



RUEC 1st | 20 INTERNATIONAL | 25 RESEARCH CONFERENCE

Theme

Advancing Knowledge
and Innovation Across
Disciplines for Social
Transformation



BOOK *of* ABSTRACTS



RAJSHAHI UNIVERSITY
EDUCATION CLUB
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RUEC 1st | **20**
INTERNATIONAL | **25**
RESEARCH CONFERENCE

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স্থাপিত-১৯৫৩

RUEC 1st International Research Conference 2025

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RUEC 1st International Research Conference 2025

SUB-THEMES

Social Sciences & Global Impact

- Environmental Sustainability & Global Challenges
- Public Health Systems & Wellness
- Social Policy Development & Societal Change
- Media, Communication & Cultural Studies
- Gender Studies & Social Inclusion
- International Relations & Global Governance
- Peacebuilding, Conflict Resolution & Justice

Arts, Culture & Humanities

- Visual Arts & Creative Industries
- Heritage, History & Cultural Preservation
- Linguistics, Language Development & Literary Studies
- Digital Media, Culture & Technological Influence
- Performing Arts: Theatre, Music & Dance
- Religious Studies & Spiritual Practices

Business, Management & Innovation

- Sustainable Entrepreneurship & Social Impact
- Market Research & Business Intelligence
- Corporate Finance & Ethical Business Practices
- Business Transformation & Digital Innovation
- Leadership & Organizational Development
- Tourism, Hospitality & Event Management

Technology, Engineering & Industry 4.0

- Artificial Intelligence, Data Science & Machine Learning
- Cybersecurity, Network Protection & Digital Infrastructure
- Cloud Computing, IoT & Smart Technologies
- Automation, Robotics & Advanced Manufacturing
- Technological Advancements in Engineering
- Industry 4.0: Future of Work & Manufacturing

Life Sciences & Biotechnology

- Sustainable Agriculture & Agricultural Innovation
- Biotechnology, Genomics & Medical Research
- Environmental Science & Ecological Sustainability
- Neuroscience & Cognitive Health
- Smart Technologies & Renewable Energy
- Molecular Biology & Biotechnology Innovations
- Microbiology & Infectious Disease Research

Applied Science & Research

- Epidemiology, Public Health & Pandemic Response
- Renewable Energy, Climate Change & Environmental Studies
- Mathematics, Physics & Computational Sciences
- Environmental Physics & Climate Modelling
- Mental Health, Neurology & Psychological Research
- Chemical Engineering & Sustainable Practices

Education & Pedagogy

- Technological Integration in Education
- Inclusive Education & Learning Diversity
- Innovative Teaching Methodologies & Curriculum Development
- Digital Literacy & Skills Development for Future Workforce
- Educational Policy, Governance & Global Trends



Message

It gives me great pleasure to extend my heartfelt felicitations to the organizers, participants, and distinguished guests of the RUEC 1st International Research Conference 2025, organized by Rajshahi University Education Club (RUEC).

The initiative of our students in arranging an international platform of this magnitude is truly praiseworthy. By bringing together researchers, academicians, and practitioners, this conference embodies the spirit of knowledge sharing and intellectual exchange that lies at the heart of higher education. Such an effort not only reflects the vision and dedication of our young scholars but also demonstrates their contribute to contributing meaningfully to both national and global discourse.

Research has always been the foundation of academic progress. In today's world, where societies are constantly evolving and challenges are becoming increasingly complex, it is research and innovation that can offer sustainable solutions. This conference, therefore, holds immense significance in encouraging students and scholars to engage in thoughtful inquiry, critical analysis, and creative exploration of ideas.

The University of Rajshahi has always been committed to advancing knowledge and academic excellence through research and scholarly practices. I am confident that this conference will inspire participants to explore new perspectives, form valuable collaborations, and carry forward the tradition of academic excellence.

I appreciate the hard work of the organizers and wish the conference every success. May this initiative continue to serve as a milestone in shaping future generations of scholars and researchers.

S.H. Naqib

Professor Dr. Saleh Hasan Naqib
Vice-Chancellor
University of Rajshahi



Message

It gives me immense pleasure to convey my warm greetings on the occasion of the RUEC International Research Conference 2025, being held under the theme Advancing Knowledge and Innovation Across Disciplines for Social Transformation. This conference is a milestone event for Rajshahi University and for the wider academic community, as it brings together scholars, researchers, and practitioners from diverse fields to share their ideas and contributions.

In today's rapidly changing world, the pursuit of knowledge and innovation across disciplines has become indispensable. Universities must not only generate new knowledge but also ensure that such knowledge is applied for the betterment of society. By creating a platform that emphasizes interdisciplinary research and transformative innovation, this conference reflects the enduring vision of Rajshahi University to contribute meaningfully to national progress and global scholarship.

The collection of abstracts presented in this volume stands as a testament to the dedication, creativity, and scholarly excellence of participants from across the world. Each submission represents a unique endeavour to address contemporary challenges, foster critical dialogue, and inspire future research collaborations. I am confident that the outcomes of this conference will extend far beyond its sessions, influencing policy, practice and the collective quest for sustainable development.

I would like to express my sincere appreciation to the organisers for their efforts in making this event a success. I also extend my best wishes to all participants, whose commitment to research and innovation will undoubtedly serve as a beacon of inspiration for generations to come.

May this conference achieve its goals with resounding success and further strengthen our collective resolve to harness knowledge and innovation for meaningful social transformation.



Professor Dr. Mohammad Main Uddin
Pro Vice-Chancellor (Administration)
University of Rajshahi



Message

I am happy to learn that the Rajshahi University Education Club is going to organize its first international research conference in 2025. I convey my warmest greetings and congratulations to organizers, participants, and esteemed guests.

This initiative is a major step toward building a strong research culture at Rajshahi University. This conference would facilitate academic exchange, innovation, and collaboration by bringing together students, young researchers, and professionals from diverse fields. In a rapidly changing world shaped by climate change, technological advances, and social changes, creating and communicating new knowledge is more important than ever.

This conference is notable for its inclusivity. Engaging young researchers and students showcases their work and helps them develop the self-confidence and critical thinking skills needed to lead academia and research. I believe this experience will enhance their skills, vision, and global competitiveness.

The Rajshahi University Education Club's dedication to organizing such a significant event is much appreciated. I hope all participants enjoy this chance to share, learn, and connect.



Professor Md. Farid Uddin Khan
Pro Vice-Chancellor
University of Rajshahi



Message

It is a great honor to extend my warmest greetings on the occasion of the RUEC 1st International Research Conference 2025, organized by the Rajshahi University Education Club (RUEC). This prestigious event, held under the theme "Advancing Knowledge and Innovation Across Disciplines for Social Transformation," reflects our institution's unwavering commitment to fostering excellence in research, academic collaboration, and innovation.

As the Registrar of Rajshahi University, I am proud to witness the dedication and collective efforts that have gone into making this conference a reality. By bringing together distinguished scholars, researchers, and practitioners from diverse disciplines, the conference serves as a platform to exchange ideas, inspire new perspectives, and encourage meaningful dialogue that transcends borders.

This gathering is not only a celebration of academic achievement but also a testament to the University's vision of contributing to national development and global scholarship. I firmly believe that the discussions and collaborations emerging from this conference will pave the way for innovative solutions and impactful contributions toward a more just and progressive society.

I sincerely commend the organizers, faculty, students, and partners for their tireless efforts in ensuring the success of this conference. I also extend my best wishes to all participants for a fruitful and enriching experience. May this conference strengthen our collective resolve to pursue knowledge with purpose and passion, and to transform that knowledge into actions that benefit humanity.

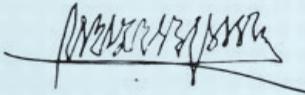


Professor Dr. Iftikharul Alam Masud
Registrar
University of Rajshahi



Message

I am very happy to learn that Rajshahi University Education Club is organizing a conference with no better befitting theme than "Advancing Knowledge and Innovation Across Disciplines for Social transformation". While we are yet to duly appreciate the power of knowledge and technology in the progress of our country, our younger generation is showing their concern and taking initiatives to turn our backwardness into advancement through harnessing the benefits of science and technology. A country with population density 24 times as large as that of the world average this is only through transforming human beings into human resources can a country like ours survive the challenges of the 21st century. Not only that with the very limited per capita natural resources we must be able to add values through exploiting potential of all disciplines and increasing productivity through applying scientific and technological skills in an integrated way as being done in Japan, Korea, Taiwan, Singapore and China. I wish that this initiative of our young forward looking energetic forerunners will begin a positive change to the fate of the toiling mass and transform it into a thriving nation.



Dr Mohammad Kaykobad
Distinguished Professor
CSE Department
Brac University
Fellow
Bangladesh Academy of Sciences.



Message

It is a profound honor and privilege to welcome you to the RUEC 1st International Research Conference 2025, organized by the Rajshahi University Education Club. This event represents a milestone in our commitment to fostering academic excellence, intellectual exchange, and interdisciplinary collaboration.

Bringing together scholars, researchers, professionals, and students from a wide array of disciplines and cultural backgrounds, this conference is more than a meeting of minds—it is a convergence of ideas, aspirations, and shared purpose. Whether your field lies in technology, education, health, business, or the social sciences, your presence here reflects a collective dedication to exploring knowledge that matters—knowledge that can lead to meaningful and lasting impact in the real world.

This platform has been thoughtfully designed to spark deep discussions, challenge assumptions, and encourage collaboration across traditional academic boundaries. It is a space for learning, questioning, networking, and growing—where insights are shared not just through formal presentations, but also in spontaneous conversations, thoughtful questions, and emerging partnerships.

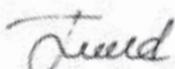
I encourage each of you to fully immerse yourself in this experience. Engage actively. Be curious. Ask questions. Connect with fellow participants. Whether you are presenting, attending sessions, or simply exchanging perspectives in informal settings, your involvement is what will make this conference truly impactful.

This event would not have been possible without the tireless dedication of our organizing team, the valuable contributions of our presenters and reviewers, and the enthusiastic support of our participants. I am deeply grateful to everyone who played a part in bringing this vision to life.

Together, let us celebrate the spirit of research, dialogue, and discovery that defines this gathering—and let it serve as a springboard for ideas and collaborations that extend well beyond this conference.

Welcome, once again, to this exciting academic journey.

Warm regards,



Founder,
Conference Chair, RUEC 1st International Research Conference 2025
Founder, Rajshahi University Education Club



Message

It is with great pride and heartfelt appreciation that I welcome you to the 1st International Research Conference 2025, an inspiring initiative organized by the Rajshahi University Education Club. As Convener, it is both an honor and a privilege to introduce this landmark event—one that brings together a vibrant and diverse community of researchers, scholars, and students from across Bangladesh and beyond.

This conference is the result of months of thoughtful planning, tireless effort, and collaborative spirit. It has been carefully designed to serve as a dynamic platform for the exchange of innovative ideas, critical inquiry, and interdisciplinary dialogue. More than just a series of presentations, this gathering reflects our collective commitment to academic excellence, intellectual curiosity, and meaningful engagement across fields.

With a rich array of sessions spanning disciplines—from science and technology to education, health, business, and the social sciences—this event aims to showcase outstanding scholarship and spark conversations that lead to real-world impact. It is our hope that the knowledge shared here will inspire fresh perspectives, set new research directions, and lay the foundation for lasting collaborations that contribute meaningfully to societal transformation.

I extend my deepest gratitude to all participants, presenters, reviewers, volunteers, and supporters. Your enthusiasm, dedication, and shared vision have made this conference not only possible but truly exceptional. I am confident that the discussions and connections formed here will echo far beyond this event, fostering new opportunities and advancing knowledge in meaningful ways.

Welcome to a conference where ideas take flight and where futures are shaped through dialogue, discovery, and unity of purpose.

Warm regards,



Rayhana Malik Senjuti

Convener, RUEC 1st International Research Conference 2025

President, Rajshahi University Education Club



Message

It is with great pleasure and a deep sense of purpose that I welcome you to the RUEC 1st International Research Conference 2025, hosted by the Rajshahi University Education Club. As Secretary of this inaugural event, I am honored to extend our warmest greetings to participants joining us from across the country and around the globe.

This conference has been thoughtfully curated as more than just an academic event—it is a vibrant forum for open exchange, critical reflection, and the forging of meaningful collaborations. It brings together a diverse array of voices and perspectives across disciplines, with each research presentation offering unique insights that have the power to inform policy, inspire innovation, and drive social change.

Beyond the formal sessions, this gathering presents invaluable opportunities to connect, challenge ideas, and grow—both personally and collectively. In an age where collaboration and interdisciplinary thinking are more vital than ever, we believe that the conversations and connections made here will serve as a catalyst for continued engagement and progress.

We hope that this conference sparks new dialogues, nurtures lasting partnerships, and inspires action that extends far beyond the boundaries of this event. Your active participation is what will truly bring this vision to life.

Thank you for being a part of this important milestone. Together, through shared knowledge and collective effort, we can shape a more thoughtful, informed, and inclusive future.

Warm regards,



Secretary, 1st International Research Conference 2025
General Secretary, Rajshahi University Education Club



Message

It is with great pleasure that I welcome you to the RUEC 1st International Research Conference 2025, a landmark initiative proudly organized by the Rajshahi University Education Club. As Chief Coordinator, I am honored to introduce this significant academic platform—one that unites a diverse community of scholars, researchers, and students dedicated to the pursuit of knowledge and the advancement of academic excellence.

This conference stands as a testament to months of careful planning, collaboration, and a shared vision to foster interdisciplinary dialogue. The research featured here represents a rigorously reviewed and thoughtfully selected body of work, showcasing the depth, diversity, and relevance of inquiry across multiple fields. From the sciences and humanities to technology, education, and social innovation, each contribution brings valuable insights with the potential to inform real-world change.

Beyond being a showcase of scholarly excellence, this event is designed as a dynamic environment for intellectual engagement, creativity, and collaboration. It offers a space where ideas are not only shared but also challenged and refined—encouraging participants to think beyond boundaries and build meaningful connections that last well beyond the conference itself.

By facilitating thoughtful dialogue and exchange, we aim to create an atmosphere that nurtures innovative thinking, mutual respect, and collective growth. We believe that the outcomes of this conference—both seen and unseen—will contribute meaningfully to academic advancement and the broader goal of societal progress.

Thank you to all who have contributed to making this event possible. Your passion and participation are the driving force behind its success.

Warm regards,



Md. Nurkutubul Alam
Chief Coordinator, RUEC 1st International Research Conference 2025
Rajshahi University Education Club



Message

It is with immense pride and heartfelt enthusiasm that I welcome you to the 1st International Research Conference 2025, a landmark event proudly organized by the Rajshahi University Education Club. This gathering marks a significant moment in our academic journey—one that goes beyond the mere exchange of research findings to become a celebration of intellectual curiosity, collaborative spirit, and the transformative power of knowledge.

Our conference is guided by the timely and thought-provoking theme: "Advancing Knowledge Across Disciplines for Social Transformation." In an era marked by complexity, uncertainty, and rapid change, we believe that the answers to our most pressing societal challenges lie not within the boundaries of a single discipline, but in the vibrant intersections of many. It is here—where diverse fields converge, where innovative minds meet, and where perspectives are shared—that true progress takes root.

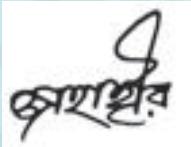
This conference brings together a dynamic assembly of scholars, researchers, educators, and students from across the globe—each one contributing a unique voice to our collective exploration. The breadth of topics, the depth of inquiry, and the rigorous standards upheld throughout the peer-review process reflect the dedication and academic integrity of everyone involved. From thought-provoking keynote addresses to meticulously researched paper presentations, every session has been carefully curated to spark dialogue, inspire innovation, and foster collaboration.

I urge all participants to engage deeply: ask bold questions, share your insights, challenge ideas constructively, and embrace the opportunity to learn from one another. Let this be more than just a conference—let it be a catalyst for new partnerships, fresh perspectives, and enduring academic relationships.

On behalf of the organizing committee, I extend my sincerest gratitude to all contributors, reviewers, volunteers, and attendees. Your commitment, passion, and participation are what breathe life into this initiative. Together, let us harness the power of knowledge to drive meaningful, lasting transformation in our communities and beyond.

Welcome to the 1st International Research Conference 2025. May it be a rewarding and inspiring experience for all.

Warm regards,



Jahangir Alam
Chief Director

1st International Research Conference 2025
Rajshahi University Education Club



Message

It is with great pride and joy that I extend my heartfelt greetings on the occasion of the RUEC International Research Conference 2025, organized by the Rajshahi University Education Club (RUEC). As the Advisor of this vibrant student-led organization and Patron of the Conference, I am deeply inspired to witness how the vision and dedication of our young learners have materialized into such a prestigious academic platform.

This initiative reflects the transformative potential of student-driven leadership in promoting research, innovation, and global collaboration. By bringing together eminent scholars, researchers, and practitioners from home and abroad, the conference exemplifies how youth engagement in research can contribute to advancing knowledge and driving meaningful social change.

The Education Club has consistently been a pioneer in nurturing research culture, encouraging academic curiosity, and fostering leadership among students of Rajshahi University. Organizing this international conference marks a historic step in strengthening the bridge between academia and society, and I firmly believe it will leave a lasting impact on the participants as well as the broader academic community.

I sincerely commend the tireless efforts of the organizers, volunteers, faculty members, and partners who have made this endeavor possible. I also extend my warm wishes to all participants for a rewarding and enriching experience. May this conference serve as a beacon of inspiration for our students to continue their pursuit of knowledge with passion, purpose, and a spirit of innovation.



Professor Rubaiyat Jahan
Advisor, Rajshahi University Education Club (RUEC)
Patron, RUEC International Research Conference 2025

Editorial Note

It gives me immense pleasure to present the proceedings of the RUEC International Research Conference 2025. This conference, organized by the Rajshahi University Education Club, embodies the spirit of academic curiosity, innovation, and collaboration that our institution proudly upholds.

We are honored to bring together distinguished scholars, young researchers, and practitioners from diverse disciplines to exchange ideas and foster meaningful dialogue. I believe the insights and collaborations emerging from this platform will not only enrich academic discourse but also contribute to social transformation.

My heartfelt appreciation goes to the dedicated organizers, contributors, and participants whose efforts have made this initiative a reality. I wish all readers and delegates a truly inspiring and rewarding experience.

Mst. Jannatul Ferdus Juthy
Editor
RUEC International Research Conference 2025

Dean's Message

The RUEC 1st International Research Conference 2025, organized by the Rajshahi University Education Club (RUEC), is a commendable initiative that fosters knowledge sharing, research innovation, and academic collaboration. This conference provides an excellent platform for students, researchers, and professionals from diverse fields to present their work, exchange ideas, and explore solutions to contemporary challenges. On behalf of the Faculty of Arts, I extend my heartfelt greetings and best wishes to all organizers, participants, and researchers. May this conference inspire continued curiosity, intellectual growth, and meaningful contributions to both national and global academic landscapes.

Prof. Dr. Muhammad Belal Hossain
Dean, Faculty of Arts
University of Rajshahi

The RUEC 1st International Research Conference 2025 creates a dynamic space for students, artists, and researchers to showcase creative work, exchange ideas, and reflect on cultural and artistic practices. I extend my warm greetings and best wishes to all participants. May the conference inspire new artist perspectives, encourage collaboration, and contribute to the growth of artistic research and expression.

Prof. Dr. Mohammad Ali
Dean, Faculty of Fine Arts
University of Rajshahi

The RUEC 1st International Research Conference 2025 organized by the Rajshahi University Education Club (RUEC) creates an inspiring platform for students, researchers and professionals to present their ideas, share insights and explore solutions to contemporary challenges in business and management. I extend my best wishes to all participants and organizers, and the event a success. I hope the discussions and exchanges will stimulate new perspectives and evolve practical solutions for future challenges.

Professor Dr. A S M Kamruzzaman
Dean, Faculty of Business Studies
University of Rajshahi 6205

The RUEC 1st International Research Conference 2025 serves as a vital platform for geoscientists, students, and researchers to share insights, explore environmental challenges, and discuss sustainable solutions. Such kind of Initiatives strengthen the research capacity and knowledge dissemination. I offer my sincere greetings and best wishes to all participants. I hope the discussions foster collaboration, inspire critical thinking, and enhance contributions to the study of earth sciences.

Professor Dr. A H M Selim Reza
Dean, Faculty of Geosciences
University of Rajshahi

The RUEC 1st International Research Conference 2025, organized by the Rajshahi University Education Club (RUEC), offers a valuable forum for students, scholars and professionals to engage in rigorous research, exchange knowledge and address pressing issues of social transformation-including those related to law, justice and governance. I commend all participants and organizers for their dedication and enthusiasm. Conferences like this not only foster critical reasoning, ethical awareness but also encourage innovative approaches to addressing legal and societal challenges. I am confident that the insights and collaborations developed through this conference will significantly contribute to academic excellence and the broader pursuit of social transformation, promoting social justice and reduce discrimination.

Professor Abu Naser Md. Wahid
Dean, Faculty of Law
University of Rajshahi.

The RUEC 1st International Research Conference 2025, organized by the Rajshahi University Education Club (RUEC), offers a distinguished platform for students, researchers, and professionals to present their work and share discoveries in the field of biological sciences. I extend my sincere greetings and best wishes to all participants. This conference encourages scientific curiosity, interdisciplinary collaboration, and innovative thinking. I hope the exchange of knowledge here will inspire future research, create new collaborations, and strengthen the impact of biological sciences in academia and beyond.

Dr. Md. Golam Mortuza
Dean, Faculty of Biological Sciences
University of Rajshahi

The RUEC 1st International Research Conference 2025 is a significant platform for Veterinarians to present findings, exchange ideas, and promote advancements in animal health, livestock development, and public health. I convey my warm greetings and best wishes to all participants. It's my sincere aspiration that scholars of RUEC of this university shall bring glory to to the country and will contribute to the building of the nation.

Prof. Dr. K.M, Mozaffor Hossain
Dean
Faculty of Veterinary and Animal Sciences
University of Rajshahi

The RUEC 1st International Research Conference 2025 offers an eminent platform for scholars and practitioners to disseminate cutting-edge research, foster intellectual exchange, and advance innovative practices in agriculture. Initiatives of this nature not only fortify the research ethos of our academic community but also contribute to sustainable development and agricultural progress at national and global levels. I extend my sincere felicitations to the organizers and participants and wish the conference every success in its endeavor to inspire excellence and cultivate scholarly thoroughness.

Prof. Dr. Md. Arifur Rahman
Dean, Faculty of Agriculture
University of Rajshahi

The RUEC 1st International Research Conference 2025 provides an excellent platform for engineers, researchers and students to share technological innovations and research outcomes. This initiative encourages practical problem-solving and interdisciplinary collaboration. I convey my heartfelt greetings and best wishes to all attendees. I hope the conference sparks creative thinking, facilitates knowledge exchange and motivates participants to make lasting contributions to engineering and technology.

Prof. Dr. Bimal Kumar Pramanik
Dean, Faculty of Engineering
University of Rajshahi

The RUEC 1st International Research Conference 2025 represents a distinguished forum for the exchange of scientific knowledge, the presentation of innovative research, and the cultivation of interdisciplinary collaboration. Such initiatives are pivotal in advancing scientific inquiry, nurturing analytical acumen, and fostering solutions to contemporary challenges. I extend my sincere appreciation to the organizers for their dedicated efforts and convey my best wishes to all participants, hoping this conference will inspire intellectual curiosity and meaningful contributions to the scientific community.

Prof. Dr. Nasima Akhter
Dean, Faculty of Science
University of Rajshahi

It is indeed a great honor and privilege for me to have the opportunity to write few words on the occasion of the RUEC Ist International Research Conference 2025 scheduled during 6-7 September 2025. I take this opportunity to convey my warm greetings and felicitations to the researchers, students and delegates from home and abroad at the green premises of Motihar. I am very certain that this occasion will be able to provide a platform towards strengthening our relationships in knowledge sharing while at the same time provide the necessary thrust in joint research collaborations.

It is my aspiration that this conference will be a foundation for the growth of new ideas towards a better tomorrow. I extend my heartfelt gratitude to the organising committee, students and researchers who have dedicated their time and effort to making this international gathering a success.

I wish the Conference all success.

Prof. Dr. Md. Mostafizur Rahman Mondol
Dean, Faculty of Fisheries
University of Rajshahi

It is my immense pleasure that the RUEC is going to arrange its 1st International Research Conference 2025 on "Advancing Knowledge and Innovation across Disciplines for Social Transformation." I hope this conference will provide an opportunity to make an exceptional platform of intellectual engagement, critical discourse, innovation and knowledge dissemination. I am sure that it will be a union of researchers, scholars, and students who are deeply interested in research. The conference will foster innovative thinking and cultivate a deeper understanding of social dynamics and challenges.

I express my sincere appreciation to the organizers for their untiring efforts and extend my best wishes to all participants. I hope this conference will inspire rigorous scholarship, collaborative inquiry, and meaningful contributions in the sphere of social science research nationally and globally.

Prof. Dr. S.M.Akram Ullah
Dean, Faculty of Social Science
University of Rajshahi

Director's Message

The RUEC 1st International Research Conference 2025 will hopefully provide an extraordinary platform for students to present their ideas, exchange perspectives, and advance their academic pursuits. By bridging disciplines and cultures, this initiative will significantly contribute to the expansion of students' intellectual horizons. The Institute of English and Other Languages, Rajshahi University is delighted to support such a remarkable initiative. I convey my appreciation to the organizers and wish all participants an enriching experience.

Dr. Maswood Akhter
Professor & Director
Institute of English and Other Languages
Rajshahi University

The RUEC 1st International Research Conference 2025 is an excellent opportunity for students to engage in intellectual exchange and develop their research capacity. By bringing together aspiring scholars from diverse fields, this initiative will encourage collaboration and a spirit of academic inquiry. The Institute of Education and Research remains committed to advancing research and supporting such initiatives. I congratulate the organizers and wish every participant success.

Dr. Akter Banu
Director
Institute of Education and Research, RU

The RUEC 1st International Research Conference 2025 is a commendable initiative that will strengthen the research ecosystem and nurture analytical skills among students. By providing a platform for knowledge sharing and academic discourse, this conference will inspire innovation and leadership in research. The Institute of Business Administration is proud to support this initiative and remains committed to advancing research excellence. I extend my best wishes for the success of this extraordinary event and its participants.

Professor Dr. Md. Shariful Islam
PhD Director
Institute of Business Administration
University of Rajshah

The RUEC 1st International Research Conference 2025 will serve as a remarkable platform for students to exchange knowledge, showcase their research and build networks at both the national and international levels.

This initiative will greatly contribute to promoting innovation and strengthening the culture of research among students. The Institute of Biological Sciences fully supports such endeavors. I extend my best wishes to the organizers and participants for a successful event.

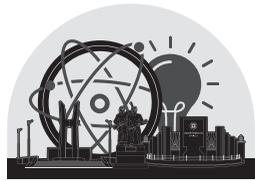
Professor Dr. Parvez Hassan
Director
Institute of Biological Sciences,
University of Rajshahi

The RUEC 1st International Research Conference 2025 is a significant step towards cultivating a culture of research and innovation among young scholars. Such platforms not only enrich academic skills but also inspire solutions to pressing environmental and societal challenges. The Institute of Environmental Sciences wholeheartedly supports this initiative and looks forward to the outcomes it will generate. I extend my heartfelt wishes to the organizers and participants.

Prof. Dr. Md. Golam Mostafa
Director
Institute of Environmental Sciences
University of Rajshahi

The RUEC 1st International Research Conference 2025 is a timely initiative that will open new avenues for student research, collaboration, and innovation. Platforms like this empower young researchers to exchange knowledge and ideas that can shape a brighter academic future. The Institute of Bangladesh Studies remains committed to creating excellence in research and scholarship. I extend my gratitude to the organizers and wish all participants success in their academic endeavors.

Mostafa Kamal
Prof. Dr. M. Mostafa Kamal
Director, Institute of Bangladesh Studies
University of Rajshahi



RUEC 1st | **20**
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RESEARCH CONFERENCE

Oral Presentation



RAJSHAHI UNIVERSITY
EDUCATION CLUB



Sub-Theme: Technology, Engineering & Industry 4.0

PID: IRC_TEIO_011

Sustainable Product Lifecycle Management in Textile Supply Chain: Integrating Smart Logistics and Waste Reduction for Environmental Impact in Bangladesh

Abhijit Dhali*

**Department of Textile Engineering, National Institute of Textile Engineering and Research (NITER), University of Dhaka, Saver, Dhaka-1350, Bangladesh.*

*Corresponding author email: abhijitdhali1377@gmail.com

ABSTRACT

Bangladesh's textile and garment industry, a global leader in apparel exports, faces increasing pressure to reduce its environment footprint. Linear production models, inefficient logistics and unsustainable waste practices hinder progress toward ecological responsibility. As global buyers demand greener practices, integrating sustainability throughout the product lifecycle has become imperative.

This study explores how Sustainable Product Lifecycle Management (SPLM), combined with smart logistics and waste reduction strategies, can improve environmental outcomes across Bangladesh's textile supply chains. It identifies scalable approaches that align production efficiency with ecological sustainability.

A mixed-method approach was adopted. Primary data were collected from ten textile and apparel units across Dhaka, Gazipur and Narayanganj through structured interviews and audits. Secondary data was sourced from industry reports and sustainability case studies. Key indicators such as resource input-output ratios, waste generation patterns and logistics efficiency were analyzed. The study also examined the adoption of Enterprise Resource Planning (ERP) systems and AI-based logistics models.

Findings showed that companies applying SPLM with real-time monitoring and predictive logistics reduced energy use by up to 18% and fabric waste by 12%. Factories with recycling and wastewater reuse systems achieved 25-30% less freshwater consumption. Smart logistics improved delivery accuracy by 22%, thereby lowering carbon emissions. Identified barriers included high initial costs and limited digital infrastructure in SMEs.

The study concludes that integrating SPLM, smart logistics and waste minimization can significantly reduce environmental impact while enhancing competitiveness, offering a roadmap for policymakers and industry leaders to promote sustainability.

Keywords: *Smart Logistics, Waste Reduction, Sustainability, Textile Supply Chain.*

PID: IRC_TEIO_019

A Hybrid YOLO-EfficientNet Framework for Fine-Grained Vegetable Recognition in Real-World, Dense Multi-Object Images

Sadia Afroz Oishi¹, Ariful Islam¹, Sajeeb Kumar Ray¹, Md. Imran Hossain^{1,*}, Md Akash Miya¹, Manob Chandra Chanda¹, Moumita Haque Mohona¹ & Nishat Tasnim Susmi¹

¹ *Department of Information and Communication Engineering, Pabna University of Science and Technology, Pabna, Bangladesh*

*Corresponding author email: imran05ice@gmail.com

Abstract

Accurate recognition of different kinds of vegetables is important to automate agriculture. However existing recognition models focus on identifying a single class or perform well in a clean, single object datasets but poorly perform on densely overlapped or noisy real world scenes. In this paper, we propose a hybrid YOLO-EfficientNet model, which combines YOLO for robust object localization and EfficientNet for accurate classification of densely arranged multi-object vegetables images. The proposed system consists of YOLOv8 for the detection of 22 vegetable classes, and then followed by EfficientNet for accurate classification of detected objects considering the fine-grain nature of the task. We evaluate the model on a custom Bangladesh vegetable dataset, where we obtained a precision rate of 82.32%, recall rate of 63.76%, and F1-score of 68.48%, showing good performance in vegetable classification but also suggesting that detection cannot generalize to small-sized or occluded object leading to very low recall score. Despite the recall issue, the hybrid architecture outperforms YOLO's native classification, demonstrating the advantage of joint detection and fine-grained classification for multi-object recognition. The results clearly indicate that hybrid models have the potential to significantly increase the reliability of both the detection and classification in complex real world environment. Future work will improve the robustness of the network using better data augmentation, denser detection algorithm to enhance recall and overall performance. This work presents a modular, scalable framework for vegetable identification, with applications in precision agriculture, automatic sorting, and food AI systems.

Keywords: *YOLOv8, Vegetable Recognition, Multi-Object Classification, Agricultural AI.*

PID: IRC_TEIO_026

AI-Based Deep Space Object Detection and Classification Using Hubble and JWST ObservationBishwajit Karmakar*¹, Mohammad Shaleh Zaed², Nushrat Mahjabeen Tanha³ & Tridib Sarkar¹¹*Department of Physics, University of Chittagong;* ²*Department of EEE, University of Chittagong;*
Chattogram, 4331, Bangladesh
Email: 20201036@std.cu.ac.bd**Abstract**

Deep space exploration depends heavily on detecting and classifying extremely distant celestial objects from complex observational datasets. The James Webb Space Telescope (JWST) and Hubble Space Telescope (HST) have seen rapid growth in data in recent years. However, manual analysis of such large-scale data remains inefficient and non-scalable, limiting timely scientific insights. Here, we present an AI-based framework for automated detection and classification of deep space objects using both tabular (CSV) and image-based (FITS) datasets derived from JWST and HST observations. We use convolutional neural networks and image segmentation to build a system that works effectively with both tabular and image data. In CSV-based training, our model achieved a detection accuracy of 93.44%, while our image-based detection pipeline currently achieves roughly 87% accuracy. These results highlight the feasibility of integrating AI into large-scale astronomical data processing, enabling real-time object classification through an interactive Streamlit-based interface. Our framework provides a scalable solution for cataloging celestial objects, reducing human effort, and accelerating future deep space exploration by enriching astronomical databases with high-quality, automatically generated classifications. Our future work will be focused on working with dynamic visual data, such as videos and time-series observations while further improving the current static image-based detection.

Keywords: *Convolutional Neural Networks (CNN), Deep Space objects, Machine Learning, Classification*

PID: IRC_TEIO_033

Assessment of Traffic-Induced Noise Pollution and Associated Residents' Health Risks in Rajshahi CityDr. Md. Abdul Wakil^{1*}, Md. Alif-Al-Maruf¹¹*Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh*
*Corresponding author email: mawakil.wakil@gmail.com

Rajshahi city is experiencing slow but steady urban expansion. While urbanisation occurs at a lower rate compared to other major cities, Rajshahi still faces urbanisation-related challenges typical of rapidly growing Bangladeshi cities. Traffic-induced noise pollution is a growing concern in Rajshahi City, adversely affecting the health and well-being of its residents. This study aims to identify the areas most affected by traffic-induced noise pollution in Rajshahi city and to determine the health risks and impacts on residents resulting from noise exposure. A 12-h equivalent continuous noise level (LAeq) noise survey conducted at different locations (n = 19) based on importance and vulnerability indicated a noise range of 56–129.6 dB. A total of 520 questionnaire surveys were conducted among city residents from different age groups who are regularly exposed to road traffic noise, including local residents, students, shop owners, policemen and drivers. The primary source was found to be auto-rickshaws. Study results revealed that all study locations exceeded the usual acceptable noise level, with the loudest noise level recorded at Kaliadanga More (113.72 dB), followed by Northern More (107.22 dB) and Kazla More (105.73 dB). Dorikhorbona, on the other hand, records the lowest at 94.98 dB. The most frequent health issues encountered by residents are headaches (26%), ringing in the ears (18%), annoyance (18%), and difficulty concentrating (17%). This study underscores the urgent need for policy interventions, including stricter traffic regulations and urban planning initiatives, to mitigate noise pollution and protect public health.

Keywords: *Noise Pollution, Urban Expansion, Equivalent Noise Level (LAeq), Rajshahi*

PID: IRC_TEIO_040

Design and Evaluation of a Sustainable Hybrid Solar Thermal System for Efficient Drying Applications
Abdullah Al Mahmood^{1*}, Md. Ashraf Alam¹, Md. Sidratul Montaha Hossain¹, Md. Roni¹ & M. Bodiul Islam¹¹*Department of Ceramic & Metallurgical Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh.**Corresponding author email: abdullah@gce.ruet.ac.bd**Abstract**

Solar energy-based drying systems serve as sustainable alternatives to fossil-fuel-driven dryers. This study examines the development and testing of an affordable hybrid solar thermal drying system designed to reduce dependence on traditional energy sources. The setup features a double-slope flat-plate solar collector enhanced with black-coated aluminum fins and a small drying chamber. During the experimental period of eight (08) months, tests were carried out at Rajshahi University of Engineering & Technology. The system was operated under different weather conditions, with both natural and forced airflow configurations tested. Results indicated that the highest outlet air temperature reached approximately 72.5°C under peak sunlight, and the drying rate for potato slices significantly increased, from 3.95%/hr in open sun to 10.12%/hr with the solar dryer. The collector's thermal efficiency varied from 42% to 66%, depending on setup and solar intensity. Forced airflow, driven by a solar-powered fan, enhanced heat circulation and cut drying times by more than a third. Overall, this hybrid dryer presents a promising solution for energy-efficient drying, particularly in rural or off-grid areas.

Keywords: *Solar Drying, Hybrid Thermal System, Moisture Reduction, Renewable Energy.*

PID: IRC_TEIO_047

Transmission Line Fault Prediction Using Machine Learning AlgorithmAli Wasif Ahmed¹, Md Khalid Hasan¹, Mosfiqur Rahman¹ & Md. Asif Hossain^{1*}¹*Department of Electrical and Electronic Engineering, Southeast University, Dhaka, Bangladesh.**Corresponding author email: asif.hossain@seu.edu.bd**Abstract**

Fault prediction on transmission lines is crucial for power system stability and safety in modern advanced power systems. This work explores the application of supervised machine learning classifiers in fault detection and classification of faults in a three-phase transmission system using a synthetic dataset consisting of over 12,000 samples. The dataset from Kaggle includes labeled current and voltage measurements of phase A, B, and C for six classes—from normal to various symmetrical and asymmetrical faults. Five models were compared: Decision Tree, Random Forest, XGBoost, Support Vector Machine (SVM), and Logistic Regression. The models were trained on and tested against split feature and label preprocessed data. Decision Tree, Random Forest, and XGBoost were 100% accurate in the test and validation set, which illustrates better capability of fault pattern identification. Logistic Regression had also been a fast and interpretable baseline with around 94% accuracy, whereas the default SVM configuration underperformed at around 75% accuracy, being sensitive to kernel choice and class imbalance. The findings show the ability of tree-based models to be employed in high-accuracy real-time fault detection of power transmission systems. Because of their strong, interpretable decisions, the models prove suitable as alternatives for inclusion in smart grid monitoring and preventive maintenance schemes. The research points out the value that machine learning can contribute to making next-generation power delivery systems more reliable and responsive.

Keywords: *machine learning algorithm, fault prediction, support vector machine, logistic regression.*

PID: IRC_TEIO_054

A Study on Performance Analysis of Cooperative Spectrum Sensing Techniques Used in Cognitive Radio Network
Sawrab Sarker¹ & Md. Asif Hossain^{1,*}

¹*Department of Electrical and Electronic Engineering, Southeast University, Dhaka, Bangladesh.*

*Corresponding author email: asif.hossain@seu.edu.bd

Abstract

The growing demand for wireless communications has caused increased scarcity of spectrum, and therefore it calls for the establishment of cognitive radio networks (CRNs) to improve the efficiency of spectrum usage. Spectrum sensing is the primary component of CRNs, wherein secondary users can identify vacant spectrum bands without causing interference to licensed primary users. Among multiple techniques, cooperative spectrum sensing (CSS) has been of keen interest as it can address the degradations of single sensing in fading, shadowing, and interference environments. In this work, performance of various cooperative spectrum sensing methods employed for cognitive radio networks is analyzed. Through the use of multiple cognitive users that exchange sensing information, CSS supports better detection capability, minimizes false alarm rates, and optimizes spectrum usage. The behavior of popular fusion rules like AND, OR, and k-out-of-n is investigated under performance measures like probability of detection, false alarm probability, and signal-to-noise ratio (SNR). The simulation demonstrates that cooperative sensing significantly enhances the reliability and robustness of low SNR spectrum detection. The results show that every fusion rule offers some compromises among complexity, energy cost, and performance, and thus they can be applied in a wide range of application environments. With wireless technologies still developing toward 5G, 6G, and the Internet of Things (IoT) in the coming future, CSS will be a fundamental technology to enable efficient, stable, and adaptive communication. This work contributes to the body of knowledge in next-generation wireless systems spectrum sensing strategy design and optimization.

Keywords: *cognitive radio networks (CRNs), cooperative spectrum sensing (CSS), next generation wireless communication, Internet of Things (IoT).*

PID: IRC_TEIO_062

Quantifying the Carbon Footprint of Digital Platforms: The Environmental Cost of User Activities

Faria Akter^{1*}, Busrat Jahan Sabiha¹ & Dr. Mamun Rashid²

^{1*}*Undergraduate Student, Institute of Information Technology, University of Dhaka, Dhaka-1000, Bangladesh.*

²*Digital Wellbeing (Futurist), ITHRA, Aramco; Affiliated with University of Southern Queensland, Australia and University of Kent, United Kingdom; Dhahran, Eastern Province, Saudi Arabia.*

*Corresponding author email: bsse1305@iit.du.ac.bd

Digital platforms dominate global communication, with 5.24 billion daily users. However, the environmental costs of their operations remain understudied. To bridge this gap, this paper investigates the carbon footprint of five major platforms (Meta, Google, TikTok, YouTube, Netflix) and assesses the environmental impact of individual user activities.

To quantify CO₂ emissions from user activities on major platforms and raise awareness of the environmental impact of digital behavior.

CO₂ emissions and their environmental cost (in tree-months) calculated as:

Key metrics:

- a. Daily Active Users (DAUs)
- b. Average Time Spent per User per Day (in hours)
- c. Data Usage (MB/hr)
- d. Energy Intensity (0.2 kWh/GB)
- e. Carbon Intensity (0.481 kg CO₂/kWh)

Calculations:

- a. **Data Consumption(GB)** = (DAU × Time × Data/hr) ÷ 1024
- b. **Energy Consumption (kWh)** = Data × 0.2
- c. **CO₂ Emission (kg)** = Energy × 0.481
- d. **Tree-months** = 0.92 kg of CO₂ per month

Average daily CO₂ emissions from video streaming are highest for TikTok (259.6M kg), followed by Netflix (139.32M kg) and YouTube (10.1M kg). On Facebook, video watching emits twice as much CO₂ as browsing feeds (7.929M kg vs. 3.964M kg), with video uploads also being major contributors. Google Search records the lowest emissions (628K kg).

This study raises public awareness by linking individual digital actions to CO₂ emissions. Fixed energy and CO₂ intensity factors were used for simplicity. Future work can use region-specific values for more accuracy.

Keywords: *Carbon footprint, Digital platforms, Environmental cost, User activities*

PID: IRC_TEIO_068

Water Hyacinth: From Ecological Burden to Sustainable High-Performance Materials – A Comprehensive Review of Extraction, Treatment, and Application AdvancementsImam Ahmed Raj^{1*}, Md. Hasinur Rahman¹, & Juli Afrin Ananna¹*¹Department of Applied Chemistry & Chemical Engineering, Faculty of Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.***Abstract**

Water hyacinth (*Eichhornia crassipes*) is a prolific aquatic plant found in lakes, rivers, and various water bodies worldwide. Due to elevated rates of regeneration, survival, and development, eradicating water bodies afflicted with water hyacinth is typically challenging. The extensive proliferation of water hyacinth poses significant ecological and economic challenges, notwithstanding its substantial annual biomass production potential. Nonetheless, some characteristics of water hyacinth may be regarded as beneficial. Researchers have explored the utilization of hyacinth in various domains, including biofuel generation, biomass and energy, wastewater treatment, compost and fertilizer, animal feed, and furniture. Despite the publication of numerous review articles in this field, to our knowledge, there is a deficiency of research that comprehensively addresses the entire process of extraction, treatment, and enhanced application of water hyacinth across various disciplines. This thorough review investigates the evolution of water hyacinth from an environmental burden to a valuable sustainable resource for high-performance polymers, composites, and general fiber applications in industries such as textiles, polymers, automotive, and construction. This article addresses the inherent mechanical constraints, ecological consequences, and efficiency of water hyacinth. This work also highlighted the advanced chemical and physical treatments, including alkali modification to promote surface roughness and bonding, silane coupling for improved matrix adherence, and nano-enhancement for superior mechanical capabilities and environmental durability of the product derived from water hyacinth. Consequently, this article might help aspiring scientists and professionals interested in converting waste materials into sustainable, eco-friendly, cost-effective, and value-added products.

Keywords: Water hyacinth, biomass, waste, value addition, advanced applications.

PID: IRC_TEIO_074

The Mitigation of Liquefaction-Induced Structural Failures in Pile Foundations Using Spring Equivalent**Support: Insights with Reference to Northern Dhaka**

Khondokar Md. Tahmid Mozakker*, Asmaul Husna Aishi, Fahim Abdullah & Apsara Chakma

*Department of Civil Engineering, Faculty of Engineering, Ahsanullah University of Science & Technology, Dhaka***Corresponding author email: khondokar.ce.20210103094@aust.edu***Abstract**

Soil liquefaction due to earthquakes is a significant threat to the geotechnical stability, especially in areas where soft saturated soil is present, such as the northern section of Dhaka. Buildings and other structures with pile foundations are particularly susceptible. The proposed research aims to evaluate the liquefaction potential of specific borehole points in the northern Dhaka area and examine its impact on pile-based facilities under seismic conditions. The main goal of this research is to develop a more realistic method for simulating soil-structure interaction by introducing a mitigation approach using spring-equivalent supports in ETABS, which better reflects the non-linear stiffness characteristics of the soil. This research aims to quantify the extent of liquefaction and extend the understanding by analyzing site-specific subsurface data and using seismic design parameters to model the dynamic behavior of piles. One would expect a comparative analysis of the behavior of the piles when subjected to spring supports and without spring supports, which would conclude the effectiveness of this method in mitigating settlements and lateral displacements during seismic events. This method can provide an affordable and exceptional design solution to the engineers operating in liquefaction-sensitive cities. Lastly, this research helps to enhance the seismic vulnerability of essential infrastructure in northern Dhaka. The outcomes can be used in future foundation design approaches and encourage safer practices in street development in urban areas.

Keywords: Spring equivalent support. Liquefaction. Pile foundation. Mitigation. ETABS

PID: IRC_TEIO_089

Life Cycle Assessment of E-Waste and its Environmental Impact in Dhaka City

Mafujul Islam Sabbir^{1*}, Antu Roy², Md. Nasibuzzaman Ratul & Taufiquazzaman Tanam³, Dr. Syeda Sultana Razia⁴.

1. Department of Chemical Engineering, Bangladesh University of Engineering and Technology.
2. Department of Chemical Engineering, Bangladesh University of Engineering and Technology.
3. Department of Chemical Engineering, Bangladesh University of Engineering and Technology.
4. Professor, Department of Chemical Engineering, Bangladesh University of Engineering and Technology.

*Corresponding author email: Sabbir82445@gmail.com

Abstract

The increasing generation of *electronic waste (e-waste)* in Dhaka City presents serious environmental challenges due to inefficient waste management practices. This study employs a *Life Cycle Assessment (LCA)* using the *ReCiPe 2016 Midpoint method* to evaluate the environmental impacts of three e-waste management scenarios: open dumping, incineration, and recycling. The analysis focuses on key impact categories, including climate change, acidification, freshwater and marine ecotoxicity, terrestrial ecotoxicity, freshwater eutrophication, human toxicity and ozone depletion. To gather reliable data, a comprehensive field survey was conducted at Yousuf Enterprise and JR Recycling Solutions Ltd. and Walton Hi-Tech Industries Ltd. to assess the current e-waste collection, dismantling, and recycling practices in Bangladesh. The results indicate that open dumping exhibits the highest environmental burden, contributing to a global warming potential (GWP) of 99.50 kg CO₂-eq, freshwater ecotoxicity of 308.67 kg 1,4-DCB-Eq, and marine ecotoxicity of 240.58 kg 1,4-DCB-Eq. Incineration significantly increases greenhouse gas emissions, with a GWP of 683.81 kg CO₂-eq, and generates a high terrestrial ecotoxicity impact of 1038.67 kg 1,4-DCB-Eq. Recycling emerges as the most sustainable option, lowering freshwater ecotoxicity to 13.17 kg 1,4-DCB-Eq and marine ecotoxicity to 16.77 kg 1,4-DCB-Eq. Nevertheless, it has the highest acidification potential of 5.93 kg SO₂-eq, likely due to chemical processing emissions. These findings emphasize the necessity of structured e-waste management policies, improved recycling infrastructure and public awareness campaigns. While recycling remains the most viable environmental solution, process optimization is required for trade-offs. Policymakers and stakeholders must implement sustainable strategies to minimize e-waste's environmental footprint in Bangladesh.

PID: IRC_TEIO_091

An Inquiry into the Emerging Carbon Capture Technologies (CCTs) and Associated Challenges Toward the Identification of Optimum Adsorbent for Effective Decarbonization

Md. Asiqul Islam^{1*}, Md. Hasinur Rahman¹, Sejuty Islam Reya & Bulbul Ahmed¹,

^{1*}Department of Applied Chemistry & Chemical Engineering, Faculty of Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: s2010271545@ru.ac.bd

Abstract:

Global warming is currently the most concerning issue, primarily attributable to excessive CO₂ emissions from industrial operations and fossil fuel consumption for energy. To mitigate this, many technologies and processes, such as pre-combustion, post-combustion, direct air capture (DAC), and calcium looping, have been proposed to improve the current state of CO₂. A wide range of adsorbents have been proposed for CO₂ capture. Nonetheless, energy consumption and efficiency in CO₂ adsorption continue to be the most formidable challenges. This study seeks to evaluate the efficacy of various processes and presents an integrated adsorbent-adsorbent system to identify a superior method for effectively reducing CO₂ with little energy usage. At present, this review analyzes through a comparative study on recent developments in CCTs, emphasizing on the development and applications of advanced sorbents and solvents, including metal-organic frameworks (MOFs), amine-functionalized materials, and solid adsorbents, due to their advantages such as pore structure, high surface area, tunability, high selectivity, and low regeneration energy. Nonetheless, optimizing pore shape of adsorbent is essential for improving selectivity for CO₂ and overall capture efficacy. A cost-benefit study indicates that MOFs, amine-functionalized adsorbents, and other solid sorbents e.g. zeolites possess the potential to enhance negative emission technologies and attain net-zero objectives. Furthermore, an adsorbent-adsorbent integrated system can be added to the existing configuration for effective capture of CO₂. Thus, this article could be useful for future researchers and industry experts looking into CCTs to lessen the world's overall impact on the environment, making it a better place to live.

Keywords: carbon capture, metal-organic frameworks (MOFs), CO₂ adsorption, environment pollution.

PID: IRC_TEIO_097

Integration of Artificial Intelligence: Enhancing Decision-Making Processes in Organisations

Md.Mehedi Hasan Mredul*, Ahona Talukder, Mst. Nure Tasnima Tania, Fariya Jannat Dristy

Begum Rokeya University, Rangpur

Abstract

This study aims at how the integration of Artificial Intelligence (AI) affects organizational decision-making effectively, exploring the mediating roles of ethical governance, cognitive bias control, organizational readiness, and leadership culture. This study reveals that 82% of the professionals believe that they are familiar with artificial intelligence, 39% of them are familiar with it from business case studies, and 73.9% of them believe that AI significantly improves organizational decision-making. The authors acquired data through questionnaires of 100 professionals from NGOs, institutions, including the finance sector, and educational sectors across northern Bangladesh. Specifically, Rangpur, Dinajpur, and Bogura, these three areas were taken for the survey. Correlation, regression, and statistical analyses were performed using SPSS to showcase relationships between organizational decision-making and artificial intelligence (AI). It is expected that this study will show how Artificial Intelligence can enhance the accuracy, speed, and efficiency of the decision-making process in an organization. It helps in predicting that organizational readiness, leadership culture, and ethical governance will become strong mediators that can influence the success of AI integration. The study also works on identifying key limitations, mainly in the areas of explainability and trustworthiness in AI systems. With alignment of technical solutions with the ethical framework and organizational capabilities, the anticipated outcome is a strategic model for effective AI adoption in an organizational environment. Real-time organizational data, long-term research restrictions on a cross-sectional design, and proper explainability are the major limitations for Artificial Intelligence to perform in organizational processes. The authors suggest that organizations seek precise explainability, proper employee training, and ethical concerns when implementing AI in the decision-making process. This study aims to add value to the limited empirical evidence on the strategic role of Artificial Intelligence in decision-making within organizations. With a social-technical-ethical framework, it suggests supporting responsible and effective AI adoption in organizational processes.

Keywords Artificial Intelligence, Decision-making, Ethical governance, Organizational readiness, Cognitive bias control, Leadership culture.

PID: IRC_TEIO_102

Effect of Calcined Wastage Materials (Clam shell, Animal bone) on the Mechanical Properties of Artificial Ceramic Teeth.Sifatulla Sharon¹, Md. Parvej Mosaraf Sohel^{1*}, Showvik Saha¹, Joyanto Saha Joy & Md. Mintu Ali¹

¹*Department of Glass & Ceramic Engineering, Rajshahi University of Engineering & Technology (RUET),
Rajshahi-6204, Bangladesh*

*Corresponding author email: parvejmosarafuetbd@gmail.com

Abstract

The high cost of bioceramic materials, combined with the environmental impact of waste disposal, has sparked interest in low-cost, sustainable alternatives. This study looks into the partial substitution of K-feldspar with calcined waste materials (clam shell and animal bone) in the production of artificial ceramic teeth. The calcium-rich waste materials were calcined at 800-900 °C and added to a typical composition of ball clay, quartz, and K-feldspar at varying percentages (7, 15, and 22 wt%). The mixtures underwent wet milling, drying, pressing, and sintering at 1150 °C. Comprehensive evaluations were performed, including physical, mechanical, thermal, and structural characterizations. X-ray diffraction (XRD) analysis revealed that the control sample consisted primarily of quartz, mullite, and cristobalite. In contrast, the 7 wt% substitution sample exhibited a phase transition to quartz and anorthite (major phases), as well as wollastonite and mullite (minor phases), indicating a reactive interaction between CaO from the calcined waste and metakaolin/silica during firing. This mineralogical evolution was associated with significant gains in bulk density, compressive strength, diametral tensile strength, and flexural strength. However, greater substitution levels (15-22 wt%) resulted in increased porosity and decreased mechanical performance due to pore structure deterioration. The optimum results were obtained at 7 wt% substitution, indicating that this level is a realistic replacement threshold for K-feldspar. This study demonstrates the viability of employing calcined clam shell and animal bone waste in dental ceramics, which provides economic and environmental benefits while retaining or improving functional qualities.

Keywords: *Calcined Waste Materials, Artificial Ceramic Teeth, K-Feldspar Substitution, X-ray diffraction (XRD).*

PID: IRC_TEIO_109

Intelligent Overspeed Control in Autonomous Vehicles with DQN Deep Reinforcement Learning
Md. Rifat Hossen¹, Md. Sarwar Hosain^{1*}

¹*Department of Information and Communication Engineering, Pabna University of Science and Technology, Pabna, Bangladesh.*

*Corresponding author email: sarwar.ice@pust.ac.bd

Abstract

Road traffic accidents are a major cause of injury and death worldwide, especially in cities with inconsistent speed regulations. Over speeding is a key factor in these incidents. Traditional approaches struggle to adapt to different speed zones, such as residential, school, or highway areas. There is growing interest in utilizing intelligent control systems in autonomous vehicles to address this issue. This study develops and assesses an intelligent speed control system based on deep reinforcement learning (DRL), specifically a deep Q-network (DQN), to automatically reduce over speeding in zones with varying speed limits. The system aims to improve road safety by ensuring compliant driving without external control. A 4×4 grid-based simulated environment was created, with each cell representing a zone with a specific speed limit from real-world data. An LSTM-enhanced DQN was trained to choose appropriate deceleration actions (high, medium, or low) when the vehicle exceeds the speed limit. The state includes the vehicle's current speed, zone speed limit, and their difference, all normalized with min-max scaling. The training involved experience replay and a double-Q approach for stability. Results showed that the DQN agent substantially decreased over speeding in most simulations. It effectively matched current speeds to target speeds for each zone and achieved positive average rewards, indicating successful learning and policy improvement. This work establishes a foundation for incorporating intelligent speed control in autonomous vehicles operating in real-world environments. Future steps involve conducting real-world tests, expanding to multi-agent systems, and integrating with traffic detection systems to enhance broader intelligent transportation systems (ITS) applications.

Keywords: *overspeed control, deep reinforcement learning, DQN, autonomous driving, intelligent transportation system*

PID: IRC_TEIO_011

“A Comprehensive Study on Heart Disease Prediction Using Machine Learning Techniques”
Md Redwan Hussain*

Department of Computer Science and Engineering, Daffodil International University, Birulia, Savar, Dhaka-1216
Corresponding author email: redwan15-12109@diu.edu.bd

Abstract:

Cardiovascular diseases (CVDs) remain the leading cause of death worldwide, highlighting the need for early diagnosis and prevention strategies to lessen their increasing impact. This study examines the effectiveness of several supervised machine learning (ML) algorithms in predicting heart disease using a publicly available dataset of 5,000 patients with clinical features such as age, cholesterol levels, blood pressure, and chest pain. The main objectives are to assess the predictive accuracy, interpretability, and reliability of ML models in managing complex medical data for clinical decision-making. A structured approach is used, including thorough data preprocessing, normalization, imputation, encoding, and SMOTE (Synthetic Minority Over-sampling Technique) for handling class imbalance, followed by implementing models with algorithms like Logistic Regression, K-Nearest Neighbors, Decision Trees, Random Forests, Gaussian Naive Bayes, Support Vector Machines, and LightGBM. Performance is evaluated using accuracy, precision, recall, F1-score, and confusion matrices, with hyperparameter tuning to enhance the top models. Results show that ensemble models such as Random Forest and LightGBM outperform traditional classifiers in predictive accuracy and interpretability, effectively identifying high-risk patients and key clinical predictors. These findings highlight the potential of ML to improve diagnostic accuracy, facilitate early intervention, and support scalable, data-driven clinical tools. Future research should focus on utilizing larger and more diverse datasets, incorporating real-time health data from wearables, and addressing ethical issues related to bias and transparency to develop fair and reliable heart disease prediction systems.

Keywords: *Heart Disease Prediction, Machine Learning Algorithms, Feature Selection and Model Evaluation, Ensemble Methods (Random Forests, LightGBM)*

PID: IRC_TEIO_119

Age and Gender Detection Using Deep Learning and Flask for South Asian and Middle Eastern Faces
Mrinmoy Saha^{1*}

¹Student, Department of Computer Science & Engineering, Faculty of Computer Science & Engineering, Hajee Mohammad Danesh Science & Technology University, Dinajpur-5200, Bangladesh

*Corresponding author e-mail: mrinmoysaha.201@gmail.com

Abstract

Age and gender detection from facial images is a challenging task for real-time security, analytics, and social computing applications, especially in diverse populations. In this study, we present a deep learning approach focused on South Asian and Middle Eastern facial features. This model was trained on a filtered subset of the FairFace dataset, which includes about 20,000 training images and 1,700 validation images, each labeled for one of eight age groups and gender. All images were preprocessed and resized to 224×224 RGB input, using categorical encoding for age labels and binary encoding for gender labels. The final architecture uses transfer learning with MobileNetV2 as the feature extractor. It has a dual-branch dense layer design to classify age groups (SoftMax, 8 classes) and gender (sigmoid) at the same time. Training lasted for 10 epochs. We achieved a peak training accuracy of 97% for gender classification and 86% for age classification. Validation accuracies were 70% for gender and 32% for age. Evaluation metrics, including confusion matrices and cross-entropy loss curves, show moderate generalization for age groups and strong gender classification. We noticed overfitting, mainly due to the small sample size and class imbalance. The deployed Flask web application incorporates real-time OpenCV face detection and displays predictions directly on the user interface. These results highlight the potential and current challenges of region-specific demographic classifiers. Future work will focus on fully utilizing the dataset, applying augmentation techniques, and implementing regularization to improve out-of-sample accuracy and model stability.

Keywords: Deep learning, Age detection, Gender prediction, Flask web application

PID: IRC_TEIO_122

Assessing Environmental Quality of Rajshahi City Corporation Using Biophysical Indicators

Mst Ilme Faridatul¹, Jannatul Ferdouse Ratu^{2*}

¹Professor, Department of Urban and Regional Planning, Rajshahi University of Engineering & Technology, Rajshahi, Bangladesh. Email: mifaridatul@urp.ruet.ac.bd.

²Graduate Student, Department of Urban and Regional Planning, Rajshahi University of Engineering & Technology, Rajshahi, Bangladesh.

*Corresponding author email: ratujannatulferdouse@gmail.com

Abstract

Urban environmental quality is a critical concern for sustainable development, particularly in rapidly urbanizing regions. This study assesses the spatial attributes of urban environmental quality in Rajshahi City, Bangladesh, using multi-temporal satellite data and population information. Remote sensing derived biophysical indicators were calculated to evaluate environmental conditions. A composite Urban Environmental Quality Index (UEQI) was constructed using Principal Component Analysis (PCA) to classify the spatial variation of urban environmental quality. To capture specific urban stress zones, two thematic indices were developed: the Urban Heat Stress Index (HSI), combining built-up intensity and population density, and the Socio-Ecological Vulnerability Index (SEVI), integrating vegetation scarcity and population pressure. The results revealed that central and western wards of the city experience poor environmental quality, high thermal exposure and ecological vulnerability. The study recommends targeted green infrastructure interventions, compact urban planning, and ongoing environmental monitoring using remote sensing tools. Overall, the research provides a data-driven framework to support sustainable urban development and environmental resilience planning.

PID: IRC_TEIO_127

Enhancing DeepFake Classification Performance Using a CNN and XceptionNet-Based Pipeline

Nishat Tasnim Susmi¹, Manob Chandra Chanda¹, Md. Sarwar Hosain^{1*}, Md. Rifat Hossen¹, Ariful Islam¹ & Sadia Afroz Oishi¹

¹*Department of Information and Communication Engineering, Pabna University of Science and Technology, Pabna, Bangladesh.*

*Corresponding author email: sarwar.ice@pust.ac.bd

Abstract

Deepfake technology, which enables the creation of highly realistic yet fake images and videos, poses a significant threat to information integrity and digital security. The popularity of generative models, such as GANs, has made it easier to produce content that often appears indistinguishable from authentic media. To combat this, the study introduces a dual-model deepfake detection system that combines a custom lightweight Convolutional Neural Network (CNN) with a transfer learning-based XceptionNet. This framework is trained and tested on the 140K Real and Fake Faces dataset, which contains an equal number of real and synthetic images. The custom CNN is built from scratch, featuring optimized convolutional layers, ReLU activations, max-pooling, and dense layers with dropout for regularization. The XceptionNet model is fine-tuned with additional dense layers for binary classification. Both models follow the same preprocessing steps and are trained with the Adam optimizer using binary cross-entropy loss. The CNN achieves an impressive 97% accuracy, while XceptionNet reaches 91%, highlighting their strong performance and ability to generalize. Metrics like precision, recall, and F1-score verify the reliability of both methods. The findings suggest that, despite limited data and resources, deepfake detection is feasible by leveraging efficient architectures and training techniques. This framework provides a scalable and resource-efficient solution for real-world deepfake forensics, particularly in environments with limited computational capacity. Future work will investigate ensemble models and real-time detection implementations.

Keywords: *Deepfake Detection, CNN, XceptionNet, Transfer Learning, Image Forgery*

PID: IRC_TEIO_132

Bangla Gesture-Based Digit and Mathematical Symbol Recognition for Expression Evaluation.

Nusrat Jahan^{1*}, Md. Saifullah Azad & Md. Khabir Uddin Ahamed¹,

¹*Department of Computer Science & Engineering, Faculty of Engineering, Jamalpur Science & Technology University, Melandah-2010, Bangladesh.*

*Corresponding author email: nusratjahan21211103@gmail.com

Abstract

For people with speech and hearing impairments in particular, mathematical expression recognition in sign language is crucial for closing communication gaps in the educational and assistive domains. In order to create and assess full mathematical expressions in real time, this paper discuss a novel system that can recognise Bangla sign language **digits** (0–9) as well as mathematical **operators** (+, −, ×, ÷, =). Numeric and symbolic gestures are stressed by this method to directly support mathematical problem-solving, in contrast to previous sign recognition studies that were mostly concentrated on alphabets or static gestures and complex landmark-based models. A custom dataset 15 gesture classes is created from multiple subjects under drivers lighting condition. High recognition accuracy for both digits and operators is achieved by implementing a classification model driven by a **CNN & LSTM**. An integrated computational engine is able to process the detected gesture sequences and automatically generate them as valid mathematical expression. The system developed is intended to increase inclusive education by **Barrier Removal** brought on by the processes of traditional usages of sign language, and enable deaf and mute students to demonstrate mathematical ideas accurately. The proposed work extends gesture recognition to symbolic mathematics which is an area rarely examined or studied in regard to sign language studies, and is a contribution towards assistive technologies. Future work will consider enhanced accessibility through augmented data set to include a broader, and more complex set of operations, and possible final deployment of the system in a mobile application.

PID: IRC_TEIO_140

Toward 5G in Developing Bangladesh: Opportunities, Challenges, and Comparative InsightsPranto Haler^{1*}, Nishat Sadia Swarna², Md. Serazul Islam²

¹Computer Science and Engineering, Faculty of Science and Engineering, Teesta University, Rangpur – 5404, Bangladesh. ORCID: 0000-0003-4786-9208

²Computer Science and Engineering, Faculty of Science and Engineering, Teesta University, Rangpur – 5404, Bangladesh.

