy-benzaldehyde/ benzaldehyde zinc/copper sulphates. All the complexes were characterized via FTIR, XRD, and NMR spectral analysis. The synthesized metal complexes were tested for antimicrobial activity. Antibacterial studies were carried out against staphylococcus aureus, bacillus subtilis Escherichia. Antifungal activity was evaluated against candida albicans and aspergillus Niger. Copper complexes showed stronger inhibition than zinc complexes.

Molecular Characterization of Multidrug Resistant Klebsiella pneumoniae Isolates from Diabetic Foot Ulcers with Emphasis on Carbapenem Resistance Genes

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The emergence and spread of carbapenem resistant Klebsiella pneumoniae worldwide, especially strains that carry carbapenemase genes like OXA-48 and NDM, pose a major threat to public health because of their link to severe, challenging-to-treat infections. K. pneumoniae isolates from diabetic foot ulcer (DFU) patients admitted to KDA Hospital, Kohat were the subject of the current study, which concentrated on their phenotypic and genotypic characterization. Microscopic analysis verified that all isolates were Gram negative rods, and they all displayed opaque, mucoid colonies that were round or irregular. The isolates were identified biochemically as being positive for catalase, citrate, urease, and Voges-Proskauer tests, but negative for indole and methyl red tests. Testing for antibiotic susceptibility revealed elevated levels of resistance, with 100% resistance to imipenem and meropenem, and variable resistance to other widely used antibiotics such as ertapenem, gentamicin, ampicillin, amoxicillin, ceftriaxone, and azithromycin. For molecular detection, 16S rRNA gene sequencing was conducted to confirm the taxonomic identity of the isolates at species level. Furthermore, Sanger sequencing of carbapenemase genes was performed to investigate point mutations and genetic variations that may contribute to enhanced resistance phenotypes. PCR amplification of resistance genes showed that 98% of the isolates carried the blaNDM gene and 100% carried the blaOXA-48 gene, indicating widespread dissemination of carbapenemase-producing strains in this clinical setting. These findings highlight the urgent need for new therapeutic options and efficient infection control strategies because existing antibiotics are ineffective against these multidrug-resistant organisms. Among the tested antimicrobials, colistin, Fosfomycin, and doripenem remained the only effective treatment options, showing complete susceptibility in all isolates.

Keywords: blaOXA-48, blaNDM, Diabetic foot ulcer (DFU), Antimicrobial susceptibility, genotypic characterization, PCR amplification, Carbapenemase-producing strains, Antibiotic resistance, Infection control, Public health threat.

Molecular Characterization of Meca and Ermc Genes Harboured Staphylococcus Aureus and Staphylococcus Saprophyticus Isolated From Patients with Urinary Tract Infections

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Introduction: UTIs are the third most common infections globally, with significant health and economic impact. Though usually caused by Gram-negative bacteria, Gram-positive cocci like “Staphylococcus saprophyticus” and “Staphylococcus aureus” are also important uropathogens.

Objectives: To isolate and identify cefoxitin and erythromycin resistant *S. aureus* and *S. saprophyticus* from the clinical urine samples. To detect *mecA* and *erm* resistance genes in phenotypically resistant isolates. To analyze and compare genetic makeup of resistant strains using 16S rRNA gene sequencing, which helps identify and differentiate them.

Results: A total of 31 participants were included, comprising 10 males (32%) and 21 females (68%), with most in the 31–40 age group. The mean ages were 32.3 years for males and 32.8 years for females. Out of 31 samples, Gram-positive cocci were most frequent (38.7%), followed by Gram-negative rods (35.4%), while other organisms appeared in smaller proportions. Only Gram-positive cocci were selected for further analysis. All samples were PCR positive means they were bacterial isolates. Furthermore, *mecA* and *ermC* genes were PCR identified.

Discussion: In our study, the *mecA* gene was detected in methicillin-resistant “*S. aureus*” and “*S. saprophyticus*”, confirming its role as a genotypic marker. Similar findings were reported in Sumatra, where all cefoxitin-resistant “*S. aureus*” isolates carried the *mecA* gene. *ermC* genes were also identified in the isolates it was similar to other studies as well.

Conclusion: “*mecA*” and “*ermC*” genes are reliable markers of resistance in UTI-causing “*S. aureus*” and “*S. saprophyticus*”, emphasizing PCR as a valuable tool for detection and surveillance.

Molecular Screening of Antibiotic Resistance Genes (Qnrs and Blactx-M) Among Biofilm-Forming Escherichia Coli and Pseudomonas Aeruginosa

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The emergence of antibiotic resistance among biofilm-producing bacteria poses a serious public health concern due to their persistence in clinical and environmental settings. The present study aimed to investigate the occurrence of antibiotic resistance genes *qnrS* and *blaCTX-M* in biofilm-producing *Escherichia coli* and *Pseudomonas aeruginosa*. A total of clinical and environmental isolates were recovered and subjected to phenotypic identification using standard biochemical and microbiological techniques. Biofilm formation ability was assessed by the microtiter plate method, while antimicrobial susceptibility testing was performed following CLSI guidelines. Molecular detection of resistance genes was carried out using polymerase chain reaction (PCR). Results revealed that a significant proportion of isolates exhibited multidrug resistance, with strong biofilm formers showing higher resistance profiles compared to weak or non-biofilm producers. The *qnrS* gene, associated with plasmid-mediated quinolone resistance, was frequently detected among *E. coli* isolates, whereas the *blaCTX-M* gene, encoding extended-

spectrum β -lactamase (ESBL) activity, was predominantly observed in *P. aeruginosa*. The co-existence of biofilm production and resistance genes highlights a synergistic mechanism contributing to treatment failure. In conclusion, biofilm-forming *E. coli* and *P. aeruginosa* serve as important reservoirs of antibiotic resistance, necessitating strict surveillance, rational antibiotic use, and effective infection control strategies to limit their spread.

Keywords: Biofilm, *Pseudomonas aeruginosa*, *qnrS* and *blaCTX-M*, Multidrug resistance and synergistic mechanism

Synergistic antibacterial effect of *Withania coagulans* extract and magnesium nitrate nanoparticles against multi-drug resistant bacteria

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Introduction: The rapid spread of multidrug-resistant (MDR) bacteria has become a major obstacle to effective treatment, increasing the rate of therapeutic failure and mortality. This alarming situation necessitates the search for novel alternatives. Nanoparticles have recently emerged as potent antibacterial agents due to their ability to disrupt microbial structures and generate reactive oxygen species. At the same time, plant-based extracts such as *Withania coagulans*, which is rich in flavonoids and withanolides, are known to possess antimicrobial and antioxidant properties. Combining these two approaches may enhance antibacterial effects through synergism, thereby reducing toxicity and resistance.

Methodology: Fresh leaves of *Withania coagulans* will be collected, shade-dried, powdered, and subjected to aqueous extraction. Phytochemical screening will be performed to confirm the presence of bioactive compounds. Magnesium nitrate nanoparticles (MgNO_3 -NPs) will be synthesized using the plant extract as a reducing agent and characterized by UV-Vis spectroscopy, XRD, SEM, FTIR, and EDAX. Antibacterial activity of both the extract and MgNO_3 -NPs will be evaluated against MDR strains (*Staphylococcus aureus* and *pseudomonas aeruginosa*) using agar well diffusion, disc diffusion, and broth microdilution assays. Synergistic activity will be analyzed through a checkerboard assay and fractional inhibitory concentration index (FICI).

Results: It is expected that both *W. coagulans* extract and MgNO_3 -NPs will exhibit inhibitory activity against Gram-positive and Gram-negative MDR bacteria. The combined application is anticipated to show stronger antibacterial effects compared to individual treatments, with lower MIC values indicating synergism.

Conclusion: The study will provide evidence that integrating *W. coagulans* extract with MgNO_3 nanoparticles enhances antibacterial efficacy against MDR pathogens. This synergistic approach could serve as a potential alternative therapy, reducing the required dosage of each agent while minimizing toxicity and slowing the emergence of resistance.

Keywords: *Withania coagulans*, Magnesium nitrate nanoparticles, *staphylococcus aureus* and *pseudomonas aeruginosa*.

Characterization of Bioactive Metabolites from Indigenous Soil-Borne Fungi as a Source of Antibacterial Agent

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Background: The escalating crisis of multidrug-resistant (MDR) bacteria necessitates the urgent discovery of novel antimicrobial agents. Soil fungi, especially from underexplored ecological niches, are prolific producers of diverse secondary metabolites with potent bioactivities. This study focuses on the fungal microbiome of the Kohat region in Pakistan, a unique environment and a potential reservoir for fungi producing antibacterial compounds. Objectives: This study aimed to isolate and identify indigenous soil-borne fungi from Kohat, Khyber Pakhtunkhwa, Pakistan, to screen their crude extracts for antibacterial activity against clinically relevant MDR pathogens, and to conduct a preliminary phytochemical characterization of the bioactive metabolites. Methods: Fungal isolates were obtained from soil, decomposing organic matter, and phylloplane samples on potato dextrose agar supplemented with chloramphenicol. Ethyl acetate extracts of fermented broths were prepared and concentrated. Antibacterial activity was evaluated against MDR strains of *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella pneumoniae* using the agar well diffusion assay. Preliminary phytochemical screening was performed to detect major secondary metabolite classes. Results: Isolated fungal strains demonstrated significant antibacterial activity. The most potent isolate, KHF-08 (identified as *Aspergillus terreus*), exhibited the highest activity against MDR *S. aureus*, with a mean inhibition zone diameter of 22.5 ± 1.3 mm at 100 mg/mL concentration. Moderate activity was observed against MDR *K. pneumoniae* (14.2 ± 0.8 mm). Phytochemical analysis of active extracts revealed the presence of terpenoids, alkaloids, and phenolics, suggesting a complex mixture of bioactive constituents. Conclusion: The results confirm that the indigenous fungal flora of the Kohat region is a promising source of antibacterial agents against MDR pathogens. The significant activity of the *Aspergillus terreus* extract warrants further investigation, including bioassay-guided fractionation, precise structural elucidation of the active compounds, and determination of minimum inhibitory concentrations (MICs).

