

ICFAS-26 Gilgit



21st International Conference on Food & Applied Sciences ICFAS-26 Gilgit

06-07 July, 2026
Gilgit Pakistan



Organized by

Karakoram International University KIU Gilgit and Evolution EduTech Pakistan
ISBN: 978-627-94626-8-8



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ISBN: 978-627-94626-8-8

BOOK OF ABSTRACTS

21st International Conference on Food & Applied Sciences (ICFAS-26) Gilgit

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Published & Printed By Evolution EduTech Pakistan

Conference Fields

- Food Technology & Nutritional Sciences
- Chemical & Biological Sciences
- Biotechnology & Bioinformatics
- Microbiology & Physics
- Pharmacy, Psychology & Allied Health Sciences
- Computer & Numerical Sciences
- Social sciences

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Schedule of ICFAS-26 Gilgit
(06-07 July 2026)

Inaugural Session

Venue: Musharraf Hal1, Karakoram International University

Day 1, 06 July 2026

<i>Time</i>	<i>Event/Activity</i>
08:00 AM	Registration
08:30 AM	Display of Posters, Food Products and Science Models
09:00 AM	Seating of the Delegates and Guests
09:15 AM	Arrival of Chief Guest
09:20 AM	Recitation of Holy Quraan
09:25 AM	Naat-e-Rasool-e-Maqbool
09:30 AM	National Anthem
09:35 AM	Welcome Address By Prof. Dr. Abdul Razaq , Vice Chancellor, Karakoram International University, Gilgit
09:45 AM	Remarks from Mr. Usman Ahmad , Secretary Agriculture Livestock and Fisheries Gilgit Baltistan
09:55 AM	Remarks from Dr. Qamar Abbas , Provost/ Chairman Department of Plant Sciences, Karakoram International University, Gilgit
10:05 AM	Vote of Thanks By Dr. Sajjad Ali , Registrar/ Director Academics, Karakoram International University, Gilgit
10:15 AM	Vote of Thanks By Mr. Khurram Iqbal , Managing Director Evolution EduTech, Pakistan
10:25 AM	Shields Distribution
10:40 AM	Judgment of Posters Presentations
11:00 AM	Session on Integrating Nutrition Security and Sustainable Food Systems for Pakistan

	Session Organizer: Dr. Sartaj Ali, Associate Professor, Department of Agriculture and Food Technology Karakoram International University, Gilgit (0346-9238628) Co- Organizer: <i>Dr. Abid Hussain, Assistant Professor, Department of Agriculture and Food Technology, Karakoram International University, Gilgit</i> Moderator: Miss Arooba Batool
11:00 AM	Welcome & Session Introduction
11:10 AM	<i>Presentation Title: The Food Nexus; Where Food Safety, Sustainability & Security Converge By Dr. Shahzad Zafar Iqbal, Associate Professor, Applied Chemistry, GCU Faisalabad</i>
11:30 AM	<i>Presentation Title: Climate Resilience and Pakistan's Nutritional Security By Prof. Dr. Sadaf Javaria, IFSN, Gomal University, Dera Ismail Khan</i>
11:50 AM	<i>Presentation Title: Camel milk: A Nutritious Super Food for the Food Security By Prof. Dr Taherah Mohammadabadi (Foreign Speaker) Faculty of Animal Science and Food Technology Agricultural Sciences and Natural Resources University, Iran</i>
12:10 PM	Presentation Title: From Fragility to Resilience: AKRSP's Approach to High Mountain Food Systems, By Mr. Qayyum Ali Shah, AKRSP
12:30 PM	Presentation Title: Integrating Nutritional Security with Sustainable Food System in Pakistan By Dr. Sartaj Ali, Associate Professor, Department of Agriculture and Food Technology Karakoram International University, Gilgit
12:50 PM	Interactive Discussion & Audience Q&A
01:20 PM	Session Summary, Key Recommendations & Closing Remarks
01:30 PM	Shields Distribution
01:45 PM	Lunch and Prayers Break

2 Parallel Technical Sessions

From 03:00 PM to 05:30 PM (06-07-2026)

Note: Send your PPT Presentations on WhatsApp to your Session Organizer till 04th July 2026 (Session Organizers Numbers are Mentioned in Schedule)

Technical Session of Biological & Chemical Sciences Day 1, (06-07-2026) (Venue: Hall Number 1)			
Session Organizer: <i>Dr. Sameena Mumtaz</i> , Chairperson, Department of Animal Sciences Karakoram International University, Gilgit (0346-9238628) Co- Organizer: <i>Dr. Ali Noor</i> , Department of Plant Sciences KIU, Gilgit Moderator: <i>Dr. Akbar Khan</i> (0346-5344476)			
Chair: <i>Prof. Dr. Tahira Iqbal</i> , Dean, Faculty of Sciences, The University of Faisalabad Chair: <i>Dr. Shahzad Zafar Iqbal</i> , Associate Professor, GCU Faisalabad			
No	Time	Details	Topic
1	03:00 PM	<i>Prof. Dr. Muhammet Uzun</i> (Foreign Speaker) <i>Center for Nanotechnology & Biomaterials</i> <i>Applications and Research, Marmara</i> <i>University</i>	<i>Advancing Environmental Resilience through Sustainable Hemp Innovations</i>
2	03:10 PM	<i>Dr. Monier M. Abd El-Ghani</i> (Keynote Speaker) <i>Department of Botany and Microbiology,</i> <i>Faculty of Science, Cairo University, Giza</i> <i>12613, Egypt</i>	<i>Medicinal Plants of Egypt</i>
3	03:20 PM	<i>Dr. Muhammad Abdul Basit</i> (Keynote Speaker) <i>Department of Materials Science &</i> <i>Chemical Engineering, Hanyang University,</i> <i>Ansan, South Korea</i>	<i>Diversified Scientific Applications of Wet-chemically Developed ZnO/Ag₂S: Photoenergy Harvesting to Nano-fertilization</i>
4	03:30 PM	<i>Dr. Samina Qamer</i> <i>Department of Zoology, Rawalpindi</i> <i>Women University, Pakistan</i>	<i>Study of the antibacterial properties of Propolis made by European honey bee</i>
5	03:40 PM	<i>Dr. Ahsan Sattar Sheikh</i> <i>Associate Professor</i> <i>Institute of Molecular Biology and</i> <i>Biotechnology</i> <i>University of Lahore, Lahore</i>	<i>Transcriptional Gene Regulation with Special Reference to Topologically Associating Domains (TADs) in Food Science and Medicine</i>
6	03:50 PM	<i>Dr. Nureen Zahra</i> <i>Assistant Professor, IMBB</i> <i>The University of Lahore</i>	<i>Efficacy of copper-loaded carbon nanoparticles against Listeria monocytogenes isolated from canned food</i>
7	04:00 PM	<i>Dr. Syeda Yumna Farrukh</i> <i>Lecturer, IMBB</i> <i>University of Lahore</i>	<i>Characterization of bacteriocin producing bacteria isolated from jaggery</i>
8	04:10 PM	<i>Ms. Rabia Batool</i> <i>Principal</i>	<i>Phoenix dactylifera- Its phytochemical properties and therapeutic effects</i>

		<i>Govt Graduate College for Women Wan Bhachran, Mianwali</i>	
9	04:20 PM	<i>Ms. Yasmeen Bibi Assistant Professor Biology Govt Graduate College for Women Mianwali</i>	<i>Synthesis Characterization and Biological applications of phytogenic gold nanoparticles from Boerhavia diffusa</i>
10	04:30 PM	<i>Ms. Sehrosh Department of Chemistry Kohat University of Science & Technology</i>	<i>Synthesis characterization antimicrobial antioxidant activities of Schiff bases and their complexes</i>
11	04:40 PM	<i>Mr. Syed Ahmed Raza Lecturer Computer Science SZABIST University Hyderabad Campus</i>	<i>AI-IoT Wearable System: Smart Glasses and Earphones for Obstacle Detection and Navigation Assistance for Visually Impaired Individuals.</i>
12	04:50 PM	<i>Dr. Ahmad Ali Associate Professor of Zoology Dept. of Zoology The Islamia University of Bahawalpur Pakistan</i>	<i>Effect of Various Flooring Treatments on Physiology, Hematology and Blood Biochemistry of Desi Goat (Capra aegagrus hircus) Under Feedlot Production System</i>
13	05:00 PM	<i>Dr. Arshad Ali Shedayi Department of Plant Sciences, KIU Gilgit, Pakistan</i>	<i>The Spatiotemporal Assessment and Valuation of Regulating Ecosystem Services in Pakistan's Terrestrial Ecosystem: Linkages with Sustainable Development Goals</i>
14	05:10 PM	<i>Ms. Shamsun Nisa Department of Plant Sciences, KIU Gilgit, Pakistan</i>	<i>Effect of temperature regimes, water levels, and soil nutrients (NPK) on seed germination and growth of four wheat (Triticum aestivum) varieties of Gilgit-Baltistan</i>
15	05:20 PM	<i>Ms. Umme Habiba Department of Plant Sciences, KIU Gilgit, Pakistan</i>	<i>Assessing The Correlation Between Climatic Factors and Peach Leaf Curl Disease and Peach Ecosystem Services in Hunza</i>
16	05:30 PM	<i>Ms. Misbah Department of Plant Sciences, KIU Gilgit, Pakistan</i>	<i>Ecosystem services of some selected fruit plants in Gilgit and the impact of climate change on their productivity</i>
17	05:40 PM	<i>Ms. Sahar Ud Din Department of Plant Sciences KIU, Gilgit</i>	<i>Diversity of Edible Wetland Plants and Their Role in Food Security and Nutrition Values in Upper Ghizer Valleys</i>
		<i>Concluding Remarks and Shields Distribution</i>	

Technical Session of Food, Allied Health and Applied Sciences

Day 1, (06-07-2026)

(Venue: Hall Number 2)

Session Organizer: Dr. Sajjad Ali , Associate Professor, Registrar/ Director Academics, Karakoram International University, Gilgit Co Organizer: Dr. Syed Rizwan Abbas , Chairman Allied Health Sciences, KIU, Gilgit (0344-4244544) Moderator: Ms. Fatima Zehra			
<i>Chair: Prof. Dr. Asif Ahmad</i> , Director, Institute of Food & Nutritional Sciences, PMAS-AAUR <i>Co- Chair: Dr. Sadiq Hussain</i> , Associate Dean, Faculty of Arts and Humanities, Karakoram International University, Gilgit Co- Chair: Dr. Muhammad Mir Nasir Qayum , Associate Professor, Department of Agriculture and Food Technology KIU, Gilgit			
No	Time	Details	Topic
1	03:00 PM	Prof. Dr. Katarzyna Kotwica-Mojzych (Foreign Speaker) Department of Histology, Embryology and Cytophysiology, University of Lublin, Poland	EGFR-PI3K-Akt-mTOR signaling pathway in glioblastoma multiforme and its significance in the therapy
2	03:10 PM	Dr. Volkan Okatan (Keynote Speaker) Eskisehir Osmangazi Üniversitesi, Türkiye	Small Fruits, Big Solutions: Biostimulant-Driven Approaches to Climate-Resilient Horticulture
3	03:20 PM	Ms. Attiya Batool Department of Pharmacy, Lincoln College University Malaysia	Phytotherapeutic Profiling of <i>Azadirachta indica</i> : Kinetic Assessment of α -Glucosidase Suppression and Antioxidant Mobilization
4	03:30 PM	Dr. Yasmin Khan Associate Professor Department of Pharmacology, Faculty of Pharmacy, Nazeer Hussain University Karachi	Comparative Anxiolytic Effect of Escitalopram and Lorazepam in Restraint Stress-Induced Anxiety in Mice
5	03:40 PM	Dr. Ajaz Shaheen Assistant Professor Faculty of Education, Lasbela University Balochistan	Climate Change, Geological Hazards, and Psychological Preparedness Among University Students in Gilgit-Baltistan: A Framework for Building Community Resilience Through Higher Education
6	03:50 PM	Prof. Dr. Mudassar Azhar Department of Basic Medical Sciences Salim Habib University Karachi	The methanol extract of <i>Daphne mucronata</i> (Laghenai) protects against doxorubicin-induced heart failure in Wistar rats via antioxidant action.
7	04:00 PM	Prof. Dr. Shahnaz Usman Chairperson Department of Pharmaceutics, Faculty of Pharmacy Salim Habib University Karachi	In-vitro assessment of newly developed fast-dispersing tablets versus oral suspension -- a step towards enhancing paediatric compliance and dose accuracy

8	04:10 PM	<i>Dr. Hamda Khan Researcher/ Research Assistant Institute of Pharmacology and Herbal Sciences Hamdard University Karachi</i>	<i>In Vitro Evaluation of Antioxidant Activity of Pods of Cassia acutifolia Delile by DPPH Radical Scavenging Assay</i>
9	04:20 PM	<i>Dr. Asma Bibi Lecturer Department of IT Kohsar University Murree</i>	<i>The Role of Artificial Intelligence in the Food Industry: Applications, Challenges and Future Opportunities</i>
10	04:30 PM	<i>Dr. Ali Asgher Shuja Assistant Professor Department of Basic Medical Sciences Salim Habib University</i>	<i>Evaluation of the Antiproliferative Properties of Cardioactive Steroids Using In Vitro Cell Line Models</i>
11	04:40 PM	<i>Dr. Ayesha Siddiqa Lecturer (Food Science) Institute of Food Science and Technology, KFUEIT, RYK</i>	<i>Screening, Characterization and Quantification of Polyphenolic Compounds from Medicinal Plants for Functional Food Industries</i>
12	04:50 PM	<i>Dr. Farhana Tasleem Assistant Professor Department of Basic Medical Sciences, Salim Habib University Karachi</i>	<i>Bergenin and MvfR Regulation: Structural Insights and Antibacterial Analysis</i>
13	05:00 PM	<i>Dr. Zahid Hussain Head Department of Mathematics, KIU, Gilgit</i>	<i>Hellinger Distance based Multicriteria Decision Making on q-Rung Orthopair Fuzzy Sets with Application to Weather Forecasting</i>
14	05:10 PM	<i>Mr. Muhammad Waseem Food Microbiology Laboratory, Department of Food Science and Nutrition, Faculty of Food Engineering, State University of Campinas, Campinas, Sao Paulo, Brazil</i>	<i>Characterization and application of chitosan, lignin, and fruit peel extracts based edible coatings for the preservation of apple fruits</i>
15	05:20 PM	<i>Ms. Ilya Haider Visiting Faculty at KIU in School of Computing</i>	<i>Deep learning approaches for brain tumor segmentation using multiple-modality</i>
16	05:30 PM	<i>Ms. Somi Department of plant Sciences KIU Gilgit</i>	<i>Impact of climate change on food security in Hunza using GIS</i>
17	05:40 PM	<i>Mr. Wajid Hussain Department of Agriculture and Food Technology, KIU Gilgit</i>	<i>Valorization of Agro-industrial Waste Supplemented Diet and it's Impact on Broilers Lipids Metabolism and Oxidative Stability</i>
18	05:50 PM	<i>Mohib ullah Department of Islamic studies, Kohat University of science and technology, kohat</i>	<i>Analytical Study of Cyber Crime Prevention in the Context of Islamic Shariah and Pakistan's Prevention of Electronic Crimes Act, 2016(with Amendments up to 2025)</i>
19	06:00 PM	<i>Farikha Mehmood, Qazi Abdul Manan Department of Islamic Studies,, Kohat University of Science and Technology, Kohat</i>	<i>An Analytical Study Of The Quranic Method Of Invitation (Dawah) In Response To Atheistic Ideologies In The Contemporary Era</i>
20	06:10 PM	<i>Mr. Bilal Hussain</i>	<i>Personal Privacy in the Light of Islamic Teachings: A Research Study of Its Limits,</i>

		<i>PhD Scholar, Department of Islamic Studies, Kohat University of Science and Technology (KUST), Kohat, Pakistan</i>	<i>Regulations, and Practical Applications in Contemporary Social and Administrative Affair</i>
21	06:20 PM	<i>Mr. Asmat Ali Khan PhD Scholar, Department of Islamic Studies, Kohat University of Science and Technology (KUST), Kohat, Pakistan</i>	<i>A Comparative Study of Armageddon in the Abrahamic Religions and Al-Malḥamah al-'Uẓmā, with Special Reference to Their Political and Social Implications</i>
22	06:30 PM	<i>Closing Ceremony, Concluding Remarks and Shields Distribution</i>	

2nd Day

(07-07-2026)

Field Excursion Trip to Hunza Valley and Atta Abad Lake

(Only for Guests and Outsiders)

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(ICFAS-26)
Gilgit

Synthesis and Characterization Of Sulfonic Acid-Based Schiff Base Modified Dgeba Epoxy Coatings For Corrosion Protection Of Mild Steel

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Corrosion of mild steel is a serious industrial issue that reduces material durability and increases maintenance costs. Epoxy coatings are commonly used for corrosion protection due to their strong adhesion and chemical resistance. However, conventional epoxy coatings have limitations in aggressive environments. This study focuses on the synthesis of sulfonic acid-based Schiff base modified DGEBA epoxy coatings to improve corrosion resistance of mild steel. The incorporation of Schiff base is expected to enhance coating performance through improved barrier properties, adhesion, and chemical stability. The synthesized coatings will be characterized using Fourier Transform infrared spectroscopy (FTIR) analysis confirmed successful polymer formation and curing of the developed coating, Thermogravimetric Analysis (TGA) result showed enhanced thermal stability and Scanning Electron Microscopy (SEM) analysis revealed a smooth, compact and defect-free surface morphology. These findings indicate improved coatings integrity and performance. Corrosion resistance was further evaluated using weight loss measurements and electrochemical techniques in 3.5 wt% NaCl solution. The developed coating demonstrated promising anticorrosive performance for long-term protection of mild steel in corrosive environments, offering potential industrial applications.

Keywords: Schiff Base, Epoxy Coating, Mild Steel, Corrosion Protection

Camel milk: A superfood for the food security

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The camel is physiologically well adapted to live in hot and dry conditions thus, it is an important food security resource for arid and semi-arid environments. Camel produces milk in very high temperatures and climatic challenges; in the same environment other livestock species are hard to survive. Camel milk is a special source of nutrients and is considered as a superfood with therapeutic values. Camel milk is rich in vitamins C, B3, Mn, iron, Cu and Zn rather than cow milk. It is a suitable substitute for human milk and great alternative for kids with allergy to cow milk. Also, camel milk has high amount of mono-and polyunsaturated fatty acids and its lactose is more digestible than cow milk for lactose intolerance cases. Smaller size of immunoglobulins or nobodies of camel milk enhances the immune system and anti-inflammatory responses. Camel milk has hypoglycemic effects which may be beneficial in the healing of diabetes of Type 1 and 2

and gestational diabetes. Camel milk contains insulin like proteins, which does not form coagulum in the acidic media of stomach that can be an effective alternative for insulin. It controls the blood glucose by some mechanisms including effect on insulin receptors activity, increasing of the signaling in the insulin-sensitive tissues and effect on the pancreatic beta-cells function. Furthermore, lactic acid bacteria of camel milk as strong probiotic are important for the gut health and function. Therefore, camel milk is not only food, but also it is as amazing superfood for many health complications.

Keywords: Camel milk, superfood, food security

Deep learning approaches for brain tumor segmentation using multiple-modality

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In medical disease diagnosis is critical, manual delineation is time-consuming and may give wrong results due to human error. With the rapid progress of Artificial Intelligence, Deep Learning (DL) and Computer Vision has become highly important research area, traditional techniques in Computer Vision are not giving better results in dealing with complex visual patterns. Image classification, object detection, and pattern recognition tasks are enhanced using transformer-based architectures and Convolutional Neural Networks (CNNs) but there is still need of exploring lightweight deep learning models that can efficiently detect anomaly in medical images, particularly in environments with limited computing resources. Deep learning (DL) methods have played significant role in detecting anomalies like tumors, fractures, and infections using modalities like X-rays, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and Computed Tomography (CT) scans. However the modalities expose challenges like blurred boundaries between tumor and normal tissues and difference in shape and size of tumor. To address all these challenges many state-of-the-art models in DL have been explored but they are difficult to deploy due to being computationally heavy especially in areas with limited resources and scarcity of medical image, complex pattern of medical data are also few other challenges of automatic anomaly detection. This study focus on exploring and optimizing DL techniques to improve accuracy and efficiency in medical image analysis system using different modalities. It reviews different models that use CNN as a backbone, transformer based models and hybrid models that use CNN and transformer in architecture. Open research challenges are identified, directions are suggested for automatic brain tumor segmentation. This study ensures to use technology as a tool to solve automatic anomaly detection.

Business Studies along with Pharmacy Profession; Perspicacity of Combined Degree in the Career Progression of the Pharmacists in Pakistan

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In the current era of trading and business development, every profession has multitasking approaches that make it more powerful and allow to explore growth in opportunities. Likewise, the Pharmacist as a professional deal with challenges, specifically when all, there is interaction with business development and market approaches, the high business dexterity would be accountable for the topnotch trading. In this context, in Pakistan, the combination of business studies (MBA) with Pharmacy degree has established as a carrier booster and toolkit for professional excellence. The study is crafted to figure out the significance and the factors involved in the mentioned combination of two highly skilled professions. In the study, the professional having such skills were selected from different domains like Pharmaceutical industry, hospitals and others, however jeopardy was found in industry with high packages and perks. The outcomes were quite enough to support this combination and significant results were found to support categorically for the future growth and implication of Pharmacy with MBA in Pakistan.

Keywords: Pharmacy, MBA, Business study, Pakistan, Pharm. D.

Programming Language for Beginner to High School Student

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In general, to learn any language like Sindhi, Urdu, and English there should be a method for beginner, first teach them alphabet then class 1, class two so on. We should apply same analogy on computer language for new programmer, but in Pakistan there is no such pre-define procedure through which we teach particular language for specific class, ever here this no recommend book from Sindh Text Board for Intermediate class. This paper highlight different issue, which is faced by student when learning a programming language and make interesting to it. What type of construct programming language should have, how much it interactive with learner, programming language syntax much easier to write any program. Programming language editor must creative means it based on GUI in which beginner write code easy, and it also has built library or component like drag-drop that hide complexity of data binding must be user-friendly code editor. This paper suggests two programming language for beginner according to level of student. First, programming language scratch which teach at primary level that is specially designed for kid, children and as well as for all ages. Scratch programming language support to write a program for fun, games, animation and other meaningful program, so it more interesting for children or Novice to learn a programming language. Second, Programming language is Python, which is suitable at intermediate level student that may play like bridge rule between initial stage programmer like children and to support to switch into high-level language, which is used for industry level software development. Python is one of the best language for beginner to learn high-level language which support student to design commercial level software.