Abstract

5G offers high speed, low latency, and enhanced connectivity, yet its deployment in developing regions like Bangladesh presents key challenges. This study investigates the prospects and barriers of 5G adoption in dense urban areas, drawing on U.S. city data to inform subcontinental contexts. 5G promises enhanced speed, low latency, and connectivity, but its deployment in developing regions like Bangladesh faces significant challenges. This study explores the prospects and limitations of 5G in densely populated areas, using U.S. city data to inform subcontinental contexts.

1. Examine key challenges of 5G deployment in Bangladesh.
2. Assess the effects of distance, orientation, and physical barriers.
3. Analyze protocol choice and server placement in effective implementation.

This study uses a machine learning approach with a University of Minnesota dataset from U.S. cities (Minneapolis, Chicago, Atlanta). It analyzes factors like distance, orientation, obstructions, and server location using correlation, regression, and visualization tools such as violin plots and heatmaps.

5G outperforms 4G in throughput but is limited by short range and sensitivity to obstacles. Performance is heavily influenced by distance, server type (with CDN servers performing better), orientation, and multipath conditions.

To address 5G challenges in dense regions, solutions like NSA with mid-range 4G LTE are recommended. Future work should focus on localized data and advanced protocols to support equitable 5G access in developing countries.

Keywords: 5G Implementation, Developing Countries, mm-Wave Technology, Network Performance

PID: IRC_TEIO_148

Integration Of Demand Side Management (DSM) For Optimizing Cost and Power In Conventional GridsPrapty Majumder Golpa^{1*}, Abrar Maksud Nahean¹

¹Department of Electrical and Electronic Engineering, BRAC University, Dhaka-1212, Bangladesh

*Corresponding author email: prapty.majumder.golpa@g.bracu.ac.bd

Abstract

Due to the rapid rise in global energy consumption, the expansion in different sectors like industry, agriculture, business has put the conventional power grids under stress. This growth in demand comes with several challenges related to efficiency, reliability, power outages and security which are damaging the balance between the supply chain and demand of energy. DSM (Demand Side Management) can be a viable solution for optimizing the energy consumption and improving the power infrastructure in both operational and economic perspectives. This study evaluates DSM system integration as a solution for optimizing power and cost effectiveness for the conventional grids. Through observation and management of energy usage and appliance schedules, the acquisition costs of energy and penalties can be reduced. DSM encourages people to shift the usage from peak to off-peak periods, ensuring the stability of the grid. Our findings show that DSM ensures significant reduction of peak loads, easing the grid pressure, flattening the demand curves and maximum use of energy resources. Integrating RES (Renewable Energy Resources) and EVs within the DSM framework improve the grid resilience and promote the decentralisation and bidirectional flow of energy where EVs function as controllable loads (H2V: Home to Vehicle) and storage devices (V2H: Vehicle to Home; V2V: Vehicle to Vehicle). TOU (Time of Use) helps to reduce the costs and energy bills. Projection of DSM studies shows energy demand can be reduced by 20.29% and generation needs by 24.35% by 2070, ensuring Carbon Emission reduction and reducing reliance on fossil fuels.

Keywords: Demand Side Management, Renewable Energy Resources, Energy Optimization, Electric Vehicles.

PID: IRC_TEIO_153

Title: Use of Explainable Machine Learning with Cluster-Based Feature Engineering to Evaluate Students' Dropout Risk Based on Eco-Life Style in Developing CountriesRasel Shikder^{1*}, Subrina Akter^{2*} & Dr. M. Helal Uddin Ahmed^{3*}¹Department of Management Information Systems (MIS), Faculty of Business Studies, University of Dhaka, Bangladesh.*Corresponding author email: raselshikderrifat17@gmail.com²Department of Management Information Systems (MIS), Faculty of Business Studies, University of Dhaka, Bangladesh.*Corresponding author email: ritusubrina@gmail.com³Professor, Department of Management Information Systems (MIS), Faculty of Business Studies, University of Dhaka, Bangladesh.*Corresponding author email: helal@du.ac.bd**Abstract**

Student dropout in lower-middle-income countries (LMICs) is increasing in a huge number by non-academic factors poorly captured in traditional early warning systems. This study addresses this gap by integrating *eco-life style* factors (lifestyle, environmental, socio-economic) with machine learning to predict dropout risk. We propose a novel framework combining unsupervised clustering and explainable AI to identify risk archetypes and key predictors. Primary data from 368 Bangladeshi university students were preprocessed (SMOTE for class imbalance, StandardScaler), and K-Means clustering identified three risk profiles: high-risk (Cluster 0), medium-risk, and low-risk. Cluster labels enhanced ensemble classifiers (XGBoost, Random Forest, AdaBoost) as engineered features. XGBoost achieved optimal performance (89% accuracy, 0.89 AUC-ROC), significantly outperforming others (Random Forest: 84%; AdaBoost: 78%). SHAP analysis revealed top predictors: academic resource access (Feature 18), work status (Feature 7), pre-university residence (Feature 4), scholarships (Feature 16), and commute burden (Feature 9). High-risk students exhibited negative centroid values in academic engagement and resource access. The framework enables early identification of at-risk students and informs targeted interventions (e.g., mobile study hubs for long-commute clusters). This study demonstrates the critical role of eco-life style factors in dropout prediction and offers a scalable tool for LMIC institutions.

Keywords: *Student dropout prediction, Eco-life style, Explainable machine learning, Cluster analysis*

PID: IRC_TEIO_156

Hydrodynamic and Morphological Assessment of the Transboundary Manu River in a Flood Year and in a Non-Flood Year Using Delft3D and Remote SensingSadia Nasrin^{1*}, Farhana Sharmeen Haque²¹Department of Environmental, Water Resources and Coastal Engineering, MIST, Dhaka-1216, Bangladesh²Department of Environmental, Water Resources and Coastal Engineering, MIST, Dhaka-1216, Bangladesh*Corresponding author email: sadianasrin2001@gmail.com**Abstract**

The Manu River is transboundary in northeastern Bangladesh, playing a vital role in local livelihoods. As 91% of its catchment area lies in India, Bangladesh is highly vulnerable to upstream rainfall events. Sometimes these trigger sudden water surges of 3 to 4 meters, resulting in flash floods, embankment failures, and widespread inundation. It is essential to investigate the river's behavior because mountain-fed flow accumulates sediment while seasonal variability alters the river's morphology.

This study uses Delft3D (Structured) Suite and remote sensing to assess the hydrodynamic and morphological behavior of the Manu River during a flood year (2017) and a non-flood year (2022). Two 2D models were developed using bathymetric data from 2017 and 2022 for the river stretch between Manu Bazar and Chadnight Bridge. The 2017 model was calibrated and validated using BWDB water level and discharge data at SW201. The same process was followed for 2022. In three cross sections, depth-average velocity and bed shear stress were observed to understand the erosion-accretion pattern. Radar images for both years were processed by ESA SNAP to further compare erosion-accretion with bankline shifting.

This study found higher velocity and bed shear stress in 2017, causing considerable erosion on the left bank, which was relatively steady in 2022. The radar image analysis confirmed the bankline shifting.

This study highlights the importance of 2D modeling and remote sensing in water resource management and can support climate-resilient infrastructure design and an adaptive water management system in the flood-prone areas of Bangladesh.

Keywords: *Delft3D, River Morphology, Hydrodynamic Simulation, Remote Sensing*

PID: IRC_TEIO_158

Securing Data Privacy in AI-Driven Industry 4.0: A Systematic Review of Risks, Challenges, and Future Directions

Khadija Sharmin¹, Sayim Uddin^{2*}

1. Department of Management Information Systems, Begum Rokeya University, Rangpur
2. Department of Management Information Systems, Faculty of Business Studies, Begum Rokeya University, Rangpur., Rangpur-5404, Rangpur, Bangladesh.

Abstract

This study investigates the challenges and implications of data privacy in the deployment of Artificial Intelligence (AI) tools within Industry 4.0 ecosystems. It explores the dual role of AI in improving operational efficiency through automation, predictive analytics, and real-time monitoring while simultaneously introducing significant data privacy vulnerabilities. The research aims to highlight emerging threats and emphasize the need for secure and privacy-aware AI practices in industrial environments.

The paper adopts a qualitative PRISMA based systematic review methodology, analyzing recent peer-reviewed literature from databases such as Scopus, Web of Science, and Google Scholar. Studies included were published between 2018 and 2024 and focus on AI-related data privacy risks and security frameworks within the context of Industry 4.0. The review categorizes threats, identifies key vulnerabilities, and explores current mitigation strategies. The findings reveal that while AI technologies significantly enhance productivity and efficiency in industrial operations, they also expose systems to critical privacy risks. These include adversarial attacks on AI models, insecure machine-to-machine communication, and misuse of data in AI training processes. Furthermore, the lack of standardized data privacy protocols and regulatory alignment within Industry 4.0 amplifies the potential for data breaches and operational disruptions.

The study underscores the urgent need for industry-specific privacy standards, privacy-by-design AI systems, and robust governance frameworks. It calls on manufacturers, developers, and policymakers to invest in secure AI development lifecycles, adopt privacy-enhancing technologies, and enforce regulatory compliance to build trust in AI adoption.

This paper presents a comprehensive, cross-disciplinary overview of the intersection between AI and data privacy in Industry 4.0. By identifying critical security gaps and offering future research directions, it contributes to the development of resilient, privacy-aware AI frameworks essential for sustainable digital transformation.

Keywords: *Data Privacy, Artificial Intelligence, Industry 4.0, Cybersecurity, Privacy-Preserving Technologies, AI Governance Frameworks*

PID: IRC_TEIO_159

Moving Through Khulna: Unpacking the Pulse of Urban Travel

Shovon Das^{1*}

¹*Urban and Rural Planning Discipline, Khulna University, Khulna-9208, Bangladesh*

*Corresponding author email: shovonkuurp@gmail.com

Abstract

In rapidly urbanizing cities like Khulna, understanding travel behavior is vital for planning sustainable and inclusive transportation systems. Travel decisions such as mode choice, trip frequency, purpose, and cost are shaped by socio-economic status and urban form. However, empirical research on mobility patterns in medium-sized cities remains limited. This study investigates the travel behavior of Khulna city residents, focusing on modal preferences, income-related travel costs, vehicle ownership, and key factors influencing trip frequency. A total of 888 household surveys were conducted across all 31 city wards using a structured questionnaire. Variables such as age, income, travel distance, trip purpose, cost, and mode choice were collected and analyzed using SPSS. Descriptive statistics and multiple linear regression were employed to identify travel trends and predictors of total trip generation. Findings reveal that 59% of households spend under BDT 200 weekly on travel. Although motorcycles are the most commonly owned vehicle (30%), most households lack personal transport. Easy bikes are the preferred mode for work, shopping, and recreation, while walking is dominant for grocery and social trips. Regression results show that household income, travel time, distance, vehicle ownership, and age composition significantly influence trip frequency, explaining 56.4% of the variance. Additionally, Origin-Destination (O-D) matrix developed in this study offer valuable tools for local agencies to optimize transport policy and resource allocation. The study underscores the need for affordable, accessible, and multimodal transport systems in Khulna, especially for low-income populations, and offers actionable insights for policy and urban mobility planning.

Keywords: *Travel behavior, Transportation, Trip, Origin-Destination (O-D) matrix*

PID: IRC_TEIO_160

A Software Based Approach in Designing Cost-effective Flexible Pavement Using Lime as Subgrade StabilizerSoyeb Mohammad Mashfi^{1*}, Monowar Hussain² & Ashikur Rahman¹¹Department of Civil Engineering, National Institute of Technology Silchar, Cachar-788010, Assam, India;²Department of Civil Engineering, Faculty of Civil Engineering, National Institute of Technology Silchar, Cachar-788010, Assam, India.

*Corresponding author email: soyebm_ug_22@civil.nits.ac.in

Abstract

In the Indian subcontinent, roads being the most preferred transportation system, play an important role in influencing the socio-economic development of this region. Especially in the hilly areas, roads are the sole means of transportation for men & materials and often in these regions the soil is mainly composed of clay. Clay soil in subgrade is subjected to swelling while in contact with water and shows shrinkage cracks in dry weather if not stabilized properly. This paper aims to study the potential of lime as a soil stabilizer and to utilize IIT PAVE software in designing the most economical road sections as per IRC 37 (Indian Road Congress) guidelines. For two types of clay soil (S1 & S2), different lime percentages (3, 5, 7 and 9) on the characteristics of soil is evaluated by obtaining California Bearing Ratio (CBR) test results from reliable published data. The results indicate that S1 soil with its large clay fraction needs relatively higher percentage of lime (7%) to alter the physicochemical characteristics whereas S2 soil with low clay content requires less lime (5%) to alter its plastic behavior. Nonetheless, road sections for each of the lime percentages (3, 5, 7, 9) have been designed, comparing the manually calculated strain values with strain values obtained from IIT PAVE output to assess the accuracy and consistency of the results. These noble results demonstrate how lime stabilization can enhance soil strength and minimize road thickness while cutting the cost of road construction in hilly regions.

Keywords: *Pavement design, Soil-stabilization, IIT PAVE, Cost-effectiveness*

PID: IRC_TEIO_163

Real – Time Accidents Detection and Emergency Response Using Deep Learning ModelsSukanta Nag Hirock^{1*} & Samiha Islam Hristee¹¹Department of Computer Science and Engineering, Mawlana Bhashani Science and Technology University

*Corresponding Author email: ce20049@mbstu.ac.bd

Abstract

Road accidents are a major cause of injury and death worldwide, particularly in densely populated countries like Bangladesh where in 2023, over 7,900 lives were lost due to road accidents. Dhaka is one of the deadliest cities for pedestrians in the world, with 65% of crashes involving them. Complex traffic conditions and limited emergency response infrastructure further worsen the situation and intervention is extremely challenging. To address these issues, this study proposes a real-time accident detection system using deep learning to automate the traffic and emergency rescue system specially designed for Bangladesh's unique traffic and environmental conditions. The research focuses on building a comprehensive dataset. Images were collected from Roboflow, Kaggle, and online news portals. Preprocessing includes resizing and annotating; every image was marked with accident and non-accident zones. The dataset covers scenarios like daytime, nighttime, foggy and rainy conditions. Models training includes existing models with YOLOv8, YOLOv9, YOLOv11, and YOLOv12 for faster, accurate detection. YOLOv12 achieved 95.37% accuracy on test data and gave 100% accuracy on frame-wise accident and non-accident detection in videos, even under challenging conditions like low light, foggy or rainy weather, proving its robustness and reliability. These findings showed that this study achieved real-time accident detection with automated alerts sent to nearby police stations, fire service, hospitals, blood banks, and emergency responders for supporting rapid response and safer urban mobility.

Keywords: *Real-time accident detection; Emergency response system; YOLO; Intelligent transportation system*

PID: IRC_TEIO_163

Cross-Modal Embedding Divergence for Robust Detection of Multimodal Adversarial Attacks in Generative Vision-Language ModelsMd Sayem^{1*}, Mostofa Fahim Hasan¹, Sadia Ahmed & Md. Rakibul Hasan¹¹*Department of CSE, School of Engineering Technology and Sciences, Independent University, Bangladesh, Dhaka, Bangladesh***Corresponding author email: 2221728@iub.edu.bd***Abstract**

Generative vision-language models (VLMs) such as BLIP-2 have demonstrated remarkable capabilities in recent works in the field of image captioning and visual question answering (VQA). However, these models remain vulnerable to adversarial attacks where minor image perturbations can lead to semantically misleading but syntactically valid textual outputs. In this paper, we present a lightweight and model-agnostic detection framework, known as LMDF, which is based on cross-modal embedding divergence to identify adversarial attacks on such generative VLMS multimodal systems. Our proposed LMDF method works based on the computation of the cosine similarity between the input image and the system-generated caption or answer using a shared vision-language encoder (e.g., CLIP or BLIP). We consider that adversarial inputs cause a measurable semantic misalignment in this shared embedding space that can be used in attack detection. We have conducted simulation work for question answering using BLIP-2 on adversarial perturbed versions of MS-COCO (for captioning) and VQAv2 (for question answering). The simulation result shows that our approach provides 91.2% accuracy compared to FGSM, PGD, and adversarial patch-based methods. Our approach shows robust, low-cost potential tool in embedding-space semantic systems for adversarial detection in real-world generative vision-language systems, particularly in safety-critical domains such as surveillance, content moderation, and accessibility-focused artificial intelligence (AI). For the future, the proposed LMDF can be applied in the autonomous vehicular transportation systems to jointly identify different roadside images and texts.

Keywords: *vision-language models, adversarial attacks, cross-modal, detection*

Sub-Theme: Life Sciences & Biotechnology

PID: IRC_LSBO_002

Microplastic in the Turag River: Occurrence, Distribution and Human Health Implications.

Naimur Rahman Sarker^{1*}, Juned Hussain Chowdhury¹, Sangita Chakroborty¹, Ryadul Alam¹, Ayesha Ahmed¹ & Dr. Mohammad Moniruzzaman²

¹Department of Public Health and Informatics, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh.

²Institute of Glass and Ceramic Research and Testing, Bangladesh Council of Scientific and Industrial Research (BCSIR) Laboratories, Dhaka-1342, Bangladesh.

*Corresponding author E-mail: naimurrahmanoni@gmail.com

Abstract

The increasing pollution of microplastic in the environment is a potential risk to the population, especially in urban rivers such as Turag river, Bangladesh. This study aims to quantify the concentration of microplastics, determine the types and sources, and the hazard of microplastic pollution to human health to guide pollutant-specific pollution control and preventive health measures. Samples (n=12) of water were taken at 6 locations (out of a distance of 4 km) in the city of Gazipur (Bangladesh) between the months February and April 2025. There was sample processing as filtration (0.45 1 mm mesh), H₂O₂ digestion and density by NaCl solution and then identification under stereomicroscope. The outputs showed that a strong spatial difference in microplastic concentrations with industrial areas giving an average of 363 particles/L as compared to non-industrial areas that had an average of 172 particles/L. Mostly fibers (64-70%), synthetic textiles, and then followed by fragments, films and pellets. Untreated wastes and industrial effluents are the causes of the high microplastic loads in the industries. There may be health risks related to eating contaminated fish because microplastic micro particles have the ability to bio accumulate chemicals, pollutants, and toxins causing intestinal diseases, endocrine disruptors, and chronic illnesses. The analysis emphasizes the need of better wastewater treatments, more effective industrial discharge laws, and the education of people to reduce the microplastic pollution problem and to serve as a data to policymakers to devise specific intervention plans to minimize the risks.

Keywords: *Microplastic, Turag River, Pollution, Human Health.*

PID: IRC_LSBO_005

Sustainable Biosynthesis of Copper Nanoparticles using *Diospyros Malabarica* Leaf Extract.

Abhi Saha¹, Dr. Mst. Jesmin Sultana^{1*}, Sajib Hossain¹

¹Department of Materials Science & Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: jesmin_mse@ru.ac.bd

Abstract: Green synthesis of nanoparticles refers to methods that use biological agents or natural compounds to reduce metal ions, minimizing environmental impact. Copper nanoparticles, known for their antimicrobial, catalytic, and electrical properties, have been extensively synthesized using green methods. This study aimed to discover the green synthesis of copper nanoparticles (CuNPs) using *Diospyros malabarica* leaf extract. A UV-vis absorbance peak at 250–269 nm, which is indicative of surface plasmon resonance, further supported the visual shift from yellow to green, which showed the decrease of Cu²⁺ ions. Functional groups like hydroxyl, carbonyl, and metal-oxygen bonds were detected by FTIR analysis, indicating the potential activity of plant phytochemicals as capping and reducing agents. Thermal stability and multistage decomposition patterns were shown by TGA-DTA analysis, indicating the organic ingredients' role in the production of nanoparticles. The study highlights the potential of *Diospyros malabarica* extract in creating stable, environmentally friendly CuNPs for future uses by establishing pH 7 as the ideal pH for nanoparticle production.

Keywords: *Copper nanoparticle, Green synthesis, UV-vis absorbance, FTIR analysis, TGA-DTA analysis.*

PID: IRC_LSBO_008

Species Composition, Habitat Use and Conservation Threats of Amphibians in Northern Bangladesh: A Case Study from Madhutula Eco Park, SherpurMd. Sabbir Ahammed^{1*}, Md Rifat Hasan², Akash Mojumdar³, Nazifa Tabassum² & Sabit Hasan⁴¹Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh²Department of Zoology, Govt. Azizul Haque College, National University, Bangladesh.³Department of Environmental Science, Stamford University Bangladesh, Dhaka-1217, Bangladesh.⁴Department of Anthropology, University of Texas, San Antonio, USA

*Corresponding author email: md.sabbirahammedshawon@gmail.com

Abstract

Eco parks serve as important semi-protected landscapes that can harbor significant biodiversity, especially in regions undergoing rapid anthropogenic changes. Monitoring the amphibian diversity of an eco-park is vital for assessing ecosystem health, as they are highly sensitive to environmental changes and hence serve as an ecological indicator. To explore the amphibian diversity, habitat preferences, and threats in Madhutula Eco-Park (MEP), Sherpur, we conducted a study between August and November 2024. Data were collected through Visual Encounter Survey (VES), roadkill surveys, and questionnaire interviews of local residents. A total of 13 amphibian species belonging to 6 families and 8 genera were recorded (n=1281). The family Dicroglossidae was the most abundant (89%), with *Euphlyctis cyanophlyctis* being the most encountered species. Diversity indices (Shannon-Weiner Diversity, $H' = 1.655$; Simpson Diversity, $1-D = 0.23$) indicate that forest patch exhibit the highest species diversity, followed by built-up area ($H' = 1.60$, $1-D = 0.24$), agricultural field ($H' = 1.56$, $1-D = 0.23$) and riparian habitat ($H' = 1.53$, $1-D = 0.29$). The Kruskal-Wallis test revealed no statistically significant differences in amphibian abundance among the four habitats ($\chi^2 = 4.35$, $df = 3$, $p = 0.2265$), indicating relatively similar abundance across habitats. Major threats include habitat destruction, pollution by tourists, roadkill, hunting, and consuming frogs, particularly by ethnic groups such as the Garo (57%) and Koch (67%) communities. This study will provide baseline data on amphibian diversity and their habitats in MEP, highlighting the need for further ecological research and effective conservation planning.

Keywords: Amphibians, Diversity, Madhutula Eco-Park, Conservation Threats

PID: IRC_LSBO_009

Assessing Residual Effect of Organic Manure and Fertilizer Management in T. Aman RiceAmanatullahi Shakira^{1*}, Imam Mehedi Hasan Tuhin¹ & Shikath Ghosh¹¹Faculty of Agriculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

*Corresponding author mail: amanatullaishakira@gmail.com

Abstract

Sustainable rice production depends heavily on maintaining soil health through efficient nutrient management. The residual effect of organic and inorganic fertilizers from one cropping season can significantly influence the growth and yield of the subsequent crop. The objective of this study was to assess the residual impact of different organic manures and fertilizer management practices applied in the previous season on the performance of T. Aman rice. The experiment was conducted at the Agronomy Field Laboratory, HSTU, Dinajpur, during the Aman season, following a prior crop grown with various nutrient inputs. The treatments included control, 100% recommended dose of chemical fertilizer, cow dung, poultry litter, vermicompost, and integrated combinations of organic and inorganic fertilizers. No fertilizer was applied to the Aman crop; only residual effects were measured. The design used was RCBD with three replications. Soil samples were collected pre- and post-harvest for chemical analysis. Plant parameters including plant height, tiller number, panicle length, and grain yield were recorded. Results showed that poultry litter and vermicompost treatments improved soil organic matter and nutrient availability. The integrated use of poultry litter and reduced chemical fertilizer produced the highest residual yield (4.25 t/ha), significantly outperforming the control. The study concludes that organic manure and integrated fertilizer management enhance residual soil fertility and can sustainably support subsequent rice cultivation.

Keywords: Residual effect, Organic manure, Integrated fertilizer management, T. Aman rice.

PID: IRC_LSBO_011

Effect of Tillage on the Production Performance and Nutritional Composition of Soybean in Coastal Areas

Dr. Md. Shafiqul Islam^{1*}, Asifa Noor¹, & Dr. Sarder Safiqul Islam

¹*Agrotechnology Discipline, Khulna University, Khulna-9208, Bangladesh*

*Corresponding Author email: shafiqueatku@gmail.com

Abstract

This study was conducted to determine the effect of tillage on the production performance and nutritional composition of soybean (*Glycine max* (L.) Merrill) in coastal areas. The experiment was conducted with factorial Randomized Complete Block Design (RCBD) involving two factors e.g. factor A (V_1 = BD-4, V_2 = BARI Soybean-6) and factor B (T_1 = Conventional Tillage, T_2 = No Tillage). The result showed significant difference ($p < 0.05$) in conventional tillage in different agronomic parameters at different DAPs like plant height, branch number, chlorophyll content and yield components like seed yield, seed weight, and harvest index of both varieties. Tillage methods and varieties had a significant effect on plant height in 75DAP and at 120DAP. Highest branch number per plant was found in BARI Soybean-6 (23.69) in the conventional tillage system. There was highly significant ($p < 0.001$) effect of branch number in tillage and varieties. Tillage systems and varieties also had a significant ($p < 0.05$) effect on Chlorophyll content at 90DAP. Biological yield had a significant ($p < 0.05$) effect on tillage systems and varieties. Tillage system and varieties had no significant ($p < 0.05$) effect on nutrient composition like DM, Ash, CP, EE etc. But tillage systems and varieties had significant effect ($p < 0.05$) on CF. The highest CF was found in BD-4 in no tillage which is V_1T_2 (9.27%). The highest CP (38.15%) was found in BARI Soybean-6 in conventional tillage. It may be concluded that, BARI Soybean-6 with conventional tillage (V_2T_1) was found best interaction in respect of most of the agronomic growth parameters and nutritional composition in coastal areas.

Keywords: Soybean, Conventional tillage, No tillage, Nutritional composition.

PID: IRC_LSBO_014

Availability of Microplastics in the Gastrointestinal Tract of Seven Selective Fishes of Marine Ecosystems of the Bay of Bengal

Aysha Akter Metu^{1*}, Md. Mahedi Hasan¹, Md Mansurul Haque¹ & Nishat Farzana¹

Laboratory of Fishery and Limnology, Department of Zoology, Jahangirnagar University, Dhaka-1342, Bangladesh.

*Corresponding author email: ayshametu@gmail.com

Microplastics (MPs) are ubiquitous in all ecosystems and are a significant source of pollution affecting the aquatic environment. The purpose of this study is to examine the presence, abundance, and polymer properties of MPs in the gastrointestinal tract (GIT) of seven specific fish species that were collected from the Bay of Bengal coastal area. The hydrogen peroxide digestion method was used to extract MPs. Stereomicroscopy, μ -FTIR analysis, and density separations were used to analyze the features of MPs and the type of polymer. A total of 151 microplastic particles were extracted from the seven fish samples, with an average concentration of 14.3% per individual fish. Harpodon nehereus had the highest MPs concentrations (22.52%; 34 out of 151), followed by Lepturacanthus savala (16.56%; 25), Pampus argenteus (13.25%; 20), Parastromateus niger (12.58%; 19), Polynemus paradiseus (9.27%; 14), Coilia dussumieri (10.59%; 16), and Setipinna phasa (15.23%). Identified microplastics were dominated by 300 μ m-1 mm size (46.24%), followed by 50-300 μ m size (28.97%), 1-5 mm size (24.79%), fragment shape (34.44%), and fiber shape (25.83%). A total of nine types of polymers have been identified, such as polytetrafluoroethylene (PTFE), polyvinylchloride (PVC), alkyd (paint particles), nylon, polyethylene, polypropylene, polyethylene terephthalate (PET), polyester, and rayon (semi-synthetic fiber). The presence of these pollutants in fish populations has been raising concerns about their potential negative effects. This study highlights the emergency required for continuous monitoring of microplastics in coastal fish species. These findings can support policies on plastic waste management and environmental protection.

Keywords: Microplastics (MPs), Gastrointestinal Tract (GIT), Polymer types, Bay of Bengal

PID: IRC_LSBO_019

Shelf-Life Extension Of Ready-To-Cook (Rtc) Battered And Breaded Tilapia Fillets Under Modified Atmosphere Packaging At Refrigerated Storage Conditions

Sumi, F.H., Begum, T.M., Amanullah, M., Hossain, M.Y., and Islam, M.T.*

Department of Fisheries, University of Rajshahi, Rajshahi 6205, Bangladesh

*Corresponding Author's E-mail: tariqul.fish@ru.ac.bd

Abstract

The iconic British dish "fish & chips" uses a fish fillet that has been battered and breaded. We have prepared battered & breaded fish fillets from tilapia (*Oreochromis niloticus*) as ready-to-cook (RTC) products by optimizing the amounts of ingredients and processing parameters. The shelf-life of RTC battered & breaded tilapia fillets was assessed by pH, total volatile base nitrogen (TVBN), thiobarbituric acid reactive substances (TBARS) and aerobic plate count (APC) under different packaging: not sealed pack as control; modified atmosphere packaging (MAP) 1 (50%CO₂ & 50%N₂); MAP 2 (40% CO₂, 30% N₂ & 30% O₂) and MAP 3 (50% CO₂ & 50% O₂) in tray (PP/EVOH/PP; 760 μm) with plastic top (PE/PA/PE; 100 μm) in 4 days interval during refrigerated storage (4°C). The pH, TVB-N, and TBARS values of the products were within the acceptable limits under all packaging conditions during the storage period. The APC gradually increased with time in all packaging conditions. The APCs exceeded the 7 log CFU/g, regarded as an acceptable limit, on approximately the 10th day for control, 14th day for MAP-1, 16th day for MAP-2, and 15th day for MAP-3 sample. MAP-2 (40% CO₂, 30% N₂ & 30% O₂) gave the highest shelf life of 16 days for battered & breaded products. Therefore, the MAP-2 is the best packaging, which can be utilized by the superstores to display those products with extended shelf life.

Keywords: Shelf-life, Quality, MAP, Ready-to-cook, Tilapia

PID: IRC_LSBO_021

Structure-Based Assessment of Methotrexate Analogues Targeting hDHFR: Substitutions at α and γ Carboxyl Positions

Md. Athar Ishtiyaq¹, Fairuz Islam^{1*}, Md. Mahmudul Hasan², Md. Tasin Nur Rahim³, Mst. Armina Akter Akhi⁴, Tamanna Tasnim¹ & Dhruvo Roy⁵

¹Department of Chemistry, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

²Department of Chemistry, Dinajpur Government College, Dinajpur 5200, Bangladesh

³Faculty of Fisheries, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

⁴Faculty of Agriculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

⁵Department of Computer Science and Engineering, Daffodil International University, Dhaka 1216, Bangladesh

*Corresponding author email: fairuz.1908070@std.hstu.ac.bd

Abstract

Methotrexate (MTX) is a potent inhibitor of hDHFR that is used in cancer chemotherapy. However, it shows highly variable pharmacokinetics and severe toxicities. Strategic substitution at the α and γ carboxyl moieties of MTX's glutamate tail enables modulation of poly-glutamation and cellular retention. This study aims to investigate α versus γ site modified MTX derivatives for the rational design of next-generation antifolates with superior pharmacokinetic profiles and reduced toxicity. Density functional theory (DFT) with B3LYP/ 6-311G(d,p) basis set have been utilized to optimize the structures, thermodynamics, dipole moment, equilibrium geometry and etc. Molecular docking was performed against hDHFR protein (1KMV) to investigate their binding affinities, modes and stability. ADMET and PASS prediction was applied to evaluate the pharmacokinetic properties. The binding affinity and non-bonding interactions of γ derivatives with the target protein were considerably higher than the α derivatives, where the highest value of binding affinity (43.09 KJ/mol) was for methotrexate-gamma-monoamide. Almost all compounds have shown Pi-Alkyl bonds. The highest BBB penetration, metabolism (CYP450C9) and rat LD₅₀ values of 0.9672, 0.9061 and 3.4955 mol/kg respectively was found for methotrexate-gamma-aspartate, methotrexate-gamma-monobutyl and methotrexate-gamma-monoamide. On the contrary, most of the alpha derivatives showed HIA>0.9. The results suggest reduced toxicity of γ derivatives but increased absorption of alpha derivatives. Gamma analogues also exhibited improved hDHFR inhibition and folate antagonist properties. Finally, strategic substitution at the γ carboxyl moiety of MTX's glutamate tail demonstrate improved pharmacokinetics properties and reduced off-target toxicity, suggesting therapeutic promise of novel MTX derivatives in cancer chemotherapy.

Keywords: Methotrexate; density functional theory; molecular docking; pharmacokinetic parameters

PID: IRC_LSBO_023

Morphological and Anatomical Changes in Water Spinach (*Ipomoea aquatica* Forssk.) under Drought Condition

Kanj Fatema Rika*, Mst. Jannatun Nayem, Md. Hadiqul Islam, Tamim Ahmed & Dr. Md. Mahabubur Rahman

Faculty of Agriculture, EXIM Bank Agricultural University Bangladesh, Chapainawabganj-6300, Bangladesh.

*Corresponding author email: Kanijrika001@gmail.com

Abstract

Drought stress is an alarming issue for plants growth and development, understanding how semi-aquatic crops respond to drought is critical. This study explores morphological and anatomical response of *Ipomoea aquatica* Forssk. to drought stress focusing identifying stress affects and adaptive traits. Plants grown under well-watered and drought condition were collected and taken to the laboratory. After washing, morphological parameters were measured including leaf (length, width and area), stem girth and internode. Free hand section of stem and peeling leaf were prepared for observation of internal structure and stomata, respectively. Results revealed, drought-stress plant showed significant reductions in all morphological parameters especially in leaf area (from $28.60 \pm 1.90 \text{ cm}^2$ to $18.46 \pm 1.61 \text{ cm}^2$). Data density plot was narrower in drought condition. Anatomical changes in epidermis observed by the formation of multilayered structure, compact vascular bundles and limited cell expansion under drought. The stomatal index (%) decreased under drought (upper: 16.04; lower: 19.42) compared to neutral condition (upper: 20.00; lower: 28.67). Interestingly, stomatal diameter was larger in drought-stressed plants (upper: $21.60 \pm 0.32 \mu\text{m}$; lower: $17.45 \pm 0.5 \mu\text{m}$) compared to neutral condition (upper: $16.84 \pm 0.29 \mu\text{m}$; lower: $16.01 \pm 0.29 \mu\text{m}$). Open stomata were fewer in drought (3.25-3.5) than neutral condition (up to 7.5). However, clogged stomata were more in drought (up to 5.25) than neutral condition (around 3). These findings highlight the effects of drought stress and plants adaptation strategy for lasting in the adverse conditions. This study will beneficiary further on morphological recovery strategies and promote drought tolerant varieties to ensure stable crop production and food security under stress condition.

Keywords: *Drought stress, Ipomoea aquatica Forssk., Morphological adaptation, Anatomical changes*

PID: IRC_LSBO_028

Identification of Microplastics in Sediments of Different Tourist Spots of Kaptai Region in Rangamati, BangladeshKazi Daniel Mamun¹*, Farzana Raihan¹, Kaniz Fatema Shepu¹ & Billal Miah¹¹ *Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet 3114, Bangladesh*

*Corresponding author email: kdmamun4@gmail.com

Abstract

Microplastic (MP) contamination in terrestrial with freshwater ecosystems has drawn more global attention because of its pervasive presence, coupled with ecological implications. In this study, the occurrence of microplastics, morphological characteristics of microplastics, and polymeric composition of microplastics in sediment samples from the Kaptai region of Rangamati in Bangladesh, which is an ecologically and touristically important area, were assessed. Ten sediment samples were collected from various tourist spots throughout the region. A combination of density separation, sieving, and chemical digestion techniques were conducted to ensure the effective isolation of MP particles from varying environmental matrices. In sediment samples, 900 MP particles total were identified. These particle concentrations varied from 5,400 to 16,000 particles/kg. Fibers as well as pellets followed fragments as the dominant type at 60.4. Identifications of polymers is done through using Fourier Transform Infrared (FTIR) spectroscopy, which confirmed for them that six major polymer types do exist: Nylon (PA), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polyethylene (PE), polypropylene (PP), and polystyrene (PS). SEM-EDX offered more understanding into surface morphology plus elemental makeup because it showed elements present like Al, Mg, S, Pt, and Fe stuck to MP surfaces. This research focuses on the possible influence that tourism might have on terrestrial ecosystems and gives significant insights on microplastic pollution state of Kaptai's sediments. The results highlight the need to develop efficient techniques for stratigically mitigating and managing plastic waste to reduce the number of microplastics that contribute to pollution in this environmentally vulnerable area.

Keywords: *Microplastics, FTIR, Pollution Ecological Risk*

PID: IRC_LSBO_031

Patterns and Causes of Hospital Discharge in Selected Public Tertiary Hospitals in Dhaka, Bangladesh
 Laiba Haq^{1*}, Amena Khatun¹, Tamanna Habib¹, Mehedi Hasan², Zaki Farhana³, Fojjun Nahar⁴, Sadhan Kumar Das⁵, Shuvojit Kumar Kundu⁵ & Md. Meshbahur Rahman⁶

¹Department of Public Health and Hospital Administration, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh

²Department of Health Education, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh

³Statistics Division, Bangladesh Bank, Dhaka 1000.

⁴Environment and Social Development Organization, Dhaka 1207, Bangladesh.

⁵Directorate General of Health Services, Ministry of Health and Family Welfare, Dhaka 1212, Bangladesh.

⁶Department of Biostatistics, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh

*Email of the presenting author: laibahaq60@gmail.com

Abstract

Hospital discharge is a crucial part of patient care, and understanding discharge patterns is key to improving outcomes. This study presents an assessment of hospital discharge patterns, underlying causes, and associated factors in selected public tertiary hospitals. This cross-sectional study was conducted among 410 discharged patients from tertiary hospitals in Dhaka between July 1, 2024, and June 30, 2025, using a semi-structured questionnaire administered through face-to-face interviews. Descriptive statistics, frequency distribution, Pearson's Chi-square test, and bivariate logistic regression were used to analyze the data. Among 410 discharged patients, 55.6% were male and 39% were aged 31–50 years, with a mean age of 45.46 ± 16.86 years. Most (68.5%, $n=281$) were discharged with advice, 26.8% ($n=110$) left against medical advice (DAMA), and 4.6% ($n=19$) were referred elsewhere. DAMA was significantly associated ($p < 0.05$) with marital status, length of hospital stays, discharge health status, and destination. Patients with deteriorating health were more likely ($OR_{adj} = 16.29$, 95% CI: 6.48–40.94, $p = 0.001$) to choose DAMA than those who improved. Married patients and those with extended hospital stays were also more likely to take DAMA. Common reasons included poor hospital conditions, long wait times, dissatisfaction with care, financial strain, fatigue from prolonged hospitalization, lack of caregiver support, and fear of job loss. To reduce DAMA and improve outcomes, hospitals should enhance care quality, communication, environment, and support—especially for high-risk patients with prolonged stays or unstable health conditions.

Keywords: Patterns of hospital discharge, DAMA, Bangladesh.

PID: IRC_LSBO_032

Taxonomic and Biochemical Investigation of Siliceous Sand Sponges (Family: Tetillidae) from the Southeast Bangladesh Coast: Implications for Marine Spatial Planning (MSP)

Mahmuda Akter Popy^{a*}, M. Shah Nawaz Chowdhury^a

^aInstitute of Marine Sciences, University of Chittagong, Chattogram 4331, Bangladesh

*Corresponding author: E-mail- mahmudapopy456@gmail.com

Abstract

Marine siliceous sand sponges, often regarded as a goldmine of marine biodiversity, exhibit a flattened to spherical morphology with a distinct osculum-ostia arrangement, lacking true tissues or organs. Their specialized water canal system enables efficient filtration, supported by a robust siliceous spicule composition, making them essential for nutrient cycling, benthic stability, and pharmaceutical research. However, research on their occurrence and biochemical properties in Bangladesh remains limited. This study bridges this gap by conducting a comprehensive taxonomic and biochemical analysis of *Tetilla dactyloidea* (Carter, 1869) from Sonadia Island, southeast Bangladesh. Specimens were collected using benthic sampling methods, followed by spicule analysis and mammographic imaging for taxonomic confirmation. Biochemical analyses included proximate composition, amino acid and fatty acid profiling via GC-MS, and heavy metal bioaccumulation using AAS. Results confirmed *T. dactyloidea* based on its characteristic spicules: anatriaenes ($89.24 \pm 1.84 \mu\text{m}$), protriaenes ($218.40 \pm 2.80 \mu\text{m}$), monoactinal monaxon styles ($91.28 \pm 2.22 \mu\text{m}$), and diactinal strongyles ($10.18\text{--}81.76 \pm 0.68 \mu\text{m}$), with an absence of sigmaspires, distinguishing it from other Tetillidae species. Habitat characterization indicated a preference for nutrient-rich substrates, consisting of a mix of sandy and muddy sediments with moderate wave action and suitable oxygenation. Biochemical composition revealed high glycine ($27.30 \pm 1.25 \text{ mg/g}$) and proline ($10.49 \pm 0.87 \text{ mg/g}$), suggesting structural resilience. The fatty acid profile was dominated by SFAs, particularly C11:0 ($49.73 \pm 2.45\%$), indicating potential antimicrobial and metabolic roles. Heavy metal analysis revealed bioaccumulation of Cd ($0.63 \pm 0.02 \text{ mg/L}$) and Ni ($2.03 \pm 0.06 \text{ mg/L}$), with MI value indicating a higher bioaccumulation capacity compared to surrounding water and sediment. This study establishes a foundational dataset for sponge research in Bangladesh, with direct implications for Marine Spatial Planning (MSP) through its bioaccumulation potential and pharmaceutical prospects. The integration of taxonomic and biochemical analyses into MSP framework can guide habitat conservation strategies and commercial sponge utilization in Bangladesh. Future research should explore the genetic characterization and pharmaceutical potential of *T. dactyloidea* through bioactive compound extraction and identification to further support sustainable marine resource management and conservation in Bangladesh.

Keywords: *Tetilla dactyloidea*, siliceous sand sponge, taxonomy, spicule, fatty acid profile, mammography, heavy metal bioaccumulation, habitat, pharmaceutical potential, Marine Spatial Planning (MSP).

PID: IRC_LSBO_035

Protocol for an Outcome-Assessor Blinded Randomized Controlled Trial Comparing the Effectiveness of Ultrasound-Guided Platelet-Rich Plasma Combined with McKenzie Exercises versus McKenzie Exercises Alone in Patients with L5/S1 Lumbar Disc Herniation

Dr. Kazi Md. Amran Hossain¹, Mahmudul Haque Udoy, Dr. Rayhan Islam

¹*Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Jashore University of Science and Technology, Jashore-7408, Bangladesh.*

*Corresponding author email: kma.hossain@just.edu.bd

Abstract

Introduction: One of the most common reasons of lower back pain and sciatica, which can make it hard to accomplish ordinary tasks, is lumbar disc herniation (LDH), especially at the L5/S1 level. Painkillers, physical therapy, and McKenzie exercises are all frequent treatments, but they don't always work entirely, which shows that there aren't many good options for treatment. We don't know how effectively regenerative platelet-rich plasma (PRP) therapy and mechanical diagnosis-based physiotherapy work together yet, but they might be a viable answer.

Objectives: The purpose of this study is to find out how well ultrasound-guided PRP injections and McKenzie therapy work together to help people with L5/S1 lumbar disc herniation get rid of pain, heal their discs, and bring their nerves back to normal. **Methodology:** The Department of Physiotherapy and Rehabilitation at Jashore University of Science and Technology will undertake a randomized controlled study (RCT) with 60 persons who have been diagnosed with L5/S1 lumbar disc herniation. Patients will be diagnosed a clinical exam and imaging (MRI or musculoskeletal ultrasonography) will confirm the diagnosis. There will be 30 patients in each group: either PRP + McKenzie therapy (n=30) or McKenzie-only therapy (n=30). The intervention will last for four weeks, and the results will be measured three times: at the start, following treatment, and again three and six months later. The major results include pain (VAS), the shape of the disc (MSK-USG), the recovery of the nervous system (SLR, EMG, NCS), and how sensitive the pain is (PPTs). **Probable Findings:** We believe that the group that gets both PRP and McKenzie therapy will do better than the group that only gets McKenzie therapy when it comes to relieving pain, fixing discs, and recovering from neurophysiological problems. If this trial works, it could lead to a strategy to treat L5/S1 lumbar disc herniation that doesn't require surgery and doesn't cost much. This would have a tremendous effect on how people are treated in nations like Bangladesh, where there aren't many resources.

Keywords: *Lumbar Disc Herniation, Platelet-Rich Plasma, McKenzie Therapy, Musculoskeletal Ultrasonography.*

PID: IRC_LSBO_038

Comprehensive In Silico Analysis of Heat Shock Proteins in Oryza Sativa Japonica: Insights into Sequence Conservation, Motif Structure, Evolution, and 3D Architecture

Md. Abdullah Al Sowrov¹*, Lipy Rani Roy¹

¹Faculty of Agriculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.

*Corresponding author email: sowrov2001022@gmail.com

Abstract: Heat shock proteins (HSPs) are considered plant molecular chaperones that play an important role in mitigating stress through the stabilization and refolding of misfolded or denatured proteins. There is, however, still limited information in terms of the sequence diversity, the evolutionary trends and the structural patterns of the HSPs in *Oryza sativa Japonica*. In this study, we have conducted a multi-layered in silico analysis of ten representative rice HSPs, using a set of tools of sequence alignment, motif discovery, phylogeny inference, subcellular location, and structure modeling. Multiple sequence alignment identified conserved amino acid blocks, while phylogenetic analysis revealed three distinct evolutionary clusters corresponding to specific functional subclasses. The MEME-based analysis of the motifs, found five recurring, highly conserved motifs, several of which are probably involved in ATP-binding or chaperone-active regions. Subcellular localization predictions also indicated the cytoplasm and endoplasmic reticulum predominantly as the targets of these proteins, since they are involved in core pathways of proteostasis. Moreover, 3D structural models obtained using Swiss-Model of two key proteins (Q6Z7B0 and P31673) indicated domain structures that matched with possible HSP families. Although the study is entirely computational, it provides valuable insights into the sequence characteristic, structural architecture, and subcellular localization of rice heat shock proteins to serve as a strong foundation of subsequent empirical research.

Keywords: *Heat Shock Proteins (HSPs), Oryza sativa Japonica, In Silico Analysis, Protein Structure and Function*

PID: IRC_LSBO_040

Assessment of Soil Microbial Community Structure in Salad Vegetables and Their Role in Agroecosystem

Md. Abu Shifat Shitol & Farzana Ashrafi Neela*

Environmental Microbiology Laboratory, Department of Botany, Faculty of Biological Science, University of Rajshahi, Rajshahi – 6205, Bangladesh.

*Corresponding author email: farzananeelabot@ru.ac.bd

Abstract

The plant microbiome is an assembly of microorganisms that live together in and near a plant and interact to form a microbial ecosystem. They stimulate plant growth through mobilizing nutrients cycling, and soil ecological function. The aim of this study is to identify the key microbiome with the potentials for improving sustainable agriculture. Field sampling was carried out from two different crops fields chili and cucumber between July 2024 to March 2025. In this study, we use Illumina Nove sequence of 16S rRNA amplicon for identifying bacterial communities across rhizosphere, bulk soil and endosphere of salad vegetables. A total of 50 bacterial genera under 20 phyla were identified. Bulk soil comprised the highest abundance of bacterial phyla and root comprised the lowest. Proteobacteria was the most dominant phylum in bulk soil, while Firmicutes in rhizosphere. Cyanobacteria was the most dominant phylum in roots. The bacteria of rhizosphere soil visualized positive relationship and they connected each other very closely. In bulk soil and endosphere visualized both positive as well as negative relationship but not closely connected. Several gene families related to environmental and genetic information processing, metabolism, cellular processes, membrane transport etc. were identified. Among them, those related to metabolism were clearly the most prevalent. This work offers important new insights about the composition of bacterial communities and their role in agroecosystem. The implications of this study will help to achieve sustainable agriculture for food security, and UN Sustainable Development Goals (SDGs).

Keywords: *Soil microbiome, Metagenomics, Food security, Agro-ecosystem*

PID: IRC_LSBO_043

Personality Trait, Cognitive Distortion, and Impulsiveness in University Students: A Gender-based StudyMd. Ashrafuzzaman^{*}, Masom Mia¹ & Torun Hasan¹¹ *Department of Clinical Psychology, Faculty of Biological Science, University of Rajshahi, Rajshahi-6205*

*Corresponding author email: mubinashraf8318@gmail.com

Abstract

Understanding the mutual interactions and contributions of individual factors (personality, impulsiveness, cognitive distortions, etc.) is crucial, especially when there is a lack of such exploration in the Bangladeshi region, in dealing with various mental health challenges. The study aims to investigate the interrelationships among personality traits, cognitive distortion, and impulsiveness with a focus on exploring the differences between males and females in terms of cognitive distortion. The present study was conducted at the University of Rajshahi, from October 2024 to December 2024, following a correlational and cross-sectional design. A total of 200 participants were selected using purposive sampling. The data were collected using a semi-structured questionnaire comprising four sections: (i) socio-demographic variables, (ii) Big Five personality Scale, (iii) Bangladesh Cognitive Distortion Scale, and (iv) Barrett Impulsiveness Scale. Pearson's product-moment correlation and independent sample t-test were conducted to explore the associations and assess gender-based differences. The result reveals that Neurotic and impulsive personality traits positively correlated ($r=0.459$, $p<0.01$; $r=0.345$, $p<0.01$) with cognitive distortion, while conscientious and extroverted personality traits negatively correlated ($r=-0.283$, $p<0.01$; $r=-0.243$, $p<0.01$) with cognitive distortion. The results also found that female participants reported significantly higher levels of cognitive distortions than their male counterparts ($M = 59.84$ vs 50.56 ; $t = -2.60$, $p < .05$). The study exhibits the intertwined nature of personality traits, distorted thinking, and impulsive behavior. Health care professionals and policymakers should focus on designing tailored psychological interventions. Development of Gender specific interventions should be coupled as well.

Keywords: *Big Five Personality, Cognitive Distortion, Impulsiveness, University Students.*

PID: IRC_LSBO_044

Impacts of ground water management in aquaculture pond on metals accumulation in fish body and consequences for human healthMd. Mahfuzur Rahman¹, Rifa Tamanna Mona¹ and Md. Abu Sayed Jewel^{1*}¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: abujewel75@gmail.com

Abstract

The research was aimed to assess the impacts of ground water management in aquaculture pond by investigating water quality, heavy metals in pond water, fish feed and fish muscles of the Barind tract of Rajshahi, Bangladesh. Water, fish feed & 3 distinct fish species (Rui, Catla, Mrigal) were collected in 18 different ponds, including 9 groundwater and 9 rainwater fed pond from November to May, 2025. Statistical analysis was done by SPSS (Var. 25) and origin (pro) version 2025. Heavy metals (Ca, Fe, As, Cr, Cd, Pb & Cu) were analyzed from these sample by Flame Atomic Absorption Spectrophotometer (FAAS). The Results showed the physicochemical parameters (DO, TDS, pH, TA, EC, temperature) significantly difference among the study pond. Decreasing order of water for groundwater and rainwater fed pond were- Ca > Fe > Cr > Pb > As > Cd and Ca > Cr > Fe > Pb > Cd > As. Among all metals from fish, Fe concentrations were highest particularly in groundwater fed pond where *Labeo rohita* showed the highest (38.87 mg/L) and children intake Fe 0.136 mg/kg/day for Rui & adult EDI values for Fe ranged 0.0312 to 0.0376 mg/kg/day from groundwater. For rainwater fed pond *Catla catla* showed the lowest concentration (28.903 mg/L) and adult intake range for Fe from 0.028 to 0.0322 mg/kg/day. To mitigate high iron levels in Barind aquaculture, this study recommends water monitoring, source management, biofilters, farmer awareness. Additionally, policy support and further research are suggested to ensure sustainable practices and protect human health.

Keywords: Fish, Aquaculture, Groundwater, Rainwater, Heavy metals, Fish Muscle, Fish feed, Barind tract.

PID: IRC_LSBO_046

Effect of Different Fertilizer Doses on the Plant Growth and Yield of Sweet Potato in Gangetic Alluvial Soil in RajshahiMd. Monirul Islam^{1*}, Most. Nure Anzuman Ara² and Md. Abul Kalam Azad³¹Ph.D. Fellow, Institute of Environmental Science, University of Rajshahi. E-mail. monirul.ru339@gmail.com²M.Phil Fellow, Institute of Environmental Science, University of Rajshahi³Professor, Institute of Environmental Science, University of Rajshahi**Abstract**

This research was carried out to observe the effect of different fertilizer doses on sweet potato in the gangetic alluvial soil at Botanical Pesticides research field of the Institute of Environmental Science (IES) of University of Rajshahi during December 2024 to April 2025. Three varieties of sweet potato (Japanese red, Bangladeshi white and Bangladeshi red) were cultivated in the IES field at four different fertilizer doses: Control (without fertilizer), TSP (100gm) + MOP (100gm); TSP (50 gm) +MOP (50 gm) + $\frac{1}{2}$ kg cowdung; and only $\frac{1}{2}$ kg cowdung. During this experiment, Bangladeshi white variety showed highest production (1.564 kg) in the treatment of TSP (100gm) + MOP (100gm). In the same treatment, Japanese variety showed lowest production (0.479 kg). The highest plant growth performances 2.893 kg and 2.38 kg was observed in the treatments of TSP (100gm)+ MOP (100gm) and TSP (50 gm) +MOP (50 gm) + $\frac{1}{2}$ kg cowdung for the Bangladeshi white sweet potato variety. The lowest plant growth (0.528kg) was observed in the TSP (100gm)+ MOP (100gm) treatment for Japanese red sweet potato. Bangladeshi white sweet potato variety in the treatment of TSP (100gm)+ MOP (100gm) showed highest size of sweet potato 10.44 cm and small size 10.33 cm was found for Bangladeshi red variety in the control treatment. From this experiment, it is concluded that inorganic fertilizer TSP (100gm) + MOP (100 gm) is suitable for the optimum production of sweet potato in Gangetic alluvial soil in Rajshahi.

PID: IRC_LSBO_050

Bio-engineered Floating Wetlands for Urban Water Purification in Dhaka's Polluted CanalsMd. Nahin Khan Oitizzo^{1*}, Khanjahan Karim Elman¹

¹*Department of Electrical, Electronics & Communication Engineering, Military Institute of Science & Technology, Mirpur Cantonment, Dhaka-1216, Bangladesh.*

**email: nahinkhanoitizzo420@gmail.com*

Abstract

Dhaka's rapid **urbanization** has severely degraded its network of canals which was once thriving. The main reasons for this are **industrial effluents, sewage, solid wastes** etc. The deteriorating water quality poses extreme hygiene and ecological threats. The research presents the use of **Bioengineered Floating Wetlands (BFWs)** as a nature based, low-cost, decentralized for purifying polluted canal water in Dhaka's canals. The primary objective is to design and deploy modular **BFWs** made from locally available bamboo or recycled plastic rifts, embedded with aquatic plants like water hyacinth, vetiver grasses etc. and specialized **microbial** communities to breakdown harmful pollutants. It includes selecting severely polluted canals across Dhaka, monitoring pre-installation water parameters (BOD, COD, DO, TDS, pH and heavy metal concentration), deploying BFWs for 5 to 6 months. This shows promising results: BOD levels **dropped 48%** while DO **increase** from **1.1mg/L to 3.4 mg/L** in pilot zones. The other surveys revealed that **70%** of nearby residents reported reduced foul odor and visible improvement in water clarity. It not only offers a promising, eco-friendly solution by restoring aquatic ecosystems but also creates green jobs through community maintenance programs.

Keywords: *Urbanization, Bioengineered Floating Wetlands, Microbial Communities, Green Jobs.*

PID: IRC_LSBO_052

Qualitative and Quantitative Analysis of Popular/BRI Rice Varieties in BangladeshMd Robiul Islam^{1*}, Md Nibir Sharkar, Md. Darun Naim, Md. Sohag Parvez & Mosammat Nilufar Yasmin;

¹*Department of Agronomy and Agricultural Extension, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh.*

**Corresponding author email: mrislam@ru.ac.bd*

Abstract: The study was conducted at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, University of Rajshahi, Bangladesh, from January to May 2023(January to May 2024), to evaluate six recently developed rice varieties: BRRI Dhan 84, BRRI Dhan 89, BRRI Dhan 92, BRRI Dhan 99, BRRI Dhan 100, and BRRI Dhan 102. The experiment was conducted using a completely randomized design (CRD) with three replications. A total of 22 qualitative and quantitative traits were assessed across six varieties. Among the evaluated rice varieties, BRRI dhan92 excelled in grain and biological yield, featuring the tallest plants, longest panicles, highest tillers per hill, most grains per panicle, heaviest thousand-grain weight, and highest chlorophyll at 45 days after transplanting. Similarly, BRRI Dhan100 demonstrated a superior harvest index, effectively converting biomass into grain while maintaining a moderate yield, optimal carbohydrate content, and sufficient levels of zinc and iron. From a nutritional perspective, BRRI Dhan 84 stood out with the highest protein and iron content, coupled with sufficient zinc, making it an ideal option for addressing nutritional deficiencies. On the other hand, BRRI Dhan89 recorded the highest carbohydrate content along with optimal grain yield, making it suitable for both productivity and energy-rich diets. Furthermore, BRRI dhan99 exhibited optimal protein and sufficient carbohydrate levels, ensuring a balanced nutritional profile, and achieved the highest total chlorophyll content at 70 days after transplanting. Lastly, BRRI Dhan 102 excelled with the highest amylose and zinc content, adequate iron levels, the highest number of productive tillers per hill, and an excellent grain yield, supporting both nutrition and high-yield farming.

Keywords: *Carbohydrate levels, Iron content, Nutritional deficiencies, Adequate iron levels.*

PID: IRC_LSBO_053

Water Quality, Sanitation Facilities, and Social Determinants of Health in Greenland Slum, Khulna: A Multifaceted Assessment of Scientific and Social Factors

Md. Rezwatul Islam Shuvo^{*1}, Md. Tamjidul Ridwan¹, Abdullah Bin Firoz¹, Md Maheenur Mizan Khan¹, Tabassum Akhter¹ & Dr. Md Abdullah Yousuf Al Harun¹

¹*Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh*

*Corresponding Author: rzshuvo001@gmail.com

Abstract

Poor sanitation poses a significant public health threat in informal settlements worldwide. Despite sanitation being recognized as a human right, residents of Greenland slum in Khulna, Bangladesh, face inadequate facilities. This study assesses drinking water quality and sanitation facilities in Greenland slum under the Khulna City Corporation. Fourteen water samples from deep tube-wells were analyzed for physico-chemical and microbial parameters, and sanitation data were collected from 200 participants via surveys, 10 key informant interviews, and 2 focus group discussions. Results showed water quality exceeding WHO standards for pH (7.3–8.1), TDS (511–1728 mg/L), and EC (1009–3775 μ S/cm), with microbial contamination significantly above limits (Total Coliform: 33–168 cfu/100ml; Fecal Coliform: 9–152 cfu/100ml; E. coli: 1–37 cfu/100ml). Sanitation surveys indicated 52% used pit latrines, 20% had no facilities, and only 30% maintained them regularly. Low education levels (30% with no formal education, 40% with only primary education) and large households (>5 members, 60%) were linked to poor access. Gender disparities in water collection and low community participation (45%) increased health risks, with 45% reporting waterborne diseases. Social capital correlated with better access. The study highlights the need for integrated strategies addressing technical and social factors to improve water and sanitation in Greenland slum.

Keywords: *Water quality, Sanitation, Social determinants, Slums*

PID: IRC_LSBO_056

Biological Features of Indian River Shad *Gudusia chapra* (Hamilton, 1822) in the Wetland (Beel Kumari) Ecosystem, North-Western Bangladesh

Abhishek Roy¹, Mst. Shahinur Khatun^{1,2}, Md. Mizanur Rahman^{1,2}, Md. Golam Sarwar^{1,2}, Tasnim Akter Akhi¹, Mst. Meherun Nesa¹, Md. Abidul Hasan², Saleha Jasmine¹ & Md. Yeamin Hossain^{1*}

¹*Department of Fisheries, University of Rajshahi, Rajshahi 6205, Bangladesh*

²*Institute of Natural Resources Research and Development, Rajshahi 6206, Bangladesh*

*Corresponding author email: yeamin.fish@gmail.com

Abstract

The Indian River shad, *Gudusia chapra*, is a well-known SIFS (Small Indigenous Fish Species) of potamodromous fish belonging to the Clupeidae family. The current study focuses on estimating biological features of *G. chapra* in the Beel Kumari, Rajshahi, Bangladesh. From July 2024 to June 2025, a total of 376 specimens were collected using traditional gear, and their lengths (TL: Total Length; SL: Standard Length; FL: Fork Length) and body weight (BW) were measured using a measuring board (cm) and a digital balance (g), respectively. Population structure showed that the majority of the population fell into the TL size class of 9 cm. The growth pattern of *G. chapra* was negative allometric ($b < 3.0$), which implies that the growth rate was relatively slow relative to length increase. The length-weight relationships (LWRs) were statistically strong ($r^2 > 0.933$). Fulton's condition factor (K_F) was the best for assessing the overall health of this species. The mean relative weight (W_R) was not significantly different from 100, indicating a balanced population. The form factor ($a_{3,0}$) of 0.0086 indicates a fusiform body shape. The calculated size at first sexual maturity was 7.18 cm (TL). Moreover, the obtained asymptotic length (L_∞) and weight (W_∞), growth coefficient (K), age at zero length (t_0), growth performance index (ϕ), and life-span (t_{max}) were 12.35 cm and 18.328 g, 0.97 year⁻¹, 0.020 year, 2.17 and 3.10 years, respectively. The estimated natural mortality was 1.49 year⁻¹, and L_{opt} was 8.17 cm (TL). This study provides an important indicator for guiding sustainable fishing practices and conservation efforts of *G. chapra* to maintain the population in the Beel Kumari.

Keywords: *Beel Kumari, Condition factors, Gudusia chapra, Population structure.*

PID: IRC_LSBO_059

Insects of the Aquatic Realm: Diversity, Distribution, and Composition in the Surma River, Sylhet, BangladeshMd. Shohag Mia^{1*}, Md Jubayer Ahmed¹, Khondoker Md Zulfiker Rahman¹, Md. Baki Billah¹ & Mohammad Abdur Razzak¹¹*Department of Zoology, Faculty of Biological Sciences, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh*

*Corresponding author email: mdshohagmia771@gmail.com

Abstract

Aquatic insects are a diverse group of organisms inhabiting riverine ecosystems, providing various ecological functions and acting as a credible signal of environmental health and water quality. The present study assessed the diversity, distribution, and composition of aquatic insects in the selected stations of the river Surma during the period May 2024 to June 2025 on a monthly basis. A total of 17,937 aquatic insects were collected, representing 24 genera from 17 families under 5 orders. Hemiptera was the most dominant (31.87%), while Coleoptera was the least dominant (5.01%). The most abundant family was Belostomatidae (19.41%), and Gomphidae (0.64%) was the least. Libellulidae was the most diverse family (4 species), followed by Coenagrionidae (3), Belostomatidae (2), and Nepidae (2). The remaining 13 families had one species each. Among the selected stations, the highest number of individuals (1,326) was recorded at station NB, while the lowest (1,010) was observed at station SP. The highest (13.79%) relative percentage abundance was shown by *Cloeon* sp., and the lowest (0.33%) was *Nepa cinerea*. Moreover, the Shannon-Wiener diversity index was highest in the station, at ($H' = 2.8$). Evenness was highest at ($E = 0.7$), and the Margalef's richness index was highest at ($d = 3.3$). This study records the patterns of the diversity, distribution, and composition of aquatic insects, which aid in the protection of river diversity and provide baseline information for future research.

Keywords: *Aquatic insects, Diversity, Composition, Surma River*

PID: IRC_LSBO_060

Evaluation of Heavy Metal Pollution in Nga-Pi, a Common Indigenous Food Ingredient Gathered from Various Sites in Cox's BazarMd. Yeasin Arifat^a, Md. Anisuzzaman^a, & Nahid Sultana^{a*}^a*Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh*

*Corresponding author: Nahid Sultana (nahid.fims@nstu.edu.bd)

Abstract

Nga-pi is a semi-fermented fish product, with usually major ingredient usually being shrimp (around 95%) & trash fish, which is a very familiar foodstuff among the indigenous community. However, because of their toxicity, the possible poisoning of such traditional foods with heavy metals presents major health hazards. This study aimed to assess the level of Lead (Pb), Cadmium (Cd), Chromium (Cr), Manganese (Mn), Mercury (Hg) & Zinc (Zn) in Nga-pi in the Cox's Bazar district. The Chowfaldandi and Moheshkhalī sites were used to gather samples. Atomic Absorption Spectroscopy (AAS) was used to determine metal concentrations at the Noakhali Science and Technology University (NSTU). The measured levels were contrasted with WHO-permitted limits, where all tested metals except Pb were within safety limits. The concentration of Pb was at 19.56 ± 2.52 mg/kg in the Chowfaldandi and 17.47 ± 4.12 mg/kg in the Moheshkhalī. Other heavy metals: Cd, Cr, Hg, Mn, and Zn were found in tolerable concentrations, such as Cd at 0.081 ± 0.009 mg/kg in Chowfaldandi and 0.0791 ± 0.023 mg/kg in Moheshkhalī. Pb concentrations were greater in Chowfaldandi than in Moheshkhalī. Nga-pi's high Pb contents underscore the urgent need for focused actions to lower consumer exposure risks, especially in the Chowfaldandi area. The causes of pollution should be investigated in future studies, and mitigating techniques should be developed. Protecting public health and guaranteeing the long-term safety of traditional fish products in coastal regions will require the implementation of routine heavy metal screening and the enforcement of regulatory norms.