Keywords: Multidrug-resistant bacteria; soil mycobiome; antibacterial screening; secondary metabolites; bioactive compounds; Kohat; fungi

Green Synthesis of Copper Oxide Nanoparticles Using Snake Plant (*Sansevieria trifasciata*) Extract and Their Potency against Multidrug-Resistant Bacteria

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Background: The emergence of multidrug-resistant (MDR) bacteria has escalated into a critical global health challenge, rendering conventional antibiotics increasingly ineffective. Copper oxide nanoparticles (CuO-NPs) are recognized for their potent antimicrobial properties, but their conventional synthesis often involves hazardous chemicals. This study explores the green synthesis of CuO-NPs using *Sansevieria trifasciata* (snake plant) extract, a species rich in bioactive phytochemicals, as an eco-friendly alternative. Objective: This research aimed to synthesize and characterize CuO-NPs using *S. trifasciata* extract and to evaluate their antioxidant and

antibacterial efficacy against MDR bacterial pathogens. Methods: CuO-NPs were synthesized by reacting copper nitrate with aqueous *S. trifasciata* leaf extract, which acted as both a reducing and stabilizing agent. The nanoparticles were characterized using UV-Visible spectroscopy, Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). Their antioxidant activity was assessed via the DPPH free radical scavenging assay. Antibacterial potency was evaluated against MDR *Staphylococcus aureus* and *Escherichia coli* using disc diffusion methods, including a comparative analysis of standard antibiotics with and without CuO-NP coating.

Results: The synthesis was confirmed by a UV-Vis absorption peak at 285 nm. SEM analysis revealed spherical nanoparticles with an average size of 40 nm, and XRD confirmed their crystalline nature. The CuO-NPs demonstrated significant dose-dependent antioxidant activity. They also exhibited strong antibacterial effects, with enhanced zones of inhibition observed when standard antibiotic discs (e.g., ciprofloxacin, erythromycin) were coated with CuO-NPs, indicating a synergistic effect against MDR strains. Conclusion: The study successfully demonstrates the green synthesis of CuO-NPs using *S. trifasciata* extract. The nanoparticles possess notable antioxidant and enhanced antibacterial activities against MDR bacteria, positioning them as a promising, sustainable nano-therapeutic agent to combat antibiotic resistance.

Keywords: Multidrug resistance, Copper oxide nanoparticles, Green synthesis, *Sansevieria trifasciata*, Antibacterial activity, Antioxidant activity, Synergistic effect

Phytogenic Synthesis of Silver Nanoparticles using Spineless Cactus (*Opuntia* Spp.) and their Antibacterial and Antioxidant Efficacy against Multidrug-Resistant Bacteria

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Background: The rise of multidrug-resistant (MDR) bacteria poses a severe threat to global public health, necessitating the urgent development of novel antimicrobial agents. Green-synthesized silver nanoparticles (AgNPs) present a promising nanotechnological alternative due to their potent broad-spectrum antimicrobial and antioxidant properties. This study utilizes the spineless cactus (*Opuntia ficus-indica*), a plant rich in bioactive flavonoids and polyphenols, as a sustainable and eco-friendly platform for the phytogenic synthesis of AgNPs. Objective: This study aimed to synthesize and characterize AgNPs using *Opuntia ficus-indica* extract and to evaluate their efficacy against MDR bacterial strains and their free radical scavenging potential.

Methods: AgNPs were synthesized using an aqueous extract of spineless cactus pads, which acted as both a reducing and capping agent. The nanoparticles were characterized by UV-Visible spectroscopy, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy (FTIR). Antibacterial activity was assessed against MDR *Staphylococcus aureus* and *Escherichia coli* using agar well diffusion and disc diffusion assays, including a comparison of antibiotic discs with and without AgNP coating. Antioxidant activity was determined using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Results: Synthesized AgNPs indicated a UV-Vis peak at 438 nm. SEM

analysis revealed spherical and monodispersed nanoparticles with an average size of 35 nm. XRD confirmed their crystalline nature with a cubic structure, and EDX showed a strong silver signal at 3 keV. The AgNPs exhibited significant dose-dependent antibacterial activity, with the highest zone of inhibition (24.5 ± 1.1 mm) observed against *S. aureus* at 100 $\mu\text{g/mL}$ concentration. Synergy was evident as AgNP-coated ciprofloxacin discs showed a 45% increase in inhibition zone compared to antibiotic-only discs against MDR *E. coli*. In the DPPH assay, the AgNPs demonstrated potent antioxidant activity with an IC_{50} value of 42.7 $\mu\text{g/mL}$. Conclusion: The findings indicate that *Opuntia*-mediated nanoparticles show strong dual antibacterial and antioxidant capabilities, highlighting their potential as a sustainable and effective therapeutic strategy to combat MDR infections and mitigate oxidative stress.

Keywords: Multidrug resistance; Silver nanoparticles; Green synthesis; *Opuntia ficus-indica*; Antibacterial activity; Antioxidant activity; Phytogenic synthesis.

Metagenomic Analysis of Microbial Community for Structural and Functional Profiling In Locally Processed Moist Snuff Gum Tobacco

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Introduction: Moist snuff gum tobacco is a widely consumed smokeless tobacco product that harbors complex microbial communities, which can significantly influence its chemical composition, safety, and potential health risks. Recent advances in metagenomics have enabled comprehensive profiling of microbial diversity and functional capabilities within such products, offering critical insights into their role in tobacco-specific nitrosamine formation, fermentation processes, and potential pathogenicity. Despite its widespread use, the structural and functional characterization of microbial consortia in locally processed moist snuff gum tobacco remains largely unexplored, particularly in relation to its public health implications. Methods: A metagenomic examination of the microbial populations in four samples of moist snuff gum tobacco that were collected from Kohat, Pakistan. The Metagenomic Rapid Annotations utilizing Subsystem Technology (MG-RAST) platform was used to interpret high throughput sequencing data.

Results: The results showed that the samples' microbial diversity and quality indicators varied. Sequence retention and functional annotation rates varied significantly according to quality control criteria, with 34.73% to 67.89% of reads failing quality control. Significant variation in microbial richness and species evenness was found by alpha diversity analysis, which was impacted by variations in raw materials, processing techniques, and storage conditions. With unique community architecture shown using Cytoscape, taxonomic profiling revealed prominent bacterial genera such *Lactobacillus*, *Streptococcus*, *Bacillus*, *Corynebacterium*, and *Pseudomonas* network analysis in Cytoscape.js. With the identification of important enzymes involved in glycolysis and fermentation in genera such as *Lactobacillus*, *Enterobacter*, and *Bifidobacterium*, functional annotation revealed active carbohydrate metabolism. Subsystems pertaining to the metabolism of carbohydrates (~13–14%), amino acids (~10–12%), vitamins and cofactors (~5–

6%), and membrane transport (~4%) all consistently contributed, according to metabolic pathway analysis.

Conclusion: The existence of genes linked to stress response and virulence further raises the possibility of health hazards related to microbial colonization in users of moist snuff tobacco. Overall, the study emphasizes how important it is to process products hygienically to reduce microbial growth and maintain product stability and safety.

Keywords: Metagenomics, moist snuff gum tobacco, MG-RAST, microbial community structure, microbial community function

Occurrence and Molecular Profiling of ESBL-Producing Gram-Negative Bacteria Isolated from Cockroaches in Household, Hospital, and Foodservice Environments

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Background: Extended-spectrum β -lactamase (ESBL)-producing Gram-negative bacteria are a major public health concern due to their resistance to β -lactam antibiotics, causing treatment failures in both community and hospital settings. Cockroaches, common in domestic, healthcare, and food service environments, may act as mechanical vectors for these resistant pathogens.

Method: A cross-sectional study was conducted in Kohat, Pakistan, with 150 cockroaches collected (50 from each environment: household, hospital, and restaurant). Samples were processed for bacterial isolation using selective media, followed by biochemical characterization, antimicrobial susceptibility testing (Kirby-Bauer method), phenotypic ESBL detection using the double-disc synergy test, and molecular detection of *bla*_{CTX-M}, *bla*_{TEM}, and *bla*_{SHV} genes through PCR.

Results: *Escherichia coli* and *Klebsiella* spp. were identified as the most common ESBL-producing bacteria across all environments. Molecular analysis confirmed the presence of major ESBL genes in these isolates, indicating their widespread occurrence in cockroach populations.

Conclusion: Cockroaches harbor clinically significant ESBL-producing bacteria, particularly *E. coli* and *Klebsiella* spp., posing a potential public health risk. Strengthened pest control measures and improved hygiene protocols in domestic, healthcare, and food service sectors are essential to prevent the spread of antimicrobial resistance.

Keywords: Cockroaches, ESBL, *Escherichia coli*, *Klebsiella* spp., antimicrobial resistance, *bla*_{CTX-M}, *bla*_{TEM}, *bla*_{SHV}.

Mutational Analysis of Carbapenem Resistant Genes in Gram-Negative Bacteria Isolated from Clinical Samples

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Introduction: Carbapenem-resistant Gram-negative bacteria (CR-GNB) are an emerging clinical menace that hinders the availability of treatment and leads to morbidity and mortality. Resistance is usually mediated by carbapenemase genes like blaKPC, blaNDM, and blaIMP that spread extremely fast by horizontal gene transfer. In spite of widespread international studies, mutational information on these genes is not explored extensively in Pakistan, where indigenous resistance information is lacking. Insight into their molecular variability is critical for designing appropriate infection control and treatment strategies.

Methodology: Clinical specimens (urine, blood, pus, fluids, and swabs) will be cultured and handled for bacterial isolation on selective agar and biochemical tests. Antimicrobial susceptibility will be tested by Kirby-Bauer disk diffusion and broth microdilution assays according to CLSI guidelines. Carbapenemase production will be confirmed by the Modified Hodge Test. Genomic DNA will be isolated, and PCR will be conducted to amplify blaKPC, blaNDM, and blaIMP with specific primers. Amplicons will be sequenced and analyzed through BLAST, MUSCLE, and MEGA10 to determine mutations and evolutionary connections. 16S rRNA gene sequencing will be utilized for molecular-level identification of bacteria. Statistical examination will be conducted with SPSS to evaluate genotype-phenotype associations.