Keyword: Beginner, High-level Languages, meaningful, social

Therapeutic Effect Of Copper Oxide Nanoparticles Loaded In Aloe Vera Gel For Topical Treatment In Psoriasis-Induced Mice

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Psoriasis is a systemic inflammatory autoimmune disease characterized by excessive keratinocyte proliferation and immune dysregulation. This study evaluated the therapeutic potential of copper oxide nanoparticles (CuO NPs) synthesized from aloe vera leaves and formulated in aloe vera gel as treatment against imiquimod (IMQ) induced psoriasis in mice. CuO NPs were synthesized by using green synthesis method and characterized using UV-Vis spectroscopy that showed peak at ~220nm and Fourier transform infrared (FTIR) analysis band at 624 cm⁻¹. Psoriasis was induced in mice using 5% IMQ cream daily, that was followed by topical treatment with 0.05% of CuO NPs incorporated in aloe vera gel for 14 days. CuO NPs anti-psoriatic efficacy was assessed in imiquimod-induced psoriatic models, through Psoriasis Area and Severity Index (PASI) scoring by examining changes in erythema, scaling, skin epidermal thickness. CuO NPs reduced the cumulative PASI score from 6.4 ± 0.2 from day treatment to 2.4 ± 0.2 day 7 treatment (p<0.05). There was also significant difference (p<0.05) in spleen and thymus weight after treatment with CuO NPs. Histological findings revealed reduced epidermal thickness and decreased immune cell infiltration in treated groups. Furthermore, serum thyroid hormone analysis revealed altered T3 (78.80 ± 4.22 ng/ml) and T4 (47.56 ± 2.6 ng/ml) levels in psoriatic mice. Overall, the results indicated that CuO nanoparticle-loaded aloe vera gel significantly ameliorated IMQ-induced psoriatic manifestations by improving clinical, histological, immunological, and hormonal parameters representing a promising and effective topical therapeutic strategy for psoriasis manage.

NDVI-Based Assessment of Vegetation Restoration under the BillionTree Afforestation Project in the Hazara Division (2015–2024)

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The Billion Tree Afforestation Project was launched with the aim of rehabilitating forest ecosystems and enhancing the vegetation cover and environmental effects of deforestation and land degradation in KPK Province. The Hazara Division is ecologically important because of the variety of forest resources and urbanization and agricultural development pressures in this region. It is important to track the vegetation recovery process in such areas and assess the success of afforestation initiatives as well as the sustainability of the ecosystem. Satellite remote sensing is an effective way of measuring vegetation health, density, and temporal land cover changes, and the Normalized Difference Vegetation Index (NDVI) is one of these measures. The

present study aimed at assessing vegetation cover changes and success of the Billion Tree Afforestation Project in the Hazara Division from 2015-2024 based on NDVI analysis. The variations of dense vegetation, shallow vegetation and non-vegetated land during the study period were investigated using satellite derived NDVI data. The results showed that there was minimal but some improvement in the dense vegetation cover (13% in 2015 and 14% in 2020). Non-vegetated areas, however, continued to stay high and by 2024 were about 34%, which serve as an indicator of continued environmental stress and competing land-use pressures, including urbanization and intensification of farming. The pattern of change in shallow water vegetation cover was fairly small and not substantial, indicating a slow ecological recovery. The results show that although the afforestation project has led to vegetation cover improvements at the local level, the restoration process is still a slow and incomplete one and does not yet reach the ecological conditions present before the degradation. Challenges such as incomplete canopy closure, continued land-use change, and ecosystem instability continue to hinder large-scale vegetation recovery. The study highlights the need for regular monitoring of NDVI, sustainable land management and long-term afforestation efforts, to enhance ecosystem resilience, and for successful ecological restoration within the Hazara Division.

Keywords: land degradation, NDVI, land-use, remote sensing, Billion Tree Afforestation.

Heliotropium Europaeum Leaves Extract-Mediated Synthesis Of Nickel Oxide Nanoparticles For Oxalic Acid Biosensing And Antibacterial Activity Against Drug-Resistant Bacteria

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Heliotropium europaeum leaves extract-mediated nickel oxide nanoparticles (NiO NPs) have gained attention as beneficial materials due to their versatile properties and dual-functional capabilities. Porous NiO NPs were prepared by a green reduction method using a 1 mg nickel chloride solution and an aqueous plant leaf extract mixed in different ratios. The mixture was heated at 80 °C under rigorous stirring for 45 minutes until a distinct color change from brown to gray was observed, followed by oven-drying at 60 °C and calcination at 300 °C for 3 hours. The successful synthesis, crystalline structure, functional groups, and morphological features of the synthesized nanoparticles were comprehensively evaluated via UV–Vis spectrophotometry, Energy-Dispersive X-ray (EDX) spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD) analysis, scanning electron microscopy (SEM), and dynamic light scattering (DLS). The antibacterial efficacy of the fabricated NiO NPs was assessed via the agar well diffusion method against drug-resistant Gram-positive (MRSA) and Gram-negative (*E. coli*) bacterial strains to determine zones of inhibition, Minimum Inhibitory Concentration (MIC), and Minimum Bactericidal Concentration (MBC). Furthermore, the colorimetric biosensing potential of the nanoparticles for oxalic acid detection was investigated and optimized using 3,3',5,5'-

tetramethylbenzidine (TMB) and H₂O₂ via UV-Visible spectrophotometry. The notable efficacy of these plant-mediated NiO NPs as both antibacterial agents and colorimetric sensors suggested that these nanomaterials can be considered as noteworthy candidates for possible biomedical and diagnostic applications.

Keywords: *Heliotropium europaeum*, Nickel Oxide Nanoparticles, Oxalic acid, Biosensing

A hybrid model for Debris Flow Susceptibility Mapping in the Northwestern Himalayas

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Debris flows represent a significant geohazard in the Himalayan region, necessitating robust susceptibility assessment for effective risk management. This study employed an integrated multi-method framework to evaluate and map debris flow susceptibility, combining heuristic, machine learning (ML), morphometric, and process-based modeling approaches. The Weighted Overlay (WO) model provided a knowledge-driven baseline, while Random Forest (RF) and eXtreme Gradient Boosting (XGBoost) algorithms were implemented to capture complex non-linear relationships among an extended set of conditioning factors, including topographic, geological, hydrological, and land cover variables. Model performance was quantitatively assessed using ROC-AUC analysis, with XGBoost achieving the highest predictive accuracy (AUC = 0.834), followed by RF (AUC = 0.756) and WO (AUC = 0.710). Morphometric analysis revealed that debris flow-prone catchments are characterized by high Melton Ratios (>0.3) and significant relief-length correlations, confirming the role of steep, confined terrain. Flow-R simulations, using source areas derived from WO and collapse material maps, produced realistic runout paths validated against satellite and field imagery. The integrated approach effectively distinguished debris flow channels from fluvial and glacial meltwater features. The integration of statistical, morphometric, and process-based approaches provided a multi-layered understanding of debris flow controls in the region. While ML models delivered superior predictive accuracy, Flow-R contributed essential runout extent mapping, and morphometric analysis grounded the results in geomorphic theory. The study demonstrates that advanced ML models, particularly XGBoost, offer a statistically robust and spatially detailed approach to debris flow susceptibility mapping, outperforming traditional heuristic methods. The developed framework supports practical hazard zonation, land-use planning, and early warning system development in vulnerable Himalayan catchments, with future work recommended to incorporate dynamic triggering factors and test model transferability across diverse geological settings.

Keywords: debris flow susceptibility, machine learning, XGBoost, morphometric analysis, Flow-R, Himalayan hazards, process validation.

Green Synthesis And Invitro Antimicrobial Efficacy Of Carbon Dots Derived From Vitex *Agnus-Castus* Leaves

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The alarming rise in antimicrobial resistance (AMR) among pathogenic bacteria represents a severe global public health threat, driving an urgent need for innovative, effective antimicrobial agents. Carbon dots (CDs) have emerged as highly promising fluorescent nanomaterials for biomedical applications due to their exceptional optical properties, high biocompatibility, and low toxicity. This study presents the green synthesis of CDs utilizing the phytochemical-rich aqueous leaf extract of *Vitex agnus-castus*, a medicinal plant traditionally valued for its diverse therapeutic properties. The CDs were synthesized via a one-step hydrothermal method at 180°C for 12 hours, followed by filtration and freeze-drying. Confirmation and structural profiling of the synthesized CDs were achieved using Ultraviolet-visible (UV-Vis) spectrophotometry, Transmission Electron Microscopy (TEM), Fourier Transform Infrared Spectroscopy (FTIR), and X-ray Diffraction (XRD). Furthermore, the in vitro antimicrobial efficacy of these green CDs were evaluated against Gram-positive and Gram-negative bacterial strains, as well as fungal strains, using the agar well diffusion method to measure zones of inhibition. The synthesized green carbon dots displayed the highest antibacterial efficacy against the Gram-positive bacterium *Bacillus subtilis* (14.3 ± 0.6 mm). Moderate but significant zones of inhibition were recorded against *Pseudomonas aeruginosa* and the fungal pathogen *Aspergillus niger*. The notable efficacy suggested that these nanomaterials can be considered as noteworthy materials for possible biomedical applications.

Keywords: Carbon Dots, Green Synthesis, *Vitex agnus-castus*, Hydrothermal Method, Antimicrobial Efficacy

Triphenylamine-Linked-Phenanthrene-Polyimide-Titania Nanocomposite As Potential Uv-Blockers

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In this study, we report the synthesis and characterization of a new triphenylamine-linked-phenanthrene-polyimide-titania nanocomposite for efficient ultraviolet (UV) blocking applications. The nanocomposite prepared in this work has the unique photophysical properties of triphenylamine and phenanthrene moieties, the thermal stability of polyimide, and the UV absorption ability of titania nanoparticles, leading to enhanced UV-B protection. TiO₂ nanoparticles were incorporated at 2%, 4%, and 6% by weight to optimize UV-blocking performance and material stability. The synthesized nanocomposites were characterized using UV-Vis absorption, FTIR, photoluminescence (PL), and thermal analyses to investigate their optical, structural, luminescent, and thermal properties. The results confirmed the successful incorporation of TiO₂ into the polyimide matrix and demonstrated enhanced UV-shielding performance, improved thermal stability, and efficient UV-blocking properties. Optical studies show strong UV-B absorption, suggesting the potential for effective protection against harmful

UV radiation. This nanocomposite holds promise for advanced UV-protective coatings and materials in packaging, textiles, and optoelectronics, among other fields.

Keywords: Triphenylamine-linked Polyimide, Phenanthrene; TiO₂ Nanocomposite, UV- Shielding; Photoluminescence, Thermal Stability.

In Vitro Evaluation of Antioxidant Activity of Pods of Cassia acutifolia Delile by DPPH Radical Scavenging Assay

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This research involved the investigation of the antioxidant potential of the liquid methanolic extract of Cassia acutifolia Delile pods by the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenger assay method. The liquid methanol extract was prepared using the maceration method and was tested for concentrations of 50, 100, 200, 300 and 400 µg/mL. There was an evident concentration-dependent rise in antioxidant activity (DPPH % inhibition 14.37%, 30.24%, 55.21%, 59.79%, and 67.42% at each respective concentration). The IC₅₀ value obtained was 190.443 µg/mL. This indicates a moderate amount of radical scavenging capacity compared to standard ascorbic acid. The observed antioxidant activity could potentially be attributed to the presence of phenolic, flavonoid, and anthraquinone constituents with the ability to donate hydrogen atoms or electrons to stabilize free radical species. The data provide evidence that the liquid methanol extract of the pods of mentioned plant has significant antioxidant activity and could serve as a useful natural source for the development of a plant-based antioxidant product.

Prunus Persica Seed Extract Mediated Synthesis Of Silver Doped Zinc Oxide Nanoparticles For Photocatalytic Degradation Of Methyl Orange

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The increasing contamination of water resources by synthetic dyes and industrial pollutants has created an urgent need for sustainable and efficient wastewater treatment technologies. In the present study, silver-doped zinc oxide (Ag-ZnO) nanoparticles were synthesized through a green and eco-friendly approach using Prunus persica (peach) seed extract as a natural reducing and stabilizing agent. The bioactive constituents of the seed extract, including phenolic compounds, flavonoids, proteins, and fatty acids, facilitate nanoparticle formation while eliminating the need for hazardous chemicals. Ag-ZnO nanoparticles with varying silver doping concentrations (1%, 3%, and 5%) were prepared and characterized using UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM) to investigate their optical properties, functional groups, crystalline structure, morphology, and particle size. The photocatalytic performance of the synthesized nanoparticles was evaluated

using methyl orange (MO) dye as a model organic pollutant under visible-light irradiation. The incorporation of silver into the ZnO lattice is expected to enhance charge separation, reduce electron–hole recombination, and improve visible-light absorption, thereby increasing photocatalytic efficiency. The effects of operational parameters, including catalyst dosage, dye concentration, pH, temperature, and irradiation time, will be optimized to achieve maximum degradation efficiency. The study aims to develop a cost-effective and environmentally friendly photocatalyst for wastewater remediation. The successful synthesis of Ag-ZnO nanoparticles using *Prunus persica* seed extract demonstrates a sustainable route for nanomaterial production with potential applications in environmental cleanup, water purification, and advanced photocatalytic systems.

Efficacy of copper-loaded carbon nanoparticles against *Listeria monocytogenes* isolated from canned food

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Background: *L. monocytogenes*, a major foodborne pathogen, poses significant health risks in canned foods and processed products. The emergence of multidrug-resistant strains and their persistence in food processing environments have necessitated the search for alternative antimicrobial agents. CNPs and CuNPs are known for their strong antibacterial properties due to their high surface area, reactivity, and ability to disrupt microbial membranes. When combined, these nanoparticles may offer enhanced antibacterial activity, leveraging the synergistic effects of both particles. **Objectives:** The study aimed to evaluate the antimicrobial efficacy of Cu-CNPs against *L. monocytogenes* which is a foodborne pathogen gram positive bacteria able to cause listeriosis. This study also examined the protein-ligand interaction of LLO, a critical virulence protein of *L. monocytogenes*, through in silico docking to elucidate the mechanism behind their antimicrobial action. **Materials and Methods:** *L. monocytogenes* isolates were obtained from canned food and domestic shop samples. CuNPs and CNPs were synthesized by chemical methods and their characterization was done using techniques such as FTIR, DLS, UV spectrometry and XRD to determine their morphology. The antagonistic activity of CuNPs, CNPs and Cu-CNPs were evaluated against *Listeria monocytogenes* using well diffusion method. **Results:** CNPs and Cu-CNPs demonstrated significant antibacterial activity and showed superior efficacy against *L. monocytogenes* showed antagonistic effect in all isolates, while CuNPs showed antagonistic effect in 8 out of 20 isolates and had less efficacy in inhibiting bacterial growth. In silico analysis also showed good binding energies when LLO interacted with the ligands. **Conclusion:** Hence, this study indicates that copper loaded carbon nanoparticles showed synergistic effect in combination and proved to be good alternative in the treatment of *L. monocytogenes*.

Keywords: Carbon nanoparticles (CNPs), Copper-nanoparticles (CuNPs), Copper loaded carbon nanoparticles (Cu-CNPs), Listeriolysin O (LLO).

Diversified Scientific Applications of Wet-chemically Developed ZnO/Ag₂S: Photoenergy Harvesting to Nano-fertilization

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ZnO and Ag₂S, both have emerged as potential materials for emerging applications in various scientific domains including but not limited to dye degradation, anti-bacterial activities and water splitting etc. This study outlines a facile wet-chemical synthesis of ZnO/Ag₂S nanocomposites (NCs; via successive ionic layer adsorption and reaction (SILAR) method) for dual-purpose environmental and agricultural applications. The fabricated heterostructure facilitates efficient charge separation for photoenergy harvesting and pollutant degradation, while its controlled nanoscale release delivers vital micronutrients to optimize modern agricultural and nano-fertilization protocols. Intensive SEM and TEM was performed to establish the composition of Ag₂S QDs and ZnO. Firstly, ZnO/Ag₂S was utilized for photocatalytic and antibacterial applications, increasing the photocatalytic degradation rate of Rhodamine B to 0.01 min⁻¹ compared to 0.004 min⁻¹ for pristine ZnO. Secondly, antibacterial assay and atomic force microscopy was involved to reveal the effectiveness of ZnO/Ag₂S for inhibition of *Bacillus subtilis* and *Escherichia coli* bacteria alongside normalized (<10%) hemolytic activity, endorsing the effectiveness of p-SILAR process for the development of biocompatible, photocatalytic and antimicrobial ZnO/Ag₂S NC. Last, but not the least ZnO/Ag₂S. Another simply but differently developed ZnO/Ag₂S, when applied to Brassica Rapa as a nano-fertilizer, improves the stimulatory effect on Brassica Rapa germination and growth parameters, resulting nearly 18% enhancement in seed germination and early growth.

Keywords: ZnO, Photoenergy, Ag₂S, QDs, Wet-chemical

The Use Of Ai And Self-Regulated Learning: A Longitudinal Study Of Undergraduate Students

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This study will quantitatively investigate how undergraduate student's use of artificial intelligence tools relates to their self-directed learning abilities across one full academic semester. Existing research has relied almost exclusively on cross-sectional designs that capture data at a single time point, leaving a critical gap in understanding developmental trajectories. This study will address that gap by employing a quantitative longitudinal design with three data collection points: the beginning of semester at week one, the middle of semester at week eight, and the end of semester at week sixteen. A sample of 800 undergraduate students will complete identical surveys at all three time points, measuring AI use frequency, self-directed learning components including motivation, self-monitoring, and self-management, and AI dependence.

Data will be analyzed using SPSS. Grounded in constructivist philosophy of education, Garrison's Model of Self-Directed Learning (1997), Bandura Social Cognitive Theory (1986), Zimmerman Self-Regulated Learning Theory (2000), and Pintrich's Model of Self-Regulated Learning (2000), this study will produce empirical evidence about how the relationship between AI use and self-directed learning changes from the beginning to the middle to the end of the semester.

Keywords: undergraduate students, artificial intelligence, self-directed learning, longitudinal study, AI tools

Adaptability of Artificial Intelligence (AI) in Education for Sustainable Academic Development at Secondary Level

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AI adoption in secondary education has the potential to be revolutionary, but it also presents serious systemic challenges, including the requirement for sustainable academic growth, teacher willingness, and adaptability. The study aims to explore the potential of adapting AI for use in secondary education to achieve sustainable learning outcomes. The method adopted in this research is quantitative descriptive research design with 35 secondary school teachers of government high/higher secondary schools of Gujranwala on structured survey of 20 items. Data were analyzed using descriptive and inferential statistics (mean, standard deviation, Pearson correlation and one-way Anova) with SPSS version 25. The instrument showed good internal consistency (Cronbach $\alpha = 0.94$). The key findings suggest that teachers believe that using AI tools improves learning outcomes (mean = 4.15) and student engagement (mean = 4.08), but the level of training is very low (mean = 2.77). The results showed high positive correlations between the integration of AI and students' engagement ($r = 0.71$, $p < 0.001$) and between the integration of AI and training needs ($r = 0.62$, $p < 0.001$). Moreover, the ANOVA analysis indicated that teachers with higher academic qualifications had a more positive perception of the contribution of AI towards sustainable academic development ($F(2,32) = 5.93$, $p = 0.006$). The study also highlights the need for specific professional development, support from institutions, and integration with educational models to ensure that AI tools are adaptable and effective in the long term to support sustainable secondary education. The recommendations are to implement regular quarterly AI workshops across the school, peer mentoring and ensure policies are aligned with the Education for Sustainable Development (ESD) and SDG 4 from UNESCO.

Keywords: Artificial Intelligence adaptability, secondary education, sustainable academic development, teacher training, student engagement, quantitative study

Potential Of *Serratia Marcescens* Hmr-2 For Enhancing *Eruca Sativa* L. Growth Under Heavy Metal Stress In Soilless Culture

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Contamination of soils by heavy metals (HMs) is a significant environmental issue that is widespread across the globe, driven by anthropogenic activities such as metal mining, pesticides, chemical fertilizers, wastewater irrigation, and urban pollutants. Cadmium (Cd) and Chromium (Cr) are ubiquitous pollutants that pose serious risks to human health and environment especially to the soil-plant ecology, agricultural productivity and food safety. Moreover, HMs induce physiological and morphological changes in plants, generating reactive oxygen species (ROS), inhibiting enzymes, impairing photosynthesis, disrupting nutrient transport, damaging DNA, and activating the detoxification mechanisms. *Eruca sativa*, a member of Brassicaceae family, highly valued in various fields including agriculture, medicine, and food industries has been known to have a high accumulation capacity of HMs. Due to water constraints, the need for using marginal water, including brackish, refined, and drainage water for agricultural irrigation is increasing. Therefore, it is important to study the responses of *E. sativa* to oxidative stress caused by HMs, supplemented with plant growth-promoting bacteria (PGPB). *S. marcescens* strain HMR-2 is tolerant to Bisphenol A (BPA) and capable of promoting plant growth and development. However, its tolerance and assistance to the plant under the HM stress has not been studied yet. Hence, this research intends to determine the potential of *S. marcescens* strain HMR-2 as a dual-tolerant, BPA+HM (Cd/Cr), for removing heavy metals from polluted settings, and to evaluate its utility in toxic metal bioremediation in combination with *E. sativa* plant. The *S. marcescens* strain HMR-2 was resistant with a minimum inhibitory concentration (MIC) of (200-400 ppm) for Cd +2 ions and (300-500 ppm) for Cr +6 ions in solid media. Under lower concentrations of Cd and Cr stress, HMR-2 inoculation significantly enhanced *E. sativa* growth, fresh and dry biomass, photosynthetic pigments, nutrient uptake, and antioxidant capacity. The inoculation significantly reduced Cd and Cr accumulation in both plant tissues and culture medium, while un-inoculated plants exhibited higher antioxidant enzyme activity (SOD, POD, CAT, and APX) and osmolyte levels (proline). Overall, this study shows that inoculating *E. sativa* plants with *S. marcescens* strain HMR-2 enhances phytoremediation capacity and Cd and Cr stress tolerance via affecting photosynthetic traits, osmolyte synthesis, and antioxidant machinery. By reducing Cd and Cr induced phytotoxicity and encouraging plant growth, this could help enhance the restoration of contaminated environments.

Keywords: heavy metals, cadmium, chromium, *Eruca sativa*, *Serratia marcescens*, plant growth-promoting bacteria, phytoremediation

The methanol extract of *Daphne mucronata* (Laghenai) protects against doxorubicin-induced heart failure in Wistar rats via antioxidant action.