Keywords: *Nga-pi, Lead, Heavy metal, Cox's Bazar*

PID: IRC_LSBO_062

Detection of Breast Cancer Utilizing Extreme Learning Machine Through Feature Fusion with CNN Deep FeaturesMd Abdulla Hasan¹* & Zaffar Abdullah¹,¹*Department of Information and Communication Engineering, Daffodil International University, Dhaka-1216, Bangladesh.**Corresponding author email abdulla242-50-058@diu.edu.bd**Abstract**

Early and precise detection of breast cancer remains the paramount method to reduce mortality rates among women. This research introduces a robust computer-aided diagnosis (CAD) architecture that enhances mammography interpretation by integrating deep learning models with meticulously designed feature descriptors in a synergistic manner. Initially, convolutional neural networks (CNNs) identify potential lesion regions, followed by the application of unsupervised extreme learning machines (US-ELMs) to categorize the areas that deviate from the norm. Subsequently, deep representations are integrated with morphological, textural, and density-based properties to create a high-dimensional and discriminative feature vector. Subsequently, we employ a supervised extreme learning machine (ELM) to categorize these aggregated properties into malignant and benign mass groupings. Our solution surpassed previous techniques on a benchmark dataset of 400 annotated mammograms across various diagnostic parameters, including accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC).

Keywords: *Computer-aided diagnosis, Deep Learning, Fusion Feature, Extreme Learning Machine.*

PID: IRC_LSBO_063

Synergistic Effects of Chitosan Nanoparticles and Vitamin E Supplement on the Antioxidant Profile, Pepsin Activity, Hormone, and Liver Morphology in *Ompok pabda*Md. Nushur Islam¹ & Sabuj Kanti Mazumder¹*¹*Department of Genetics and Fish Breeding, Faculty of Fisheries, Gazipur Agricultural University, Gazipur 1706**Corresponding Author: sabujgfb@gau.edu.bd (S.K. Mazumder)**Abstract**

Optimizing fish health and performance requires innovative dietary interventions that foster fish immunity by a stable and pathogen resilient condition while ensuring stress free environment. Current study was performed to determine the interactive actions of chitosan nanoparticle and vitamin E on the antioxidant profile (catalase, glutathione s-transferase, peroxidase, and ascorbate peroxidase), pepsin activity, growth hormone (GH) and stress-hormones namely thyroid hormones (triiodothyronine, T3, & thyroxine, T4), cortisol and adrenocorticotrophic hormone (ACTH), and liver histology in butter catfish (*Ompok pabda*). A total of 240 healthy fish with an average body weight of 13.56±0.23 g was randomly divided into 4 experimental treatment of 3 replicates. Four experimental diets were provided in fish following as T1: control (basal diet); T2: chitosan nanoparticles (CNP); T3: vitamin E (vit-E) and T4: (CNP+vit-E). A significant interaction was obtained between chitosan nanoparticle and vitamin E on antioxidant status, pepsin enzyme activity and hormonal profile in pabda fish. Our results indicated that significantly improvement was noticed in CAT, GST and POD activity in fish reared under combined treatment T4. APX activity was found to be higher at T1 treatment. Notably, maximum level of pepsin enzymatic activity was found in T4 treatment. Regarding hormonal profile, higher level of GH, thyroid hormones (T3 & T4) were observed in fish reared under CNP+vit E dietary treatment. Aside, stress hormone like cortisol and ACTH were observed at the lowest level in fish that treated with combination of chitosan nanoparticle and vitamin E. Moreover, no alteration of liver architecture by feeding CNP+vit E would suggest new avenues to combat stress and safeguard fish health.

Keywords: *Synergistic effects, Chitosan nanoparticle, Vitamin E, antioxidant, hormone, pepsin enzyme and fish health*

PID: IRC_LSBO_065

Population Size and Roost Use of the Greater False Vampire Bat (Family: Megadermatidae) in a Northern Hill Forest with Updated Distribution Records from BangladeshMd Rifat Hasan^{1*}, Akash Mojumdar², Md. Sabbir Ahammed³, Sabit Hasan⁴ & Md Ashraf Ul Hasan⁵¹Department of Zoology, Govt. Azizul Haque College, National University, Bangladesh.²Department of Environmental Science, Stamford University Bangladesh, Dhaka-1217, Bangladesh.³Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh.⁴Department of Anthropology, University of Texas, San Antonio, USA.⁵Department of Biological Sciences, Texas Tech University, Lubbock, Texas, USA.

*Corresponding author email: rifat.hasan2898@gmail.com

Abstract

Bats play a crucial role in ecosystems by providing pest control, pollination and seed dispersal services. Synanthropic bats use anthropogenic structures as roosts, indicating a close association with humans. The greater false vampire bat (*Lyroderma lyra*) is a predominantly insectivorous synanthropic species. Although *L. lyra* is globally classified as a Least Concern species and commonly roosts in human-modified landscapes, this species remains ecologically understudied with limited data on its roosting ecology and poorly documented distribution in Bangladesh, despite its role in ecosystem functioning through arthropod suppression. This study aimed to fill these gaps by identifying roosts, estimating population size, and updating the distribution of *L. lyra* in the country. Fieldwork was conducted between September and November 2024 at Madhutila Eco-Park (MEP) hill forest in northern Bangladesh, where preliminary roost survey and direct visual counts were followed to identify and monitor active roosts. Moreover, we compiled distribution records from published literature and different observations between 2022 and 2024. At MEP, we documented four night roosts and one diurnal roost, all located in anthropogenic structures, with an estimated population size of 394 to 443 individuals based on detection probabilities ($\beta = 0.8 - 0.9$). We identified five additional diurnal roosts that were recorded across five protected areas in both natural environments and anthropogenic structures between 2022 and 2024. Literature review revealed scattered records of this species in Bangladesh due to very limited ecological research. Overall, this study provides fundamental data for future conservation ecology research on *L. lyra* within a rapidly changing landscape.

Keywords: *Lyroderma lyra*, synanthropic bats, roost ecology, Bangladesh.

PID: IRC_LSBO_070

Effectiveness of Functional Neural Stretching and Weight-Bearing Exercise for the Management of Diabetic Neuropathy. A Protocol for Randomized Controlled TrialMd. Feroz Kabir^{1*}, Mehedi Hasan Badsha, KM Amran Hossain,¹Department of Physiotherapy and Rehabilitation,

Jashore University of Science and Technology, Jashore-7408, Bangladesh.

*Corresponding Author email: feroz@just.edu.bd

Abstract: Diabetic neuropathy is a common and debilitating complication of diabetes mellitus. Conventional treatments often administer functional rehabilitation approaches. Functional neural stretching and weight-bearing exercises may offer an effective alternative to improve pain, mobility, neuropathy symptoms and quality of life. To determine the effectiveness of a structured physiotherapy intervention involving functional neural stretching and weight-bearing exercises in improving pain, neuropathy symptoms, functional status, and quality of life among patients with diabetic neuropathy. A randomized control trial design will be used. 100 participants diagnosed with diabetic neuropathy (duration ≥ 1 year, HbA1c $\geq 9\%$) will be randomly assigned into an experimental group (functional neural stretching and weight-bearing exercises) and a control group (standard physiotherapy care). Intervention duration will be 8 weeks. Outcomes such as pain (Visual Analog Scale), sensation (monofilament testing), Neuropathy Symptoms (Michigan Neuropathy Screening Instrument), functional status (Timed Up and Go test), and quality of life (WHOQoL) will be measured at baseline and post-intervention. Expected outcomes include a significant reduction in pain and Neuropathy Symptoms and improvement in functional mobility and quality of life in the experimental group compared to the control group. This study suggests that functional neural stretching and weight-bearing exercises can effectively reduce pain, improve mobility, and enhance functional independence in diabetic neuropathy patients. It offers a safe, low-cost, and home-friendly physiotherapy approach suitable for clinical use.

Keywords: Diabetic Neuropathy, Functional Neural Stretching, Weight-Bearing Exercise, Physiotherapy.

PID: IRC_LSBO_076

Estimation of Population Parameter for Tank Goby *Glossogobius Giuris* (Hamilton, 1822) From The Rani River In Northwestern Bangladesh Throughs The Multimodal Approaches

Rifa Tamanna mona¹, M Mahfuzur Rahman¹ and Md Yeamin Hossain^{1*}

¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: yeamin.fish@ru.ac.bd

Abstract

The Tank goby *Glossogobius giuris* (Hamilton 1822) is a nutrient-dense and commercially significant fish species and serves as a bio indicator of water quality. Therefore, the present study was under taken to estimate the population parameters to understand both the current status and yield, and to suggest sustainable management measures for this species, using monthly samples collected from July-November 2023. The study examines various aspects of a small indigenous fish species *G. giuris* (Perciformes: Gobiidae) in the Rani River, Northwestern Bangladesh, including population structure; Length Frequency Distribution (LFD), Length-Length Relationship (LLRs), Length-Weight Relationship (LWRs), Conditions factors (K_A , K_F , K_R), prey-predator status (W_R), Form factor ($a_{3.0}$), Size at sexual maturity (L_m), Natural mortality (M_w). It aims to provide insights into the species ecology and dynamics within its habitat. A diverse range of small species were caught by using traditional fishing gear. The total count was 100 individuals measuring total length and body weight by measuring board and electronic digital balance respectively. In our study LFD showed that the largest 10 cm and smallest 5.40 cm TL. Growth pattern was indicated negative allometric growth based on b in LWRs, Allometric condition factor is best suited among other condition for this study. The form factor ($a_{3.0}$) 0.0106 indicates the elongated body shape. The estimated L_m has been found 6.26 cm, which represents the earlier maturity than Gajner *beel* and Radbanad channel in Bangladesh. The estimated natural mortality (M_w) was 1.17 year⁻¹. This findings would be very effective for further stock assessment (MSY, MEY), Exploitation Rate (E), Biodiversity Conservation, Government Policy making by establishing suitable mesh size and sustainable management of this tank goby fish not only in our country but also in neighbouring countries.

Key words: *Glossogobius giuris*, Conditions Factors, Size at sexual maturity Natural mortality, Conservation and Management, Rani River

PID: IRC_LSBO_080

Biometric indices of the Asian Striped Dwarf Catfish *Mystus tengra* (Hamilton, 1822) in the Wetland Ecosystem of Northwestern Bangladesh

Md. Saiyed As Saadat¹ and Dr. Md. Yeamin Hossain^{1*}

¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: yeamin2222@yahoo.com

Abstract

The significance of the study is to prioritize the conservation efforts and proper guidelines for effective management plans by comprehending the physiological features, population dynamics, and reproductive behavior of *Mystus tengra*. The research provides insightful conclusion on biometric parameter including the length-length relationships (LLRs), length-weight relationships (LWRs), condition factor (CF), form factor ($a_{3.0}$), growth pattern, length frequency distribution (LFD), size at sexual maturity (L_m) and mortality assessment (M_w) of *Mystus tengra* which is highly nutritious freshwater small indigenous fish species (SIS). From June 2022 to July 2023, a total of 100 specimens were examined with Total Length (TL) ranging from 6.6 - 9.1 cm and Body Weight (BW) between 2.34 - 7.33 g in the Hinnar *Beel* of Rajshahi district, northwestern Bangladesh. The allometric growth is negative ($b < 2.23$) according to the computed allometric coefficient (b). The LLR was statistically significant ($P < 0.001$) with r^2 value ≥ 0.90 . K_F performed the best in the current investigation for evaluating the health of the species in the surrounding ecosystem. The W_R was just below than 100 from 100 ($W_R=98.051$) suggests that the habitats were still in good shape but in near future it will going to face great crisis with available of food and lower predators. The $a_{3.0}$ was 0.0096 which indicating elongated body shape and M_w for *M. tengra* was 1.23 year⁻¹. The results of this study will be highly beneficial in the development of sustainable management strategies and techniques for stock assessments in the northwestern wetland and surrounding habitats.

Key words: Biometric indices, Asian Striped, Dwarf Catfish, Ecosystem, Northwestern, Sustainable management, Stock assessments

PID: IRC_LSBO_085

SHELF-LIFE OF READY-TO-COOK (RTC) FISH SAUSAGE UNDER MODIFIED ATMOSPHERE PACKAGING AT REFRIGERATED STORAGE CONDITION

Salma, M.I.J., Amanullah, M., Begum, T.M., Hossain, M.Y., and Islam, M.T.*

Department of Fisheries, University of Rajshahi, Rajshahi 6205, Bangladesh

*Corresponding Author's E-mail: tariqul.fish@ru.ac.bd

Abstract:

Fish sausage is a very popular snack in the world, though it is not very available in the market of Bangladesh. We have prepared fish sausage from pangas (*Pangasianodon hypophthalmus*) fish as ready-to-cook (RTC) products by optimizing the amounts of ingredients and processing parameters. The shelf-life of RTC fish sausages were assessed by pH, total volatile base nitrogen (TVBN), thiobarbituric acid reactive substances (TBARS) and aerobic plate count (APC) under different packaging: not sealed pack as control; modified atmosphere packaging (MAP) 1 (50%CO₂ & 50%N₂); MAP 2 (40% CO₂, 30% N₂ & 30% O₂) and MAP 3 (50% CO₂ & 50% O₂) in tray (PP/EVOH/PP; 760 µm) with plastic top (PE/PA/PE; 100 µm) in 4 days interval during refrigerated storage (4°C). The pH, TVB-N, and TBARS values of the products were within the acceptable limits under all packaging conditions during the storage period. The APC gradually increased with time in all packaging conditions. The APCs exceeded the 7 log CFU/g, regarded as an acceptable limit, on approximately the 15th day for control, the 26th day for MAP-1, the 23rd day for MAP-2, and the 25th day for MAP-3 sample for pangas. MAP-1 (50% CO₂ & 50% N₂) demonstrated the highest shelf life of 26 days for fish sausage, which can be utilized by the superstores to display those products with extended shelf life.

Keywords: *Shelf-life, Quality, MAP, Ready-to-cook, Pangas*

PID: IRC_LSBO_090

IDENTIFICATION OF RISK FACTORS FOR CONCEPTION FOLLOWING FIRST ARTIFICIAL INSEMINATION IN DAIRY COWS IN NORTHERN BANGLADESH

MD. MATIUR RAHMAN, Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

PROF. DR. MD. JALAL UDDIN SARDER, Dept. of Veterinary & Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh. jalalvas@ru.ac.bd

PROFESSOR DR. MD. AKHTARUL ISLAM, Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

DR. JASHIM UDDIN, ASSOCIATE PROFESSOR, Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

Corresponding authors: shotonvet@gmail.com,

Abstract

This study aimed to identify and analyze the risk factors influencing conception success at the first artificial insemination (FAI) service among dairy cows in northern Bangladesh. Conducted from July 2024 to March 2025 across 10 districts in the Rangpur and Rajshahi divisions, the research surveyed 942 cows through structured interviews and both tabular and financial analyses. The overall FAI conception rate was 61.12%, with significant variations attributed to multiple genetic and non-genetic factors. Breed composition played a critical role: cows with 87.5% Holstein Friesian (HF) blood achieved the highest exotic conception rate (82.7%), surpassing pure HF cows (73.1%). Notably, Sahiwal Cross cows with 67.5% exotic blood had the highest FAI success rate at 84.2%. Among breed types, HFCs showed a conception rate of 68.7%. Cervical insemination resulted in the highest success (90.1%), followed by uterine (78.6%) and vaginal (46.6%) insemination routes. Bull age also influenced outcomes, with bulls in the 2–6 months spermatogenic window achieving an 85.3% conception rate. Cow parity had a significant effect, with the highest conception rate (96.7%) observed in cows at their fourth parity. Proper timing of insemination post-estrus was crucial; cows inseminated after 18 hours of heat detection had an 88.8% conception rate. AI technician experience was also relevant, with those having 3–5 years' experience achieving superior conception outcomes. Non-genetic factors such as age at first service (AFS), days from calving to first service (DFS), feeding practices, and health conditions also significantly impacted FAI success. Cows under good feeding conditions showed a conception rate of 65.1%, compared to just 21.1% in poorly fed cows. The study further highlighted economic losses due to FAI failure, estimated at BDT 14,650 per extra open day and BDT 1,150 per additional service per conception. Health issues were widespread, with 83.3% of cows affected by diseases. The most reported were repeat breeding (40%), retention of placenta (19.5%), and vaginal prolapse (17%). Inadequate vaccination (54%) and deworming (65%) practices further exacerbated reproductive issues. In conclusion, FAI success in dairy cows in northern Bangladesh is significantly influenced by breed composition, insemination practices, cow parity, technician experience, feeding quality, and health management. Enhancing farmer training, veterinary support, and routine reproductive monitoring could substantially improve conception outcomes. Strategic cow replacement and economic cost-benefit analysis are recommended for sustainable dairy productivity.

Keywords: *Artificial insemination; Dairy Cow; First Service; Conception; Risk Factor; Economic Impact.*

PID: IRC_LSBO_106

Efficacy of biocontrol agent to control leaf spot disease of *Azadirachta indica*

Mohooa Yasmin^{*1}, Mahbuba Khan², Mohashweta Roy³, Md. Ahsanur Rahman⁴, Shameema Nasrin⁵

^{1,2}Department of Botany, Chittagong College, Chattogram, 4000, Bangladesh

³Department of Botany, Government Women College, Chattogram, 4000, Bangladesh

^{4,5}Bangladesh Forest Research Institute, Chattogram, 4000, Bangladesh

Corresponding author: yasminmohooa@gmail.com

Abstract

Azadirachta indica is an important plant for its various kinds of usefulness. *Azadirachta indica*, also known as 'Neem', has been used for treating various diseases, including malaria, skin, viral, AIDS, oral, and sexually transmitted diseases. In Bangladesh, the leaf spot of *Azadirachta indica* is the most serious problem for farmers and researchers. The disease not only affects the health and productivity of neem plants but also impacts the livelihood of small-scale farmers. As the need for neem products continues to grow, it has become increasingly important to develop useful strategies for the management and control of leaf spot disease in neem plants.

A study was directed at Bangladesh Forest Research Institute to identify the leaf spot disease affecting neem plants and to find useful ways to control it. *Colletotrichum sp.* was found to be the major causal organism responsible for the disease. The use of *Trichoderma sp.* bio-fertilizer formulations were found to be a useful, durable and eco-friendly way to develop a sustainable fertilizer use strategy. The findings of the study can be applied to develop effective strategies for the management and control of the disease, which can help enhance the overall health and productivity of neem plants in the country.

Keywords: Neem, *Azadirachta indica*, *Colletotrichum sp.*, Leaf spot disease, bio-fertilizer, *Trichoderma*.

PID: IRC_LSBO_110

Production Performance and Economic Evaluation of Tiger Shrimp Integrated with *Artemia* Sp. in an Improved Traditional Culture System

Mst. Afia Humaira^{1#}, Shikder Saiful Islam¹, Romana Akter Shapla¹, Israt Jahan¹

¹ Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna, Bangladesh

*Email: humairaafia06@gmail.com

Abstract

Bangladesh's tiger shrimp (*Penaeus monodon*) industry, a crucial economic pillar, faces significant setbacks from traditional practices and climate change, leading to suboptimal yields. This research proposes integrating *Artemia sp.*, a highly nutritious and resilient live feed to revitalize the sector. *Artemia's* exceptional nutritional profile (rich in proteins, amino acids, and fatty acids) and environmental adaptability are poised to enhance shrimp growth, bolster immune responses, and build overall aquaculture resilience, thereby fostering a climate-adaptive farming model. Conducted in Shyamnagar Upazila and Khulna University, this study meticulously evaluated *Artemia's* impact on shrimp performance, nutritional quality, and economic viability. The experimental design comprises a control group fed commercial pelleted feed and four treatment groups incorporating *Artemia* in various ways: a combination of commercial feed and *Artemia*, exclusive *Artemia* feeding, nutrient-enriched *Artemia*, and *Artemia* integrated into the culture system via a separate cage respectively T1, T2, T3, T4. Treatment 4 yielded the most superior results. This innovative approach demonstrably improved key performance indicators, including specific growth rate and feed conversion ratio, while also maintaining optimal water and soil quality. Crucially, shrimp in Treatment 4 exhibited the highest total haemocyte count, a vital indicator of robust immune responses. The standard deviations for total haemocyte count across groups were: Control (0.696467), T1 (0.174322), T2 (0.224963), T3 (0.755632), and T4 (0.844004), illustrating the variability within each treatment. These compelling findings underscore the immense potential of *Artemia* cage integration to forge a sustainable and highly profitable shrimp farming model in Bangladesh, directly addressing pressing industry challenges and contributing to long-term economic stability.

Keywords: *Artemia* integration, Production performance of shrimp, Climate-adaptive farming, Resilient live feed

PID: IRC_LSBO_116

Assessing Sustainable Fisheries Management and Population Parameters of *Aspidoparia jaya* (Hamilton, 1822) in the Padma River, BangladeshMst. Masuma Tabassum^{1*}, Mst. Hafiza Khatun Happy¹, Mst. Fatema Akter & Sadia Rahman¹¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi – 6205, Bangladesh;

*Corresponding author email: mussmasuma@gmail.com

Abstract

Aspidoparia jaya (Hamilton, 1822), a small indigenous cyprinid fish, plays a vital role in the riverine biodiversity and local fisheries of Bangladesh. Despite its ecological and economical importance, limited scientific attention has been given to its population structure and biological parameters in the Padma. This is the most comprehensive description of *A. jaya*'s population characteristics, including population structure (Length-Frequency Distributions, LFDs), growth (Length-Weight and Length-Length Relationships; LWRs, LLRs), condition factors (Allometric, KA; Fulton's, KF; Relative, KR; Relative weight, WR; and Form factor, a 3.0), Reproduction (first sexual maturity, Lm) and Natural mortality (MW) in the Padma River, northwestern (NW) Bangladesh. Between September 2024 to February 2025, samples were obtained using various fishing techniques. Each individual's Total Length (TL) and Standard Length (SL) were measured using digital slide calipers, and their Body Weight (BW) was determined using a digital balance. The present study examined 94 individuals with body weights ranging from 1.2 g to 6.2 g and TL measurements between 5.2 cm to 9.1 cm. The population as a whole was numerically led by the 7.50 cm to 9.50 cm TL group. For TL vs. BW, the allometric coefficient (b) of LWRs shows negative allometric growth ($b < 3.0$) and also negative allometric growth ($b < 3.0$) for SL vs. BW relationship. According to the current study, KF (with a range of 0.777 to 0.794) was the optimal condition factor for the health of *A. jaya* in the Padma River. The Lm was 5.69 cm, the a3.0 was 0.0069 which indicates this fish has a short, deep body shape, and the MW was calculated to be 1.67 year⁻¹. The outcomes would provide a sound sustainable conservation strategy for this species in the Padma River and its surrounding habitat.

Keywords: *Aspidoparia jaya*, condition factor, growth pattern, the Padma river.

PID: IRC_LSBO_120

Antibiotic Utilization and Sensitivity Patterns Across Different Ages in Commercial Layer Farms in The Chattogram DivisionMd Shariful Islam^{1*}, Mysha Hossain Prome², Prantor karmaker¹, Syed Sarwar Jahan¹, & Md. Mehedi Hasan¹¹Department of Veterinary & Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.²Department of Zoology, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: msips06@ru.ac.bd

Abstract

Antimicrobial resistance (AMR) in poultry farming poses significant challenges to animal and public health. This study assessed antibiotic sensitivity and resistance patterns in bacterial isolates from commercial layer farms across different age groups, flock sizes, and districts in the Chattogram Division, Bangladesh. Ten commonly used antibiotics were tested, revealing an overall sensitivity rate of 48% and a resistance rate of 52%. Although no statistically significant association between flock size and resistance/sensitivity ($p > 0.05$), though small flocks showed higher resistance (58.57%) descriptively. Age-wise trends declining sensitivity in mid-aged (31–54 weeks) and older (55–86 weeks) birds, with young layers (13–30 weeks) exhibiting the highest sensitivity (57.5%). Geographically, Comilla (75% resistant) and Chattogram (70%) had significantly higher resistance than Feni (47.27%) ($p < 0.05$). Among antibiotics, Doxycycline (100% sensitive) and Colistin (95%) were highly effective, whereas Erythromycin (90% resistant) and Amoxicillin (85%) showed alarming resistance. The findings highlight the impact of antibiotic misuse, regional variations in drug accessibility, and age-related resistance trends. Stringent antibiotic stewardship, region-specific AMR surveillance, and evidence-based treatment protocols to mitigate resistance escalation in poultry production. These measures are crucial for safeguarding both animal health and public health in the face of growing AMR threats.

Keywords: Antimicrobial resistance, Antibiotic sensitivity, Layer chickens, Antibiotic stewardship.

PID: IRC_LSBO_126

Food Safety Assessment of *Staphylococcus aureus* Contamination in Bakery Products from Local Markets in Mymensingh City

Asif Ahmed¹, Nusrat Jahan Niju¹, Arnob Saha², Mst. Minara Khatun² & Md. Ariful Islam^{2*}

¹Food Safety Management, Interdisciplinary Institute for Food Security, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

²Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

*Corresponding author's email: islamma@bau.edu.bd

Abstract

Bakery products are food items made primarily from flour or meal base and typically baked in an oven, most consumed food worldwide and a good source of different essential nutrients. However, its contamination by multidrug-resistant (MDR) bacteria, especially *Staphylococcus aureus*, presents a serious public health concern. This study aimed to isolate, molecular detection and antibiogram profiles of *Staphylococcus aureus* from bakery products named biscuit, bread and cake obtained from local markets in Mymensingh city. A total of 45 samples of bakery products including biscuit, cake and bread were collected from three locations: KR Market, Jobbarer Mor, and Shes Mor, were analyzed, of which 33.33% showed growth consistent with *Staphylococcus aureus* based on cultural, morphological, and biochemical characteristics. Gram-positive cocci arranged in grape-like clusters were confirmed as *Staphylococcus aureus* through biochemical tests, including catalase and coagulase assays, and molecular detection using PCR targeting the nuc gene (279 bp amplicon). Among the isolates, bread samples had the highest prevalence (33.33%), followed by cakes (26.27%) and biscuits (13.33%). Antibiotic susceptibility testing against five antibiotics revealed that *Staphylococcus aureus* exhibited the highest resistance to Penicillin (100%) and Ciprofloxacin (54.54%) and moderate resistance to Tetracycline (54.54%). Oxacillin showed a resistance rate of 45.45%, while Vancomycin displayed the highest susceptibility (45.45%). These study underscore the presence of antibiotic-resistant *Staphylococcus aureus* in bakery products, posing a potential public health risk and highlighting the urgent need for improved hygiene, food safety monitoring, and market education to mitigate the risk of spreading MDR bacteria.

Keywords: Bakery products; *Staphylococcus aureus*; Antibiotic resistance; Food safety.

PID: IRC_LSBO_130

Evaluation of the Antimicrobial Potentiality of *Syzygium aromaticum* Extracts on Pathogenic Bacterial Strains-An In-vitro Study

Parna Paul¹, Kowsar Ahamed¹, Ifte Khairul Islam¹, Fahim Alam Nobel¹, Mohammad Nasir Uddin¹, Mohammad Kamruzzaman¹, Mohammad Johirul Islam^{1*}

¹Department of Biochemistry and Molecular Biology, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh

*Correspondence to Mohammad Johirul Islam

Email: johirbmb@mbstu.ac.bd

Abstract

Antibiotics were once seen as miracle cures that changed the way we treat infections. But over time, using them too much has caused a serious problem, many bacteria have become resistant, making these drugs less effective. As a result, scientists are now looking for safer and more natural options. One promising source is medicinal plants, among these, clove (*Syzygium aromaticum*) is well known. It is often used as a natural preservative and in traditional medicine, and studies have shown it can help fight different types of bacteria and fungi. **Method:** The extracts of clove were prepared using water, methanol (60%) and ethanol (70%). The disc diffusion technique was implemented for the evaluation of antimicrobial activities of the extracts and the zone of inhibitions was recorded in millimeters. The antimicrobial test was done against 6 pathogenic Bacterial strains namely *Vibrio cholera* (10 strains), *S.aureus*, *k.pneumonia*, *E.coli*, *E. faecalis*, *P.aeruginosa*. **Result:** The result of this study showed that clove ethanol and methanol extracts had the highest antimicrobial property than aqueous extract against all the test microorganisms. The MIC value of aqueous extract was 2 mg (10 μ l), for methanol extract the MIC value was 1mg (5 μ l) and for ethanol extract the MIC value was 1 mg (5 μ l) against *vibrio cholera N16961*. At a test concentration, 60 μ l (12 mg) from stock 200 mg/ml stock solution against *V.cholerae N16961* showed the diameter of the zone of inhibition for aqueous extract was [14.23 \pm 0.21], for methanol extract the zone of inhibition was [28.67 \pm 0.58] and for ethanol extract the zone of inhibition was [30.10 \pm 0.10]. For other pathogenic bacteria ethanol extract showed the maximum diameter of zone of inhibition *S.aureus* [19.67 \pm 0.58] for 30 μ l (6 mg), *E.faecalis* [11.47 \pm 0.06] for 70 μ l (14 mg), *E. coli* [11.07 \pm 0.06] for 70 μ l (14 mg), *P.aeruginosa* [8.03 \pm 0.06] for 30 μ l (6 mg), *K.Pneumoniae* [9.03 \pm 0.06] for 30 μ l (6 mg). **Conclusion:** This study has demonstrated the significant antimicrobial potential of *Syzygium aromaticum* (clove) extracts against *Vibrio cholerae* N16961 and other pathogenic bacterial strains.

Keywords: *Vibrio cholera*, *Syzygium aromaticum*, Antimicrobial activity, MIC value

PID: IRC_LSBO_136

Sustainable Development and Characterization of Biodegradable Collagen-Calcium Carbonate (COL-CaCO₃) Microporous Composite Scaffold For Bone Tissue Regeneration
Prantor Karmaker¹, Md Shariful Islam^{1*}, Md Zakaria³, Jafor Raihan¹, Alam Khan¹, Razon Ahmad² & GM Shafiur Rahman¹

¹Department of Veterinary & Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

²Department of Materials Science & Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.

³Bangladesh Army University of Science and Technology, Saidpur, Bangladesh.

*Corresponding author email: msips06@ru.ac.bd

Abstract

Microporous CaCO₃ scaffolds were synthesized using the polyurethane (PU) sponge template method in various compressive ratios (95%, 75%, and 50%) by the presence or absence of additives to evaluate their effect on mechanical properties. The obtained CaCO₃ scaffolds were then coated with collagen (COL) at room temperature. The microporous structure and mechanical properties of the produced biomaterials were tested using Field Emission Scanning Electron Microscopy (FE-SEM) and the Shimadzu Compact Tabletop Testing Machine (EZ Test), correspondingly. The results showed that the integration of additives and the COL coating directed to a reduction in porosity and an upgradation in the mechanical properties of the biomaterials. In particular, the presence of additives resulted in the most significant reduction in porosity at a 50% compressive rate. The maximal compressive modulus of the CaCO₃-COL composite scaffolds with additives at this compression rate was 10.78 MPa. Furthermore, the composite scaffolds of CaCO₃-COL with additives at a 75% condensation rate were used to record the maximum strain energy density (539 J/m²) and fracture stress (253 KPa). These results show that the properties of porous composite scaffolds are gradually improved by combining pure CaCO₃ with collagen and additives, increasing their suitability for long-term bone tissue engineering applications.

Keywords: *Microporous CaCO₃ scaffolds, Collagen coating (COL), Mechanical properties, Bone tissue engineering.*

PID: IRC_LSBO_140

Isolation and Molecular Detection of Antibiotic Resistant *Staphylococcus Aureus* from Pet Birds of Mymensingh City Corporation Areas, Bangladesh

Sharmin Sultana Royal^{1*}, Salauddin Yousup² & Md. Shafiqul Islam³

¹Department of Microbiology and veterinary Public Health, Habiganj Agricultural University

²Department of Anatomy and Histology, Habiganj Agricultural University, Habiganj-3300

³Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh

*Corresponding author email: dr_royal@hau.ac.bd

Abstract

Pet bird (ornamental bird) rearing is gradually increasing in Bangladesh. For unemployment, pet bird farming acts as an income source. But pet birds are considered one of the reservoirs or carriers of AMR bacteria in humans. As a result, it is necessary to know the risks associated with antibiotic-resistant bacteria for humans who are directly involved in pet bird rearing. This research was performed for the isolation and molecular detection of antibiotic-resistant *Staphylococcus aureus* (MRSA) from pet birds. A total of 169 feces samples including pigeon (n=57), budgerigar (n=56), and cockatiel (n=56), were collected from different pet shops in Mymensingh city corporation. The bacterial isolates were identified using staining and biochemical assays, followed by molecular identification using PCR. Isolated organisms were then tested for antibiotic sensitivity using disk diffusion methods with ten frequently used antibiotics. Among the 169 samples, 35 (20.71%) were positive for *Staphylococcus spp.* by conventional and molecular tests. The prevalence of the nuc gene was 33.34% in pigeons, 22.23% in budgerigar and 7.14% in cockatiel. The prevalence of the mecA gene in *S. aureus* was 28.57% in pigeons. *S. aureus* isolates were resistant to methicillin (100%), cotrimoxazole (85.71%) and tetracycline (71.43%). So, it can be concluded that pet birds harbor enteric bacteria that are resistant to most antibiotics used in our study, and the presence of such antibiotic resistant bacteria in pet birds might pose a potential threat to humans and animals' health.

Keywords: *pet birds, molecular detection, antibiotic resistance, Staphylococcus aureus*

PID: IRC_LSBO_146

Title: Battery Waste-Derived Zn-BTC Metal–Organic Framework: A Green Route to Electrochemical Sensing and Antibacterial Functionality

Md Sohag Hossain¹, Sharuk Alam Aumi², Nourin Tarannum³, Fariha Chowdhury⁴, Md. Sahadat Hossain¹, Md. Farid Ahmed¹, Nazmul Islam Tanvir⁵, Umme Sarmeen Akhtar¹, Samina Ahmed^{1*}, Mashrafi Bin Mobarak^{1*}

¹*Institute of Glass and Ceramic Research and Testing (IGCRT), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh.*

²*Department of Chemistry, University of Dhaka, Dhaka- 1000, Bangladesh.*

³*Institute of Technology Transfer and Innovation (ITTI), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh.*

⁴*Biomedical and Toxicological Research Institute (BTRI), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh.*

⁵*BCSIR Dhaka Laboratories, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh.*

*Corresponding Authors: shanta_samina@yahoo.com; mashrafi binmobarak@gmail.com

Abstract:

In this study, a sustainable way was revealed for synthesizing zinc-based metal-organic framework (Zn-BTC MOF) by using zinc precursor extracted from discarded dry cell batteries. This process followed a simple three-step method, which includes recovering zinc from dry cell batteries, converting it into hydroxide, and then combining it with 1,3,5-benzenetricarboxylic acid (BTC). All this involved solvothermal process to form the final crystalline MOF. The synthesized material was characterized using a series of detailed analyses like XRD, FTIR, Raman, XPS, EDS, and TG-DSC to confirm that the resulting material had successfully synthesized and the morphology and nanostructure was analyzed using FESEM and TEM. All the data shows a well-structured framework of the synthesized material at the nanoscale, along with good thermal stability. Interestingly, the Zn-BTC MOF showed strong potential as an electrochemical sensor for uric acid, offering a wide detection range (0–200 μM) of uric acid concentration, a low detection limit (1.43 μM), and a high electrochemical surface area (0.16 cm²). Along with this, it also displayed impressive antibacterial activity, effectively inhibiting *Bacillus subtilis* and *Escherichia coli* at very low concentrations. By using recycled zinc from battery waste, this work highlights not only a greener way to produce MOFs but also their promise as multifunctional materials for sensing and antibacterial applications.

Keywords: Zn-BTC MOF; Waste Batteries; Antibacterial Activity, Electrochemical Sensor.

PID: IRC_LSBO_150

Microplastics: An Emerging Pollutant in Bangladesh

Md. Rezwanul Islam Shuvo¹, Tabassum Akhter*¹, Md. Tamjidul Ridwan¹, Abdullah Bin Firoz¹, Md Maheenur Mizan Khan¹, Khondoker Maksumul Alam¹ & Dr. Md Abdullah Yousof Al Harun¹

¹*Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh*

*Corresponding Author: tabassumakhter01@gmail.com

Microplastic pollution is an escalating environmental issue in Bangladesh, adversely affecting riverine and coastal ecosystems. This study assesses the presence, characteristics, and sources of microplastics in the Kirtankholla and Rupshha rivers, as well as on Saint Martin's Island. Surface water and sediment samples were collected from multiple sites, and microplastics were quantified and characterized using microscopy and FTIR spectroscopy. Additionally, fish samples from Saint Martin's Island were analyzed for microplastic ingestion. Results revealed high microplastic concentrations: in the Kirtankholla River, surface water contained 18.67 to 78.33 particles per liter (MPS/L), primarily fragments and fibers. In the Rupshha River, concentrations ranged from 37 to 86.33 MPS/L in water and 840 to 2920 items per kilogram in sediment. On Saint Martin's Island, water samples showed 4 to 22 MPS/L, and sediment contained 1 to 4 MPS per gram. Fish predominantly ingested fibers, with polypropylene, nylon, PVC, and rayon being the most common polymers identified. FTIR analysis across sites indicated that polyethylene and polypropylene were prevalent, suggesting origins from packaging materials and textiles. These findings highlight the urgent need for comprehensive waste management strategies, enhanced public awareness, and stringent regulatory measures to mitigate microplastic pollution and safeguard Bangladesh's aquatic ecosystems.

Keywords: Water quality, Sanitation, Social determinants, Slums

PID: IRC_LSBO_156

Satisfaction of Patients with Health Care Services in Tertiary Care Facilities of Dhaka, Bangladesh: A Cross-Sectional StudyTamanna Habib^{1*}, Laiba Haq¹, Amena khatun¹, Mehedi Hasan², Zaki Farhana³, Fojjun Nahar⁴, Sadhan Kumar Das⁵, Shuvojit Kumar Kundu⁵ & Mohammad Meshbahur Rahman⁶¹Department of Public Health and Hospital Administration, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh²Department of Health Education, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh³Statistics Division, Bangladesh Bank, Dhaka 1000.⁴Environment and Social Development Organization, Dhaka 1207, Bangladesh.⁵Directorate General of Health Services, Ministry of Health and Family Welfare, Dhaka 1212, Bangladesh.⁶Department of Biostatistics, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh

*Corresponding author email: dr.tamannahabib@gmail.com

Abstract

Patient satisfaction is a vital measure of healthcare quality, reflecting the effectiveness of patient-centered care. In public tertiary hospitals in Bangladesh, service limitations may negatively influence patient satisfaction, impacting treatment outcomes and public trust. This study assessed patient satisfaction using the Patient Satisfaction Questionnaire Short Form (PSQ-18) in selected public tertiary care hospitals. A cross-sectional study was conducted from July 1, 2024, to June 30, 2025, involving 410 currently discharged patients. Data were collected through face-to-face interviews using a semi-structured questionnaire incorporating the PSQ-18 tool. Of the 410 respondents, 55.6% were male and 44.4% female. The PSQ-18 showed strong internal consistency, with an overall Cronbach's alpha of 0.9. Domain-specific reliability ranged from 0.42 (General Satisfaction) to 0.97 (Financial Aspects). The mean overall satisfaction score was 3.38 (SD ± 0.50). The highest satisfaction was reported in the interpersonal manner domain (mean = 3.90, SD ± 0.54; 86.36%), followed by time spent with doctors (mean = 3.63; 73.46%) and technical quality (mean = 3.54; 72.4%). Moderate satisfaction was noted in communication (66.76%) and general satisfaction (61.96%). Lower scores were observed in accessibility and convenience (57.58%), while the financial aspects domain had the lowest satisfaction (mean = 2.43, SD ± 1.07; 24.76%). The findings highlight the need to improve financial affordability and service accessibility in public tertiary hospitals. They provide essential evidence to guide policymakers and administrators in enhancing patient-centered care and restoring trust in the healthcare system.

Keywords: Patient Satisfaction, PSQ-18, Public tertiary

PID: IRC_LSBO_160

Effect of Tree Spinach (*Cnidocolus aconitifolius*) Foliage on Gas Production and Methane Emissions Using *In Vitro* Gas TechniquesTanusree Chowdhury², Nittaya Taethaisong¹ & Pramote Paengkoum^{1*}¹ School of Animal Technology and Innovation, Suranaree University of Technology, Muang, Nakhon Ratchasima 30000, Thailand² Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

*Corresponding author: pramote@sut.ac.th

Abstract

Tree Spinach foliage (*Cnidocolus aconitifolius*) is a protein-rich leafy plant with potential as a natural livestock feed additive. This study was aimed to determine how the TSF affected rumen fermentation, focusing on gas and methane productions, using *in vitro* gas techniques. Rumen fluid was incubated with five treatments containing varying TSF levels (0% [control], 2%, 4%, 6%, and 8%), gas production was assessed at 2, 6, 8, 10, 12, 24, 48, and 72 hours, while CH₄ production and pH were estimated at 6 and 12 hours. Results showed that 8% TSF consistently produced higher gas volumes across all time points when compared to the control, with significant differences observed at multiple time points (p<0.05) and the highest values observed at 72 hours (132.00 vs. 123.33 ml/g DM). Analysis of fermentation parameters revealed that the 8% TSF treatment had the maximum possible extent of gas generation (a+b) (133.00 ml/g DM) in contrast to the control (123.11 ml/g DM) and other treatments. Additionally, 8% TSF supplementation modified rumen pH, with values decreasing as TSF concentration increased and altered the CH₄/total gas ratio, with a significant reduction in methane production observed at both 6 and 12 hours (p<0.0001), where values decreased progressively from 44.90 to 32.71 at 6 hours and from 11.90 to 4.71 at 12 hours, representing substantial reductions of 27.1% and 60.4% in methane emissions, respectively. These findings suggest that TSF can positively influence rumen fermentation and substantially reduce methane emissions, with 8% inclusion delivering the most favorable outcomes.

Keywords: *in vitro* gas production techniques, methane emissions, rumen fermentation, Tree Spinach foliage

PID: IRC_LSBO_165

Association of Single Nucleotide Polymorphism of PDGFD (rs974819) Gene on the Risk of Coronary Heart Disease in Bangladeshi Population: A Case-Control Study

Md. Mizanur Rahman Moghal^{1*}, K. M. Kaderi Kibria², Md. Shakil¹, Sathi¹, Nafiul Hasan¹, Noor-E-Zannat Tamanna & Md. Jahangir Alam¹

¹Department of Pharmacy, Faculty of Life Science, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

²Department of Biotechnology and Genetic Engineering, Faculty of Life Science, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

*Corresponding author email: mizan.phar@mbstu.ac.bd

Abstract

Background: Coronary heart disease (CHD) is a major death-causing illness worldwide. Genome-wide association studies revealed that rs974819 polymorphism in the platelet-derived growth factor D (PDGFD) gene is a susceptible locus for CHD in many ethnic groups. However, there are no confirmatory studies regarding the relation of rs974819 polymorphism with CHD in the Bangladeshi population. **Objectives:** To standardize the molecular detection of PDGFD (rs974819) gene polymorphism in the Bangladeshi population. **Methodology:** A total of 300 individuals were enrolled in this study, comprising 166 participants diagnosed with coronary heart disease (CHD) and 134 healthy control subjects. Peripheral blood samples from the study participants were used to isolate their genomic DNA. Allele-specific PCR was performed on case-control samples to distinguish between the wild-type and mutant-type alleles of rs974819 polymorphisms (T/C). **Findings:** In the Bangladeshi population, we found that rs974819 polymorphism is significantly associated with coronary heart disease (*P value* < 0.05). A significant linkage of rs974819 variant with the increased CHD risk was found in co-dominant model (TT vs. CC: OR = 2.678; 95% CI = 1.354-5.298, *p* = 0.005); dominant model (TT vs. TC+CC: OR = 1.797; 95% CI = 1.134-2.847; *p* = 0.013); and in recessive model (TT+TC vs. CC: OR = 2.275; 95% CI = 1.188-4.357; *p* = 0.013). Moreover, rs974819 polymorphism was significantly associated with blood pressure and family history of CHD (*P value* > 0.05). **Future direction:** The findings reveal the urgent need for standardizing a treatment procedure of CHD based on the genetic link.

Keywords: PDGFD, CHD, Single Nucleotide Polymorphism, AS-PCR.

PID: IRC_LSBO_165

Dietary Overlap and Feeding Ecology of *Lyroderma lyra* in Human Modified Landscape

Adnan Ahmed¹ & Md Ashraf Ul Hasan^{2*}

¹Department of Medicine, Bangladesh Agricultural University, Mymensingh-2200, Bangladesh

²Department of Biological Sciences, Texas Tech University, Lubbock, Texas, USA

*Corresponding author email: Md-Ashraf.Ul-Hasan@ttu.edu

Abstract

Background: *Lyroderma lyra* is a bat species distributed throughout Asia. The dietary habits of *L. lyra* include a wide array of prey, such as insects, birds, reptiles, amphibians, and smaller bats. However, the comprehension of food behaviour associated with human-modified landscapes is still quite restricted.

Objective: The aim of the study was to understand the food behaviour of *L. lyra* in human-modified landscapes based on sexual orientation and reproductive stage among females.

Methodology: This study collected faecal samples from 21 individuals of *L. lyra* at a roosting site in Satchari National Park, Bangladesh, to identify their diets through microscopic observation.

Results: Microscopic analysis of faecal samples revealed the presence of 10 insect orders. Coleoptera constituted 35.5%, followed by Orthoptera at 24.7%, Blattodea at 6.7%, Hymenoptera at 5.4%, and Lepidoptera at 4.25%. The remaining orders, which include Acari, Diptera, Ephemeroptera, Hemiptera, and Ixodid, accounted for less than 10% of the total. Additionally, 16.2% of the unidentified food components were hypothesised to consist of vertebrates. The non-metric multidimensional scaling (NMDS) stress values based on sex and reproductive stage were 0.08 and 0.07. This finding was followed by PERMANOVA results, with F values of 0.19 (*p*=0.95) and 0.75 (*p*=0.66), as well as Pianka's niche overlap indices of 0.98 and 0.85. The analysis revealed significant spatial assimilation.

Implications: The food behaviour linked to anthropogenically modified landscapes shows no distinction in niche partitioning based on sex and female reproductive stages. Overall, *L. lyra* exhibits opportunistic feeding behaviour, which categorises this species as a generalist.

Keywords: *Lyroderma lyra*, Dietary overlap, Niche partitioning, Human-modified landscape

Community-Led Waste Management: A Sustainable Pathway to Pollution Reduction.Arpita Das^{1*}¹*School of Ecology & Environment Studies, Nalanda University, Rajgir - 803116, India.*

*Corresponding author email: arpi4462@gmail.com

Abstract

With growing urbanization and increased consumption, the generation of waste has become a critical international challenge that leads to landfill overflowing and extreme air, water and land pollution. Top-down traditional systems of waste management do not succeed much in solving these issues at the grass roots level. This article examines the way in which community-led methods provide realistic, low-cost and green solution by engaging residents actively in the reduction of waste and pollution control. It reviews four essential strategies: behavioural change that minimizes single use plastics and food waste; citizen science approach that allow communities to measure data and track pollution from unmanaged waste; resident-led waste audits that guide focused and place-based action; and participatory recycling schemes that minimize harmful dumping and burning & incorporate informal waste workers. The research relies on secondary data, such as published case studies, NGO reports, policy documents and academic literature from urban and rural environment, especially in low-resource environments where pollution tends to overlooked. Through these experiences, the paper illustrates how local ownership, trust development and flexibility lead to tangible environmental gains. Such community-led initiatives, despite their potential are challenged by weak policy backing, inadequate technical training and inadequate funding. The sustained change in pollution and waste reduction relies not only on infrastructure but also on empowered communities. It is suggested that governments, NGOs, and institutions actively engage these local initiatives by providing flexible resources, capacity-building opportunities, and inclusive planning platforms to effectively scale their impact.

Keywords: *waste management, pollution reduction, behavioural change, citizen science participation*

Sub-Theme: Applied Science & Research

PID: IRC_ASRO_012

Assessing Marine Zoning and MSP Nexus in Coastal Zone and Marine Waters of Bangladesh for Sustainable Development Goals (SDG's)

Rufaída Siddiquee^{1*}, Md. Jahidul Hasan²

¹Institute of Marine Sciences, University of Chittagong, Chattogram-4331, Bangladesh

²BRAC Centre, 75 Mohakhali, Dhaka-1212, Bangladesh

*Email: rufaidasafa13@gmail.com

Abstract

The coastal zone and Exclusive Economic Zone (EEZ) of Bangladesh is characterized by a complex interplay of various sectors, each with its own unique environmental implications. As a result of diverse utilization and extensive economic activities these areas are experiencing numerous conflicts. It is crucial to understand and address these conflicts in order to ensure sustainable development and the preservation of the delicate coastal ecosystem. This study evaluates the integration of Marine Spatial Planning (MSP) and marine zoning in the coastal and marine waters of Bangladesh to achieve sustainable development goals (SDGs), with a focus on SDG 14. This research utilized satellite images from the USGS archive to analyze coastline dynamics for 2003, 2013, and 2023 using Landsat 7 (ETM+), Landsat 8 (OLI), and Landsat 9 (OLI). Images with less than 10% cloud coverage were selected for higher classification accuracy, and QGIS 3.18 was used to fix scanline issues in Landsat 7. Through a comprehensive analysis of literature and the systematic collection of data from the Moderate Resolution Imaging Spectroradiometer (MODIS), the discernible patterns and characteristics pertaining to areas of conflicts have been identified and documented. By examining Bangladesh's 710-kilometer-long coastline and its 118,813 square kilometers of maritime area, the research highlights the ecological, economic, and social significance of these regions. It identifies challenges such as overfishing, habitat degradation, and climate change impacts while emphasizing the need for effective management strategies. Utilizing satellite data, field observations, and stakeholder input, the study assesses land use changes, coastal dynamics, and environmental vulnerabilities. The findings aim to inform policy recommendations to balance resource use, protect marine ecosystems, and address conflicts, ensuring the sustainable use of Bangladesh's coastal and marine resources.

Theme: *Ocean Governance (MSP and ICZM)*

PID: IRC_ASRO_014

Trend Analysis of seasonal Rainfall in the Sylhet Region: A Mathematical perspective

*Anik Chandra Sarker¹, Pallab Chowdhury², Sanjib Deb Promit³, MD Khairul Islam Refat⁴

Department of Mathematics, National University, (Murari Chand College, Sylhet) Bangladesh

*Corresponding author email: sarkeraniik45@gmail.com

Abstract

Rainfall is a natural phenomenon that varies in frequency from location to region. Understanding the pace of rise and decline in this trend each year is critical for economic progress. The objectives of this study are to examine rainfall patterns in Sylhet, Bangladesh, from 1981 to 2024, as well as the rate of decline and rise from year to year, and to determine the impact of these changes on Sylhet. The study have also aim to predict of the rainfall trends at next 24 month. Rainfall data for this study were gathered from several research articles over the course of four decades as well as monthly and yearly. Data is collected based on monthly, yearly and four separate seasons: pre-monsoon, monsoon, post-monsoon, and dry season. Processed and analyzed using Microsoft Excel and Python. Trend identification is performed using mathematical approaches such as Fourier series, Runge-kutta and Numerical differentiation. The study's findings show that rainfall patterns persist in a circle, which implies that the monsoon season naturally has a high rainfall ratio and the dry season has a low rainfall ratio. In the pre- and post-monsoon periods, the average ratio is maintained. According to the study, the rainfall ratio has been changing annually. It also uses mathematical techniques to forecast that the ratio would shrink over the following 24 months. This research illustrates and clarifies the importance of regional rainfall patterns for agricultural planning, economic growth, and flood preparedness.

Keywords: Rainfall, Sylhet, Trend, Analysis.

PID: IRC_ASRO_118

Synthesis of Chitosan/Hydroxyapatite Composites from Waste Materials for the Tuning of Properties: Effects of Metal Doping in Hydroxyapatite

Bipul Mondal Sagar^{1,2}, Kazi Imtiaz Ahmed Nakib³, Sanjida Khan⁴, Subarna Sandhani Dey⁵, Md. Lawshan Habib^{2*}, Samina Ahmed^{1*} & Md. Sahadat Hossain^{1*}

¹*Institute of Glass and Ceramic Research and Testing, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh.*

²*Department of Applied Chemistry and Chemical Engineering, Gopalganj Science and Technology University, Gopalganj-8100, Bangladesh.*

³*Department of Applied Chemistry and Chemical Engineering, University of Dhaka, Dhaka, Bangladesh.*

⁴*Institute of Leather Engineering and Technology, University of Dhaka, Dhaka-1000, Bangladesh.*

⁵*Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka, Bangladesh*

*Corresponding author email: Md. Sahadat Hossain (saz8455@gamil.com)

Abstract

The hunt for multipurpose, sustainable composites with improved antibacterial qualities has been fueled by the growing threat of antibiotic-resistant diseases and the requirement for sophisticated biomaterials in medication administration. This research studied the effectiveness of metal-doped Chitosan-hydroxyapatite (CS-HAp) composites, synthesized from waste materials, as an efficient biomaterial. CS-HAp composites made from shrimp and snail shells, respectively, and doped with copper (Cu²⁺) and zinc (Zn²⁺) nanoparticles are synthesized and thoroughly characterized in this work. A sequence of chemical procedures, including demineralization, deproteinization, deacetylation, and calcination, was used to create the composites. Metal doping was then applied during the composite creation process. The effective integration and interaction of chitosan, hydroxyapatite, and metal ions were validated by structural investigations employing FTIR and XRD, and the crystalline integrity of the composites was preserved throughout drug loading and release. Antimicrobial testing showed modest antibacterial activity, primarily against Gram-positive *Staphylococcus aureus*, with effectiveness boosted by increasing metal ion concentration, whereas thermogravimetric studies showed great heat stability. Specifically in Zn-doped materials, drug release tests in simulated bodily fluid showed a quick initial release phase (80–90% within 50 hours) followed by persistent release. Chitosan, hydroxyapatite, and metal ions work in concert to provide biocompatibility, structural stability, and regulated drug administration, as the data demonstrate.

Keywords: *Chitosan; Hydroxyapatite; Composite; Antimicrobial property.*

PID: IRC_ASRO_049

Knowledge Regarding Breast Cancer Risk Factors and Practice of Breast Self-Examination in Tangail Sadar

Deya Das^{1*}, Gowranga Kumar Paul & Samiul Islam¹,

¹*Department of Statistics, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh.*

*Corresponding author email:deyadas42@gmail.com

Abstract

Breast cancer, the most prevalent cancer worldwide is one of the major public health concerns in Bangladesh. Despite the potential of Breast Self-Examination (BSE) in early detection, its practice is restricted by lack knowledge, social stigma and inadequate health education. This study tries to evaluate knowledge, Attitude and Practice (KAP) about breast cancer and BSE among women in Tangail Sadar. The study also determines the important sociodemographic factors that affect BSE behaviors. Using a structured questionnaire, a cross-sectional study was conducted to gather information from 400 adults' women. Three-stage convenience sampling was used to gather the data and univariate, bivariate and multinomial logistic regression methods were used for analysis. For predictive modelling, machine learning techniques were used. Even though most women had heard of breast cancer, a significant gap persisted in understanding its risk factors and proper BSE techniques. Results revealed 58% women knew about breast-cancer, only 28% practiced BSE. Bivariate analysis showed significant associations between BSE practice and sociodemographic factors such as age, education, income, and residence. Multinomial logistic regression identified higher awareness and knowledge as key predictors of regular BSE practice, especially among educated and urban women. Machine learning models validated these findings with a high predictive accuracy. Machine learning, particularly Random Forest (82% accuracy), confirmed awareness, education, and marital status as key predictors. AI-driven models can enhance community health efforts through targeted interventions. Future research should focus on longitudinal studies and culturally tailored education. Predictive analytics can support better screening and policy planning to prevent breast cancer.

Keywords: *Breast Cancer, Breast Self-Examination, Awareness, Predictive Modeling.*

PID: IRC_ASRO_104

Seven Days Monitoring of Systolic and Diastolic Blood Pressure: Preventive Perspective of Pseudo Hypertension Induced Anxiety
Chowdhury Md Navim Kabir*

Department of Emergency & Casualty, Sarkari Karmachari Hospital, Fulbaria, Dhaka, Bangladesh
Email: protik167@gmail.com

Globally hypertension is a prevalent non-communicable disease affecting diverse age groups around. Acute raise of blood pressure becomes a significant concern for its contribution in cardiac and cerebrovascular morbidity. Routine monitoring of both systolic and diastolic blood pressure is recognized as a preventive strategy to reduce the occurrence and complications of hypertension-induced morbidity. Introduction of preventive anti-hypertensive approach for decreasing dependency on curative treatment as well as cost effective preventive protocol for low socio-economic community. Between February 2024 and July 2024, 120 patients were identified with newly diagnosed (maiden) hypertensive during initial assessment. 65 patients were subsequently found not to meet hypertension criteria. The study cohort comprised of 39 females and 26 males, with age range of $33-39 \pm 2$ years. Participants were instructed to measure and record their systolic and diastolic blood pressure (SBP and DBP) three times daily over a consecutive 7-day period for follow-up assessment. Patients of systemic diseases were excluded for avoiding biased results. Relevant questionnaire was used for data collection followed by cross sectional study. During follow-up, the percentage reduction in SBP and DBP among patients with thrice-daily monitoring was 88.02% and 78.49%, respectively. For those monitoring twice daily, the reductions were 76.80% (SBP) and 73.15% (DBP), while patients who did not monitor showed reductions of 60.78% (SBP) and 56.35% (DBP). Early diagnosis enables prompt patient awareness of potential systemic comorbidities and facilitates the implementation of preventive strategies. Regular and systematic blood pressure monitoring significantly reduces anxiety-related symptoms and lessened associated complications.

Keywords: SBP, DBP, cerebrovascular, morbidity

PID: IRC_ASRO_092

The Impact of Fluctuating GPS Sensor Tracking on Forests Health to Accelerate Wildfires

Md Rahimullah Miah^{1,2,*}, Alexander Kiew Sayok², Jorin Tasnim Parisha³, Mohammad Belal Uddin⁴, Shahriar Hussain Chowdhury⁵, Md Main Uddin Miah⁶, Md Bodrud Huda⁷, Md Shoaibur Rahman⁸, Md. Amir Sharif⁹, Md Sher-E Alam¹⁰, Mohammed Selim Reza¹¹ and Md Mehedi Hasan¹²

¹Department of Health Information Technology (HIT), North East Medical College and Hospital, Affiliated to Sylhet Medical University, Sylhet, Bangladesh. and PhD Awardee from the IBEC, UNIMAS, Sarawak, Malaysia. Email: dmrriah@gmail.com, ORCID: <https://orcid.org/0000-0002-6271-4100>

* Corresponding Author Email: dmrriah@gmail.com and drmmiah@gmail.com

Abstract

Introduction: The world is ablaze with digital fire and the air is heavy with the cries of people, animals and plants in the forest region. Until now, climate professionals have been confronting large-scale forest fires as a scientifically widespread problem for several years. A class of humanoid forest criminals are responsible for these fires. Everyone is incorporating advanced sensor technology, but no one is fully aware of its impact on wildfires. The study aims to restore ecosystems, manage fire-adapted landscapes, and improve forest resilience to reduce the risk of destructive wildfires in the future. The selected forest was imaged by ISNAPHO method and its water vapor was converted into chemical energy by dissociating oxygen and hydrogen through wireless high-radiation atmospheric electrolysis. This chemical energy is converted into electrical energy due to regular GPS sensor tracking in the cloud network systems. The study area was surveyed using semi-structured questionnaires. The results showed that the converted thermal energy leads to hydrogen fusion, which causes nuclear reactions in electromagnetic radiation under atmospheric conditions. The study found that the occurrence of digital wildfires in a specific forest area caused widespread reactions. The study also found that as long as the cloud sensor 'network switch' is active, the forest continues to burn digitally and biodiversity is severely damaged, which has an impact on the environment and climate. The results showed that most GPS tracking exaggerates the severity of the wildfire. The study analyzed the ISNAPHO effect based on the elements of sensor exposure, sensitivity and adaptive capacity at a specific GPS location in light and dark environments. Almost 90% of respondents expressed their opinion about the serious risk to life caused by digital wildfires. The study found that the activation of the Forest Area Network Control Unit (FANCU) immediately isolated the cloud network system and stopped this fire. The findings highlight the proactive digital fire mitigation through advanced sensor technology (DFMAST) model coupled with FANCU devices is presented, to protect forests and other objects from unwanted fires and to achieve the goals of the Sustainable Development Goals 2030.

Keywords: Tracking, Forest, Fusion, ISNAPHO

PID: IRC_ASRO_090

Understanding Recycling Behaviour: A Case Study of Source Segregation in DhakaElmee Tabassum^{1*}, Saiful Momen¹, H. M. Rayhanul Islam² & Rai Dhar Ruchi³¹*Department of Environmental Science & Management, North South University, Dhaka, Bangladesh.*²*Department of Environmental Science Bangladesh Agriculture University, Mymensingh-2202.*³*Department of Environmental Science, Siksha Bhavana, Visvabharati University, Santiniketan, India.**Corresponding author email: elmee.tabassum@gmail.com**Abstract**

Rapid urbanization has intensified pressure on municipal solid waste systems, particularly in densely populated cities like Dhaka. Among the available strategies, source segregation of household waste stands out as one of the most cost-effective and environmentally sustainable solutions. Yet, adoption remains low, often hindered by behavioral, social, and infrastructural challenges. This study investigates the long-term impact of the “Value for Waste” project on recycling behavior among residents of Uttara, Dhaka. It focuses on three core indicators: knowledge retention, attitudinal shifts, and behavioral changes, following a structured intervention, with special emphasis on women, housemaids, and informal actors in the waste value chain. Conducted as an ethnographic study, the research employed a mixed-method approach over several months. Data were gathered from over 50 households through in-depth interviews, immersive observations, and surveys. Waste collectors, informal traders, and housemaids were also engaged to understand systemic dynamics, power relations, and lived experiences within the recycling ecosystem. Findings reveal that economic incentives, consistent household-level supervision, and targeted community monitoring significantly influence long-term recycling behavior. Fixed-hour housemaids emerged as key actors, motivated by the resale value of recyclables. In contrast, men and live-in workers demonstrated lower engagement due to entrenched gender roles and lack of direct incentives. The study underscores that source segregation is not merely a technical fix. It is a behavioral and social practice shaped by class, gender, and informality. This research contributes to inclusive urban waste policy and advocates for incentivized, community-driven models that empower households and integrate informal waste actors.

Keywords: *Informal sector, recycling behavior, source segregation, urban waste management*

PID: IRC_ASRO_69

Enhancing Biochemical Resilience and Nutrient Uptake Through Foliar application Copper Sulphate (CuSO₄), Bulk Copper Oxide and Copper Oxide Nanoparticles of Rice Seedlings.Fatematu Juhura Mina¹, Md Robiul Islam^{1*}¹*Department of Agronomy and Agricultural Extension, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh*Corresponding author email: mrislam@ru.ac.bd**Abstract:**

Rice (*Oryza sativa* L.) production is a cardinal part of Bangladeshi agriculture, providing livelihoods for millions and acting as the country’s primary staple food having a substantial influence on yields and food security. This study aims to evaluate the effects of different copper sources on rice seedlings to investigate biochemical responses. A total of seven treatments of variable concentrations of copper sulfate (125mg/L & 250 mg/L), bulk copper oxide (125mg/L & 250 mg/L), copper oxide nanoparticles (125mg/L & 250 mg/L) along with control treatment were applied. 16 days old seedlings were exposed to these treatments by foliar application. The investigation revealed that 125 & 250mg/L copper oxide nanoparticles significantly elevating the growth rate of rice seedlings compared to the control and treatment of other forms of copper formulations, while, treatment with 125mg/L and 250mg/L copper oxide nanoparticles balancing the proline content in plants induced by nanoparticles showing no significant toxicity at applied concentrations. While in other forms of Copper formulations show increment in proline content. The activity of both superoxide dismutase and peroxidase increased in rice leaves treated with 125mg/L and 250mg/L copper oxide nanoparticles, showing significant improvement in rice seedlings. Overall, copper oxide nanoparticles, especially at 125 & 250mg/L concentration, established the growth and development of rice seedlings, probably through balancing oxidative stress and enhancement of chlorophyll synthesis.