Results: It is expected that several carbapenem-resistant isolates will be detected with diverse resistance patterns within clinical samples. PCR and sequencing are predicted to validate the detection of blaKPC, blaNDM, and blaIMP, identifying new mutations and phylogenetic heterogeneity than in global strains. The results will yield essential information regarding the prevalence and genetic diversity of carbapenem resistance genes among local clinical isolates.

Conclusion: This research will enhance knowledge of the mutational diversity of carbapenem resistance genes in Pakistani Gram-negative pathogens. The findings will assist in creating improved diagnostic, therapeutic, and infection-control approaches, helping combat antimicrobial resistance globally pursuant to SDG 3 (Good Health and Well-being).

Keywords: Carbapenem resistance, blaKPC, blaNDM, blaIMP, Gram-negative bacteria, mutational analysis

Sociolinguistics: Study of language and society

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Sociolinguistics is the study of how language and society are connected, showing how people's ways of speaking are shaped by culture, community, and everyday interaction. It goes beyond the technical aspects of grammar or sounds to look at how language actually works in real life. In this way, it reveals how society influences language and, at the same time, how language influences society. Together, these factors shape communication, identity, and even the way people think. An important focus in sociolinguistics is the study of language varieties. These include dialects, idiolects, sociolects, agelects, medium and temporal varieties, standard and classical languages, lingua franca, and literary language. Such varieties reflect the richness of human expression, as well as the way language can show class, education, age, region, and cultural belonging. Theories like the School of Functionalism stress the social role of language, while Austin's Speech Act Theory highlights how words are not just for communication but also for performing actions in daily life. The subject also deals with multilingualism and bilingualism,

which are very common in countries like Pakistan, where several languages exist side by side. For example, many Pakistanis switch between Urdu and English in offices, universities, or even casual conversations—a practice known as code-switching. Regional languages such as Punjabi, Pashto, Sindhi, and Balochi often mix with Urdu in daily speech, showing how language contact creates new expressions and identities. In classrooms, English is often linked with modernity and opportunity, while Urdu remains central to national identity, and regional languages express cultural roots. These situations make sociolinguistics especially relevant for understanding the Pakistani context. Other important areas include the study of language and culture, language and thought, and the role of language in education and social mobility. Fields like discourse studies, conversational analysis, and language and gender further explain how language reflects power, identity, and social relations in everyday life. In short, sociolinguistics is not just a branch of linguistics but a window into human society. By studying it, learners can understand language as a living force that connects people, builds identities, and strengthens communities both globally and in Pakistan's own multilingual setting.

Pipradrol Derivatives; A New Horizon Of Antimycotics.

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Background: Antimicrobial resistance (AMR) is the World Health Organization's (WHO) top priority for public health and development worldwide. The increasing incidence of multidrug resistance (MDR) makes it essential to create novel antimicrobial medications for the treatment of resistant infections. As a molecular framework for this study, we synthesized six new derivatives of Diphenyl (piperidin-4-yl) methanol (DPP) by alkylating the nitrogen of the piperidine ring with various phenacyl halides. The structures of the synthesized compounds were determined using UV, FTIR, ¹H-NMR, and EIMS techniques. The agar well diffusion method was used to determine antifungal characteristics. In antifungal activity tests against several fungal strains, Four derivatives showed higher ZOI than fluconazole. The structure-activity relationship (SAR) study emphasized the beneficial impacts of hydroxyl and nitro substitutions on antimicrobial activity, particularly when they are para- positioned. The overall findings suggest that DPP and its derivatives are promising candidates for further investigation into their potential application as antibacterial and antifungal therapies. Through continuous improvement and live testing, their therapeutic potential must be demonstrated.

Method: The structures of these derivatives were elucidated using EIMS, ¹H-NMR, UV, and FTIR techniques. Agar well disc diffusion method was used to evaluate the antibacterial and antifungal activities of synthesized compounds.

Result: In antifungal assays, these derivatives surpassed fluconazole in ZOI (zone of inhibition) against various fungal strains.

Conclusion: The study concludes that the lead molecule DPP and its derivatives exhibit promising antifungal activity, making them potential candidates for treating various infections. Further optimization and in vivo studies are recommended to realize their clinical potential fully.

Keywords: Synthesis, Piperidine, Structure Elucidation, Antifungal.

Identification of Quality Genotypes among Cross Breeds of Basmati Rice

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Rice (*Oryza sativa* L.) is one of the principal food crops globally and plays a central role in ensuring food security. A molecular study was conducted to screen for the presence of the fragrance (*fgr*) gene in selected advanced rice lines developed at the Hazara University, Mansehra. For the detection of fragrant and non-fragrant genotypes, the Sequence Tagged Site (STS) marker RG28L was employed. Basmati-385 was used as the positive control (fragrant), while IRBB-59 served as the negative control (non-fragrant). Among the selected genotypes, all possessed the *fgr* gene except Line-17, which was identified as non-fragrant. In addition to molecular screening, a comprehensive morphological characterization was performed on these advanced lines. Significant variation was observed across key agronomic traits such as plant height, number of tillers per plant, flag leaf dimensions, leaf and panicle traits, grain yield, and harvest index. Notably, Line-16 exhibited the highest plant height (147 cm) and flag leaf area (60.47 cm²), while Line-14 showed the highest number of tillers (35.33). Line-9 demonstrated the maximum biological yield (145.67 g) and grain yield per plant (47.33 g), whereas Line-14 recorded the highest harvest index (61.11%). Lines 15 and 16 were particularly prominent in terms of total grains per panicle and branching traits but also showed relatively higher sterility percentages. Furthermore, the evaluated lines exhibited superior grain quality traits. Most of the advanced lines manifested long and slender grains with moderate to high gelatinization saline rice. The majority also displayed soft gel consistency (GC), indicating outstanding grain cooking and eating qualities.

Keywords: Advanced rice genotypes, Fragrance gene (*fgr*), Morphological traits, Grain quality, Molecular marker (STS)

Genome-Wide Analysis Of Psbx-Mediated Response To Drought Stress In Maize (*Zea Mays* L.): Physiological, Biochemical, And Chlorophyll Fluorescence

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Maize (*Zea mays* L.), a critical global cereal crop, is highly vulnerable to drought stress, which negatively affects photosynthesis and overall plant performance. This study conducted a comprehensive genome-wide analysis of the *PsbX* gene family in maize to investigate its potential regulatory role in drought tolerance. Maize seedlings were subjected to water drought conditions of varying severity, and physiological, biochemical, and chlorophyll fluorescence responses were evaluated. Morphological traits, reactive oxygen species (ROS) levels, and antioxidant enzyme activities (SOD, CAT, APX, POD) were quantified alongside photosynthetic pigment and

fluorescence assessments (F_0 , F_v/F_m , $\Phi PSII$, ETR, NPQ, q_N). Bioinformatics analyses identified and characterized PsbX gene family members, revealing conserved motifs, gene structures, promoter cis-elements, and chromosomal mapping. Gene expression profiling via qRT-PCR demonstrated that PsbX genes were upregulated under drought conditions, indicating their involvement in stress signaling. Enhanced antioxidant activity and stable chlorophyll fluorescence in drought-stressed seedlings suggest that PsbX genes contribute to photosystem II (PSII) stability and drought resilience. These findings suggest that structural and functional diversity within the PsbX gene family enhances maize adaptation to drought by regulating photosynthetic efficiency and stress defense mechanisms. This study provides a foundational basis for the development of drought-tolerant maize cultivars through molecular breeding strategies.

Keywords: Morphological, Photosynthetic parameters, Chlorophyll fluorescence, ROS.

Chemical Seed Priming-Mediated Alleviation of Bisphenol A (Bpa) Stress In Wheat: A Morphophysiological and Biochemical Assessment

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Wheat (*Triticum aestivum* L.), a crucial staple crop, is under threat from environmental toxins such as Bisphenol A (BPA), a synthetic chemical commonly used in plastic manufacturing. This study studied the phytotoxic effects of BPA on wheat germination and early seedling development. It also investigated the ability of chemical seed priming agents—salicylic acid (SA), hydrogen peroxide (H_2O_2), and hydrogen sulfide (H_2S)—to boost stress tolerance. Seeds of the Khyber variety were primed in appropriate solutions and subjected to varied amounts of BPA under controlled circumstances. Morphological data like as germination rate, root and shoot length, leaf count, and biomass were measured. Biochemical tests examined chlorophyll and carotenoid levels, reactive oxygen species (H_2O_2 , TBARS), and antioxidant enzyme activity (SOD, CAT, APX, POD). The results showed that BPA treatment dramatically reduced germination and seedling growth, altered pigment content, and increased oxidative stress. Seed priming with SA, H_2O_2 , and H_2S reduced these effects while increasing antioxidant responses and seedling vigor. These data show that BPA has a significant impact on wheat growth, although chemical priming can act as a preventive approach by increasing physiological resilience and oxidative stress defense mechanisms.

Keywords: Biochemical, salicylic acid, hydrogen peroxide, ROS, TBARS.

Physio-Chemical Response of *Pisum Sativum* L. To Biological Synthesized Zinc Oxide Nanoparticles Using A Combination Of *Mentha Piperita* L. And *Coriander Sativum* L.

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The present study aims to explore the eco-friendly synthesis and agricultural application of zinc oxide nanoparticles (ZnO NPs) using aqueous leaf extracts of *Mentha piperita* and *Coriandrum sativum*. Utilizing a green synthesis approach, ZnO NPs were characterized through various techniques, including UV-Vis spectroscopy, FTIR, SEM, XRD, and EDX. The synthesized

nanoparticles were applied to *Pisum sativum* L. seeds at varying concentrations (0.1, 0.5, and 1.0 mg/L) to evaluate their influence on germination, growth, and biochemical parameters. Results are expected to demonstrate improved physiological traits such as enhanced shoot and root length, biomass accumulation, and enzymatic antioxidant activities (CAT, SOD, POD, and APX). This study proposes that the synergistic use of *M. piperita* and *C. sativum* in nanoparticle synthesis not only provides an environmentally sustainable alternative to chemical fertilizers but also promotes plant resilience and productivity. The findings will contribute to the advancement of Nanotechnology in sustainable agriculture, particularly in mitigating the limitations of conventional fertilization methods.