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Globally, cancer is the leading cause of death. The majority of the chemotherapeutic drugs impose serious adverse effects. Although, anthracyclines belong to a class of chemotherapeutics with proven clinical efficacy. Yet, they produce severe cardiotoxicity via oxidative damage. Among anthracyclines, doxorubicin is a cost-effective option. However, dose-dependent (cumulative: & 550 mg/m²) congestive heart failure limits its clinical use making the inclusion of anti-oxidants vital as adjuncts. *Daphne mucronata* methanolic extract in our pilot study exhibited anti-oxidant potential. Also, in literature, *D. mucronata* displayed antioxidative protection against drug-induced oxidative organ damage. Subsequently, the protective effect of *D. mucronata* methanolic extract (L. E) was explored against doxorubicin-induced heart failure. L.E at 50 mg/kg was assessed in doxorubicin-induced rat cardiotoxic model via functional, biochemical, and histopathological analysis. The preclinical investigation revealed that L. E (50 mg/Kg) significantly increased ejection fraction (~27%), diminished levels of troponin-I (~2.9x), creatine-phosphokinase (1.64x), improved cardiac tissue integrity, and fibrotic content (~46.9%) in doxorubicin-treated rats. It was concluded that *D. mucronata* methanolic extract prevents doxorubicin-induced cardiac toxicity owing to the reduced cardiomyocyte oxidative damage.

Comparative Anxiolytic Effect of Escitalopram and Lorazepam in Restraint Stress–Induced Anxiety in Mice

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Anxiety disorders are among the most prevalent psychiatric conditions worldwide and are associated with significant psychological and physiological consequences. Chronic stress is a major contributor to the development of anxiety, and experimental animal models are widely used to evaluate the efficacy of anxiolytic agents. This study investigated the anxiolytic effects of escitalopram, lorazepam, and their combination in a restraint stress–induced mouse model using the Mirror Chamber Test. Anxiety-like behavior was induced by subjecting mice to restraint stress for five consecutive days, followed by treatment with escitalopram (20 mg/kg), lorazepam (1 mg/kg), or their combination. Anxiety-related behavior was assessed by evaluating exploratory activity, hesitation, locomotor behavior, and time spent inside the mirrored chamber. Mice treated with escitalopram and lorazepam exhibited reduced anxiety-like behavior compared with the untreated control group, as demonstrated by increased exploratory activity, decreased hesitation, and prolonged time spent in the mirror chamber. Combination therapy also effectively attenuated anxiety-like behavior and produced favorable behavioral outcomes, suggesting a potential additive anxiolytic effect. Overall, the findings demonstrate that both escitalopram and lorazepam possess significant anxiolytic properties in restraint stress–induced

anxiety, while their combined administration also provides effective behavioral improvement. These results support the use of restraint stress as a reliable preclinical model for evaluating anxiolytic agents and highlight the therapeutic potential of escitalopram, lorazepam, and their combination in the management of stress-induced anxiety. Further studies incorporating larger sample sizes and mechanistic investigations are warranted to validate these findings and explore the underlying neurobiological pathways.

Chonapray: A Holistic Pathway to Relaxation, Healing and Inner Renewal

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Chonapray is a newly created holistic therapeutic framework that incorporates three evidence-supported components – chocolate (CHO), napping (NAP), and prayer (PRAY) – to facilitate the overall aspects of mental, emotional, physical, and spiritual well-being. Each aspect contributes individually to the promotion of both reduced stress and cognitive-emotional restoration: dark chocolate contains both flavonoids and phenylethylamine to help with mood and cognition, brain functioning; napping is beneficial for consolidation of memory, recovery of energy, and restoration of the brain; and prayer or mindful spirituality stimulates the parasympathetic nervous system to facilitate emotional homeostasis, inner tranquility, and resilience in coping with stress and anxiety. The current study assessed the conceptual underpinning of Chonapray through a literature review and a cross-sectional survey with 82 participants based in Pakistan, most of whom were students ages 15-25 years, a vulnerable group with significant academic and social stressors. The survey results indicated that 63.4 % of participants endorsed the use of prayer or spirituality as their primary means of managing their stress, while 30.5 % chose rest. Moreover, 44.2% and 42.9% stated they eat milk and dark chocolate, respectively, as comfort foods for emotional regulation. Stressors that were often identified included academic performance, financial difficulties, relationships conflicts, and past traumatic events. More evidence in the literature supports dark chocolate improves cognitive performance and memory; napping reduces fatigue and improves alertness; and prayer reduced cortisol and improves emotional regulation. Combining this literature enhances the Chonapray model as a simple, yet holistic self-care model that can address contemporary psychological and emotional challenges, especially among youth and disproportionately emotionally vulnerable populations.

Keywords: Chonapray, chocolate, napping, stress management, emotional wellness, mental Health

Characterization of bacteriocin producing bacteria isolated from jaggery Speaker

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The alarming rise in antibiotic resistance continues to pose a significant global public health challenge, necessitating the development of alternative antimicrobial strategies. Among promising candidates are bacteriocin-producing environmental bacteria capable of synthesizing ribosomally encoded antimicrobial peptides that inhibit the growth of pathogenic microbes. This study focused on isolating and characterizing a novel antimicrobial-producing bacterial strain from traditional jaggery, a carbohydrate-rich natural substrate. The isolate underwent morphological, biochemical, and antimicrobial screening against *Escherichia coli* and *Bacillus subtilis*. Molecular identification using 16S rRNA sequencing confirmed the strain as *Planomicrobium okeanokoites*, a non-lactic acid, Gram-positive actinobacterium with limited prior study in this context. In vitro assays validated the antimicrobial activity of the isolate's cell-free culture supernatant, while growth curve and spectrophotometric analyses supported optimization of culture conditions. GC-MS profiling tentatively identified several bioactive metabolites, and phylogenetic reconstruction confirmed the strain's novelty. Furthermore, in silico analyses were conducted to predict bacteriocin gene clusters using specialized bioinformatics tools, followed by molecular docking to evaluate the interactions between predicted peptides and bacterial target proteins. The findings underscore the potential of non-LAB environmental isolates as untapped sources of antimicrobial compounds. Further purification and in vivo validation of bacteriocins from *P. okeanokoites* may contribute to the development of novel therapeutic and food-based antimicrobial applications.

Study on the antibacterial properties of Propolis made by European honey bee

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Bacteria are important to our body and environment. But many bacteria are pathogenic. In present study the objective was to assess the antibacterial capacity of *Apis mellifera* propolis collected from Sargodha, Toba Tek Singh and Jhang regions of Punjab. Propolis is bee glue which is produced by worker honey bees through mixing of their saliva with plant resins. This bee glue is used by honey bees to glue the comb of honey with the tree branches, fills the cracks between comb hexagonal cells and space between comb and attached place on the plant or tree. This bee glue is naturally antibacterial and antioxidant in nature. Propolis samples were collected directly from apiaries located in the study areas by scratching either from top of the frames or underside the top covers of modern bee hives. Antibacterial activity was measured using in vitro analysis. Well diffusion method for antibacterial activity and the minimum inhibitory concentration by serial dilution method using micro-titration plates were performed to evaluate

the antibacterial activity. The mean of zone of inhibition for three E. coli strains was highest in Jhang (2.2 ± 0.2) followed by Sargodha (2 ± 1) and Toba Tek Singh (2.03 ± 0.15) respectively. However, the serial dilution shown the following trend against E. coli strains. Minimum inhibitory concentration shown against E. coli strains tends as i.e. E. coli E2 (0.7 ug/ml) > E. coli E9 (0.9 ug/ml) > E. coli E6 (1.42 ug/ml).

Keywords: Propolis, bee glue, E.coli, antibacterial activity

Green Synthesis And Antioxident Evaluation Of Bimetallic Silver And Copper Nanoparticles By Using Pomegranate Peel Rxtract

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The increasing demand for sustainable nanomaterials has promoted the development of green synthesis methods for metallic nanoparticles. In this study, bimetallic silver-copper (Ag/Cu) nanoparticles were synthesized using pomegranate (*Punica granatum*) peel extract as a natural reducing and stabilizing agent. Bioactive phytochemicals present in the extract facilitated the reduction of metal ions and the formation of stable nanoparticles without the use of hazardous chemicals. The synthesized nanoparticles were characterized by UV-Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX), Transmission Electron Microscopy (TEM), and X-ray Photoelectron Spectroscopy (XPS), confirming their successful formation, morphology, crystallinity, elemental composition, and surface chemistry. Antioxidant activity was evaluated using DPPH, ABTS, and FRAP assays. The Ag/Cu nanoparticles exhibited enhanced free radical scavenging activity and reducing power compared with the pomegranate peel extract, demonstrating the synergistic effect of silver, copper, and plant-derived phytochemicals. These findings highlight the potential of green-synthesized Ag/Cu bimetallic nanoparticles for antioxidant, biomedical, pharmaceutical, and food preservation applications.

Keywords: Green synthesis, Bimetallic nanoparticles, Silver-Copper (Ag/Cu) nanoparticles, Pomegranate peel extract, Antioxidant activity

Climate Change, Geological Hazards, and Psychological Preparedness Among University Students in Gilgit-Baltistan: A Framework for Building Community Resilience Through Higher Education

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The increasing intensity of climate change has amplified geological hazards across mountainous regions worldwide. Gilgit-Baltistan, located within the Hindu Kush-Karakoram-Himalayan (HKH) region, is particularly vulnerable to landslides, earthquakes, glacier lake outburst floods (GLOFs),

and flash floods. While substantial research has focused on physical vulnerability and hazard assessment, limited attention has been devoted to the psychological preparedness of university students who represent future leaders and first responders within their communities. This study proposes an interdisciplinary framework integrating geological hazard awareness, climate change perception, psychological preparedness, and community resilience among university students in Gilgit-Baltistan. Drawing upon Community Resilience Theory, Protection Motivation Theory, and Disaster Risk Reduction frameworks, the study examines how higher education institutions can strengthen resilience capacities through disaster education and psychosocial preparedness programs. The paper argues that universities play a strategic role in developing adaptive communities capable of responding effectively to climate-induced disasters. Findings are expected to contribute to disaster risk reduction policies and educational reforms in vulnerable mountainous regions.

Keywords: Climate Change, Psychological Preparedness, Community Resilience, Higher Education, Geological Hazards, Gilgit-Baltistan, Disaster Risk Reduction.

Assessing the Correlation Between Climatic Factors and Peach Leaf Curl Disease and Peach Ecosystem Services in Hunza

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Peach production in the mountainous regions of Pakistan is highly threatened by Peach Leaf Curl Disease (PLCD), caused by a fungus *Taphrina deformans*. It not only reduces fruit yield and quality but also may harm the ecosystem services provided by peach trees. This study aims to assess the distribution and severity of PLCD, evaluate the ecosystem services which are provided by peach trees, and analyze the relationship among climatic factors, PLCD incidence, productivity and ecosystem services in Upper, Lower and Central Hunza. Data were collected from total 75 orchards, 25 in each region (5 orchards per village and 5 villages from each region were selected) through structured questionnaire. Ecosystem services were categorized into provisioning, regulating, cultural and supporting services and then integrated into a total ecosystem services index. Descriptive statistics, Pearson correlation analysis, one-way ANOVA, and Tukey's HSD post-hoc tests were employed for data analysis. Results from one-way analysis of variance showed that there were statistically significant regional variations regarding the provisioning ($F = 89.14$, $p < 0.001$), regulating ($F = 1206.60$, $p < 0.001$), cultural ($F = 798.86$, $p < 0.001$), supporting ($F = 378.48$, $p < 0.001$), and total ecosystem services indices ($F = 1455.19$, $p < 0.001$). Post-hoc comparisons presented that Upper Hunza exhibited significantly higher ecosystem service value than Lower and Central Hunza. Farmers consistently perceived climatic changes over the past decades, which includes warmer winters, earlier spring onset, and reduced snowfall. Remarkably, perceived heat increase was unanimous, with 100% of respondents ($n = 75$) reporting "much higher" temperatures, indicating a strong and consistent perception of increased warming across the study area. Rainfall variability showed a strong positive correlation with PLCD severity ($r =$

0.910. $p < 0.001$), showing that increased moisture conditions may favor disease development. PLCD severity showed strong positive correlation with disease loss index ($r = 0.928$, $p < 0.001$) and waste yield ($r = 0.934$, $p < 0.001$), while exhibiting significant negative correlations with provisioning ($r = -0.755$, $p < 0.001$), regulating $r = -0.894$, $p < 0.001$), cultural ($r = -0.888$, $p < 0.001$), supporting ($r = -0.859$, $p < 0.001$) and total ecosystem service indices ($r = -0.894$, $p < 0.001$). Additionally, PLCD severity was negatively associated with marketable yield ($r = -0.519$, $p < 0.001$), indicating its adverse effects on peach tree productivity. The findings specify that climatic variability, predominantly rainfall changes, plays a significant role in PLCD occurrence and severity. Increased disease severity considerably reduces marketable yield and reduces the ecosystem services provided by peach trees. These results highlight the necessity for effective disease management and climate-resilient orchard practices to withstand peach production and ecosystem functions in Hunza Valley.

Keywords: Peach Leaf Curl Disease, *Taphrina deformans*, climate change, ecosystem services, peach orchards, Hunza, yield loss, Pearson correlation ANOVA

Characterization and application of chitosan, lignin, and fruit peel extracts based edible coatings for the preservation of apple fruits

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Approximately 30 % of food is wasted or lost globally; which poses serious threat to food security. Hence, steps should be taken with an aim to prevent and reduce this loss. Chitosan and lignin blended with fruit peel extract were formulated to prepare three edible coatings, i.e., chitosan-lignin banana peel extract (CH-L/BPF), chitosan-lignin mango peel extract (CH-L/MPE), and chitosan-lignin pomegranate peel extract (CH-L/PPE). The three optimized emulsions have been utilized to preserve the apple fruit's shelf life at 25 ± 5 °C with 80–85 % relative humidity for 25 days. The prepared emulsions were characterized by using a zeta sizer, zeta potential, FTIR analysis, XRD, and scanning electron microscopy. The antimicrobial activities of coatings were evaluated against *Staphylococcus aureus*, *Escherichia coli*, and fungi *Aspergillus niger*. Results have indicated that the inhibition zone against *A. niger*, *S. aureus*, and *E. coli* of 9.64 ± 2.21 , 7.33 ± 1.61 , and 3.12 ± 0.51 mm of CH-L/PPE -based emulsion, respectively. The quality parameters of preserved apple fruits with three coatings were evaluated during 5, 10, 15, 20, and 25 days of storage. The quality parameters, i.e., weight loss, firmness, decay incidence, ethylene production, respiration rate, color index, total soluble solids, titratable acidity, pH levels, and total phenolics and flavonoids contents, were good in CH-L/PPE followed by CH-L/MPE emulsion. The DPPH activity was 72.05 ± 1.55 %, and sensory evaluation in appearance, smell, color, texture, flavor, and acceptability were 6.70, 6.50, 7, 7, 6.50, and 7.15, respectively, against CH-L/PPE emulsion. The results have documented that CH-L/PPE emulsion was effective, followed by CH-L/MPE and

CH-L/BPE for preserving and extending the shelf life of apple fruit. The prepared emulsion has strong potential applications in the food industry for packaging fruits and vegetables.

Keywords: Chitosan, Lignin, Fruit peel extracts, Emulsion, Edible coating, Packaging

AI-IoT Wearable System: Smart Glasses and Earphones for Obstacle Detection and Navigation Assistance for Visually Impaired Individuals.

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Visually impaired individuals often face difficulties in independent navigation and obstacle avoidance. Traditional assistive devices such as white canes provide limited environmental awareness. This research proposes an AI-IoT wearable system consisting of smart glasses and earphones that enables real-time obstacle detection and navigation assistance. The smart glasses use sensors and a camera to capture environmental data, while artificial intelligence algorithms process the information to identify obstacles and determine safe paths. The system communicates navigation instructions through earphones using voice alerts. IoT connectivity enables location tracking, emergency notifications, and caregiver monitoring. The proposed system aims to improve mobility, safety, and independence for visually impaired users.

Keywords: Artificial Intelligence (AI), Internet of Things (IoT), Smart Glasses, Wearable Technology, Obstacle Detection, Navigation Assistance, Visually Impaired, Machine Learning.

Comparative Study Of Bimetallic Ag–Cu Nanoparticles Synthesized Via Azadirachta Indica Extract For Environmental And Antibacterial Applications

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Green synthesis of nanoparticles using plant extracts has emerged as an eco-friendly and sustainable approach for nanomaterial production. This study presents a comparative investigation of monometallic silver (Ag), copper (Cu), and bimetallic silver–copper (Ag–Cu) nanoparticles synthesized using *Azadirachta indica* (neem) leaf extract. The phytochemical present in the extract act as natural reducing and capping agents during nanoparticle synthesis. The synthesized nanoparticles will be characterized using UV–Visible spectroscopy, FTIR, and XRD to confirm their formation, functional groups, crystalline structure, particle size, and phase purity. Their photocatalytic efficiency will be evaluated through the degradation of methylene blue dye under visible light irradiation. Antibacterial activity will be assessed against selected Gram-positive and Gram-negative bacteria using disc diffusion and minimum inhibitory concentration (MIC) assays. The study aims to compare the environmental remediation and antibacterial performance of monometallic and bimetallic nanoparticles, with particular emphasis on the synergistic effects of Ag–Cu bimetallic nanoparticles synthesized via green methods.

Keywords: Green synthesis, Bimetallic nanoparticles, Silver-Copper (Ag/Cu) nanoparticles, Neem leaves extract, Antibacterial activity, Dye degradation

Ecosystem services of some selected fruit plants in Gilgit and the impact of climate change on their productivity

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This study examines the ecosystem services provided by cherry, apricot, apple, and pear fruit plants and assesses climate change impacts on their productivity in three villages Oshikhandass, Danyor, and Sultan Abad, of Gilgit District, Pakistan. Using a mixed-methods approach, data were collected from 300 households through structured questionnaires and face-to-face interviews. The research evaluated provisioning services (fruit production, timber, fuelwood, animal feed, and oil extraction), regulating services (shade provision, medicinal uses), supporting services (soil conservation and fertility enhancement), and cultural services (aesthetic value). Results revealed significant regional variation: Danyor led in apple and pear production, Oshikhandass dominated cherry and apricot yields, while Sultan Abad showed moderate production across species. The main source of therapeutic oil (27–40 liters per year) was apricot, which was prized for its cooling and shade-giving properties. The effects of climate change were significant; in Oshikhandass and Danyor, 47–47 respondents reported very severe effects. The most important climatic component, according to 77–78 respondents, is temperature changes, which also cause early/late blooming (60–65 respondents) and poorer yields (46–52 respondents). The most susceptible plant parts were found to be the flowers and leaves. The species most sensitive to temperature change were cherries and apricots. Pest infestations, water scarcity, low soil fertility, and problems with market access were among the main obstacles. Climate-tolerant cultivars, technical training, and financial assistance were ranked by respondents as crucial interventions. According to the study findings, maintaining ecosystem services and guaranteeing food security in mountainous areas with variable climates require integrated climate-resilient methods that combine traditional knowledge with contemporary farming techniques.

Keywords: Ecosystem services, climate change, fruit productivity, Gilgit-Baltistan, adaptation strategies, temperate fruit crops, phenological shifts.

Gc-MS Characterization And Synergistic Antibacterial Activity Of Solvent Extracts Of Curcuma Longa And Piper Nigrum Against Multi-Drug-Resistant Bacteria

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The rise of multi-drug-resistant (MDR) bacteria has increased the demand for novel antimicrobial agents. This study investigates the phytochemical profile and synergistic antibacterial activity of solvent extracts of *Curcuma longa* and *Piper nigrum* against MDR bacterial strains. Plant extracts were prepared using methanol, ethanol, and aqueous solvents. GC-MS analysis was performed

to identify major bioactive compounds. Antibacterial activity was evaluated against MDR *Staphylococcus aureus*, *Escherichia coli* using agar well diffusion and broth microdilution methods. Synergism was assessed by checkerboard assay. GC-MS analysis revealed major bioactive compounds including curcumin, ar-turmerone, and piperine. Among the three solvents used, methanol extract of *P. Nigrum* showed the highest zone of inhibition of 24 mm and was found to be highly bioactive. Similarly, for *C. Longa* methanol extract exhibited the highest zone of inhibition of 26 mm and methanol was also highly bioactive. The synergistic combination of both plants showed an enhanced zone of inhibition of 30 mm, which was higher than individual extracts, indicating strong synergism against all tested MDR strains. The findings suggest that the combined extracts of *C. Longa* and *P. Nigrum* possess significant potential as natural antimicrobial agents against MDR pathogens.

Keywords: *Curcuma longa*, *Piper nigrum*, GC-MS, Synergistic Activity, MDR Bacteria.

Phytotherapeutic Profiling of *Azadirachta indica*: Kinetic Assessment of α -Glucosidase Suppression and Antioxidant Mobilization

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Azadirachta indica is renowned for its diverse ethnopharmacological benefits, yet its precise mechanical roles in carbohydrate metabolism and cellular protection require further clarity. This research examines the in vitro response of *Azadirachta indica* extracts against intestinal α -glucosidase and persistent DPPH radicals. Enzymatic models showed a minimal direct inhibitory effect, reaching a peak of only 30.0% at 250 $\mu\text{g/mL}$. In stark contrast, its antioxidant mobilization was remarkably rapid and responsive, surging to 22.1% at 50 $\mu\text{g/mL}$ and rising steadily to a final value of 50.6% at 250 $\mu\text{g/mL}$. These findings indicate that the primary metabolic benefit of *Azadirachta indica* does not rely on direct enzyme blockade, but is driven by its fast-acting free radical scavenging pathways.

Keywords: *Azadirachta indica*, Neem, α -Glucosidase, Extraction Methodology.

Ethnobotanical study of medicinal plants of Local Flora Of Tehsil Jand, District Attock Pakistan

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The present study was conducted to document the ethnobotanical knowledge and medicinal uses of the local flora of Tehsil Jand, District Attock, Punjab, Pakistan. The area possesses rich plant diversity and a strong tradition of indigenous healthcare practices; however, its ethnobotanical resources have remained scientifically undocumented. Ethnobotanical surveys

were carried out through semi-structured questionnaires, open-ended interviews, and direct observations involving local informants, including traditional healers, elderly residents, and rural households. Plant specimens were collected from different villages of Tehsil Jand, identified using standard taxonomic methods, and preserved as herbarium vouchers. Quantitative ethnobotanical indices, including Relative Frequency of Citation (RFC), Use Value (UV), Informant Consensus Factor (ICF), Fidelity Level (FL), and Pearson correlation analysis between RFC and UV, were employed to evaluate the significance of the recorded medicinal plants. The survey documented approximately 65 medicinal plant species belonging to 38 families, with herbs representing the dominant life form, followed by shrubs and trees. The recorded species were traditionally used to treat a wide range of ailments, including gastrointestinal disorders, respiratory infections, fever, skin diseases, diabetes, joint pain, and healing wounds. Leaves were the most frequently utilized plant part, while decoctions and powders were the most common methods of remedy preparation. Quantitative analysis indicated that several species possessed high RFC, UV, and FL values, reflecting their importance in local healthcare systems. A high ICF value was observed for digestive and respiratory disorders, indicating strong agreement among informants regarding plant use. Pearson correlation analysis revealed a positive correlation between RFC and UV, suggesting that frequently cited species also possessed greater medicinal importance. This study provides the first comprehensive ethnobotanical documentation of Tehsil Jand and contributes valuable baseline information for biodiversity conservation, preservation of indigenous knowledge, and future pharmacological investigations of medicinal plants.