Keyword: *Copper sulphate, Copper oxide nanoparticles, Foliar applications, Bulk copper oxide*

PID: IRC_ASRO_181

Determining Region Specific Risk Factors for Diabetes, Hypertension and Overweight among Women of Reproductive Age in Bangladesh

Gowranga Kumar Paul¹, Md. Atiqul Islam^{2*} & MD. Asraf-Ul-Alam²

1. Department of Statistics, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh

*2. Department of Statistics, Jaggannath University, Dhaka-1100
Corresponding Author Email: atique@stat.jnu.ac.bd*

Abstract

Non-communicable diseases (NCDs) are the major causes of mortality globally responsible for seventy-five percent of deaths in 2021. The most important risk factors for NCDs were being overweight, having diabetes, and having high blood pressure. Studying these three disorders together has greater significance than studying them separately because they frequently co-occur and share risk factors. Objectives: This study aims to ascertain the region-specific risk factors of overweight, hypertension, and diabetes among Bangladeshi women of reproductive age.

A national representative sample of 5346 women was selected from the Bangladesh Demographic and Health Survey (BDHS)-2022 in this study. Both descriptive and inferential statistics were used. To identify the risk factors, the Generalized Linear Mixed Model (GLMM) was employed considering division as cluster effect.

According to the survey, over half of the respondents are overweight, and 15% of the respondents have diabetes. Diabetes, Hypertension and overweight are significantly vary across division. Rural residents are less likely than their urban counterparts to suffer from hypertension (OR=0.783, 95%CI=0.662, 0.928), diabetes (OR=0.729, 95%CI=0.598, 0.889). Respondent's current age ($P<0.001$), number of children ($P<0.001$), wealth index ($P<0.001$) of the family, education level ($P<0.001$) all are significant effect on all three conditions. The GLMM showed significant regional variability in the prevalence of hypertension, with a random intercept variance of 0.04 and significant variation at the division level.

Since dietary habits, lifestyle choices, and other factors all play a distinct role in their incidence and severity, the government must implement region-specific strategies.

Keywords: *Non-Communicable Disease, Diabetes, Hypertension, GLMM*

PID: IRC_ASRO_050

Pathways to a Sustainable Future: Renewable Energy Challenges and Opportunities in Bangladesh

Himadri Chowdhury Bristi^{1*}, Shaurabh Roy¹ & Aunika Das¹

¹Department of Physics, Faculty of Science, Hajee Mohammad Danesh Science And Technology University, Dinajpur 5200

**Corresponding author email: hchowdhury.hstu@gmail.com*

Abstract

The rapid acceleration of global economic development, driven by industrial expansion and population growth, has intensified pressure on finite natural resources particularly fossil fuels leading to environmental degradation and escalating climate risks. Sustainable development offers a balanced framework that integrates economic growth with environmental protection and social equity, making the efficient use of natural resources vital. Bangladesh, a densely populated and climate-vulnerable country, exemplifies these challenges. With over 50% of its electricity derived from natural gas reserves projected to be depleted by 2031 the country faces urgent energy security concerns. Simultaneously, it is highly susceptible to climate-induced hazards such as cyclones, floods, and sea-level rise. In response, Bangladesh has implemented the Bangladesh Climate Prosperity Plan, targeting 40% renewable energy generation by 2041. By 2024, more than 6 million rural households have access to electricity through solar home systems, making it one of the largest off-grid solar initiatives globally. This paper highlights the central role of renewable energy in achieving sustainable development and presents Bangladesh as a model for how policy innovation, investment in green technology, and community engagement can drive energy transformation in developing nations.

Keywords: *Renewable energy, Sustainable development, Energy security, Climate vulnerability.*

PID: IRC_ASRO_074

Junk Food Consumption Trends, Patterns and Awareness of Its Health Risks Among University Students in Bangladesh.

Istiaque Bin Islam¹, Md. Rakibul Islam¹, Nazifa Tabassum¹, Sumaia Islam¹, Md. Samiul Ali¹ & Arafat Hassan Razon^{2*}

¹Department of Food and Nutritional Science, Rajshahi Institute of Biosciences, Affiliated with University of Rajshahi, Rajshahi-6205, Bangladesh

²Food Science and Nutrition Programme, School of Science and Technology, Bangladesh Open University, Gazipur-1705, Bangladesh.

*Corresponding author email: arafat.sst@bou.ac.bd

Abstract

The increasing consumption of junk food (JF) by university students in low- and middle-income countries like Bangladesh is a developing public health issue. With easy accessibility and rising consumption, behavior change has occurred sparsely even when the health risks are well documented.

The objective of this study was to examine the prevalence of JF consumption, and the awareness of its health risks among university students in Bangladesh.

This was a cross-sectional study; the sample consisted of 516 university students from different universities across the country stratified by academic year. An interview-based structured questionnaire that included information on dietary habits, awareness levels on JF-related health hazards, and anthropometric measurements was administered. Associations were tested using chi-square analysis and $p < 0.05$ was considered significant.

Results indicated frequent JF intake, 95.4% of students reported JF consumption and 79.1% at least once a week. Awareness of JF-related NCDs was good (87.6%) but 36.2% and 59.3% reported moderate and small servings, respectively, in daily basis. Final-year students had a higher intake of packaged snacks than first-year students ($p = 0.010$). The higher the BMI, the larger the portion size; a strong relation was detected. The majority were motivated to consume based on taste (70%) and convenience (11.6%), with moderate awareness of nutritional risks such as excessive salt, sugar and fat.

The observations highlight the need for focused, targeted food-based interventions, behavior change communications strategies, and policy actions to reduce future NCD risk in this at-risk population.

Keywords: *Junk Food, Non-communicable Diseases, Nutritional Awareness, University Students.*

PID: IRC_ASRO_116

A Strategic Approach to Radioactive Waste Management in Bangladesh: Policy Evaluation and Site Selection Using Multi-Criteria Decision Analysis (AHP)

Kh Rokibul Hasan Rayhan, Tasmia Tabassum Sara, Dr. Khondokar Nazmus Sakib

Department of Physics, MBSTU

Abstract The growing use of nuclear technology in Bangladesh-highlighted by the Rooppur Nuclear Power Plant (RNPP)- has brought the safe and sustainable management of radioactive waste into sharp focus. This study combines a policy-oriented assessment with a decision-making framework to propose a comprehensive solution for radioactive waste management in the country. It begins by evaluating Bangladesh's current practices, regulatory infrastructure, and institutional capacities, with a focus on key facilities such as the Central Radioactive Waste Processing and Storage Facility (CWPSF) and the Atomic Energy Research Establishment (AERE). Benchmarking against international standards reveals several critical gaps, including outdated policies, technical limitations, and a reliance on foreign solutions for high-level waste. To support effective long-term planning and site selection, this study applies Multi Criteria Decision Analysis (MCDA) methods- specifically Analytic Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Straight Rank Sum (SRS), and Ratio Scale Weighting (RSW). Through comparative analysis and a sample AHP calculation, AHP emerges as the most suitable method for the Bangladeshi context, offering transparency, consistency checks, and the ability to handle conflicting criteria such as geological stability, hydrology, cost, and population density. Despite some limitations, such as reliance on expert input and subjectivity in pairwise comparisons, AHP's strengths can be enhanced through integration with tools like GIS in future research. The study recommends adopting AHP-based decision frameworks for selecting near surface disposal sites for low and intermediate-level waste, initiating geological studies for high-level waste. By aligning policy reform with analytical tools, Bangladesh can take meaningful steps toward a safe, self-reliant, and future ready radioactive waste management system.

PID: IRC_ASRO_147

X-ray Line Diffraction Study of Preferred Oriented Hexagonal Zincite Nanocrystals: A Crystallographic Investigation

Md. Ashraful Alam^{a*}, Md. Khalid Hossain Shishir^b, Debasish Sarkar^c, Raton Kumar Bishwas^a, Shirin Akter Jahan^{a*}

^a Institute of Glass and Ceramic Research and Testing (IGCRT), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh

^b Department of Applied Chemistry and Chemical Engineering, Islamic University, Kushtia-7003, Bangladesh

^c Department of Ceramic Engineering, National Institute of Technology (NIT), Rourkela, Sundargarh, Odisha 769008, India

Corresponding author: shirin_akter@bcsir.gov.bd; ashrafulalam@bcsir.gov.bd

Abstract

Multifunctional nanoscale, pure and high crystalline ZnO (Zincite) at room temperature synthesis through zinc nitrate hexahydrate and ammonium hydroxide prefers to develop hexagonal wurtzite structure consisting of lattice parameters $a=b= 3.251 \text{ \AA}$, $c= 5.208 \text{ \AA}$; $\alpha=\beta= 90^\circ$, $\gamma= 120^\circ$ with a Zn-O bond length of 1.9785 \AA . Different crystallographic parameter calculated and several identical models were employed to analyze crystallite sizes, lattice strain, stress and density. The specific processing condition prefers to grow in direction of (101), which may influence electronic, optical and functional properties. The Rietveld refinement revealed that synthesized material consists entirely of 100 % Zincite phase. Transmission electron microscope (TEM) analysis revealed a homogeneous distribution of interface nanocrystals, indicating the nanocrystals were in pure form and exhibited a unified contribution with polyhedral morphology. TEM histogram of Zincite showed a nanoscale particle distribution with an average size of approximately 48.39 nm. Selected area electron diffraction (SAED) pattern analysis confirmed that Zincite crystals were highly oriented, predominantly along the (002) plane, with d-spacing of 0.2577 nm, indicating a highly crystalline and well-ordered lattice structure. The atomic mass composition was calculated to be 81 % Zn and 19 % O, confirming a unified crystal structure. Vibrating sample magnetometer (VSM) analysis revealed that the synthesized Zincite nanocrystals exhibited paramagnetic behavior. X-ray photoelectron spectrometer (XPS) analysis explored characteristic Zn 2p peaks, with Zn 2p_{3/2} at a binding energy of 1022.19 eV, indicating the presence of Zn²⁺ in wurtzite (ZnO).

Keywords: Crystallography, Crystallinity, Nanocrystals, Preferred orientation, Zincite.

PID: IRC_ASRO_108

Noise Pollution and Audibility: A Study on Stone Crushing Industries in Jaflong, Sylhet

Md. Abdullah Yousuf Al Harun^{1*}, Asif Fayaz¹, Abdur Rahim¹, Md. Asiful Haque Judge¹ & Sadia Anjum¹

¹Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh.

*Corresponding author email: harun@es.ku.ac.bd

Abstract

Stone crushing industries tremendously affect environment and human health. This study investigates the noise pollution from stone crushing industries in Jaflong, Sylhet and the corresponding impact on audibility of the workers. Noise level of twenty stone crushing sites was measured using Sound Level Meter while tuning forks of three frequencies (90 Hz, 120 Hz, and 512 Hz) were used to evaluate hearing loss of the sixty purposively selected workers with equal male female ratio. The findings underscore that the noise level produced from all the stone crushing sites exceed the Occupational Health and Safety threshold of 85 dB, the maximum permissible limit for continuous exposure without protection. Noise level at different distance from stone crushing sites indicates that based on the WHO guidelines, silent zones like schools, hospitals, and religious places could be established to a minimum buffer distance of 500 m from the stone crushing site while residential and commercial areas are suggested to be established at least 300 m and 100 m away. Tuning forks test demonstrates that 73% of the male stone crushing workers have low audibility with slightly higher percentage (80%) among female workers. The study addresses the urgent need for the use of personal protective equipment in reducing the impact on audibility. Sustainable land use zoning is imperative to safeguard from the adverse impact of noise pollution of stone crushing. Future studies on assessing the long-term effects of stone crushing on health and the efficacy of potential preventative measures are needed to draw robust conclusion.

Keywords: Stone Crushing, Noise Pollution, Audibility, Land use zoning.

PID: IRC_ASRO_147

X-ray Line Diffraction Study of Preferred Oriented Hexagonal Zincite Nanocrystals: A Crystallographic InvestigationMd. Ashraful Alam^{a*}, Md. Khalid Hossain Shishir^b, Debasish Sarkar^c, Raton Kumar Bishwas^a, Shirin Akter Jahan^{a*}^a *Institute of Glass and Ceramic Research and Testing (IGCRT), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh*^b *Department of Applied Chemistry and Chemical Engineering, Islamic University, Kushtia-7003, Bangladesh*^c *Department of Ceramic Engineering, National Institute of Technology (NIT), Rourkela, Sundargarh, Odisha 769008, India*

Corresponding author: shirin_akter@bcsir.gov.bd; ashrafulalam@bcsir.gov.bd

Abstract

Multifunctional nanoscale, pure and high crystalline ZnO (Zincite) at room temperature synthesis through zinc nitrate hexahydrate and ammonium hydroxide prefers to develop hexagonal wurtzite structure consisting of lattice parameters $a=b= 3.251 \text{ \AA}$, $c= 5.208 \text{ \AA}$; $\alpha=\beta= 90^\circ$, $\gamma= 120^\circ$ with a Zn-O bond length of 1.9785 \AA . Different crystallographic parameter calculated and several identical models were employed to analyze crystallite sizes, lattice strain, stress and density. The specific processing condition prefers to grow in direction of (101), which may influence electronic, optical and functional properties. The Rietveld refinement revealed that synthesized material consists entirely of 100 % Zincite phase. Transmission electron microscope (TEM) analysis revealed a homogeneous distribution of interface nanocrystals, indicating the nanocrystals were in pure form and exhibited a unified contribution with polyhedral morphology. TEM histogram of Zincite showed a nanoscale particle distribution with an average size of approximately 48.39 nm. Selected area electron diffraction (SAED) pattern analysis confirmed that Zincite crystals were highly oriented, predominantly along the (002) plane, with d-spacing of 0.2577 nm, indicating a highly crystalline and well-ordered lattice structure. The atomic mass composition was calculated to be 81 % Zn and 19 % O, confirming a unified crystal structure. Vibrating sample magnetometer (VSM) analysis revealed that the synthesized Zincite nanocrystals exhibited paramagnetic behavior. X-ray photoelectron spectrometer (XPS) analysis explored characteristic Zn 2p peaks, with Zn 2p_{3/2} at a binding energy of 1022.19 eV, indicating the presence of Zn²⁺ in wurtzite (ZnO).

Keywords: *Crystallography, Crystallinity, Nanocrystals, Preferred orientation, Zincite.*

PID: IRC_ASRO_108

Noise Pollution and Audibility: A Study on Stone Crushing Industries in Jaflong, SylhetMd. Abdullah Yousuf Al Harun^{1*}, Asif Fayaz¹, Abdur Rahim¹, Md. Asiful Haque Judge¹ & Sadia Anjum¹¹*Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh.*

*Corresponding author email: harun@es.ku.ac.bd

Abstract

Stone crushing industries tremendously affect environment and human health. This study investigates the noise pollution from stone crushing industries in Jaflong, Sylhet and the corresponding impact on audibility of the workers. Noise level of twenty stone crushing sites was measured using Sound Level Meter while tuning forks of three frequencies (90 Hz, 120 Hz, and 512 Hz) were used to evaluate hearing loss of the sixty purposively selected workers with equal male female ratio. The findings underscore that the noise level produced from all the stone crushing sites exceed the Occupational Health and Safety threshold of 85 dB, the maximum permissible limit for continuous exposure without protection. Noise level at different distance from stone crushing sites indicates that based on the WHO guidelines, silent zones like schools, hospitals, and religious places could be established to a minimum buffer distance of 500 m from the stone crushing site while residential and commercial areas are suggested to be established at least 300 m and 100 m away. Tuning forks test demonstrates that 73% of the male stone crushing workers have low audibility with slightly higher percentage (80%) among female workers. The study addresses the urgent need for the use of personal protective equipment in reducing the impact on audibility. Sustainable land use zoning is imperative to safeguard from the adverse impact of noise pollution of stone crushing. Future studies on assessing the long-term effects of stone crushing on health and the efficacy of potential preventative measures are needed to draw robust conclusion.

Keywords: *Stone Crushing, Noise Pollution, Audibility, Land use zoning.*

PID: IRC_ASRO_175

Design and Performance Investigation of Metal Free Organic D- π -A Dyes Using Porphyrin as π Spacer for Dye Sensitized Solar Cells

Md Mahmudul Hasan^{1*}, Chiara Bordin², Fairuz Islam³, Tamanna Tasnim³, Dhrubo Roy⁴, Md. Tasin Nur Rahim⁵, Md. Athar Ishtiyag³ & Mst. Armina Akter Akhi⁶

¹Department of Chemistry, Dinajpur Government College, Dinajpur 5200, Bangladesh

²Department of Computer Science, UiT The Arctic University of Norway, 6050, Langnes, 9037, Tromsø, Norway

³Department of Chemistry, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

⁴Department of Computer Science and Engineering, Daffodil International University, Dhaka 1216, Bangladesh

⁵Faculty of Fisheries, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

⁶Faculty of Agriculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

*Corresponding author email: mdmahmudulhasan.1630@gmail.com

Abstract

Metal free Porphyrin based dye sensitized solar cells (DSSCs) offers a promising low-cost alternative to photovoltaic energy conversion. This study aims to evaluate the optoelectronic properties of metal free porphyrin-based dyes using density functional theory (DFT), time dependent density functional theory (TD-DFT) via a donor- π -acceptor (D- π -A) framework. In order to design novel organic dyes, three anchoring groups and four donating groups were introduced to the base porphyrin structure at different strategic positions, resulting in a total of twelve dyes. The singlet ground state geometries of the dyes were optimized utilizing DFT with B3LYP and the excited state optical properties were explored through TD-DFT using the PCM model with THF as solvent. Both DFT and TD-DFT calculations were carried out using the 6-311G(d,p) basis set. It can be seen that the HOMO energy levels of almost all the modified dyes are lower than that of the redox potential of I⁻/I₃⁻ and LUMO energy levels are higher than the conduction band of TiO₂. The calculated absorption maxima λ_{max} values ranged from 690.6 to 793.9 nm with the oscillator strength (f) between 0.502 and 0.908 while dye O2 showed the most red shifted λ_{max} . The M1, M2 and M3 dyes which used BPA-DHF as the donor group showed comparatively higher oscillator strength and light harvesting efficiency than the other dyes, while M3 exhibited the largest values of 0.908 and 0.877 respectively. In conclusion, this newly modified organic dye with enhanced LHS is remarkably effective for the dye-sensitized solar cells (DSSC) industry.

Keywords: Porphyrin, Dye sensitized solar cell, TD-DFT, DFT

PID: IRC_ASRO_047

Eco-Friendly Hybrid Supercapacitor Electrode Development Using Cellulose Nanocrystals (CNCs) and Reduced Graphene Oxide (rGO)

Md. Shohidul Islam¹, B.M. Mohibur Rahman¹, Md. Mahbubur Rahman^{*2}

¹Department of Chemistry, Dhaka College, Dhaka.

²Fiber and Polymer Research Division, BCSIR Dhaka Laboratories, Bangladesh Council of Scientific and Industrial Research.

Corresponding Author email: Mahbub.besir@yahoo.com

Abstract

As global demand for sustainable energy storage rises, there is an urgent need for eco-friendly, high-performance supercapacitor electrodes. This work reports a hybrid electrode comprising renewable cellulose nanocrystals (CNCs) and conductive reduced graphene oxide (rGO), prepared via a green, water-based synthesis. CNCs serve as natural dispersants and nanoscale spacers that prevent rGO nanosheet aggregation. Material characterization (FTIR, XRD, TGA, SEM) confirms successful CNC-rGO integration: FTIR verify removal of oxygen functional groups, XRD indicates structural compatibility, TGA shows enhanced thermal stability, and SEM reveals an interconnected porous network with uniformly distributed CNCs that mitigates graphene restacking. Electrochemical testing demonstrates that the CNC-rGO electrode behaves predominantly as an electric double-layer capacitor with minimal pseudocapacitive contributions. Cyclic voltammetry (CV) curves remain nearly rectangular even at high scan rates, evidencing ideal capacitive behavior and excellent rate capability. Notably, the optimized 20 wt% CNC-rGO composite delivers peak current densities of $\pm 4.5 \text{ A g}^{-1}$ in CV, more than four times the $\pm 1.0 \text{ A g}^{-1}$ observed for pure rGO, indicating a substantially higher specific capacitance. Galvanostatic charge-discharge (GCD) profiles are nearly symmetric triangular shapes for all samples, reflecting ideal charge-discharge behavior and excellent Coulombic efficiency ($\sim 100\%$). The 20 wt% CNC-rGO electrode exhibits the longest discharge time ($\sim 7-8 \text{ s}$) versus $\sim 1-2 \text{ s}$ for pure rGO or an 80 wt% CNC-rGO sample, confirming its much greater stored charge. The voltage drop at the charge-discharge transition is only $\sim 0.05-0.13 \text{ V}$, indicating low internal resistance. Electrochemical impedance spectroscopy (EIS) further corroborates these findings: composites with moderate CNC loading (10-20 wt %) exhibit low equivalent series resistance and charge-transfer resistance, whereas excessive CNC raises both. Pure rGO and low-CNC electrodes show nearly vertical Warburg tails at low frequency, signifying minimal ion diffusion impedance. Together, these results show that incorporating bio-derived CNCs into rGO electrodes enhances electrolyte wettability and ionic accessibility without sacrificing conductivity, yielding a CNC-rGO electrode with roughly double the capacitance of pure rGO ($\sim 220 \text{ F g}^{-1}$) and excellent cycling stability. This sustainable CNC-rGO hybrid thus offers a promising strategy for high-rate, high-capacitance supercapacitors.

Keywords: Cellulose nanocrystals (CNCs), reduced graphene oxide (rGO), hybrid supercapacitor, eco-friendly.

PID: IRC_ASRO_157

Interpretable Machine Learning to Identify Key Predictors of Maternal Quality of Life: Evidence from Pabna DistrictMimosa Saha¹, Dr. Md. Shamim Reza^{2*}¹*Department of Statistics, Faculty of Science, Pabna University of Science and Technology, Pabna-6600, Bangladesh.*²*Professor, Department of Statistics, Faculty of Science, Pabna University of Science and Technology, Pabna-6600, Bangladesh.*

*Corresponding author email: shamim.reza@pust.ac.bd

Abstract

Health-related quality of life (HRQoL) provides a more complete picture of maternal well-being than clinical indicators alone. Using cross-sectional study was carried out on the basis of the Bangladesh Demographic and Health Survey (BDHS), the study aimed to assess maternal health-related quality of life (HRQoL) and to identify the significant socio-demographic and healthcare-related factors that contribute to its variation among women in the Pabna District. The HRQoL was measured using the EQ-5D tool exploring five dimensions. HRQoL was measured using the EQ-5D tool that tested five dimensions. Machine learning tools like SVR, DTR, LASSO and OLR were used to explore correlations with HRQoL and establish the most important influencing factors. The study shows that most of the women in the study had a moderate HRQoL for health, and lower percentages had good and poor HRQoL. Institutional delivery, iron supplements, and antenatal care were all positive predictors of good maternal health status. Emotional distress, gestational morbidity, and increasing maternal age were all strongly associated with poor health status. The study reveals that most of the women in the study had a moderate HRQoL for health, and a lower percentage had good and poor HRQoL. Results highlight the need for targeted maternal health interventions in rural Bangladesh. Improved access to education, medical care, and narrowing social disparities could enhance postnatal HRQoL. The work adds to policy recommendations on maternal improvement in resource-limited settings.

Keywords: *Maternal Health, Health Related Quality of Life, EQ-5D, Bangladesh*

PID: IRC_ASRO_055

SHELF-LIFE OF READY-TO-COOK (RTC) FISH SAUSAGE UNDER MODIFIED ATMOSPHERE PACKAGING AT REFRIGERATED STORAGE CONDITION

Salma, M.I.J., Amanullah, M., Begum, T.M., Hossain, M.Y., and Islam, M.T.*

Department of Fisheries, University of Rajshahi, Rajshahi 6205, Bangladesh

*Corresponding Author's E-mail: tariqul.fish@ru.ac.bd

Abstract:

Fish sausage is a very popular snack in the world, though it is not very available in the market of Bangladesh. We have prepared fish sausage from pangas (*Pangasianodon hypophthalmus*) fish as ready-to-cook (RTC) products by optimizing the amounts of ingredients and processing parameters. The shelf-life of RTC fish sausages were assessed by pH, total volatile base nitrogen (TVBN), thiobarbituric acid reactive substances (TBARS) and aerobic plate count (APC) under different packaging: not sealed pack as control; modified atmosphere packaging (MAP) 1 (50%CO₂ & 50%N₂); MAP 2 (40% CO₂, 30% N₂ & 30% O₂) and MAP 3 (50% CO₂ & 50% O₂) in tray (PP/EVOH/PP; 760 μm) with plastic top (PE/PA/PE; 100 μm) in 4 days interval during refrigerated storage (4°C). The pH, TVB-N, and TBARS values of the products were within the acceptable limits under all packaging conditions during the storage period. The APC gradually increased with time in all packaging conditions. The APCs exceeded the 7 log CFU/g, regarded as an acceptable limit, on approximately the 15th day for control, the 26th day for MAP-1, the 23rd day for MAP-2, and the 25th day for MAP-3 sample for pangas. MAP-1 (50% CO₂ & 50% N₂) demonstrated the highest shelf life of 26 days for fish sausage, which can be utilized by the superstores to display those products with extended shelf life.

Keywords: *Shelf-life, Quality, MAP, Ready-to-cook, Pangas*

PID: IRC_ASRO_146

Synthesis & Investigation of Electrical & Magnetic Properties of NiFe₂O₄ via Sol-gel Auto-combustion Method for Multifunctional Applications.Musfiqur Rahman Chowdhury^{1*}, Mst. Saima Tuzzohora Jinia, Shafayet Hossain & Dr M A Razzaque Sarker¹.**Abstract**

Nano-crystalline NiFe₂O₄ powder was synthesized through sol-gel auto combustion method at pH 7. This project was aimed to investigate electrical and magnetic properties of NiFe₂O₄ & to find the precise applications of this sample based on this investigated properties. The thermal analysis and the phase evolution of as-burnt powder with the 2:1 ratios of Fe/Ni were investigated by DTA/TGA techniques. The functional groups and chemical bonds were investigated by FTIR (Fourier Transform Infrared Spectroscopy). The electrical properties were investigated by two probe method. The resistivity vs temp. graph shows that the resistivity decreases with the increase of the temperature & the value is about 1Ωm to 63Ωm at the temp. range 313-633K. TCR was found negative which denotes the semiconducting nature of the NiFe₂O₄ sample. Conductivity is almost constant in this temp. range. Activation energy was found 0.384eV at 353-473K & 1.449eV at 483-633K. The magnetic properties were investigated by VSM test. Hysteresis loop explains the ferrimagnetic nature of the sample of moderate saturation magnetization & coercivity. This sample is a soft magnet. These properties make this sample suitable for multifunctional application such as magnetic sensors, electromagnetic shielding, catalysis, magneto-optical applications, microwave absorbing materials, NTC thermistors(temperature sensors), spintronic & magneto-electronic devices etc. All these applications were discussed briefly based on the usefulness of these properties for individual applications.

PID: IRC_ASRO_016

Utilizing Rice Husk in Brick Manufacturing: A Theoretical Approach Toward Eco-Friendly Construction Solutions.Mushfikur Rahman^{1*}, Md. Taufiq Islam², Md. Nazmul Hasan² & Md. Jahidul Haque²

¹*Department of Ceramic & Metallurgical Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh*

²*Department of Ceramic & Metallurgical Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh*

*Corresponding author email: mushfiqurhimel75@gmail.com

Abstract

Extensive utilization of energy-intensive materials such as cement and clay bricks is the primary reason the building industry significantly contributes to environmental degradation and carbon emissions. In this context, rice husk, a waste product of rice milling, offers promising prospects as a sustainable alternative to traditional building materials. This theoretical investigation explores the viability, performance characteristics and environmental benefits of utilizing rice husk and rice husk ash (RHA) in the manufacture of eco-friendly bricks for pavement structures. With a view to reducing carbon emissions, production costs, increased energy consumption and the accumulation of agro-waste, the primary objective of this investigation is to examine the physicochemical prospects of rice husk as a partial substitute for clay and cement in the brick-making process. This also analyzes the thermal insulation, compressive strength and durability of rice husk-based bricks by way of a review and synthesis of available literature and experimental data. The methodology involves undertaking an in-depth analysis of research articles, laboratory reports and analyzing various ratios of rice husk to clay/cement and production processes such as drying and low-temperature sintering. Theoretical modeling techniques are applied in predicting mechanical and thermal performance under typical load and weather conditions. The results indicate that bricks incorporating up to 2-15% RHA can significantly enhance heat resistance and weight reduction while maintaining suitable compressive strength for non-load-bearing pavement structures. The investigation supports the utilization of rice husk in sustainable construction solutions and highlights the need for further experimental validation, standardization, and regulatory incentives to facilitate large-scale utilization.

Keywords: *Eco-friendly, Heat resistance, Weight reduction.*

PID: IRC_ASRO_122

Exploring the Impact of Brown HT Dye on Mammary Tumor Formation and Its Possible Connection to Breast Cancer and Cardiac Toxicity in Female RatsNirmal Chandra Mahat¹, MD. Bedarul Islam Pranto¹, Md. Abul Kashem Tang.^{1*}¹Department of Applied Nutrition and Food Technology, Islamic University, Kushtia-7003, Bangladesh.

*Corresponding author Email: makashemsa@gmail.com, akashem@anft.iu.ac.bd

Abstract

Brown HT, a synthetic food color, is widely used in food and beverages but has raised health concerns due to its prolonged consumption and potential advancement of diseases like cancer. The research aims to determine whether Brown HT may induce mammary tumors to breast cancer and cardiovascular toxicity. The study evaluated the safety of Brown HT food color using GC-MS analysis. Twenty female virgin Long Evans rats were divided into five experimental groups. The NC group was kept on a standard diet, while the PC group was treated with DMBA, a carcinogenic compound. The remaining three groups were given Brown HT orally at different doses. The analysis assessed potential toxicological effects using biochemical and histological analyses. GraphPad Prism was used for statistical analysis. Initially, body weight increased; however, it significantly decreased in the F400 and F600 groups following tumor development. The lipid profile study revealed higher levels of triglycerides, cholesterol, and LDL, and diminished levels of HDL. Significantly increased values ($p < 0.001$) of CK-MB, uric acid, creatinine, SGPT, and SGOT indicated abnormal liver and renal function. The tumor markers AFP and CA 15-3 were ($p < 0.001$) elevated beyond the normal range. Mammary gland histopathology indicated abnormal cells and fibrotic stroma, whereas heart tissue showed edema and hypertrophy. The findings suggest that prolonged exposure to Brown HT increases the probability of developing mammary tumors, which in turn increases the risk of breast cancer and cardiovascular disease.

Keywords: Breast Cancer, Creatine Kinase-MB (CK-MB), Alpha-fetoprotein, Chocolate Brown HT

PID: IRC_ASRO_135

Trend Analysis and Forecasting of Greenhouse Gas Emissions from the Energy Sector in Bangladesh: A Comparative Study of ARIMA and Machine Learning ModelsOmmey Salma¹ & Md. Sabit Al-saba Rion^{1*}¹Department of Statistics, University of Dhaka, Dhaka 1000, Bangladesh.

Corresponding author email: rionsabit@gmail.com

Abstract

Accurate forecasting of greenhouse gas (GHG) emissions is essential for informed climate policymaking and sustainable energy planning. This study examines emission trends and future projections of CO₂, CH₄, and N₂O from Bangladesh's energy sector using data from 1990 to 2022. The rationale for this study is grounded in the dual need to understand the temporal evolution of energy-sector GHG emissions and to evaluate the effectiveness of different predictive modeling techniques. This study addresses a significant gap in the literature: the absence of a rigorous statistical comparison between classical time-series models and state-of-the-art ML techniques for forecasting Bangladesh's energy-sector GHG emissions. Four forecasting models were compared: ARIMA, Support Vector Regression (SVR), XGBoost, and LightGBM. The results demonstrate that ARIMA consistently outperformed all machine learning models across all GHG types, highlighting its strength in modeling structured, time-dependent, and linear environmental datasets. For CO₂ emissions, ARIMA achieved the lowest errors, while XGBoost ranked best among machine learning models. Similar patterns were observed for CH₄ and N₂O emissions, where ARIMA again yielded the most accurate forecasts. Although XGBoost showed moderate effectiveness in capturing nonlinear patterns, LightGBM exhibited poor generalization, likely due to overfitting and sensitivity to hyperparameters. SVR delivered stable but suboptimal results. These findings underscore the continued relevance of traditional time-series models like ARIMA for environmental forecasting, particularly in contexts with limited data and dominant linear trends, while also recognizing the potential of XGBoost as a competitive machine learning alternative.

Keywords: Greenhouse Gas, ARIMA, Machine Learning Models, Comparison.

PID: IRC_ASRO_166

Radiotherapy Evolution in Cancer Care: Integrating the Bangladesh Perspective with International Progress
M.S. RahmanSecondary Standard Dosimetry Laboratory, Bangladesh Atomic Energy Commission, Dhaka, Bangladesh
E-mail: shakilurssdl@baec.gov.bd**Abstract**

Cancer, a leading global cause of death, is characterized by uncontrolled cell growth leading to tissue invasion and malignant tumors. These cancers fundamentally originate from irregular mutations in DNA during replication. Among the various treatment modalities—including chemotherapy, surgery, and immunotherapy—radiotherapy plays a vital role and is used in the management of 60-70% of cancer patients, either alone or in combination. According to the WHO, cancer caused approximately 9.7 million deaths globally in 2022 out of an estimated 20 million new cases, with 70% of these deaths occurring in low- and middle-income countries. In Bangladesh specifically (BBS data), there are an estimated 1.5 million cancer patients. Lung cancer is the most common site for males (25.5%), while breast (25.6%) and cervical (21.5%) cancers are predominant among females. Without effective preventive measures, projections suggest that as many as 1 in 2 people could develop cancer in their lifetime.

Radiotherapy, a fundamental cancer treatment using targeted high-energy radiation (X-rays or protons) to kill cancer cells by damaging their DNA, began remarkably soon after Roentgen's 1895 X-ray discovery. Its history is marked by progressive technological leaps: early orthovoltage X-rays (1910s-1930s) offered improved penetration, followed by the 1950s introduction of Cobalt-60 isotopes providing more powerful, targeted gamma rays for deep tumors. The advent of linear accelerators (Linacs) delivering megavoltage X-rays revolutionized the field, enabling precise treatment of deep-seated tumors with less skin damage and better dose distribution. From the 1960s to the present, continuous refinements led to advanced techniques like 3D Conformal Radiation Therapy (3D-CRT), Intensity-Modulated Radiation Therapy (IMRT), Image-Guided Radiation Therapy (IGRT), Stereotactic Radiosurgery (SRS/SBRT), proton beam therapy, and adaptive radiotherapy. Integrated with sophisticated software systems, these methods further optimize treatment, maximizing tumor control while minimizing toxicity to surrounding healthy tissue and reducing treatment time.

Radiotherapy journey in Bangladesh commenced in 1947 with the installation of its first deep therapy X-ray unit at Tangail's Kumudini Hospital. A significant advancement followed in 1959-64 when Cobalt-60 machines for treating deeper tumors were introduced at Dhaka Medical College Hospital and Chittagong Medical College Hospital. Today, the nation's capacity has undergone substantial expansion. A network of 25 operational radiotherapy centers nationwide is now equipped with 29 Linear Accelerators (Linacs), 13 Cobalt machines, 19 Brachytherapy units, and 25 CT simulators. These facilities employ advanced treatment planning and delivery techniques, including IMRT, VMAT, IGRT, and SBRT. To ensure the highest quality of care, Bangladesh established a Secondary Standard Dosimetry Laboratory (SSDL), serving as the national radiation metrology laboratory. The SSDL maintains international dosimetry standards and conducts mandatory, six-monthly quality assurance (QA) audits across all radiotherapy centers. Looking ahead, eight new divisional-level cancer hospitals are poised to join this growing network. Furthermore, Bangladesh is actively advancing towards introducing proton therapy, representing the most precise form of pencil beam radiotherapy. The nation is committed to strengthening national cancer control programs, integrating radiotherapy into universal health coverage schemes, and fostering public-private partnerships to significantly enhance the accessibility and affordability of these critical treatments nationwide.

PID: IRC_ASRO_192

Sustainable synthesis of nano-crystalline α -alumina from waste food packaging for efficient azithromycin removal

Raton Kumar Bishwas*, Md. Ashraful Alam, Shirin Akter Jahan*

Institute of Glass and Ceramic Research and Testing (IGCRT), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka 1205, Bangladesh

Abstract

Nanocrystalline α -alumina was successfully synthesized from waste aluminum food packaging (AFP) using a simple and novel method. This material was employed for the efficient removal of azithromycin (AZM) from aqueous systems. X-ray diffraction (XRD) analysis revealed a 99.93 % α -alumina phase with a hexagonal lattice structure. FTIR analysis showed the presence of –OH groups in diaspore but their absence in α -alumina. The zero-point charge (pHzpc) of α -alumina was 6.84, indicating its surface charge behavior. The synthesized α -alumina demonstrated high purity (99.93 %) and promising adsorption properties, with a moderate band gap of 5.07 eV and nanoscale absorbance characteristics. The hydrodynamic diameters of diaspore and α -alumina were 310.7 nm and 267.2 nm, respectively. The Transmission Electron Microscopy (TEM) reveals the irregular spherical shape of the particle with an average particle size of 60.53 nm. Adsorption studies demonstrated that AZM removal increased with contact time and adsorbent dosage but decreased with higher initial AZM concentration. The maximum adsorption capacity was 16.0691 mg/g at 25 °C and pH 10.0. Adsorption followed the Langmuir model, indicating monolayer coverage, while the pseudo-second-order kinetics suggest the rate depends on both the adsorbent and adsorbate. These results confirm that α -alumina synthesized from AFP is an effective adsorbent for AZM removal.

PID: IRC_ASRO_061

Synthesis of Nano Calcium Silicates from Waste Calcite and Aragonite Phase for Efficient Removal of Industrial Organic Pollutants

Sumaya Tabassum¹, Mashrafi Bin Mobarak¹, Farah Nigar¹, Samina Ahmed¹, & Md. Sahadat Hossain^{1*}

¹*Institute of Glass & Ceramic Research and Testing, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh*

Corresponding author email: Md. Sahadat Hossain (saz8455@gmail.com)

Abstract

Contamination of water by dyes, phenolic compounds, pharmaceuticals, and personal care products is a significant environmental concern. This study examined the adsorption capacity of calcium silicate for removing Congo red dye, which was synthesized through solid-state reactions at 1000 °C. Two natural waste sources, such as aragonite (*P. globosa*) and calcite (Eggshells), were used as calcium precursors. Structural analysis and functional groups of the synthesized samples were carried out by X-ray diffractometer (XRD) and a Fourier Transform Infrared Spectrometer (FTIR). The crystallite size of the synthesized E-CaSiO₃, S-CaSiO₃, and C-CaSiO₃ was less than 100 nm, depending on various well-known models, such as the Monshi-Scherrer model (MSM), the Williamson-Hall model [involving Uniform Deformation Model (UDM), Uniform Stress Deformation Model (USDm), and Uniform Deformation Energy Density Model (UDEDm)], the Sahadat-Scherrer Model (SSM), the Size-Strain plot method (SSP), and the Halder-Wagner Model (HWM). The adsorption efficacy of the synthesized E-CaSiO₃ and S-CaSiO₃ was assessed under various conditions for eradicating Congo red dye from wastewater and observed by UV-vis spectroscopy. The highest removal percentage was nearly 100% for 0.2 g of E-CaSiO₃ adsorbent. Moreover, the method of adsorption of dye by the adsorbent was more clearly comprehended by the Langmuir, the Freundlich, and the Temkin adsorption isotherms. So, this exploration not only highlights scientific insights but also fosters a sustainable waste-to-resource strategy and circular economy by converting food waste and natural waste materials into valuable added products for effective wastewater treatment and environmental protection.

Keywords: Aragonite, Calcite, Adsorption, Congo red.

PID: IRC_ASRO_180

Prevalence of Drug-Resistant Pulmonary Tuberculosis in South Asia: Systematic Review and Meta-Analysis Authors
 Swyed Noby Hossan^{1†}, Farista Tasnim^{1†}, Md. Kaderi Kibria^{1 2*}

¹Department of Statistics, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.
 Corresponding author email: kibria.stt@tch.hstu.ac.bd

Abstract

Drug-resistant pulmonary tuberculosis is a significant challenge to the health of the population in South Asia. This study systematically analyses existing data to determine DR-TB prevalence across the region and provides crucial evidence to improve treatment strategies and TB control programs. A total of 6400 papers were collected from PubMed, Research Gate, and Google Scholar to identify studies on reporting drug-resistant tuberculosis (DR-TB) prevalence in South Asia (Bangladesh, India, Pakistan, Nepal, Sri Lanka, Bhutan, Myanmar, and Afghanistan). After cleaning the data, the 35 studies from the year 2005 to 2025 are considered in the research. A meta-analysis was conducted using a random-effects model to estimate the pooled prevalence of DR-TB. Egger's test was performed to assess potential publication bias, and heterogeneity among studies was evaluated using the I^2 statistic. The combined prevalence estimates for mono-DR-TB (0.09, 95% CI: 0.04–0.18), any-DR-TB (0.53, 95% CI: 0.43–0.64), and poly-DR-TB (0.08, 95% CI: 0.04–0.17). Additionally, for MDR-TB (0.29, 95% CI: 0.21–0.39), and XDR-TB (0.04, 95% CI: 0.01–0.11). There was significant variation among the studies ($I^2 > 97\%$). For mono-DR-TB ($p = 0.064$), poly-DR-TB ($p = 0.095$), MDR-TB ($p = 0.240$), and XDR-TB ($p = 0.109$), Egger's tests showed no significant publication bias; however, any-DR-TB showed possible bias ($p = 0.006$). Although XDR-TB exhibited lower prevalence rates, it was identified across all nations. The highest prevalence of MDR-TB was observed in Bangladesh and India. An analysis of individual studies indicated a pervasive resistance to Ethambutol and Streptomycin. High rates of resistance are seen in MDR-TB and XDR-TB cases to second-line injectable medications (amikacin, kanamycin, capreomycin) and fluoroquinolones (levofloxacin, ofloxacin). The high prevalence of DR-TB in South Asia underscores the urgent need to strengthen tuberculosis control programs, improve diagnostics, and implement appropriate treatment strategies. Closing surveillance gaps and ensuring treatment adherence are critical to mitigating the DR-TB epidemic in the region.

Keywords: Prevalence, Drug-resistant tuberculosis, MDR-TB, South Asia, systematic review.

PID: IRC_ASRO_71

NiFe-Based Layered Double Hydroxide for Electrochemical Detection of trace Heavy Metal in Aqueous Media
 Md. Sahadat Hossain^{a*}, Md. Sahadat Hossain^{a*}, Tanvir Islam Rabbi^{a,b}

^aInstitute of Glass and Ceramic Research and Testing (IGCRT), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhanmondi, Dhaka 1205, Bangladesh.

^bDepartment of Applied Chemistry and Chemical Engineering, University of Dhaka, Dhaka, Bangladesh.
 Corresponding author email: saz8455@gmail.com and shanta_samina@yahoo.com

Abstract

Heavy metal ion contamination in water sources poses a significant threat to environmental safety and public health, particularly in regions with limited access to advanced monitoring infrastructure. Lead (Pb^{2+}), in particular, is a highly toxic metal that accumulates in biological systems and can cause severe neurological and physiological disorders. This study presents the development of a sensitive electrochemical sensor based on hydrothermally synthesized nickel–iron layered double hydroxide (NiFeLDH) for the detection of Pb^{2+} ions in aqueous media. The NiFeLDH nanostructure was prepared via a one-step hydrothermal synthesis route, yielding a highly crystalline material with abundant hydroxyl groups and interlayer spacing conducive to heavy metal ion interaction. The synthesized NiFeLDH was then drop-casted onto an electrode surface to fabricate the sensor. Electrochemical characterization was carried out using cyclic voltammetry (CV) in lead nitrate ($Pb(NO_3)_2$) solution. The modified electrode exhibited enhanced electrochemical responses with well-defined redox peaks and improved peak currents compared to the unmodified electrode. This enhancement is attributed to the high surface area, redox-active nature, and strong ion-exchange capabilities of NiFeLDH, which facilitate the adsorption and detection of Pb^{2+} ions. The sensor demonstrated excellent signal stability, repeatability, and sensitivity toward trace-level detection. These results indicate the potential of NiFeLDH as an effective material for constructing low-cost, portable electrochemical sensors for environmental monitoring. Future work will focus on real-sample analysis, selectivity evaluation in the presence of interfering ions, and miniaturization for field-deployable applications.

Keywords: Heavy metal ion (Pb^{2+}) Sensing; nanostructured materials, transition metal hydroxides, water quality analysis.

PID: IRC_ASRO_76

Quantifying Carbon Footprints: A Comparative Analysis of Carbon Emission from Different Land Uses of Khulna to Measure Global Warming PotentialTasnia Haque*¹ & Ibrat Ara²

1. Department of Urban and Regional Planning, Khulna University of Engineering & Technology, Khulna, Bangladesh
2. Department of Urban and Regional Planning, Khulna University of Engineering & Technology, Khulna, Bangladesh

Corresponding author email: haquetasnia13@gmail.com

Abstract

Urban expansion of built environments significantly contributes to greenhouse gas emissions, yet few studies exist to quantify their global warming potential in developing cities like Khulna, Bangladesh. This study aimed to determine the global warming potential (GWP) of Wards 7, 8, 13, 17, 18, and 19 in Khulna City by assessing carbon emissions through a comprehensive life cycle assessment (LCA) of built-up areas across residential, commercial, and industrial land uses. A bottom-up modeling approach was applied, incorporating occupant surveys, field monitoring, and historical energy consumption records to estimate monthly building energy use. Carbon emissions were calculated by combining energy data with emission factors from standard carbon metric models and analyzed across three stages: construction, operation, and end-of-life. Construction-phase data were gathered from under-construction buildings and industries, while data for the end-of-life stage were collected from decommissioned sites such as closed jute mills. To understand the spatial implications of land use changes, NDVI (Normalized Difference Vegetation Index) and NDBI (Normalized Difference Built-up Index) were used to assess green space loss and expansion of built-up areas. The results revealed that industrial areas were the highest contributors to carbon emissions, accounting for 54% of total CO₂ emissions—primarily during the production phase due to energy-intensive processes reliant on fossil fuels. The project was presented at the 1st National Research Conclave, where it received valuable feedback. If implemented at scale, this approach could support sustainable energy use and emission reduction in urban environments.

Keywords: Carbon Footprint, Life cycle assessment (LCA), Global warming potential (GWP), Urban Sustainability

PID: IRC_ASRO_79

Comparative Analysis of SMOTE And ROSE For Handling Class Imbalance in Mental Health Prediction Among Ever-Married Women Using Ensemble and Non-Ensemble Machine Learning Models.Tufazzul Miah Saju^{1*}, Gowranga Kumar Paul & Md. Abul Hossain¹,¹Department of Statistics, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

*Corresponding Author Email: tufazzulmiah18027@gmail.com

Abstract

Mental health significantly influences quality of life but often receives inadequate attention. The imbalance in mental health data challenges building accurate predictive models. Machine learning can handle complex, imbalanced data, offering new opportunities for early detection and improved mental health care. This study develops accurate machine learning models for mental health prediction among women by addressing class imbalance using resampling techniques and comparing performance, leveraging socio-demographic data to enhance early detection and support interventions aligned with SDG 3. This study used BDHS 2022 secondary data of 19,987 ever-married women with two-stage stratified cluster sampling. Feature selection employed the Chi-square and Boruta algorithms; SMOTE and ROSE addressed the imbalance. Both ensemble and non-ensemble ML models were applied. Approximately 1 in 5 women experience depression, while 1 in 20 have anxiety. After applying SMOTE and ROSE, XGBoost and Gradient Boosting had the highest accuracy but very low sensitivity and F1 scores. Naïve Bayes and SVM under SMOTE showed balanced results: 77.76% (depression), 61.75% (anxiety) accuracy, with 32.68% and 58.09% sensitivity, and the highest F1 scores. Under ROSE, Naïve Bayes yielded 89.52% (depression) and 76.81% (anxiety) accuracy, with sensitivity at 19.51% and 23.44%. Overall, SMOTE outperformed ROSE in sensitivity, specificity, and F1, proving more effective for imbalanced data. The findings highlight the urgent need to address class imbalance in mental health prediction by using effective oversampling and suitable algorithms. This research guides policymakers to design targeted interventions for vulnerable women, supporting improved mental health aligned with SDG 3.

Keywords: Mental Health, Machine Learning, Class Imbalance, SDG 3.

PID: IRC_ASRO_83

Demand Potential of Water Transport for Urban Mobility in Kamrangirchar, Dhaka
Yeasir Mohammad Amin^{1*}¹*Student (MURP), Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh***Corresponding author email: yeasir.amin108@gmail.com***Abstract**

The capital city of Bangladesh, Dhaka, is situated along a network of four major rivers. It was once renowned for its vibrant water-based transportation. However, over time, the city's mobility system has shifted towards land transport, leading to chronic traffic congestion and growing environmental concerns. This study aims to assess the demand potential for sustainable urban water transport in Kamrangirchar, Dhaka, a densely populated mixed-use residential-industrial area. This study utilizes a mixed-methods approach, combining both qualitative and quantitative analyses, where field surveys for SP and RP method and direct observations to assess existing condition was used for data collection. Data was analyzed to assess the existing water transport infrastructure and commuter preferences for comparison. Results from the study indicate that while there is a water transport network that exists, it remains underutilized although water-based transport demonstrates notable advantages. That is in terms of cost-effectiveness and reduced travel time compared to existing road-based alternatives. The study also reveals a perception gap that many users view water transport as slower, and more expensive, which limits its broader applicability. The study tries to conclude that strategic interventions such as improvements in infrastructure, service quality and targeted public awareness are essential to shift perception and promote water transport as a viable, sustainable urban mobility solution in Dhaka.

Keywords: *Inland waterways, Sustainable urban mobility, Transportation demand, Urban water transport*

PID: IRC_ASRO_85

Bio Waste to Building Blocks: Sustainable Ceramic Tile Development Using Fish Bone DerivativesShah Sadia Rahman Joya¹, *Sadia Samanta¹, Md Shamim Hossain Raju¹¹*Department of Ceramic & Metallurgical Engineering, Rajshahi University of Engineering & Technology (RUET), Rajshahi-6204, Bangladesh***Corresponding author email: sadiasamanta2712@gmail.com***Abstract**

The need for effective bio-waste management and high-quality materials has led scientists to work on recycling bio-waste into ceramics. One of the bio-wastes from the Seafood Processing Industry that has Calcium Phosphate as a by-product is the Fish Processing Industry. This research aims to use calcined fish bone waste to improve the sustainability and mechanical properties of ceramic tiles. The fish bone waste underwent purification and sun-drying before being calcined between 700-900°C, allowing for the removal of organic material and primary conversion to hydroxyapatite. The residues were then powdered, processed, and blended with ceramic powders to form test samples. The samples undergo drying and a 1200°C firing. The resultant ceramic tiles maintain improved mechanical properties alongside 0-4% improvements. These include bending strengths of 4.5 MPa, 5.6 MPa, and 6.0 MPa. A 5% addition yielded the optimal performance, achieving 6.29 MPa while surpassing the plateau increase. Increased addition of calcined fishbone up to 5% enhances bending strength, weight, and thermal stability of the ceramic tiles as well as reduces LOI, water absorption, and porosity. Following this point, the benefits level off or decrease slightly. The findings confirm that utilizing calcined fishbone as an ecological reinforcing additive in ceramic products is beneficial from both the perspectives of environmental waste reduction and improved product functionality for eco-friendly applications.

Sub-Theme: Education & Pedagogy

PID:IRC_EP_005

Translation Studies and Artificial Intelligence: A Futuristic Approach to Bangla-to-English Translation

*Abdullah Ul Noor**

*Department of English, Faculty of Humanities and Social Science, Pabna University of Science and Technology,
Pabna-6600, Pabna, Bangladesh.*

*Corresponding author email: abdullah.201832@s.pust.ac.bd

Abstract

The modern world is being shaped and shattered by the support and overuse of Artificial Intelligence (AI). Yet, the technology is not competent enough to produce spotless translated works as translators independently do with their human brains. Both translation studies and Artificial Intelligence are promising industries, and so connecting them should help reduce the current workload of most publishers who are seeking standard and qualified translated works. This paper seeks a solution to the problem that, after so many years of the AI revolution, the connection is yet to become trustworthy and effortless. The paper evaluates the translations of eight different poems of Jibanananda Das (Bangla to English) using three independent AI chatbots (Gemini, ChatGPT, and DeepSeek) and identifies their incompetence as of July 2025 compared to human translations. The comparative analysis reinforces the importance of human touch. The paper aims to explore the potential of Artificial Intelligence to work better with the help of a "prompt structuring" approach. The supremacy of the human brain gives emotion to a translated work, but for faster production and easier exchange, this paper establishes the necessity of AI in the field of modern translation studies.

Keywords:

PID:IRC_EP_007

Did the Curriculum Prepare Us? Examining Digital Literacy and Employment Readiness in Bangladeshi Educational Pathways

Aklimatul Jannat Fabia^{1*} & Nabila Nahian²

¹*MSS Thesis Researcher, Department of Sociology, Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh*

*Corresponding author email: aklimatul71@student.sust.edu

²*BSS in Social Work, Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh*

Abstract

The 21st century workforce demands professionals who can navigate technology and adapt to rapidly changing work environments. In Bangladesh, 'Information and Communication Technology' is incorporated into secondary school curricula with the goal of developing fundamental digital skills. However, not enough research has been done on how well this curriculum prepares students for both digital labor markets and higher education. In this study, the alignment of university students' digital abilities and employment readiness with the national secondary ICT curriculum will be critically evaluated. It will examine whether students in non-technical fields develop critical digital awareness and meaningful digital literacy as a result of the early curriculum's concentration on fundamental ICT. The methodology used in the study is two tiered. First, a curriculum content analysis will be conducted using national secondary ICT syllabi and education policy documents, focusing on critical digital literacy, ethical use and tech integration. Secondly, 180 university students from both public and private institutions will be given a quantitative survey to assess their digital access, skill levels, critical awareness, and perceived readiness for work in an economy mediated by digital means. By statistically tying curriculum design to real-world preparation, the study intends to inform evidence-based educational reform and contribute to national discourses on digital inclusion, workforce development, and fair learning transitions from school to university.

Keywords: *Digital literacy, Curriculum analysis, Employment readiness, Educational Policy*

PID:IRC_EP_009

Designing Education for the Margins: An Anthropological Exploration of FIVDB's Dropout Prevention Schools in Rural BangladeshAnwar Hossain^{1*}, Md. Ashraful Haque¹¹*Department of Anthropology, Shahjalal University of Science and Technology (SUST), Sylhet-3114, Bangladesh.**Corresponding author email: anwarahmedsust@gmail.com**Abstract**

This study explores how education is designed and how the learning experiences of marginalized children in rural Bangladesh are shaped through dropout prevention schools run by Friends in Village Development Bangladesh (FIVDB) under the ENRICH (Samriddhi) program. The main aim was to understand how these community-based schools work in low-resource settings and how different actors—teachers, students, and families—shape this educational experience. A qualitative approach was used, incorporating ethnographic fieldwork, observation, informal interviews, and document review. Data were collected during a 40-day internship across several schools in Hatkhola and Jalalabad unions of Sylhet Sadar Upazila. Classroom environments, teaching practices, parental roles, and flexible learning strategies were documented using field diaries and reflective memos. Braun and Clarke's thematic analysis was adopted to analyze primary data. Findings show that teachers and communities actively use local knowledge to make learning more flexible and meaningful—teachers, for example, use everyday scenarios such as measuring paddy or counting fruits to teach math, and incorporate folk stories and local myths to make lessons more engaging and culturally relevant. Community members support the learning environment by providing mats and seating for classrooms. However, these schools remain structurally weak and receive little formal policy support. Broader challenges such as poverty, gender roles, and child labor continue to affect school participation. While FIVDB's efforts help children stay in school, the program still relies on top-down decision-making and lacks long-term sustainability. The study argues for more inclusive and context-sensitive education models grounded in local realities and justice-driven design.

Keywords: *Ethnographic Fieldwork, Local Knowledge, Marginalized Education, Context-Sensitive Pedagogy*

PID:IRC_EP_011

Exploring WASH Block Facilities and Challenges in Schools of the Coastal RegionJannatul Ferdous^{1*} & Dr. Md. Abdul Halim²¹*Department of Educational Administration and Leadership, Institute of Education and Research, University of Dhaka, Dhaka-1000, Bangladesh*²*Department of Pre-Primary and Primary Education, Institute of Education and Research, University of Dhaka, Dhaka-1000, Bangladesh**Corresponding author email: jannatulferdoustarita@gmail.com**Abstract**

This study investigates the condition and sustainability of Water, Sanitation and Hygiene (WASH) block facilities in five primary and secondary schools situated in Kuakata, a cyclone-prone coastal town in Bangladesh. Guided by a pragmatic paradigm and a mixed-method design, the research combined structured surveys of thirty students with semi-structured interviews, focus-group discussions and on-site observations that engaged head teachers, cleaners, parents and teachers. Descriptive statistics revealed that although every school possessed a dedicated WASH block and on-premises water source, only two met the WHO–UNICEF criteria for basic sanitation and none provided soap consistently throughout the day. Qualitative analysis illuminated the factors behind these shortfalls: irregular operation-and-maintenance budgets, saline corrosion of fixtures, limited community oversight and persistent gender-related privacy concerns that discouraged girls from using the facilities during menstruation. The convergent interpretation of quantitative and qualitative findings demonstrates that infrastructure presence alone is insufficient, functionality depends on climate-resilient design, predictable financing and behaviour-reinforcement strategies. The thesis recommends ring-fenced maintenance funding, saline-resistant retrofits, student-led hygiene clubs and digital monitoring dashboards to enhance accountability. It further proposes future longitudinal and microbial water-quality studies, participatory action research and technology pilots to deepen understanding and ensure sustained service. By linking local evidence to national policy ambitions under SDGs 4 and 6, the research offers an actionable roadmap for improving school WASH in coastal Bangladesh and similar vulnerable settings.

Keywords: *WASH blocks, school sanitation, mixed-methods, coastal Bangladesh*

PID:IRC_EP_013

Assessment Styles and Students' Mental Health at Bangladeshi Private Universities
Maimuna Shafiqul Islam

Department of English and Humanities, School of Humanities and Social Sciences, BRAC University, Dhaka
*Corresponding author email: saziamaimuna@gmail.com

Abstract

This qualitative study officializes four private university undergraduate students' deteriorating mental health during COVID-19 by depicting the relationship between online assessment and mental health so that they can harmonise, instead of sabotaging one another. Participants are selected through purposive sampling to fit the purposes of the study. Data is collected through 27 Facebook post screenshots from university groups on students' mental health and 16 semi-structured interviews, using pseudonyms. A conceptual framework is used by combining established theoretical knowledge on depression, anxiety and burnout, drawn from official medical websites. Interviews are transcribed, codes derived, themes generated, then analysed thematically to relate to framework. Findings revealed, most participants faced alienation, depression, despite having few advantages (recorded lecture availability) and two students experienced negligible change. Their symptoms matched the ones outlined in the literature review and upon data analysis it showed that, such symptoms resulted because the online assessment styles broke the principles of assessment – validity, reliability, practicality and authenticity, resulting in a negative washback. The researcher concluded – the online assessment styles worsened the students' mental health – they have functional depression, burnout, and panic disorder, which was absent during their pre-pandemic times. The study findings, if applied, will help formulate universities' assessment criteria, contributing to the country's sustainable development. It can also prepare universities better for the future that may require online education again. Though setting chosen is private university, this study also applies to public and national university as, all tertiary level students deserve quality education being the stakeholders of the universities.

Keywords: *Assessment, depression, Bangladeshi private university students, sustainable development*

PID:IRC_EP_015

Title: Artificial Intelligence Awareness, Usage, and Perceptions among Secondary Grade Students in Rural Schools of Bangladesh.

Md. Hasan Mahmud^{1}, Moniruzzaman Bhuiyan¹, Nusrat Jahan Nisha¹ & Nahid Hasan¹.*

*¹Department of English, Faculty of Arts and Humanities, Comilla University, Comilla-3500,
Corresponding author email: mdhasan54177@gmail.com*

Abstract:

The arrival of Artificial Intelligence (AI) has been transforming many sectors around the globe, including education. Although cities schools in Bangladesh are gradually welcoming AI technologies into learning and teaching processes, students in rural areas are significantly behind due to lesser exposure and access. This study will explore the awareness, usage pattern, and attitude towards AI among rural Bangladesh secondary school students. Specifically, the research will examine the way in which these students utilize AI-tool-based applications—such as ChatGPT, Grammarly, and Google Translate—in their learning process and what are their views toward the associated risks. The research is based on a quantitative design, and it utilizes survey data obtained from approximately 80 to 100 students learning in various rural schools. There was utilization of a standardized questionnaire involving four broad areas of questioning: general awareness regarding AI, utilization of specific AI tools, motivations and incidences of utilizing AI, and awareness of potential disadvantages in a learning environment. Demographic variables like grade level, gender, and age were also studied to analyze how they relate to patterns of AI use. Initial findings indicate that although many students are familiar with the concept of AI—largely through social media or websites—many are not well aware of its functionality or the potential for it to be used in education. Among the students employing AI tools, grammar checking, translation assistance, and essay writing for assignments were the most common activities. However, the study showed that there was a lack of awareness of the limitations and ethical issues of AI.

Keywords: *Artificial Intelligence (AI), Rural Education, Student Awareness, AI Tools.*

PID:IRC_EP_018

The Impact of Generative AI Tools on Students' Writing, Critical Thinking, and Creativity: A Critical InquiryMd. Rifat Mia^{1*}¹*Department of English, City University, Dhaka, Bangladesh**Corresponding author email: mdrifatmia399@gmail.com**Abstract**

The rapid proliferation of generative AI tools such as ChatGPT in higher education has introduced both valuable opportunities and complex challenges globally and within university-level learning practices in Bangladesh. This study critically investigates the impact of these tools on Bangladeshi university students' writing skills, critical thinking abilities, and creative expression. The research investigates to understand how generative AI tools such as ChatGPT, are influencing students' learning behaviour, with a particular focus on academic writing quality, analytical reasoning, independent thought, and the capacity for original creative expression among the Bangladeshi university students. A mixed-methods research design was utilized, combining quantitative surveys conducted with 45 students and 15 educators. While educators insights revealed behavioral shifts and academic concerns, the student survey explored usage frequency, purposes, and perceived impact. Semi-structured interviews were conducted to collect data, and thematic analysis was used to identify common patterns in usage habits, perceived benefits, and challenges related to originality and critical thinking. Findings reveal that generative AI tools not only boost efficiency and provide structural guidance in writing, but also compromise originality, independent thought, and authentic critical learning. Educators expressed concerns regarding students' overdependence on such tools, highlighting academic dishonesty, erosion of foundational writing skills, potential decline in critical engagement and authentic learning. However, the study also explores that using these tools responsibly can contribute academic writing development and foster self-directed learning. It urges for the emergency digital literacy frameworks, ethical, and critical integration of generative AI in academic settings.

Keywords: *AI in education, academic writing, critical thinking, digital literacy*

PID:IRC_EP_022

Exploring the Teaching-Learning Practices of ICT in Rural Secondary Schools of BangladeshMd. Sourav Hasan^{1*} & Iffat Naomee²¹ *Department of Curriculum and Instructional Technology, Institute of Education and Research (IER), University of Dhaka, Dhaka-1000, Bangladesh*² *Department of Curriculum and Instructional Technology, Institute of Education and Research (IER), University of Dhaka, Dhaka-1000, Bangladesh*Corresponding author email: souravhasan23611@gmail.com**Abstract**

In 2025, Bangladesh reinstated the National Curriculum 2012, replacing the recently introduced National Curriculum 2022. A significant change accompanying this shift was the reintroduction of Information and Communication Technology (ICT) as a subject, replacing the previously adopted Digital Technology subject. Despite these curricular adjustments, the implementation of ICT education continues to pose substantial challenges, particularly in rural areas. This study explores the teaching and learning practices associated with the reintroduced competency-based ICT curriculum in rural secondary schools of Bangladesh, focusing on pedagogical approaches, curriculum implementation, and the barriers encountered. Following a qualitative approach, the study investigates two key areas: the current classroom practices for ICT teaching-learning, and the barriers faced by the teachers in implementing the curriculum effectively. Data were collected through purposive sampling from ICT teachers and students of three rural secondary schools in the Rangpur district of Bangladesh. Thematic analysis was conducted to triangulate the data from in-depth interviews of the teachers and focus group discussions with the students. The findings highlight the need of reconsidering, refining and reorganising the pedagogical practices and systemic hurdles that hinder the effective implementation of the ICT curriculum in rural areas. Key recommendations include infrastructural development, enhanced teachers training, equitable access to resources for all students and teachers, and a context-sensitive approach to technology education, which have the potential to drive both educational and social transformation. The study proposes targeted interventions for policymakers and educators to support inclusive, effective digital literacy education, particularly for students in underserved areas.