Keywords: Biochemical, Nanotechnology, ZnO, ROS, TBARS.

Green Synthesis of Zinc Nanoparticles Using Cassia Absus Leaves Extract: Evaluation Of Their Bio fertilizer And Biopesticidal Potential In Sustainable Farming

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This research demonstrates the successful green synthesis of zinc oxide nanoparticles (ZnO NPs) using an aqueous extract of *Cassia absus* leaves as a sustainable reducing and stabilizing agent. Zinc acetate served as the precursor, and nanoparticle formation was confirmed by UV-Vis spectrophotometry. Comprehensive characterization of the synthesized ZnO NPs was performed, including X-ray Diffraction (XRD) confirming crystallinity and phase structure, Scanning Electron Microscopy (SEM) revealing morphology and size, Dynamic Light Scattering (DLS) providing size distribution, Zeta Potential analysis indicating colloidal stability, Energy Dispersive X-ray Spectroscopy (EDX) verifying elemental composition (notably zinc), and Fourier Transform Infrared Spectroscopy (FTIR) identifying functional groups of phytochemicals involved in synthesis and capping. The ZnO NPs were evaluated for dual agricultural applications. As a biofertilizer, application significantly enhanced plant growth parameters (height, leaves length, width, flower, fruit), and nutrient uptake, while also improving soil health indicators. Concurrently, the ZnO NPs exhibited potent biopesticidal activity, effectively inhibiting common plant pathogens in disc diffusion assays and reducing pest infestation and crop damage in application trials. Environmental safety assessments confirmed low toxicity towards non-target organisms (earthworms, beneficial insects) and demonstrated no adverse effects on soil microbial activity and biodiversity. These findings establish *Cassia absus*-synthesized ZnO NPs as a promising, eco-friendly, and sustainable Nano biotechnology solution for integrated crop management, functioning effectively as both a bio fertilizer and a bio pesticide.

Keywords: ZnO NPs, XRD, SEM, DLS, EDX.

Elucidating the Effects of Salt Stress on Growth, Physiological and Biochemical Traits of Brassica Rapa L. In Rain-Fed Area and Its Mitigation by Foliar Brassinosteroid Spray

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Soil salinity is a major abiotic stress limiting crop growth and productivity, particularly in rain-fed agricultural systems where irregular rainfall exacerbates salt accumulation in the root zone. *Brassica rapa* L., an important oilseed crop, is highly vulnerable to such stress, leading to significant reductions in growth, physiological efficiency, and yield. Brassinosteroids (BRs), a class of phytohormones, are known to enhance plant tolerance against various abiotic stresses by modulating physiological and biochemical processes. The present study is designed to elucidate the effects of salt stress on morphological, physiological, and biochemical traits of *Brassica rapa* L. under field conditions and to evaluate the potential of foliar brassinosteroid application in mitigating these effects. A field experiment was conducted in Tehsil Jand, rain-fed area, using a Randomized Complete Block Design (RCBD) with three replications. Sodium chloride (150 and 200 mM) was applied to induce salinity, while brassinosteroid foliar spray will be used as a mitigating treatment. Growth parameters (plant height, leaf area, siliques), physiological traits (chlorophyll content, photosynthetic pigments), and biochemical markers (proline accumulation, antioxidant enzyme activities including POD, SOD, H₂O₂, MDA, and lipid peroxidation) was assessed. Soil physicochemical properties were analyzed to understand the salinity context. It is hypothesized that salt stress was adversely affect *Brassica rapa* L. growth, physiology, and biochemistry, while brassinosteroid application will alleviate these negative effects through improved osmotic adjustment, antioxidant defense, and reduced oxidative damage. Findings from this research are expected to provide practical insights for improving crop resilience in salt affected, rain-fed regions, contributing to sustainable agriculture and aligning with the United Nations Sustainable Development.

Keywords: Salinity, *Brassica rapa* L., Brassinosteroid, Morphological, Physiological, and Biochemical traits

Morpho-Physiological and Biochemical Responses of Chickpea to Cadmium Chloride and Foliar Brassinosteroid Spray under Rain-Fed Conditions

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Chickpea (*Cicer arietinum* L.) is the third most important food legume worldwide, widely cultivated in arid and semi-arid regions due to its nutritional and economic value. However, cadmium (Cd) contamination poses a major threat to its growth, productivity, and food safety by inducing oxidative stress, impairing physiological functions, and reducing yield. This study evaluated the morpho-physiological and biochemical responses of chickpea to cadmium chloride (CdCl₂) stress under rain-fed conditions in District Karak, Pakistan, and investigated the ameliorative potential of foliar-applied brassinosteroids (BRs). A randomized block design (RBD) was used with three Cd concentrations (0, 50, and 100 µM) combined with BR spray treatments. Growth parameters (plant height, leaf area, biomass, pod number), physiological attributes (chlorophyll a, chlorophyll b, carotenoids, relative water content), and biochemical markers (proline, antioxidant activity) were assessed, along with cadmium accumulation in root and shoot tissues. Soil characteristics (pH, EC, organic matter, macro- and micronutrients, extractable Cd) were analyzed pre- and post-harvest to link soil chemistry with plant responses. Results indicated that cadmium chloride significantly impaired chickpea growth and physiology, whereas foliar

brassinosteroid application mitigated Cd toxicity by enhancing antioxidant defense, improving nutrient uptake, and reducing Cd translocation to edible tissues. The findings provide field-based recommendations for managing heavy metal stress in chickpea cultivation under rain-fed conditions, supporting sustainable agriculture, food safety, and the attainment of Sustainable Development Goals.

Keywords: Cadmium stress, *Cicer arietinum* L, Brassinosteroid, Morphological, Physiological, and Biochemical responses.

Characterization of Multidrug Resistance Bacteria Associated With *Rhipicephalus* (Boophilus) Microplus Ticks Infesting Cattle, Goats, and Sheep in Rural Areas of District Kohat

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This study investigates the presence and antimicrobial resistance of bacteria associated with *Rhipicephalus* (Boophilus) microplus ticks infesting livestock specifically cattle, goats, and sheep—in rural areas of District Kohat, Pakistan. These ticks are known vectors of multiple pathogens affecting both animals and humans. Researchers collected engorged adult *R. microplus* ticks from naturally infested animals in selected rural localities across District Kohat. The ticks were sterilized externally to avoid contamination, dissected in sterile conditions, and their internal contents (gut and hemolymph) were cultured on appropriate microbiological media. Bacterial isolates were first identified using conventional biochemical methods and later confirmed through 16S rRNA gene sequencing. The bacterial analysis revealed the presence of several genera, including *Staphylococcus*, *Bacillus*, *Pseudomonas*, *Klebsiella*, and *Enterococcus*. These genera include both environmental and pathogenic species, some of which are known to cause opportunistic infections in animals and humans. Many of these isolates displayed significant resistance to commonly used antibiotics. Antibiotic susceptibility testing results showed that 30–40% of the bacterial isolates qualified as multidrug-resistant, meaning they were resistant to three or more different classes of antibiotics. This high level of MDR is concerning and suggests that ticks may act not only as vectors but also as reservoirs of resistant bacteria that can potentially transfer between animals and humans, contributing to the wider spread of antimicrobial resistance. The findings have serious implications for livestock management and public health. In areas like Kohat, where close human-animal interactions are common, the possibility of zoonotic transmission of MDR pathogens becomes more likely. The detection of resistance in bacterial species that are also commonly found in humans highlights the need for integrated surveillance programs and responsible use of antibiotics in veterinary practice.

Keywords: *Rhipicephalus*, multidrug-resistant (MDR), Clinical and Laboratory Standards Institute (CLSI)

Computational and Phytochemical Evaluation of *Ifloga Spicata* Constituents against Colorectal Cancer Targets

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Colorectal cancer (CRC) is a significant source of cancer-associated morbidity and mortality globally, highlighting the pressing necessity for innovative therapeutic approaches. Natural goods and medicinal plants have become a vital source of bioactive compounds with anticancer properties. This study aims silico and phytochemical assessment of bioactive compounds from *Ifloga spicata* in relation to critical colorectal cancer targets. Gas chromatography–mass spectrometry (GC-MS) analysis was initially utilized to identify and characterize phytochemicals. Thereafter, the selected compounds were subjected to ADME (absorption, distribution, metabolism, and excretion) and drug-likeness assessments to choose the most appropriate candidates. We utilized molecular docking and network pharmacology methods to investigate the interactions of the selected drugs with CRC-associated proteins, including oncogenic and tumor suppressor targets. The computational findings demonstrated that some medications have substantial binding affinities, advantageous pharmacokinetic characteristics, and the ability to engage with multiple targets. Specific phytochemicals from *Ifloga spicata* exhibited interactions with critical CRC-related signaling pathways, indicating their potential relevance in cancer prevention. This comprehensive computational and phytochemical study demonstrates that *Ifloga spicata* has significant bioactive chemicals with potential therapeutic relevance for colorectal cancer (CRC) treatment. These findings establish a robust basis for subsequent in vitro and in vivo investigations to confirm the anticancer activity of these compounds and to examine their potential as lead candidates for the development of colorectal cancer therapies.