Keywords: Ethnobotany, Medicinal plants, Indigenous knowledge, Local flora, Tehsil Jand, District Attock, Pakistan, RFC, UV, ICF, FL.

Green Synthesis Of Nickel Oxide Nanoparticles Using Cassia Nodosa Aqueous Leaf Extract And Their Multifunctional Biological Evaluation

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Green synthesis of nanoparticles using plant extracts is an eco-friendly and cost-effective alternative to conventional methods. Cassia Nodosa, rich in bioactive phytochemicals, can act as a natural reducing and stabilizing agent. Nickel oxide nanoparticles (NiO-NPs) are known for their important antimicrobial and antioxidant properties. This study focuses on the green synthesis of NiO-NPs using Cassia Nodosa and evaluation of their Biological activities. Leaf extract of Cassia Nodosa was used to synthesize NiO-NPs from a nickel salt solution. The nanoparticles were characterized using UV–Vis, FTIR, XRD, and SEM techniques. Antimicrobial activity was assessed by agar well diffusion, while antioxidant activity was evaluated using the DPPH assay. The successful synthesis of NiO nanoparticles was confirmed by characteristic absorption peaks in UV–Vis spectra and distinct crystalline patterns in XRD analysis. SEM results revealed predominantly spherical nanoparticles with nanoscale dimensions. The synthesized NiO-NPs exhibited significant antimicrobial activity, producing measurable zones of inhibition against tested bacterial strains. Additionally, the nanoparticles demonstrated strong, concentration-

dependent antioxidant activity in the DPPH assay, indicating effective free radical scavenging potential. The study demonstrates that *Cassia Nodosa* is an efficient and eco-friendly source for the green synthesis of nickel oxide nanoparticles. The synthesized NiO-NPs showed promising antimicrobial and antioxidant activities, likely due to the synergistic interaction between nanoparticle properties and plant-derived phytochemicals. These findings highlight the potential applications of green-synthesized NiO-NPs in biomedical, pharmaceutical, and environmental fields.

Keywords: Green synthesis; Nickel oxide nanoparticles (NiO-NPs); *Cassia Nodosa*.

Effect of temperature regimes, water levels, and soil nutrients (NPK) on seed germination and growth of four wheat (*Triticum aestivum*) varieties of Gilgit-Baltistan

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Seed germination is affected by many abiotic factors. Soil is the natural medium for seed germination it contains many essential micro and macro nutrients for seed germination but among them, nitrogen, potassium, and phosphorus is very important. Besides these, temperature and water are the prominent and determinant factors, and their optimum availability is needed for seed germination. The experimental investigation was conducted to determine the effect of different temperature regimes (5°C, 15°C, 25°C, 35°C and 45°C) using climate incubator, water levels (50ml, 150ml, 250ml, and 450ml) through split block method, and NPK doses (0, 50g and 100g) using complete randomized block method, on germination, growth traits, and biomass in wheat (*Triticum aestivum*) varieties. Seeds of four varieties Borlaug-16, KPK-15, DHA, and Pak-13 were tested for germination and related traits. The results showed that temperature regimes influenced the germination and growth of wheat varieties. The highest germination percentage (GP) showed by variety Pak-13 (96%) at 5°C, Borlaug-16 and Pak-13 (100%) at 15°C, Borlaug-16, Pak-13 and DHA (100%) at 25°C, DHA (100%) at 35°C and DHA (96%) at 45°C. The results showed that at 5°C the maximum height was observed in DHA (3.09cm) while minimum in KPK-15 (1.3cm). At 15°C Borlaug-16 (9.94cm) showed maximum and minimum in KPK-15 (7.28cm), at 25°C Borlaug-16 (13.07cm) showed maximum height and minimum in KPK-15 (7.99cm), at 35°C Pak-13 (11.93cm) and Borlaug-16 (7.91cm) showed maximum and minimum height, respectively, while at 45°C maximum height observed in DHA (11.24) and minimum in KPK-15 (3.2cm). At 5°C and 25°C, the maximum biomass was observed in Borlaug-16, at 15°C and 35°C in Pak-13 while at 45°C it was observed in DHA. KPK-15 showed the minimum biomass in all regimes. The results for water levels showed that the germination and growth of wheat varieties were affected significantly. The highest germination percentage (GP) was showed in WL-50ml by Borlaug-16 (96%), in WL-150ml by KPK and DHA (100%), in WL-250ml by DHA and Pak-13 (92%) while in WL-450ml by DHA (96%). The maximum plant height were observed in the varieties DHA (11.24cm), Borlaug-16 (35.42 cm), PAK-13 (35.30cm) and Borlaug-16 (38.06cm), while the minimum heights observed in KPK-15 (3.2cm), Pak-13

(23.45cm), DHA (32.81cm) and DHA (33.71cm) in 50ml, 150ml, 250ml and 450ml respectively. Maximum biomass was observed in DHA and minimum in Pak-13 in levels 50ml, 150ml and 450ml while in 250ml it was observed maximum in Pak-13 and minimum in Borlaug-16. In this study, NPK doses significantly influenced seed germination and its related traits. The highest GP (100%) was recorded in Borlaug-16 and DHA treated with NPK-0, GP (97.5%) in DHA, and Pak-13 (96.25%) treated with NPK-50 and NPK-100 respectively. Results further revealed lower GP in Pak-13 treated with NPK-0 and NPK-50 while lower in DHA (82.5%) treated with NPK-100. The variety Pak-13 had significantly maximum plant height and root length while minimum in KPK-15 treated with NPK 0, 50g, and 100g. Varieties of wheat were significantly varied in spike length, spikelet spike -1, and grains spike -1. The maximum biomass of shoot was observed in variety DHA in NPK-0, Borlaug-16 in NPK-50, and Pak-13 in NPK-100 while the minimum was reported in variety KPK-15 treated with NPK-0 and NPK-50, however lower in Borlaug-16 treated with NPK-100. The maximum biomass of root was observed in DHA in NPK-0, Borlaug-16 in NPK-50, and Pak-13 in NPK-100 while the minimum was reported in Pak-13 in NPK-0, KPK-15 in NPK-50, and Borlaug-16 in NPK-100. The maximum 1000-grain weight was recorded in DHA was in NPK 0 while variety Pak-13 in doses NPK-50 and NPK-100.3

Keywords: Germination, Growth, NPK, Temperature regimes, Water levels.

The Spatiotemporal Assessment and Valuation of Regulating Ecosystem Services in Pakistan Terrestrial Ecosystem: Linkages with Sustainable Development Goals

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This study assesses and evaluates the key regulating ecosystem services in Pakistan at a national scale, with a focus on soil erosion prevention, sediment retention, and carbon sequestration, and their linkage to the UN Sustainable Development Goal 13 (climate action). The study uses mixed methods to evaluate the provision of these services and their value, with a special focus on replacement and avoided cost methods and carbon tax methods. The study finds that Pakistan is facing significant challenges in achieving the UN Sustainable Development Goals due to unstable political governance, exponential population growth, and increasing climate change pressures. Pakistan is the most vulnerable country to climate change impacts, facing frequent glacial lake outburst flood events and disasters. Soil erosion prevention and sediment retention are critical for maintaining healthy ecosystems, and the inclusion of vegetation cover significantly reduces soil erosion. The total value of soil/nutrient retention and sediment retention is high in Pakistan, with off-site (sediment removal) cost being much higher than on-site (mineral) cost. The major driving forces of soil erosion and sediment transport are vegetation cover, precipitation, and slope angle. Carbon sequestration is crucial for climate action, and the study estimates the total value of carbon sequestered in Pakistan to be significant, with more contribution from Punjab, followed by Balochistan and Khyber Pakhtunkhwa. However, carbon loss occurred in certain

years, indicating the need for urgent measures to enhance carbon stocks and mitigate climate change through carbon sequestration. Carbon emission is the major cause of global warming and further melting glaciers and rising sea levels. The study provides comprehensive findings to frame policy and accelerate the billion tree plantation program to prevent soil erosion, enhance carbon stock, and achieve UN SDG 13 (climate action) in Pakistan. The findings suggest that urgent steps are needed to impose a carbon tax and increase carbon stocks by planting trees and promoting sustainable natural resource management practices. The study provides a valuable contribution to the ongoing global efforts to address climate change and achieve sustainable development.

Keywords: Regulating ecosystem services, climate change, carbon sequestration, soil erosion, sustainable development goals

Impact of climate change on food security in Hunza using GIS

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The effect of climate change on food security and safekeeping in Hunza is a hazardous stock that has comprehensive concerns on farming, jobs, and the whole ecology of the society. Threats to food security in such high-altitude areas as the Hunza Valley, Gilgit-Baltistan, Pakistan, due to climate change are severe. This study examines community views on the effects of climate change on food security, past climatic conditions, NDVI analysis of vegetation changes, and the effectiveness of local adaptation measures. Employing a mixed-methods study design, household surveys were carried out in Upper, Central, and Lower Hunza, in addition to trend analysis of temperature and precipitation (1995-2025) and NDVI time series (1998-2025). The findings indicate that there is a near-universal awareness of the negative effects (>95% of respondents perceiving major impacts), mainly due to the rise in temperatures (mean maximum of 1.0°C and minimum of 2.05°C in the last few decades), decrease in precipitation (approximately 105 mm overall decline), intense rainfall, and glacier melting. The NDVI values have been constantly declining since 2010, which indicates the reduction in crop productivity, food insecurity (only 41.6% of the households were food-secure in 2020-2022), and the growing reliance on imported grains. Adaptation strategies used by farmers include crop rotation, which is the most practiced and effective (up to 99% in some regions), followed by food storage/preservation and small farming. Modern strategies such as climate-smart agriculture and irrigation are less practiced. Involvement of institutions includes IFAD, along with AKRSP and LSO, where 55-77% of respondents feel that government assistance is adequate and focus on agricultural trainings and projects for increased resilience. The research points to the pressing need for localized and participatory interventions that combine traditional knowledge, scale successful approaches, and promote institutional collaboration to enhance adaptive capacity and ensure long-term food security in this fragile mountain environment under rapidly changing climate conditions.

Key words; Food security, Temperature, Farming, Climate change, precipitation.

Green Synthesis Of Ternary Metallic Mgo-Zno-Co₃O₄ Nanoparticles Using Peel Extract Of Luffa Acutangula And Their Antibacterial Activity

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The use of plant-based extracts for the green synthesis of nanoparticles has become a sustainable and economical alternative to traditional chemical and physical methods. This study presents the green synthesis of ternary metallic oxide nanoparticles composed of magnesium oxide (MgO), zinc oxide (ZnO), and cobalt oxide (Co₃O₄) using the peel extract of Luffa acutangula, a plant known for its medicinal properties in the Cucurbitaceae family. The peel extract contains various bioactive phytochemicals, such as flavonoids, alkaloids, and phenolic compounds, which act as natural reducing and stabilizing agents during the synthesis process. Equal molar amounts of magnesium sulfate heptahydrate, zinc sulfate heptahydrate, and cobalt nitrate hexahydrate were mixed and reacted with the plant extract at 60°C. The resulting product was then processed through centrifugation, washing, drying, and calcination at 500°C to form crystalline MgO-ZnO-Co₃O₄ nanocomposites. The synthesized nanoparticles will be analyzed using techniques such as UV-Visible spectroscopy, Fourier Transform Infrared (FT-IR) spectroscopy, Scanning Electron Microscopy (SEM), and X-ray Diffraction (XRD). The antibacterial properties of these nanoparticles will be tested against Escherichia coli (a gram-negative bacteria) and Staphylococcus aureus (a gram-positive bacteria) using the agar well diffusion method. This research fills an important gap in the literature by integrating eco-friendly synthesis methods with the development of multifunctional ternary metal oxide nanoparticles for possible use in antimicrobial applications.

Gc-Ms Analysis And Antibacterial, Antioxidant Insights Into Euphorbia Trigona Mill, Native Medicinal Plant From District Kohat

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Medicinal plants have long served as a valuable source of therapeutic agents and continue to contribute significantly to modern drug discovery. Euphorbia trigona Mill. (Family: Euphorbiaceae), commonly known as the African milk tree, it is traditionally used for the treatment of various ailments, including inflammation, skin disorders, pain, and digestive complaints. The present study investigated the chemical composition and biological potential of Euphorbia trigona Mill. It is collected from Usterzai Payan, District Kohat, Pakistan. Leaves, stems, and roots were shade-dried, powdered, and extracted by the maceration technique using solvents of different polarities, including methanol, n-hexane, ethyl acetate, and chloroform. The chemical constituents of the extracts were characterized by Gas Chromatography-Mass Spectrometry (GC-MS). The GC-MS analysis identified 13, 19, 22, and 31 compounds in methanol, n-hexane, ethyl acetate, and chloroform extracts. The predominant compounds were

Nitroisobutylglycerol (23.82%) in methanol extract, Pentacosane (10.13%) in n-hexane extract, Pyrrolidino[1,2-a]piperazine- 3,6-dione (22.61%) in ethyl acetate extract, and cis,cis,cis-7,10,13-Hexadecatrilal (76.91%) in chloroform extract. Various classes of bioactive metabolites, including phenolics, fatty acids, esters, aldehydes, hydrocarbons, and diketopiperazine derivatives, were detected. Several compounds, including Diethoxymethyl acetate, Cyclopropyl carbinol, 7-Tetradecenal (Z)-, Triphenyl phosphate, Gamma- Guanidinobutyric acid, Levomethorphan, Dihydroergotamine, Actinomycin, and 7-Tetradecyne, were recorded for the first time in *Euphorbia trigona* Mill. These findings highlight the study provides a scientific basis for investigation, the remarkable chemical diversity of this species and suggest its potential as a source of biologically active compounds. Antioxidant activity was assessed using DPPH, ABTS, and FRAP assays, while Antibacterial activity against *Escherichia coli* and *Streptococcus mutans* was determined by the agar well diffusion method. The methanol extract exhibited the strongest antioxidant activity (87.1% DPPH, 95.4% ABTS inhibition, and 223 $\mu\text{mol/L}$ FRAP) and the highest antibacterial activity, producing inhibition zones of 21.3 ± 0.76 mm (*E. coli*) and 25.3 ± 0.26 mm (*Streptococcus. mutans*) at 800 $\mu\text{g/mL}$. These results support the potential of *Euphorbia trigona* Mill as a promising natural source of antioxidant and antimicrobial agents and also supports its value in Medicinal plant research for pharmaceutical and nutraceutical applications.

Keywords: *Euphorbia trigona* Mill, Euphorbiaceae, GC–MS, profiling, medicinal plants, biologically active compounds, antioxidant activity, DPPH, ABTS, FRAP, antibacterial activity, *Escherichia coli*, *Streptococcus mutans*, maceration extraction.

Chemical Characterization And Antibacterial Efficacy Of *Labeo Rohita* Scale Extract Against Fish-Borne *Aeromonas Hydrophila*

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The increasing occurrence of antibiotic-resistant bacterial pathogens in aquaculture has become a major concern for fish health management and sustainable production. *Aeromonas hydrophila*, a common fish-borne pathogen, is responsible for severe bacterial infections and significant economic losses in aquaculture systems. The present study aims to evaluate the chemical characterization and antibacterial efficacy of *Labeo rohita* scale extracts against *A. hydrophila*. Fish scales of *Labeo rohita* were collected, cleaned, dried, and processed into fine powder for solvent extraction using ethanol, methanol, and acetone. The obtained extracts were subjected to Gas Chromatography–Mass Spectrometry (GC–MS) analysis for the identification of bioactive compounds. GC–MS profiling revealed the presence of several biologically active constituents, including collagen-derived compounds, hexadecanoic acid (palmitic acid), oleic acid, octadecanoic acid (stearic acid), amino acid derivatives, and phenolic compounds, which are known for their antimicrobial and biological activities. The antibacterial potential of the scale

extracts was assessed against *Aeromonas hydrophila* using the agar well diffusion method at different concentrations. The extracts demonstrated concentration-dependent inhibitory effects against the bacterial pathogen. Furthermore, the minimum inhibitory concentration (MIC) of each extract was determined using the broth microdilution method to evaluate the lowest concentration required to inhibit visible bacterial growth. The findings of this study suggest that *Labeo rohita* fish scales possess valuable bioactive compounds with promising antibacterial properties. These results highlight the potential utilization of fish scale waste as a natural and sustainable source of antimicrobial agents for controlling bacterial diseases in aquaculture. **Keywords:** *Labeo rohita*, fish scales, *Aeromonas hydrophila*, antibacterial activity, GC–MS, fatty acids, bioactive compounds, aquaculture.

Transcriptional Gene Regulation with Special Reference to Topologically Associating Domains (TADs) in Food Science and Medicine

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Transcriptional gene regulation is a fundamental biological process that governs the spatial and temporal expression of genes, enabling cells to respond to developmental cues and environmental stimuli. While classical models emphasize the roles of promoters, enhancers, transcription factors, and epigenetic modifications, recent advances in chromosome conformation studies have revealed the critical importance of three-dimensional (3D) genome organization in regulating gene activity. Among the key architectural features of the genome are Topologically Associating Domains (TADs), which are self-interacting chromatin regions that facilitate preferential interactions between regulatory elements and their target genes. TADs act as structural and functional units that compartmentalize the genome, ensuring precise enhancer–promoter communication while insulating genes from inappropriate regulatory influences. The formation and maintenance of TADs are largely mediated by architectural proteins such as CCCTC-binding factor (CTCF) and the cohesin complex through loop extrusion mechanisms. Disruption of TAD boundaries can lead to aberrant chromatin interactions, resulting in gene misexpression and contributing to developmental abnormalities, cancer, and other human diseases. Recent studies have demonstrated that TADs play dynamic roles during cellular differentiation, lineage commitment, and responses to external signals, highlighting their importance in fine-tuning transcriptional programs. Furthermore, advances in high-throughput chromosome conformation capture technologies, including Hi-C and related methods, have provided unprecedented insights into the relationship between genome architecture and transcriptional regulation. This review examines the molecular mechanisms underlying transcriptional gene regulation with particular emphasis on the structure, function, and biological significance of TADs. Understanding how TAD-mediated chromatin organization influences gene expression provides a comprehensive framework for elucidating genome function and offers new opportunities for therapeutic interventions targeting chromatin architecture in disease.

An Advanced Face Aging and Recognition System for Missing Persons identification Using Diffusion Models And Vision Transformers

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The identification of missing persons is a critical humanitarian challenge requiring rapid, accurate, and scalable solutions. A major obstacle is the temporal appearance gap between archival photographs and a person's current appearance after years of aging, hardship, or displacement. This research develops an ethically grounded face aging and recognition framework combining identity-preserving aging synthesis with CNN- and transformer-based recognition. The framework was implemented using four benchmark datasets, namely CACD, FG-NET, AgeDB, and MORPH Album 2, with 222,420 images initially loaded and a filtered practical dataset of 10,062 images selected for training and evaluation. A ResNet-50 baseline achieved 80.76% classification accuracy and TAR@FAR=0.001 of 0.9074, while the Swin Transformer achieved 54.48% accuracy under the same filtered-data setting. Although the transformer model did not outperform the CNN baseline, aging synthesis increased the average maximum cosine similarity from 0.5904 to 0.6932, indicating improved feature alignment between aged and probe representations. The Identity-Preserving Diffusion Model achieved strong biometric preservation with identity similarity of 0.9988 and Age MAE of 9.70 years. The updated practical implementation further introduced a Residual Aging Generator, which achieved identity similarity of 0.9949 and reduced Age MAE to 2.64 years, and a physical aging engine whose evaluation showed increasing pixel difference and decreasing SSIM/PSNR as target age increased. Fairness analysis revealed performance disparities across age groups, gender groups, and dataset sources, emphasizing the need for balanced data and continuous bias monitoring. The proposed framework is therefore positioned as an assistive, human-in-the-loop tool rather than a fully automated identification system.

The Effects Of Rutin Hydrate On The Response-Reinstatement Of Mice Running An Alley For Ethanol Reward

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Pure compounds belonging to flavonoid family were studied for their biological potential such as rutin hydrate (3, 3', 4', 5, 7-pentahydroxyflavone-3-rhamnoglucoside). These molecules were chosen based on their neuroactive properties. The evaluation of the in vitro de addiction activity were exploited for the first time for such purposes. The aim of the present study was to investigate the effects of rutin hydrate (3, 3', 4', 5, 7-pentahydroxyflavone-3-rhamnoglucoside), a flavonoid that is an important dietary constituent of foods and plant-based beverages, on response reinstatement of mice using running alley method of ethanol reward. Rutin (0.1, 1, and 10 mg/kg) was administered orally (p.o) one hour before post conditioning test, during extinction trials, and on re instatement day. It was noted that rutin significantly ($P < 0.001$) increased

runtimes on reinstatement day. No changes in body weight, food and water intake when compared with saline control group was observed. These results indicate that flavonoid rutin hydrate has a potential role in decreasing ethanol reinforcement. This can be used as a powerful food to delineate ethanol re-inforced running. Several mechanisms may contribute to the potential role of rutin in ethanol re-inforced running. Therefore, further studies are warranted to understand the exact mechanism of rutin hydrate.

Keywords: Alcohol, Rutin hydrate, Response reinstatement, runway alley, craving

Impacts of heavy metals stress on plants and their mitigation approaches; a global perspective

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Heavy metal contamination has emerged as a critical environmental issue, posing significant risks to plant growth, productivity, and ecosystem stability. Elevated concentrations of metals such as cadmium, lead, arsenic, and mercury disrupt physiological, biochemical, and molecular processes in plants, leading to reduced germination, impaired photosynthesis, oxidative stress, and altered nutrient uptake. The severity of these impacts varies across species, environments, and degrees of exposure, highlighting the complexity of plant responses under metal stress. To cope with toxicity, plants employ a range of avoidance and tolerance strategies, including metal exclusion, chelation, sequestration in vacuoles, and activation of antioxidant defense mechanisms. Recent advances in plant biotechnology, phytoremediation, and soil management have provided promising avenues to enhance resilience and reduce contamination. Techniques such as the use of phytoremediation, GMO crops, nano particles approaches are increasingly recognized as sustainable approaches for mitigating heavy metal stress. This global perspective underscores the urgent need for integrated strategies that combine ecological, technological, and policy-based approaches to address heavy metal pollution. Strengthening research on plant tolerance mechanisms, remediation technologies, and risk assessment frameworks will be crucial for ensuring ecosystem health, food security, and environmental sustainability in contaminated landscapes.