Keywords: *Digital Literacy, Rural Secondary Education, Educational Barriers in Rural Areas, Technology Education*

Assessing Research Enthusiasm among Higher Secondary Students under the National Curriculum of Bangladesh

Md Hasin Hasnat^{1*}, Nudrat Towsif² & Subha Mahmud³

1. Higher Secondary Section, Sirajganj Government College, Sirajganj-6700, Bangladesh.
2. Higher Secondary Section, Adamjee Cantonment College, Dhaka-1206, Bangladesh.
3. Department of Biochemistry and Biotechnology, School of Health & Life Sciences, North South University, Dhaka-1229, Bangladesh.

Corresponding author email: hasinhasnat2000@gmail.com

Abstract

The national educational curriculum of Bangladesh incorporates higher secondary education as the intermediate level of education, comprising classes XI to XII (Intermediate and Secondary Education Ordinance, 1961, 1977). This study examines the level of research enthusiasm among higher secondary students within the general education stream, excluding technical-vocational and madrasah education streams. Despite curricular reforms, research engagement remains largely absent from formal educational policies and practices at this level. This paper investigates several aspects, such as students' perception of research, motivations, structural barriers, and the impact of geographic disparities between metropolitan and non-metropolitan area-based institutions. By implementing a qualitative approach, data was collected through semi-structured interviews with students from four institutions and observational field notes from two institutions representing different areal settings. Thematic analysis indicates that both intrinsic and extrinsic motivations exist among students interested in research. However, substantial challenges remain, including insufficient systemic facilitation, inadequate resources, curriculum inflexibility and limited support. The findings also highlight a noticeable contrast in research exposure and opportunities between urban and non-urban areal settings. The study emphasizes the need for systemic inclusion of research-based learning within the curriculum and calls for infrastructural reforms to develop a sustainable research culture among the students of higher secondary level in Bangladesh.

Keywords: secondary education, research engagement, thematic analysis, challenges.

PID:IRC_EP_027

Test Accommodations in Higher Education: An Exploration of Perceptions and Challenges Faced by Undergraduate Students with Disabilities

Jeba Anika Chowdhury^{1*}, Atika Raisa Archi¹, Md. Sud Uddin Sadi¹
¹Institute of Education & Research, University of Rajshahi, Rajshahi-6205, Bangladesh.
Corresponding Author Email: jebaanika81@gmail.com

Abstract

Test accommodations are essential in providing equal opportunities for students with disabilities. This qualitative study aims to explore the perceptions of undergraduate students with disabilities and the challenges they face regarding test accommodations at the University of Rajshahi, Bangladesh. Twelve students with disabilities, specifically those with visual impairments, physical disabilities, and cerebral palsy, participated in semi-structured interviews. Thematic analysis of the data reveals that students often perceive test accommodations as generalized, not specifically adapted to meet their individual needs, with experiences varying depending on the type of disability. Students initially face social stigma when using test accommodations. Additionally, the findings suggest a lack of awareness among both students and faculty regarding the formal policies governing test accommodations. Despite these challenges, students acknowledge that test accommodations have a positive impact on their academic performance. The study concludes that greater personalization of test accommodations, increased awareness and training for both faculty and students, involvement of students with disabilities in decision-making, enhanced institutional support and resources, and the urgent reform of existing policies are crucial for improving the effectiveness of test accommodations in higher education.

Keywords: test accommodations, disabilities, higher education, student perceptions, challenges, individualized support, special needs education, Bangladesh.

PID:IRC_EP_030

**Banking System in Education:
Practice of Banking System in Bangladesh Education Sector and My Educational Trajectory**
Monira Sultana

Assistant Professor, Department of Zoology, Sylhet Government College, Sylhet, Bangladesh
Corresponding Author Email: monirasust@gmail.com

Abstract

Education is one of the main keys to human development and welfare. The purpose of education is to do better for the society and to prepare the next generation to keep sustainable development. However, every country has their own education system but as an educator Paulo Freire finds some similarities within the education system all over the world, so for example the banking system in education. The main objectives of this study are to learn about the education system in Bangladesh and make connection with my educational experiences and with the banking concept. This is an auto-ethnographic research. As auto-ethnographers rely on various methods of data gathering and research tools, I have used some tools such as observation, context analysis, and storytelling. The findings revealed that there are many factors which plague the education of Bangladesh, like the memorization culture, conflict between teachers and students, less practice of dialogue in the classroom between the teacher and the students, illegal political pressure and so on, so it is very difficult for us whether we should accept or reject the banking concept of education in Bangladesh. I think, this paper will be useful for the educators to find out the actual scenario of Bangladesh education system, also for the policymakers to formulate effective policy in education, for the administrator to take appropriate initiative for the betterment of the students, and also for the teachers and students who are directly involved into the education in Bangladesh.

Keywords: *Practice, Banking System, Education Sector, Bangladesh*

PID:IRC_EP_032

**Assessing the Teachers' Perception on the Curriculum Changes in
Secondary Level Education: A Study on Dhaka City**

Rashad Ahmed^{1*}, Md. Tuhin Bhuiyan², Jannatul Yesmin Shimantow³, Md. Nazmus Sakib⁴ &
Mobaassira Monowar Mim⁵

BSS, 4th Year, Department of Public Administration, FASS, Bangladesh University of Professionals (BUP), Dhaka-1216, Bangladesh.

Corresponding author email: rashadahmed8824@gmail.com

Abstract

The education system in Bangladesh has been changing frequently by reforming while facing different challenges. The initiation of the National Curriculum Framework (NCF 2021) concentrated to exchange memorization with competency-based, student-centered, and active learning but its implementation resolved gaps between policy and practice. The study primarily focused on how secondary school teachers in Dhaka City perceive the perception on the curriculum changes, the level of adaption to the new curriculum requirement and institutional challenges. The study used the Stages of Concern (SoC) model to get information and follow mixed method to collect data from participants 414 (KII 2 experts, Interview 8 principles/teachers, Survey 404 teachers). The qualitative analysis has been done by using thematic analysis and quantitative data analyzed by Statistical Packages for Social Sciences (SPSS. V.25) including descriptive statistics, regression tests, chi-square tests, and factor analysis. The study uncovered that the teachers (53.1%), (16.4%), (15.3%) and (20%) are strongly agreed to have capabilities are sufficient to adapt from the curriculum (NCF 2021) to the previous curriculum, enough teaching materials/resources, enough institutional support, and the role of teacher are essential for curriculum reforms respectively. Statistical results indicate that the perceptions vary less significantly by age, gender, and teaching experience. This paper indicates the inadequate training, teaching materials, time allocation, and teaching strategies. The study recommends on technical changes including strengthening teacher training, capacity building, institutional support, and promote collaboration learning. The participants highlight the difficulty of investment in continuous professional development and creating two-ways communication between policymakers and practitioners.

Keywords: *Curriculum change, Perception, Education, Capabilities, Stages of Concern (SoC).*

PID:IRC_EP_036

Barriers to Accessing Quality Education in the Coastal Regions of Bangladesh: A Socioeconomic and Environmental PerspectiveReemly^{1*}, Md Wahid Tausif Utshab², Sohanur Rahman³ & Md. Touhiduzzaman⁴^{1,2,3}Graduate student, Department of Sociology, Dhaka International University⁴Assistant Professor, Department of Sociology, Dhaka International University

*Corresponding author email: reemlystar@gmail.com

Abstract

Children living in the coastal regions of Bangladesh face a unique set of challenges when it comes to accessing quality education. In these areas, poverty and environmental instability often reinforce one another, creating persistent barriers that disrupt schooling and limit educational outcomes. This study explores how intersecting socioeconomic and environmental factors shape the educational experiences of students in disaster-prone coastal communities. Using a mixed-methods approach, the research draws on fieldwork conducted in several coastal districts. Qualitative interviews were held with students, parents, teachers, and local administrators to gain insight into lived experiences, while quantitative data were used to assess broader trends in school participation and access. The findings reveal that financial hardship, child labor, and gender-based inequalities remain major obstacles to education. These issues are further compounded by frequent natural disasters such as cyclones, tidal floods, and salinity intrusion that damage school infrastructure, displace families, and lead to long-term school closures. Girls, in particular, are disproportionately affected due to safety concerns and increased domestic responsibilities during and after crises. This study highlights the need for a more resilient and inclusive educational framework in coastal Bangladesh. Key recommendations include investing in disaster-resistant school infrastructure, providing targeted financial incentives to low-income families, and implementing gender-responsive education policies. The findings point to the importance of coordinated action among government agencies, community organizations, and development partners to address the root causes of educational exclusion and build long-term resilience in coastal education systems.

Keywords: *Coastal Education, Environmental Vulnerability, Socio-economic inequality, Access to education*

PID:IRC_EP_039

Unlocking Words: L2 Learners' Perceptions of Mobile-Assisted Vocabulary LearningMd. Saber Hossain Nishad^{1*}¹Department of English, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh.

*Corresponding author email: saberhossainn@gmail.com

Abstract

Learning new words in a second language (L2) can be easier with the help of mobile apps, especially those that use spaced repetition systems (SRS) to help learners remember new words longer than with traditional methods. However, there is insufficient research on Mobile-Assisted Vocabulary Learning (MAVL), especially on learners' perceptions and actual effectiveness of these apps. This study investigates how 50 L2 learners use MAVL apps like Duolingo and Quizlet, which are widely used worldwide, and what their perceptions about them are. The survey asked learners to rate on 5-point Likert scales how simple and effective the apps were for learning and collected participants' open-ended feedback and suggestions. Results showed that apps with spaced repetition and game-like features were considered easy to use (average score = 4.00) and effective for learning words (average score = 4.11). Learners who used the apps more often found them overall more helpful ($r = .65$, $p < .05$). Most participants liked the use of pictures, sounds, and games, but some complained about too many ads and not enough examples of words used in real-life sentences. Although the study did not include tests to measure vocabulary gains, some participants felt significantly more motivated and capable of remembering more. These results suggest that well-designed MAVL apps can serve as valuable and efficient tools for learning new vocabulary. Therefore, teachers can use these apps in classes and in other pedagogical segments. Moreover, app developers should enhance the learning process by reducing ads and including more practical features and examples.

Keywords: *Mobile-assisted language learning, vocabulary retention, spaced repetition, L2 learners.*

PID:IRC_EP_041

Artificial Intelligence Supported Tools in Learning of the Students with Visual Impairment in Higher Education: Practice and Prospects

Syed Shafiul Alam* & Dr. Md. Shahrier Haider

Institute of Education and Research, University of Dhaka

*Corresponding author email: Syedshafiulalam5@gmail.com

Abstract

With the massive transformation of technologies, the landscape of education is changing rapidly. Artificial Intelligence (AI), a branch of technology, emerged as a transformative tool to support inclusive education. For students with visual impairment in higher education, AI-supported tools provide promising opportunities to reduce the barriers of participation by enhancing accessibility and offering personalized opportunities. Despite global advancements, the applications of AI in Bangladeshi higher education remains unexplored, particularly in relation to students with visual impairment. Therefore, the study aims to explore the usage, challenges and opportunities of AI-supported tools for students with visual impairment in higher education Bangladesh.

The study adopted a multiple case study approach guided by the Unified Theory of Acceptance and Use of Technology. The data were collected through In-depth interviews from 6 students with visual impairment who are enrolled in higher education and analyzed by thematic analysis approach.

The findings identified the use of AI-supported tools such as screen readers, chatbots and voice-based assistants. The adoption of AI is followed by necessity and informal support due to limited institutional support system. Moreover, the findings also explored that AI offers opportunities by enhancing accessibility. Independence and personalization of learning. However, Students with visual impairment also face several challenges such as lack of awareness and training, infrastructural limitations, digital divide and teachers' inadequate knowledge and skill. Students stressed about training initiatives, institutional support, extensive research and comprehensive policy formulation on AI. Lastly, the findings provide valuable recommendations for policy, institutional practice and future development of AI-supported inclusive higher education.

Keywords: *Artificial Intelligence, students with visual impairment, higher education, UTAUT.*

PID:IRC_EP_043

Academic Stress and Its Effect on Students' Well-Being: A Cross-Sectional Study at Khulna UniversityUmmay Huraira Pranto¹, Md. Limon Sheikh² & Md. Fajlay Rabbi³¹*Undergrad student, Education Discipline, Khulna University*²*Undergrad student, Education Discipline, Khulna University*³*Assistant Professor, Education Discipline, Khulna University*

*Corresponding author email: ummayhuraira07@gmail.com

Abstract

Academic pressure is growing as a major concern in higher education institutions across borders, affecting students' mental health, academic performance, and overall well-being. Khulna University, one of Bangladesh's most important public universities, confronts particular problems due to competitive academic settings, limited resources, and socioeconomic circumstances that may increase academic stress among its students. The purpose of this study was to look into the prevalence, causes, and effects of academic pressure on undergraduate and graduate students at Khulna University, as well as to identify factors that contribute to academic stress within the university. A cross-sectional survey of 366 students was conducted using stratified random sampling. Structured questionnaire data contained verified scales (such as the Academic Stress Scale, DASS-21). The analysis encompassed descriptive statistics, correlations, and multiple regression. 78.4% reported moderate to high academic stress. The main reasons were test anxiety (89.2%), grade competition (82.7%), teacher workload (74.3%), and financial constraints (68.9%). Academic stress had a significant correlation with anxiety ($r = 0.67$, $p < 0.001$) and depression ($r = 0.54$, $p < 0.001$). Female students ($p = 0.032$), those from lower socioeconomic backgrounds, and those studying science/engineering disciplines all experienced higher levels of stress. The findings reveal academic stress as a major mental health challenge at Khulna University, which is intensified by several factors. To create a positive learning environment, extensive institutional interventions such as academic support, mental health counselling, policy reforms, peer mentorship, flexible assessment, and broadened welfare services are required.

Keywords: *Academic pressure, university students, mental health, Bangladesh*

PID:IRC_EP_046

“Teachers’ Perception toward Immersive ‘Virtual Reality’ in Special Education: A Qualitative Study in Dhaka City”

Md. Emran Shawkat1*

1Department of Education, Proyash Institute of Special Education and Research, Bangladesh University of Professionals, Dhaka Cantonment, Dhaka 1206, Bangladesh.

**Corresponding author email: mdemranshawkat@gmail.com*

Abstract

This study explores how special educators in Bangladesh perceive the use of immersive Virtual Reality (VR) technology as an instructional tool in special education. As technological innovation increasingly influences education, understanding how VR can be effectively integrated to support students with diverse learning needs is crucial. The research employed a qualitative approach, conducting semi-structured interviews with special educators throughout Dhaka City. The findings indicate a progression in educators' attitudes, evolving from considering VR solely as a source of entertainment to acknowledging its educational potential in enhancing engagement, motivation, and experiential learning for learners with special needs. Educators have noted the effectiveness of VR in supporting individual learning needs, including cognitive, behavioral, and social growth, particularly through multisensory interactions and simulations. Several obstacles to VR adoption have been identified, including infrastructural deficiencies, a lack of teacher training, limited content, and socio-economic disparities between urban and rural areas. Despite these issues, participants remained strongly optimistic about the future role of VR in special education, emphasizing the importance of tailored implementation strategies, pre-assessment procedures, and collaborative content creation. The study highlights subjects like science, social studies, mathematics, daily living skills, and social stories as particularly suitable for VR-based teaching. The research concludes that VR has transformative potential in special education, but its success depends on the implementation of comprehensive policies, strategic investments, ongoing teacher training, and inclusive practices. These insights are valuable for educators, policymakers, and developers aiming to create a more inclusive, engaging, and technology-driven special education system in Bangladesh.

Keywords: **Virtual Reality (VR), Educational Technology, Special Educators, Immersive Learning, Implementation Barriers in Bangladesh**

PID:IRC_EP_049

Superbrain Yoga as a Pedagogical Tool for Superior Intellect and Wellbeing.

Ande Jeevan Rao

Designation: *Dist.Voc.Edn.Officer, (F.A.C.) (Rtd.)*

Name of the Institution: *O/o Dist. Intermediate Education Officer, Nizamabad-503001, Telangana state, India.*

Email Id: *gl2rao@gmail.com*

Abstract

Uthak Baithak or Murga punishment (sit-ups) is a form of punishment given in schools of Indian sub-continent, especially in India, Bangladesh, Sri Lanka, Nepal and Pakistan. Performing sit-ups was aimed at enhancing brain function and Memory. After corporal punishment was banned, this exercise was also forgotten in schools. Uthak Baithak or Murga punishment is now been transformed into `Superbrain Yoga (SBY) which has attained international status. SBY is a distilled version of Uthak Baithak. SBY is based on the principle of ear acupuncture and the science of energy movement through various chakras.

Superbrain Yoga (SBY), a specific yogic exercise aimed at: Cognitive enhancement by boosting memory, concentration and learning ability, Emotional and psychological, wellbeing by reducing stress, anxiety., Pedagogical integration as daily routine, Holistic development by cultivating discipline and mindfulness.

Literature collection and analysis, interview, organizing workshops and presentations on SBY and tracking follow up activity, observation, feedback reports analysis. Significant improvement in memory, concentration and attention was observed in persons who practiced SBY regularly. Enhanced academic performance with upward shift in the grades (example: C to B & B to A) was reported in the students who were regular to the school and performed SBY. Renaissance of SBY by treating it as an exercise enhances the overall performance of the students. It is suggested for the inclusion of SBY in curriculum as co-curricular activity and make it mandatory during morning assembly. Yogic exercise, mind body integration, cognitive enhancement, holistic practice

PID:IRC_EP_052

The Impact of Gamified Teaching on Student Engagement and Academic Performance in Secondary Education

Anamika Debnath

English Discipline, Khulna University

Email : ana.nath191459@gmail.com

Abstract

In schools, students often lose interest because traditional teaching can feel boring. To make learning engaging, teachers often use gamification, which integrates game elements like scores, badges, rewards, incentives in classroom activities. This study explored whether gamification really improves students' engagement and academic performance. Using a quasi-experimental method, 60 secondary school students from Khulna division participated over six weeks. The students were split into two equal groups of 30; Group A was taught using gamified methods, while Group B received conventional instruction. Students' engagement was evaluated before and after the treatment through questionnaire survey covering cognitive, behavioral, and emotional aspects. The data were analyzed using mean and standard deviation to assess changes in engagement and performance. The result revealed that after using gamification in classroom, students' cognitive engagement score increased from 16.4 to 20.1, behavioral engagement rose from 15.8 to 19.5, and emotional engagement grew from 17.1 to 21.3. Overall, the total average engagement score improved from 49.3 to 60.9. These results suggest that students were more engaged when taught through gamification. To evaluate academic performance, both groups took a test at the study's end. Group A scored higher, with an average of 84.5 compared to 77.3 in Group B. The t-test analysis revealed that with a t-score of 4.56 and 58 degrees of freedom, the p-value was around 0.0000078, which is well below 0.001, suggesting a strongly significant variation. This suggests that gamified teaching can positively influence learning outcomes, providing meaningful guidance for educators aiming to improve academic performance.

Keywords: *Gamification, Student Engagement, Academic Performance, Secondary Education*

Sub-Theme: Social Sciences & Global Impact

PID:IRC_SSGIO_005

Challenges Faced by Juveniles in the Juvenile Justice System of Bangladesh: An Empirical Study

Md. Shahjalal

Department of Criminology and Police Science, Faculty of Life Science, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

Email: cp20044@mbstu.ac.bd

Abstract

This study explores the challenges faced by juveniles in the juvenile justice system of Bangladesh, mainly focusing on three institutions: police, court, and correctional centers, which they faced during the proceedings of the justice system. Despite efforts to create a juvenile-friendly justice system, this study identifies major gaps in its implementation. Juveniles often experience arbitrary detention, mistreatment by law enforcement agencies (police), delays in court proceedings, and does not receive adequate rehabilitation facilities in centers. The study follow qualitative data collection, including interviews with juveniles, probation officers, and Child Affairs Police Officers (CAPO), and this study provides an in-depth exploration of the lived experiences of juveniles navigating the justice system. The data were analyzed by using a theme-based narrative analysis approach. This analysis technique helped to identify the recurring patterns, challenges, and institutional failures. Key findings show that juvenile offenders frequently faced physical and psychological abuse, lack of legal representation, and delays in their trials. This study highlight that juveniles are facing some major problems in correctional centers, such as overcrowding, poor healthcare, unsatisfactory educational service, a lack of gender-sensitive environments, and a lack of resources. These findings emphasize the urgent need for systemic reforms in Bangladesh's juvenile justice system. Along with improvements in police training process, how to handle juvenile case, access to timely legal aid, and enhanced rehabilitation services. The study concludes that a more child-friendly approach is essential to identify these issues and to align Bangladesh's practices with international standards for juvenile justice.

Keywords: *Juvenile Justice System, Legal Representation, Correctional Centers, Institutional Reform*

PID:IRC_SSGIO_007

Growth Centers and Agricultural Diversification: Evidence from Narshatpur Hat, Chirirbandar

Jahid Hasan^{1,*}

¹*Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology (RUET), Bangladesh*

*Corresponding author email: jahid@urp.ruet.ac.bd

Abstract

The economy of Bangladesh predominantly relies on agriculture. The rural markets were upgraded as growth centers (GCs) by LGED to enhance the agricultural sector. The importance of growth centers for agricultural diversification and productivity is not recognized yet. The aim of this study is to assess the influence of Narshatpur Hat (a growth center) in Chirirbandar Upazila of Dinajpur District on changing agricultural practices. In this study, Focus Group Discussions (FGDs), Key Informant Interviews (KIIs), seasonal diagrams, trend analyses, and mobility mapping were used to explore stakeholders' perceptions and local agricultural dynamics. The findings illustrate that the accessibility to quality seeds, equipment, and fertilizers for agriculture has been enhanced through the establishment of Narshatpur Hat. This enhancement significantly changed the agricultural patterns, mostly the emergence of garlic as a commercial crop in this area. The trading system of this area also improved, which helped the farmers to get better pricing of crops. These growth centers played a vital role in advancing market-orientated agricultural crops and identified the physical and governance obstacles that impede their full potential. This research will help the policymakers to consider the issues that are hindering the progress of the rural agricultural sector to improve the rural market system and enhance the strategic agricultural diversification in Bangladesh.

Keywords: *Growth Center, Agricultural Production, Rural Development, Crop pattern*

PID:IRC_SSGIO_011

Focus on the Global South Understanding Indian Muslims' Identity and Advancing Knowledge for Social Transformation

Nahid Afrose Kabir¹

¹*Professor of History, Department of English and Humanities, School of Humanities and Social Sciences, BRAC University, Dhaka, Bangladesh*

*Corresponding author email: n.kabir@bracu.ac.bd

Abstract

India is a multicultural country where minorities have the right to practise their religion and retain their culture. Muslims constitute about 14 per cent of the total Indian population. Yet the Muslim community in India has faced communal riots and violence, and some Muslims have been denied equal participation in Indian economic development, as evident from poverty and discrimination indicators. This study examines and compares the identity of Indian Muslims from different regions in India and from two time periods. About 200 Muslims in Delhi, Mumbai and Ahmedabad were interviewed in 2012 to understand their life experiences, beliefs and identity. Further 34 interviews were conducted with Muslims in Chennai, Delhi, Kolkata and Kashmir in 2024–25. A grounded theory approach was used to foreground the voices and interpretations of the participants, creating a nuanced understanding of diverse human experiences, and to compare different sets of data. The study found that Muslims from different regions of India have some commonalities in their Muslim identity and experiences, and some also have a national Indian identity, while for others their identity is more local, for example identifying as a Muslim in Delhi. For some participants identity politics affects their identity and sense of belonging in India, sometimes with detrimental impacts on their self-development. The findings highlight the diversity of Indian Muslim voices and the importance to them of national, religious and local identities. The study points to areas of public policy that need improvement and thereby to social transformation and positive change.

Keywords: *India, Muslims, identity, grounded theory.*

PID:IRC_SSGIO_013

Postcolonial Politics of Language in Bangladesh: Identity, Hegemony, and Resistance

Antor Roy

English, Nabiganj Government College under National University, Bangladesh

*Corresponding author email: royantor572@gmail.com

Abstract

The politics of language policy in Bangladesh is embedded in a unique and distinct historical trajectory shaped by colonialism, nationalism, and the search for identity. During British colonial rule, English was introduced and established as the administrative language. From the Partition of 1947 until the Language Movement of 1952, the imposition of Urdu on the people of East Pakistan remained at the heart of national consciousness. It was during this period that the rise of Bengali nationalism took shape, centered around language. This study highlights the predominance of the Bengali language in national discourse while drawing attention to the neglect of indigenous and less widely spoken languages. Due to the lack of recognition of the linguistic rights of indigenous communities—such as the Chakma, Marma, and Santal—there has been a noticeable erosion of cultural diversity and social inclusion. The research also observes the growing influence of the English language in contemporary education systems and elite institutions. Based on postcolonial theory and sociolinguistic analysis, this study argues that the Bengali language historically played a crucial role in uniting the Bengali nation. However, the state's monolingual policies have resulted in cultural alienation for non-Bengali communities. An inclusive and multilingual education policy must be introduced. Preservation and practical use of minority languages are essential. In conclusion, the research asserts that the formulation of an inclusive and multilingual language policy is vital for sustaining the multilayered foundations of Bangladeshi identity and democracy.

Keywords: *Language policy, Postcolonial theory, Bengali Nationalism, Linguistic rights.*

PID:IRC_SSGIO_015

Digital Hate Speech and Its Impact on Conflict Escalation: Need for Legal Innovation in Peacebuilding

Ateed Siddique^{1*}

¹Final Year LL.B. (Hons.) Student, Department of Law & Justice, Bangladesh University of Business and Technology (BUBT), Dhaka-1216, Bangladesh.

*Corresponding siddiqueateed700@gmail.com author email:

Abstract

Abstract: Bangladesh has experienced a surge in social unrest and violence due to online hate speech, as seen in incidents like the 2012 Ramu attack, the 2021 Comilla violence, and the 2024 Faridpur lynching. The spread of false information and misinformation online has led to real-life unrest, highlighting the need to understand the role of hate speech and the limitations of Bangladesh's legal system in regulating it. The study analyzed the limitations and challenges of existing legal frameworks in Bangladesh, such as the Digital Security Act 2018, the Cyber Security Act 2023, and the recently enacted Cyber Security Ordinance 2025. While prior laws were successful in preventing cybercrime, people's freedom of expression was frequently restricted as a result of their ambiguity and excessive powers. The Cyber Ordinance 2025 has introduced measures to the law to prevent the spread of false information caused by artificial intelligence on online platforms, digital sexual harassment, and religious intolerance. The research reviewed numerous documented cases of conflicts based on digital hate speech, including relevant laws and decisions by courts, applying the doctrinal method. International human rights standards related to the control of hateful speech and freedom of expression have also been taken into account. Preliminary findings indicate that current laws lack clarity, an independent judicial system, and efficient oversight. The paper emphasizes the need for legal innovation and highlights the need for a balanced legal framework for stakeholder participation, digital literacy, and human right in Bangladesh's quickly changing digital system.

Keywords: *Digital Hate Speech, Peacebuilding, Freedom of Expression, Disinformation, and Violence.*

PID:IRC_SSGIO_017

Environmental Law and Climate Vulnerability: A Socio-Legal Study of Climate-Induced Displacement in Bangladesh

¹Badhon Kumar Rakshit

¹*Law and Land Administration, University of Rajshahi*

Abstract

Bangladesh is experiencing an increasing rate of climate-induced displacement. Rising sea levels, river erosion, and extreme weather are displacing thousands of Bangladeshi people every year, particularly affecting residents in coastal and lowland areas. Although there are various laws and policies for environmental protection and disaster management in Bangladesh, there remains a mentionable gap in legal recognition and protection for internally displaced persons (IDPs). This research will analyze how well the existing environmental laws are consistent with the realities of displaced populations using a socio-economic-legal approach. It will investigate the limitations of the existing legal framework, specifically regarding legal identity, rehabilitation, and long-term resettlement issues of those people. Additionally, it will appraise how consistent these laws are with international human rights and climate justice principles. By analyzing both national laws and relevant international legal documents, this study highlights the crying need for climate-resilient and inclusive legal reforms. It argues that innovative legal thinking that integrates social equity with environmental law is necessary to ensure justice and dignity for climate displaced populations. This research contributes to broader interdisciplinary discussions on climate governance, legal reform, and social transformation in climate-vulnerable contexts such as Bangladesh.

Keywords: *Climate change, displacement, Bangladesh, environmental law, human rights, legal reform, socio-legal research, climate justice*

PID:IRC_SSGIO_019

From Protest to Partnership: Reassessing the Bangladesh-India Confidence-Building Measures (CBMs) in the Wake of the July Uprising 2024¹Borhan Uddin

¹*Department of Political Studies, Shahjalal University of Science & Technology, Sylhet, Bangladesh*
Email: borhan37@student.sust.edu

Abstract

Historically, Bangladesh-India had a relationship that was based on trust in various sectors. After the July uprising in 2024 in Bangladesh, this relationship has taken a new shape, which is forcing the confidence-building measures (CBMs) of the two countries to rethink. This study aims to reassess the confidence-building measures (CBMs) between Bangladesh and India during times of political turmoil. This study uses a qualitative case study approach, utilizes policy analysis, media narratives, and interviews with experts. The discussion is framed through the perspectives of regionalism and political sociology. The findings show that existing CBMs currently fail to address domestic political instability and highlight how the July Uprising can be a platform to develop new, people-centred diplomatic approaches. It proposes the integration of civic resilience and active state democratic responsiveness in the study and design of CBMs, where not only is the potential for unrest within states not a hindrance to cooperation, but it can present an opportunity for deeper, more effective, adaptive and sustainable regional interaction. It provides larger insights into the debate on South Asian diplomacy by reiterating the importance of domestic realities in shaping bilateral strategies.

Keywords: *Confidence-Building Measures, Bangladesh-India Relations, July Uprising 2024, Political Turmoil*

PID:IRC_SSGIO_023

The Impact and Use of Remittances in Rural Households: A Case Study of Chhagalnaiya, Feni District¹Hasibur Rahman

¹*Department of Economics, Faculty of Social Science, University of Rajshahi, Rajshahi-6205, Bangladesh*
*Corresponding author E-Mail: hasiburrahmanru059@gmail.com

Abstract

Migrant economic remittances are an important and growing source of foreign funds for several developing countries and it plays vital role in economic development of those countries. This study aims to analyze the economic impact of remittances at the household level, with a specific focus on Chhagalnaiya Upazila in the Feni district of Bangladesh. Using primary data collected from 45 migrant-sending households, the research investigates three core areas: the demographic characteristics of remittance-earning members, the effect of remittance on household income, and the utilization pattern of monthly remittance income. To examine the relationship between remittance and household income, a multiple regression model has been applied, estimated through the Ordinary Least Squares (OLS) method. The regression results reveal that remittance income has a positive and statistically significant impact on total household income, highlighting its role as a key economic contributor. Moreover, the findings indicate that a significant portion of remittance fund is allocated toward the consumption of basic necessities, particularly food, which suggests that remittances are primarily used to meet household needs rather than for investment purposes.

Key words: *Remittances, Impact on Household Income, Utilization of Remittance.*

PID:IRC_SSGIO_027

Inequalities Facing by Female Students: A Study in Rajshahi UniversityIshrat Jahan¹*

¹Department of Law, Faculty of Law, University of Rajshahi, Rajshahi-6205, Bangladesh. *Corresponding author
email: ishrat.jahan1095@gmail.com

Abstract

Female education helps to lead an educated and developed nation. Although access of female students in higher education at university level have been increased but unfortunately higher education sector like university is characterised by a wide range of inequalities which influence the lower participation of female students at university level.

This research explores the existing inequalities faced by female students of Rajshahi University and aims to identify existing barriers that hinder gender equality in the campus, and also propose a transformative framework aligned with national and international commitments.

The study adopts a mixed-method approach. Where qualitative approach have been used for the detailed analysis of relevant data and quantitative methods for measuring the level of inequalities faced by the female students of Rajshahi University. The study also examines relevant laws and policies intended to address these issues and highlights critical gaps under CEDAW and constitutional guarantees.

The research identifies five core areas of concern: insufficient residential facilities, weak enforcement of anti-harassment policies, inadequate academic infrastructure, discriminatory rules such as sunset law and limited transport facilities for female students. These practices contribute to gendered inequalities in both academic and professional development of female students in Rajshahi University.

This study highlights that there is a clear disconnection between existing legal guarantees and actual practice. It argues that existing legal protections are not properly matched by institutional reforms and also suggest that urgent policy recommendations are needed to improve gender equality within the university.

Keywords: Gender inequality, higher education, feminist legal theory, CEDAW, campus discrimination

PID:IRC_SSGIO_030

Effects of Meditation on the Quality of Sleep: An Experimental Study from Quantum Method Meditation in Bangladesh

Israt Jahan Kakoly

¹Institute of Health Economics, University of Dhaka
*Corresponding author email: isratijk.ih@du.ac.bd

Abstract

Sleep is an important indicator of sound health. About forty nine percent people face sleep problem; and thirty percent people have sleep less than seven hours per night in Bangladesh. There are growing number of people having less sleep hours during the last couple of years. Meditation, yoga and pranayama are recommended intervention to get relief from health problems such as stress, anxiety, depression, sleep.

This study examined the effects of quantum method meditation on the quality of sleep for Bangladeshi people. It also investigated the health gain of the meditation practitioners' before and after getting the intervention. The Quantum Method Meditation (QMM) was utilized as the intervention in this study.

This was an experimental study design attempted to administer a pre-test and a post-test of the QMM intervention on 40 heterogeneous adults living in different areas of Bangladesh. The pre and post-tests were carried out using the Pittsburg Sleep Quality Index (PSQI) and the EuroQol-5D-5L health measures along with sociodemographic information.

The QMM intervention was carried out for three months starting with a four-day intensive QMM training. The subjects were recruited from new participants at different divisional QMM course registration centers during September 2024 to November 2024. To get the follow up data, this study administered the follow up surveys during December 2024 to February 2025.

The general cut-off points to determine the patients of sleep was PSQI > 5. The paired sample t-test was executed to examine the pre-post intervention results. The sample mean of PSQI was 10.30 before the intervention and was 7.80 after the intervention. These results were supported by the improvement of the mean values in the subscale of PSQI such as sleep disturbance, sleep duration, sleep dysfunction, sleep latency and sleep efficiency. The pre-post health gain measured by the utility scores were 0.63 and 0.82 respectively.

Meditation, the QMM in case of Bangladesh, may have potentials to improve the quality of sleep for the meditation practitioners. It may not only reduce the out-of-pocket health care expenditure but also contribute to access the universal health coverage.

PID:IRC_SSGIO_032

Echoes of Defiance: Political Space and Poetic Protest in Kaiser Haq's "Published in the Streets of Dhaka"¹Israt kamal Tinni¹*Department of English, Metropolitan University*
Email: kamalisrat24@gmail.com**Abstract**

This paper explores how urban poetry can function as a subtle yet potent form of resistance against political control and social oppression. Centering on Kaiser Haq's *Published in the Streets of Dhaka*, the study examines how the chaotic and layered imagery of the city streets reflects a deeper political commentary on contemporary Bangladesh. By reading the poem through the lenses of postcolonial resistance and spatial theory, this paper highlights how poetic language transforms ordinary urban spaces into charged sites of protest. The city becomes a character alive, defiant, and fragmented mirroring the voices that are often silenced in official narratives. Haq's work subtly exposes the interplay between power and place, mobility and restriction, silence and survival. The paper argues that *Published in the Streets of Dhaka* does not merely describe the urban experience but reclaims it, reimagining public space as poetic space. This approach contributes to larger interdisciplinary conversations at the intersection of literature, politics, and social science, demonstrating how creative expression offers critical insight into urban life and resistance. In doing so, the article aligns with the conference's thematic focus on global social impact and the humanities, offering a literary reflection on power, place, and protest within an evolving urban landscape.

PID:IRC_SSGIO_038

Sweeping in Silence: A Qualitative Exploration of Mental Health and Social Stigma among Cleaners of Sylhet City Corporation, Bangladesh**Jannatul Ferdous^{1*}, Sinchon Deb Swarna²**¹ Department of Public Administration, Shahjalal University of Science and Technology (SUST). Session: 2019-20² Department of Social Work, Shahjalal University of Science and Technology (SUST). Session: 2018-19**Abstract:**

Urban cleaners form the invisible backbone of city sanitation, yet their mental well-being and social dignity are often overlooked. In Bangladesh, especially within Sylhet City Corporation (SCC), cleaners routinely endure psychological distress and social exclusion, shaped by deep-rooted stigma and institutional neglect. This study explores the lived experiences of mental health challenges and social stigma among cleaners employed by the Sylhet City Corporation. A qualitative phenomenological approach was adopted, involving 18 in-depth interviews, four key informant interviews, two focus group discussions, and field observations. Participants included both male and female cleaners, as well as administrative staff, to provide comparative insights. A purposive sampling technique was employed to ensure diversity in gender, age, and social background, and thematic analysis was conducted to interpret their lived experiences of psychological burden, identity erosion, and emotional pain, often shaped by social invisibility and systemic neglect. Participants reported feelings of exhaustion, self-deprecation, and intergenerational shame, driven by public disrespect, occupational concealment, and exclusion from communal spaces. Institutional barriers, including inadequate mental health support and entrenched class, caste, and gender hierarchies, further compound their marginalization. Despite these hardships, many cleaners demonstrated remarkable resilience through quiet endurance, a strong peer network, and spiritual hope. The study highlights the pressing need for mental health interventions, institutional recognition, psychosocial support, and inclusive urban policies to improve the well-being and dignity of this vulnerable occupational group. These findings contribute to a deeper understanding of the intersection between urban sanitation labour, mental health, and structural stigma in the Global South.

Keywords: *Mental health, cleaner, social stigma, Sylhet City Corporation, Bangladesh*

PID:IRC_SSGIO_040

Impact of Climate Change on Indigenous Communities: A Study of the Munda People in the Southwest Region of BangladeshHabibur Rahman^{1*}, Umme Habiba¹ & Kamrul Hasan¹.¹Development Studies Discipline, Khulna University, Khulna-9208, Bangladesh.

Email: habiburds2@gmail.com; habiba.ds@ku.ac.bd; khasan@ds.ku.ac.bd.

*Corresponding author email: habiburds2@gmail.com

Abstract

Climate change poses a significant threat to vulnerable communities globally, particularly indigenous groups who inhabit environmentally sensitive regions and rely heavily on natural resources for their survival. In Bangladesh, the southwest coastal region is especially prone to adverse impacts of climate change, including cyclones, tidal surges, salinity intrusion, and land degradation. This study investigates the climate change impacts on the Munda people an indigenous community residing in Sundarbans-adjacent areas of Satkhira and Khulna districts who face growing socio-economic and ecological challenges due to climate-induced stresses.

A mixed-method approach was adopted, combining 325 household surveys, in-depth interviews, and focus group discussions (FGDs), with participants selected through random and purposive sampling across several villages. The findings indicate that the Munda community is disproportionately affected due to geographical exposure, limited access to education and healthcare, and insecure land tenure. Rising salinity levels have reduced agricultural productivity, heightened waterborne diseases, and disrupted traditional livelihoods such as farming, fishing, and forest-based activities.

To cope with these impacts, the Munda people have adopted various adaptation strategies, including rainwater harvesting, seasonal migration, income diversification, and indigenous knowledge-based practices. However, these efforts often fall short due to a lack of institutional support. The study emphasizes the need for inclusive policy interventions to strengthen community resilience by ensuring access to resources and recognizing the unique vulnerabilities of indigenous populations.

Keywords: *Climate change, adaptation, indigenous communities, Munda people, salinity, resilience, Bangladesh.*

PID:IRC_SSGIO_043

Bridging the Gap: Environmentally Sustainable Transport and Climate Resilience in Bangladesh's Regional Mobility NetworksMd. Tarik Jamil^{1*}, Mst. Rafia Tasnim¹¹BSc, Department of Civil & Environmental Engineering, Islamic University of Technology, Board Bazar, Gazipur, Bangladesh¹BSS, Department of social work, Shahjalal University of Science and Technology, Sylhet, Bangladesh

*Corresponding author email: tarikjamilhere.04@gmail.com

Abstract

Since its rapid rural-urban migration combined with a transport system that remains strongly dependent on fossil fuels, the southern region of Asia is subjected to the primary risks concerning climate changes. The growth of the regional centers also shows that climate-resisting transport infrastructure should be constructed through inclusive planning that is both environmentally and socially balanced. A mixed-methods study conducted to investigate these issues in August of 2024 to March of 2025. This initiative merged emission modeling, mobility surveys, 50 qualitative interviews conducted to transport workers, urban planners and commuters, scenario models forecasting and community mapping. The findings also reveal a grim contrast between the official sustainability ambitions and the actual states of transportation where planners need to strive to quantify the carbon effects as well as the real social benefits. It is evident that short distances in Sylhet and Dhaka are done by battery-powered three-wheelers with over 30 percent coverage. The sector has over 3 million workers who comprise a fifth of the total number of transportation workers and the industry has great potential in reducing emissions. If current adoption levels continue, regional towns are likely to reduce the emissions by 20 percent by 2030. However, there are key challenges and among them are high costs of vehicles and inadequate infrastructure and policy guidelines. Overall, the study mentions that implementing the changes in the transport systems in a way that matches prevailing sustainability objectives necessitates a combination of planning that equally considers the reduction of carbon and social inclusion.

Keywords: *Mental health, cleaner, social stigma, Sylhet City Corporation, Bangladesh*

PID:IRC_SSGIO_045

The Social Construction of Gender: An Ethnomethodological Analysis of Reactions to Gender Mocking in Bangladeshi Society
Jubayer Hossain*

¹ *Department of Sociology, University of Dhaka, Dhaka-1000, Bangladesh*
Corresponding author email: jubayersociology15@gmail.com

Abstract

When a person is being called by the wrong gendered term, intentionally or as a joke can spark immediate discomfort, laughter, or even aggression. Whether someone is calling a man ‘apa’ (sister), a woman ‘bhaiya’ (brother), or using terms linked to the third gender or homosexuality like ‘hijra’, or ‘gay’; these moments are more than casual teasing, carrying social weight, having deep-seated ideas about gender roles, status, and deviance. This study investigates how individuals in Bangladeshi society respond when addressed by gendered or queer-associated terms that do not align with their identity, and what these reactions reveal about the way gender is constructed socially and protected in everyday life. Grounded in symbolic interactionism and using an ethnomethodological approach, the research observes initial interactions in informal social settings such as tea stalls and university campuses, followed by informal conversations with participants to understand their interpretations. Early insights show that male participants often react strongly when labeled with female or queer-associated terms, indicating how masculinity is tied to status and the fear of being feminized or ‘othered’. Female participants sometimes accept brave masculine labeling as a compliment, while third-gender and homosexual labels produce the most intense negative reactions, indicating social and cultural stigma. By analyzing these small exchanges, the study seeks to highlight how ordinary language becomes a strong form of gender policing. The findings will contribute to broader discussions on gender, exclusion, and the quiet ways power operates in everyday life.

Keywords: *Gender Mocking, Social Construction, Ethnomethodology, Symbolic Interactionism, Bangladeshi Society, Social Stigma*

PID:IRC_SSGIO_046

Early Marriage Among Adolescent Girls: A Contextual Analysis of Northern Bangladesh.
Md. Rishad Babu*, Md. Sadman Hafiz*, Ratna Begum, Anika Taskin

Begum Rokeya University Rangpur

Abstract

Early marriage and school dropout remain critical barriers to girls’ education in Northern Bangladesh, particularly in the socioeconomically disadvantaged districts of Rangpur and Kurigram. These challenges are deeply interconnected and disproportionately affect adolescent girls, especially within urban slums and rural communities. This study provides a contextual and comparative analysis of the structural and cultural drivers of early marriage and educational discontinuation among adolescent girls across these two settings.

Employing a mixed-methods approach, the research integrates quantitative surveys with in-depth qualitative interviews to explore the lived realities of girls and their families. Findings reveal that in urban slums, early marriage is often precipitated by economic instability, inadequate infrastructure, and a lack of institutional support, factors that concurrently contribute to high school dropout rates. In contrast, rural contexts are shaped by entrenched generational poverty, parental illiteracy, and cultural norms that reinforce early marriage as a social expectation over continued education.

By highlighting both commonalities and contextual differences, this study moves beyond existing research that typically examines these issues in isolation or within a singular context. It contributes localized, comparative insights into the multi-layered social dynamics at play. Key contributing factors to early marriage include poverty (55.3%), fear of social stigma (20.3%), parental pressure (16.3%), cultural traditions (6.5%), and safety concerns (1%). These findings underscore the urgent need for targeted, context-sensitive policy interventions to address early marriage and promote girls’ educational retention in Northern Bangladesh.

Keywords: *Early Marriage, School Dropout, Socioeconomic Factors, Northern Bangladesh*

PID:IRC_SSGIO_048

Healthcare, Violence and Sufferings of Autistic Children: A Ethnographic Study in Sylhet City, Bangladesh

Juniya Khanum Mili^{1*}, Dr Mohammad Monjur-Ul-Haider²

¹*Department of Anthropology, Undergraduate Student, Shahjalal University of Science and Technology, Sylhet, Bangladesh*

²*Department of Anthropology, Professor, Shahjalal University of Science and Technology, Sylhet, Bangladesh*

*Corresponding author email: juniyakhannummili@gmail.com

Abstract

Families of the children with autism in Bangladesh face challenges in accessing healthcare of their children. The aim of the study is to explore the challenges of the parents who live in Sylhet city. Besides the role of existing stigmas and socio-political forces on the issue. Qualitative ethnographic approaches were employed in the study where data were collected through IDI, KII and FGD. The participants were chosen conveniently, and the sample size was 25. Findings of the study show that the major challenges include lack of specialized autism centers, shortage of skilled professionals, inadequate infrastructure, negligence of duties among professionals and high cost of getting services. The existing stigmas, such as the cesarian section or any past bad deeds of mother is responsible for autism, it is also seen as supernatural possession, contagious disease which not only make the healthcare access difficult but also leads them to social exclusion. Additionally, healthcare inequalities based on region, income, and corruption contribute to increasing the parents' sufferings. The study concludes that, to reduce the challenges, a proper policy is needed where autistic children will get adequate care regardless of region and income, the budget in the sector should increase to develop infrastructure and to raise medical supplies, arrange awareness programs for parents and community members. The findings of the study will contribute to the intersection of medical anthropology and disability studies as well as may contribute to creating an inclusive policy to achieve SDG 3 (Good Health and Wellbeing).

Keyword: *Autism spectrum disorder, Structural violence, Healthcare challenges*

PID:IRC_SSGIO_050

Justice Behind Closed Doors: Domestic Violence, Gender Rights, and Social Inclusion

Kazi Md Ashaduj jaman¹ Sheikh Mehzabin Chitra²

^{1,2}Department of Anthropology, Shahjalal University of Science and Technology

Email: *kazi34@student.sust.edu & sheikh15@student.sust.edu

Abstract

The COVID-19 pandemic resulted in a sharp increase in reports of domestic violence in Bangladesh, disproportionately impacting women who lived in rural settings with poor access to justice and support services. This qualitative study examines the effect of domestic violence on women's gender rights and social inclusion both amid and after the pandemic in the rural area of Barura under Cumilla district. Informed by social justice and gender equality values, the research seeks to (1) explore how domestic violence influences women's access to justice and the exercise of their rights, (2) identify gaps in legal, health, and social service coverage, and (3) give voice to survivors through narratives.

The study employs in-depth interviews with survivors and key informants, including municipal officials, NGO staff, and health professionals, to reveal how economic poverty, social stigma, and weakened institutional response in lockdowns heightened the risk posed to women who were experiencing abuse. Initial results indicate that informal mediation and local support frequently comprised the initial response but consistently failed to enforce victims' rights or obtain durable justice. Survivors' testimonies highlight persistent barriers like legal illiteracy, fear of retaliation, and social stigma.

PID:IRC_SSGIO_052

Unveiling the Invisible Scars: Exploring the Post-Rape Experiences of Female Child Survivors in Bangladesh
Mahfuza Mysha Prothoma^{1*}, Moumita Paul²¹*M.S.S. Student, Department of Criminology and Police Science, University of Chittagong, Chittagong-4331, Bangladesh*²*Assistant Professor, Department of Criminology and Police Science, University of Chittagong, Chittagong-4331, Bangladesh*

*Corresponding author email: mysha.prothoma@gmail.com

Abstract

The rape of female children is a pervasive issue all over the world, and the consequences of rape sometimes are even heavier to bear for children in a developing country like Bangladesh. Although there has been concerted effort in eliminating the problem, nothing has been documented on the challenges and struggles of child rape survivors and how they carry on after their traumatic experience. This qualitative study analyzes the post-rape circumstances of Bangladeshi female child rape survivors with an in-depth analysis of their persisting challenges and experiences a year following the assault. For this research, a sample of 22 female child rape survivors were purposively selected and in-depth interviews were conducted among them. 5 additional key informant interviews were conducted with criminal justice officials, academicians and psychologists in relevant fields. It was found out that young children do not understand the rape and struggle to describe their experience of rape. Survivors also suffer from severe physical and mental issues after being raped. They struggle to obtain justice, as well as to pursue their education. This research seeks to provide light on the complex aspects of post-rape trauma and provide guidance for targeted interventions that aid in the healing and recovery of child rape survivors by amplifying their voice and narratives.

Keywords: *child rape, post-rape experiences, justice system, challenges.*

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Social Media, Consumerism, and Moral Decay: Exploring Youth Culture in Contemporary Bangladesh

Marjuk Mustavi Meraj*, Md. Sohel Rana, Niaz Morshed, Biplop Hasan

¹*Sociology, Dhaka International University***Abstract**

With the onset of digital globalization, Bangladesh's youth culture is experiencing profound change through the mass expansion of social media and growing consumer values hegemony. This current study analyzes the ways in which social media platforms and modern consumer culture are reshaping the moral world of young people. It seeks to investigate the ways that new media shape attitudes, conduct, and moral reasoning among youth and how consumerism elevates materialism, narcissism, and devaluation of traditional standards. The research also takes into account broader consequences of such shifts for society, including implications for family life, educational priorities, and civic participation. A mixed-methods approach, incorporating both survey responses collected from 105 students from universities and colleges in Dhaka and Rajshahi and in-depth interviews with parents, teachers, and youth counselors, was applied to extract such findings. The findings actually report a strong connection between extended social media exposure and shifts in behavior, such as reduced empathy, increased peer pressure, and normalcy for unethical practices. The consumerist urge, fueled by influencer culture and online marketing, fuels competition, self-esteem insecurity, and the abdication of collective moral responsibility. These are eroding moral bases and social bonding. This study highlights the need for value-based education, critical media literacy, and increased family and community engagement to guide adolescents towards moral development. It contributes to the overall discourse of morality, digital culture, and Bangladesh's generational transformation.

Keywords: *Youth culture, moral decline, social media, consumerism, Bangladesh*

PID:IRC_SSGIO_057

Political Transition in Myanmar: Exploring Implications on Rohingya Repatriation

Mayesha Zerín Khan Deesha

*Department of International Relations, University of Rajshahi, Rajshahi, Bangladesh**Email: mayeshazerinkhan12@gmail.com***Abstract**

Although the principles of Myanmar's foreign policy have always been independent, and unaffiliated under respective governments, there are indeed different implications on Rohingya repatriation because of different political transitions in Myanmar. The transition in 2021, which has reintroduced military control, is the justification for this. Using a qualitative approach (literature review and expert interviews) and the concept of "garrison state", this paper focuses on the political transition of Myanmar (from February 2021 to February 2023) and links it with the repatriation process. The main aim of this paper is to give a new angle on understanding the problems and hopes for the repatriation. The paper describes how military control has changed the pattern of negotiations regarding repatriation as Myanmar is now working as a garrison state and only focuses on the national interest rather than the humanitarian interests of the country. The paper also sheds light to the Burma Act, and the "business as usual" policy from the allies of Myanmar to prove the validity of the changed dynamics towards repatriation. The paper identifies political transition as the driving force behind both the constraints and solutions to ensure voluntary, safe, dignified, sustainable Rohingya repatriation.

Keywords: *Rohingya repatriation, political transition, garrison state.*

PID:IRC_SSGIO_059

Assessing Vulnerability and Survival Strategies of Riverbank Erosion Displacees in Bangladesh: A Study on the Teesta Riverine EcosystemMd. Abu Saleh Shamim^{1*} & Shammy Islam¹¹*Department of Sociology, Begum Rokeya University, Rangpur, 5404, Bangladesh***Corresponding author email: mdabusalehshamim22@gmail.com***Abstract**

Riverbank erosion in Bangladesh, intensified by climate change and fragile sandy soils, displaces thousands every year all over the country, leading to widespread human suffering and economic hardship. The present study is organized to investigate the vulnerabilities and survival strategies of displacee households in Char Bidyananda, a separated village in the Teesta riverine ecosystem of Bangladesh. Employing a mixed-methods approach, the present study is primarily based on data gathered through structured interviews with 107 purposively selected displacee household heads, supplemented by observation, focus group discussions (FGDs), case studies, and informal interviews with key stakeholders. Research findings show that repeated displacements have caused severe financial, social, and health insecurities **and pushing them into a precarious world of plight**. Significant losses include homesteads (100%), crops (92.5%), agricultural land (64.5%), social care (94.4%), and reported experiences of depression and anxiety (17.8%). These losses illustrate multidimensional vulnerabilities that are physical, social, and motivational. The Pressure and Release (PAR) model is applied to analyze how these vulnerabilities arise from underlying root causes, dynamic pressures, and unsafe conditions. *Charland* people **are compelled to engage in** a range of adaptive strategies involving unpaid household chores and low-income earning activities in the absence of institutional support. The study **recommends** the urgent need for community-based policy interventions, infrastructure development, vocational training, and sustainable livelihood initiatives to reduce vulnerability and strengthen resilience among households.

Keywords: *Riverbank Erosion, Displacee Households, Vulnerability, Survival Strategies*

PID:IRC_SSGIO_061

Md Vision Zero for Bangladesh: Adapting Global Traffic Safety Standards LocallyAbu Sayeed Munna^{1*}, Md. Abdullah Al Asad²¹ *Mphil Fellow, Department of Law, University of Rajshahi, Rajshahi-6205, Bangladesh.***Corresponding author email: sayeedmunna59@gmail.com.*² *Lecturer, Department of Law, Khwaja Yunus Ali University, Enayetpur, Chauhali, Sirajganj-6751, Bangladesh.***Abstract**

Bangladesh faced its highest number of road accidents in 2024—6,927 in total—causing 7,294 deaths and injuring 12,019 people, according to the Road Safety Foundation. This prompted us to write this paper exploring the inevitability of adapting the idea of Vision Zero in our country prioritizing human life over speed and convenience, emphasizing a system-based approach that includes safe roads, responsible road users, effective enforcement, and proactive policymaking. A qualitative approach integrating stakeholder insights as well as policy overview was used to elicit the utility of Vision Zero in Bangladesh. This paper offers a comprehensive critique of the challenge of accident-prone roads, unfit vehicles, deficient law enforcement and the thinking of 'more trips-more earnings' of the poor drivers who get only 20% of the total amount of a trip. Based on effective international models, for Bangladesh this paper proposes compulsory detailed school level education on road safety as well as a course on road safety at the university level in the Department of Social Work, arranging World Road Safety Series here, taking initiatives to widen all the roads and highways, imposing practical legal accountability for breaching any traffic rule and so on. The findings draw attention to the promising prospect of an adapted Vision Zero framework considerably reducing road traffic fatalities in Bangladesh.

Keywords: *vision zero, road safety, policymaking, effective international model*

PID:IRC_SSGIO_063

Legal Blindness: A Qualitative Study on the Absence of Adult Male Rape Recognition in Bangladeshi LawMd. Al Nahian Bin Ratan^{1*}.¹ LL.B (Hons), Department of Law, Green University of Bangladesh, 4th year undergraduate.**Corresponding author email: 222911011@student.green.edu.bd***Abstract**

This paper critically explores the absence of legal and social exclusion of adult male and third-gender victims of rape in Bangladesh. Section 375 of the Penal Code declares rape a crime by a male against a female or child; male survivors are forced to seek justice under archaic and abusive laws. This paper aims to investigate how male victims are silenced by social stigma, masculine myths, and institutional neglect and recommend reforms for gender-inclusive legal protection. By thematic analysis of 60 anonymized survey responses from approximately 200 Bangladeshi university students, of which 12 individuals reported experiencing unwanted sexual contact. The findings from the survey reveal that male survivors rarely disclose such experiences due to shame, fear of disbelief, and legal and social exclusion. Respondents unanimously called for gender-neutral legal reform, awareness campaigns, and support services for equitable access to justice. Comparative analogy with the legal systems of the UK, South Africa, and international human rights organizations (ICC, WHO, UNODC) demonstrates that inclusive legal recognition is both feasible and essential. This paper contributes to gender justice studies by challenging gender-based victim-perpetrator assumptions and promoting the inclusion of survivors and a gender-aware legal approach. It makes an argument that meaningful inclusion in laws and policies is necessary for both equality before the law and the rehabilitation of the oppressed survivors' dignity. To create an inclusive, rights-based judicial system in Bangladesh, such blind spots must be addressed.

Keywords: *Adult male rape, Gender-neutral laws, Masculinity and stigma, Male rape myths*

PID:IRC_SSGIO_065

Exploring the Pattern and Narrative of Disinformation on Social Media: A Study of Pre-July Movement in BangladeshMd. Azharul Islam ^{1*}¹*Journalism and Media Studies Department, Jahangirnagar University, Dhaka 1342, Bangladesh*

*Corresponding author email: Mdazharulislam349@gmail.com

Abstract

Disinformation has been identified as a major digital threat to society. Bangladesh faced this threat incredibly after the July 2024 Movement. The objectives of the study are to examine the patterns, narrative tactics, and impact of fake news that were transmitted on online platforms after the protest. It adopts a mixed-method approach, combining quantitative content analysis with qualitative discourse analysis. To gain a clear understanding of the narrative, this analysis examines 900 pieces of debunked content from Rumor Scanner and Dismiss Lab websites, encompassing Facebook, Instagram, X, and YouTube. Data were coded based on the type of disinformation categories, Primary Target, Purpose, Tone of content, and Sources. After analyzing, the result revealed four main narratives: Discredit the Movement, Communal violence, Discredit the interim government, and Political gain. Most of the disinformation was spread on Facebook (65%), X (Former Twitter) (17%), Instagram (12%), and other platforms (6%). From July to August, most of the disinformation focused on targeting the interim government, inciting communal violence. The findings underscore the tactical use of disinformation as a digital weapon in our society. It highlights how visual manipulation and emotionally charged posts were employed to influence the public's beliefs and create a chaotic situation in society. This research highlights the policy recommendations, including digital literacy and policy reform to combat disinformation. It also offers empirical insights for guiding future interventions, regulatory policies, and academic inquiry into media manipulation in South Asia.

Keywords: *social media; disinformation; Bangladesh; pattern*

PID:IRC_SSGIO_066

Displaced Traditions: Tracing the Transformation of Rural Built Form and Social Life in Botiaghata, KhulnaMd. Ezajul Islam ^{1*}, Sharafat Zaman Saurov ², Amina Tabassum Proma ³ & Md. Reza-E-Rabbi ⁴¹ *Lecturer, Department of Architecture, Rajshahi University of Engineering and Technology, Bangladesh.*^{2&3} *Lecturer, Department of Architecture, Fareast International University (FIU), Dhaka, Bangladesh.*⁴ *B.Arch., Architecture Discipline, Khulna University, Bangladesh.*

*Corresponding author email: ezajulislam@ruet.ac.bd

Abstract

The built environment of rural Bangladesh, originally more accommodating to vernacular forms, has been significantly altered during the past few decades. This transition — from being locally-sensitive organic climate-responsive organizations to permanent concrete constructions — asks important questions about what it means for spatial organization and social life. In an effort to contribute to this discussion, we will look at the spatial and social implications of such a transformation within the village community in Botiaghata, Khulna. The objective of the study is to explore how modern construction techniques have transformed the architectural language and traditional social interactions, domestic and cultural livelihoods of the community. A qualitative research methodology was used with physical surveys, household mapping, key informant interviews, and photographic documentation within selected transformed and less transformed sampling units. The study concludes that the proliferation of concrete buildings was driven, and continues to flourish, by the eagerness to have durable houses, assert status, and generate opportunities for people to move up the economic ladder, but it also led to spaces becoming enclosed, family relationships including intergenerational connections started eroding and an erasure of the spatial logic that people used to build and rebuild community together. The courtyard house, with its multifunctional courtyards, detached kitchens, and shaded thresholds, has vanished, and the city has become an increasingly privatized and closed-figure spatial formation. The study underscores the pressing need to rethink policies of rural housing development and architectural design based on the subservience of material permanence to socio-cultural resilience. The article is a reflection of space and rural space in planning, advocating for practical and balanced nature of spatial planning in the countryside that should respect both, new demands and traditional wisdom.

Keywords: *vernacular transformation, rural architecture, social fabric, settlement pattern*

PID:IRC_SSGIO_067

Recreational Space and Its Effects on Child Growth: A Study of Dhaka

Most. Sahara Akter¹, Md. Hasibul Hossain^{1*}.

¹Department of Sociology, Faculty of Social Sciences, University of Dhaka, Dhaka-1000, Bangladesh.

^{1*}Department of Criminology, Faculty of Social Sciences, University of Dhaka, Dhaka-1000, Bangladesh.

*Corresponding author email: mdhasibul-2017617989@crim.du.ac.bd

Abstract

Recreational spaces are those in which leisure-time work takes place. The number of recreational spaces has been reduced gradually due to the rapid urbanization and uneven development of industrialization. Lack of open spaces hampers the social development and health of children, as they have lost their recreational spaces. This study examines the existence and characteristics of recreational spaces and their impact on child development in Dhaka City, with a focus on the Azimpur and Mirpur colonies. This study has been conducted by using a mixed-methods approach (both qualitative and quantitative methods), which includes a semi-structured interview, FGD, and surveys from 115 respondents. This study shows that about 80% of the respondents agreed that open spaces are necessary for the overall development of children, and 80% of them report that there is an absence of sufficient recreational spaces, and the maintenance system is too poor for the existing spaces. They agreed that recreational spaces have played a vital role in socialization by enhancing communication skills with others, but nowadays, technology has taken over these places. Children are more likely to engage with technology, which affects them both physically and mentally. It also decreases their social bonding with others. Although gardening, indoor games are taken as alternatives to recreational spaces, these are not enough to fulfill the thirst for outdoor activities. This study also identifies some barriers for recreational facilities and suggests some policies to enhance the recreational infrastructure, which will make the urban areas a better place for children.

Keywords: *rapid urbanization; child growth; technology; socialization.*

PID:IRC_SSGIO_069

Re-imagining Borders: A Social Science Blueprint For Ethical Migration And Global Solidarity

Md. Jonaidul Islam^{1*}, Nafiza Nasrin Sharna¹, Md. Solayman Rafil & Kazi Zahid Hasan¹

¹Department of Mass Communication and Journalism, Bangladesh University of Professionals (BUP), Dhaka-1216, Bangladesh.

Corresponding author email: nashitmdjonaidulislam@gmail.com

Abstract:

Migration is increasingly an emerging moral issue, set against the backdrop of displacement, inequality, and increasingly transnational crises. This study examines the global system of migration with an interdisciplinary approach of social science-sociology, political theory, and human rights - to provide a moral critique of *ethical migration*, mobility and global interdependence. It also seeks to understand how restrictive border control policies are framed as state interests but are, in fact, structural exclusion, and how these policies can be re-framed within a governance approach that upholds dignity, justice, and *global solidarity*. This is done through a comparative case analysis of the Rohingya refugee crisis, the U.S-Mexico *border* policies, and the migration narratives of the EU. The study analyzes the impact of media and public discourse from the host countries in relation to policy and public opinion. The approach includes discourse analysis of media framing, policy analysis, and analysis of relevant international legal instruments. The findings of this study show that xenophobic and inhumane migration response are often the result of a secularized *media narrative*. On the other hand, narratives framed from a human rights-based approach foster public discourse toward greater inclusion. This research comes to the conclusion that global migration challenges cannot be approached with isolationist policies; they must be addressed with new ethics based on collective responsibility. This paper draws on critical media analysis as well as political and social theory to contribute to the migration discourse that regards migration not as a crisis to be controlled but rather a collective human condition that demands compassion and adjudication.