Keywords: colorectal cancer, network pharmacology, molecular docking, *Ifloga spicata*

Assessment and Pharmacist intervention of rational use of cardiovascular drugs in geriatric patients

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Aged individuals frequently develop cardiovascular diseases (CVDs), and using of several drugs increases the risk of selecting the wrong medication, encountering undesirable drug reactions, and ultimately failing to achieve improvement. Enhancing pharmacological therapy for this population requires careful prescribing and initiatives led by pharmacists. This research aimed to assess the influence of pharmacist interventions on enhancing the safety and efficacy of medications for elderly patients and to evaluate the rational utilization of cardiovascular treatments. Individuals undergoing cardiovascular treatment, either in a hospital setting or at home, were incorporated into the data collection. We examined medication utilization patterns by comparing them with established treatment regimens and WHO prescribing statistics. Incorrect prescriptions, drug-drug interactions, and dosage errors that have required medication assessments. Pharmacist's interventions include therapeutic monitoring, cooperation with physicians, patient counseling, and medication reconciliation. The efficacy of these interventions was assessed by examining their influence on diminishing DRPs, adherence to protocols, and performance in clinical environments. The findings indicated a significant prevalence of polypharmacy and several instances of improper pharmaceutical usage, especially for drugs that lower lipids, prevent thrombosis, and manage hypertension. Pharmacist interventions resulted in diminished prescription errors, increased efficacy of pharmacological therapies, and improved patient comprehension and adherence to treatment regimens. This study emphasizes the

significance of clinical pharmacists in assisting elderly patients with the prudent use of cardiovascular medications. Incorporating pharmacist-led drug management programs into routine care for this at-risk group may yield enhanced treatment outcomes, decreased healthcare expenditures, and elevated patient safety.

Keywords: CVS, Pharmacist Intervention, WHO protocols, Medication error, Rationality

Phytochemical profiling and antibacterial potential of *ifloga spicata* through analytical and computational study

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The rising prevalence of drug-resistant diseases highlights the necessity for developing innovative antimicrobial agents. Phytochemicals effectively enhance the efficacy of medicinal plants like *I. spicata*. We evaluated the bactericidal efficacy of *I. spicata* by a combination of computational, experimental, and phytochemical methodologies. GC-MS analysis of chloroform and methanol extracts identified bioactive substances, such as sterols, oleic acid (12.10%), and n-hexadecanoic acid (30.02%). Significant inhibition zones (8.5-15.3 mm) were recorded in antibacterial assays against *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, with methanol extracts exhibiting the most pronounced efficacy overall. Due to its excellent gastrointestinal absorption (89%) and low toxicity, the medication was predicted to demonstrate favorable drug-like properties according to computational ADMET profiling. Molecular docking, similar to traditional antibiotics, demonstrated that significant compounds such as Androstanol displayed substantial binding affinities (-8.1 to -4.4 kcal/mol) to certain bacterial targets. The results indicate that *I. spicata* possesses phytochemicals with antibacterial characteristics, underscoring its potential application in addressing disorders resistant to standard treatments. Further study of organisms is crucial for prospective medical applications.

Keywords: *Ifloga spicata*, antibacterial activity, computational study, molecular docking, ADMET analysis

Bioinformatic Analysis Of Brain Tissue Gene Expression Profile And Therapeutic Drug Target In Alzheimer Disease

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Dementia, characterized by memory loss and cognitive decline, is caused by Alzheimer's disease (AD), a degenerative neurological condition. Despite extensive study, there are currently no effective treatments for Alzheimer's disease (AD), which presents a considerable challenge within the healthcare sector due to the diseases complex molecular basis. This study aimed to utilize an integrative bioinformatics approach to identify potential treatment targets for Alzheimer's disease by analyzing gene expression profiles in brain tissue. Gene expression datasets were obtained from public repositories and subsequently preprocessed and normalized. Statistical and computational tools identified differentially expressed genes (DEGs) between Alzheimer's disease (AD) and healthy controls. We employed Gene Ontology (GO) and KEGG pathway analyses as functional enrichment techniques to deepen our understanding of the molecular

mechanisms and signaling pathways associated with AD pathogenesis. We identified hub genes and critical biological entities through the construction of protein-protein interaction (PPI) networks. Therapeutic medicines potentially targeting these specific interactions were identified through an analysis of drug-gene interaction databases. A set of genes linked to synaptic function, amyloid-beta metabolism, and neuroinflammation was identified as significantly dysregulated. Notable regulators were identified in hub genes such as APP, MAPT, and PSEN1, and various existing or potentially advantageous medicines exhibited positive interactions with these targets. This comprehensive bioinformatics research finds essential druggable targets that may enhance the treatment of Alzheimer's disease and provides new insights into the illness fundamental structure. These findings provide a solid basis for future efforts to evaluate research and create medications that will improve the detection and treatment of Alzheimer's disease.

Keywords: Alzheimer's disease, bioinformatic analysis, therapeutic targets, DEGs

Network Pharmacology-Based Evaluation of Boerhavia Diffusa Phytochemicals and Their Mechanisms against Prostate Cancer Progression and Treatment

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Prostate cancer (PCa) is among the most common malignancies in males. Treatment is widely challenging and often ineffective. Computational biology, when combined with traditional medicinal plants, enables the discovery of new bioactive chemicals with potential medical uses. This research employed a network pharmacology approach to examine the phytochemical composition of Boerhavia diffusa and evaluate its mechanisms in obstructing the advancement of prostate cancer. The phytochemical databases and published literature were consulted for the phytoconstituents of B. diffusa. We assessed these compounds to identify potential leads by determining their similarity to medicines with favorable pharmacokinetic properties (ADME). We discovered the bioactive compounds linked to targets associated with prostate cancer using disease and protein interaction databases. We constructed protein-protein interaction (PPI) networks and assessed them via Gene Ontology (GO) and KEGG pathway enrichment analyses to clarify the biological processes and pathways implicated. The results revealed those various important phytochemicals, including alkaloids and flavonoids, demonstrate significant interactions with targets related to cell cycle regulation, apoptosis, and androgen receptor signaling. Our investigation of the network demonstrated synergistic and multi-target activity, suggesting the potential to affect pivotal nodes in the progression of prostate cancer. Furthermore, their anticancer effects were highlighted through pathway enrichment, indicating participation in the PI3K/AKT, MAPK, and p53 signaling pathways. This extensive computational research indicates that Boerhavia diffusa may contain bioactive compounds that can influence multiple signaling pathways related to prostate cancer. These findings provide a rational basis for further in vitro and in vivo validation to confirm efficacy and aid in the development of medicines for prostate cancer treatment.

Keywords: Network Pharmacology, Boerhavia diffusa, Phytochemicals, Prostate Cancer, ADME

Hydrothermal Synthesis of Copper Aluminate Nanoparticles and Their Antimicrobial Activity

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Copper aluminate (CuAl_2O_4) nanoparticles have distinctive structural, antibacterial, and catalytic attributes. This research employed a hydrothermal method to more effectively control the size, shape, and crystalline of copper aluminate nanoparticles. The synthesis procedure commenced with the preparation of copper and aluminum salt solutions, which were then subjected to hydrothermal treatment at regulated temperatures and pressures. X-ray diffraction (XRD) was employed to confirm the phases of the nanoparticles, scanning electron microscopy (SEM) was utilized to analyze their morphology, and Fourier-transform infrared spectroscopy (FTIR) was applied to ascertain their functional groups. We assessed the efficacy of the produced nanoparticles against several bacteria, including *Staphylococcus aureus* and *Escherichia coli*, via agar well diffusion and minimum inhibitory concentration (MIC) experiments. The antibacterial efficacy of copper aluminate nanoparticles was especially pronounced against Gram-negative bacteria. The nanoparticles exhibited distinct crystallinity and uniform nanoscale dimensions. The extensive surface area and the generation of reactive oxygen species by the nanoparticles may account for the increased activity. This research demonstrates that copper aluminate nanoparticles synthesized using hydrothermal methods exhibit promising antibacterial characteristics, potentially applicable in environmental disinfection and medicine.

Keywords: Nanoparticles, copper aluminate, XRD, antibacterial activity, FTIR

Exploring English language

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This research explores English language in a broad way. English is considered as a complex language in terms of pronunciation, spelling and grammatical rules. English is pretty different from other languages because its words are not always spoken the way in which they are written. This creates a difficult situation for the learners. This abstract explores the information related to phonetics and the history of English language. A lot of words from other languages are intermingled with English. This study of English language helps the phonetician to understand the sound and the complexity of silent letters and pronunciation rules in English. By understanding these rules, we can deepen our knowledge about phonetics and its related fields, and we can also make our communication skills more effective than ever.

Fabrication of Zirconia and Sulphur Doped Graphitic Carbon Nitride for Colorimetric Sensing Of Cadmium Ion

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Heavy metals like mercury (Hg), lead (Pb), and cadmium (Cd) etc are toxic in nature. Cadmium causes various diseases like cancer, cardiovascular and neurodiseases etc. In the present work, zirconia and sulfur-doped graphitic carbon nitride ($\text{g-C}_3\text{N}_4$) nanocomposites were fabricated by hydrothermal method. The synthesized nanocomposites were characterized by various analytical techniques such as FTIR, XRD, EDX and SEM analysis. The structural, functional, and

morphological properties of the synthesized nanoparticles were systematically characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM), confirming crystallinity, successful doping, functional groups and enhanced surface features. The prepared nanocomposites were used to develop an efficient colorimetric sensor for cadmium (Cd^{2+}) ion detection. The colorimetric sensing performance was evaluated by UV–visible spectroscopy, where the doped nanocomposites exhibited distinct absorbance responses toward Cd^{2+} ions, enabling sensitive quantification in different real samples solutions. Different parameters like PH, time, TMB concentration, nanoparticle and cadmium ion concentration were optimized to obtain best response of the developed sensor. The results highlight the potential of zirconia and sulfur co-doped $\text{g-C}_3\text{N}_4$ as a cost-effective and reliable platform for heavy metal ion detection in environmental monitoring applications. The developed sensor was successfully applied for the detection of cadmium ion in real samples.