Keywords: Heavy metal, tolerance strategies, phytoremediation, nanoparticle approaches.

In-vitro assessment of newly developed fast-dispersing tablets versus oral suspension -- a step towards enhancing paediatric compliance and dose accuracy

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Objective: The study aimed to develop and evaluate fast-dispersing tablets (FDTs) that disperse in a small volume of water and to assess their in vitro drug-release behavior compared with a marketed pediatric suspension. **Methods:** The FDTs were prepared based on the drug release profile from a suspension marketed for pediatric use. Design-Expert (version 13) was used to optimize and validate the prepared formulation. The HPLC method was designed and validated to ensure the accuracy and reliability of the analytical results claimed in the proposal. **Results:** The calibration curve was linear with a regression coefficient, $R^2 = 0.9998$. The method accuracy was between 97.68%–99.99% across three concentration levels (50, 100, and 150%), with a %RSD of 0.306–1.18% (Limit $\leq 2.0\%$). The in vitro drug-release profiles of the FDTs showed similarity to those of the innovator suspension, achieving $\geq 85\%$ ($n=6$) drug release within 5 minutes ($F_2 = 88.36 \pm 1.86$; $F_9 = 97.67 \pm 1.55$). Although ANOVA indicated statistical significance at certain time points when $p < 0.05$ ($p = 0.0007$ for F_2 ; $p = 0.001$ for F_9), similarity factor f_2 values of 67.03 and 57.64 for F_2 and F_9 , respectively, against CEF1 supported overall dissolution similarity. **Conclusion:** It was concluded that the formulated tablets can provide a patient-friendly system with equivalent dissolution profiles comparable to the marketed cefixime suspension. The findings demonstrated the potential of FDTs to enhance treatment adherence by reducing the risk of dose inaccuracies and improving the ease of administration and stability. The proposed approach may serve as a basis for future pilot-scale development to verify the claimed results.

Keywords: Cefixime trihydrate, Fast-dispersing tablets, patient-centric tablet, superdisintegrants, DD Solver, Design Expert.

Phytochemical Analysis And Antifungal Efficacy Of Mangifera Indica Leaves And Seeds Extract Against Malassezia Globosa And Restricta For The Management Of Dandruff In Humans

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Dandruff is one of the most common scalp disorders worldwide and is primarily associated with the overgrowth of *Malassezia globosa* and *Restricta* a lipophilic fungus that causes scalp irritation, itching, inflammation, and excessive flaking. Although synthetic antifungal agents are commonly used for dandruff treatment, their prolonged use may result in adverse effects and the emergence of antifungal resistance. Therefore, there is an increasing interest in plant-based alternatives with improved safety and therapeutic potential. *Mangifera indica* L. (mango), a medicinal plant belonging to the family Anacardiaceae, is rich in bioactive phytochemicals such as flavonoids, phenolics, tannins, alkaloids, saponins, and terpenoids, which possess well-documented antimicrobial and antifungal properties. The present study aims to evaluate the antifungal efficacy of methanolic extracts of *Mangifera indica* leaves and seeds against *Malassezia globosa* and *Restricta* to characterize their phytochemical constituents. Plant

materials will be collected, shade-dried, powdered, and extracted using methanol. Different extract concentrations (15, 30, 60, and 90 mg/mL) will be prepared and assessed for antifungal activity using the agar well diffusion method on Potato Dextrose Agar (PDA). *Malassezia globosa* isolated from dandruff samples will be cultured under appropriate laboratory conditions, while ciprofloxacin will serve as the positive control according to the study protocol. Zones of inhibition will be measured to determine antifungal effectiveness. Preliminary phytochemical screening and GC–MS analysis will be performed to identify major bioactive compounds present in the extracts. The findings of this study are expected to provide scientific evidence supporting the traditional use of *Mangifera indica* in dandruff management and identify phytochemicals responsible for its antifungal activity. The study may contribute to the development of a safe, effective, and affordable plant-based formulation for controlling dandruff caused by *Malassezia globosa*.

Keywords: *Mangifera indica*, *Malassezia globosa* and *restricta*, Dandruff, Antifungal activity, Phytochemical analysis, GC–MS, Medicinal plants.

Spatiotemporal Analysis of Land Use Land Cover Change and Its Influence on Water Quality and Trophic Conditions of Rawal Lake

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The increasing population growth experienced by the world in the last few years has resulted in enormous pressure on freshwater resources. Pakistan being a developing country is experiencing a major freshwater crisis. Rawal Lake, an important freshwater reservoir adjacent to Islamabad has shown evidence of ecological and hydrological deterioration over the past few years. The aim of the study is to ascertain the alteration of the Land Use and Land Cover (LULC) in Rawal Lake catchment area as well as to assess the trophic condition and the water quality of the lake. In this study, a geospatial approach where multi-temporal Landsat images of 2000, 2010, 2020, and 2024 are applied to extract spatiotemporal dynamics of LULC through Maximum Likelihood Classification (MLC) and Normalized Difference Water Index (NDWI) in the catchment. To determine the water quality of the lake, different physicochemical parameters were analyzed and samples of the water were taken from twenty sampling points all distributed in the lake. The LULC analysis revealed that there was a considerable decrease in water bodies (2.3% of the total area in 2000 to 1.1% of the total area in 2024) and vegetation cover (51.3% of the total area in 2000 to 40.2% of the total area in 2024). Meanwhile, the built-up area massively grew by 23.1% in 2000-2024. The analysis of the water quality revealed severe enrichment of the nutrients and eutrophication of the critical physio-chemical parameters. The phosphorus (P) concentration is 19.21ug/L in the form of orthophosphate, the nitrogen (N) concentration is 10.408ug/L in the form of nitrates and the chlorophyll-a (Chl-a) concentration was 32 ug/L as well, which means that the algal biomass was high. The transparency of water in terms of the Secchi disk (SD) was appalling at 0.5 meters signifying poor water quality. The value of Carlson Trophic State Index (CTSI) calculated as 67.3 indicate that Rawal Lake is in eutrophic state, a fact that indicates how

intense the enrichment of nutrients in the ecosystem and the lack of balance. These results reveal the imminent necessity of combined land use and water quality administration approaches to reduce deterioration of Rawal Lake.

KeyWords: LULC, NDWI, Trophic levels,

A DFT study of vacancy-ordered lead-free double inorganic perovskites Na₂PtA₆ (A = Cl, I) for sustainable technologies

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The structural, optoelectronic, mechanical, and thermoelectric properties of Na₂PtA₆ (A = Cl, I) for renewable energy applications were examined using Density Functional Theory (DFT) calculations. Structural and thermodynamic stabilities were confirmed through the Birch-Murnaghan equation of state, cohesive energy, and formation energy. The compounds exhibit ductility, as indicated by structural parameters and elastic constant analysis. The calculated direct band gaps of 2.50 eV for Na₂PtCl₆ and 2.18 eV for Na₂PtI₆ suggest effective light absorption in the visible and ultraviolet ranges, making these materials suitable for solar cell and optoelectronic applications. Thermoelectric properties were analyzed using the Boltztrap code, based on the semi-classical Boltzmann transport equations (BTE). Electrical and thermal conductivities, Seebeck coefficient, power factor, and figure of merit (ZT) were calculated across temperature, carrier concentration, and chemical potential variations. This study indicates that Na₂PtA₆ (A= Cl and I) holds significant promise as a thermoelectric material for power generation devices over a wide temperature range in the future.

Water Quality Effect of Various Flooring Treatments on Physiology, Hematology and Blood Biochemistry of Desi Goat (*Capra aegagrus hircus*) Under Feedlot Production System

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Background: Animals habitually choose a floor with minimal heat loss and low thermal conductivity, for instance straw bedding or mattresses. The wellness of the animals is primarily shown in the form of their behavior, physiological, biochemical and hematological responses. Hence, the perfect floor should be hygienic, easy for the animals, dry, resilient, and temperature resistant. Goats are typically regarded as the main source of meat production in developing nations, particularly those in South-East Asia and Africa.

Objectives: The main objective of present study was to ascertain in what way the type of floor has an impact on the body weight, blood profile in addition to serum biochemistry of goats. This

study aided to develop technical guidelines for planning proper housing facilities for growing desi goat (*Capra aegagrus hircus*).

Methodology: The Bahawalpur district of Punjab was selected for current study. 21 desi male goats (*Capra aegagrus hircus*) having age of 1 year were selected and categorized into three groups, 7 animals each. Each group provided with different floor named ground (T1), wooden (T2) and plastic (T3) for a term of 3 months from February to May 2023. Goats jugular veins were used to draw blood at the interval of 15 days. These blood samples were used for hematological (RBC, Hb, PCV etc) and biochemical (glucose, albumin, total protein etc) analyses. For physiological parameter goats body weight was measured after every two weeks using a digital electronic weighing scale.

Results: The study developed no significant change in body weight of desi goats enrolled in three groups ($P > 0.05$). Lymphocytes were significantly increased in blood samples of desi goats of group T2 with wooden floor collected at 0th day ($P = 0.01$). A significant rise in white blood cells ($P = 0.001$), monocytes ($P = 0.02$), Lymphocytes ($P = 0.002$), Red blood cells ($P = 0.006$), hemoglobin ($P = 0.004$), hematocrit ($P = 0.002$) and mean cell volume ($P = 0.006$), urea ($P = 0.02$) was observed in group T2 at 15th day of experiment. At 15th day it was observed that albumin ($P = 0.02$) in group T1 was significantly high. Significantly increased hemoglobin ($P = 0.006$) and alanine phosphate ($P = 0.05$) level was also observed on 30th day of experiment in group T2. Aspartate aminotransferase ($P = 0.03$) was significantly decreased in group T2 at 45th day of experiment. Significantly increased lymphocytes observed in group T1 with ground floor at 60th day ($P = 0.05$). Alanine phosphate ($P = 0.01$) in group T2 while Creatinine ($P = 0.04$) was significantly high in group T3 at 60th day. Uric acid ($P = 0.05$) was significantly decreased in group T1 at 75th day of experiment. No significant change in leukocytes observed in group T3 with plastic floor in whole experiment. Parameters including mean corpuscular hemoglobin, triglycerides, total protein, mean corpuscular hemoglobin concentration, glucose, cholesterol, high density and low density lipoprotein ($P > 0.05$) remained unaffected when compared among three groups during the time period.

Screening, Characterization and Quantification of Polyphenolic Compounds from Medicinal Plants for Functional Food Industries

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Aboriginal medicinal flora of dessert is widely recognized for their ethnomedicinal significance and pharmacological potential, distributed across Rahim Yar Khan. Study was focused on phytochemical profiling of polyphenolic compounds and their antioxidant activities in selected plant species for their food application as Nutraceutical/ functional foods. Comprehensive

profiling and tentative identification of polyphenolic compounds were also performed using LC-ESI-QTOF-MS/MS analysis. Among the evaluated species, total phenolic content was observed highest in Acacia plant species ranged from 150-157 mg GAE/g. Flavonoids and total condensed tannins were exhibited highest quantity. The radical scavenging activities (DPPH, ABTS) were observed in range from DPPH 311 mg AAE/g and ABTS 64.0 mg AAE/g. These results of antioxidant assays demonstrated that plants with higher TPC had a stronger antioxidant activity. Compound identification analysis tentatively identified 52 polyphenolic compounds including phenolics (18), flavonoids (22), lignans (2), stilbenes (1) and other polyphenols (9). Current study findings highlight the potential of Australian Aboriginal medicinal plants as potential source of polyphenolic compounds and may suggest their potential applications as functional ingredients in food industries.

Keywords: Aboriginal medicinal flora, plant-derived antioxidants, Bioactive compounds, Fabaceae, Polyphenols, LCMS-QToF

Gas Chromatography-Mass Spectrometric Analysis And Selected Biological Activities Of Different Solvent Extracts Of *Asparagus Capitatus Baker*

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Medicinal plants are rich natural reservoirs of bioactive compounds with significant therapeutic effects. This study investigated the chemical profile and bioactive properties of *Asparagus capitatus Baker*, a medicinal plant native to Kohat, Khyber Pakhtunkhwa, Pakistan. Plant material was extracted using Soxhlet extractor with different solvents including methanol, acetone, ethyl acetate, chloroform and n-hexane. Gas chromatography–mass spectrometry (GC–MS) analysis was performed for the identification of chemical constituents of each extract, which revealed diverse classes of chemical compounds including terpenoids, fatty acids and their derivatives, aldehydes, ketones, alkanes, alkenes, alkynes, phenolic compounds, epoxides, halogenated compounds, ethers, oxygen- and nitrogen-containing heterocycles, fatty acid methyl esters, aromatic esters and long-chain alcohols. The major compounds identified were *cis,cis,cis*-7,10,13-Hexadecatrienal (10.32%) in the methanolic extract, *cis,cis,cis*-7,10,13-Hexadecatrienal (19.96%) in the acetone extract, 9,12,15-Octadecatrien-1-ol, (Z,Z,Z)-(12.10%) in the ethyl acetate extract, Phosphoric acid, tris(2-ethylhexyl) ester (58.80%) in the chloroform extract, and Benzyl Benzoate (47.15%) in the n-hexane extract. Most of the identified compounds have been reported to possess antimicrobial and antioxidant activities. The antioxidant capacity of the plant extracts was measured through DPPH, ABTS and FRAP assays. In the DPPH assay, the free radical scavenging activity of THE extracts followed the order: Methanol (86%) > Ethyl Acetate (81.86%) > Acetone (78%) > Chloroform (76.29%) > n-hexane (69.42%). Similarly, ABTS radical scavenging activity was highest in the methanolic extract (98.43%), followed by ethyl acetate (95.14%), acetone (92.57%), chloroform (85.71%), and n-hexane (83.86%). The FRAP assay showed reducing power in the order: Ethyl Acetate > Acetone > Methanol > Chloroform > n-hexane. Antimicrobial activity was tested against *Staphylococcus aureus*, *Klebsiella pneumoniae* and

Candida albicans strains using the agar well diffusion method. The extracts exhibited strong inhibitory action at concentrations ranging from 25 to 400 µg/mL. The results demonstrate that *A. capitatus* is a rich source of biologically active phytochemicals with promising antioxidant and antimicrobial activities, supporting its traditional medicinal use. This study provides a foundation for future work on isolating active compounds and developing plant-based drugs.

Keywords: *Asparagus capitatus* Baker, GC-MS analysis. Antioxidant activity, Antimicrobial activity

First-principles investigation of optoelectronic, thermoelectric, and mechanical properties of double perovskites K_2AgGaX_6 ($X = I, Br$) for energy harvesting applications

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Potassium-based perovskites have significant potential to advance renewable technology through the development of eco-friendly devices. A comprehensive analysis of the structural, electronic, optical, transport, and mechanical properties of the double perovskites K_2AgGaX_6 ($X = I, Br$) was performed using the Wien2K code. Stability was confirmed by examining optimization curves, tolerance factors, and formation enthalpies, while AIMD simulations further validated the thermodynamic stability of both compounds. Electronic band structure analysis shows that K_2AgGaI_6 has a bandgap of 1.75 eV, which decreases to 1.24 eV for $K_2AgGaBr_6$. Optical properties, evaluated using the Kramers-Kronig relations, reveal strong absorption across the visible spectrum for both materials, making them suitable for photovoltaics and optoelectronics. Thermoelectric properties, calculated using the Boltzmann semi-classical approach, indicate high ZT values, supported by elevated Seebeck coefficients and electrical conductivities, demonstrating potential for renewable energy applications. The mechanical analysis confirms ductility, stiffness, anisotropy, and high melting points. Overall, this study provides theoretical evidence that these perovskite compounds are promising candidates for green energy harvesting.

Next-Generation Universal Influenza Vaccines: Broad-Spectrum Immune Targets

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The development of next-generation universal influenza vaccines is based on the assumption that wide-ranging immunity will be produced by targeting conserved viral antigens or those with little sequence variation in the entire range of circulating influenza strains. Two antigenic determinants have become of special interest in this regard: the extracellular domain of matrix protein 2 (M2e) and the stalk region of hemagglutinin. Both are highly conserved and play critical roles in the infectivity and replication of the virus, thus making them resistant to the antigenic drift and shift that can render the current seasonal vaccines less effective. Recent developments

in nanoparticle-based delivery systems have significantly improved the immunogenicity of these epitopes by enhancing the stability of antigens, independent release, and optimal presentation of antigens to the immune system. The resulting immunological environment is one of strong humoral and cellular immune responses, in particular, the generation of broadly neutralizing antibodies and the recruitment of cytotoxic T lymphocytes that can attack various strains of influenza. In addition to systemic immunity, there has been immense focus on the induction of mucosal immunity with the help of intranasal vaccination. The initial line of defense is the mucosal defenses, specifically secretory IgA antibodies and resident memory tissues situated in the respiratory mucosa, which neutralize the virus particles at their point of entry, thus reducing the infection as well as further infection. The combination of conserved antigen targets with nanoparticle-mediated delivery models and mucosal immunization approaches is likely to overcome the drawbacks of conventional vaccines. This is a versatile strategy that not only enhances the protective range but also increases the longevity and total effectiveness of the immune response. Overall, this review summarizes the current advances in the field of conserved antigen detection, nanoparticle vaccines, and mucosal immunization approaches and highlights the combination of these systems to achieve actual universal influenza vaccines. Such innovations constitute a significant milestone towards effective, broad-spectrum influenza prophylaxis, which can swiftly adapt to emerging viral strains, ultimately reducing the impact of influenza worldwide.

Keywords: Universal influenza vaccine, Broad-spectrum immunity, conserved viral antigens, Matrix protein 2 ectodomain (M2e), Hemagglutinin stalk domain, Nanoparticle-based vaccine Delivery

Vegetation Dynamics as a Determinant of Ecosystem Resilience under Global Climate Change

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Vegetation dynamics are central to ecosystem resilience, mediating the capacity of terrestrial systems to withstand and recover from climate-induced disturbances. Recent global analyses using remotely sensed vegetation indices and resilience metrics demonstrate that vegetation resilience is closely associated with water availability. Higher resilience is typically observed in regions with greater precipitation and lower inter-annual variability. However, increased precipitation variability, temperature extremes, and anthropogenic pressures have led to widespread declines in resilience, particularly in tropical, arid, and temperate regions. Over 60% of global ecosystems have shifted from increasing to declining resilience trends in recent decades. Future projections under high-emission scenarios (SSP5-8.5) suggest that resilience loss will intensify, particularly in cold and equatorial regions. Vegetation growth, as measured by NDVI

and LAI, has generally increased in many regions, yet this does not uniformly translate to enhanced resilience. In equatorial and high-latitude ecosystems, resilience degradation occurs despite greening trends, highlighting the complex interplay between vegetation productivity and system stability. The time-lag and accumulation effects of climate drivers—such as temperature, precipitation, and solar radiation—play a critical role in shaping vegetation responses. These lag periods can range from less than a month to several months, depending on vegetation type and prevailing climatic conditions. Human activities, such as land use change and grazing, exert spatially heterogeneous impacts on ecosystems. In some cases, these pressures can offset or even reverse the positive effects of climate amelioration. Modeling studies and empirical evidence underscore the multidimensional nature of resilience, with metrics such as recovery rate, autocorrelation, and variance capturing different aspects of ecosystem response. Notably, forests with historically high disturbance regimes may retain resilience longer but are also at greater risk of abrupt regime shifts under escalating climate stress. These findings emphasize the urgent need for adaptive management and climate mitigation strategies to sustain ecosystem resilience in the face of accelerating global change.

Keywords: vegetation dynamics, ecosystem resilience, climate change, remote sensing, disturbance regimes

Structural, elastic, electronic, and optical properties of double perovskites Ba_2NaXO_6 ($X = \text{Br}, \text{I}$) for Optical gadgets; A DFT Study

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The structural, elastic, electronic, and optical properties of double perovskites Ba_2NaXO_6 ($X=\text{Br}, \text{I}$) were investigated through first-principles calculations. The results show that all three compounds exhibit stable mechanical and dynamical properties, with anisotropic elastic behavior. These materials are direct bandgap semiconductors, with bandgap values of 0.61 eV (2.43 eV), and 2.38 eV (4.09 eV) for PBE (HSE06), respectively. The electron localization function (ELF) was used to analyze their internal chemical bonds and electronic characteristics. In terms of optical properties, all three materials show strong absorption and photoconductive behavior in the UV region. Among these compounds, $\text{Ba}_2\text{NaBrO}_6$ demonstrates the most favorable photovoltaic performance and conversion efficiency, making it a promising candidate for optoelectronic applications in the UV region.

Do Financial Inclusion and Energy Efficiency Determine Environmental Quality in Pakistan

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This study will investigate the impact of financial inclusion, and energy efficiency on environmental quality along with other factors in Pakistan from 1990 to 2024, using the Auto-Regressive Distributed Lag (ARDL) method. It is expected that the impact of both energy efficiency and financial inclusion will be positive on environmental quality. Whereas both the trade openness and GDP growth rate are hypothesized to cause higher levels of pollution thereby causing environmental degradation. On the Basis of the findings, the policymakers will be recommended to design such strategies that can promote financial inclusion, and energy efficiency vis-à-vis economic growth and trade policies should be aligned with objective of environmental sustainability and maintenance of cleaner environment in Pakistan.

Keywords: Financial inclusion, Trade openness, Energy efficiency, Environmental quality, Economic growth

Network-Based Bioinformatics Approaches for Unraveling Nutrient Transport Pathways in Plants

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Nutrient transport is a fundamental process that influences plant growth, stress adaptation, and crop yield. Understanding the complex interactions governing nutrient uptake, translocation, and signaling is crucial for developing strategies to improve plant nutrition efficiency. In this study, we employ network-based bioinformatics approaches to reconstruct and analyze plant nutrient transport pathways, integrating multi-omics datasets, including transcriptomics, proteomics, and metabolomics. Using publicly available databases and experimentally validated transporters, we constructed a gene- protein-metabolite interaction network focusing on key macronutrients (N, P, K) and micronutrients (Fe, Zn). Graph theory-based network analysis identified highly connected hub genes and regulatory modules, highlighting critical transporters and signaling components. Co-expression and functional enrichment analyses revealed candidate genes involved in crosstalk between nutrient stress responses and hormonal regulation. Additionally, machine learning algorithms were applied to predict novel transporters based on structural and evolutionary similarities. Comparative analysis across plant species provided insights into conserved and species-specific transport mechanisms. This system's biology approach offers a holistic perspective on nutrient transport, enabling targeted genetic modifications and precision breeding for improved nutrient use efficiency. Our findings provide a foundation for engineering crops with enhanced nutrient acquisition and resilience to soil nutrient limitations, contributing to sustainable agricultural practices.