Keywords: *Ethical Migration, Borders, Global Solidarity, Media Narratives*

PID:IRC_SSGIO_070

Estimation and Prediction of Methane Gas Emission from Kastuara Ghat Landfill Site, Cox's Bazar: A Model Using Satellite Based Approach

Md. Marjanul Haque Rishad^{1*}, Mahshuva Zahan Munia¹, A.S.M. Saifullah¹, Shorove Roy¹ & Md. Mahamudul Haque Rifat²

¹Department of Environmental Science and Resource Management, Mawlana Bhashani Science and Technology University, Tangail

²Faculty of Animal Science and Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

*Corresponding author email: mrishad1618@gmail.com, saifullahasm@yahoo.com

Abstract

Methane (CH₄), a potent greenhouse gas that has a significantly higher global warming potential than CO₂, plays a crucial role in driving climate change. One of the greatest sources of methane emissions, particularly in lower-income countries, is landfills where open dumping is common. This study encompasses the estimation and projection of methane emissions from the Kastura Ghat landfill site in Cox's Bazar, Bangladesh since 1994 and will close in 2027 by utilizing several methane estimation models such as *In-situ* method for field measurement and sentinel-5P (satellite) to estimate real-time methane in combination with three projection models such as; IPCC Zero-Order Decay Model (ZODM), First-Order Decay Model (FODM) and LandGEM-v3.1(SP and SP1). The study revealed that more than 77% of the municipal solid waste (MSW) is biodegradable, leading to significant methane generation under anaerobic conditions. Methane emissions in 2024 were estimated as follows: *In-situ* measurement: 0.55 Gg/year, and according to Sentinel-5P, the landfill annual average atmospheric concentrations of methane are 1934.62 ppb and results from projection models are as follows: ZODM: 3.32 Gg/year, FODM: 2.30 Gg/year, LandGEM-SP: 8.63 Gg/year, LandGEM-SP1: 6.96 Gg/year. The LandGEM SP1 model was the most consistent with the in-situ measurements as compared with the other models for methane projection on a regional basis. Temporal projections for methane emission peaks in 2028 (one year after landfill closure) with the following rates: FODM: 3.06 Gg/year, Land GEM-SP: 11.5 Gg/year, and Land GEM-SP1: 9.42 Gg/year. The annual emissions will gradually decrease after 2028; however, they will last until at least 2050, causing long-term environmental impacts. Although methane has a big impact on the climate, it has the potential to be a renewable energy source if it can be captured successfully. This research highlights the opportunity and necessity for methane recovery infrastructure for energy generation and a policy intervention model for sustainable waste management in Cox's Bazar and similar coastal areas. Notably, this study is the first to apply the updated LandGEM-v3.1 (SP and SP1) model for methane estimation at the Kastura Ghat Landfill, Cox's Bazar.

Keywords: Zero-Order Decay Model (ZODM), First-Order Decay Model (FODM), LandGEM v3.1, Satellite Methane Detection (TROPOMI), In-Situ Methane Measurement, Waste Acceptance Rate (WAR), Degradable Organic Carbon (DOC), Methane Correction Factor (MCF), Climate Change, Global Warming Potential (GWP)

PID:IRC_SSGIO_072

Smart Waste Solutions In Rajshahi: Addressing The Plastic Pollution Using Communities And AI-Based Tools
Md. Mehedi Hasan^{1*}, Tayub Bin Shahajahan & Maksudul Hasan Rocky¹

Department of Arabic, Faculty of Arts, University of Rajshahi, Rajshahi-6205, Bangladesh, Department of Arabic, Faculty of Arts, University of Rajshahi, Rajshahi-6205, Bangladesh.

Corresponding author email: md.mahdihasan488@gmail.com

Abstract

Currently, Bangladesh has an ever-increasing environmental problem of plastic waste. The annual production of plastic is significantly high, and there is limited recycling of it, posing severe problems in managing waste. This paper dwells on the Padma River in Rajshahi, where plastic accumulation worsens in summer due to inadequate waste management. Plastic materials, when exposed to sunlight and heat, especially bottled water, emit hazardous chemicals into the environment. A mixed-method approach was used, with data gathered from urban slums and communities through surveys, focus group discussions, and environmental observations. Research was conducted to determine the local tendencies in the usage of plastic, disposal habits, and the negative outcomes. The findings indicate that plastic trash is highly correlated with the decline in river water quality. The presence of abandoned plastic waste in the waters reduces the quantity of oxygen, negatively impacts aquatic life, and disrupts the ecological system. These plastics eventually break down into what are referred to as microplastics, which are even more harmful since they contaminate the food chain through fish and others, and thus are detrimental to both wildlife and human beings. The study puts stress on the necessity of implementing practices of the circular economy, including the reuse of products. It observes the implications of biodegradability and recycling systems to reduce environmental degradation. Besides, the study suggests creating an AI-enhanced smartphone app that can warn users about correct waste disposal and grant a reward for eco-friendly actions, attracting communities to take part in environmental protection.

Keywords: Plastic Pollution, Microplastics, Circular Economy, AI-Based Waste Management

Influence of Socioeconomic and Nutritional Factors on Infant Birth Weight in Nilphamari District
Md. Mehedi Hassan Ridoy^{1*}, S. M. Salman Sabbir², Mehedy Hasan³, Md. Mehedi Hasan⁴,
Md. Sajjad Hossain⁵, Md. Alfaj Uddin⁶

¹*MSS student, Department of Social Work, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

²MSC student, Department of Statistics, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

³MSS student, Department of Social Work, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

⁴BSS student, Department of Social Work, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

⁵BSS student, Department of Social Work, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

⁶BSS student, Department of Social Work, University of Rajshahi, Rajshahi, Bangladesh. E-mail:

*Corresponding author email: mehedihasanridoy.ru20@gmail.com

Abstract

Low birth weight (LBW) presents a substantial public health concern in Bangladesh. LBW impacts neonatal mortality, long-term health, and hinders the achievement of Sustainable Development Goal 3 (SDG 3) for health and well-being.

This study aims to explore the influence of socio-economic and nutritional elements on infant birth weight within the Nilphamari District in Bangladesh.

This study was followed a quantitative approach and a cross-sectional survey design. Data were collected from the legal parents of 128 infant rural adults through a structured questionnaire using a two-stage cluster sampling approach.

The findings of this research illustrated significant correlation between low birth (LBW) outcome and maternal health. Mothers who were identified with hypertension were nine times more likely in term of giving birth to the infants with LBW. In addition, the risk of (LBW) increased three times higher for the mothers who had preeclampsia. Additionally, tobacco use during pregnancy was linked to a two-fold risk of LBW. Socioeconomic factors like lower family income noticeably increased the chances of LBW. An increment of each year in maternal age corresponded to a 21% rise in LBW risk, and births occurring prior to 37 weeks of gestation were particularly common among LBW cases. This study emphasizes the complex nature of the determinants influencing infant birth weight.

This study suggests that educators and policy makers should focus to address these significant risk factors in reducing the prevalence of low birth weight and enhancing maternal and child health outcomes in rural Bangladesh.

Key Words: Socioeconomic factors, Nutritional factors, Infant birth weight

PID:IRC_SSGIO_077

Assessing the Social and Health Impact of Water Salinity on Children: A Study on Southern Coastal Area of Bangladesh

Md. Muhimenu Islam¹ Margia Mahamud Rubiya²

^{1,2} Department of Sociology, Faculty of Social Science, University of Barishal-8254, Bangladesh
mdmuhimenuislam.bu@gmail.com¹

marjiarubiya123@gmail.com²

Corresponding Author: Md. Muhimenu Islam

Corresponding author email: mdmuhimenuislam.bu@gmail.com

is one of the most climate vulnerable country in the world and every year faces various environmental challenges in which high salinity affected in certain regions, especially in southern coastal area including Khulna, Satkhira and Bagerhat. In coastal area, salinity intrusion into ground fresh water supplies is common phenomena due to frequently cyclone and unsustainable land and water management like shrimp cultivation practice. This study aims to explore and analyze social and health related consequences of water salinity on children who are living in coastal area as well as it investigates how enormous impacted on children physical health and access to fresh water. This study applied quantitative research method in order to identify severity of water scarcity influence on health. Data were collected from randomly 150 children through kobo Toolbox whose age under 18 in that case we took permission from their parents. This research study was conducted in Koyra Upazila, a remote coastal upazila of Khulna district where salinity is the biggest problem. This study reveals that using saline water for a long time have direct impact on children health, 94% of the children affected by salinity. Half of the (50%) respondent affected in skin disease which proved water salinity impacted on children health. 72% of the respondent were not aware about the effect of salinity on health especially girls. Water salinity has a severe negative impact on children of coastal belt of Bangladesh. This study suggested that increasing water purification system as well as community health education could be protect vulnerable child population.

Keyword: Water salinity, Vulnerability, Coastal Bangladesh, Health, Climate change

PID: IRC_SSGIO_079

**Determinants of Public Perceptions of Environmental Impact at Bangladesh's Payra Thermal Power Plant.
Md. Naem Gazi**

Department of Economics, Barishal University
Corresponding author email: mnaem19.eco@bu.ac.bd

Abstract

As Bangladesh expands coal-based energy infrastructure to meet growing electricity demand, concerns about environmental degradation and public health risks have intensified, particularly in communities near large-scale power plants. This study examines the perceived threats from the Payra Thermal Power Plant (1320 MW) in Kalapara, Patuakhali, by analyzing how individual-level attitudes and socio-demographic factors shape public perception of its environmental impact. Using a structured questionnaire based on a 5-point Likert scale, data will be collected from residents through simple random sampling. The analysis incorporates four key independent variables: perceived environmental threats, perceived local pollution, political interest, and political trust, with gender, age, education, and household income as control variables. The dependent variable is the perceived environmental threat from the Payra plant. Multivariate regression analysis will be conducted using Stata 17 to test three hypotheses: (1) perceived environmental threats are positively associated with perceived threats from the plant, (2) political trust is negatively associated with perceived threats, and (3) political trust moderates the relationship between perceived environmental threats and perceived plant-related threats. Anticipated findings suggest that perceived environmental degradation and local pollution experiences significantly increase threat perceptions, while higher political trust mitigates such concerns. These insights underline the importance of trust-building, transparency, and inclusive governance in addressing community concerns and ensuring sustainable energy development in Bangladesh.

Keywords: *Perceived environmental threat; Local pollution; Political trust; Political interest; Public perception; Coal-fired power plant.*

PID: IRC_SSGIO_082

Influence of Climate Change and Disaster on the Pregnancy and Menstruation Management among Married Women at the River Island Char-Kajal of Patuakhali District in Bangladesh.

Md. Nayeem Islam^{1*}, Syed Billal Hossain² & Joydeb Garai³

¹*Faculty of Social Sciences and Humanities, University of Science and Technology Chittagong, Chittagong, Bangladesh.*

²*Department of Public Health, Faculty of Life Sciences, University of Science and Technology Chittagong, Chittagong, Bangladesh.*

³*Department of Sociology, Faculty of Social Science, University of Chittagong, Chittagong-4331, Bangladesh.*

*Corresponding author email: Md. Nayeem Islam. email: nayeemislam@ustc.ac.bd

Abstract

Bangladesh's river islands (chars) are highly susceptible to health disorders due to the implications of natural disasters, geographical isolation, and poverty, leading to inadequate menstruation and pregnancy management. This study aimed to explore the influence of climate change and disaster on pregnancy and menstruation management among married women at river island. It was a cross-sectional survey-based quantitative study by utilizing a structured questionnaire through face-to-face interviews among 120 married women with pregnancy experience living in the river island Char-Kajal of the Patuakhali District in Bangladesh. Majority of the respondents' age were ranging in 22 to 28 years, were uneducated and with income below 20000 BDT. Over 81% of the participants were married and experienced their first pregnancy (46.67%) below 20 years of age. Among the participants, menstrual irregularities (40%), painful menstruation (18.34%), and heavy bleeding (11.67%) were common. Complications during pregnancy including eclampsia (45%), excessive bleeding (33.34%), and premature birth (13.33%), and post-natal illnesses including malnutrition (50%), breast milk deficiency (21.67%), and urinary problems (23.3%) hypertension (35%), vector-borne diseases (30%), and menstrual disorders (23.34%) were also reported. However, for many, the nearest health facilities are situated away over 60 minutes travelling distance. 93.34% reported anxiety or worriedness linked to climate stress, and 91.67% believed climate change and disaster experiences adversely affected their menstrual hygiene and pregnancy management. The study's findings indicate an urgent need for the implementation of climate-resilient reproductive health policies and resource support for women in river islands and coastal Bangladesh.

Keywords: *Climate Change; Natural Disaster; Pregnancy Management; Menstrual Hygiene*

PID: IRC_SSGIO_085

Environmental Law and Social Transformation in Bangladesh: Navigating Global Challenges and legal Pathways for SustainabilityMd. Rifat Tasnim^{1*}, Kh. Tasmia Islam² & Md. Shafiur Rahman Shanto³¹*Department of law & Justice, faculty of Law, Bangladesh University of Business and Technology, Dhaka-1216, Bangladesh.*²*Department of law & Justice, faculty of Law, Bangladesh University of Business and Technology, Dhaka-1216, Bangladesh.*³*Department of law & Justice, faculty of Law, Bangladesh University of Business and Technology, Dhaka-1216, Bangladesh.*

*Corresponding author email: rifattasnim83@gmail.com

Abstract

In recent years, people have become more worried about the environment in Bangladesh, and traditional brick making has been found to cause serious harm. Brick manufacturing in Bangladesh causes severe environmental harm deforestation for fuel, toxic air pollution, and water contamination from waste. Improper soil transport worsens road conditions, making them slippery and dangerous during rain. These issues pose serious health and safety risks, demanding urgent attention to protect people and the environment. This research explores how traditional brick factories in Bangladesh contribute to environmental damage and examines how well current environmental laws are addressing these problems. It aims to highlight gaps in enforcement and suggest ways to improve regulations for a more sustainable and healthier future. This qualitative study employs doctrinal legal analysis, policy review, and case studies. Data were collected from legal texts, governmental reports. The findings indicate that traditional brick kilns are a major source of environmental degradation, causing deforestation, air and water pollution, and road safety risks. The study reveals that current legal provisions are outdated and poorly implemented, allowing non-compliant factories to continue operations and legal reforms are urgently needed to support eco-friendly technologies. To address these challenges, this research suggests improving environmental governance by updating existing laws and ensuring better enforcement. It also highlights the importance of using sustainable alternatives like concrete blocks, energy-efficient kilns, and tree-planting programs. These steps can help reduce pollution and deforestation, improve public health, and fair development in Bangladesh.

Keywords: *Brick kiln, environment, pollution, Bangladesh.*

PID: IRC_SSGIO_086

Sustainable Agricultural Practices and Rural Transformation: A Report on a Village of ChapainawabganjMd. Sayad Abdul Hadi^{1*}, Dr. Md. Mehedi Hasan, Dr. Jahangir Alam, Md. Iftakharul Alam, Aunanya Rahman Tuba & Most. Sadika Islam Kashfi¹.¹*Faculty of Agriculture, EXIM Bank Agricultural University Bangladesh, Chapainawabganj-6300, Bangladesh.*

*Corresponding author email: sahadil6901@gmail.com

Abstract

Dakshin Shahar, a remote village in the Chapainawabganj district of northwest Bangladesh, heavily relies on agriculture yet lacks widespread adoption of modern sustainable techniques. This study aimed to evaluate the current implementation level of Sustainable Agricultural Practices (SAPs), analyze farmers' perceptions, and investigate their role in rural transformation. A purposive sample of 30 local farmers was surveyed using semi-structured questionnaires. Data were analyzed through descriptive statistics and visual representation using SPSS and Excel. Findings show that 79.3% of the villagers depend primarily on agriculture, and 83.3% possess only primary or no formal education. Crop rotation is the most common SAP (96.15%), while 75% of aquaculture practices use integrated feeding, and 69.2% of livestock are given balanced rations. Although 60% of farmers perceive SAPs as profitable, barriers such as lack of knowledge (30%) and limited resources hinder wider adoption. Risk perception is moderate for 60% of respondents. Key rural challenges identified include water scarcity (21.6%) and disease prevalence (13.5%). The study suggests that SAPs can support rural transformation if combined with infrastructure, education, and financial support. Despite limitations such as small sample size and self-reported data, the research highlights the potential of targeted interventions to enhance sustainable agriculture and socio-economic resilience in underdeveloped rural settings.

Keywords: *Sustainable agriculture, rural livelihoods, crop rotation, farmer perception.*

PID: IRC_SSGIO_089

Groundwater Dynamics and Regional Crop Productivity: Exploring Locally-Led Adaptation Strategies in the Barind Tract, BangladeshMd. Shakil Ar Salan^{1,*}, Dr. Habib Mohammad Ali² & Irraz Bin Idris³¹*Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology (RUET), Rajshahi-6204, Bangladesh.; sarsalan@urp.ruet.ac.bd*²*Department of Journalism and Media Communication, Green University of Bangladesh, Narayanganj-1461, Dhaka, Bangladesh.; habib@jmc.green.edu.bd*³*Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology (RUET), Rajshahi-6204, Bangladesh.; 2107004.irraz@gmail.com*

*Corresponding author email: sarsalan@urp.ruet.ac.bd

Abstract

The North-West Region of Bangladesh is a crucial agricultural center that relies heavily on groundwater for irrigation due to unpredictable surface water availability. Groundwater levels fluctuation in the region is a growing concern, as it directly affects agricultural output and the socio-economic situation of local populations. Understanding the complex connection between groundwater levels and agricultural productivity is crucial for developing efficient management methods. The study intends to measure how changes in groundwater levels impact crop yields, cropping patterns, and agricultural production in the North-West Region through the multiple regression analysis of historical data of agricultural production, irrigated area, rainfall, static water level, number of deep tube-well (DTW) used for irrigation purposes and cost of irrigation collected from Barind Multipurpose Development Authority (BMDA). The research intends to find community-based coping techniques for managing groundwater. The study has involved farmers, community leaders, and stakeholders to investigate sustainable groundwater management through Focus Group Discussion (FGD) and Key Informant Interview (KII). The findings of the study emphasize the heterogeneous nature of groundwater trends, underscoring the need for localized groundwater management strategies. The groundwater levels significantly impact agricultural productivity, but the effects are complex and context specific. Majority of adaptation techniques applied by community farmers are successful, with crop diversification, mixed cultivation/intercropping, and modifying irrigation systems being assessed as highly efficacious. The findings of present study are expected to provide useful guidelines to policy makers for facilitating farmers in sustaining agricultural yield against adverse impacts of seasonal ground water fluctuation in Barind Tract of Bangladesh.

Keywords: *Agricultural Productivity, Groundwater, Local Knowledge, Seasonal Variation.*

PID: IRC_SSGIO_091

Climate Change Induced Adaptation Strategies and Its Impact on Farm Income: A Study in Natore District of BangladeshMd. Sojib Rana^{1*} & Md. Mehedi Hasan²^{1*}*Economics Discipline, Social Science School, Khulna University, Khulna-9208, Bangladesh*²*Economics Discipline, Social Science School, Khulna University, Khulna-9208, Bangladesh*

*Corresponding author email: mdsajibrana.ku20.bd@gmail.com

Abstract

Adoption to adaptation strategies by farmers with respect to climate change are significant to increase productivity, where the agriculture sector is primarily vulnerable to the unfavorable effects of climate change. Therefore, this study examines the impact of adaptation to climate change on farm income in northwestern Bangladesh. Three unions from the Natore district were selected, and 180 farmers were sampled using multi-stage sampling. Attitudes of farmers towards climate change indicators such as temperature, rainfall and soil quality were captured on a five-point Likert scale. The effect of adaptation practices on farm incomes was estimated from a two-stage endogenous switching regression model. Off-farm income, farm size, access to extension services and migration were some prominent factors affecting the adoption of adaptation practices among farmers during farming activities. Adopters gained BDT 15,886 and non-adopters gained BDT 12,00, an ATT of BDT 3,886. Co-operation, extension services and off-farm income had a positive effect on intra-crop shifting adaptation. Adopters gained BDT 3,949 and non-adopters gained BDT 2,617, an ATT of BDT 1,332. For inter-crop shifting adaptation, off-farm employment and collaboration played a major role, yielding adopters BDT 8,962 in contrast to BDT 6,650 by non-adopters (ATT = BDT 2,312). This study unveils the benefits of climate change adaptation and some steps taken to overcome its impact, providing incentives to policymakers who plan to optimize the income and resilience of farms to the effects of climate change in consideration.

Keywords: *Climate changed adaptation strategy, Farm income, northwestern Bangladesh*

PID: IRC_SSGIO_094

From Screen to Mind: A Quantitative Analysis of Emotional Responses to Violent Social Media Content among Young UsersMd. Waresul Zannat Razu^{1*}, Farhana Yasmin²^{1,2} *Department of Sociology, Dhaka International University, Dhaka-1212, Bangladesh*

*Corresponding Author Email: zannatrazu003@gmail.com

Abstract

As violent content becomes more common on social media, concerns have grown about its effects on emotional well-being, particularly among young users. This study examines the emotional impact of exposure to violent posts such as videos, images, and graphic news; on social media users aged 16 to 30. The objective is to quantify emotional responses, such as anxiety, sadness, anger, and emotional detachment, associated with repeated exposure to online violence. Using Cochran's formula, a sample of 385 participants was selected through stratified random sampling. A structured questionnaire was administered, incorporating validated Likert-scale items measuring emotional responses, frequency of exposure, and content sensitivity. Data are analyzed using descriptive statistics, Pearson correlation, and regression analysis to assess relationships between exposure levels and emotional outcomes. The results show a significant positive correlation between frequent exposure to violent content and increased levels of anxiety ($r = 0.62$, $p < 0.01$) and emotional exhaustion ($r = 0.54$, $p < 0.01$). Additionally, those exposed to violent content multiple times per day were 2.3 times more likely to report emotional numbness compared to low-exposure users. Age and gender were found to moderate some emotional responses, with females reporting higher emotional sensitivity than males. This study provides quantitative evidence of the psychological effects of violent digital media and emphasizes the importance of content regulation, emotional education, and public health awareness related to social media usage.

Keywords: *Social Media, Violent Content, Emotional Impact, Quantitative Analysis.*

PID: IRC_SSGIO_095

Protecting Education in Post-Conflict Societies: Legal Frameworks, Innovative Solutions, and Social Transformation

MD Miraz Hossain Chowdhury*, Md. Mahamodul Hasan

¹ *Department of Law, Faculty of Law, University of Chittagong, Chittagong-4331, Bangladesh*¹ *Department of Law, Faculty of Law, University of Chittagong, Chittagong-4331, Bangladesh*

*Corresponding author email: mirazhossainchowdhury@gmail.com

Abstract

In post-conflict situations, the right to education is a pillar of social change but it is usually undermined by infrastructural destruction, population displacement and the psychological consequences of war. The fourth Geneva Convention and, since 2013, the Safe Schools Declaration, with 118 participants in 2023, are the most significant international legal protections to education during hostilities and in the post-conflict period. The paper will engage in an analysis of international law-based and human-rights-based legal implementations and how these normative tools drive educational efforts and social change. The paper records the pioneering approaches, including the use of radio-based learning programmes in Afghanistan to reach thousands of students, online education in Palestine, and makeshift learning centres in South Sudan and Democratic Republic of the Congo, through a legal study of relevant treaties and case studies in Afghanistan, Syria, and Nigeria. The measures not only restore access to education but also support reconciliation and social cohesion. The results highlight the need to use a context-specific approach that incorporates human-rights education into peacebuilding initiatives and that the work of organisations such as UNICEF and UNESCO is essential when it comes to translating legal obligations into practical results. Furthermore, the research demonstrates the need to maintain international cooperation to continue with education as a foundation of long-standing social change in post-conflict scenarios.

Keywords: *Right to education, post-conflict societies, international law, human rights*

PID: IRC_SSGIO_098

Assessing the User Acceptance of Online Tax Return in Bangladesh: A Study on Dhaka City
MD Rafiul Bakhtiar^{1*}, Maria Aaka², Atia Sanjida³, Kashmira Nahrin⁴, Mst.Rowshon Tabassum⁵ & Mohammad Nur Ullah⁶

Abstract

Online tax return system is being introduced globally to save time, reduce hassle and increase tax compliance. The online tax return in Bangladesh has also been launched to simplify tax return submission process, enhance the number of tax payers, ensure transparency and accountability in tax return submission process. The research aims to know the existing scenario of online tax return and assess the user acceptance of online tax return in Dhaka city. The study followed a mixed method, including qualitative and quantitative approach. Data were collected through 400 survey questionnaires and 10 semi structured interviews with the participants. The study analyzed data through descriptive statistics, chi-square test, factor analysis, utilizing the statistical packages for Social Sciences (SPSS) version 25. The study finds that most participants are regular taxpayers who are satisfied with the online tax returns system since it is convenient and simple to use. User knowledge and availability of necessary resources are the key drivers. Peer and government encouragement also positively impact behavioral intention. The majority of users despite some security concerns, considered the e-Tax system as more secure than manual paper-based operations. Most of them expressed high interest in using it in future tax periods. People need to be trained on how to fill out online tax returns. Tax audits need to be strengthened. The National Board of Revenue needs to collaborate with banks to prevent fraud. Server capacity should be increased. There should be workshops in government and private sectors to increase awareness.

Keywords : *Use acceptance, Online tax return, Behavioral Intention, Dhaka City*

PID: IRC_SSGIO_099

Exploring the Effects of Climate Change on Coastal Children's Educational Attainment: A Mixed Method Study in Bhola, Bangladesh
Meraz Hossen Cesti^{1*}

¹*Department of Sociology, Faculty of Social Sciences, University of Barishal, Barishal – 8254, Bangladesh
merazhossencesti@gmail.com*

Abstract

Climate change poses a severe threat to education systems in vulnerable coastal regions, with children bearing the brunt of recurring environmental disruptions. This study investigates the multifaceted effects of climate change on educational attainment among children in Bhola. Using a convergent parallel mixed-method approach, the research incorporates quantitative surveys (n=158) and qualitative data from in-depth interviews, FGDs, and KIIs with students, parents, and stakeholders. The findings reveal that frequent climate-induced hazards disrupt school attendance, delay academic calendars, and degrade performance. Findings show 100% of students missed school due to disasters, 77.2% faced direct educational disruptions, and 89.2% experienced academic setbacks. Climate change provoked socio-economic shocks forced 89.9% of families into financial strain, pushing children into labor or early marriage. Infrastructure damage (91.1%), impassable routes, and communication failures worsened outcomes. Health impacts of climate change (97.5%) further hindered learning, with no schools providing mental health support or catch-up classes. Only 11.4% received NGO aid, and 97.5% rated disaster response as poor. Students prioritized better infrastructure (38.6%) and online learning (35.4%). Chi-square analysis confirmed significant associations ($p < 0.01$) between climate-induced disruptions and educational outcomes across socio-economic, health, and infrastructural dimensions. The study recommends integrated, climate-resilient educational planning, trauma-informed teaching, and inclusive policy frameworks aligned with SDGs 4 and 13. This research underscores the urgent need for localized, child-centered strategies to safeguard education in the face of escalating climate threats, advocating for a justice-oriented response that views education as both a right and a tool for climate adaptation.

Keywords: *Climate Change, Educational Attainment, Coastal Vulnerability, Child Rights*

PID: IRC_SSGIO_100

Weaponizing Artificial Intelligence Through Deepfake and Synthetic Media-Based Misinformation on Bangladeshi Social Media Platforms
Mou Das

Department of Journalism and Media Studies, Jahangirnagar University, Saver, Dhaka.
Email: moudas2592@gmail.com

Abstract

The proliferation of artificial intelligence (AI) technologies has transformed the dynamics of information dissemination, giving rise to a new form of misinformation: deepfake and synthetic media. This study investigates how AI-generated content, particularly deepfake videos, manipulated images, and synthetic audio is used to spread political disinformation and communal incitement across Bangladeshi social media platforms. Grounded in Framing Theory and the concept of Computational Propaganda, the research aims to answer the following questions: (1) What types of AI-generated misinformation are most prevalent on social media in Bangladesh? (2) How are these contents framed to manipulate public opinion and incite polarization? The study employs a qualitative content analysis of 30 verified cases collected between 2023 and 2025 from credible fact-checking organizations such as Rumor Scanner and Dismislab, along with Facebook and YouTube archives. Data shows that nearly 70% of misinformation utilized deepfake videos, often impersonating political leaders or fabricating protest footage, while 30% involved synthetic images or AI-generated audio. About 65% of the content was politically motivated, especially surrounding election cycles, while 35% exploited religious sentiment to provoke communal outrage. Findings reveal that AI-generated misinformation is systematically weaponized to erode public trust, destabilize democratic processes, and polarize communities. The rapid algorithmic spread of such content, coupled with low digital literacy, amplifies its societal harm. The study recommends developing AI-powered detection tools, promoting digital literacy to build public resilience, and creating cross-platform monitoring systems to effectively identify and curb the spread of synthetic misinformation in Bangladesh.

Keywords: *AI-generated misinformation, Deepfake technology, Computational propaganda, Political disinformation in Banglades*

PID: IRC_SSGIO_101

Parental Separation: Psychological Impacts on Children in Urban Areas of Bangladesh

¹Mst Airin Sultana Akhi

¹Department of Social Work, Jagannath University, Dhaka, Bangladesh.
Corresponding author email: airinakhi3639@gmqil.com

Abstract

The alarming rate of divorce mostly affects children, particularly in terms of their psychological well-being. While much research has been conducted about divorce, limited studies have focused on what children experienced mentally and emotionally after parental separation. This study examined the psychological impacts of parental separation on children in urban areas of Bangladesh. A mixed-methods approach was employed to investigate the impact of parental separation on 105 children aged 10 to 17. Participants were selected from three orphanages, one child welfare organization (Government Shishu Paribar), and three parks in Dhaka City. Quantitative data were gathered through structured questionnaires. Additionally, qualitative data were collected through in-depth interviews and case studies to gain a deeper understanding of the cognitive impact of separation. Interview data were analyzed thematically to explore how various psychological factors influence the children's ability to move forward in life. Findings reveal that children often experience loneliness (67.95%), anxiety (10.26%), social withdrawal (20.99%), and bullying (36.19%), particularly verbal bullying (81.5%). Additionally, 77.14% expressed sadness when they saw other children with their parents, 74.29% experienced emotional disturbance and 35.80% reported crying when they missed their parents. This research helps with a deeper emotional understanding of the challenges faced by children of separated parents. The findings highlight an urgent need for mental health interventions, school-based counseling services, and greater societal awareness to address the long-term psychological consequences of parental separation.

Keywords: *Parental separation, psychological impact, children, emotional disturbance*

PID: IRC_SSGIO_104

Ecological Security Assessment through Multi-Dimensional Approach in Saint-Martin Island, Bangladesh.
Muhaiminul Islam^{1*}, Towfiqur Rashid¹ & Rubayet Arafin Rimon¹¹*Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh.*

*Corresponding author email: muhaiminul@urp.ruet.ac.bd

Abstract

Saint Martin's Island, the sole coral island in Bangladesh, has been facing increasing ecological pressure and stress from the rise in tourism, an unsustainable extraction of resources and environmental degradation. The purpose of this research was to evaluate the ecological security of the island through a comprehensive, multi-dimensional methodology by applying the PSR (Pressures–State–Response) framework. The Study developed an Ecological Security Index (ESI) that has three modules from which social, economic and environmental indicators were integrated to assess the overall health of the ecosystem. The methodology includes spatial analysis, land-use change analysis, climate data from WorldClim, and community-based survey methods to both quantify driving forces and to evaluate ecological vulnerabilities. The results of the assessment indicate that the ecological security value of Saint Martin Island is 0.598, placing this study in an “Early Warning” category. The ecological environment has experienced moderate degradation, and there are signs of compromised ecosystem services function and loss of integrity. Despite the ecological restoration is notably possible and whilst performing ecological reconstruction can also be achieved, ongoing and repeated ecological issues have occurred and infrequent and occasional ecological disasters have come and gone and could occur with alarming perceptions of frequency and also consequence. By quantifying the ecological risk and supporting strategic responses in interventions, this study has developed a quantitatively grounded, evidence-based planning that will aim to maintain biodiversity and ensure ecological resilience of the restored ecosystem exists on Saint Martin's Island.

Keywords: *Ecological Security, Saint Martin's Island, PSR Framework, Biodiversity Conservation*

PID: IRC_SSGIO_105

Animating Hope: Climate Literacy and Youth Empowerment through the Bangladeshi Film *Tomorrow* (2019)
Muhammad Mustafizur Rahman^{1*}¹*Department of Media and Communication, School of Liberal Arts and Social Sciences, Independent University, Dhaka-1229, Bangladesh*

*Corresponding author email: 2312744@iub.edu.bd

Abstract

Climate change poses one of the most urgent challenges of our time, particularly affecting youth who will inherit its consequences. Yet traditional education methods often fall short in engaging young audiences or translating complex climate science into meaningful action. This study examines the 2019 Bangladeshi animated short film *Tomorrow* as a case study of how creative media can bridge the climate knowledge-action gap. The 25-minute film contrasts two alternate futures—one shaped by climate inaction, the other by sustainability—to convey climate risks and solutions through a culturally relevant, emotionally resonant narrative. Using a qualitative case study approach, the research applies textual analysis grounded in environmental communication, ecocinema theory, and social cognitive theory. Findings indicate that *Tomorrow* simplifies complex scientific concepts using metaphors, visuals, and youth-centered storytelling techniques, effectively enhancing comprehension and emotional engagement. It also emphasizes hope and agency by portraying Bangladesh as a global leader in renewable energy, offering a counter-narrative to victimhood. The film's local setting, Bangla language, and relatable characters contribute to its impact as a tool for climate literacy. This study recommends integrating such animated content into formal and non-formal climate education, particularly in vulnerable regions. By examining *Tomorrow's* content and potential, the paper contributes to broader discourse on how localized storytelling and multimedia can empower the next generation to act on climate change.

Keywords: *climate literacy, youth engagement, animation, environmental storytelling*

PID: IRC_SSGIO_107

Criminal Offence and the Elite Agenda: A Study on Crime Report Coverage in Bangladeshi Newspapers
Nadia Sultana

*Department of Mass Communication and Journalism, Jagannath University, Dhaka-1100, Email:
nadia.jnu.mcj100@gmail.com*

Abstract

Crime and corruption occupy a central place in mass media, and there are many examples that mass media favor the elite in their coverage, even though the elite in many cases become the main perpetrators and provide shelter for criminal offences. This study, examining three mainstream newspapers—the *Daily Star* (DS), the *Prothom Alo* (PA), and the *Bangladesh Pratidin* (BP)—also identified a similar finding—supporting the elite interest. It examines the representation of four crime issues—the former Chief of Military Staff General Aziz Ahammed, former Inspector General of Police (IGP) Benazir Ahmad, NBR official Matiur Rahman and PSC driver Abed Ali—that were involved in serious corruption in terms of financial and unlawful activities—supplying secret documents to others. Examining news reports and editorials, this study also argues that these newspapers sidelined and dehumanized the officials who did not hold a superior position but provided less inflammatory coverage when the high officials came to their table. It argues that the criminals were able to continue their corruption with the support of the power elite, but the newspapers never challenged the power elite. Interestingly, the newspapers' report appears after the top-ranking elite aides—Mr. Aziz and Mr. Benazir—went into retirement. It is very likely that their corruption did not happen overnight, but these newspapers were silent during that time. This study also observes that these newspapers did not serve the information accurately to serve the power elite.

Keywords: *Crime, Newspaper, Power elite, Elite agenda, Social Discourse, Bangladesh*

PID: IRC_SSGIO_108

Countering Disinformation and Radicalization Through Youth-Led Peacebuilding in Conflict-Prone Regions of Bangladesh
Niamat Ullah^{1*}

¹*Office of the Registrar (Legal Cell), Bangladesh University of Professionals (BUP), Mirpur Cantonment-1216*
*Corresponding author email: niamatullahbdt@gmail.com

Abstract

Disinformation, hate speech, and online radicalization have emerged as major threats to social cohesion in Bangladesh, particularly in the post-COVID-19 era. Conflict-affected regions such as Chattogram, the Chittagong Hill Tracts (CHT), Rajshahi, and Cox's Bazar continue to face challenges arising from historical tensions, digital vulnerabilities, and exclusion of marginalized youth from civic participation. This study evaluates the impact of the Peace Building Training (PBT) program conducted from 2020 to 2023 by Surge Bangladesh with the support from EMK Center, engaging 130 youth across five districts. The program was designed to enhance youth capacity to counter digital extremism through a blended model consisting of 28 interactive online sessions and a two-week offline community project phase. A mixed-methods research approach was followed, including pre- and post-training surveys, participant reflections, and stakeholder feedback collected from the five project locations. Participants were selected from diverse educational backgrounds, including Madrasa, Bengali, and English medium, ensuring religious and cultural inclusion. In total, 16 Youth-led community projects reached over 6,000 individuals and focused on themes such as digital literacy, disinformation detection, peaceful communication, ethical leadership, and online safety. The findings reveal substantial improvements in participants' knowledge of disinformation dynamics, digital security, and conflict resolution skills. Furthermore, the community project initiatives impacted local dialogues and fostered wider awareness. Despite these successes, the sustainability of such initiatives is challenged by limited institutional support, collaboration, and funding constraints. This research highlights the transformative potential of grassroots peace education in countering radicalization and calls for the integration of youth-led peacebuilding into national policies and digital civic education strategies.

Keywords: *Peacebuilding, Disinformation, Radicalization, Youth Engagement*

PID: IRC_SSGIO_109

A Panel Analysis of the Impact of a Sudden Fuel Price Hike on Urban Motorbike Usage: Evidence from Barishal, Bangladesh.

Partho Sikder^{1*}, & Israt Jahan Mete²

1BIDS Graduate School of Economics, University of Dhaka, Dhaka-1000, Bangladesh.

2Department of Economics, University of Barishal, Barishal-8254, Bangladesh.

*Corresponding author email: psikder121@gmail.com

Abstract

Fuel price volatility has long been an important topic for understanding how consumers react to immediate price shocks. The sharp fuel price rise of approximately 52 percent in 2022 was a major economic concern to investigate about the consumption behavior of urban commuters in developing countries like Bangladesh. The objective of this study is to assess how personal motorbike users reacted to the sudden increase in fuel price in terms of fuel consumption in the short run. We collected 220 samples through face-to-face surveys at key strategic locations such as petrol stations, parking areas, and main traffic junctions across Barishal city. Respondents were randomly selected motorbike owners who use their bikes for personal purposes only. Our survey captured both pre-shock and post-shock usage, enabling a within-individual panel analysis. The random effect regression results suggest a statistically significant decline in monthly fuel consumption by 2.492 liters after the shock. Additionally, age, income, occupation, and riding experience, as other demographic factors, are included in our study to explore how they affect fuel consumption. Overall, the findings offer new evidence regarding the effects of the sharp increase in energy prices on the urban transportation patterns within the context of a developing economy. These insights are relevant for energy policymakers aiming to design targeted fuel pricing or subsidy reforms that alleviate the adverse welfare effects on urban commuters.

Keywords: *Fuel Price Shock, Motorbike Usage, Fuel Demand, Energy Policy*

PID: IRC_SSGIO_111

"Empowered Matriarchy: Advancing Education, Healthcare, Economic Strength, and Safety for Garo Women in Bangladesh"

Purnima Rani¹

*¹Department of Gender and Development studies, Begum Rokeya University, Rangpur
purnimaroy318@gmail.com*

Abstract

This study examines the paradox of empowerment among Garo women in Bangladesh, a matrilineal community that grants inheritance rights yet continues to marginalize women in education, healthcare, economy, and safety. Employing a mixed-method design, data were collected from 150 survey respondents and 20 key informants through interviews and focus group discussions in the Madhupur Sal Forest area of Tangail. Findings reveal that 49% of Garo women lack formal education, while only 7% pursue higher studies. Healthcare access remains inadequate, with over one-third relying on traditional healers due to poor infrastructure. Economically, Garo women actively contribute through farming, handicrafts, and small enterprises but face insecure land ownership and limited decision-making power. Alarming, 54.8% reported experiences of marital or gender-based violence, with inadequate community and institutional responses. Despite symbolic authority in inheritance, structural barriers such as religious conversion, patriarchal influence, and insufficient institutional support limit their empowerment. The study highlights the need to strengthen women's agency, not only through access to resources but also through strategic achievements. Inspired by the Queen Mother model of Ghana, the research recommends inclusive education policies, improved healthcare infrastructure, recognition of indigenous leadership, and robust legal protections to ensure women's safety. These insights contribute to bridging the gap between cultural inheritance and real socio-economic equality, offering actionable strategies for policymakers and development practitioners to foster sustainable empowerment for Garo women in Bangladesh.

Keywords: *Garo women, Matrilineal society, Women's empowerment, Education, Healthcare, Economic participation, Gender-based violence, Bangladesh*

Unveiling The Students Understanding in Post Quota Bangladesh: A Mixed Method Analysis with Policy Direction

Raihan Kobir ^{1*}, Most. Shammi Jahan ²

¹Department of Public Administration, University of Rajshahi, Rajshahi-6205, Bangladesh.

² Department of Public Administration, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding Author Email: s2110848157@ru.ac.bd

Abstract

Demolishing the unjust quota system through the antidiscrimination movement in 2024, the students perceived that they gained their just rights. Although the quota reformation was established, the perceptions, understanding, awareness and career motivation of the students remain unexplored in the post quota context. This study concisely presents the level of awareness, perceptions, motivation and aspirations of students in post quota Bangladesh by adopting a mixed methods approach. Both primary and secondary data were collected from the students of different years of study, and the collected data were analyzed through statistical and thematic analysis. The findings were divided into several themes. First, 90.9% of the students were aware of the quota abolition, 69% of the students had read the official gazette, and approximately 40% agreed with statements about understanding recruitment structure, indicating a high level of awareness. The students' perceptions, including merit-based recruitment, equality, political influence and underprivileged rights, are particularly mixed. While approximately 69.1% of the students expressed that the system is currently merit-based and 43.7% expressed that the recruitment process ensures fairness, approximately 23.7% of the students expressed that political influence still exists, and 54.5% of the students indicated high competitiveness in the recruitment process. Motivation and career aspirations reflect confidence, high competitiveness, and job preferences. The study subsequently offered policymakers by highlighting the policy recommendations with a view to improving the current recruitment policy.

Keywords: Post quota context , Recruitment policy, Students' perceptions, Policy feedback theory , Bangladesh

PID: IRC_SSGIO_113

“Reforming Bangladesh Civil Service: Student Perception on Recruitment Effectiveness”

Roquuzzaman Naim¹, Arifa Sultana², Samiha Akhter Soumik³, & Nahin Anzoom Sayed⁴

Student, Department of Public Administration, Faculty of Arts and Social Sciences (FASS), Bangladesh, University of Professionals (BUP).

Student, Department of Public Administration, Faculty of Arts and Social Sciences (FASS), Bangladesh University of Professionals (BUP).

Student, Department of Public Administration, Faculty of Arts and Social Sciences (FASS), Bangladesh University of Professionals (BUP).

Lecturer, Department of Public Administration, Faculty of Arts and Social Sciences (FASS), Bangladesh University of Professionals (BUP).

Email: roquuzzamannaim.bup@gmail.com

Abstract

The recruitment process of the Bangladesh Civil Service is a highly competitive and multi-stage examination system used to recruit merit-based candidates for public administrative services. This research aims to evaluate university students' opinions on the Bangladesh Civil Service recruitment effectiveness, specifically addressing fairness, transparency and trust. This study used a mixed-methods approach to evaluate university students' perceptions. The simple random selection of 380 respondents provided quantitative data by use of a survey questionnaire. Qualitative data were obtained through five key informant interviews (KIIs) and semi-structured interviews with fifteen participants, including BCS exam participants and students. Quantitative data were analyzed with SPSS version 25 by implementing the descriptive statistics and the chi-square test. The result shows that although opinions are quite positive, significant disparities exist. BCS aspirants were strongly supportive of the idea of making marks public ($p < 0.01$), and students were concerned about the mismatch between the content of tests and job relevance ($p = 0.030$). The degree of trust depended on the institution type and region, especially on the viva voce fairness and the result publication timeline. Future BCS reform should focus on making the marks public, minimizing the biasness of viva voce, the test content being relevant to the real job skills and the availability of the complaints process. These steps are essential in gaining trust and ensuring meritocratic results.

Keywords: BCS recruitment, Effectiveness, Student perception, Fairness

PID: IRC_SSGIO_114

Understanding the Impact of Socioeconomic and Healthcare Barriers on Breast Cancer Patients: A Qualitative study in Dhaka, Bangladesh.

Saima Jaman¹, Md. Ashraful Haque

Department of Anthropology, Faculty of Anthropology, Shahjalal University of Science and Technology, Sylhet, Bangladesh.

Email: saima29@student.sust.edu

Abstract

Introduction: Breast cancer remains the most common cancer among women worldwide, with low- and middle-income countries (LMICs) like Bangladesh experiencing disproportionately high mortality rates due to delayed diagnosis and inadequate treatment. In Dhaka, structural violence and socioeconomic inequalities intersect with healthcare disparities, significantly shaping patient experiences.

Objective: This study investigates how socioeconomic status, healthcare infrastructure, and social exclusion affect the diagnosis, treatment, and coping strategies of breast cancer patients.

Methods: Using a qualitative research design with a deductive approach, the study conducted 15 in-depth interviews (IDs) with breast cancer patients and caregivers, alongside three key informant interviews (KIIs) with healthcare professionals at two major public hospitals in Dhaka. Thematic analysis was applied to explore patterns in the data, guided by Johan Galtung's theory of structural violence.

Findings: Findings reveal that delayed diagnosis is largely attributed to financial hardship, limited awareness, and cultural stigma. Patients from low-income households often lacked access to early diagnostic tools and reported multiple misdiagnoses before confirmation. Treatment delays, unaffordable medication, and travel costs further complicated the journey to care. Social exclusion and shame, especially among women, exacerbated their suffering, while familial emotional and financial support played a key role in coping. Despite advances in medical services, systemic inequities persist, particularly within overcrowded and underfunded hospitals.

Future implications: This study underscores how structural violence operates through health systems, cultural norms, and economic deprivation to produce unequal outcomes. Addressing breast cancer in Bangladesh requires systemic reforms including equitable healthcare financing, improved public awareness, and culturally sensitive support programs.

Keywords: *Breast cancer, Structural violence, Socioeconomic disparities, Diagnosis and Treatment.*

PID: IRC_SSGIO_116

Exploring the Influential Factors of Patients' Preferences to Private Hospitals Over Public Hospitals: A Qualitative Study in Sylhet City

Samiur Rahman Anadi

BSS in Anthropology, Shahjalal University of Science and Technology, Sylhet, Bangladesh

Correspondence to Samiur Rahman Anadi; anadisamiur@gmail.com

Abstract

This qualitative study explores the factors influencing patients' preferences for private over public hospitals in Sylhet City, Bangladesh. Despite public healthcare being more affordable, many choose private facilities due to perceived higher quality, efficiency, and patient-centered care. CIET Canada survey conducted in Bangladesh found that 13% of treatment seekers use government facilities, 27% choose private or non-governmental organization services. Using in-depth interviews with 17 patients and key informant interviews with four healthcare providers, enhanced by non-participant observations at Mount Adora Hospital, the research employed purposive sampling and thematic analysis to identify three key determinants of patients' preferences. First, socio-cultural factors, including the association of private hospitals with higher social status, better hygiene, and religious considerations such as privacy for female patients, contrasted sharply with negative perceptions of public hospitals' long wait times and unprofessional staff. Second, systematic preferences emerged for private facilities' cleanliness, efficient service delivery, advanced diagnostics, medicine corner, economy zone, and well-maintained cabins. Third, reference networks, family, peers, pharmacists, and Online networks, played a pivotal role in guiding decisions. The findings carry significant policy implications, suggesting that public healthcare reforms should prioritize infrastructure upgrades, staff capacity building, and patient-centered service delivery to enhance trust and utilization. Specifically, policymakers could implement improvements in working conditions for public healthcare workers and launch public awareness campaigns to rebuild confidence in government facilities.

Keywords: *Private hospitals, public hospitals, patient preferences, healthcare access, influence, qualitative study, Bangladesh.*

PID: IRC_SSGIO_119

The societal construction and its influence in our gender role and education.

Shah Md Toufiqe Ahmed

International Relations, Rajshahi University
toufiq3.ahmed@gmail.com

This study aims to explore how the students of International Relations of the University of Rajshahi perceived their participation in classroom discussion of the course ‘Gender and International Relations’ from the gender lens. The research methodology involved the use of a qualitative case study design, which employed interviews to collect data from a sample of 16 undergraduate students enrolled in international relations course ‘Gender and International Relations’. The study aimed to identify the influence gendered perspectives of students in classroom participation and to understand how these patterns affected the students' academic experiences. The findings of this study indicate that there are significant disagreement among students regarding course content and specific notions studied in that particular course. The study also identified several factors that contribute to these gender lens formations, including cultural and societal norms, power dynamics, and personal experiences and perceptions. The implications of this research highlight the need for increased attention to gender dynamics in the society and the importance of creating more inclusive and equitable learning environments for all in the society so that no one is left behind getting proper education. This study contributes to the literature on gender and education by providing insight into the experiences of international relations students and offering recommendations for authorities to promote more equitable environment that eradicate problems indicated in this research.

PID: IRC_SSGIO_120

The Impact of Environmental Regulations on Reducing Negative Externalities in Industrial Production
Shahanaj Akter Moriom^{1*}, Shuvo Kumar Mallik & M Abeedur Rahman¹*Department of Economics, Southeast University, Dhaka, Bangladesh.*

*Corresponding author email: Shahanaj1232@gmail.com

Abstract

Industrialization is a key driver of economic development, particularly in emerging economies; however, it frequently results in significant negative externalities such as pollution, resource depletion, and ecological degradation. This paper critically examines the effectiveness of environmental regulations in mitigating these adverse outcomes and promoting sustainable industrial practices. Drawing on contemporary empirical literature and international case studies, the study highlights the strategic importance of integrating green economy principles—such as low-carbon growth, resource efficiency, and inclusive development—into national regulatory frameworks (OECD, 2021; UNEP, 2019). It argues that robust environmental governance, coupled with institutional accountability and public engagement, can substantially reduce industrial environmental impacts while enhancing long-term economic resilience. Furthermore, the paper explores the evolving roles of governments, regulatory agencies, and private industries in facilitating a just transition toward sustainable production systems. The findings support the need for adaptive and enforceable policy mechanisms that align industrial expansion with environmental stewardship and sustainable development goals (SDGs).

Keywords: *Sustainable, pollution, Environment, Externalities.*

PID: IRC_SSGIO_121

The Impact of Environmental Regulations on Reducing Negative Externalities in Industrial Production
Shahanaj Akter Moriom^{1*}, Shuvo Kumar Mallik & M Abeedur Rahman

¹*Department of Economics, Southeast University, Dhaka, Bangladesh.*
*Corresponding author email: *Shahanaj1232@gmail.com*

Abstract

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Keywords: *Sustainable, pollution, Environment, Externalities.*

PID: IRC_SSGIO_124

The Impact of Environmental Regulations on Reducing Negative Externalities in Industrial Production
Shahanaj Akter Moriom^{1*}, Shuvo Kumar Mallik & M Abeedur Rahman

¹*Department of Economics, Southeast University, Dhaka, Bangladesh.*
*Corresponding author email: *Shahanaj1232@gmail.com*

Abstract

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Keywords: *Sustainable, pollution, Environment, Externalities.*

PID: IRC_SSGIO_126

Green Energy Transition and Economic Resilience in Bangladesh: A Structural VAR Approach with Policy Simulation

Sumiya Afrin^{1*}, Saroar Hossain²¹*Department Of Economics, Faculty of Social Science, Islamic University, Kushtia -7003, Bangladesh,*²*Department of Marketing, Faculty of Business, Jagannath University, Dhaka – 1100, Bangladesh.***Corresponding author email: sumiyasnigsha63@gmail.com*

Abstract:

Bangladesh is confronted with balancing economic growth and environmental sustainability amidst extreme levels of fossil fuel usage. The uptake in energy access has increased significantly, but the volatility of energy prices and disruptions of energy supply (and indicated power shortages), threaten economic growth and increase carbon emissions. This study looks at whether Bangladesh can continue to grow economically while making the transition to cleaner forms of energy. This research is intended to look at the viability of sustainable growth through moving to a technology of green energy. Specifically it looks at how the growth of renewable energy impacts GDP and emissions, and is focused on resiliency of the economy and energy supply shock. A Structural Vector Autoregression (SVAR) Model is able to study 30 years of time-series data. The long-term relationships among the variables were estimated using theoretical restrictions. Data included proportions of renewable energy and fossil fuel consumption, GDP adjusted for inflation, carbon emissions and shocks such as global oil prices. The SVAR framework can simulate the policy scenarios to identify the causal effects of the investment in green energy and shocks. It was found that investments in renewable energy have the potential to increase growth, and to buffer risk from external energy shocks. Where a government does not act proactively, some benefits of the transition are likely to be lost, or disproportionately distributed. Policy simulations show that governments can take targeted intervention and reduce or minimize disruptions and impacts on the economy while enhancing the resilience of the economy. The results provide some evidence-based recommendations on energy policy direction for Bangladesh. The simulated interventions (e.g., clean energy subsidies, carbon taxes) provide illustrations on how to make decisions align economic development with sustainable practice. These factors have the potential to give valuable insights to inform policymakers towards reaching the objective of a more resilient low-carbon economy and the sustainable development goals.

Keywords: *Green Energy, SVAR, Policy Simulation, Economic Resilience*

PID: IRC_SSGIO_127

A Study of the Impact of Campus Climate clubs on Environmental Awareness in Bangladesh

Swasreeya Roy Prapti

*World Religions and Culture, University of Dhaka***Corresponding author email: swasreeyaroy1324@gmail.com*

Abstract

In recent times, student-led climate clubs and local organizations have played a major role in spreading awareness about sustainability and environmental consciousness among students and local communities in Bangladesh. This paper focuses on the effects of ecological clubs on shaping students' views. It also studies the role of these clubs in policy making in society. Approaching a mixed method, combining surveys, interviews, and case studies across the top active environmental clubs and organizations in Bangladesh, this paper examines the extent to which climate clubs instill awareness and social responsibility among students. Findings reveal that students involved in these clubs are more eco-friendly and have a higher level of civic sense. Active participation in those clubs also empowers youths who can help not only students but also the broader community. These clubs organize workshops, community awareness, and tree plantations on the campus and in local areas. Through analyzing the student and grassroots-level feedback, this paper argues that strategic and well-supported campus climate clubs can serve as the root for bigger changes in society. Although these clubs are quite active, they face problems due to not having enough support from the university, a lack of resources and collaborations, and overall societal hindrance. The study proposes a solution to how these problems can be solved to have maximum involvement of students and locals in environmental awareness. This study opens the door for further research on environmental issues within or beyond the campus on a broader scale.

Keywords: *Climate Club, Sustainability, Student, Community, Environment*

PID: IRC_SSGIO_128

Cultural Backwardness and Environmental Impediments in Social Transformation of the Charland Children in Bangladesh

Tulika Podder1* & M Zulfiqar Ali Islam, PhD2

1*Assistant Professor, Department of Sociology, Gopalganj Science and Technology University, Gopalganj-8100, Bangladesh, tulikapodder02@gmail.com, +880 1884-868016 (What's app)

2 Professor (Grade 1), Department of Sociology, University of Rajshahi, Rajshahi-6205, Bangladesh, drzulfiqarai@gmail.com, +880 01715-359715

Abstract

The present paper primarily focuses on the cultural backwardness and environmental impairments in social transformation of the riverbank erosion affected *charland* children on the unstable Padma riverine habitat at Vangi Dangi village is located at Decree Char Union in Faridpur district of Bangladesh. This paper reveals the insecure educational status, adventurous development and primary socialization of the affected children because of *char* cultural backwardness and environmental degradation in their life cycle. The paper explores socioeconomic hardships causing *charland* children to engage in subsistence activities, resulting in irregular schooling or dropout rates, despite partial or full schooling and cultural-fair socialization. The paper is primarily based on empirical data gathered through direct interviewing with the purposively chosen 193-*charland* children from 127 households, case studies, and informal interviews with some stakeholders. Both the qualitative interpretation and quantitative measurement of social reality are considered to be reciprocally focused here. Results clearly highlight their lack of access to livelihood (78.25%), transportation system (93.23%), poor network of social media (98.78%), lack of mass communication (98.43%), lack of proper GOs and NGOs support (87.45%), engaged in both paid and unpaid activities (100%), irregular schooling (94.67%) and dropout from schooling (77.62%) that are created barriers in their social transformation. The study recommends implementing a strong ICT network in policy formulation to eradicate cultural backwardness and promote cultural progressiveness in children's education.

Keywords: *Cultural Backwardness, Environmental Impediments, Social Transformation, Charland Children*

PID: IRC_SSGIO_131

Prevalence and Predictors of Modern Contraceptive Use among Garo Indigenous Women in Bangladesh

A. B. M. Rokonzaman^{1*} & Ohedujjaman Shawon¹
B.

¹ Department of Population Science, Faculty of Social Science, Jatiya Kabi Kazi Nazrul Islam University, Mymensingh-2224, Bangladesh.

*Corresponding Author Email: rokonuzzaman9569@gmail.com

Abstract

Garo indigenous population in Bangladesh, around 76000, remains one of the most underprivileged communities. The use of modern contraceptives and its promotion have benefits of reducing unwanted children, induced abortion, and increasing maternal and child health. This study aims to determine the prevalence of contraceptive use and identify the associated factors that influencing contraceptives use. A total of 493 married women were selected using a non-probability sampling of convenient sampling method. Descriptive statistics are used for frequency distribution for socio-demographic variables. The association between dependent and independent variables was assessed in bivariate analysis using the Chi-square test and binary logistic regression models were employed to explore the predictors of using contraception among Garo women. Only 44% of respondents were using modern contraceptives. Among modern methods, the contraceptive pill ranked first. The methods used were pills (73%), condoms (15%), injectables (5%), implants (4%), and sterilization (3%). Logistic regression models revealed that place of residence, respondent's age, respondent's occupation, husband's age, husband's occupation, age at first marriage, age at first pregnancy, intention of child, family income and expenses, and living total children had not any effects on use of contraception. This model showed that type of family (OR: .68, CI: .472-.98, p = .039), household head (OR: .1.14, CI: .999-.2.058, p = .05), and total family members (OR: .535, CI: .332-.852, p = .009) had significant effects on use of contraception. Addressing the reproductive health demands of the Garo community necessitates cultural suitability and developing inclusive strategies that empower women, involve men, and improve healthcare services.

Key words: *Garo women, Modern contraceptives use, Married women, Prevalence, Mymensingh, and Bangladesh.*

PID: IRC_SSGIO_131

Mental Health of Adolescents under Climate Extreme Events: Insights from Coastal Villages of Bangladesh

Anika Haque Biswas 1*, Md Nazmul Hasan 2

1 Mphil Fellow, Institute of Education and Research, University of Rajshahi, Bangladesh.

2 Department of Social Work, University of Rajshahi, Bangladesh.

*Corresponding author email: anikabiswas.sw@gmail.com

Climate extreme events are the most common scenarios in a hazard prone country like Bangladesh. It leads to several issues interconnected to disrupted mental health, especially adolescents who are more likely to vulnerable. This study explores how climate extreme events affect the mental health of adolescents in the coastal villages of Bangladesh. Following qualitative method, this study conducted FGDs, KIIs and case studies in two coastal villages in Paikgacha Upazila of Khulna district. The study found that adolescents grow up in coastal areas deal with extreme anxiety, depression, post-traumatic stress disorder (PTSD) due to their surroundings. They face significant behavioral issues including emotional stress. It may cause difficulty in their daily social interaction and adjusting sudden changes. This study argues that most of the remote coastal villages lack of adequate coping strategies along with mental health services. Moreover, adolescents often have limited access to basic healthcare and sanitation. Even the families' lack of proper knowledge of adolescents needs. This study suggests that adolescents from climate vulnerable region need strong educational support through awareness raising campaigns. Besides strengthening community safety nets and collaboration between agencies and policies should be focused.

Keywords: *Climate extreme events, Adolescents, Mental health, Coastal villages, Bangladesh*

PID: IRC_SSGIO_132

Vulnerability and Adaptation: The Effects of Climate Change on Tea Workers' Livelihoods in Sylhet

Iffat Jahan Erin^{1*}, Sabikunnahar & Nishat Jahan Haque¹

¹Department of Public Administration, Shahjalal University of Science and Technology, Sylhet 3100, Bangladesh

Corresponding author email: iffaterin197@gmail.com

Abstract

This study explores the impact of climate change on the livelihood of tea workers in the Sylhet division of Bangladesh, concentrating on the ways that shifting climate trends affect their general well-being, financial status, medical condition, and livelihood circumstances. Fieldwork was carried out across three key tea-producing regions, Sylhet, Moulvibazar, and Sreemangal, using a qualitative approach with a purposive sample of 30 tea workers. In-depth interviews were used to collect data. Using an integrated thematic analytic approach, qualitative data were examined to reveal how tea workers view the changing climate, how it affects their workplace, and how adaptable they are. The results show that tea workers, who work in difficult conditions from 9 a.m. to 5 p.m., face more work-related difficulties when there are high temperatures, intense rainfall, and erratic weather. Heat stress, respiratory disorders are becoming more common because of climate change. With an average salary of 170 taka per day, many workers find it difficult to cover their basic expenses, do not have access to healthcare, and face financial hardships that impact social well-being, family welfare, children's educational possibilities. A cycle of poverty is maintained by the daily wage system, which limits earnings and involves deductions. As discussed in the study, the indigenous tea workers respond positively to poor healthcare, cultural deterioration, neglect by the administration in managing climate changes by depending on their own way of adapting the conditions. It requires critical social economic policies and community-based climate adaptation like supporting workers, drought tolerant crops and better water management to save the tea agriculture workers and industry in Sylhet against the effects of climate change.

Keywords: *Climate change, tea workers, tea cultivation, adaptation strategies*

Sub-Theme: Business, Management & Innovation

PID: IRC_BMIO_013

The Role of Informal Communication on Workplace Performance and Productivity: An Exploratory Study in an E-Commerce Organization

Abu Aiub Ansary Hameem^{1*}

¹*Department of Management, Faculty of Business Administration, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh-2224, Bangladesh.*

*Corresponding author email: hamim648432@gmail.com

Abstract

Informal communication is one of the most underrated and overlooked components of organizational dynamics, particularly in a South Asian country like Bangladesh, where collectivist approaches are emphasized. In such cultural settings, informal networks play a crucial role in sharing information, building relationships, and improving interpersonal understanding, which can ultimately influence productivity. This becomes even more crucial in a fast-paced e-commerce environment, where individuals and groups must rely on effective communication to stay agile, responsive, and proactive. This study aims to explore the role of informal communication on workplace productivity at Bikroy.com, a leading e-commerce platform in Bangladesh. A mixed-methods case study approach was adopted, utilizing a structured questionnaire administered to employees, with 19 valid responses collected. Data were analyzed using descriptive statistics (mean, standard deviation, and frequencies) and thematic analysis of open-ended responses. The study found that informal communication is beneficial for collaboration, problem-solving, and building relationships. While 73.7% of respondents believe their productivity increases through informal communication, they also think that its impact mostly depends on leadership style and organizational structure. Although most rated communication positively, some raised concerns about occasional breakdowns and misunderstandings. The findings demonstrated the need to foster and encourage informal communication, optimize the physical work environment, address communication challenges, align leadership styles, and ultimately enhance organizational performance and productivity. The insights from this study will be a baseline and cornerstone for future research with larger and more diverse samples, which will contribute to advancing organizational knowledge that promotes social transformation through more human-centered communication.

Keywords: *Informal communication, workplace productivity, e-commerce, social transformation*

PID: IRC_BMIO_017

The Impact of Dark Triad Traits on Social Entrepreneurship Intention: Moderating Roles of Empathy, Moral Disengagement, and Cultural Values

Background of the study: Social entrepreneurship has developed as an essential force by addressing societal problems. Literature has mostly focused on prosocial features encouraging social entrepreneurial ambition, but less is known about the impact of socially aversive personality traits, particularly the Dark Triad traits. However, the moderating roles of moral disengagement, empathy, and cultural values in shaping this relationship is suitable for further investigation, especially in developing economies. **Objectives:** This study aims to investigate the influence of the Dark Triad traits on individual's intention to start social entrepreneurship and to assess the moderating impacts of moral disengagement, empathy, and cultural values from Bangladesh perspective. **Methodology:** A quantitative approach was used. Data was collected selecting 410 business undergraduates and graduates from universities using structured questionnaire survey. To investigate the direct effects and moderating roles of the factors, data were analyzed using SPSS 25, the researchers used descriptive statistics, regression and correlation analysis to evaluate the impact of dark triad traits on social entrepreneurship intention. **Findings:** The findings indicate that narcissism and Machiavellianism have significant negative effects on social entrepreneurship intention. Additionally, psychopathy demonstrated no direct impact. While empathy intensified the positive effects of narcissism, moral disengagement reinforced the negative influence of Machiavellianism. Moderation analysis revealed that cultural values partially moderated all three relationships, indicating a strong contextual influence. **Implications:** The findings highlight the psychological understanding of social entrepreneurship by connecting personality traits and socio-cultural moderators. The result suggests that academicians and policy maker increasing empathy and decreasing moral disengagement may oppose the detrimental effects of Dark Triad traits, particularly in diverse cultures.