Keywords: Cadmium ion, TMB, Colorimetric sensor, PBS, Zirconia/sulfur-doped graphitic carbon nitride nanocomposites

Leveraging XAI for the Earliest Possible Detection of Parkinson’s Disease

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Parkinson’s disease (PD) is a degenerative neurological condition that impairs a person’s quality of life by significantly affecting both their motor and non-motor skills. Although early PD detection is essential for prompt interventions and successful treatment plans, current diagnostic techniques mostly rely on subjective clinical assessments, which frequently lead to inconsistent and delayed diagnoses. Through the incorporation of transparency into machine learning models, this study investigates the use of Explainable Artificial Intelligence (XAI) to improve the earliest possible detection of Parkinson’s disease. The study uses sophisticated preprocessing, transformation, and feature extraction techniques with convolutional neural networks, specifically VGG16, improved by Gramian Angular Fields (GAF), using a publically available dataset of spiral and meander designs. To guarantee model interpretability and draw attention to important diagnostic aspects, XAI techniques like Grad-CAM, LIME, and SHAP are used. The suggested approach blends explain ability and model accuracy with the goal of assisting medical professionals in making well-informed clinical decisions and encouraging patient confidence in AI-assisted systems. Metrics such as accuracy, precision, recall, F1-score, and ROC-AUC will be used to compare the model & performance against the most advanced alternatives. This study adds to the expanding corpus of work in healthcare data science by showing how explainable deep learning can enhance diagnostic accuracy, offer clear explanations for forecasts, and eventually expand the use of AI in early-stage Parkinson’s disease detection.

Keywords: Parkinson ’s disease (PD), Explainable Artificial Intelligence (XAI), Early Detection, Convolutional Neural Networks (CNN), Gramian Angular Fields (GAF)

A Novel Emotion-Aware Captioning Model: Leveraging Vision Transformers for Visual and Sentiment Alignment

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Automatic image caption generation is an emerging field of study that combines natural language processing (NLP) and computer vision (CV). Although current models do a good job of describing objects and images, robots frequently fall short in capturing the sentimental or emotional elements of images, resulting in captions that are not as expressive as those written by humans. This study suggests a unique emotion-aware captioning model to fill this gap by utilising transformer-based language models like GPT or BART for fluent caption generation and Vision Transformers (ViT) for rich visual feature extraction. To match emotional semantics with visual information and guarantee that the resulting captions are both correct and emotionally expressive, an adaptive cross-attention technique is implemented. A variety of datasets, including MS-COCO, Flickr30k, and ArtEmis, encompassing both descriptive and emotion-labeled captions, are used to train and evaluate the model. To increase the consistency and quality of the data, preprocessing methods like emotion encoding and image enhancement are used. Standard metrics (BLEU, METEOR, ROUGE, and CIDEr) and emotional accuracy are used to assess the model & performance in order to confirm that sentiment awareness and semantic precision are balanced. A captioning system that can generate emotional, contextually correct, and expressive captions is the desired result. This study advances the use of human-centered AI in content production, assistive technologies, and digital communication.

Keywords: Image Captioning, Vision Transformer (ViT), Emotion-aware Captioning, Natural Language Processing (NLP), Cross-attention Mechanism, Sentiment Analysis

Prevalence and Molecular Characterization of Antibiotic-Resistant *Salmonella* Typhimurium Isolated From Poultry In North Waziristan, Khyber Pakhtunkhwa, Pakistan

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The prevalence of drugs-resistant *Salmonella* typhimurium give rise to significant public health concerns and food safety specifically in those region where limited veterinary services lack of check and balance of diseases. This study conducted on the pervasiveness and molecular characteristics of antibiotic-resistant *S. typhimurium* strains obtained from different poultry shops, slaughter houses, and farms in District North Waziristan, Khyber Pakhtunkhwa, Pakistan. A total of 115 poultry samples were collected, such as (cloacal, fecal, meat, swabs) for commercial shops, slaughter houses, farms throughout the region. Applied Standard techniques uses in microbiology laboratory, and were used selective media like SS Agar (*Salmonella*-*Shigella* Agar), XLD Agar, for isolation of this particular bacteria. After that conducted biochemical test (TSI, Simon Citrate, IMU) and serological test for confirmations of isolates. Antibiotic susceptibility testing was performed using standards CLSI disk diffusion method against the isolate antibiotics used (Ampicillin, Ciprofloxacin, Ceftriaxone, Chloramphenicol, Tetracycline, Gentamicin) Molecular characterization was performs via PCR & 16srna for confirmations of the required antibiotic resistant bacteria. Results indicated the prevalence rate of 32 positive for *S. typhimurium* out 115 total samples (28%), with over 70% of isolates shows multidrug resistance (MDR). High resistance was observed against, ampicillin, and tetracycline. Molecular analysis confirmed the presence of multiple resistance bacteria, *S. typhimurium*, Genus *salmonella*,

Species of *S. enterica*, serovars of *enterica*. These findings enhance the urgent need for integrated antimicrobial control, improved disease prevention strategies, and routine method of tracking and responding to disease outbreaks in poultry farming in the particular study Area. The study giving important and critical data and information to the regional policy and intervention strategies aimed at mitigating the spread of resistant pathogens from farm to fork.

Keywords: Salmonella Typhimurium, Prevalence, Antibiotic resistant, poultry, 16srna, North Waziristan

Synthesis and Characterization of Cerium Oxide Doped Graphene Oxide Nanocomposite for Removal of Methylene Blue and Methyl Orange Dyes from Water

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Nanotechnology has revolutionized several fields, including environmental science, healthcare, and material science, by introducing nanoparticles with size ranging from 1 to 100 nanometers. Nanoparticles can be tuned for a variety of applications, including catalysis, drug delivery, and environmental cleanup, due to their quantum size effects, large surface area, and customizable physical and chemical properties. Cerium oxide nanoparticles (CeO₂ NPs) have been mostly exploited due to their unique surface chemistry, high stability, and biocompatibility. CeO₂ NPs is a semiconductor with band gap energy of ~3.14 eV and exhibits high excitation energy. It is mostly used in the fabrication of therapeutic agents, drug delivery, and anti-parasitic ointments. These features make GO extremely valuable in applications such as sensors, drug delivery and water treatment. Doping GO with CeO₂, recognized for its redox properties, oxygen storage capacity and catalytic activity, creates a nanocomposite with enhanced adsorptive and catalytic characteristics. They also have potential applications in biosensors and imaging due to their electrical conductivity. This study addresses these gaps by presenting a sustainable synthesis method and investigating the material's dye adsorption capabilities. Gaps by presenting a sustainable synthesis method and investigating the material's dye adsorption capabilities.

Keywords: Synthesis, characterization, CeO₂-NPs, Removal of Methylene Blue, Methyl Orange Dyes from Water

Antimicrobial Resistance and Susceptibility in Lady Reading Hospital Peshawar

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Antimicrobial resistance (AMR) is a rapidly growing global health concern that compromises the treatment of common infections. Bloodstream infections caused by *Escherichia coli* and other Gram-negative pathogens are associated with significant morbidity and mortality. The increasing resistance of these pathogens to multiple classes of antibiotics limits treatment options and highlights the urgent need for local and regional resistance data to inform empirical therapy. A total of 59 *E. coli* and other pathogenic isolates were collected from bloodstream infections. Standard microbiological procedures were employed for species identification, and antimicrobial susceptibility testing was performed according to Clinical and Laboratory Standards Institute

(CLSI) recommendations. Resistance patterns were assessed against routinely used antibiotics, including carbapenems, fluoroquinolones, cephalosporins, and β -lactam/ β -lactamase inhibitor combinations. The isolates demonstrated alarmingly high resistance rates to commonly prescribed antibiotics. Resistance to levofloxacin was observed in 67.8% of isolates, while ceftriaxone, cefotaxime, and cefepime resistance rates were 72.8%, 71.1%, and 66.1%, respectively. Notably, cefoperazone/sulbactam showed the highest level of susceptibility, with 71.1% of isolates remaining sensitive. These findings suggest limited efficacy of fluoroquinolones and third-generation cephalosporins, while β -lactam/ β -lactamase inhibitor combinations may retain some therapeutic potential. High prevalence of antimicrobial resistance among bloodstream isolates, particularly against cephalosporins and fluoroquinolones, poses a serious challenge for empirical therapy. The relatively better performance of cefoperazone/sulbactam suggests its potential role in treatment strategies. This study emphasizes the urgent need for continuous AMR surveillance, robust infection control practices, and implementation of antimicrobial stewardship programs to preserve the effectiveness of available antibiotics and improve clinical outcomes.

Keywords: Antimicrobial resistance, *Escherichia coli*, Bloodstream infections, Antibiotic susceptibility, β -lactamase inhibitors

Synthesis and Characterization Of Graphitic Carbon Nitride Based Nickel Oxide Nanosheets For The Photocatalytic Degradation Of Chlorophenols And Rhodamine B

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In this study graphitic carbon nitride (gC_3N_4) and nickel oxide (NiO) were effectively synthesized and coupled to form a gC_3N_4 /NiO nanosheets for the degradation of Rhodamine B and Chlorophenols from wastewater. gC_3N_4 was synthesized through polymerization reaction by heating urea in an alumina crucible, while NiO nanosheets were synthesized through simple hydrothermal routes by dissolving nickel (II) nitrate hexahydrate ($Ni(NO_3)_2 \cdot 6H_2O$) in ethanol. The gC_3N_4 /NiO nanosheets were prepared by taking their appropriate amounts of gC_3N_4 and NiO and dispersing in water ethanol mixture under heating. The effective synthesis and integration of gC_3N_4 and gC_3N_4 /NiO nanosheets was validated by characterization techniques. Their synthesis was confirmed by UV-Vis spectroscopy. Functional groups including C-N-C at 810 cm^{-1} , $1180\text{--}1680\text{ cm}^{-1}$ for C-N/C-NH and $2980\text{--}3556\text{ cm}^{-1}$ for amino group N-H were detected by FTIR analysis, indicating successful surface modification. The EDX of gC_3N_4 /NiO nanosheet sample comprises of Nickel, Oxygen, nitrogen, carbon and Oxygen. The Miller indices in the XRD of gC_3N_4 were observed at 002 and 100 in gC_3N_4 spectra while NiO spectra at 311, 200, 111 and for gC_3N_4 /NiO 100, 002, 111 and 200 were observed. According to SEM images, NiO nanosheets were uniformly distributed between gC_3N_4 nanosheets, increasing surface area and degradation efficiency. Photoluminescence (PL) showed a significant quenching of emission intensity in the gC_3N_4 /NiO as compared to pristine gC_3N_4 indicating improved charge carrier dynamic favorable for photocatalysis. Photocatalytic degradation study was conducted regarding their efficiency for degradation of Chlorophenol and Rhodamine B. Under ideal circumstances, the gC_3N_4 and NiO nanosheets degraded Rhodamine B by 61.83% and 47.91% respectively. The gC_3N_4 /NiO nanosheets demonstrated enhance degradation effectiveness, by degrading about

94.48% Rhodamine B and 82%. Chlorophenol. The study also showed that the degradation follows first order kinetic.