Keywords: Bioinformatics, Nutrient Transport, Network Analysis, Systems Biology,

Advancing Inclusive English Language Pedagogy: A Qualitative Case Study of Differentiated Instruction and Understanding by Design in Pakistani Higher Education

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This qualitative case study is an instrumental study focused on how inclusion-based English language pedagogy can be developed through incorporation of Differentiated Instruction (DI) and Understanding by Design (UbD) among the undergraduate English language learners in Pakistani higher education. The research was carried out in Bahauddin Zakariya University (BZU) in Multan in a sample of 50 (40 students and 10 teachers). Semi-structured interviews were used to collect data and analyzed by means of thematic analysis. The findings indicate that the integration of DI and UbD had a great benefit to students as it allowed the organization of instruction content, process and products to meet the preparedness, interests and the learning profile of the learners. Such a dynamic strategy resulted in a more active student participation, their confidence and enhanced knowledge of English language, and was seen as more accommodating and efficient when compared to the old-treated teaching in one size. Nonetheless, there were issues encountered during implementation including huge classes, lack of teacher training and rigidity in institutional curricula. Regardless of these challenges, the participants believed that the DI-uBd strategy has a high potential in the long run, particularly when institutional changes are supportive, professional help is provided continuously, and technology is incorporated. Comprehensively, the research results in the conclusion that environmentally sound practices of DI-uBd may create more equitable, student-centered, and context-relevant teaching of English language in Pakistan.

Keywords: Differentiated Instruction (DI), Understanding by Design (UbD), Inclusive Pedagogy, English Language Teaching (ELT), Higher Education; Academic Diversity, Pakistan

Mitigating SARS-CoV-2–Exacerbated Neuroinflammation and Alzheimer’s Pathology: Synthesis of Quinoline-Based Dual Inhibitors Targeting Cysteine and Aspartyl Proteases

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Viral and neurodegenerative proteases, such as the cysteine protease and aspartyl protease, offer strategic targets in a multi target therapeutic approach for Alzheimer’s disease, especially when viral infection may exacerbate neurological degeneration. To establish a multi target

therapeutics for treating Alzheimer disease, we chose β -secretase (BACE-1), an aspartyl protease, and the SARS-CoV-2 main protease (Mpro), a cysteine protease, as dual targets. In search of BACE-1 and Mpro inhibitors, a set of novel quinoline-4-carboxamide derivatives (2a-k, 3a-c, 4a-d, 5a-c, 6a-c) was synthesized using the Suzuki coupling reaction in good to excellent yields. All the synthesized compounds were screened in vitro for their potential inhibitory activities against two proteases. Compounds 2e, 6b, and 6c emerged as dual inhibitors of both proteases. Furthermore, a kinetic study revealed the mechanism of BACE-1 inhibition by compound 6c. Safety profiling of the most potent dual inhibitor 6c was performed via an in vivo acute cytotoxicity assay on Swiss albino mice. Molecular docking studies were conducted against aspartyl protease (2HM1) and cysteine protease (6XHM) to elucidate the binding interaction of synthesized quinolone derivatives. The compound 6c exhibited strong binding affinities through multiple hydrogen bonds, π -Sulphur and π - π stacking interactions, within key subpockets of both targets, supporting inhibitory potential. These studies revealed that the lead compound 6c could be a good drug candidate with further structural modifications.

Keywords: Aspartyl protease, cysteine protease, Quinoline, Suzuki coupling, Alzheimer's Disease

Greening or Grinding: Unpacking the Environmental Impact of Globalization in Eurasia

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This study investigates the impact of globalization (GL), ecological footprint (EFP), natural resources (NR), and total reserves (TR) on environmental crisis (EC), examining 84 Eurasian nations from 1991 to 2021 through a comprehensive index integrating CO₂ and GHG emissions metrics and leveraging dependency theory. Employing a robust methodological approach combining parametric and non-parametric methods, the analysis reveals that GL and NR negatively correlates with EC, while EFP and TR positively correlates with EC. The effects of globalization dimensions encompassing economic globalization, political globalization, and social globalization on EC vary across developed and developing economies. Introducing an innovative environmental crisis index, the research uncovers complex relationships between globalization and environmental sustainability, offering guidance for policymakers to reduce EC through resource-independent, low-carbon pathways. While the findings are limited to Eurasian nations, future studies could extend this analysis for broader applicability. The study provides practical insights for fostering sustainable economies and mitigating EC, supporting global initiatives to decrease CO₂ and GHG emissions and promoting healthier environments and sustainable living conditions worldwide.

Keywords: Environmental Crisis, Ecological Footprint, Natural resources, Total Reserves, Globalization, Dependency Theory.

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.

Assessing the Differences between Agriculture Techniques and Indigenous Farming Practices: A Study on Crop Productivity and Sustainability

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This study examines the differences between modern agricultural techniques and farming practices, with a focus on their impacts on crop productivity and long-term sustainability. Using wheat, chana, makai, ganna, and mongi (local names) as representative crops, the research compares input requirements, soil health outcomes, water use efficiency, and yield patterns across both systems. Findings indicate that modern techniques generally enhance short-term productivity through high-yield varieties, chemical inputs, and mechanization, while indigenous methods prioritize ecological balance, resilience, and resource conservation. The study highlights how traditional practices such as mixed cropping, organic soil amendments, and water-conserving cultivation contribute to sustained productivity under variable climatic conditions. Overall, the research underscores the potential for integrated approaches that combine the efficiency of modern methods with the sustainability of indigenous knowledge to support both food security and environmental health.

The agricultural sector in Pakistan is a significant contributor to the country's economy, with crops such as wheat, chana (chickpea), Makai (maize), Ganna (sugarcane), and mongi (mung bean) being major players. However, the sustainability of these crops is threatened by the widening gap between technical agricultural techniques and indigenous farming practices. This study aims to assess the differences between these two approaches and their impact on crop sustainability. Technical agricultural techniques involve the use of modern machinery, high-yielding varieties, and chemical fertilizers, which can lead to increased yields but also contribute to environmental degradation and soil fertility decline. In contrast, indigenous farming practices, passed down through generations, emphasize the use of local varieties, organic fertilizers, and traditional irrigation systems, promoting soil conservation and biodiversity. The study focuses on the Bhakkar region, where these crops are commonly grown, and evaluates the effects of technical and indigenous practices on crop yields, soil health, and water usage. Results show that while technical practices increase short-term yields, indigenous methods promote long-term sustainability and environmental stewardship.

Mealworms (*Tenebrio molitor* L.) as a Substituent of Protein Source for Fisheries and Aquaculture: A Mini Review: Mealworms as a Substituent of Protein Source

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Development of aquaculture and fisheries depend on the availability of sustainable feed sources. Using insects is one new option that is gaining popularity. The high protein content, rapid growth and little environmental impact of yellow mealworms have made them an appealing solution. Mealworms contain a substantial protein content (47-64%), essential amino acids, energy-dense lipids, and vital micronutrients, making them a viable substitute for traditional protein sources in fisheries and aquaculture. Historically consumed in various cultures, Mealworms have gained attention for their economic and nutritional value. In aquaculture, they

enhance fish growth, feed efficiency, and overall health. Studies have shown that incorporating mealworm meal into fish diets improves immune functions, growth performance, and liver health, although excessive inclusion may have adverse effects. The nutritional content of mealworms can be optimized by adjusting rearing conditions, diet, and developmental stage. The European Union approval of mealworms for human consumption further validates their safety and potential as a sustainable protein source. This review emphasizes the nutritional benefits of mealworms as a substitute for fishmeal, addressing protein shortages and environmental concerns associated with traditional feed production. By integrating mealworms into aquaculture, we can significantly improve sustainability, economic efficiency, and global food security.

Keywords: Sustainable Feed Sources, Aquaculture, Yellow Mealworms, Fishmeal Substitute, Environmental Impact

Development of Nanomaterial-Based Portable Sensors for Detecting Trace Environmental Pollutants

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The escalation of industrial and urban activities has led to increased release of trace environmental pollutants, such as heavy metals, (VOCs), and fine particulate matter, which pose serious threats to both human health and ecosystems. Conventional laboratory-based detection methods, although precise, are often time-consuming, expensive, and unsuitable for on-site monitoring. This study explores the design and development of portable sensors utilizing nanomaterials for rapid, sensitive, and selective detection of trace pollutants in air, water, and soil. Nanomaterials including graphene, carbon nanotubes (CNTs), metal oxide nanoparticles (ZnO, TiO₂), and noble metal nanoparticles (Au, Ag) are employed due to their high surface-to-volume ratio, excellent electrical conductivity, and customizable surface properties, which significantly enhance detection capabilities. For instance, graphene-based electrochemical sensors have successfully measured lead (Pb²⁺) and cadmium (Cd²⁺) ions in water at sub-parts-per-billion (ppb) levels, while CNT-based chemiresistive devices enable real-time detection of NO₂ and NH₃ in ambient air. The portable prototypes incorporate microcontrollers and wireless data transmission for on-site analysis and remote monitoring. Experimental results confirm rapid response, reproducibility, and selectivity against interfering species, demonstrating the potential of nanomaterial-enhanced sensors as efficient tools for environmental monitoring and pollution management.

Keywords: Portable sensors (CNTs), Graphene-based sensors, Real-time detection

Representation of Gender Identity Crisis in Pakistani Society: A Critical Discourse Analysis of Durrani's My Feudal Lord

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Women have always suffered from patriarchal power abuse, identity crisis, marginalization, oppression and segregation. The researchers probe the suppression and subjugation of women in Pakistani society with reference to Tehmina Durrani's autobiography *My Feudal Lord* (1995). In this research, the researcher's objective is to identify the gender identity crisis and the sort of oppressions that are faced by the women in Pakistani society. For this purpose, the researcher has chosen five extracts from the selected narrative through purposive sampling technique. The nature of this research is qualitative in which the selected extracts have been analyzed through Fairclough's three-dimensional model of critical discourse analysis (1995). This study's findings reveal that women in Pakistan are oppressed, marginalized, subjugated and their identity is challenged. By taking gender discrimination and women oppression into consideration, this research brings to the fore the fact that Pakistani women are marginalized and considered as sex objects and marriage is emphasized as the only social identity in the life of a woman.

Keywords: Identity Crisis, Marriage, Marginalization, Critical Discourse Analysis, Gender Discrimination, Oppression

The Effects Of Bacteria-Based *Serratia Marcescens* Biofertilizer On Maize Seedlings Growth In Bpa Contaminated Soil

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Bisphenol A (BPA) is an emerging environmental pollutant that adversely affects plant growth and physiology. In the present study, maize plants were subjected to BPA stress (100mg) and treated with different remediation strategies, including *Serratia marcescens*, biochar and their combination as a biofertilizer. Plant growth parameters such as roots and shoots length, fresh biomass and antioxidants enzymes activities (SOD, POD, CAT, and H₂O₂) were evaluated. Results revealed that BPA stress significantly reduced roots and shoots growth, as well as fresh biomass compared to the control. *Serratia marcescens* and biochar individually improved plant performance under BPA toxicity, while their combined application as a biofertilizer showed the most pronounced effect. Biofertilizer treatment not only enhanced root length and root fresh weight but also increased shoot growth surpassing the control. Under BPA stress, biofertilizer application mitigated toxicity, restoring root and shoot biomass close to control levels. Enhanced antioxidants enzyme activities in biofertilizer treated plants further demonstrated their protective role against oxidative stress induced by BPA.

KeyWords: Bisphenol A, *Serratia marcescens*, Biofertilizer, Biochar, Antioxidants Enzymes.

Does FDI inflow insecure workers in developing countries? Evidence from a two-step system GMM estimation

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This study investigates the effects of Greenfield Foreign Direct Investment (GFDI) inflows on labor market volatility in 100 developing countries. Our goal is to examine whether GFDI increases labor market volatility and thereby workers economic insecurity and provide support to the idea behind compensation hypothesis. The hypothesis suggests that economic openness increases government size by increasing the economic insecurity of workers. To that goal, we built a data set (2003-2019) that merges data on the level of employment from Penn World Table, country economic and institutional indicators from World Development Indicators and World governance indicators, and data on GFDI from the United Nations Conference on Trade and Development. By applying the two-step system GMM estimation technique, we find that GFDI contributes to economic insecurity by increasing employment volatility in developing countries thus provide support to the existence of compensation hypothesis. Further, we find that population density and output volatility have a positive effect on employment volatility while government expenditure and political stability have a negative effect.

Keywords: Greenfield FDI, Labor market volatility, Employment, Government Expenditures, Population density.

Characterization of TetM and FosX multi-drug resistant genes in *Listeria monocytogenes* isolated from canned food samples

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Listeria monocytogenes is a critical foodborne pathogen implicated in severe infections and is increasingly exhibiting antibiotic resistance, presenting a public health challenge. The aim of this study was to detect the presence of *Listeria monocytogenes* in canned food samples and to identify antibiotic resistant genes tetM and fosX. A total of 30 canned and retailed food samples comprising canned mushrooms, retailed chicken, milk, and canned pineapple were collected for analysis. Isolation and biochemical identification of *L. monocytogenes* were conducted using standard microbiological techniques. Additionally, antibiotic susceptibility testing was performed via the Kirby-Bauer disk diffusion method as per CLSI guidelines. Molecular detection of the tetM and fosX genes was carried out using DNA extraction, PCR amplification, and genome sequencing.

Listeria monocytogenes isolates were successfully isolated from 55.33% of canned food samples. Nine antibiotics were tested on the positive samples and then 16S rRNA sequencing was performed. Phenotypic resistance to tetracycline corresponded with the molecular detection of the tetM gene in 100% positive isolates. The fosX gene was not detecting any isolate. Other antibiotics, including amoxycillin, meropenem, gentamicin, chloramphenicol, and ciprofloxacin, retained high efficacy against the isolates. The presence of tetM highlights the potential for tetracycline resistance dissemination in foodborne *L. monocytogenes*. Overall, the data suggest that canned foods could serve as reservoirs for antimicrobial resistance genes. Continued molecular surveillance and phenotypic testing are vital to monitor emerging resistances. The detection of the tetM gene confirms tetracycline resistance in *L. monocytogenes* from canned foods, posing a possible public health risk. Ongoing surveillance and strict food safety measures are essential to control the spread of resistant *Listeria* strains.

Keywords: *Listeria monocytogenes* (*L.monocytogene*), Polymerase chain reaction (PCR)

Isolation of lactic acid bacteria from raw cow milk samples collected from Bhakkar district

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Raw cow milk is a rich source of beneficial microorganisms, especially lactic acid bacteria (LAB), which are essential for dairy product fermentation and contribute significantly to human health. This study was conducted to isolate and characterize LAB present in raw cow milk samples collected from the Bhakkar district of Punjab, Pakistan. A total of 20 raw milk samples were aseptically collected from lactating cows at local dairy farms and households during the period from March to May 2025. The samples were processed using standard microbiological techniques, including serial dilution and culturing on MRS agar under anaerobic conditions at 37°C. A total of 68 LAB isolates were successfully obtained and subjected to morphological, physiological, and biochemical characterization. The study identified isolates based on Gram staining, catalase reaction, cell shape, carbohydrate fermentation, temperature tolerance, and salt tolerance tests. The most prevalent genus was *Lactobacillus* (23.41%), followed by *Lactococcus* (23.53%), *Leuconostoc* (16.18%), *Enterococcus* (14.71%), *Pediococcus* (10.29%), and *Streptococcus* (5.88%). Fermentation tests showed all isolates could ferment glucose and lactose, with sucrose fermentation primarily observed in *Leuconostoc* and *Enterococcus*. Temperature tolerance test showed most isolates grew well at 15°C and 45°C. The findings of this study confirm that raw cow milk from the Bhakkar district is a valuable source of diverse LAB populations, particularly *Lactobacillus* species known for their probiotic and fermentation potential. This diversity not only reflects the natural microbial richness of raw milk but also highlights its potential for application in dairy fermentation and probiotic product development.

Keywords: Cow milk, Lactic acid bacteria (LAB), *Lactobacillus*, Bhakkar, fermentation

Microplastics as Emerging Contaminants in Freshwater and Marine Ecosystems: A Critical Review of Their Impact on Aquatic Food Web Dynamics

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Microplastics (MPs) have become the emerging contaminants in the aquatic resources, especially freshwater and marine, where they enter mainly through anthropogenic activities such as improper waste management and neglected MPs disposal mitigation strategies. Micro plastics, as very small particles of size less than 5 millimeters in dimension, enter the aquatic food chain at the lower trophic level (microalgae) and migrate, concentrate, and magnify towards the higher trophic levels (human, marine mammals, and sea birds) across the aquatic feeding networks. They become concentrated in the animal tissues and which has adverse effects on its health and transfers low energy to the next trophic level as they are consumed by their predator and ultimately reduces the energy flux in the ecosystem dynamics. MPs, as emerging pollutants, have adverse toxicological impacts on the health system, such as disturbance of the immune system, Oxidative stress, and nanoparticles induce cell membrane permeation. By understanding MPs' bio magnification mechanism and trophic transfer, we can ensure a stable aquatic system. To maintain the aquatic biodiversity and stable aquatic ecosystem resilience, we need to make conservation and mitigation strategies, policy making, and implementation, and raise their awareness about their adverse effects.

Keywords: Microplastics, Aquatic resources, Toxic impacts, Aquatic food web dynamics, Biomagnification, Disruptions

Real-World Case Studies Featuring Dermatologist Guidance in Comparison with AI Skincare Assessments (e.g., YourAIDerm)

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Introduction and Background: In the past few years, skincare assessment AI websites and software have risen ominously to provide virtual medical for common dermatological concerns such as YourAIDerm. AI is a valuable tool to assist dermatologists by enhancing diagnostic accuracy and clinical decision-making, but there are some challenges surrounding AI from under representation of skin of colour in datasets and issues with image quality and standardization. The accuracy of image-based AI tools is incumbent on images in training sets, which requires patient consent for sharing. Despite its potential, the ethical, clinical, and practical implications of its application remain insufficiently explored. In contrast to this perspective, traditional dermatological techniques observe proper clinical evaluations through guidelines and years of

specialized training in their domain. This paradigm shift towards technology-based skincare consultancy, leaves population with two simultaneous advisory paths.

Objective: AI is fast emerging in the field of dermatology. While it boasts great capabilities, it still faces some issues, such as its inability to perform any direct image analyses and the risk of inaccurate suggestions. AI still has insufficient

Psychosocial Predictors of Post-Migration Stress among Afghan Refugee Youth: Testing the Buffering Effect of Community Integration

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For over four decades, Afghan refugees in Pakistan have experienced displacement, socio-political marginalization, and cultural erosion. This protracted crisis has resulted in well-documented mental health challenges. However, the specific psychosocial experiences of young refugees during emerging adulthood remain critically understudied. This study examined the complex interplay between cultural bereavement, perceived discrimination, and post-migration stress among young Afghan refugees in Pakistan. Additionally, the study investigated how perceived discrimination mediates the relationship between cultural bereavement and post-migration stress, and the moderating role of community integration in this pathway. Purposive sampling was used to collect data from 141 English-speaking Afghan refugees (men = 60, women = 81; age range = 18–25 years) residing in Islamabad, Lahore, Karachi, Peshawar, and Quetta. The Cross-Cultural Loss Scale (Wang et al., 2015), the Everyday Discrimination Scale (Williams et al., 1997), the Community Integration Scale (McColl et al., 2001), and the Refugee Post-Migration Stress Scale–Revised (Malm et al., 2023) were used to measure study variables. Data were analyzed using SPSS Version 26, and the moderated mediation model was tested using the PROCESS macro. Findings revealed that cultural bereavement predicted post-migration stress both directly and indirectly through perceived discrimination. Furthermore, community integration moderated this pathway, such that higher levels of integration buffered the negative effects of cultural bereavement and perceived discrimination on stress. These results underscore the need for culturally grounded interventions that build on social support networks and community resilience. Such efforts should be integrated into local service-providing systems, including educational and mental health programs, to ensure sustainable support for refugee youth.

Keywords: cultural bereavement, perceived discrimination, post-migration stress, community integration, Afghan refugees, Pakistan

AI-Driven Predictive Nutrition: Integrating Metabolomics, Machine Learning, and Digital Phenotyping for Next-Generation Dietary Interventions

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Recent advances in artificial intelligence (AI) have transformed human nutrition and dietetics from empirical dietary assessment to data-driven precision nutrition. This research explores the innovative integration of metabolomic profiling, machine learning algorithms, and digital phenotyping to predict individual dietary responses and optimize nutrient interventions. A hybrid deep learning framework is proposed, combining convolutional and recurrent neural networks to analyze multi-layered datasets that include metabolomic biomarkers, gut microbiome diversity indices, and lifestyle digital traces captured through wearable devices. These AI models enable the identification of hidden nutritional patterns and metabolic phenotypes that are often undetectable through conventional statistical methods. Preliminary findings demonstrate that AI-based predictive nutrition systems can forecast glycemic variability and lipid metabolism responses with over 90% accuracy, facilitating the design of dynamic and adaptive meal plans for personalized health management. Moreover, the study addresses the ethical and translational challenges of implementing AI in clinical dietetics, emphasizing the need for transparent algorithms, equitable datasets, and cross-disciplinary collaborations between nutritionists, computer scientists, and healthcare practitioners. The integration of intelligent algorithms into dietetic practice has the potential to revolutionize preventive nutrition, metabolic disorder management, and public health policy design. This interdisciplinary framework situates AI not merely as a computational tool but as an evolving cognitive partner in advancing human nutrition science.

Keywords: Predictive Nutrition, Artificial Intelligence, Metabolomics, Digital Phenotyping, Precision Dietetics, Machine Learning

Political Corruption and Governance: Anti-Corruption Measures and Policy Gaps in Pakistan

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This research examines the persistent challenge of political corruption in Pakistan and evaluates the effectiveness of existing anti-corruption measures within the country's governance system. The study aims to identify key policy gaps that weaken institutional accountability and hinder transparency. It also seeks to understand how governance structures, public sector reforms, and institutional coordination shape the overall integrity framework in Pakistan. The research uses a qualitative methodology, drawing on policy documents, official reports, and academic literature.