Keywords: *Social Entrepreneurship Intention, Dark Triad, Moral Disengagement, Empathy, Cultural Values*

PID: IRC_BMIO_019

Human Resource Management in Bangladesh: A Conceptual Analysis of Present Practices and Future Challenges

Akhi Khatun*, Md. Akash Rahman, Md. Shawan Uddin, PhD

¹ MBA in HRM, Islamic University, Bangladesh & Independent Researcher, e-mail: akhikhatun244230@gmail.com orcid- 0009-0006-9887-1833¹ Undergraduate Student, Department of Management Studies, University of Rajshahi, Bangladesh, e-mail: rahman.akash.md@gmail.com¹ Associate Professor, Department of Management Studies, University of Rajshahi-6205, Bangladesh, e-mail: shawanmgt@ru.ac.bd orcid-0000-0002-2516-7144

Background of the study: Human resource management (HRM) in Bangladesh is evolving beyond traditional approaches gradually increasing strategic practices combined with organizational goals. However, this transition is hindered by cultural barriers, structural barriers, and skill gaps within the labor force. By connecting theory and practice, this paper analyzes HRM in the socioeconomic context of Bangladesh and identifies key areas for enhancing organizational strategies and policies. **Objectives:** The primary purpose of this study is to examine Human Resource Management (HRM) practices in Bangladesh through a conceptual analysis, with a focus on identifying present organizational challenges and imposing their ability to address passing future challenges. **Methodology:** A qualitative approach is adopted in this study. Purposive sampling technique is used to get the study participants. Using a semi-structured questionnaire, the researchers conducted 10 in-depth face-to-face interviews of HR manager from two divisions including Dhaka and Rajshahi. Thematic analysis approach is applied to analyze data. **Findings:** The result of this study that HRM in Bangladesh is gradually evolving from traditional personnel management to more strategic human resource practices. However, there are still issues like a lack of skilled workers, a lack of technological adaptation, regulatory constraints, and global competition. The study also highlights the increasing need for Performance management, employee engagement, Training and Development and effective leadership development. **Implication:** These findings provide guidance for future empirical research and provide insights for policymakers and academics regarding the gaps between HRM theory and practice in Bangladesh. The results can be used by organizations to evaluate their HR strategies, securing alignment international standards and local requirements, particularly in the areas of performance management, training and employee retention.

Keywords: HRM, Challenges and opportunities, Private sector in Bangladesh, Qualitative Approach

PID: IRC_BMIO_020

Performance Expectancy and User's Adoption Intention: The Metaverse Perspective

Shamima Easmin Shanta¹, Tusher Ghosh², Md. Abdul Alim^{3,4} & Anam Afrin^{4*}¹Department of Business Administration, Bangladesh Army University of Engineering and Technology, Bangladesh.²Department of Business Administration, Ahsania Mission University of Science & Technology, Bangladesh.³Department of Marketing, Griffith Business School, Griffith University, Gold Coast Campus, QLD 4215, Australia.⁴Department of Marketing, University of Rajshahi, Bangladesh.

Corresponding Author email: anamafrin.712@gmail.com

Abstract

This study examines the behavioral intention of the user to use the metaverse by integrating the Technology Acceptance Model (TAM) and Uses and Gratification Theory (UGT).

The study aims to examine the influence of performance expectancy on users' perceived utilitarian and hedonic benefits and their consequent effect on behavioral intention. Positivist paradigm-based, the study applied a quantitative research design by following a structured questionnaire using a six-point Likert scale. 249 responses were collected through convenience sampling from the Bangladeshis who have basic knowledge about the metaverse. The conceptual framework was confirmed by Structural Equation Modeling (PLS-SEM). Findings indicate that performance expectancy significantly forecasts hedonic and utilitarian benefits, and subsequently, these significantly influence users' behavioral intentions to employ metaverse platforms. Furthermore, mediation analysis confirms that hedonic and utilitarian benefits significantly mediate the connection between performance expectancy and behavioral intention. This research provides theoretical contributions through an extension of TAM and UGT in the context of adopting metaverse technology. In practice, it suggests that maximizing performance-related and rewarding aspects of the metaverse would enhance activity among users. Limitations are geographic restriction to Bangladesh and non-probability sampling. Cross-cultural analysis and platform-specific dynamics ought to be addressed in further research.

Keywords: Metaverse Marketing, Technology Acceptance Model, Uses and Gratification Theory, Behavioral Intention

PID: IRC_BMIO_025

“The Effect of One-Stop Kiosk Services on Purchase Decision-Making and Customer Satisfaction for Building Materials in Bangladesh”
Ananya Talukder^{1*}, Ahona Talukder²

¹*Department of Business Administration, Faculty of Business Administration, Shahjalal University of Science and Technology, Sylhet*

²*Department of Management and Information System, Faculty of Business Studies, Begum Rokeya University, Rangpur*
Corresponding Author Email: ananyaatalukdersust@gmail.com

Abstract

Bangladesh's traditional building material procurement procedure is frequently laborious, requiring clients to deal with several suppliers, haggle over costs, and oversee logistics. This can result in delays, cost overruns, and discontent. For the building materials industry in Bangladesh, this study intends to explore how a one-stop kiosk service might improve customer satisfaction and impact purchasing decisions. In addition to providing a wide range of building materials, from basic supplies like steel and cement to specialty finishing items, the proposed kiosk would act as a central location and incorporate cutting-edge technologies like interactive displays, digital catalogs, and online ordering platforms.

The study intends to identify how one-stop kiosk services can improve both decision-making and satisfaction of customers in the Bangladesh building materials market by fixing issues that individual buyers and professional contractors experience.

The research was done by surveying people, selecting responses from both individual buyers and contractors randomly. Sample size for this research was 500. Challenges, preferences and views were recorded using a structured questionnaire and statistical tools were applied to test hypotheses. Since the data was ordinal, non-parametric methods were applied to give strong results for understanding customer behaviours and expectations.

The study found that customers have to deal with issues like difficulty comparing prices, limited choices, not enough information and long processes, so they prefer kiosk because it is seen as both time-saving and fun alternatives for decision-making. Most businesses see kiosk as important for remaining competitive which highlights their potential to make a strong difference.

The results recommend setting up kiosks in retail shops and combining them with online and wholesale platforms to solve customer problems. The study suggests that suppliers should link their inventories with kiosk which can help the market shift and become more profitable.

Keywords: *One-stop kiosk services, building materials market, purchase decision-making, customer satisfaction.*

PID: IRC_BMIO_029

Exploring Customer Perspectives on AI-powered Chatbots Implementation in Bangladesh's Banking Industry
Anik Paul*, Md. Shawan Uddin, Md. Sanzid Alam, Md. Tanvir Hasan Khan

¹Department of management studies university of Rajshahi, Rajshahi-6205, Bangladesh
Corresponding authors Email: anikpaulru@gmail.com

Abstract

The objective of the research is to identify the factors influencing the acceptance of AI-powered chatbots in the banking industry and to propose acceptable solutions that ensure their acceptance. The research method employed is qualitative. A total of 50 respondents where 25 respondents are bank account holders and 25 respondents are bank officials were interviewed using semi-structured questions, and thematic analysis was applied to analyze the collected data. Seven themes and sub-themes were developed from the bank account holder's analyzed data. After analyzing their data, it was found that most respondents desired recommendations from bank employees to ensure the safety of using chatbots. Three themes relative advantages, employee convenience, and operational efficiency along with sub-themes, were identified from the bank officials' analyzed data. This study can assist banks in developing successful systems to eliminate barriers to AI-powered chatbots adoption, while the government can use the findings to create suitable laws and regulations. This research is entirely novel in the context of Bangladesh and is also among the first to consider the responses of bank employees to AI-powered chatbots acceptance globally. Future researchers can also use the technical team opinion of the bank with customer and bank employee opinion to explore the drivers and barriers to acceptance of AI-powered chatbots in the banking industry in Bangladesh.

Keywords: *AI-powered chatbots, Chatbots acceptance, Bank industry, Artificial intelligence in bank.*

PID: IRC_BMIO_036

Development of an E-Hostel Management System for Efficient Residential Administration in BangladeshAntor Biswas^{1*}, Arpita Saha¹, Sabah Azad Shakib² & Mahafuzar Islam³¹Department of Marketing, University of Rajshahi, Rajshahi-6205, Bangladesh.²Department of Mathematics, University of Rajshahi, Rajshahi-6205, Bangladesh.³Department of Marketing, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding Author: Antor Biswas

Corresponding Author Email: antorru65@gmail.com

Abstract

In Bangladesh, "e-hostel management" refers to the digital administration of residential services for hostels, apartments, and dormitory-style accommodations. This study aims to streamline and enhance the efficiency of hostel management, addressing the limitations of the current manual system, which is time-consuming, inefficient, and cumbersome for both students and hostel owners. The proposed solution replaces traditional methods with an intuitive, user-friendly graphical interface that incorporates robust access controls and enhanced data security. Educational institutions and accommodation providers have faced operational challenges due to outdated administrative processes. To inform system design, primary data were collected through an online survey of 300 participants, including students, job seekers, and professionals. Developed using PHP, CSS, and HTML, the resulting Hostel Management and Allocation System offers a reliable, secure, and scalable platform tailored to the needs of Bangladeshi users. The adoption of this electronic system is strongly recommended, as it significantly reduces paperwork, minimizes administrative workload, and saves valuable time previously lost to manual operations.

Keywords: *E-Hostel Management, Digital Administration, Hostel Allocation System, Student Accommodation, Web-Based Application*

PID: IRC_BMIO_039

Investigating Immersive Virtual Reality Experiences in Tourism: A Developing Country PerspectiveArpita Saha^{1*}, Antor Biswas¹ & Nizum Ahmed Sumi²¹Department of Marketing, University of Rajshahi, Rajshahi-6205, Bangladesh.²Officer, General Banking Department, Bank Asia PLC, Badda Branch, Dhaka, Bangladesh

Corresponding Author Email: arpitasa1952@gmail.com

Abstract

The hyper-accelerating advancement of immersive virtual reality technologies in the metaverse draws so much attention because of its ability to affect tourist decisions on an immersive experience. Underpinned from telepresence theory and construal level theory, this research tends to illuminate the effects of enhancing mental imagery, vividness, and escapism added by technology in virtual tourism on tourists' intentions to practice immersive VR, mediation of the tourist attitude from a perspective of a developing country such as Bangladesh. The research is conducted through a quantitative approach, conducting an online questionnaire survey to collect data from 272 tourists in Bangladesh who have prior knowledge and interaction with the metaverse using convenience sampling technique. The outcome establishes that mental imagery, escapism, and vividness have positive effects on attitudes toward immersive VR, leading to an increased intention to experience an immersive VR tour. In addition, the attitude toward immersive VR serves as a mediating variable, thus strengthening the relationship between mental imagery, escapism, and vividness and the intention to participate in VR tourism activities. The study offers crucial insights not only for tourists and the tourism industry but also for destinations. Most of the participants have limited access to immersive VR, lending much to assumption in their findings. Also, it's a barrage of tourism, thus leaving out other sectors such as education, hospitality, and healthcare. Future research should expand into these areas, taking a look from the marketing perspective. This research offers original insights into the impact of immersive VR on tourism in developing countries.

Keywords: *Metaverse, Immersive VR Tour, telepresence theory, construal level theory.*

PID: IRC_BMIO_134

Source Credibility of Social Media Influencers on the Customer Engagement and Purchase Intention of Beauty and Cosmetics Products in Bangladesh: Moderating Role of Information TrustKamron Naher^{1*}, Ayeasatul Kobra², Shishir Das³, Joy Mondol⁴ & Md. Najim Uddin⁵*Department of Business Administration, School of Business, Presidency University, Dhaka-1212, Bangladesh***Corresponding author email: naherk@pu.edu.bd***Abstract**

Social media platforms have become a powerful weapon for companies to engage and attract customers through influencers. The study aims to explore how the elements of source credibility of social media influencers, such as expertise (EXP), trustworthiness (TW), attractiveness (ATTR), and reputation (REPU), have an impact on customer engagement. It also examines the mediating effect of customer engagement (CA) between the relationship source credibility and purchase intention (PI). The study was grounded in source credibility theory and employed stimulus-organism-response (SOR) theory to construct a framework. Moreover, the moderating effect of information trust (IT) as an external variable was also examined between the relationship of CA and PI. The data were collected from 205 females, and the analysis was conducted using structural equation modeling. The findings show that EXP, TW, and ATTR are the most contributing factors to engaging customers. Additionally, CA has a mediating effect between source credibility and the PI of beauty and cosmetic products. Information trust moderates the relationship between CA and PI. Theoretically, the study integrates SOR theory. Our study was able to contribute to our existing knowledge of the primary antecedents of source credibility theory. The research can be an insightful direction for the marketers of beauty and cosmetic products who want to promote their products through influencers.

Keywords: *social media influencer, influencer marketing, source credibility, customer engagement*

PID: IRC_BMIO_049

UniNet: A Student-Driven University Networking System for Retrieving Our Green Agriculture into Golden EconomyMaria Kabir^{1*}, Kaniz Fatema¹¹*Department of Biotechnology and Genetic Engineering***Corresponding author email: mariakabir1917048@gmail.com***Abstract**

Bangladesh is agriculture-based country where farmers face challenges such as unfair pricing, limited access to markets, financial insecurities, and inefficient distribution systems. UniNet is a networking system composed of university students from every district of Bangladesh that connects students and farmers to create an academic knowledge based agricultural support and distribution network via solving financial problem during studentship. It works as a structured network of elected and selected central, monitoring and working team offering certified organic seeds, biofertilizers to ensure food safety to consumers. It also offers fair product pricing for both farmers and consumers, equitable distribution of crops whole over the country via its own transportation system, marketing support to farmers through its own marketing system, scientific technology-based storage of crops, offering fund for both farmers and students, empowering students by part-time job. By aligning innovation, youth engagement and agricultural development, UniNet stands as a sustainable business framework and ultimately contribute to national economic growth.

Keywords: *UniNet, Networking system, Agriculture, Golden economy*

PID: IRC_BMIO_058

The Impact of Organization Culture on Employees' Adoption of Artificial Intelligence: A Study in Bangladesh

Md. Mostafizur Rahman*

Assistant Professor, Department of Business Administration, First Capital University of Bangladesh.

Corresponding author email: mostafizurmg@gmail.com

Abstract

Artificial intelligence has brought about a massive revolution almost in all sectors. So organization wants to ensure a culture that can easily and quickly adopt Artificial Intelligence (AI). The purpose of this study was to measure the effect of organization's culture on employee's AI adaption. Stratified Random Sampling was used. A total of 500 employees were enrolled for the study. Study used a semi-structured questionnaire containing pre-coded and open-ended questions. Questions were rated with the Likert five-point scale. Merging five dependent variables study formed composite score and to do this it ran Cronbach's Alpha which result was 0.8. Descriptive statistics, chi square and binary logistic regression test were used to analyze the data. Chi square test revealed that organization culture was significantly associated with employees AI adaption. AI adaption was higher among employee with PhD/higher degree, (84.6%, $p < 0.05$), fear on AI would replace job (84.5%, $p < 0.000$), and rewarded for innovative ideas allied to AI (79.2%, $p < 0.000$). Employees who were taking risk to use AI had almost 10 times higher chance of AI adoption (AOR=9.693, 95% CI: 4.146-22.660). People with fear of AI would replace job and participate in decision making had almost 7 and 2 times higher possibility of AI Adaption (AOR=6.975, 95% CI: 4.125-11.791 and AOR=2.389, 95%CI: 1.206-4.527) respectively. The study help the policy maker to understand the impact of organization culture on artificial intelligence which guide them to shape an environments where people can adopt AI comfortably. Further research is needed to reveal new insight on the topic.

Keywords: *Organization Culture, Employees' Adoption of Artificial Intelligence, Chi Square, Binary Logistic Regression.*

PID: IRC_BMIO_066

FORENSIC AUDITING AS A TOOL FOR ENHANCING FINANCIAL TRANSPARENCY IN THE BANKING SECTOR.Md.Robiul Islam^{1*}, Md. Rahim*Department of Accounting and Information Systems, Begum Rokeya University, Rangpur.*

Corresponding authors Email: Robiul.ais15@gmail.com

Abstract

Financial transparency faces unparalleled challenges in the banking sector due to rising fraudulent affairs and financial difficulty in globally. This study explores the effectiveness of forensic auditing as a tactical implementation for detecting fraudulent activities and financial transparency for the commercial banks in Bangladesh. And then this paper conveys the critical gap between sophisticated nature and traditional auditing approaches of modern financial offence. In this paper conducted with descriptive quantitative study appoint a cross-sectional research approach, and then the analyzed data has collected from 12 commercial banks which is regulated by The Central Bank of Bangladesh. The research employ data from annual reports, data is analyzed through SPSS or STATA software to evaluate relationship among Profitability, Liquidity, Leverage, Operational efficiency, Capital turnover. The study disclose that forensic auditing enhance financial transparency in the banking sector through accounting principles, legal knowledge, and investigative techniques. By analyzing strong correlation between fraud detection capabilities and forensic auditing implementation with specific effectiveness in identifying operational irregularities, financial fraud statement, and asset embezzlement. This study integrates technological tools substantially to raise forensic auditing as well as enhance authenticity and proficiency in comparison to traditional auditing methods. The research build an effective forensic auditing mechanism for sustaining financial cohesion and building stakeholder trust in the banking sector. The study suggests that enlarge forensic auditing skills, integrate IT-based advanced tools, and convey contextual factors to strengthen fraud protective measures. The feature importance analysis provides important insights about the determinants of financial distress in banking systems. The Debt to Asset Ratio became as the most significant predictor with 77.53% of the model's predictive power and the Debt-to-Equity Ratio at 9.44%. This finding underscores the critical importance of leverage management in banking financial assessment. Return on Assets contributes 4.07% to the predictive model while Working Capital Turnover make 3.70% impact on the model which indicating the moderate but meaningful role of profitability and efficiency metrics in financial distress prediction.

Keywords: *forensic auditing, financial transparency, fraud detection, banking sector*

PID: IRC_BMIO_075

Exploring How Travel Vlogs Shape Tourist Destination Choices: A Case Study of Rajshahi University
Md. Sujan Ali Joardar¹, Abid Bin Anam¹, Md. Enayet Hossain (PhD)^{1*} & Tanjil Bhuiyan¹¹*Department of Tourism & Hospitality Management, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: mehossain@yahoo.com

Abstract

Travel decision process is shifting due to the rapid rise of digital platforms, especially travel vlogs on various social media, among the young and technologically savvy audiences. In Bangladesh, university students are increasingly relying on travel vlogs for their travel motivation and planning. The purpose of this study is to examine the impact of travel vlogs on tourist destination choices among Rajshahi University students. A qualitative approach was performed using semi-structured interviews with 11 purposively selected students who had traveled at least once after watching a travel vlog. Data were collected over three weeks and analyzed manually by content analysis to identify themes and patterns. The result shows that vlogger credibility (100% of respondents), authenticity of contents (100%), and emotional attachment by parasocial interaction (82%) factors are building trust and influencing travel motivation, whereas confidence of travel planning is enhanced by high-quality visuals (91%), useful details about cost, security, and cultural experiences (73%). Students give importance to the destinations that are culturally rich, affordable, and perceived as safe. The study highlights the pair role of vlogs as emotional influence and informative tools. These results reveal that tourism policymakers should collaborate with credible vloggers to create ethical and engaging content that highlights a destination and caters to the needs of student travelers. Further research should focus on diverse demographics and employ a mixed-methods approach to validate these findings.

Keywords: *Travel Vlogs, Destination Choice, Parasocial Interaction, Digital Tourism.*

PID: IRC_BMIO_080

Impact of Intellectual Capital on Financial Performance of Commercial Banks in Bangladesh
Dr. Md. Sumon Hossain¹, Abdullah Al-Salman², Shamalia Binte Haque² & Rabeya Khatun Taniya³*Department of Accounting and Information Systems; University of Rajshahi; Bangladesh.*

Corresponding Author Email: sumon7027@ru.ac.bd

Abstract

This study investigates the impact of intellectual capital (IC) on financial performance (FP), as measured by return on assets (ROA), return on equity (ROE), and earnings per share (EPS), using the modified value-added intellectual coefficient (MVAIC) model. Utilizing SPSS 20.0 and Stata 15.0, panel data regression techniques are applied to a dataset of 232 observations to analyze the relationship. The results indicate that human capital (HC) and capital employed (CE) have a positive effect on FP, whereas structural capital (SC) negatively influences FP in both fixed and random effects models. Firm size is also found to have a positive impact on FP. However, relational capital (RC) and the Covid-19 pandemic show no significant influence on the financial performance of the Bangladeshi banking sector. Additionally, MVAIC demonstrates a positive and statistically significant relationship with the profitability indicators of commercial banks in Bangladesh. The findings provide empirical insights into how various IC components contribute to FP, offering theoretical and managerial implications for managing intellectual capital in the banking industry. As IC and its elements are vital sources of organizational value, the study recommends that decision-makers manage them with strategic care.

Keywords: *MVAIC; Structural Capital; Human Capital; Relational Capital; Capital Employed; Financial Performance*

PID: IRC_BMIO_086

Determinants of Microcredit Satisfaction: A Case Study of Dhunat Upazila, Bogura
Shamalia Binte Haque¹; Tanjir Hassan Jim¹; Sabbir Hosen¹ & Dr. Md. Sumon Hossain^{2*}

Department of Accounting and Information Systems, University of Rajshahi.
Department of Accounting and Information Systems, University of Rajshahi,
* Corresponding Author Email: sumon7027@ru.ac.bd

Abstract

The purpose of the study is to investigate the factors affecting the level of satisfaction of micro-credit borrowers of Dhunat Upazila, Bogura in Bangladesh. The research employed quantitative research approach and a sample of 140 micro credit beneficiaries from Dhunat Upazila, Bogura was surveyed using close ended questionnaire. The collected data are analysed using mean, standard deviation, minimum, maximum, correlation and regression techniques. Social influence has the greatest mean value among the variables under investigation, according to the descriptive statistics. Security, cost, trust, and service quality are the next most important factors. Furthermore, regression analysis reveals complex associations. Security and trust are found to be important positive predictors of borrower satisfaction, highlighting their vital role in promoting trust and dependability in microcredit systems. On the other hand, there is a statistically significant negative correlation between satisfaction and cost and social influence, indicating that externally pushed borrowing and financial strain could negatively impact the borrower experience. Even while the service quality coefficient is positive, it falls short of statistical significance, suggesting a possible but unproven factor that merits more research. Microfinance institutions and regulators should develop a borrower-centered approach, emphasizing security, trust-building, and cost reduction, while also curbing coercive or excessive social influence and gradually enhancing service quality. Such strategies can improve borrower satisfaction, repayment behavior, and the long-term sustainability of microcredit programs. This study uniquely explores how financial and non-financial factors—specifically security, trust, cost, service quality, and social influence—affect borrower satisfaction in microcredit, emphasizing a borrower-centric perspective. It reveals that while social influence has a high presence, it negatively impacts satisfaction, and high costs further reduce satisfaction, offering new insights for improving microfinance policy and service delivery.

Keywords: *Service Quality; Security; Ease of use; Trust; Satisfaction*

PID: IRC_BMIO_90

Impact of Regional and Socioeconomic Disparities on Digital Divide in Bangladesh: A Study on Demographic and Technological Inequities
Md. Ahasanul Alam^{1*}

*Department of Management Information Systems, Faculty of Business Studies, Begum Rokeya University, Rangpur.,
Rangpur-5404, Rangpur, Bangladesh.*
Corresponding Email: alam.12022055@student.brur.ac.bd

Abstract

This study investigates the extent to which regional and socioeconomic conditions affect the digital divide in Bangladesh, particularly how variables like location, income, digital access, occupation, and digital literacy influence digital disparities. With Bangladesh's aspiration to become a "Smart Nation," bridging the digital gap is critical for inclusive development. The research employed a quantitative approach with 185 survey responses gathered from the northern region of Bangladesh using both online and offline questionnaires. Data were analyzed using SMART PLS 4.0 and IBM SPSS 25 to assess structural relationships between key variables. Five hypotheses were tested to evaluate how digital skills, income, occupation, access to digital tools, and location contribute to the digital divide. The findings reveal that all selected factors—income level, location, occupation, digital access, and digital skills—positively and significantly affect the digital divide. Among these, digital access ($\beta = 0.495$, $p < 0.001$) and digital skills ($\beta = 0.426$, $p < 0.001$) emerged as the most influential. The analysis confirmed strong structural relationships among variables and established high reliability and validity for the constructs. The urban-rural divide, economic status, and education level were shown to be substantial predictors of digital inequality. The research highlights the urgent need for targeted policy interventions, especially infrastructure investment in rural areas, digital literacy programs, and financial support for low-income groups. Stakeholders and policymakers can utilize these insights to craft inclusive digital strategies that ensure equitable access to digital technologies and services across Bangladesh.

Unlike prior studies that focus narrowly on either access or skills, this research offers a comprehensive, empirically validated model incorporating both socioeconomic and regional dimensions. It provides a robust framework for understanding and addressing the digital divide in developing nations, particularly in South Asian contexts.

Keywords: *Digital Divide, Socioeconomic Status, Regional Inequality, Bangladesh, Digital Skills, Internet Access, Occupation*

PID:IRC_ACHO_049

The Speech of Fled Prime Minister Sheikh Hasina: A Rhetorical ArgumentSamantha Ali^{1*}, Jubayer Ahmed²¹*Department of Journalism and Media Communication, Faculty of Arts and Social Sciences, Green University of Bangladesh, Narayanganj-1461, Dhaka, Bangladesh*²*Department of Journalism and Media Communication, Faculty of Arts and Social Sciences, Green University of Bangladesh, Narayanganj-1461, Dhaka, Bangladesh*

*Corresponding author email: samanthaali.jmc@gmail.com

Abstract

Leadership is a quality that requires enormous elements that need to be acquired to accomplish the goal of the well-being of a particular nation and its people. Analyzing the speeches of the fled Prime Minister Sheikh Hasina of Bangladesh, who left the country after a historical student-general citizen uprising in July-August 2024, this study argued that the way she delivered her speeches, the terminology she used, the lexical choices she preferred in communicating people or the nation, implies that she had a lack of democratic norm but wanted to enjoy and practice powerful authoritarian rule during her regime. Employing rhetoric analysis, this study discursively argues that she did not think about the well-being of the people of Bangladesh despite her speeches being full of proclamations that she, her party, and her family have sacrificed for the development of Bangladesh. In addition, she tried to emotionally blackmail Bangladeshi citizens through her speech by connecting some historical events. The study also observes that through her rhetorical speeches, Sheikh Hasina tried to sideline people and divide the nation by arguing that the people who do not support her and her party were a threat to the nation, and they are the enemy of the country, and worked against the development that she and her party employed inside Bangladesh. Eventually, the pain of the nation, the agony of the people, and the anguish of the whole nation were overlooked, ignored, and rejected in her speeches all along the way.

Keywords: *Language, Leadership, Rhetoric, Sheikh Hasina, July Uprising*

PID:IRC_ACHO_052

Between Mud and Museum: Ceramics on the Edge of Art and AnthropologyA K M Ariful Islam^{1*}, Sanat Krishna Dhali¹, Md. Abdul Mubeen¹, Md. Mostahid Prodhan¹, Nazrul Islam² & Mst. Baly Khatun³¹*Department of Ceramics & Sculpture, University of Rajshahi, Rajshahi-6205, Bangladesh.*²*Department of Anthropology, University of Rajshahi, Rajshahi-6205, Bangladesh.*³*Department of Folklore, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: sculptorarif@ru.ac.bd

Abstract

This research examined the dual nature of pottery objects which exist between artistic masterpieces and cultural relics. The people of Bangladesh along with their South Asian neighbors have utilized clay materials for creating household objects and performing rituals and creating symbolic artifacts throughout history. The transition of these objects into galleries or museums leads to their reclassification into either "art" or "heritage" categories which transforms how people understand their worth and significance. A comparative study between art galleries, craft markets, and museum exhibits was conducted to analyze the display methods of these objects. Interviews were conducted with pottery makers to determine how institutional framing affected their self-identification process. Artworks from rural and marginalized communities received appreciation for their cultural importance yet failed to gain recognition within the modern art world. The research incorporated Bourdieu's cultural capital theory together with Hall's representation framework and postcolonial critique. The study revealed that the terms "artisan" and "artist" demonstrate social structures that stem from colonialism and class divisions. The research demonstrated that pottery represents both labor practices and identity formation and resistance while demanding a thorough evaluation of cultural object classification and exhibition practices.

Keywords: *Pottery Classification, Cultural Identity, Art vs Heritage, Postcolonial Representation.*

PID:IRC_ACHO_054

Syncretic Dialogues in Bengal Thought: A Comparative Study of Vaishnavism, Advaita Vedanta, and Baul Traditions

Sohan Sharif*, Mahtab Jabin Anto

¹ Graduate Student, Institute of Comparative Literature and Culture, Jahangirnagar University, Dhaka, Bangladesh-1342.¹ Graduate Student, Institute of Business Administration, Jahangirnagar University, Dhaka, Bangladesh-1342.

*Corresponding author email: sharif.stu2017@juniv.edu

Abstract

This paper explores how three influential traditions in Bengal—Vaishnavism, Advaita Vedanta, and Baul mysticism—have interacted, overlapped, and shaped one another over time. Despite their different spiritual frameworks—devotion, non-duality, and lived mysticism—they share a common cultural ground where ideas about the self, divinity, and liberation are constantly in conversation. The study draws on both classical texts and lived practices, while also listening to oral traditions and considering the social contexts that have shaped these philosophies. Special attention is given to the Bauls, whose songs and way of life blur the boundaries between the sacred and the everyday, and between religious identities themselves. They embody a kind of spiritual openness that both challenges and bridges established doctrines. By looking at how these traditions have coexisted and influenced each other in Bengal's pluralistic setting, the paper reflects on what they can still teach us—about living with difference, imagining unity, and seeking meaning in a divided world. In doing so, it contributes to broader conversations around indigenous knowledge, cross-cultural philosophy, and the ongoing effort to rethink how we study traditions beyond rigid disciplinary or sectarian lines.

Keywords: *Syncretism, Baul Philosophy, Comparative Religious Thought, Bengal Intellectual Tradition*

PID: IRC ACHO 058

Influence of Turkish Loanwords on the Bengali Language in the 21st Century**Mumtahnina Khatun**Student of Post-Graduate in General Linguistics
mumtahnina1997@gmail.com**Abstract**

This research paper aimed to study various types of Turkish loanwords used in the Bengali language during the 21st century. The relationship between Bengali and Turkish, two languages that belong to different language families, has been the subject of research by scholars for a long time. However, an interesting aspect is the significant influence of the Turkish language on the Bengali language. The main objective of this paper is to identify Turkish loanwords in the Bengali language that have either changed meaning or shifted away from the denotations of their original meanings, altered the phonological system, and been used in various sectors, including literature, economy, politics, religion, and media. This paper followed the descriptive-qualitative method. The data for this research were collected through interviews and surveys with native Bengali speakers from Bangladesh. The discussion concludes with the significance of loanwords in the continuous evolution of languages and emphasizes the role of Turkish loanwords in the contemporary Bengali language in the 21st Century. However, the researcher explained that most of usages words selected were under a particular category.

Keywords: *Turkish Loanwords; Bengali Language; 21th Century; Native Speaker, Usages Words*

PID: IRC_ACHO_062

Empirical Rationalism

Tazim Hossain, Dept. of Philosophy

*Jatiya Kabi Kazi Nazrul Islam University, Trisal***Abstract**

Rationalism believes that Humans can realize a truth through reason that is Universally acknowledged and accepted. However, there is a component of reason that is derived from experience. Previously, it was understood that rationalism independently provides knowledge without the influence of any other doctrine. However, a detailed examination of the internal workings of reason reveals that one aspect of reason, derived from experience, guides another element, and the combination of these two forms knowledge. This research aims to uncover the mystery of the experience-derived component of reason. This is an analytical research study. Data was collected through the review of primary and secondary philosophical literature and related articles. Most respondents acknowledged the existence of experience-derived reason. They thoughtfully responded that one part of the reason, gained through experience, directs another part. Experience-derived reason from education, professional life, and family life aids in making appropriate decisions. When seeking solutions to problems from wise individuals, they provide resolutions based on their experience-derived reasoning. Participants stated that they rely on experience-derived reasons for most of their life's decision-making processes. Future research could explore the differences in experience-derived reasoning among people of various ages and professions. Studies could investigate the impact of technology on experience-derived reason. Applied research could examine the influence of experience-derived reason in the field of education

PID: IRC_ACHO_066

Devi Dance: A Semiotic Exploration and Cultural Identity of Newar Community in BhaktapurRajan Phelu^{1*}¹Lecturer, Bagiswori College, Bhaktapur, Nepal

*Corresponding author email: phelurajan@gmail.com

Abstract

This study aims to explore the Devi Dance [a traditional masked performance] that serves as a dynamic medium for expressing religious devotion, social cohesion, and cultural identity in Bhaktapur Newar community. Despite its significance, semiotic dimensions of the dance remain underexplored. The Devi dance symbolizes the mythological victory of the goddesses Mahakali, Mahalaxmi, and Kumari over demons. The paper analyzes the visual elements of the dance—masks, costumes, gestures, spatial arrangements, and rhythmic movements with traditional music—to depict the underlying meanings and cultural myths embedded within the performance from the perspective of Roland Barthes' semiology. The study adopts qualitative narrative research design, including in-depth semi-structured interviews with Devi Dance performers and senior citizens of Bhaktapur to capture personal narratives and cultural perspectives. Field observations of the dance during Gai Jatra [cow procession] festival in Bhaktapur provide contextual depth, revealing how visual signs interact with ritual and communal identity. The integration of narrative accounts and observational data underscores the dance's role as a dynamic cultural text, preserving spiritual and cultural heritage of Bhaktapur. Findings highlight the interplay between the dance's denotative elements, connotative significations, and mythic dimensions reflecting Barthes' concept of second-order signification. The denotative elements include the dancers' vigorous movement, gestures, and the rhythmic traditional music. Connotatively, this evokes awe and reassurance, symbolizing the goddess's protective power. At the mythic level, the performance affirms Mahakali's role as a protecting deity, aligning with the larger Hindu narrative of Devi's victory over evil powers. This study contributes to the interpretation of traditional performances as semiotic systems and offers insights into the preservation of intangible cultural heritage.

Keywords: *Devi Dance, Bhaktapur, Newar Cultural Identity, Semiology*

PID: IRC_ACHO_066

Graffiti as a Tool of Communication for Political Expression: A Case Study of the July Uprising in Bangladesh

Jubayer Ahmed^{1*}, Dr. Md. Aliur Rahman¹ and Samantha Ali¹

¹*Department of Journalism and Media Communication, Faculty of Arts and Social Sciences, Green University of Bangladesh, Narayanganj-1461, Dhaka, Bangladesh*

*Corresponding author email: jubayer.jmc@gmail.com

Abstract

Graffiti serves as a significant medium of alternative communication in political movements. Particularly when mainstream media is influenced by state pressure or control, graffiti emerges as a crucial tool for political expression. In the absence of impartial media, activists transform public walls into alternative platforms for disseminating their messages. During the July Uprising of 2024, graffiti was observed across various regions and educational institutions in Bangladesh, with messages primarily addressing issues of injustice, irregularities, and discrimination. This research aims to conduct a detailed observation and in-depth analysis of the language and messaging used in the graffiti painted during the July Uprising, focusing on its effectiveness as a means of political communication. The study adopts a mixed-method approach, combining qualitative and quantitative techniques. Data were collected through in-depth interviews, content analysis, and case study analysis to examine the communicative strategies employed in protest graffiti. Selected graffiti samples from the July Uprising were identified and analyzed. The findings reveal that the language of protest used by the young generation, their patterns of communication behavior, and their creative expressions were strategically innovative and inspiring. These elements became an inseparable part of this unprecedented movement, significantly influencing public opinion and fostering unity among individuals from diverse social and professional backgrounds. The outcomes of this research are expected to provide valuable insights for future studies by evaluating the role and impact of graffiti as an alternative medium in political communication.

Keywords: *Graffiti, Political Communication, July Uprising, Alternative Media.*

PID: IRC_ACHO_070

Problems and Prospects of Managing University Museums in Bangladesh

A K M Khademul Haque^{1*}

¹*Department of Islamic History and Culture, University of Dhaka, Dhaka-1208, Bangladesh.*

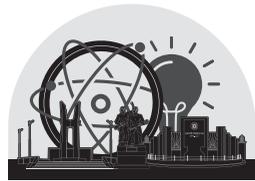
*Email: khademulhaque@du.ac.bd

Abstract

University museums in Bangladesh serve as vital warehouses of cultural, historical, and scientific heritage. However, they face significant challenges in management due to the absence of standardized frameworks. This research aims to investigate the problems and prospects of managing university museums in Bangladesh. It would focus on key museums at Dhaka University (Departmental museums at Islamic History and Culture, Geology and Zoology department, DUCSU Collections, and Bhasa Shahid Barkat Smrity Jadughor), Rajshahi University (Shahid Smrity Songrohoshala), Chittagong University (Central Museum), and Jahangirnagar University (Department of Archaeology Museum). Despite their diverse collections—ranging from archaeological artifacts to natural history specimens—these museums lack clear Terms of Reference (ToR), leading to inconsistent governance, inadequate funding, and underutilization of their educational potential.

The study adopts a qualitative research methodology. Primary data will be collected through structured and semi-structured interviews with museum curators, university administrators, and stakeholders, as well as surveys of museum visitors to assess accessibility and public engagement. Secondary data will include policy reviews, archival records, and comparative analyses with international university museums. Case studies of selected museums will examine operational challenges, such as collection preservation, staffing shortages, and institutional neglect. It will also identify opportunities for improvement through policy reform, digital archiving, and interdisciplinary collaboration.

This article aims to enhance the role of university museums as dynamic educational and cultural hubs by proposing strategic recommendations. The findings will contribute to museum studies in Bangladesh and offer a draft idea for sustainable management practices in academic contexts.



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Poster Presentation



RAJSHAHI UNIVERSITY
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Sub-Theme: Business, Management & Innovation

PID: IRC_BMIP_003

Entrepreneurship In Progress: How Students Prepare to Lead as Chief Everything Officers (CEO)

Eshamuzzaman Esham, Anindo Rahman

¹ Eshamuzzaman Esham, Undergraduate Student, Army Institute of Business Administration (Army IBA), Savar Cantonment, Dhaka-1344, Bangladesh.

¹ Anindo Rahman, Undergraduate Student, Army Institute of Business Administration (Army IBA), Savar Cantonment, Dhaka-1344, Bangladesh.

Corresponding author email: esham.armyiba@gmail.com

Abstract

Student entrepreneurship is an emerging trend in the university campuses, as more youths are taking initiative to be innovative and to take up leadership in their own businesses. Such start-up entrepreneurs often take on every role—strategy, marketing, finance, operations, and, in effect, serve as the Chief Everything Officer (CEO).

This paper explores the way the students are ready to do all these hats and the problems they encounter in balancing academics and entrepreneurial interests.

The objective of this paper is to understand student perceptions, preparedness, and the extent of institutional support in developing entrepreneurial leadership among undergraduates in Bangladesh.

This survey used a Likert-scale as well as multiple-choice questions to survey 240 university students on the topic of entrepreneurial intention, time management, confidence in multitasking and perceived access to support systems.

The findings indicate that 73% of the respondents were highly entrepreneurially oriented, and 65% were confident that they could take up a number of roles.

However, 59% reported inadequate mentorship access, and 48% noted a lack of practical exposure to business management tools. Students from non-business disciplines and females showed relatively lower confidence and support access. We have a lot of ambition, but structural preparedness is uneven.

These insights emphasize the growing entrepreneurial mindset among students and underline the urgent need for institutions to offer more structured mentoring, experiential programs, and inclusive support for aspiring student founders.

Keywords: *Student Entrepreneurship, Leadership Readiness, Startup Culture, Chief Everything Officer (CEO)*

PID: IRC_BMIP_007

ESG Adoption and Cost of Capital in Family vs. Non-Family Firms: Evidence from Bangladesh

Author(s)

Siam Mahmud^{1*}, Nawshin Nawal Khan¹

¹ *Department of Economics and Social Sciences, BRAC University, Dhaka, Bangladesh*

**Corresponding author email: siaamsaadman@gmail.com*

Abstract

Family-owned businesses in Bangladesh's capital market often struggle with high borrowing costs due to perceived opacity and agency risks. Improved environmental, social, and governance (ESG) disclosure may serve as a signal for better firm transparency and lower risk, according to emerging global data. This study aims to examine whether ESG reporting by Bangladeshi firms contributes to lower cost of capital in a context of inadequate investor protection. Specifically, our goal is to examine the relationship between ESG scores and firm-level borrowing costs using panel data from listed firms. The methodology includes collecting primary data on ESG disclosures through structured firm interviews and supplementing it with financial data from secondary sources like annual reports or DSE filings. We plan to conduct multiple linear regression analyses to understand whether higher ESG disclosure scores are connected with lower debt costs. While conducting the regression, we will be controlling for firm size, age, ownership structure, and industry fixed effects. A vital focus will be identifying whether family-owned businesses exhibit a different relationship compared to non-family businesses. The study aims to contribute to the unfolding body of knowledge on sustainable finance in developing economies. Moreover, it aims to offer policy implications for capital market regulators, investors, and financial institutions. We are currently working with the empirical data to support initiatives to encourage ESG transparency as a mechanism for reducing information asymmetry and enhancing access to affordable finance.

Keywords: *ESG disclosure, Cost of capital, Family firms, Bangladesh*

Sub-Theme: Arts, Culture & Humanities

PID: IRC_ACHP_005

Theatre For Social Justice: Performing Marginalized Voices In Bangladesh

Sylina Biswas Purba, Sadman Shoumik Siam*

Department of Theatre and Performance Studies, Faculty of Arts, University of Dhaka

Corresponding author email: sylinabiswas-24-2020319292@tps.du.ac.bd

Abstract

Bangladeshi theatre is defined in this paper as interdisciplinary praxis for social transformation. In evading the usual mode of aesthetic analysis, history, sociology and political theory are synthesized to answer how theatre has been used in confronting systemic injustice. Using qualitative methodology, this article will describe narrative structures and dramatic strategies through characterization, participation & processional elements that expose hidden power relations while challenging social orders. This study further attempts to analyze performances such as *Lal Mojlum* (directed by Dr. Shahman Moishan), *Roktokorobi* (directed by Tanvir Nahid Khan) and *Mukhomukhi* (directed by Dhiman Chandra Barman) that amplify marginalized voices through presentational productions. It tries to bring together textual and performative analyses of production engagement strategies in transforming the audience from passive receivers into spect-actors by employing Boalian Forum Theatre principles. It brings out hidden truths and encourages the audience to stay alert, therefore going beyond just reflecting societal realities. It aids advocacy, conscientization and represents the issues as they arise. This paper argues that indeed these works are a resistance archive quintessential in terms of providing an example for pedagogy and activism towards equity. Thus, this study makes an addition to performance studies by bringing in a systematic, contextually based model through the socio-political efficacy of theatre in Bangladesh. The findings show how indispensable theatre is pedagogically active in attaining social justice because it has a particular way of making the experience of those who have been marginalized and building community agency.

Keywords: *Bangladeshi Theatre, Marginalized Voice, Performance, Social Transformation.*

Sub-Theme: Applied Science & Research

PID: IRC_ASRP_009

Catalytic Conversion of Hemicellulose to Furfural: Synthesis, Characterization, and Industrial Applications

Abdullah Al Mamun¹, Tanvir Muslim^{1*} & Swapan Kumer Ray²

¹Department of Chemistry, University of Dhaka, Dhaka-1000, Bangladesh

²Fiber and Polymer Research Division, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka, Bangladesh

Abstract

In this work, three new nanostructured catalysts for the extraction of furfural from hemicellulose are synthesized and characterized: V_2O_5 - ZrO_2 , Al_2O_3 - La_2O_3 - V_2O_5 , and TiO_2 - SiO_2 - La_2O_3 . Effective nanoscale fabrication was demonstrated by the average particle sizes of 58 nm, 49 nm, and 65 nm for the corresponding catalysts as determined by scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS). Through the use of UV-vis spectroscopy, the optical band gap energies were determined to be 1.41 eV, 1.77 eV, and 1.50 eV, indicating high photocatalytic activity. By observing distinctive peaks at 700 cm^{-1} , 455 cm^{-1} , and 498 cm^{-1} , FTIR analysis verified the existence of functional groups. To establish catalyst stability and crystallinity, further structural and compositional confirmation was carried out using Raman spectroscopy, X-ray diffraction (XRD), and thermogravimetric analysis (TGA). Furfural was effectively extracted from 4 g of hemicellulose using these catalysts, producing about 1.30 ml. High-Performance Liquid Chromatography (HPLC), Proton Nuclear Magnetic Resonance (¹H NMR), and Gas Chromatography–Mass Spectrometry (GC-MS) were used to confirm the extracted product. A useful platform chemical generated from biomass, furfural has great potential as a sustainable precursor to biodiesel and other bio-based chemicals and fuels. These results highlight the potential of customized nano-catalysts in biomass valorization, offering a productive path toward applications using renewable energy.

Keywords: Hemicellulose, Furfural, Catalyst characterization, Biomass valorization

PID: IRC_ASRP_012

Solvent-Free Synthesis and Characterization of a Linear Biginelli-Type Intermediate: Spectroscopic and In Silico Insights

Labiba Rufaida Zaman, Abdullah Wasif¹, Fatema Tuz Zohora¹, Md Saiful Islam and Md. Ershad Halim^{*1}

¹Department of Chemistry, University of Dhaka, Dhaka - 1000, Bangladesh
 Pharmaceutical Science research Division, BCSIR Laboratories, Dhaka, Bangladesh
 Council of scientific and Industrial research
 (BCSIR), Dhaka -1205, Bangladesh

*Corresponding author's e-mail address: ershadhalim@yahoo.com

Abstract

In this study, one of the key intermediates of the Biginelli reaction was successfully isolated, confirming that the reaction followed the Knoevenagel pathway. The reaction used *N,N'*-dimethylurea, ethyl cyanoacetate, and 4-methoxybenzaldehyde, and was carried out under solvent-free conditions—making the process cost-effective and environmentally friendly by avoiding harmful organic solvents. The structure of the intermediate was confirmed using UV-Vis, FT-IR, and both ¹H and ¹³C NMR spectroscopy, as well as elemental analysis. To better understand its properties, density functional theory (DFT) calculations were also performed, revealing important details about its electronic structure and stability. In addition, molecular docking studies showed strong interactions between the intermediate and bacterial enzyme targets, suggesting possible biological activity. The use of a recyclable nickel catalyst $[Ni(NO_3)_2 \cdot 6H_2O]$ and the simplicity of the procedure make this method a practical and eco-friendly approach for generating and studying Biginelli intermediates with future potential in medicinal chemistry.

PID: IRC_ASRP_017

A Novel One-Pot Approach for the Fabrication of Magnetic-Reduced Graphene Oxide Nanocomposite Using Starch for Strontium Capture

Abdur Rahman¹, Md. Saiful Islam Monir¹, Prianka Saha¹, Ismail M. M. Rahman² & Md. Mahiuddin^{1*}

¹Chemistry Discipline, Khulna University, Khulna- 9208, Bangladesh

²Institute of Environmental Radioactivity, Fukushima University, Japan

*Corresponding author e-mail: mahiuddin@chem.ku.ac.bd

Abstract

Contamination of water by radionuclides is a significant global concern, affecting human health and ecosystems. Magnetic graphene-based sorbents have emerged as promising materials for removing radionuclides from contaminated solutions due to their efficient separation via external magnetic fields. This study presents a novel one-pot synthesis of a magnetic reduced graphene oxide (M-rGO) nanocomposite using starch as a green carbon source to replace conventional carbon allotropes. The synthesized M-rGO was well investigated by UV-Vis, FT-IR, Raman, and EDX spectroscopy along with XRD, SEM, VSM, and TG analyses. The magnetic property was first observed through easy magnetic separation and subsequently quantitatively verified by VSM measurement. The UV-Vis spectra showed an absorption peak at 280 nm and a broad band between 370-405 nm, corresponding to rGO and M-rGO, respectively. Simultaneous rGO and Fe-O bands (541 cm⁻¹) are also observed from the FT-IR spectra, which aligns with the presence of IONPs in the integrated structure. XRD patterns and Raman spectra also confirmed the coexistence of IONPs and rGO, and the SEM images demonstrated 10-20 nm IONPs decorating nano rGO with a size of 40-60 nm. The M-rGO nanocomposite was employed for strontium (Sr(II)) removal from aqueous solutions via batch adsorption experiments. Results demonstrated an adsorption capacity of 45 mg/g and 45% removal efficiency after 4 hours. Kinetic analysis favored the pseudo-second-order model, suggesting chemisorption as the dominant mechanism. Overall, this facile synthesis of starch-derived M-rGO presents a sustainable and effective adsorbent for strontium remediation in contaminated water systems & can be a promising adsorbent for other radionuclides.

Keywords: magnetic reduced graphene oxide (M-rGO), radionuclides, adsorption, magnetic separation.

PID: IRC_ASRP_023

Comparative Study of Mineral Content and Antioxidant Analysis in Local and Imported Dragon Fruits (*Hylocereus polyrhizus*)

Afia Murshida Kusum¹, Md. Sakil¹, Monira Akter Shomapti¹, Md. Kamrul Hasan^{1*} & Md. Anowar Hosen²

¹Department of Chemistry, University of Dhaka-1000, Bangladesh

²Center for Advanced Research in Sciences (CARS), University of Dhaka-1000, Bangladesh

*Corresponding author e-mail: kamrul_du79@du.ac.bd

Dragon fruit, an edible cactus from the Cactaceae family, is rich in essential nutrients including vitamins, minerals, and antioxidants. This study compares the mineral content and antioxidant properties of red dragon fruit (*Hylocereus polyrhizus*) cultivated locally in Bangladesh and imported from Thailand. Mineral concentrations were measured using atomic absorption spectrometry, while vitamin C and polyphenolic compounds were quantified through high-performance liquid chromatography (HPLC). Results show that imported dragon fruit contained significantly higher levels of Fe (12.12 mg/100 g), Mn (2.78 mg/100 g), Zn (4.29 mg/100 g), and Mg (3.96 mg/100 g) compared to local samples (4.10, 2.60, 2.06, and 1.98 mg/100 g, respectively). Vitamin C was also more abundant in the imported fruit. Conversely, local varieties displayed greater antioxidant potential with higher levels of polyphenolic compounds such as Catechol (1.22±0.05 mg/100 g), Rutin hydrate (1.47±0.04 mg/100 g), Myricetin (1.47±0.04 mg/100 g), and Kaempferol (0.36±0.03 mg/100 g), which were either undetectable or present in lower amounts in Thai samples. These findings underscore the nutritional differences of *Hylocereus polyrhizus* based on geographic origin, highlighting mineral and vitamin C of imported fruits superiority, while local fruits have stronger antioxidant properties. Future research should aim to optimize cultivation techniques and sustainable practices to enhance the nutritional quality and market potential of Bangladeshi dragon fruit.

Keywords: *Hylocereus polyrhizus*, Mineral Content, Antioxidant, Geographic Origin

PID: IRC_ASRP_029

Extraction and Chemical Modification of Cellulose from Jute Fibers for Application in Methylene Blue Dye Adsorption

Bishwajit Kumar Karmokar, A. K. Mohiuddin, Farhana Khanam Ferdousi, G. M. Golzar Hossain and Ahsan Habib*

Department of Chemistry, University of Dhaka, Dhaka-1000, Bangladesh

*Corresponding Author E-Mail: habibchem@du.ac.bd

Abstract

Rapid industrialization has made surface water contamination by dyes and pigments a major global environmental concern, particularly in the textile and dyeing industries. Over the past few decades, Bangladesh's export-driven textile industry has expanded significantly, significantly contaminating neighboring water bodies. Because synthetic dyes are poisonous and resistant to biodegradation, their presence in wastewater poses major dangers to human health and aquatic life. This study aims to develop a cost-effective and environmentally friendly adsorbent derived from jute fibers for efficient removal of organic dyes from aqueous solutions. Raw jute fibers were chemically treated using alkali solution for delignification to obtain cellulose. After that it was treated with hydrogen peroxide and sodium chlorite and washed it thrice with distilled water to get purified cellulose. The purified cellulose was further treated with hydrochloric acid in order to obtain micro-sized cellulose. The structural and morphological characteristics of the cellulose samples were analyzed using Scanning Electron Microscopy, Fourier Transform Infrared Spectroscopy, and Energy Dispersive X-ray techniques. Here, methylene blue was taken as a model dye. Adsorption experiments were conducted at neutral pH demonstrated that methylene blue (MB) removal efficiency increased progressively with time and found 92% removal of MB at pH 7.00 with 400 mg cellulose ($[MB] = 1.50 \times 10^{-6} \text{ M}$). Additional attempt was taken to impregnate silver into the cellulose structure to remove chloride ion and found 75% of removal. These findings indicate that chemically modified jute fibers would be a promising, sustainable, and low-cost adsorbent suitable for wastewater treatment applications aimed at removing hazardous cationic dyes as well as removal of chloride from drinking water.

Keywords: *Jute Fiber, Chemical Modification, Micro-sized Cellulose, Wastewater Treatment*

PID: IRC_ASRP_031

Correlates of Glycemic Control and Other Biochemical Parameters Among Patients with Controlled and Uncontrolled Type 2 Diabetes: A Bangladeshi Hospital-Based Cross-Sectional Study

H M Monowar Hossain^{1†}, Fardin Al Fahad Shakib^{1*}, Ifratul Hasan², Mahmud Hossain¹ & Mohammad Borhan Uddin¹

¹*Department of Pharmaceutical Sciences, School of Health and Life Sciences, North South University, Dhaka, Bangladesh*

²*Department of Statistics, Shahjalal University of Science and Technology, Sylhet, Bangladesh*

*Corresponding author email: fardin.shakib@northsouth.edu

Abstract

Type 2 diabetes mellitus (T2DM) is a major public health concern in Bangladesh, where delayed diagnosis and limited healthcare access lead to impaired glycemic control and abnormal biochemical profiles. Despite its severe complications, including cardiovascular, renal, and neuropathic issues, comparative biochemical data between controlled and uncontrolled diabetic patients in Bangladesh remain limited. This study aimed to compare biochemical parameters of some major organs and comorbid conditions among controlled and uncontrolled T2DM patients. A cross-sectional study was conducted from December 2023 to June 2024 at a tertiary hospital in Dhaka, involving 183 T2DM patients aged 30–82 years (84 controlled, 99 uncontrolled) based on HbA1c levels. Data collection included demographics, comorbidities, and laboratory parameters such as glucose levels, lipid profile, renal and liver function, and urine markers. Associations were analyzed using Pearson's chi-square test and logistic regression in R (version R.4.4.2), with statistical significance set at p -value < 0.05 . Uncontrolled patients exhibited significantly higher HbA1c levels (11.58% vs. 6.47%, $p < 0.001$) and a greater prevalence of cardiovascular disease (24% vs. 7%, $\chi^2 = 9.694$, $p = 0.002$) and diabetic ketoacidosis (22% vs. 7%, $\chi^2 = 7.973$, $p = 0.005$). Logistic regression identified random blood sugar (odds ratio (OR) = 1.841, 95% confidence interval (CI): [1.489–2.275], $p < 0.001$), diabetes duration OR = 1.136, 95% CI: [1.041–1.239], $p = 0.004$) as significant predictors of poor glycemic control. Findings emphasize early intervention, routine monitoring, and personalized care to enhance diabetes management in Bangladesh.

Keywords: *Type 2 Diabetes Mellitus, Glycemic Control, Biochemical Markers, Comorbidities.*

PID: IRC_ASRP_036

Facile Fabrication and Characterization of Lignin-Enhanced PVA-Starch Bioplastic Films for Sustainable Packaging Applications

Israt Jahan Nisa¹, Md. Kamruzzaman¹ & Swapan Kumer Ray^{2*}

¹Gopalganj Science and Technology University, Gopalganj, Bangladesh
²Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh
 *Corresponding author's email: swapanray_bcsir@ymail.com

Abstract

This study presents the development of an environmentally friendly bioplastic film composed of alkali-lignin, cassava starch, and polyvinyl alcohol (PVA), plasticized with glycerol and chemically crosslinked using glutaraldehyde. The bioplastic film (LPS) was synthesized using a thermally assisted solution casting method to ensure uniform component dispersion and network integration. Structural and functional characterizations were performed using Fourier transform infrared spectroscopy (FTIR), Thermogravimetric analysis (TGA), X-ray diffraction (XRD), Scanning electron microscopy (SEM), Tensile testing, and assessments of water solubility, moisture content, antimicrobial activity, and biodegradability. FTIR spectra indicated successful integration of components and effective crosslinking. TGA revealed superior thermal stability, with around 7% moisture up to 110°C and residual mass retention of 9% at 650°C. XRD analysis confirmed semi-crystalline morphology that contributes to mechanical enhancement. The optimized film exhibited a tensile strength of 7.87MPa and 38.29% elongation at break. SEM images confirmed a homogeneous microstructure. Additionally, passive antimicrobial resistance against bacterial pathogens and controlled biodegradation in soil were observed. These results suggest that the LPS film is a viable biodegradable packaging material, aligning with circular economy principles and offering a pathway toward reducing dependency on synthetic plastics.

Keywords: Bioplastics, Alkali-lignin, Tensile strength, Biodegradation

PID: IRC_ASRP_043

Solvent-Driven Modulation of Structural and Nonlinear Optical Properties of a Novel Hydrazone Derivative: A Combined Spectroscopic and DFT Study

Jenia Afrin Tanni, Md. Sohel Rana, Md. Abdur Rakib & Md. Rezaul Haque Ansary*

Department of Chemistry, Faculty of Science, University of Rajshahi, Rajshahi -6205, Bangladesh.
 *Corresponding author email: ansary_chem@ru.ac.bd

Abstract

The investigation of solvent effects on molecular structure and optical properties is gaining prominence for the design of advanced functional materials. Solvents can significantly influence the electronic distribution, intermolecular interactions, and geometry of molecules, which in turn affect their spectroscopic behavior and nonlinear optical (NLO) response. **Objectives:** The structural, optical, and charge transfer properties of a new hydrazone derivative, 2-((4-methylbenzyl)oxy)benzoylhydrazine, have been studied in different solvents. The compound was synthesized by refluxing methyl 2-((4-methylbenzyl)oxy)benzoate and hydrazine hydrate in ethanol. The compound was characterized by FTIR, UV-Vis, and ¹H NMR spectroscopy. Theoretical studies of solvatochromism, electronic properties, stability, and reactivity were assessed using thermodynamic parameters, FMOs, MEP, NBO, atomic charges and NCI-RDG analyses. Calculations were carried out using DFT and TD-DFT at the B3LYP/6-311++G(d,p) level, with solvent effects modeled via the IEFPCM approach. The compound exhibited excellent NLO properties, which were enhanced approximately 2 to 3 times with increasing solvent polarity. The $\pi \rightarrow \pi^*$ transition of the compound was prominent and shows a slight red shift between the theoretical and experimental data. The charge transfer analysis revealed solvent-independent excitation behavior, and polar solvents significantly impact the electronic structure of the molecule. Notably, the LUMO level is more responsive to changes in solvent polarity, and softness rises with an increase in polarity. The natural bond orbital (NBO) analysis revealed its 97.441% Lewis structure. These findings highlight the role of solvent polarity in the electronic and NLO properties of hydrazone-based compounds, guiding their design for optoelectronic and photonic applications.

Keywords: NLO, Solvent Effect, Hydrazone derivative, Optoelectronics

PID: IRC_ASRP_047

Influence of Imidazolium-Based Ionic Liquids on Water Structure at Different Concentrations: Role of Alkyl Chain Length and Temperature

 Kawsar Ahmmmed¹ & Md. Abu Bin Hasan Susan^{*1,2}
¹Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

²Dhaka University Nanotechnology Center (DUNC), University of Dhaka, Dhaka 1000, Bangladesh

*Corresponding author email: susan@du.ac.bd

Abstract

The molecular-level interactions of ionic liquids (ILs) in aqueous medium are crucial for understanding how they alter the structure of water. By carefully selecting ILs and controlling their concentration, it is possible to influence reaction pathways, leading to higher product yields or the formation of alternative products. In this work, the modification of water structure by ILs having different chain lengths on imidazolium ions is investigated. The effect of additive concentrations at different temperatures has been studied using spectroscopic, volumetric, and viscometric methods. When water and solutes interact, different types of clusters are formed, and the strength of the hydrogen bonding in these clusters varies. Using dynamic light scattering (DLS), the hydrodynamic diameter is measured to examine the degree of aggregation. The DLS analysis demonstrates that with increasing concentration, large networks of adjacent water layers form. These networks become unstable at higher temperatures and tend to split into smaller fragments. These tiny particles move in a Brownian motion and appear to either form larger aggregates through collisions or further scissions to form very small fragments. To understand molecular-level interactions, intermolecular close-packing, and the extent of solute-solute and solute-solvent interactions, apparent molar volume (Φ_v), Jones-Dole constants, changes in free energy (ΔG), changes in entropy (ΔS), and changes in enthalpy (ΔH) of activation for viscous flow have been investigated. Viscometric and volumetric analysis reveal that ILs having smaller chain lengths tend to function as structure-makers while larger chain lengths function as structure-breakers. This work enhances understanding of IL-water interactions and supports the design of greener and eco-friendly solvents, separation media, or industrial fluids to replace volatile organic solvents.

Keywords: *Ionic Liquids, Water Structure, Hydrogen Bonding, Molecular Level Interactions*

PID: IRC_ASRP_049

Physicochemical and Thermodynamic Properties of Double Salt Protic Ionic Liquids Based on Diethylmethylammonium Ion

Md. Arif Ullah, Jakia Sultana, & Muhammed Shah Miran*

Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

*Corresponding author's email: shahmiran@du.ac.bd

Abstract

Protic ionic liquids (PILs) are the subset of ionic liquids that are prepared through the stoichiometric neutralization of certain Brønsted acids and Brønsted bases. Recently, PILs have been drawing the researcher's attention since they have many exceptional properties such as low melting point (below 100 °C), low vapour pressure, high electrical conductivity, high thermal stability, etc. Mixtures of two PILs having common cation or anion are termed as double salt protic ionic liquids (DSPILs) have a wide range of applications as solvents and electrolytes. To explore the complete potential of PILs and DSPILs as novel functional fluids it is necessary to understand the interactions among the constituent ions in PILs and DSPILs. Two PILs diethylmethylammonium hydrogensulfate ([demaH]HSO₄) and diethylmethylammonium trifluoroacetate ([demaH]CF₃COO) and their DSPILs have been synthesized and characterized using FTIR, TG-DTA analytical method, and their physicochemical properties. Highest conductivity (1.12 S cm² mol⁻¹ at 30 °C) observed for the DSPIL [demaH](HSO₄)_{0.6}(CF₃COO)_{0.4} among the DSPILs. Walden plot shows that [demaH]HSO₄ and the prepared DSPILs are good ionic liquids. Excess molar volume (V_m^E) found positive for DSPILs except [demaH](HSO₄)_{0.5}(CF₃COO)_{0.5}. Excess Gibbs free energy of activation for viscous flow ($\Delta G_m^{\ddagger,E}$) for these DSPILs indicates there exists strong interaction leads to the formation of either dimer, trimer, or oligomer by (HSO₄⁻) ion that introduce free volume in the system. The values of excess entropy of activation for viscous flow ($\Delta S_m^{\ddagger,E}$) indicates system become disordered with the increase of mole fraction of [demaH]HSO₄. The values excess enthalpy of activation for viscous flow ($\Delta H_m^{\ddagger,E}$) suggests physical interaction such as dipole-dipole interaction and London dispersion force also present in the PILs and DSPILs.

PID: IRC ASRP 058

A Preclinical Trial on Antidiabetic Properties of Discarded Litchi chinensis Seeds: A Sustainable Strategy for Utilizing Agricultural Waste

Nirmal Chandra Mahat¹, MD. Bedarul Islam Pranto¹, Sanjida Haque¹, Tamima Yasmin¹, Md. Abul Kashem Tang,^{1*}

¹Department of Applied Nutrition and Food Technology, Islamic University, Kushtia-7003, Bangladesh.
Dept. of Applied Nutrition and Food Technology, Islamic University
Email: makashemsa@gmail.com, akashem@anft.iu.ac.bd

Background: Diabetes mellitus is a significant health and economic challenge, necessitating the development of new, safer, and more effective antidiabetic drugs. Traditional medicinal plants, often regarded as valuable therapeutic options, are being considered as timely and essential in addressing this serious health issue. **Objective:** Assessing the possible anti-diabetic effects of extracts from Litchi chinensis seeds (LCS) is the main objective of the study. **Methods:** The extract was prepared using an aqueous solvent and 80% ethanol. It was subsequently used in laboratory settings to investigate primary alpha amylase inhibition, with acarbose serving as the reference standard. The extract was then administered in vivo to observe the effects on STZ-mediated diabetes rats. The induction of diabetes in Long-Evans rats was achieved by administering a solitary intraperitoneal injection of streptozotocin at a dosage of 80 mg/kg. The hydroethanolic extract of litchi seed were used at different concentrations (100 and 200 mg/kg BW) to treat rats with diabetes. The finding analyzed various biochemical and histological parameters in diabetic rats over a period of 28 day, using established protocols. **Findings:** The results showed significant improvements in plasma glucose ($p < 0.001$) and considerable increased in body weight ($p < 0.0001$). The LCS extract (200 mg/kg BW) showed significant ameliorative effects on glycemic markers, lipid profile, and renal functioning. Additionally, histopathological studies reveal that LCS can potentially reduce renal inflammation as well as hepatic tissue damage. **Implications:** The findings indicate that hydroethanolic litchi seed extracts may have potential therapeutic benefits in managing diabetes and reducing lipid levels.