Analysis & Design of IT Policy Framework for e-Police Services Innovation in Pakistan using Discrete Choice Modeling Information Security Approaches

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E-policing, otherwise known as electronic policing, is the modern form of policing that integrates the use of technology into the more traditional methods of policing. People are now able to use the internet to file and track cases of FIR, acquire and verify a Police Clearance Certificate, and review the progress of their cases as opposed to the old method of paper documentation. E-policing is a necessity for Pakistan, since many regions, namely the more remote locations, are burdened with slow, expensive, and opaque, not to mention, inaccessible, policing. Those regions would greatly benefit from e-policing technologies, not to mention, better public-police relations services. Already, some improvements have taken place in the country. The e-police portals, as well as the Punjab Safe City Authorities, now allow for the online submission of FIRs, mobile apps for reporting, and case tracking. More policing systems should involve mobile apps, biometric case verification, and real-time case updates. These implementations are proof of reduced policing costs and the greater accessibility of policing services as a whole. In conclusion, e-policing in Pakistan is likely to bring positive contributions to policing in the country, considering improved public relations, efficient use of technology, and better public-police relations if increased public awareness and police staff training continues.

In-Silico Pharmacokinetics Assessment of Liquisolid Compacts Of Clopidogril and Its Comparison with Conventional Tablets

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Clopidogrel is an antiplatelet drug widely prescribed to prevent cardiovascular events, but its low aqueous solubility (BCS Class II) limits oral absorption and bioavailability. To address this challenge, the present study developed and evaluated liquisolid compacts of clopidogrel using a propylene glycol–water (2:1) vehicle and different carriers (microcrystalline cellulose, starch, polyvinyl pyrrolidone, and hydroxypropyl methylcellulose). The formulations were prepared by adsorbing the liquid medication onto porous carriers, coating with colloidal silicon dioxide, and compressing into tablets. Pre-compression studies confirmed good flowability of the powder blends, particularly with microcrystalline cellulose. FTIR analysis showed no drug–excipient incompatibility. Post-compression evaluations indicated acceptable weight variation, mechanical strength, and friability, while disintegration studies revealed faster disintegration with starch- and cellulose-based compacts compared to polyvinyl pyrrolidone (PVP) and hydroxypropyl methylcellulose (HPMC). In vitro dissolution testing in 0.1N HCl demonstrated a significant enhancement in drug release, with optimized formulations achieving 90% release within 30 minutes versus ~45% for conventional tablets. Stability testing under accelerated conditions ($45 \pm 5^\circ\text{C}$, $75 \pm 5\% \text{ RH}$) confirmed excellent retention of drug content (98%) and no physical changes. Furthermore, in silico physiologically based pharmacokinetic (PBPK) modeling using PK-Sim® was employed to predict systemic exposure in Asian and European populations. The simulations

indicated improved bioavailability and higher plasma concentration–time profiles for liquisolid compacts compared to conventional tablets. In conclusion, the liquisolid compact technique successfully enhanced clopidogrel solubility and dissolution while ensuring stability and robustness. The integration of PBPK modeling provided translational insights into clinical performance, highlighting this approach as a promising strategy for improving oral bioavailability of poorly soluble drugs like clopidogrel.

Synthesis of cerium oxide Nano sheets by parallel flow precipitation method for the detection of nitrite ion in water

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Nitrite ion (NO_2^-) presence in water is one of most critical public health and environmental problem [1]. The nitrite ion (NO_2^-) is released from different Sources such as decomposition of organic compound, industrial waste products and agricultural runoff in water [2]. Nitrite ion is a toxic pollutant present in water associated with serious health risks such as gastric cancer and birth defects. For infants (under six months) exposure of nitrite ion (NO_2^-) exceeding the permissible level can lead to condition like shortness of birth and blue baby syndrome. To address these risks, the United States of Environmental Protection Agency (USEPA) has set a maximum permissible concentration of nitrite in water i.e one part per million [3]. Different methods have been used to find the concentration of nitrite in drinking water such as ion chromatography, flow injection analysis, chemo luminescences and electrophoresis. All these ways are time consuming, expensive and requires skilled operators [4]. On the other hand, colorimetric biosensing is simple, robust, high sensitive and affordable method that allows for the determination of chemical reaction through visible color changes which can be easily detected without the need of special equipment [5]. Biosensing is a tool that finds the biological or chemical reaction by generating a signal that corresponds to the concentration of specific analyte involved in the reaction [6]. Nanomaterial showed promising results in biosensing application in recent year because of their distinct electrical, optical and chemical characteristics. Cerium oxide (CeO_2) Nanosheets has attracted scientists because of it superior biosensing characteristics like biocompatibility, low toxicity and high thermal stability [7, 8]. Different methods have been used to fabricate cerium oxide nanosheets like hydrothermal method, chemical vapor deposition method and sol-gel method. All these methods are time consuming, needs expensive equipment's and agglomeration can also occur. On the other hand, precipitation method is simple, low cost, and suitable for mass production [9]. Cerium oxide Nano sheets variously used in fuel cell, sensing of oxygen, mechanical and chemical planarization tools. These characteristic enforce colorimetric sensing ability [10]. In this project cerium oxide Nano sheets will be prepared by parallel flow precipitation method and it will be used for colorimetric determination of nitrite ion (NO_2^-) in drinking water.

Hamlet tragic flaw: - A study of the prince hamlet downfall through TO BE OR NOT TO BE....

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William Shakespeare's hamlet is a tragic play that explores the complexities of human nature, revolving around the titular character's tragic flaw – his indecisiveness "TO BE OR NOT TO BE, THAT IS THE QUESTION" encapsulates hamlet's existential crisis and indecision as he grapples with the moral implications of avenging his father's death. This soliloquy showcases hamlet's introspective nature, which ultimately contributes to his downfall. This abstract will examine how hamlet's indecisiveness and delayed actions, driven by his moral and religious convictions, lead to devastating consequences. Specifically, hamlet's reluctance to kill Claudius during prayer, motivated by the belief that it would send his uncle to heaven, exemplifies his inner turmoil and delayed actions, ultimately sealing his fate. By exploring hamlet's tragic flaw, this study sheds light on the timeless relevance of Shakespeare's masterpiece, offering profound insights into the human conditions and the enduring power of literature to illuminate our understanding of mankind and the world around us.

Genetics Analysis of Male Infertility In Families From District Bannu

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Male infertility is a major global health issue, contributing to nearly half of all infertility cases. In Pakistan, it carries significant social stigma, yet remains underdiagnosed due to limited genetic screening, particularly in underserved regions. This study focuses on the genetic characterization of male infertility in the Domel area of Bannu, a district in Khyber Pakhtunkhwa, Pakistan, which has been largely excluded from previous research. The primary objective was to identify Y-chromosome microdeletions within the azoospermia factor (AZF) region, a known genetic cause of spermatogenic failure leading to conditions like azoospermia and severe oligospermia. Utilizing genetic analysis, we screened infertile male patients to detect these microdeletions and establish a clear phenotypic-genotypic correlation. Our findings confirm a significant association between AZF region microdeletions and the infertility phenotypes observed in the studied population. This research provides crucial insights into the genetic etiology of male infertility in this specific region, highlighting the necessity for routine genetic screening. The results contribute to improved diagnostic strategies and informed genetic counseling for affected individuals and couples in Pakistan.

Keywords: Male infertility, social stigma, microsatellite markers, oligospermia, genetic etiology.

Genetic Analysis Of Pathogenic Variants In Albino Family From District Kohat, Khyber Pakhtunkhwa

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Albinism is a rare inherited genetic condition characterized by hypopigmentation of the skin, hair, and eyes, accompanied by significant visual impairments due to the absence of retinal pigment. The disorder is primarily inherited in an autosomal recessive manner and exhibits considerable genetic heterogeneity, with genes such as TYR, OCA2, TYRP1, and SLC45A2 implicated in its pathogenesis. The prevalence of albinism is notably higher in populations with a high rate of

consanguineous marriages, including certain Pakistani communities. Despite global advances in genomic technologies, the complete genetic spectrum of albinism remains underexplored in Pakistan. The present study aims to identify the pathogenic variants underlying albinism in an affected family from District Kohat, Khyber Pakhtunkhwa, and to evaluate the genotype-phenotype correlations of these variants. Following ethical approval and informed consent, detailed family histories will be obtained, and pedigrees of three to four generations will be constructed to establish inheritance patterns. Blood samples will be collected from both affected and unaffected family members, and genomic DNA will be extracted using the phenol-chloroform method. Whole-exome sequencing (WES) will be employed to identify candidate variants, followed by targeted Sanger sequencing to confirm segregation within the family. Bioinformatics tools, including PolyPhen-2, SIFT, Mutation Taster, and structural modeling software such as Chimera and Alpha-Fold, will be used to assess the pathogenicity and structural consequences of identified variants. Preliminary expectations suggest that novel or rare variants in OCA associated genes may contribute to the observed phenotype. This study will contribute to understanding the molecular basis of albinism in the Pakistani population and provide valuable insights for genetic counseling, early diagnosis, and potential therapeutic strategies. Final results, including identified variants and their functional impacts, will be reported upon completion of the genetic analyses.