A systematic review approach is employed to evaluate the performance of key anti-corruption institutions, including the National Accountability Bureau (NAB), provincial anti-corruption departments, and internal administrative mechanisms. The analysis focuses on governance dynamics, including political interference, bureaucratic discretion, weak oversight, and limited citizen participation. The findings indicate that, despite Pakistan having several anti-corruption laws and institutions, their impact remains limited due to inconsistent implementation, overlapping mandates, politicization, and gaps in monitoring and evaluation. The study also reveals that public awareness campaigns and digital governance reforms are gradually improving transparency, but structural challenges continue to undermine long-term progress. The research concludes that Pakistan needs a more coordinated and autonomous accountability system, stronger whistleblower protections, and enhanced parliamentary oversight. Strengthening institutional capacity and ensuring political neutrality emerge as essential steps toward building an effective national integrity system. The study highlights that sustainable anti-corruption reforms require not only legislative improvements but also a clear commitment to good governance, ethical leadership, and citizen engagement.

Keywords: Political Corruption, Governance, Anti-Corruption Measures, Accountability Mechanisms, Policy Gaps

Evaluation of methanolic extract of abutilon indicum on Pseudomonas isolated from urinary tract and Skin infection

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The resistance of emerging microbial strains against existing drug has become challenge for the scientific world to eradicate or inhibit the disease or growth of these bugs. This study aims to investigate the evaluation of methanolic extract of abutilon indicum on *pseudomonas aeruginosa* isolated from wound and urinary tract infections. The leaves of Abutilon indicum were collected, identified by the botany department and subjected to Soxhlet apparatus for extraction with methanol and then evaporated. The active phytochemical compounds against the Pseudomonas were found by High Performance Liquid Chromatography. The bacterial samples were collected from tertiary care hospital, isolated, and identified by standard microbiological practices and biochemical tests. The inhibitory effect of extract and the antibiotics against the Pseudomonas were determined by antimicrobial sensitivity testing following CLSI guidelines. The MIC and MBC values of extract and drugs were determined using CLSI guidelines to evaluate the bacteriostatic and bactericidal effect. The biofilm assay under Tecan spark microtiter plate reader was performed to demonstrate the inhibition of planktonic and biofilms produced by Pseudomonas. The overall findings described the presence of bioactive compounds such as quercetin, kaempferol, p coumaric acid and beta sitosterol and the zones of inhibition were up to 24mm were measured. The bacteriostatic and bactericidal values of extract were up to 25mg/ml and 12.5mg/ml for the extract. The values for antibiotic solution were different such as 512µg/ml,

256 µg/ml, 128 µg/ml. The resistance pattern of antibiotic disc revealed the bacteria to be XDR with MIC and MBC values were up high. The biofilm inhibition was reported to inhibit 58% of the microbial cells in biofilm and planktonic form. These conclusions suggest that the methanolic extract of *Abutilon indicum* was effective against *Pseudomonas* isolates with inhibitory and antibiofilm effect.

Keywords: AST, Soxhlet Apparatus, HPLC, Biofilm Inhibition Assay, *Abutilon indicum*

Understanding Knowledge Of The Farmers About Climate Smart Food System Practices: An Empirical Review

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The integration of climate-smart farming techniques has increasingly become essential for the sustainability of food systems, especially in regions prone to climate variability, such as the arid areas of Punjab. Groundnut producers, who are largely dependent on climatic conditions for their crop production, are confronting several challenges related to soil degradation, water scarcity, erratic weather phenomena and limited knowledge about climate smart food system. To this backdrop, it was unclear about knowledge of the farmers about climate smart food system. Therefore, the present study was designed to understand the current situation. The data were collected from 384 farmers, inhabitant of Chakwal District, through a structured and pre-tested research instrument. The collected data were analyzed through SPSS software. The findings reveal that farmers' understanding about Climate Smart Food System (CSFS) practices was moderate, with many only partially aware of practices such as drought-tolerant varieties, conservation tillage, and efficient irrigation. The farmers showed higher knowledge of basic practices like crop rotation though limited understanding of advanced methods, including drought-tolerant varieties and integrated pest management. Access to education, extension services, and timely climate information significantly affects their knowledge. While most of the farmers recognize the benefits of CSFS for productivity and profitability, gaps remained in technical knowledge, pest management, and disease control. Thus, it is suggested that groundnut farmers need to be equipped about climate smart food system through state of the art training programs. These findings may be useful for academia, researchers working on groundnut crop and its growers, policy makers and farmers.

Proliferation of Waterborne Diseases: A Comparative Analysis of drivers and Alleviation Strategies in Global and Pakistani Contexts

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Water contamination is emerging health crisis if not addressed properly .Climate change and inadequate infrastructure are major drivers of water contamination, leaving approximately 785 million people globally without access to potable waste. This crises aggravate in Pakistan where 70 % of population is vulnerable to natural hazard. Pakistan agriculture sector utilizes approximately 6 million tons of fertilizer and 50,000 tons of pesticides annually; during flood these chemicals discharged into local sewage system and river bodies. 2025 monsoon around 1000 water supply scheme are damaged make situation more alarming. Waterborne diseases cholera, diarrhea, Hepatitis A and E have significance influence on public health. In2024 alone 560,000 cholera cases were reported worldwide. Mortality rate of children is reach to 444,000 due to diarrhea .In specific context of Pakistan waterborne diseases account for 30% of all diseases and total 40% of total mortality and about 270,000 children lose their lives annually. 53,000 child death is due to diarrhea. In Rawalpindi 80,000 reported cases of waterborne disease and 4000 registered hepatitis cases .Despite the complexity of these challenges, mitigation is achievable at the individual level. Water boiling remains one of the simplest and most effective methods for eliminating microbial contamination. In addition, chlorination provides an affordable to disinfecting stored water, although its efficacy remains limited in removing dissolved heavy metals and salts. For more purification, low-cost multi-layer filtration systems; utilizing charcoal, sand, and a biological layer offer a sustainable method for significant pollutant reduction. However, the successful adoption of these techniques is hindered by a critical knowledge gap; studies indicate that limited health literacy is prevalent, with 65% to 75% of mothers lacking essential health literacy. Therefore, educational campaigns and awareness are necessary to reduce the incidence of waterborne diseases.

Synergistic Application of Rice Husk Biochar and Green-Synthesized Iron Oxide Nanoparticles for Enhancing Drought Tolerance in Wheat

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Wheat (*Triticum aestivum* L.) is a major cereal crop and a primary food source for millions of people worldwide. Its productivity is highly sensitive to abiotic stresses, particularly drought, which affects more than 50% of wheat-growing areas and significantly reduces both yield and grain quality. Climate change–induced water scarcity has further exacerbated this challenge, highlighting the need for sustainable and environmentally friendly mitigation strategies. This study investigates the potential of rice husk–derived biochar and green-synthesized iron oxide nanoparticles (FeO-NPs) to improve soil physicochemical properties and enhance drought tolerance in wheat. Rice husk biochar will be produced through controlled pyrolysis at 450°C and

500°C with a heating rate of 20°C for 4 hours. Detailed characterization will include analysis of pH, particle size distribution, porosity, moisture content, surface morphology, thermal stability, and other relevant physicochemical properties to optimize its performance as a soil amendment. FeO-NPs will be synthesized using pomegranate peel extract as a natural reducing and stabilizing agent, ensuring an environmentally friendly synthesis process. The structural and functional properties of the nanoparticles will be evaluated using UV–Visible spectroscopy, Fourier Transform Infrared spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM). A controlled pot experiment under induced drought stress will assess individual and combined treatments: Biochar (BC), FeO-NPs, and BC + FeO-NPs. Plant responses will be evaluated through morphological, physiological, and biochemical parameters, including antioxidant enzyme activity and proline accumulation. The integrated application is expected to improve soil water retention, nutrient availability, oxidative stress regulation, and overall wheat performance under drought conditions. This combined approach represents a sustainable and climate-adaptive strategy for enhancing wheat productivity under water-limited environments.

Keywords: Rice husk biochar, Iron oxide nanoparticles, Wheat, Drought stress, Green Synthesis

Evaluating Yield–Water Productivity Trade-offs in Rice under Continuous Flooding and Alternate Wetting–Drying Regimes

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Decreasing water availability in essentially irrigated rice systems of Pakistan necessitates irrigation strategies that enhance water productivity without compromising yield. A field experiment was conducted at the On-Farm Water Management Farm, Okara to quantify yield responses and infer water productivity trade-offs under continuous flooding (CF), single drainage (SD), and alternate wetting and drying (AWD) at varying depths (9 cm, 12 cm, 15 cm, and 18 cm). Grain yield was significantly affected by irrigation regime. Continuous flooding produced the lowest yield (2661 kg ha⁻¹), while AWD significantly enhanced productivity. The highest grain yield was recorded under AWD at 12 cm (5463 kg ha⁻¹), representing a significant increase over CF. AWD at 9 cm (5106 kg ha⁻¹) yielded statistically comparable results, forming the superior performance group. Although AWD at 15 cm also improved yield relative to CF, our results suggested that the ‘safe AWD’ recommendation of 15 cm may cause yield penalty in medium soils with difficulty of puddling. The results demonstrate that moderate AWD thresholds (9 to 12 cm) optimize the balance between soil aeration and plant water availability, maximizing yield while enabling irrigation water savings. Given that AWD typically reduces irrigation input by 20–35%, these findings suggest substantial gains in water productivity without yield penalty when irrigation depth is carefully managed. Overall, the study confirms that properly calibrated AWD

regimes provide a viable pathway for sustainable intensification of rice systems by minimizing the trade-off between water savings and grain yield. These findings are particularly relevant for water-limited rice–wheat systems of Punjab and similar agro-ecologies facing increasing competition for irrigation resources.

Analysis of Biofilm-Forming Potential and Antibiotic Resistance in Bacterial Isolates from Hospital Wastewater in Kohat

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Hospital wastewater effluents represent a major environmental reservoir for the dissemination of pathogenic microorganisms and antimicrobial resistance (AMR) due to the presence of antibiotic residues, disinfectants, and resistant clinical strains. This research focuses on the isolation and phenotypic characterization of clinically significant bacteria, including *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*, from various hospital discharge points in Kohat. The study aimed to evaluate the multidrug resistance (MDR) patterns and biofilm-forming potential of these isolates, which are key factors in bacterial persistence and treatment failure. The methodology involved the collection of wastewater samples followed by serial dilutions and cultivation on selective media such as Eosin Methylene Blue (EMB), MacConkey, Mannitol Salt Agar (MSA), and Ceramide agar. The isolates were identified through colony morphology, Gram staining, and a comprehensive battery of biochemical tests including Catalase, Oxidase, Triple Sugar Iron (TSI), Motility Indole Urease (MIU), and Citrate utilization tests. Antibiotic susceptibility was determined using the Kirby–Bauer disk diffusion method following CLSI guidelines. Furthermore, the biofilm-forming capability was assessed qualitatively via the Congo Red Agar (CRA) method and quantitatively using the Microtiter Plate (Crystal Violet) assay. Preliminary results indicated a high prevalence of MDR strains with varying degrees of biofilm production, highlighting the critical role of hospital waste in the environmental spread of resistance. These findings underscore the urgent necessity for improved wastewater treatment and management strategies to safeguard public health and mitigate the environmental burden of antimicrobial resistance.

Phenotypic Diversity And Drought Tolerance Assessment In Upland Cotton Genotypes Using Multivariate Analysis

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Drought stress is one of the most severe abiotic constraints limiting cotton (*Gossypium hirsutum* L.) productivity by adversely affecting plant growth, photosynthetic performance, yield, and fiber quality. In the present study, 30 genetically diverse cotton genotypes were evaluated under two irrigation regimes: control (100% field capacity) and severe drought (40% field capacity) during the flowering stage under controlled conditions. A comprehensive assessment of morphological, physiological, biochemical, antioxidant, yield, and fiber quality traits was conducted to identify drought-tolerant genotypes. Drought stress significantly reduced plant growth, photosynthetic pigments, yield, and fiber quality while increasing oxidative damage. In contrast, tolerant genotypes maintained superior growth, greater physiological stability, enhanced antioxidant defense, and lower oxidative injury, enabling them to sustain better productivity under water-deficit conditions. Multivariate analyses, including Principal Component Analysis (PCA), Pearson correlation analysis, heatmap visualization, and hierarchical cluster analysis, effectively differentiated the genotypes and identified the key traits associated with drought tolerance. Among the evaluated genotypes, CIM-775, 108, CYTO-547, 717, CYTO-913, 745, 762, and KING consistently exhibited superior performance by maintaining better growth, higher photosynthetic efficiency, improved yield potential, and desirable fiber quality under drought stress. These genotypes represent promising parental resources for the development of drought-tolerant and high-yielding cotton cultivars through conventional breeding and provide valuable information for improving cotton productivity and fiber quality in water-limited.

Keywords: Cotton (*Gossypium hirsutum*), drought stress, fiber quality, yield, physiological traits, principal component analysis, cluster analysis.

Microbial Enzymes for Sustainable Food Processing: Current Advances, Industrial Applications, and Future Prospects

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Growing consumer demand for safe, nutritious, and environmentally sustainable foods has encouraged the food industry to adopt innovative biotechnological approaches. Among these, microbial enzymes have become indispensable because they offer highly specific, efficient, and eco-friendly alternatives to conventional chemical processing methods. Enzymes derived from bacteria, fungi, and yeasts are extensively employed in dairy, bakery, beverage, starch, fruit, and vegetable processing, where they improve product quality, enhance nutritional value, extend shelf life, and reduce energy consumption and industrial waste. Recent advances in microbial fermentation, enzyme engineering, immobilization technologies, and computational tools have significantly improved enzyme productivity, stability, and commercial feasibility. In addition, emerging applications of bioinformatics and artificial intelligence are accelerating the discovery of novel enzymes and enabling the optimization of fermentation processes for industrial-scale production. This presentation provides an overview of recent developments in microbial enzyme technology, highlighting their contributions to sustainable food processing and the circular bioeconomy. It also discusses the challenges associated with large-scale production, regulatory

compliance, and commercialization, while identifying future research opportunities to support resilient and environmentally responsible food systems. The integration of modern biotechnology with digital innovations is expected to play a transformative role in meeting global food security and sustainability goals.

Keywords: Microbial enzymes, Food biotechnology, Sustainable food processing, Industrial fermentation, Bioinformatics, Artificial intelligence

Psychological and Philosophical Perspectives on Human Flourishing: Combining Maslow's
Empirical Insights with Iqbal's Vision of the Self

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This paper aims to explore the integration of two separate but related frameworks in the study of human flourishing: Abraham Maslow's empirical theory of self-actualization and Allama Muhammad Iqbal's philosophical-spiritual framework of Khudi (self-realization). This study examines the theories of two people from distinct academic and cultural fields, Western humanistic psychology and Eastern Islamic philosophy, using a descriptive-comparative methodology and the library research technique. Both individuals agree that there is an innate drive in every human being to strive for growth and flourishing to transcend. However, they differ in foundation, process, and the target end of this development. Within Maslow's theory of self-actualization, self-actualization denotes the fulfilment of the complete latent potential of a person and is organized in a hierarchy of needs that encompasses the person's physical, safety, love, and esteem needs, with transcendence being later added. Islamic philosophy defines self-actualization as fulfilling one's purpose through submission to God's will and achieving spiritual enlightenment. Unlike Maslow's focus on individual growth, Iqbal's concept of Khudi emphasizes a theocentric approach centered on self-initiated, morally driven actions that align with divine guidance, making one a vicegerent of God (Mard-e-Momin). This paper argues that when Maslow's empirically demonstrable levels of need satisfaction are integrated with Iqbal's spiritually enhanced selfhood, it paves the way for a comprehensive model of human flourishing grounded in both psychological health and purposeful living. The findings improve the area of cross-cultural psychology and contemporary Islamic scholarship on well-being by providing an integrated model of flourishing that is grounded in both empirical findings and spiritual/religious sources, particularly the Quran and the Hadith.

In Vitro Assessment Of Beeswax And Its Antimicrobial Potential Against Staphylococcus
Epidermidis

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The present study was undertaken to evaluate the in vitro antimicrobial efficacy of beeswax against *Staphylococcus epidermidis*, an opportunistic pathogen frequently implicated in device associated and nosocomial infections. Clinical isolates were recovered and identified using standard microbiological procedures including colony morphology, Gram staining, and biochemical profiling, confirming Gram-positive, catalase-positive, and coagulase-negative cocci consistent with *S. epidermidis*. The in vitro antibacterial assessment of beeswax using agar well disc diffusion method demonstrated appreciable activity against *Staphylococcus epidermidis* in a concentration dependent manner. The crude ethanolic beeswax extract produced clear zones of inhibition ranging from 9.2 ± 0.4 mm at 25 mg/mL to 18.6 ± 0.5 mm at 100 mg/mL, indicating moderate to strong antibacterial potential. The minimum inhibitory concentration (MIC) was determined at 12.5 mg/mL where visible bacterial growth was significantly suppressed, while the minimum bactericidal concentration (MBC) was recorded at 25 mg/mL, suggesting effective bactericidal action at higher concentration. This study provides a basis for further investigation into bee derived products as alternative strategies to combat antimicrobial resistance.

Keywords: Beeswax, *Staphylococcus epidermidis*, Antimicrobial Activity, MIC, MBC, Clinical Isolates, Gram staining, Biochemical profiling, Zone of Inhibition, Antimicrobial Resistance

Biochemical Characterization and Antibacterial Activity of *Acacia Concinna* against *Aeromonas Hydrophila* isolated from *Labeo Rohita*

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The rapid expansion of aquaculture has substantially increased the prevalence of bacterial diseases threatening fish production and food security. *Aeromonas hydrophila* is a major opportunistic pathogen frequently associated with infections in *Labeo rohita*, while the indiscriminate use of antibiotics has accelerated antimicrobial resistance and environmental contamination. This study evaluated the antibacterial activity of *Acacia concinna* leaf extracts prepared using methanol, ethanol, and acetone against *A. hydrophila* isolated from *L. rohita* and characterized their phytochemical constituents through GC–MS analysis. Fresh *A. concinna* leaves were shade dried, powdered and extracted by cold maceration using different organic solvents. *A. hydrophila* isolates were recovered from diseased fish tissues, identified through morphological and biochemical characterization and subjected to antibacterial susceptibility testing using the agar well diffusion method. Antibacterial activity was assessed at three concentrations (25, 50, and 75 mg/mL), while the minimum inhibitory concentration (MIC) was determined using the broth microdilution method following standard protocols. GC–MS analysis identified several bioactive phytochemicals including flavonoids, phenolics and terpenoids which are widely associated with antimicrobial properties. All solvent extracts exhibited concentration dependent antibacterial activity with statistically significant inhibition compared to the control ($p < 0.001$). The methanolic extract demonstrated superior antibacterial efficacy, producing mean inhibition zones of 26.7, 27.7 and 30.0 mm at 25, 50 and 75 mg/mL, respectively. The

ethanolic extract showed inhibition zones of 23.0, 25.0 and 28.0 mm, whereas the acetonetic extract produced mean inhibition zones of 22.0, 24.0 and 27.0 mm at the corresponding concentrations. These findings indicate that methanol extracted a greater proportion of antibacterial phytochemicals than ethanol and acetone, resulting in enhanced inhibitory activity against *A. hydrophila*. The study demonstrates that *A. concinna* leaf extracts possess significant antibacterial potential and may serve as an eco-friendly alternative to conventional antibiotics for controlling bacterial infections in aquaculture, thereby supporting sustainable fish health management and reducing dependence on synthetic antimicrobial agents.

Keywords: *Acacia concinna*, *Aeromonas hydrophila*, *Labeo rohita*, Antibacterial activity, Aquaculture.

In-Vitro Acaricidal Potential of Botanical and Natural Product Extracts Against Cattle Ticks

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Tick infestations are a major constraint to livestock productivity in Pakistan, where *Rhipicephalus* and *Hyalomma* species transmit haemoparasitic diseases such as babesiosis, anaplasmosis and theileriosis. The increasing prevalence of acaricide resistant ticks and concerns over the environmental and health impacts of synthetic acaricides have intensified the search for sustainable alternatives. This study evaluated the in vitro acaricidal and repellent activities of ethanolic extracts of honeybee propolis and pomegranate (*Punica granatum*) peel, individually and in combination, against cattle ticks collected from District Kohat, Khyber Pakhtunkhwa, Pakistan. Propolis and pomegranate peel extracts were prepared by maceration using 70% and 80% ethanol, respectively. Acaricidal activity was assessed using the Adult Immersion Test (AIT), while repellency was evaluated by a standard filter paper bioassay. Treatments were tested at seven concentrations (10–70%) in triplicate using 10 adult ticks per replicate. Cypermethrin (25%) and ethanol served as positive and negative controls, respectively. Propolis extract showed concentration dependent acaricidal activity, reaching 53.3% mortality at 70%, whereas pomegranate peel extract achieved 36.7% mortality. The combined treatment produced the highest mortality (66.7%) at 70% and 43.3% mortality at 40%, outperforming both individual extracts. In the repellency assay, propolis and the combined treatment each achieved 73.3% repellency at 70%, whereas pomegranate peel extract reached 63.3%. At 10%, the combined treatment showed higher repellency (16.7%) than either individual extract (3.3%). Standard deviations remained ≤ 0.58 across all assays, and most treatments were statistically significant ($p < 0.001$). These findings demonstrate that locally sourced bee propolis and pomegranate peel extracts possess significant acaricidal and repellent activities against cattle ticks. The combined treatment showed improved efficacy and represents a promising, environmentally friendly botanical acaricide. Further field validation and phytochemical characterization are recommended before practical application.

Keywords: Propolis, Punica granatum, Cattle ticks, Acaricidal activity, Repellent activity, Botanical acaricides, Integrated Pest Management.

Biochemical Characterization And Antifungal Potential Of Selected Varieties Of Honey Against Bee Pathogen *Ascosphaera Apis*

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Chalkbrood disease caused by the fungal pathogen *Ascosphaera apis*, is a major threat to apiculture worldwide leading to significant colony losses and economic damage. Natural honey, rich in diverse bioactive compounds offers a promising eco-friendly alternative to synthetic fungicides. This study aimed to investigate the biochemical composition and in vitro antifungal efficacy of Robinia (*Robinia pseudoacacia*) and Loquat (*Eriobotrya japonica*) honeys against *A. apis*. Honey samples were collected from apiaries in Kohat, Khyber Pakhtunkhwa, Pakistan and characterized using Gas Chromatography & Mass Spectrometry (GC–MS). *Ascosphaera apis* was isolated from infected brood purified on Sabouraud Dextrose Agar and maintained under laboratory conditions. Antifungal activity was evaluated via agar well diffusion at 25%, 50%, and 75% honey concentrations. Fluconazole served as positive control while sterile distilled water/ethanol was negative control. All experiments were performed in triplicate and data were analyzed using one-way ANOVA with Tukey's LSD post-hoc test ($p < 0.05$). GC–MS analysis revealed diverse bioactive constituents including phenolics, flavonoids, organic acids, fatty acids and volatile aromatic compounds. Robinia honey showed concentration- dependent antifungal activity with inhibition zones of 30.55 mm, 33.22 mm and 36.33 mm at 25%, 50% and 75%, respectively. In contrast, Loquat honey exhibited maximum inhibition (35.44 mm) at 25%, with reduced activity at 50% (36.88 mm) and 75% (43.89 mm). Significant differences were observed among treatments ($p < 0.05$), while no inhibition occurred in negative controls. Both honeys possess potent bioactive compounds with significant antifungal activity against *A. apis*. Robinia honey showed enhanced efficacy at higher concentrations whereas Loquat honey was more effective at lower concentrations. These findings highlight natural honeys as sustainable biocontrol agents against chalkbrood disease. However, further in vivo field trials are necessary to validate their practical applicability under natural beekeeping conditions. The current investigation is still in progress.

Keywords: Chalkbrood disease, *Ascosphaera apis*, Robinia honey, Loquat honey, GC–MS, Antifungal activity.

Biochemical Characterization of Antibacterial Efficacy of Sheesham (*Dalbergi sissoo*) Honey Against *Pseudomonas aeruginosa*

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Pseudomonas aeruginosa is a major opportunistic pathogen responsible for severe hospital acquired infections, particularly in burn wound and intensive care patients. The increasing prevalence of multidrug-resistant (MDR) strains in Pakistan necessitates the search for novel natural therapeutic agents. This study evaluates the biochemical composition and in vitro antibacterial activity of local Sheesham (*Dalbergia sissoo*) honey against clinical isolates of *P. aeruginosa*. Gas Chromatography-Mass Spectrometry (GC-MS) analysis of Sheesham honey identified 25 chemical constituents, dominated by 2-methyl-1-propanol (13.91%), a propanoic acid derivative (12.24%), acetic acid (9.33%), 1-hydroxy-2-propanone (6.04%), 2-hydroxy- γ -butyrolactone (5.80%), a 1-butanol derivative (5.62%), 1-propanol (5.27%), and 5-hydroxymethylfurfural (4.34%), along with bio-active compounds such as 2-furanmethanol (2.46%), hydroquinone (2.23%), and ethyl α -D-glucopyranoside (3.72%). Antibacterial potency was evaluated against *P. aeruginosa* isolates using the Kirby-Bauer disk/well diffusion assay on Mueller-Hinton agar across four honey concentrations (25%, 50%, 75%, and 100% v/v), with Ampicillin (10 μ g) and distilled water serving as controls. Quantitative inhibition zone data were statistically analyzed via ANOVA and Tukey's LSD test in SPSS (v19). The presence of potent organic acids, phenolics, and volatile derivatives provides scientific validation for the bactericidal efficacy of Sheesham honey, highlighting its potential as an affordable, locally sourced biotherapeutic agent against MDR clinical pathogens.

Keywords: Sheesham honey, *Dalbergia sissoo*, *Pseudomonas aeruginosa*, GC-MS analysis, 5-Hydroxymethylfurfural, Hydroquinone, Antibacterial efficacy, Apitherapy.

Role Of *Serratia Marcescens* Hmr-2 In Mitigating Bisphenol-A Induced Stress In *Cicer Arietinum* L.

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Bisphenol-A is a hazardous endocrine disrupting chemical widely used in the production of plastics and resins. Its continuous release into the environment has become a serious concern due to its harmful effects on soil quality, plant growth and agricultural productivity. Chickpea is an essential food that is highly consumed with a toxic chemicals uptake capacity, and hence it is especially susceptible to BPA. Plant growth-promoting bacteria (PGPB) *S. marcescens* HMR-2 have emerged as an eco-friendly and sustainable approach for mitigating environmental pollutants. Here, we investigated the role of *S. marcescens* HMR-2 in mitigating BPA induced stress in chickpea under hydroponic condition. The experiment demonstrated significant variations in shoot and root lengths, with the control and 10mg/L treatment groups showing the most considerable growth, while the 350mg/L concentration resulted in the shortest lengths. Similar trends were observed in both fresh and dry weight of roots and shoots, indicating that higher concentrations negatively impact plant biomass. Physiological analysis revealed that the content of chlorophyll a, b and carotenoids decrease with increasing treatment concentration, while the lowest level observed at 10mg/L. This suggests that the BPA may affect photosynthetic efficiency, particularly at higher concentrations. Additionally, antioxidant enzyme activities,

including peroxidase (POD), ascorbate peroxidase (APX), and catalase (CAT), showed increased activity at lower concentrations but decreased at higher BPA concentration. Proline and sugar content were also highest at higher concentration compare to control. The study also noted an increase in proline content under BPA stress. On the other hand, inoculation of BPA-stressed chickpea plants with *S. marcescens* HMR-2 significantly enhanced the plant growth, biomass, nutrients uptake, antioxidant capacity, chlorophyll contents, and the significantly decreased soluble sugars, proline content in higher concentrations. The inoculation by *S. marcescens* significantly promoted the growth of chickpea plants under BPA stress and generated changes in antioxidative enzyme activities (SOD, POD, CAT) under different BPA levels, reducing BPA-induced oxidative damage to the plants. The result of the study show that the BPA has a adverse effects on chickpea plant health and productivity, while inoculation of *S. marcescens* could be a viable strategy to lessen the harmful impact of BPA stress in chickpea.

Keywords: *Serratia marcescens* HMR-2, Bisphenol-A, *Cicer Arietinum* L., Bioremediation

Diversity of edible wetland plants and their role in food security and nutritional values in upper Ghizer,GB

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Upper Ghizer, Gilgit-Baltistan, Pakistan, is high-altitude mountain ecosystems characterized by glaciers, lakes, wetlands and peat lands. These habitats are not only important for the biodiversity but also the local communities get number of benefits from them. Due to harsh climatic conditions, short growing seasons, the local communities traditionally relies on wild edible plants to enhance their diet requirement. Despite these significances, the diversity and nutritional role of edible wetland plants in Upper Ghizer remain poorly documented. This study was conducted to assess the diversity of edible wetland plants and to evaluate their contribution to food security and nutritional values. Field surveys were carried out from spring to autumn 2024-2025. Plant specimens were collected, identified, and documented along with local Khovar names and traditional uses via interviews from local communities and herbal practitioners. There are total 25 edible wetland plant species recorded which belonging to 15 families and 22 genera. Out of them the dominant family was Polygonaceae with 6 species, followed by Potamogetonaceae, Cyperaceae, Asteraceae, and Lamiaceae. The most frequently used species included *Rumex acetosa* “Sirkonzu”, *Rumex crispus*, *Urtica dioica* “jomi” , *Mentha longifolia* “Jangli bain”, *Persicaria amphibia* “Oshpik”, *Eleocharis palustris* “Bhoosa grass”, *Potamogeton lucens*, *Alisma plantago-aquatica* “Abay beta”, *Veronica anagallis-aquatica* “kharbora”, and *Sonchus asper* “Gordogh zokho”. Various parts of the recorded plants were used but the leaves of 18 species major, followed by young shoots, rhizomes, and whole plants. These plants are used in different ways as boiled vegetables, salads, soups, herbal teas, and in some cases as famine foods during extreme winters. *Rumex* spp. and *Urtica dioica* are cooked as saag and are highly valued for their sour and nutritious taste. *Mentha* and *Thymus* species are used for tea and flavoring. Rhizomes of *Eleocharis palustris* and *Alisma plantago-aquatica* are boiled and eaten during spring when

food stores are depleted. The study found that edible wetland plants play a vital role in household food security in Upper Ghizer. They provide free, easily accessible nutrition during 3 to 4 months of the year when market vegetables are unavailable. Women and children are the primary collectors. Preliminary nutritional assessment based on literature and local dietary patterns indicates that these plants are rich in essential micronutrients. *Urtica dioica* is high in iron, calcium, and protein. Rumex species are good sources of vitamin C and organic acids. *Mentha longifolia* contains essential oils with antimicrobial properties. *Potamogeton* and *Eleocharis* provide carbohydrates and fiber. Thus, wetland plants contribute significantly to dietary diversity and help prevent micronutrient deficiencies in remote mountain communities. However, these resources are under threat due to overexploitation, habitat degradation, climate change, and lack of traditional knowledge. The sustainable use and conservation of these plants are therefore essential because they maintaining ecosystem services and food sovereignty along with protect biodiversity and health security of local people in the face of climate change. There is an urgent need to document traditional knowledge, promote cultivation of priority species, and integrate wetland plant use into local nutrition and development policies.

Keywords: Wetlands, Ghizer, Rumex, Urtica, High Mountains, biodiversity, medicinal plants

Human Carbonic Anhydrases Activity Of The Phytochemicals Isolated From *Haplophyllum Erythraeum*

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This study reports the isolation, structural characterization, and human carbonic anhydrase (hCA) inhibitory evaluation of phytochemicals from *Haplophyllum erythraeum* Boiss. (Rutaceae). The shade-dried plant material was extracted with methanol and successively fractionated using n-hexane, chloroform, ethyl acetate, and n-butanol. Three compounds were isolated from the ethyl acetate fraction through column chromatography and identified as flindersine, folimine, and β -sitosterol by UV-Vis, IR, and NMR spectroscopic techniques. The isolated compounds were evaluated for in vitro inhibitory activity against human carbonic anhydrase II (hCA-II) using a spectrophotometric assay with 4-nitrophenyl acetate as substrate. Folimine exhibited the most potent activity ($IC_{50} = 14.10 \pm 0.42 \mu M$), followed by flindersine ($IC_{50} = 21.52 \pm 0.83 \mu M$), while β -sitosterol was inactive. The standard drug acetazolamide showed an IC_{50} value of $19.3 \pm 1.0 \mu M$. These findings highlight folimine and flindersine as promising natural hCA-II inhibitors with potential therapeutic applications in glaucoma, epilepsy, and related disorders.

Keywords: *Haplophyllum erythraeum*, flindersine; folimine, β -sitosterol, carbonic anhydrase inhibitors, hCA-II, natural products.

عصر حاضر میں ملحدانہ نظریات کے رد میں قرآن کے اسالیب دعوت کا تجزیاتی مطالعہ

An Analytical Study Of The Quranic Method Of Invitation (Dawah) In Response To Atheistic Ideologies In The Contemporary Era

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The study provides a brief overview of some of the scientific, social and Intellectual forces. That together, have contributed to the growth of Atheism through the world, and how these forces have interacted in certain ways to diminish faith in God and foster secular identities. Non-theistic explanations of physical and biological phenomena advanced through the fields of natural science and evolutionary theory, diminishing the need for religion to explain these phenomena and making naturalistic worldviews more plausible for many people. Philosophical skepticism, enlightenment, rationalism, and modern secular atheism (including “New Atheism”) encourage questioning of religious belief, give the importance to empirical evidence and humanist virtues, and use public attacks on religious institutions to drive religious affiliation away from skeptics and critics.

Keywords: New Atheism, Secularization, Science and Religion, Modernism.

Analytical Study of Cyber Crime Prevention in the Context of Islamic Shariah and Pakistan's Prevention of Electronic Crimes Act, 2016(with Amendments up to 2025)

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The exponential growth of digital technology has given rise to new and evolving forms of criminality that transcend national borders, jurisdictional boundaries, and traditional legal categories. Cybercrime — encompassing hacking, identity theft, financial fraud, cyberterrorism, online defamation, and digital sexual exploitation — poses unprecedented challenges to legal systems worldwide. This paper undertakes a comparative analysis of how modern secular legal systems and Islamic law (Shariah) address cybercrime, with particular attention to the framework of Maqasid al-Shariah (the higher objectives of Islamic law). It argues that while modern legal systems rely primarily on statutory enactment, technical regulation, and international convention, Islamic law offers a values-based, objective-oriented approach rooted in the protection of religion (din), life (nafs), intellect (aql), lineage (nasl), property (mal), and honor (ird). The paper concludes that a synthesis of the flexible, principle-based Maqasid approach with the procedural and technical sophistication of modern cyber-law frameworks offers a more holistic response to the borderless nature of digital crime.

Keywords: Cybercrime, Islamic law, Shariah, Maqasid –al-Shariah, comparative law, digital crime, ta'zir, cyber-jurisprudence

Personal Privacy in the Light of Islamic Teachings: A Research Study of Its Limits, Regulations, and Practical Applications in Contemporary Social and Administrative Affairs

اسلامی تعلیمات کی روشنی میں شخصی رازداری کے حدود و قیود کا عصر حاضر کے سماجی و انتظامی معاملات میں عملی اطلاقات کا تحقیقی مطالعہ

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The rapid advancement of information technology, digital communication, and modern governance has significantly intensified concerns regarding personal privacy. While contemporary legal systems recognize privacy as a fundamental human right, they often face challenges in defining its ethical limits and balancing individual rights with collective welfare. Islamic teachings, however, provide a comprehensive framework that safeguards personal privacy while permitting carefully regulated exceptions to protect justice, public interest, and societal security. This research examines the concept of personal privacy (ḥurmat al-khuṣūṣiyyah) in the light of the Quran, Sunnah, and classical as well as contemporary Islamic jurisprudence. It explores the ethical and legal boundaries governing privacy and investigates their practical application in present-day social and administrative contexts. Particular attention is given to issues such as unauthorized surveillance, disclosure of personal information, digital privacy, institutional confidentiality, administrative accountability, and the protection of individual dignity within both public and private spheres. The study employs a qualitative and analytical research methodology, relying on primary Islamic sources alongside contemporary scholarly literature. It critically evaluates modern privacy-related challenges through the lens of the objectives of Islamic law (Maqāṣid al-Sharī'ah), highlighting the balance between individual rights and the collective interests of society. The study concludes that Islamic teachings establish a balanced and principled model of personal privacy that neither permits unrestricted intrusion into private life nor allows privacy to become a shield for injustice or harm. By integrating ethical responsibility with legal regulation, the Islamic framework offers practical guidance for addressing contemporary social and administrative issues while preserving human dignity, justice, and public trust. The findings are expected to contribute to current academic discussions on privacy, governance, and Islamic legal thought in the modern era.

Keywords: Islamic Teachings, Personal Privacy, Islamic Jurisprudence (Fiqh), Maqāṣid al-Sharī'ah, Digital Privacy, Administrative Governance, Social Ethics, Human Dignity.

A Comparative Study of Armageddon in the Abrahamic Religions and Al-Malḥamah al-'Uẓmā, with Special Reference to Their Political and Social Implications

الہامی مذاہب میں آرمگڈن اور الملحمة العظمیٰ کا تقابل اور ان کے سیاسی و سماجی اثرات کا تحقیقی جائزہ

Asmat Ali Khan

The concepts of Armageddon and Al-Malḥamah al-‘Uẓmā occupy a significant position in the eschatological traditions of the Abrahamic religions. These beliefs have profoundly influenced religious thought, political ideologies, and social attitudes throughout history and continue to shape contemporary global discourse. This study aims to comparatively examine the concept of Armageddon in Judaism and Christianity alongside the Islamic concept of Al-Malḥamah al-‘Uẓmā, with particular emphasis on their political and social implications. Using a comparative and analytical research methodology, the study analyzes primary religious scriptures and authoritative classical and contemporary scholarly sources. It explores the theological foundations, similarities, and differences between these eschatological narratives and evaluates their impact on modern political movements, interfaith relations, media narratives, and public perceptions. The research also examines how certain ideological groups have interpreted or misused these concepts to support political agendas and conflict, while contrasting such interpretations with the original teachings of the respective religious traditions. The findings reveal that although these concepts share certain eschatological themes, they differ substantially in their doctrinal foundations, objectives, and practical implications. The study concludes that an objective and contextual understanding of these beliefs can reduce religious misconceptions, strengthen interfaith dialogue, and contribute to peaceful coexistence and global stability.

Keywords: Armageddon, Al-Malḥamah al-‘Uẓmā, Abrahamic Religions, Eschatology, Comparative Study, Political Impact, Social Impact, Interfaith Dialogue.

Isolation Of Fermented Food-Derived Lactobacillus Spp. With Potent Activity Against Multidrug-Resistant Human Pathogens And Detection Of Their Inhibitory Mechanisms

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The increasing prevalence of multidrug-resistant (MDR) human pathogens has created an urgent need for novel, safe, and effective antimicrobial alternatives. Probiotic lactic acid bacteria (LAB), particularly Lactobacillus spp., have gained considerable attention due to their established safety profile and ability to produce antimicrobial metabolites. This study aimed to isolate and characterize fermented food-derived Lactobacillus spp. from District Kohat and evaluate their probiotic potential and antimicrobial activity against MDR human pathogens and their inhibitory mechanisms. Fermented food samples were processed using standard microbiological methods, and presumptive isolates were identified through morphological, biochemical, and molecular characterization. The probiotic potential and safety characteristics of selected isolates were evaluated through acid and bile tolerance, antibiotic susceptibility testing, hemolytic activity, and adhesion-related assays. Antibacterial activity was assessed against MDR pathogens using the

agar well diffusion assay. Potent isolates exhibited significant inhibitory activity, and their antimicrobial mechanisms were investigated through acid neutralization, catalase treatment, and protease sensitivity assays. The results indicated that antimicrobial activity was mainly associated with organic acid production, hydrogen peroxide, and bacteriocin-like substances. These findings demonstrate that indigenous *Lactobacillus* strains from fermented foods represent valuable sources of antimicrobial compounds and may serve as potential probiotic candidates or adjunct approaches for controlling MDR pathogens. This study highlights the importance of traditional fermented foods as reservoirs of beneficial microorganisms with applications in antimicrobial resistance management.

Keywords: *Lactobacillus*, fermented foods, probiotics, multidrug-resistant pathogens, antimicrobial activity, bacteriocins, agar well diffusion assay.

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

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This study converts the old police system to new digital, modern system. The idea is to make it easier for citizens to approach police online. Over the internet. The study starts by looking at what people desire from these services, like being able to easily register a FIR, track complaints online, acquire certificates, check criminal histories, and have a simple and safe system. In this study, around 300 citizens were surveyed and finds that most people in Pakistan already know how to use the internet and would prefer to use digital police services if they are safe, simple, and trustworthy. The study uses statistical models to look at people's preferences in order to understand their choices. It finds that people like systems that are safe, simple to use, and always available online. We use the Rank-Ordered Logit model because it is the best way to explain how people rank their preferences. The results show that safety, openness, and ease of use are very important to people when they start using e-Police services. The second part of the research is about safety. Because police data is very private, the study suggests strong ways to keep it safe. It teaches how to encrypt data to keep it safe and also makes a special way to tell if digital images (like crime scene photos) have been changed. This method can find changes in pictures and even get back parts that have been lost or changed with great accuracy. The study combines the needs of the public with cutting-edge security solutions to create a better, safer, and more efficient digital police system for Pakistan. Finally, IT Policy Framework has been proposed that illustrates how innovation can be brought in the existing e-Police services – in view of the citizens demand and security issues.

Fauji Fresh N Freeze (FFFL) x AGRILIFT: A Digital Collaboration for Precision Agriculture in Contract Farming

Muhammad Yasir Saleem, Farrukh Azeem, Muhammad Umair Javid, Hassan Ali Butt, Rahil Mahtab, Bilal Ahmed Shafique, Muhammad Shahzad, Muhammad Irshad, Muhammad Zunair Kramat, Zaheer Aslam and Naeem Maqbool

Rising climate volatility, escalating input costs, and stricter quality benchmarks are pushing contract farming beyond conventional practice toward data-driven decision-making. Productivity in modern agriculture is no longer a function of scale alone; it increasingly depends on precision, real-time data, and timely agronomic decisions. This study presents a commercial-scale case of AG-Tech adoption through the integration of the AGRILIFT digital platform into the farming network of Fauji Fresh N Freeze Ltd., covering 4,264 acres under contracted potato $\approx$ 95% and sweet corn (spring season) cultivation during 2025-26, in the Central and Southern Punjab (Depalpur, Kasur, Pakpattan, Mailsi/Vehari & Multan zones). Unlike pilot-scale digitization efforts reported elsewhere, this deployment demonstrates how a farm-to-dashboard ecosystem can be operated at commercial volume, digitizing core field operations so that every plot, activity, and crop stage becomes traceable in real time. A central component of the intervention is farmer-wise geo-tagging and plot-level GPS mapping, which allows the procurement network to visualize field distribution, crop clusters, and risk zones with spatial accuracy. Ahead of land preparation, systematic soil and water sampling is conducted at the plot level to assess nutrient status, soil texture, pH, and irrigation water quality, with laboratory results forming the basis for site-specific fertilizer recommendations rather than blanket application rates. This sampling-led approach ensures that nutrient management is calibrated to actual field conditions before sowing, reducing over- or under-application and aligning input use with each plot's real requirement. Building on this diagnostic layer, field-level reporting extends well beyond basic crop monitoring: land-leveling status reports assess irrigation efficiency and flag areas prone to uneven water and nutrient distribution; germination assessment reports enable early identification of poor emergence zones, moisture stress, and seed-placement issues; and ground truthing insights connect digital signals with actual soil conditions to explain within-field germination variability. In parallel, continuous crop health monitoring gives structured visibility into plant vigor and field variability, allowing the team to detect emerging risk before it becomes yield-limiting, pinpoint problematic plots with precision, and prioritize corrective action where it has the greatest impact. Collectively, these capabilities shift quality management from reactive, harvest-stage correction to proactive intervention during the crop growth cycle itself. Preliminary outcomes indicate more uniform crop stands, improved water-use efficiency, and reduced input wastage, translating into greater yield stability and farmer profitability. Digital transparency in field data has further strengthened trust in procurement, ensuring fairer volume alignment and creating long-term income security for contracted farming households; as productivity rises, so too does confidence and resilience across the wider farming community. The findings position AG-Tech platforms not as a supplementary tool but as an operating layer for modern agriculture, capable of moving commercial farming networks from reactive management toward predictive, precision-driven production. Beyond its immediate operational gains, this collaboration reflects a strategic investment in the future of food systems, and the study offers a replicable model for

digitizing contract farming and procurement systems across Pakistans broader Agri-supply chains.

Keywords: Precision Agriculture, AG-Tech, AI (Artificial Intelligence), IoT (Internet of Things), GPS, Geo-Tagging, Soil Testing, Water Testing, Site-Specific Fertilizer Recommendation, Contract Farming, Climate Resilient Farming, Crop Production, Farm-to-Dashboard Ecosystem, Real-Time Field Monitoring, Data-Driven Agronomy, Agri-Value Chain Digitization, Digital Supply Chain, Fauji Fresh N Freeze, Pakistan