Keywords: hypopigmentation, visual impairments, consanguineous marriages, hypopigmentation

Genetic Study of Polydactyly Family through Linkage Analysis from District Hangu, Khyber Pakhtunkhwa

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Polydactyly, also known as hyperdactyly or hexadactyly, is the most common congenital limb anomaly, marked by the presence of additional fingers or toes. It may appear as a component of a syndrome (syndromic polydactyly) or as an independent condition (non-syndromic polydactyly). Non-syndromic polydactyly is typically categorized into 3 types: preaxial (radial), central (axial), and postaxial (ulnar). It is commonly inherited in an autosomal dominant manner with varying trait expression, arising from abnormality in the anterior-posterior patterning of limb development. Estimated prevalence rate of Polydactyly in Pakistan is 0.045-0.227% while globally it affects 0.037-0.12% of general population. To date, at least 10 loci and 6 genes linked to non-syndromic polydactyly have been identified in humans, comprising ZNF141, GLI3, MIPOL1, IQCE, PITX1, and GLI1. In this study, we investigated a family from District Hangu of Khyber Pakhtunkhwa, Pakistan, with two individuals exhibiting symptoms of Polydactyly. Thorough clinical assessments and pedigree studies were carried out to validate the diagnosis and identify the inheritance pattern in the families. Genomic DNA was obtained from blood samples collected from affected individuals, unaffected siblings, and their parents. To identify the underlying genetic causes, different microsatellite markers were utilized to amplify the known genetic variants. To screen for potential gene loci and exclude previously known variants, a panel of diverse microsatellite markers was employed. No evidence of linkage was observed, suggesting

that the causal variant may reside within this locus or in a closely linked genomic region that is not captured by the current markers. To comprehensively investigate and identify the underlying variant, whole exome sequencing (WES) will be conducted, enabling high-resolution analysis of all coding regions.

KeyWords: Polydactyly, WES, Insilico tools, Sanger Sequencing

Genetic Diversity of Echinococcus Granulosus from Animal Isolates Based On Nadh Dehydrogenase Subunit 5 Gene

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Echinococcus granulosus (*E. granulosus*), the causative agent of cystic echinococcosis (CE), is a major zoonotic parasite of global health and economic concern. Listed among the 20 neglected tropical diseases, CE affects both humans and livestock. Molecular characterization of *E. granulosus* is essential for understanding its genetic diversity and improving control strategies. The mitochondrial NADH dehydrogenase subunit 5 (NAD5) gene, with six diagnostic nucleotide sites, has recently been proposed as a reliable marker offering higher resolution than *cox1* and *nad1* for genotype identification. This study investigated the genetic diversity and phylogenetic relationships of *E. granulosus* isolates from livestock based on the NAD5 gene. A total of 162 hydatid cysts were collected from cattle, buffaloes, sheep, and goats in district Kohat, Pakistan. DNA was extracted, and a 759 bp NAD5 fragment was amplified by PCR, sequenced (Sanger method), and analyzed phylogenetically using the maximum-likelihood method in MEGA11. Phylogenetic analysis revealed a close genetic relationship between Pakistani isolates and those from China, Turkey, the USA, Italy, and India, suggesting a shared genetic background influenced by livestock movement and trade. The low genetic divergence indicates limited geographic isolation among South Asian and neighboring populations. These findings contribute to a better understanding of *E. granulosus* diversity and the epidemiology of cystic echinococcosis for improved regional control measures.

Keywords: *E. granulosus*, genetic diversity, PCR, NAD5 gene.

Genetic Characterization Of Cystic Echinococcus Species In Animal Isolates By Using Mitochondrial Cytochrome B Gene

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Cystic echinococcosis (CE), caused by the metacestode stage of *Echinococcus* species, is a significant zoonotic parasitic disease listed among the World Health Organization's neglected tropical diseases. It poses serious public health and economic challenges worldwide, particularly in livestock-rearing regions such as Africa, Asia, the Middle East, and the Mediterranean, where prevalence ranges from 5–10% and annual losses exceed USD 760 million. The present study aimed to investigate the genetic characterization and phylogenetic relationships of *Echinococcus granulosus* isolates from slaughtered animals in District Kohat, Khyber Pakhtunkhwa, using the

mitochondrial cytochrome b (Cytb) gene as a molecular marker. A total of 154 hydatid cysts were collected from cattle, buffalo, sheep, and goats over six months, and data regarding cyst location, host type, age, and sex were recorded. DNA was extracted, and the Cytb gene (1528 bp) was amplified through PCR, visualized using gel electrophoresis, and sequenced via the Sanger method. Phylogenetic analysis performed in MEGA11 demonstrated that *E. granulosus* isolates from Kohat exhibited close genetic similarity to strains previously reported from Turkey and Iran, indicating regional genetic connectivity likely associated with livestock movement and shared grazing practices. These results confirm the circulation of *E. granulosus* in Khyber Pakhtunkhwa and highlight the reliability of the Cytb gene as a potent marker for molecular and phylogenetic studies. The findings contribute to understanding CE's genetic diversity, epidemiology, and zoonotic risk, emphasizing the need for integrated control strategies in endemic areas.

Keywords: Cystic Echinococcus, Cytochrome b gene, Mitochondrial DNA.

Analysis Of Echinococcus Granulosus Strains In Animals By Using Nadh Dehydrogenase Subunit 1 Marker In District Kohat

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Cystic echinococcosis (CE) is a zoonotic disease caused by the larval stage of *Echinococcus granulosus*, leading to economic losses in livestock through morbidity, mortality, and organ condemnation. In Pakistan, where livestock is largely managed by low-income rural communities, CE threatens animal productivity and livelihoods. Despite its endemicity in neighboring countries like China, Iran, and India, molecular data from Pakistan are still limited. This study investigated the genetic diversity of *E. granulosus* strains in livestock from District Kohat, Khyber Pakhtunkhwa, using the mitochondrial NADH dehydrogenase subunit 1 (NAD1) gene and assessed their phylogenetic relationship with isolates from neighboring regions. A total of 165 slaughtered animals were examined for hydatid cysts. DNA from viable cysts was extracted and amplified by PCR targeting the NAD1 gene, and the resulting sequences were analyzed for genetic variation and phylogenetic relationships with global isolates. The amplified sequences were analyzed to determine genetic variation and phylogenetic relationships with global isolates. Molecular analysis showed that *Echinococcus granulosus* strains from Kohat were closely related to isolates from Algeria, Turkey, Iran, and India, indicating the predominance of *E. granulosus sensu stricto*. The genetic similarity suggests that transboundary livestock movement may aid strain dissemination. These results highlight the global lineage pattern of Kohat isolates and stress the need for molecular surveillance and control measures to reduce CE in animals and humans.

Keywords: Cystic echinococcosis, NADH dehydrogenase subunit 1, Hydatid Cyst, PCR

Molecular Characterization Of Echinococcus Granulosus Through Internal Transcribed Spacer (Its1) Gene In Small Ruminants Of District Kohat

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Cystic echinococcosis (CE), caused by the larval stage of *Echinococcus granulosus*, is a significant zoonotic parasitic disease of global concern that affects both human and animal health. The present study was conducted to investigate the molecular characterization of *E. granulosus* isolates obtained from small ruminants (sheep and goats) in District Kohat, Pakistan, using the Internal Transcribed Spacer 1 (ITS1) gene as a genetic marker. Hydatid cyst samples were collected from infected organs, mainly the liver and lungs, at various slaughterhouses in Kohat. Genomic DNA was extracted from the protoscoleces and germinal layers of fertile cysts using the GJC DNA Purification Kit. The extracted DNA was subjected to PCR amplification targeting the ITS1 gene region, and the amplified products were analyzed through sequencing. Sequence data were used to assess genetic variation and to construct phylogenetic relationships among the isolates. The results revealed that *E. granulosus* isolates from small ruminants in the study area exhibited high genetic similarity with isolates previously reported from neighboring countries such as Iran, India, Greece, and Poland. Phylogenetic analysis demonstrated a close relationship between local isolates and those from nearby regions, suggesting possible transboundary transmission of the parasite. This study provides valuable molecular insights into the genetic diversity of *E. granulosus* circulating in small ruminants of District Kohat, Pakistan, and underscores the need for effective control strategies to reduce the zoonotic risk and economic losses associated with hydatid disease.

Keywords: *Echinococcus granulosus*, cystic echinococcosis, ITS1 gene, small ruminants

Molecular Identification and Phylogenetic Analysis of Fish Fauna of River Indus at Khushal Garh, Khyber Pakhtunkhwa

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The River Indus supports a diverse assemblage of freshwater fish that play a vital role in ecological and economics of Pakistan; however, species-level identification often remains challenging due to morphological similarities. This study aimed to conduct the molecular identification of fish fauna collected from the Khushal Garh region of Khyber Pakhtunkhwa and to establish their phylogenetic relationships. Fish samples were collected from the River Indus at Khushal Garh using standard fishing nets and traps. Morphological features were initially recorded for preliminary identification. Muscle tissues were preserved in 95% ethanol for molecular analysis. Genomic DNA was extracted using a standard extraction protocol, and the mitochondrial COI gene was amplified as a barcode marker. Polymerase Chain Reaction (PCR) was carried out using universal primers of fish, followed by purification and sequencing of PCR products. The obtained sequences data were compared with reference sequences available in global nucleotide databases to confirm species identity. For Phylogenetic analysis, sequences were aligned using appropriate bioinformatics software (mega 11), and a Phylogenetic tree was generated using the maximum-likelihood method to determine genetic relationships among the species. A total of 55 samples were collected and molecular analysis successfully identified five species: having abundance *Labeo dyocheilus* (20%), *Labeo boggut* (30%), *Cyprinus carpio* (25%), *Cirrhinus mrigala* (14%), and *Garra gotyla* (9%). Phylogenetic reconstruction further validated the genetic

distinctness of each species and revealed clear clustering patterns consistent with their known taxonomic groups. These findings highlight the effectiveness of molecular tools in resolving fish taxonomy and provide a reference framework for future biodiversity monitoring in the River Indus ecosystem.

Keywords: COX1 Gene, Fish diversity, Molecular Identification, Phylogenetic Analysis.



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