Keywords: *Litchi chinensis*, Anti-hyperglycemic activity, Streptozotocin, Hyperlipidemia

PID: IRC ASRP 060

Cellulosic derivatives-based polymeric hydrogel nanocomposites: synthesis, antimicrobial activities, and sustainable agricultural applications

Md. Hridoy Ali, Sagar Kumar Dutta^{1*}

¹Chemistry Discipline, Khulna University, Khulna-9208, Bangladesh
*Corresponding Author's E-mail: sagar@chem.ku.ac.bd

Abstract

The goal of green synthesizing metal oxide nanoparticles (NPs) for eco-friendly agriculture is to offer comprehensive details on how to incorporate and develop polymeric hydrogels based on chitosan, polyvinyl alcohol (PVA), sodium alginate, and carboxymethyl cellulose (CMC) for antimicrobial applications and to support agricultural sustainability. To avoid utilizing dangerous chemicals and promote ecological sustainability, NPs were synthesized employing non-toxic plant extracts as organic reducing and stabilizing agents. Using crosslinking procedures, these biosynthesized NPs were incorporated into networks of hydrogels based on biopolymers to produce nanocomposite hydrogels with improved functional and physicochemical characteristics. FTIR, XRD, FESEM, and UV-Vis comprehensive analysis verified the effective production of NPs and homogeneous hydrogel incorporation. The combined action of metal oxide nanoparticles and bioactive polymers resulted in nanocomposite hydrogels that demonstrated potent antibacterial activity towards plant pathogenic fungi, Gram-positive bacteria, and Gram-negative bacteria. In addition to their antibacterial properties, these hydrogels showed remarkable water retention capacity and regulated water release properties, which qualified them for use as soil conditioners. Their porous construction makes it possible to distribute moisture continuously, which is essential for increasing seedlings' resistance to drought. Furthermore, adding essential plant nutrients (NPK fertilizers) through the metal oxide NPs (CeO₂, ZnO, TiO₂) improved soil fertility and encouraged the growth of healthy plants. Their versatility was confirmed by field application tests that showed enhanced development of roots, germination of seeds, and resistance to infection by microbes. Combining nutrient delivery, water management, and antimicrobial safeguarding, these green nanocomposite hydrogels present a viable substitute for synthetic fertilizers and traditional irrigation techniques, making them promising instruments for sustainable, resource-efficient, and eco-friendly cultivation methods.

Keywords: *Metal oxide nanoparticle (NPs), Chitosan, Polyvinyl Alcohol (PVA), Carboxymethyl Cellulose (CMC), NPK fertilizers*

PID: IRC_ASRP_068

Bifurcation Analysis in Understanding Insights of Light Propagation in Nonlinear Optical MediaMd. Masedul Islam^{1*}, Al-Amin Kabir Khan Shohag² & Md. Tarikul Islam¹¹*Department of Mathematics, Faculty of Science, Hajee Mohammad Danesh Science & Technology University, Dinajpur-5200, Bangladesh.*²*Department of Financial and Insurance Mathematics, Ludwig Maximilian University, Munich-80539, Germany.*

*Corresponding author e-mail: masedulislam266@gmail.com

Abstract

The space-time fractional Eckhaus equation is applicable in various fields, including fluid dynamics, optical systems, and wave signal propagation. In this study, we conduct a bifurcation analysis, including the chaotic behavior of the system. By applying the Galilean transformation, the equation (ODE) converts into a dynamical system. For finding the potential energy and equilibrium points, this system is set up in Hamiltonian form. We can determine the conditions under which centers, saddles, or nodes exist by analyzing the Jacobian matrix near the critical points. To illustrate 3D and 2D plots of the bifurcation model and its chaotic behavior, we use the Python programming language, utilizing several libraries such as NumPy, Matplotlib, SciPy, and others. These plots illustrate how the system evolves as well as different dynamic states while parameters are changing. The outcomes check the existence of multiple equilibrium points and system sensitivity to perturbations. This technique delivers an organized way to study the behavior of fractional-order partial differential equations. It can also be a starting point for future research on stability and multi-stability in complex nonlinear systems.

Keywords: *Bifurcation analysis, Chaotic behavior, Eckhaus equation, optical systems.*

PID: IRC_ASRP_075

Effect of intercalating agent composition for the microwave exfoliation of graphite to graphene and their effect on lead ion adsorption by surface tension modification of water.Md. Masum Billah¹, Md. Kamruzzaman^{*,1}, Mohammad Amirul Hoque^{*,2}¹*Gopalganj Science and Technological University, Gopalganj, Dhaka.*²*Fiber and Polymer Research Division, BCSIR Dhaka Laboratories, Bangladesh Council of Scientific and Industrial Research.*

*Corresponding Author email: Amirul.bcsir@yahoo.com

Abstract

Lead ion (Pb²⁺) contamination poses serious environmental and health risks due to its high toxicity and tendency to bioaccumulate. Traditional removal methods are often inefficient, costly, and generate secondary waste. This study explores a rapid, eco-friendly synthesis of few-layer graphene via microwave irradiation using graphite and ammonium bicarbonate, aiming to provide an effective solution for Pb²⁺ removal from water. Two graphene samples, MG (1:1) and MG (1:2), were synthesized, achieving a remarkable yield of 99.5%, surpassing yields reported in prior methods. The structural, morphological, and thermal characteristics of the synthesized graphene were confirmed by FTIR, SEM, TGA, and XRD analyses. Surface tension measurements further indicated enhanced dispersion behavior in aqueous media, influenced by the intercalating agent ratio. Both graphene variants demonstrated excellent Pb²⁺ adsorption efficiency 98.81% for MG (1:2) and 96% for MG (1:1) within 20 minutes, with high adsorption capacities of 296.43 mg/g and 285.93 mg/g, respectively. The adsorption process followed a pseudo-second-order kinetic model, indicating chemisorption, and was best described by the Langmuir isotherm, suggesting monolayer coverage. In regeneration studies, MG (1:2) retained 85% efficiency over four cycles, while MG (1:1) maintained 80%, confirming their reusability and potential for industrial-scale applications. Overall, this research highlights the effectiveness of microwave-activated graphene as a sustainable, high-performance adsorbent for heavy metal remediation. It offers a scalable and low-cost approach toward future-oriented water purification technologies, addressing the urgent need for clean and safe water resources in lead-contaminated regions.

Keywords: *Microwave graphene, lead adsorption, surface tension, reusability.*

PID: IRC_ASRP_079

Empowering Coastal Resilience: Innovative Floating Agriculture for Mitigating Salinity and Flooding in Southwest BangladeshMd. Rezwanaul Islam Shuvo^{1*}, Antora Das², Shabbir Ahammad¹¹*Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh*²*Development Studies Discipline, Khulna University, Khulna-9208, Bangladesh*

*Corresponding Author: rzshuvo001@gmail.com

Abstract

Coastal Bangladesh faces severe challenges from soil salinity and flooding, with Gabura Union, Shyamnagar, exhibiting soil electrical conductivity (EC) of 8–12 dS/m and water EC of 6–10 dS/m, rendering traditional agriculture nearly unfeasible. This study introduces an innovative floating agriculture system to address these issues, enhancing food security and livelihoods. Floating beds were constructed using 40% local saline soil, 20% cocopeat, 20% soil amendments, 15% river sand, and 5% activated charcoal, with gypsum applied at 5 tons/ha to reduce sodicity. Halophytes like (*Eichhornia crassipes*), Ionapata (*Suaeda maritima*), and helencha (*Enhydra fluctuans*) were integrated for their rapid growth and salt absorption capacity (30–40% of dry weight). Field experiments conducted in Gabura Union from January to March 2025 involved 200 farmers, with soil and water EC monitored over 45 days. Results showed a reduction in soil EC to 4–6 dS/m and water EC to 3–5 dS/m, alongside a 30% yield increase for BRRRI dhan 67 and 30% improved water use efficiency compared to conventional methods. The system reduced fertilizer needs by 25% and remained stable under simulated flooding. These findings underscore the potential of floating agriculture to transform saline, flood-prone areas into productive lands, empowering communities, particularly women micro-entrepreneurs, and aligning with SDGs for zero hunger, gender equality, and climate action.

Keywords: *Floating agriculture, Soil salinity, Flood resilience, Halophytes*

PID: IRC_ASRP_089

A Green Approach for the Synthesis of Magnetic Reduced Graphene Oxide as a Promising Adsorbent for the Fast Removal of Pb²⁺ Ion from WastewaterMd. Saiful Islam Monir¹, Abdur Rahman¹, Prianka Saha¹, Ismail M. M. Rahman² & Md. Mahiuddin^{1*}¹*Chemistry Discipline, Khulna University, Khulna- 9208, Bangladesh.*²*Institute of Environmental Radioactivity, Fukushima University, 1 Kanayagawa, Fukushima-Shi, Fukushima 960-1296, Japan.*

*Corresponding author email: mahiuddin@chem.ku.ac.bd

Abstract

Water contamination with heavy metals, especially lead (Pb), poses a significant threat to human health and ecosystems. Removal of Pb(II) through adsorption has garnered considerable research interest. Developing affordable adsorbents is crucial for removing these contaminants. Here, we present a simple and environmentally friendly method for generating a magnetic reduced graphene oxide (rGO/Fe₃O₄) nanocomposite as a promising adsorbent for removing Pb(II). The synthesized rGO/Fe₃O₄ nanocomposite was characterized using UV-Vis spectroscopy (UV-Vis), Fourier transform infrared spectroscopy (FTIR), X-ray diffraction XRD, Field-emission scanning electron microscopy (FE-SEM), Energy-dispersive X-ray (EDX), Vibrating sample magnetometer (VSM), and Thermogravimetric analysis (TGA). Characterization of the composition and morphology reveals that the Fe₃O₄ NPs, with an average diameter of 40 nm, are uniformly distributed within the rGO sheets. Due to the higher electromagnetic properties of rGO and the magnetic properties of Fe₃O₄ nanoparticles, the prepared rGO/Fe₃O₄ nanocomposite exhibited a good adsorption capacity for removing Pb (II) from wastewater through simple magnetic separation. rGO/Fe₃O₄ nanocomposite was used for the removal of Pb (II) from aqueous solution by batch adsorption experiments. The results show that adsorption followed the pseudo-second-order kinetic model. The adsorption capacity was found to be 56.67 mg/g, and the removal efficiency was 60% at 303 K. The results demonstrate that the as-synthesized rGO/Fe₃O₄ nanocomposite serves as an efficient adsorbent for removing Pb (II) from aqueous solutions. The overall results of the study indicate that this newly synthesized magnetically separable rGO/Fe₃O₄ nanocomposite may be potentially utilized for many environmental remediation applications.

Keywords: *rGO/Fe₃O₄ nanocomposite; heavy metals; Piper chaba; adsorption; magnetic separation*

PID: IRC_ASRP_091

Carbonization of Ionic Liquid for Preparation of Nitrogen-Doped Carbon Materials as Counter Electrode in Dye Sensitized Solar Cell

Md Rasel Ali¹ & Md. Abu Bin Hasan Susan*^{1,2}

¹Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

²Dhaka University Nanotechnology Center (DUNC), University of Dhaka, Dhaka 1000, Bangladesh

*Corresponding author email: susan@du.ac.bd

Abstract

Dye-sensitized solar cells (DSSCs) are a promising photovoltaic technology due to their cost-effectiveness, ease of preparation, low toxicity, and manufacturability. However, the widespread adoption of DSSCs is hindered by the high cost and poor durability of platinum (Pt) counter electrodes (CE). This study focuses on the synthesis and characterization of nitrogen-doped carbon (NC) materials from the protic ionic liquid [HDBU]HSO₄, aiming to develop efficient and cost-effective CE for DSSCs. FTIR spectra confirmed the formation of [HDBU]HSO₄, with characteristic bands for N–H, C=N, and S=O groups. Thermogravimetric analysis showed high thermal stability, with [HDBU]HSO₄ retaining 23% weight at 1000 °C, enabling successful carbonization. NC materials were synthesized at 450 °C, 700 °C, and 1000 °C (NC-450, NC-700, and NC-1000). XRD and FESEM revealed that NC-1000 possesses a partially graphitized, porous nanostructure. Elemental analysis showed that carbon content increased and nitrogen decreased with temperature, indicating enhanced graphitization at higher temperatures. Electrochemical studies using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were performed to evaluate CE performance in a typical DSSC electrolyte. NC-1000 exhibited a low peak-to-peak voltage separation ($E_{pp} = 0.12$ V), similar to platinum, and a moderate current density, suggesting good catalytic activity. EIS confirmed a reduced charge transfer resistance ($R_{ct} = 148$ Ω), close to that of platinum (97 Ω). These findings indicate that NC-1000 has promising electrochemical characteristics and structural features suitable for replacing platinum-based CEs in DSSCs. Its low cost, high thermal stability, and good electrocatalytic activity make it a viable alternative for sustainable solar energy technologies.

Keyword: *Dye-sensitized solar cells, Counter electrode, Protic ionic liquid, Nitrogen-doped carbon, Graphitization*

PID: IRC_ASRP_093

Biosynthesis of ZnO Nanoparticles from Lantana camara Leaf and Flower Extracts: A Green and Sustainable Approach for Diverse Applications

Md. Rosly[†], Afrajur Jaman Shefat & Abdul Zabbar[†]

[†]Department of Applied Chemistry and Chemical Engineering, Faculty of Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.

Corresponding author email: rosly0172@gmail.com

Abstract

As the world transitions toward greener technologies, the demand for sustainable nanomaterials are rising. This study introduces an eco-friendly approach to synthesizing zinc oxide (ZnO) nanoparticles using the extracts of *Lantana camara*—an invasive plant commonly regarded as an environmental nuisance. The goal was to create a synthesis method for ZnO nanoparticles that is easy to access, budget-friendly, and safe for the environment. We aimed to thoroughly analyze their properties and test how well they perform in real-world applications. To ensure ecological safety and efficiency, we also compared these nanoparticles with those synthesized through traditional chemical methods. ZnO nanoparticles were synthesized at room temperature by reacting zinc acetate dihydrate with *Lantana camara* extract. Characterization through UV–Vis spectroscopy, FTIR, and XRD confirmed the formation and structural integrity of the nanoparticles. Comparative analysis with chemically synthesized ZnO nanoparticles revealed comparable or superior performance across multiple functional assays. The biosynthesized ZnO NPs demonstrated over 90% photodegradation efficiency of dyes under sunlight, potent antibacterial activity against *E. coli* and *S. aureus*, and antioxidant activity exceeding 65%. When incorporated into biopolymer films, they exhibited notable UV-blocking properties. All experiments were conducted in triplicate to ensure reproducibility. The findings not only validate the effectiveness of this green synthesis route but also highlight the broader potential of using invasive plant species as renewable sources for functional nanomaterials. This work opens promising pathways for sustainable applications in wound healing, water purification, active packaging, and environmental remediation—showcasing how ecological challenges can be transformed into technological solutions.

Keywords: *Lantana camara, Green nanotechnology, ZnO nanoparticles, Sustainable applications.*

PID: IRC_ASRP_100

Sustainable Fabrication of CuO@rGO Hybrid Materials from Battery Waste for High-Performance Glucose Detection.

 Md. Sakil¹, Afia Murshida Kusum¹, Santa Islam², Sabina Yasmin^{2*} & Md Humayun Kabir^{2*}
¹Department of Chemistry, Faculty of Science, University of Dhaka, Dhaka-1000, Bangladesh

²Institute of National Analytical Research and Service (INARS), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhanmondi, Dhaka 1205, Bangladesh

*Corresponding author email: sabinayasmin@bcsir.gov.bd

Abstract

Diabetes is an emerging global health issue, which is promoting the demand for sustainable and affordable glucose monitoring technologies. Simultaneously, lithium-ion battery (LIB) waste poses a tremendous environmental challenge owing to the presence of heavy metals and carbon-rich elements. In this work, we propose to devise a green synthesis approach by recycling spent LIBs to synthesize copper oxide (CuO) nanocubes deposited on reduced graphene oxide (rGO) for nonenzymatic glucose sensing. Copper and graphite were recycled from spent LIBs and served as precursors for the synthesis of rGO/CuO nanocomposites. The structural and morphological characteristics were determined by FESEM, FTIR, XRD, and XPS. Electrochemical behavior was evaluated via cyclic voltammetry (CV), differential pulse voltammetry (DPV), and amperometry with rGO/CuO-modified glassy carbon electrodes (GCE). Real-sample analysis was performed in human saliva. The rGO/CuO hybrid displayed well-dispersed CuO nanocubes and excellent electrocatalytic activity towards glucose oxidation. The sensor showed linear detection range of 8.77 μM –6.04 mM, high sensitivity of 957 $\mu\text{A mM}^{-1} \text{cm}^{-2}$, and a low detection limit of 0.08 μM . It also showed high selectivity, reproducibility, and stability under repeated testing. Recovery in real samples was over 97% with an RSD <3%. This study showcases a green strategy for e-waste valorization through the creation of high-performance glucose biosensors. The approach aligns with circular economy objectives while presenting an auspicious avenue for low-cost, nonenzymatic diagnostics in biomedical and environmental applications.

Keywords: Nonenzymatic Glucose Sensor, Waste LIB Recycling, rGO/CuO Nanocomposite, Green Electrochemical Synthesis

PID: IRC_ASRP_103

Green Fabrication of Silver Nanoparticles (AgNPs) Using *Persicaria chinensis* Leaf Extract and their Antimicrobial Activity Screening Against Multidrug-Resistant Bacteria.

 Dr. Sumon Ganguli¹, Mohammad Sazid Hossain¹
¹Department of Applied Chemistry and Chemical Engineering, Faculty of Science, University of Chittagong, Chittagong-4331, Bangladesh.

*Corresponding author email: sumonganguli@cu.ac.bd

Abstract

The world is facing a serious problem that occurs due to a surge in antimicrobial resistance. Multidrug-resistant (MDR) bacteria are causing increased disease burden. Due to their wide-ranging damage to the bacterial membranes and with the ability to disrupt the DNA of the bacteria, AgNPs are utilized as potential antimicrobial agents. A medicinal herb *Persicaria chinensis* (*P. chinensis*), which is known to contain high amounts of polyphenols, flavonoids and terpenoids, has also shown some antioxidant and antimicrobial activity. The goal of this study is to develop a green and sustainable approach for synthesizing AgNPs using *Persicaria chinensis* leaf extract and antibacterial potential of these AgNPs against MDR bacteria. AgNPs were synthesized by coprecipitation method using 0.001M silver nitrate (AgNO_3), using varying concentrations of *P. Chinensis* extract as reducing and stabilizing agent. UV-Vis spectroscopy confirmed nanoparticle formation. Functional groups were identified by FTIR analysis. While XRD and SEM identified nanoparticle shape and size of about 22 nm. Antibacterial activity was tested against *Proteus* spp. and *Enterobacter* spp. using the agar well diffusion method. The UV-Vis spectra, which revealed a surface plasmon resonance peak at around 425 nm, verified the synthesis of AgNPs, while SEM images demonstrated the irregular spherical form of the nanoparticles. The AgNPs effectively demonstrated antibacterial activity with unique inhibition zones. Further study will focus on improving synthesis parameters and using AgNPs against more gram positive and gram-negative bacteria.

Keywords: Silver Nanoparticles (AgNPs), Medicinal Plant, Green Synthesis, Antibacterial Activity

PID: IRC_ASRP_108

Synthesis, Characterization And Antibacterial Activity Of Picolylamine-Based Schiff Base And Its Transition Metal ComplexesShumiya Akter Shoma^{1*}, Md. Saiful Islam¹, Mahfuza Islam¹, Abdullah Eamin¹ & Dr. Md. Ahsan Habib¹¹*Chemistry Discipline, Khulna University, Bangladesh.*

*Corresponding author email: 211820@ku.ac.bd

Abstract

Picolylamine-based Schiff bases and their transition metal complexes have garnered significant attention due to their diverse biological activities and coordination behavior. In this study, a novel tridentate Schiff base ligand was obtained by the condensation reaction between 2-picolylamine with an appropriate aldehyde under room temperature conditions. The ligand was subsequently reacted with transition metal salts of Ni(II), Co(II), Cu(II), and Zn(II) to form stable metal complexes. All compounds were characterized using various spectroscopic techniques, including FTIR, UV-Vis, ¹H NMR, and elemental analysis. The spectral data suggest that the ligand coordinates through the azomethine nitrogen, one of the phenolic hydroxyl oxygens, and the pyridine nitrogen, confirming its tridentate nature.

The antibacterial activity of the synthesized compounds was evaluated against Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacterial strains using the disc diffusion method. Results revealed that the metal complexes exhibited enhanced antibacterial properties compared to the free Schiff base, attributed to the increased lipophilicity and cell membrane permeability upon complexation (as per the chelation theory). Among the tested complexes, the Cu(II) complex demonstrated the highest antibacterial efficacy. These findings suggest the potential of picolylamine-based Schiff base metal complexes as promising antimicrobial agents and open avenues for further pharmacological studies.

Keywords: *Schiff base, Picolylamine, Transition metal complexes, Antibacterial activity*

PID: IRC_ASRP_116

AI-Driven Simulation and Ray Tracing Framework for Real-Time Fish Detection Analysis vibration in the Bay of BengalMst Ifat Zahan Soma¹, Ratna Ghosh Disha¹, Sanjida Binta Saif Jyoti¹, Shahariar Ryeahan²¹*Department of Mathematics, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh*²*Department of Engineering, Aix-Marseille University, France***Abstract**

The inaccessibility, severe weather, and high expense of physical surveys are some of the main obstacles to monitoring marine species in deep and active ocean regions such as the Bay of Bengal. Our solution to this problem is a simulation-based, AI-integrated ray tracing system that can identify fish presence zones in a virtual setting with limited data. First, we use artificial oceanographic characteristics, including temperature, salinity, depth, and changes in sound speed, to simulate the undersea environment. Models of ecological behaviours are used to generate patterns of movement in fish. Using this artificial dataset, an AI module learns to forecast the dispersion of fish in real time. Refraction, reflection, and attenuation in layered undersea media are considered while simulating the propagation of sonar signals using an acoustic ray tracing model. After that, a machine learning classifier is employed to determine which ray pathways are most likely to cross fish zones. Autonomous updates and detection map construction are made possible by the process's near-real-time pipeline design, eliminating the need for human intervention. In addition to providing a scalable and affordable alternative to conventional fish surveys, this automated method creates new opportunities for observing inaccessible maritime zones in real time.

Keywords: *Bay of Bengal, Underwater Fish Detection, Acoustic Ray Tracing, Artificial Intelligence in Oceanography, Simulation-Based Prediction, Real-Time Marine Monitoring.*

PID: IRC_ASRP_119

An Integrated SEIR Type Model to Understanding the Spread of COVID-19 in Bangladesh: The Role of Vaccination and Waning ImmunityNusrat Jahan Nijhum^{1*}, M. Osman Gani¹¹*Department of Mathematics, Jahangirnagar University, Savar, Dhaka, Bangladesh*

*Corresponding author email: nijhum.stu2017@juniv.edu

Abstract

COVID-19 remains a major threat to global health, especially in regions with limited resources and insufficient access to predictive analytical tools. In the context of Bangladesh, reliable disease modeling is vital for shaping effective public health interventions. This study seeks to better understand how COVID-19 spreads and persists by extending the traditional SEIR model to include vaccination effects, waning immunity, and the possibility of recovery among exposed individuals after vaccination. The goal is to explore how these real-world factors influence the course of the outbreak in Bangladesh. To explore how COVID-19 spreads under real-world conditions, we developed an extended SEIR model using a system of nonlinear differential equations, including vaccination & waning immunity. We used COVID-19 data for Bangladesh, sourced from 'Worldometer' which were further cross-checked with values reported in published studies. Simulations were performed in MATLAB using ode45 solver to capture how the disease evolves over time then also ran a sensitivity analysis. The results showed that infection and recovery rates largely shape the outbreak's peak, while vaccination and waning immunity influence long-term trends. Vaccination alone proved insufficient for controlling the disease without added interventions. When compared to existing SEIR models that include vaccination, our extended model provided a comparatively more realistic reflection of how COVID-19 behaves, particularly in the context of Bangladesh. Future work will focus on introducing a separate vaccination compartment to better capture immunization dynamics. We also aim to apply optimal control techniques to determine effective vaccination strategies.

Keywords: *Epidemiology, COVID-19 SEIR Compartmental Modeling, Vaccination & Waning Immunity Impact, Stability Analysis.*

PID: IRC_ASRP_124

Landslide Prediction and Mitigation in the South Asian Region using Multi-Modal Dataset and Hybrid Machine Learning Approaches.Shyama Barna Bhattacharjee^{1*}, Pritom Gupta & Tanmay Das¹¹*Department of CSE, Faculty of Science and Engineering Technology, University of Science and Technology Chittagong, Chittagong-4202, Bangladesh.*

shyama@ustc.ac.bd

Abstract

Landslides, one of the most devastating natural calamities, cause numerous deaths in South Asian countries each year, especially during the monsoon season. The increasing frequency of landslide events is linked to a combination of environmental and human-induced factors.

In this work, we propose a hybrid machine learning model designed with high landslide prediction accuracy by combining visual terrain features with structured environmental data including amount of rainfall, slope gradient, soil properties, seismic activity, and past landslide records.

Our method follows a two-step process. First, Convolutional Neural Network (CNN) is trained to recognize features such as vegetation cover and drainage presence from the satellite images and convert them into confidence scores of landslide occurrence prediction. To get better accuracy, these outputs are then fed along with the environmental dataset to Random Forest and XGBoost algorithms for classification and testing with cross-validation.

Initial results suggest that for only textual data, Random Forest and XGBoost have achieved 80% and 87% accuracy respectively. However, the CNN assisted hybrid approach improves accuracy where XGBoost showed better precision around 94% with lower learning speed and Random Forest approach showed 88% accuracy with faster learning speed. In our future research scope, we will include more visual features and train and test other learning algorithms to explore better performance. As a part of inference, we will apply these models to a web based application with real-time prediction and practical mitigation guidance.

Keywords: *Landslide prediction, hybrid model, CNN, Random Forest, XGBoost.*

PID: IRC_ASRP_129

Electrochemical Profiling of Azobenzene in Cetyltrimethylammonium Bromide-based Organized Media: Insights into Photoresponsive Systems

Sabikun Naher Sumi¹ & Md. Abu Bin Hasan Susan*^{1,2}

¹Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

²Dhaka University Nanotechnology Center (DUNC), University of Dhaka, Dhaka 1000, Bangladesh

*Corresponding author email: susan@du.ac.bd

Abstract

Azobenzene (AB) and its derivatives are widely recognized for their reversible photoisomerization, making them attractive for molecular switches and optoelectronic devices. This study investigates the electrochemical behavior of AB in surfactant-organized media such as micelles, reverse micelles, and microemulsions formed using cationic surfactant cetyltrimethylammonium bromide (CTAB). Microemulsions were formulated using a CTAB/1-butanol/cyclohexane/water system with varying water-to-surfactant ratios ($W_o = 60.3, 50.2, \text{ and } 40.1$), while reverse micelles were prepared with increasing butanol content (7.0%, 17.0%, and 27.0% w/w). UV-Visible spectroscopy revealed the characteristic $\pi-\pi^*$ absorption for 0.05 mM AB at 309, 311, and 312 nm for reverse micelle, microemulsion, and micelle, respectively. Dynamic Light Scattering confirmed particle sizes below 10 nm across all media, indicating nanoscale organization. Electrochemical behavior was examined using cyclic voltammetry in the range 0 to -1.5 V at a glassy carbon electrode. In reverse micelle and microemulsion systems, a distinct cathodic peak at around -0.7 V indicated a two-electron reduction of AB, while micellar media yielded negligible currents. The systems showed complexity in the electrochemical behavior of AB due to the reduction of CTAB. Comparisons with acetonitrile highlight the unique confinement effects of organized assemblies. These findings advance the understanding of redox dynamics of AB in nanostructured media with a foundation for designing photoresponsive molecular devices with enhanced electrochemical control.

Keywords: Azobenzene, photoresponsive system, microemulsion, electrochemistry

PID: IRC_ASRP_136

Taxonomic Variation of a Marine Teleost Yellowfin Seabream, *Acanthopagrus Latus* of Coastal Population in Bangladesh

Dr. Md Ariful Alam^{1*}, Sk Sefat Ul Islam¹, Md. Rifat Hossain¹, Mallika Roy¹, Sabrina Rinju¹ & Dr. Md. Rajib Sharker¹

¹Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Dumki, Patuakhali-8660, Bangladesh

*Corresponding Author E-mail: arif.genetics@pstu.ac.bd

The yellowfin seabream (*Acanthopagrus latus*) is one of the edible foods of the recently opened coast, which is rich in essential nutrients. All the 56 were sampled in a coastal area of Bangladesh referred to as Kalapara. The present study offers baseline data on morphometric and meristic features, length-length and length-weight ratios, and condition factors as well as seasonal change of *A. latus*. Meristic characters were 5 branchiostegal rays, 21-24 dorsal fin rays, 14 and 15 pectoral fin rays, on the right and left side respectively, 6 pelvic fin rays, 11 anal fin rays, and 17-23 caudal fin rays. Morphometric measures were total length (TL), standard length (SL), fork length (FL) and body weight (BW), the range of 6.2-24.5 cm TL to 6.2-270.4 g BW. The correlations between TL, FL, and SL were unhindered ($r^2 > 0.95$). The values of length-weight relationship (LWR; B) were 2.33 (TL vs BW), 2.17 (SL vs BW), and 2.37 (FL vs BW), which shows me that it grew negatively allometrically. The condition factor (K F) was between 1.1 and 4.2. The effect of seasonal variation was the largest TL (21.94 0.58 cm) and BW (217.12 13,96 g) in December and the smallest (7 0.19 cm, 9 0.8 g) in March. Its maximum growth factor was 1.74 in December and lowest 0.21 in April. The sex index was 3.1:1 (male: female) and the males were predominant in those recorded in January and the females in December. These findings serve as a reference for the management and conservation of *A. latus* in Bangladesh's coastal ecosystem.

Keywords: *Acanthopagrus latus*, Taxonomic variation, Length-weight relationship, Yellowfin Seabream.

PID: IRC_ASRP_139

Harnessing Nature's Chemistry: *Solanum Sisymbriifolium*-Mediated Synthesis of Copper Nanoparticles for Green Biosensors

 Sourav Biswas¹, Tanvir Ahmed Monon¹, Bellal Hossen¹ & Dr. Mst. Jesmin Sultana^{1*},

¹Department of Materials Science and Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh.
 Corresponding author email: jesmin_mse@ru.ac.bd

Conventional nanoparticle synthesis involves some energy-intensive processes and also dangerous chemical emissions, along with major health and environmental risks. Therefore, some practical alternatives have emerged as some eco-friendly synthesis methods through plant extracts. Currently, research about the production of nanoparticles from *Solanum sisymbriifolium* is lacking. Still, further study is needed. This research seeks to assess the biosensing capabilities within the produced particles and to create a cost-effective and eco-friendly process so that green synthesis of copper nanoparticles (Cu-NPs) utilizes *Solanum sisymbriifolium* leaf extract. A 0.01 M copper sulfate solution was stirred constantly at 45 to 50 °C during aqueous leaf extract addition dropwise to it. A shift of color indicated nanoparticle formation. The product was then centrifuged and also purified. The product was analyzed through UV-Vis and FTIR spectroscopy then. In biosensing for detection of heavy metals, Cu-NPs were tested against ferric chloride, ferrous sulfate, also lead acetate 0.01 M solutions. Cu-NP creation was verified via clear surface plasmon resonance at 306 nm using UV-Vis spectrum. FTIR analysis also showed functional groups related to bioactive capping agents. The Cu-NPs demonstrated clear colorimetric responses to each tested metal ion, so this suggests potential for use within simple, fast biosensing devices. *Solanum sisymbriifolium* mediated synthesis shows to us the feasibility of this sustainable nanotechnology approach. The findings set the stage for future researchers toward creating low-cost, plant-based biosensors to use in environmental monitoring and green chemistry.

Keywords: Green Synthesis, Copper Nanoparticles, *Solanum Sisymbriifolium*, Biosensor

PID: IRC_ASRP_143

Fluorescent Nitrogen-Doped Carbon Dots Synthesized from Carbohydrates for Sensing and Bioactivity Applications

 Sumaiya Hasan Suma¹ & Md. Abu Bin Hasan Susan^{*1,2}
¹Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

²Dhaka University Nanotechnology Center (DUNC), University of Dhaka, Dhaka 1000, Bangladesh

 *Corresponding author email: susan@du.ac.bd

Abstract

Carbon dots (CDs) are biocompatible, economical, and environmentally benign nanoparticles with intriguing applications in biomedicine and biophotonics. In this work, highly fluorescent CDs were synthesized from glucose, fructose, sucrose, raffinose, starch, and cellulose through a hydrothermal process. Among these, fructose-derived CDs exhibited the highest fluorescence intensity. To further enhance their optical properties, nitrogen doping was carried out using ammonium hydroxide and urea as nitrogen sources, resulting in nitrogen-doped carbon dots (NCDs) with significantly improved fluorescence performance. Particle size and morphology analyses using dynamic light scattering (DLS) and transmission electron microscopy (TEM) revealed uniform, quasi-spherical particles (0.5-8 nm). UV-visible and attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectroscopy confirmed the presence of -OH, C=O, C=C groups in CDs and additional presence of -NH₂, C-N, C=N groups in NCDs. Elemental analysis using a CHNS analyzer and photoluminescence enhancement observed by a fluorescence spectrophotometer confirmed the nitrogen doping in CDs. Varying the solvent volume (20, 30, and 40 mL) during hydrothermal synthesis revealed that lower volumes produced CDs with higher fluorescence intensity. The synthesized CDs and NCDs exhibited excellent thermal stability (up to 60 °C) and maintained a particle size below 10 nm even after one month of storage. Antimicrobial activities tested on *E. coli* and *B. subtilis* bacterial culture showed no inhibition of growth, inferring negligible antimicrobial property of CDs and NCDs. Cytotoxicity analysis via cell viability assay revealed that CDs and NCDs were highly toxic at the prepared concentration but exhibited reduced toxicity at lower concentrations. Finally, real-sample bilirubin sensing was achieved using the synthesized NCDs.

Keywords: Carbon dots, hydrothermal process, fluorescence, bilirubin.

PID: IRC_ASRP_147

Microplastics Contamination in Cultured Freshwater Fish Species: A Case Study from Trishal Upazila, MymensinghTofa Tus Sadia^{1*}, Shahrin Tabassum¹, Md. Rased Hasan¹ & Md. Badiuzzaman Khan¹¹ *Institute of Environmental Science and Disaster Management, Bangladesh Agricultural University, Mymensingh*

*Corresponding author email: sadiatofa@gmail.com

Abstract

Microplastic pollution is an emerging environmental threat in freshwater ecosystems, with serious implications for aquaculture productivity, ecological health, and food safety. This study presents a baseline assessment of microplastic occurrence, characterization, and influencing factors in two commonly cultured freshwater fish species *Pangasianodon hypophthalmus* (pangas) and *Labeo rohita* (rui) collected from aquaculture farms in Trishal Upazila, Mymensingh. A total of 50 specimens (25 per species) were analyzed. Microplastics were detected in 10 specimens of *P. hypophthalmus* and 9 of *L. rohita*, revealing species-specific differences in ingestion. Contamination prevalence was 40% in *P. hypophthalmus* and 36% in *L. rohita*, with an overall mean of 2.16 ± 1.63 particles per fish. Fragments (35%) and fibers (28%) were the dominant shapes, with most particles (57%) measuring between 1 and 5 mm, indicating ingestion potential across a wide range of aquatic organisms. Carnivorous species exhibited a higher microplastic burden (71%) than omnivorous ones (29%). Demersal fish showed greater microplastic ingestion (55%) than benthopelagic (31%) and pelagic types (14%), suggesting feeding behavior and habitat preferences significantly influence exposure. A positive correlation was observed between microplastic abundance and gastrointestinal tract weight ($R^2 = 0.3387$, $p < 0.05$). ATR-FTIR spectroscopy identified six polymer types, with polypropylene (24%) and polystyrene (21%) most prevalent commonly associated with packaging, feed bags, and aquaculture gear. The presence of microplastics in edible fish raises public health concerns and highlights the need for improved waste management and regular monitoring in freshwater aquaculture.

Keywords: *Microplastics, Freshwater aquaculture, ATR-FTIR spectroscopy, Food safety, Environmental Pollution*

PID: IRC_ASRP_149

Review on Hydro-Chemical Status of Bhairab River in Khulna City, BangladeshUrmi Das¹ & Sharmin Akter^{2*}¹ *Department of Soil, Water and Environment, Khulna University, Khulna-9208, Bangladesh.*² *Department of Environmental Science and Disaster Management, Gopalganj Science and Technology University, Gopalganj-8100, Dhaka, Bangladesh.*

*Corresponding author email: sharminakter.env@gstu.edu.bd

Abstract

Bhairab River is a south-western river of Bangladesh which is passing through the Khulna city. Bhairab River is a source of reserves on aquatic organisms. It is affected by tidal characteristics and seasonal or locational differences. The study represents various hydro-chemical parameters over year in Bhairab, Rupsha Rivers. Some hydro-chemical parameters of Bhairab River such as pH, chloride, hardness, arsenic, lead, cadmium, chromium etc. are considered under appropriate level in water according to World Health Organization (1993) and Bangladesh Standards (ECR, 1997) for river water. But some other parameters of Bhairab River such as temperature, turbidity, DO, BOD, COD, Fe etc. are overcoming standard values of World Health Organization (1993) and Bangladesh Standards (ECR, 1997) for river water. But water parameters of Rupsha River showed diverse changes according to World Health Organization (1993) and Bangladesh Standards (ECR, 1997). The water parameters of Bhairab River showed that river water is congruent for irrigation purposes and aquatic resources. The hydro-chemical parameters of Bhairab River are mostly near to or edge of the standard values. In rainy season, nutrients concentrations are rich in river but in summer and winter seasons, there is a lack of tidal flow of rich nutrients. The water of Bhairab River is still worthy for irrigation purposes. Now, it needs to be monitored to keep concordant record of Bhairab River for better environment.

Keywords: *Hydro-chemical parameters, Tidal Flow*

PID: IRC_ASRP_152

Comprehensive Soliton Solutions and bifurcation analysis for the Landau-Ginzburg-Higgs Equation

Md. Mahfuzur Rahman^{1*}, Palash Kumar Das¹ & M.M.I. Rhifat¹

Department of Mathematics, Faculty of Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

* *Corresponding author email:* mahfuzurrahman6543@gmail.com

Abstract

Real-world nonlinear phenomena can be characterized through nonlinear partial differential equations. This research mainly aims to find the new exact soliton solutions with applications in tropical troposphere's and mid-latitudes of the Landau-Ginzburg-Higgs (LGH) equation by applying the rational method. A variety of solutions illustrates important physical characteristics of nonlinear wave forms. Different varieties of solitons, such as bright shape, dark shape, periodic, M-shaped, W-shaped, kink, anti-kink, bell, anti-bell and so on, are graphically represented by 3D shape and contour plots. Multiple 2D plots for high lightening different wave speeds. Additionally, phase portrait within bifurcation theory is analysed as the part of the qualitative assessment of the undisturbed planar system. Using Galilean transformation, we examine the govern model's bifurcation behaviour. Dynamic phenomena in chaos theory are then carried out by adding the perturbation term to the dynamical system. The detection of chaotic trajectory in the perturbed system is achieved through 2D plots, 3D plots and time scale plots with the same initial condition. This comprehensive research may inspire academics to adopt the proposed skilful, innovative, and concise method throughout their future research endeavours.

Keywords: Landau-Ginzburg-Higgs (LGH) equation; Rational $(1/\phi)$ -method; Analytical wave solutions; Solitons; Bifurcation analysis

PID: IRC_ASRP_155

Augmentation of Photocatalytic and Antibacterial Properties of CuO NPs Via a Green Synthesis Method

Synthesis Method Sumaiya Akter¹², Md. Saiful Alam¹, Sumaya Tabassum², Muhammad Shahriar Bashar³, Subarna Sandhani Dey⁴, Sanjida Khan⁵, Md Farid Ahmed², Samina Ahmed² & Md Sahadat Hossain^{2*}

1 Department of Applied Chemistry and Chemical Engineering, Noakhali Science and Technology University, Noakhali, Bangladesh.

2 Institute of Glass & Ceramic Research and Testing, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka 1205, Bangladesh.

3 Institute of Energy Research & Development, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka 1205, Bangladesh.

4 Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka 1205, Bangladesh.

5 Institute of Leather Engineering and Technology, University of Dhaka, Dhaka-1000, Bangladesh.

**Corresponding author email:* saz8455@gmail.com

Abstract:

CuO NPs are exquisite semiconductors and have a high potential to be utilized in water treatment, though their limited efficiency limits their commercial application in this sector. The current research endorsed a green route to synthesize nano-crystalline CuO having enhanced photocatalytic and antimicrobial properties utilizing *Kalanchoe pinnata*, *Coccinia grandis*, *Ipomoea quamoclit*, *Mirabilis jalapa*, and *Evolvulus glomeratus* plant extract. The characteristics of each CuO NPs specimen were evaluated employing X-ray powder diffraction (XRD), Fourier transform infrared (FTIR), thermogravimetric analysis (TGA), scanning electron microscopy (SEM), and energy dispersive X-ray analysis (EDAX). The peaks of XRD analysis were analogous to the standard CuO peaks, which ascertained the formation of CuO of the tenorite phase. The XRD data were employed to enumerate the dimensions of the samples utilizing different model analogies, and the results were observed to range between 6.44 and 92.37 nm. A noticeable improvement transpired concerning the specific surface area, microstrain, and dislocation density for all the plant extract-mediated synthesized specimens. The morphological analysis carried out by SEM reveals that the synthesized specimens were spherical. TGA analysis confirmed the adequate consistency of the specimens at an elevated thermal state (up to 720 °C). FTIR and EDAX scanned out the existing functional groups and elements, respectively. The green synthesized CuO NPs were observed to develop an amplified photocatalytic behavior towards the concerned dye and antibiotic. A similar trend was observed regarding antibacterial assay for gram-negative (*Escherichia coli*, *Salmonella abony*), as well as gram-positive (*Listeria monocytogenes*, *Staphylococcus aureus*) bacterial species.

Keywords: Water treatment, photocatalysis, antibacterial properties, crystallite size.

Sub-Theme: Education & Pedagogy

PID:IRC_EPP_003

Addressing the Challenges of Technological Advancement in the Teaching and Learning Process of Legal Education: An Analysis from Bangladeshi Academic Institutions

Dr. Md Ataur Rahman

PhD in Law, *G D Goenka University, Haryana, India.*
Legal practitioner & Researcher, *Supreme Court of Bangladesh.*
Corresponding Author's email: ataurresearch17@gmail.com

Abstract

Recent technological advancements that have permeated every facet of education and the teaching and learning methodology demonstrate to be an extremely effective research instrument for addressing the innovative issues facing Bangladeshi academic institutions, particularly those involved in legal education. Consequently, technologically driven pedagogy has replaced the traditional legal education process, creating emerging and challenging problems for Bangladeshi legal institutions. Academic institutions in Bangladesh must revisit their traditional curricula, teaching and learning strategies, and the viability of technology in light of financial constraints. The implementation of technology-oriented legal education is proving to be extremely difficult in Bangladesh, a less technologically advanced country, where the establishment of legal institutions is becoming increasingly necessary. The main issues facing the Bangladeshi educational system were a lack of funding, the absence of curriculum design of technology oriented teaching-learning approach as a required subject, and the lack of technologically feasible techniques application in teaching process. E-learning has currently been advocated as an appropriate alternative for the traditional educational system to help the nation and its educational system progress. This is in order to meet the demand for legal education, which is followed by curriculum design that is focused on technology. This study examined cutting-edge technology-based teaching and learning strategies in the context of legal education in order to pinpoint its contemporary features and the pressing need to compete in this highly technological era. Finally, this paper examines what challenges are facing the teaching and learning methodology of Bangladeshi legal education institutions in light of technology advancements and identifies potential remedies and suggestions.

Keywords: *Teaching and Learning process; Legal Education; Academic Institution; Emerging Technology*

PID:IRC_EPP_009

Bridging Folklore and Education: The Role of Traditional Bengali Theatre for Primary Education in Bangladesh

Sadman Shoumik Siam*, Sylina Biswas Purba

Department of Theatre and Performance Studies, University of Dhaka
**Corresponding author email: sadmanshoumik-24-2020219293@tps.du.ac.bd*

Abstract

This research defines traditional Bengali theatre as a cultural bridge between folklore and primary education in Bangladesh. Significantly, it explores how theatre can be a friendly option for primary education. The value of Jatra and Pala is still undiscovered for educational purposes. As storytelling is in our culture, it can help students understand any study through theatre. Despite our rich cultural heritage, the educational value of Bengali theatre remains poorly understood in education. By exploring educational ways through our indigenous and folklore culture theatre becomes prime content. By using a mixed-method approach, the paper stresses qualitative and quantitative study through the investigation of Bengali traditional theatre. By understanding traditional theatre in a pedagogical way, students can learn more about their own heritage and culture. This research illustrates the possibilities for primary education in Bangladesh to connect themselves through performances like puppetry with their own stories. These stories will make their study more lively and interesting. Traditional theatre can help students imagine creative ways of studying. In the future this paper can play a vital role in the pedagogical movement. It can show a path not only to the teachers but also to the students to realize how our own culture, theatre can demonstrate creative writings and study fields through storytelling.

Keywords: *Traditional theatre, Primary education, Folklore, Puppetry*

PID:IRC_EPP_011

Gamified Learning Interface: A Visual Mapping Approach with Emotional Cues to Combat Academic Apathy in Bangladesh.

Sayma Siddique Mitu^{1*}, Mohammad Abdun Nur², Rukaiya Hassan Anjhum³, Tanjim Mostofa Ratul⁴ & Nishat Naila Tasnim Oishee⁵

¹*Department of Botany, University of Chittagong, Chattogram-4331, Bangladesh*

²*Department of Textile Engineering, DUET, Gazipur-1707, Dhaka, Bangladesh*

³*Department of Physics, Govt. Bangla College, Dhaka Central University, Dhaka, Bangladesh*

⁴*Department of Zoology, Kazi Azimuddin University College, Gazipur-1707, Dhaka, Bangladesh*

⁵*Department of Zoology, Muminunnisa Govt. Mohila College, Mymensingh, Bangladesh.*

*Author for correspondence Email: saymasiddique515@gmail.com

Abstract

The widespread integration of smartphones has led to an excessive gaming habit among today's youth, leading to psychological challenges like lower self-regulation and a reduction of academic focus. This study applies an EdTech gaming interface that aims to examine the prevalence, causes, and academic impact of online gaming addiction among both rural and urban students in Bangladesh. However, very few studies so far have proposed educational approaches that are both emotionally engaging for students and practically accessible. This study proposes a feasible, low-cost, and sustainable visual concept mapping strategy enriched with emotional cues to counter gaming-related academic disengagement. Instead of limiting screen time, it redirects digital interest toward effective and accessible learning. As a solution, we explore how learning interest can be restored among students through the use of visual concept mapping enriched with human facial cues. A perception-based pilot survey (N = 71) was then conducted among school students to compare traditional textbooks versus visual mapping tools. Only 19.7% found traditional textbooks highly engaging, while 85.9% preferred the visual learning experience; 76.1% reported better understanding and faster learning; and 87.3% supported integrating visuals in future textbooks. Findings show that emotionally engaging visual tools can serve as both educational aids and psychological defenses against gaming addiction. With wider trials and teacher training, the model could be scaled nationally as a sustainable and policy-backed solution.

Keywords: *Online Gaming Addiction, Visual Concept Mapping, Sustainable EdTech Innovation, Emotional Engagement in Learning.*

Sub-Theme: Education & Pedagogy

PID:IRC_LSBP_005

Comparative Evaluation of Antibacterial, Anti-inflammatory and Antioxidant Activities of Methanolic Seed Extract of *Asteracantha longifolia* and Its Silver Nanoparticles (AgNPs) Formulation

A.H.M Mazbah Uddin¹, Sanjida Khandakar Konka¹, Mim Akter Brishti¹ & Tamanna¹

¹Department of pharmacy, Faculty of life Science, Mawlana Bhashani Science and Technology University, Tangail 1902, Bangladesh.

*Corresponding Author email: mazbahphar09@gmail.com

Abstract

Background: *Asteracantha longifolia* commonly known as talmakhna or kokilaksha, belongs to Acanthaceae family. The seeds of *Asteracantha longifolia* contain bioactive compounds contributing to their medicinal efficacy such as managing urinary disorders, kidney health, liver function, and reproductive health. **Objectives:** This study aimed to investigate the antibacterial, anti-inflammatory and antioxidant activity of methanol extract of *Asteracantha longifolia* and AgNPs-extract. **Methodology:** *Asteracantha longifolia* was collected, washed, dried and crushed into fine powder, then dissolved into methanol. Silver nanoparticles were prepared by reducing AgNO₃ in the presence of NaBH₄. Then mixed the previously prepared AgNPs with methanol extract. Antibacterial, anti-inflammatory and antioxidant activity was measured using *Vibrio cholerae*, egg albumin and DPPH respectively. **Findings:** Antibacterial activity increased with concentration. The methanolic extract showed zones of 7.5–12.5mm, while the AgNPs-extract showed slightly higher zones of 8.5–14mm across 50–400µg/mL concentrations. Ciprofloxacin (30 µg/disc) showed the highest activity with a 28 mm zone. The anti-inflammatory assay showed IC₅₀ values of 268.225µg/mL and 237.403µg/mL for methanolic extract and AgNPs-extract respectively, indicating improved activity with nanoparticle combination where standard aspirin exhibited the highest activity with an IC₅₀ of 192.22µg/mL. Antioxidant assay demonstrated IC₅₀ values of 60.20µg/mL and 45.99µg/mL for methanolic extract and AgNPs-extract respectively, indicating enhanced antioxidant potential with nanoparticle formulation. Interestingly, AgNPs combination showed greater activity than the standard ascorbic acid with an IC₅₀ of 54.25µg/mL. **Future directions:** Future studies should explore molecular mechanisms, in vivo efficacy, toxicity, and formulation of AgNPs-extracts, while optimizing activity through alternative nanoparticles and isolation of key bioactive compounds.

Keywords: AgNPs, antibacterial activity, anti-inflammatory activity, antioxidant activity.

PID:IRC_LSBP_007

Computational Prediction and Construction of a Multi-Epitope Subunit Vaccine Against *Haemophilus ducreyi*

A. M. Sadik¹, Nazmul Ahsan Sarker¹, Mst. Afroja Akter¹, Most. Anamika Khatun¹ & Md. Tariqul Islam¹, Shahidur Rahman^{1,2*}

¹Department of Biochemistry and Biotechnology, Khwaja Yunus Ali University, Enayetpur, Sirajganj-675, Bangladesh

²Department of Biomedicine, University of Eastern Finland

*Corresponding author email: shahidur.rahman.bge@gmail.com

Abstract

Background: *Haemophilus ducreyi* is an important human pathogen associated with chancroid and other soft tissue infections, a primary cause of genital ulceration in underdeveloped countries. The absence of an effective vaccine highlights the need for new immunoprophylactic strategies. **Objectives:** This study aimed to design a multi-epitope subunit vaccine against *H. ducreyi* using immunoinformatics tools to predict and validate promising immunogenic targets. **Methods:** Proteins of *H. ducreyi* were extracted from NCBI database and then screened for vaccine designation. ABCPred was applied for prediction of B cell epitopes and T-cell epitopes were identified by IEDB server. All predicted epitopes were evaluated based on antigenic property (VaxiJen 2.0), allergenicity (AllerTOP) and conservancy. Population coverage analysis of T-cell epitopes based on IEDB. Selected epitopes were joined with EAAAK and GPGPG linkers, and a 50S ribosomal protein L7/L12 adjuvant was added to enhance immunogenicity. The final vaccine construct's 3D structure was modeled with trRosetta and validated by Ramachandran plot analysis. **Findings:** Finally designed vaccine exhibited high antigenic property, non-allergenic and non-toxic property. All selected epitopes showed 100% conservancy. Also, T-cell epitopes have achieved broad population coverage (91-98%). In terms of structural validation, the results revealed that 93% of residues were in favored regions of Ramachandran plot. **Future Implications:** This in silico designed multi-epitope vaccine is a promising candidate for further in vitro and in vivo experiments to evaluate immunogenicity and protective efficacy of vaccine candidate in confirmation to be used as an efficient preventive strategy against this life-threatening pathogen.

Keywords: *Haemophilus ducreyi*, chancroid, epitope-based vaccine design, population coverage

Investigation of Sundarban's Medicinal Plant *Heritiera fomes* Targeting Bacterial Quorum Sensing and Biofilm Inhibitory Potentials: An Innovative Approach to Antibacterial Drug Development

Fawzia Tabassum¹, Argho Mukherjee¹, Pritam Sarkar¹ & Nripendra Nath Biswas^{1*}

¹Pharmacy Discipline, Life Science School, Khulna University, Khulna-9208, Bangladesh

*Corresponding author email: nnathbiswas@gmail.com

Abstract Background: Antimicrobial resistance is a global health threat, necessitating innovative strategies to target bacterial virulence without inducing resistance. **Objective:** This study investigates bioactive compounds from *Heritiera fomes*, a Sundarban mangrove plant, for their anti-biofilm and anti-quorum-sensing (QS) activities against *Pseudomonas aeruginosa*. **Methodology:** *H. fomes* leaves were extracted with ethanol and separated into n-hexane, dichloromethane, ethyl acetate, and water layers. Their anti-biofilm and anti quorum-sensing effects were tested using crystal violet staining, swarming motility assays, and pyocyanin inhibition. Active compounds from the dichloromethane fraction were isolated with column chromatography, identified via GC-MS, and examined through molecular docking with the LasR protein. **Findings:** Dichloromethane and ethanolic extracts at 4 mg/ml showed significant anti-biofilm (67.16%, 65.88%), pyocyanin inhibition (66.34%, 61.26%), and swarming motility inhibition (72.38%, 67.87%). The isolated compound, trans-2-methyl-4-n-butylthiane, S, S-dioxide (identified through GC-MS), exhibited notable antibiofilm (60.25%), pyocyanin inhibition (50.02%), and swarming inhibition (65.5%) activities. Docking analysis revealed strong binding to LasR (-7.2 kcal/mol) protein compared to the standard Furanone C-30 (-5.2 kcal/mol). **Future Direction:** The findings support *H. fomes* as a promising source for developing novel anti-quorum-sensing and anti biofilm agents as alternative antimicrobial therapies, avoiding resistance.

Keywords: *Anti-quorum sensing, Antibiofilm, Column chromatography, GC-MS*

Isolation of Multidrug-Resistant *Staphylococcus aureus* From Surface Water Samples

Fariha Nowshin^{*1}, Kamrunnahar Sarker¹, Tafsir Karim¹, Shabani Sultana Anny¹, Israk Iram Oyshe¹ & Fariza Shams¹

¹ Department of Biochemistry and Microbiology, School of Health and Life Sciences, North South University, Dhaka-1229, Bangladesh.

Corresponding author email: fariha.nowshin02@northsouth.edu

Abstract

Aquatic ecosystems, particularly river waters, play critical roles in the water cycle. River water can become polluted by various types of pollutants, including antibiotics. Thus, these environments are ideal for acquiring and disseminating antibiotic resistance. Human exposure to antibiotic-resistant bacteria (ARB) and antibiotic-resistance genes (ARGs) in aquatic environments may present an extra health concern. The study aimed to investigate the presence of multidrug-resistant *Staphylococcus aureus* in lakes and rivers near Dhaka. Surface water from lakes and rivers was aseptically collected. Phenotypic characteristics and conventional Polymerase Chain Reaction (PCR) detected and identified *Staphylococcus aureus*. The Kirby-Bauer disc diffusion method was used to find the antibiotic susceptibility pattern. The biofilm-forming ability was tested by Congo red agar and 96-well microtiter plate methods.

Eighteen *S. aureus* strains were isolated. Ninety per cent of isolates were multidrug-resistant (MDR). Using Cefoxitin as a surrogate marker, five isolates were found to be MRSA, and thirteen strains were MSSA. All the strains showed the ability to form biofilms of varying strength.

The environment harbours antibiotic-resistant microorganisms and facilitates the spread of resistant genes. Further investigation of the impact of antibiotic-resistant bacteria on human health is crucial. A comprehensive plan must be developed with concerted efforts towards infection prevention, better antibiotic usage, and halting the spread of resistance when it does arise.

Key words: *Staphylococcus aureus, Antibiotic resistance, Biofilm.*

PID:IRC_LSBP_015

Ameliorative effects of a Phyto therapeutic ‘Plant-Based Powder Mix’ on arsenic induced multiple organ dysfunctions in Swiss albino mice.

Fatema Hossain Chowdhury¹, Shetu Roy¹, Farhana Forhad Nayma¹, Taiyara Mahjabin¹ & Md. Khairul Islam^{1*}

¹Department of Biochemistry and Molecular Biology, Faculty of Life Science, Mawlana Bhashani Science and Technology University, Santosh, Tangail- 1902, Bangladesh.

*Corresponding author email: drkhairul.mbstu.ac.bd

Abstract

Chronic exposure to arsenic is a major public health concern globally. In Bangladesh, particularly in rural areas, naturally occurring arsenic in groundwater continues to pose potential health risks. Chronic arsenic exposure is associated with a wide range of health issues, including neurotoxicity, hepatic injury, metabolic dysfunction, and multi-organ damage. Although current treatments exist, their side effects and limited accessibility in rural areas need safer and more sustainable alternatives. Plant-derived compounds have shown potential in reducing oxidative and inflammatory damage, but limited studies have investigated the combined effect of multiple phytochemicals in mitigating arsenic toxicity of different doses. This study aims to explore the protective role of a plant-based powder mix including *Moringa oleifera*, *Spinacia oleracea* (spinach), *Nigella sativa* (black seed), and *Curcuma longa* (turmeric) against arsenic induced multi-organ dysfunction and dose response relationship in mice model. Seventy-two Swiss albino mice were randomly assigned into eight experimental groups, including controls, arsenic-only (10, 20, and 30 mg/L doses), treatment-only, and corresponding arsenic + treatment groups. After 4 weeks of arsenic exposure, the herbal formulation was administered orally for 8 weeks. Blood samples were collected for biochemical analysis. Histopathological evaluations were conducted on the liver, heart, lungs, stomach, and brain using Hematoxylin and Eosin (H&E) staining. Tissues were treated with TRIzol for RNA extraction to evaluate gene expression of *Nrf2*, *TRβ*, and *Ghrl* performed by quantitative RT-PCR. Arsenic exposure induced dose-dependent histological damage across multiple organs, including myocardial edema, hepatocellular vacuolation, neuronal degeneration, gastric mucosal disruption, and pulmonary inflammation. Conversely, treatment with the herbal powder significantly ameliorated these pathological changes. **Biochemical analysis of serum markers** showed that arsenic exposure led to significant elevation ($p < 0.05$) in **ALT, AST, LDH, glucose and TG** levels compared to the control group and the treatment reversed these effects in a dose dependent manner. Gene expression analysis revealed that arsenic exposure down regulated *Ghrl* (0.8-fold) and *TRβ* (0.73-fold), while slightly increasing *Nrf2* (1.13-fold). The findings suggest that the synergistic action of four plant compounds contributed to effectively reducing arsenic toxicity.

Keywords: Arsenic toxicity, multi-organ dysfunction, biochemical analysis.

PID:IRC_LSBP_017

Development of Shrimp-*Artemia* Co-culture: An Approach of Climate Adaptive Shrimp Culture in Coastal Bangladesh

Israt Jahan^{1*}, Mst Afia Humaira¹, Romana Akter Shapla¹, Hridoy Saha¹, Mst. Muslima Khatun¹, Md Mostafizur Rahman², Shikder Saiful Islam¹

Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna-9208
Corresponding author E-mail: isratjahanjyoti199920@gmail.com

Abstract

This study investigated the hatching performance, naupliar and reproductive development of three *Artemia* strains (*Artemia* sp. GSL1, *Artemia* sp. A4B, and *Artemia* sp. GSL2) to evaluate their suitability for shrimp-*Artemia* co-culture, as well as their influence on shrimp survival and nutritional benefits. Cysts were incubated under optimal temperature, salinity, and light conditions, and hatching rates were recorded at 8, 12, 24, and 30 hours (Figure.1). *Artemia* sp. GSL1 exhibited early and consistent hatching (44.84%–67.81%), while *Artemia* sp. A4B showed delayed but high hatching at 24 hours (86.86%). No hatching was observed in *Artemia* sp. GSL2 up to 24 hours. Microscopic observation of naupliar and reproductive development revealed that *Artemia* sp. A4B reached reproductive maturity faster than other two strains. Reproductive performance of *Artemia* sp. A4B was further assessed by culturing a single pair in two water volumes (250 ml and 500 ml) (Figure.2). The 500 ml setup yielded significantly higher number of nauplii, adults, and female production, suggesting water volume as a key factor in optimizing reproduction. To assess the impact on shrimp survival and nutrition, a six-day feeding trial was conducted with three groups: control (shrimp + commercial feed), T₁ (Shrimp + *Artemia*), and T₂ (shrimp + commercial feed + *Artemia*) (Figure.3). Shrimp survival declined across all groups, with mortality increasing sharply after day 4 and ending at 20–25% survival. Although *Artemia*-fed groups initially had higher survival, no treatment prevented long-term decline. Nutritional analysis showed no significant differences in moisture, lipid, or ash content among groups (Figure.4). However, protein content was significantly lower in T₁, indicating *Artemia* alone is insufficient to meet shrimp protein needs. Overall, *Artemia* sp. A4B showed superior hatch performance and reproductive potential, supporting its application in co-culture. While *Artemia* supplementation enhanced early survival and nutrition, its combination with commercial feed (T₂) offered the most promising results for integrated shrimp-*Artemia* system.

PID:IRC_LSBP_019

Isolation and Identification of Marine Fungi from Intertidal Sediments in Cox's Bazar, Bangladesh
Kakon Saha^{1*}, Dr. SM Sharifuzzaman²¹Student, Institute of Marine Sciences, Faculty of Marine Sciences and Fisheries, University of Chittagong, Chattogram 4331, Bangladesh²Professor, Institute of Marine Sciences, Faculty of Marine Sciences and Fisheries University of Chittagong, Chattogram 4331, Bangladesh

*Corresponding author e-mail: sahakakon284@gmail.com

Abstract

Marine fungi are crucial to coastal ecosystem functioning yet inadequately explored in Bangladesh. This research aimed to isolate and identify marine fungi from the intertidal sediments of Cox's Bazar, Bangladesh, employing culture-dependent techniques. Sampling was conducted in December 2023 across ten intertidal locations, where key environmental parameters such as water salinity (32 ± 3 ppt), pH (8.35 ± 0.5), temperature (24.95 ± 2.35 °C), electrical conductivity (17.22 ± 2.8 mS/cm), sediment pH (6.6 ± 0.2), and air temperature (25.5 ± 2.5 °C) were recorded to understand habitat influences on fungal colonization. Fungi were isolated using serial dilution (10^{-1} to 10^{-3}) and spread plate methods on Potato Dextrose Agar (PDA) supplemented with 3.2% NaCl and antibiotics to suppress bacterial proliferation. Plates were incubated at 28 ± 2 °C for 7-14 days, followed by subculturing to obtain pure isolates. Fungal identification was based on colony morphology and microscopic features according to standard taxonomic protocols. A total of 21 purified fungal isolates representing 7 genera, including *Saksenaea*, *Fusarium*, *Aspergillus*, *Eurotium*, *Trichophyton*, *Rhizopus*, and *Penicillium*, were identified from the intertidal sediments of Cox's Bazar, reflecting a diverse and well-adapted fungal community in this coastal region. The average fungal spore count was 4.0×10^4 CFU/g of sediment, indicating a moderate fungal biomass consistent with a nutrient-rich and relatively unpolluted intertidal environment. The results provide foundational insights into the mostly ignored fungal diversity of Bangladesh's intertidal zones, highlighting their ecological significance and potential in molecular and biotechnological applications. Advancing knowledge of the marine fungi supports conservation efforts, enhances ecosystem resilience, and promotes sustainable coastal management and broader environmental transformation goals.

Keywords: Marine fungi, Intertidal sediments, Fungal diversity, Coastal ecosystems

PID:IRC_LSBP_021

Isolation And Characterization Of Bacteriophages Against Multi-Drug Resistant *Klebsiella* spp.Khadizatul Kobra^{1*}, Asifa Siddika Badhon¹, Maisha Manowara¹, Toshin Prottasha¹, Fouzia Ferdous & Fariza Shams¹ Department of Biochemistry and Microbiology, School of Health and Life Sciences, North South University, Dhaka-1229, Bangladesh.

Corresponding author email: Khadizatul.kobra21@northsouth.edu

Abstract

The emergence of multidrug-resistant (MDR) bacteria and antimicrobial resistance (AMR) are considered a global threat. Alternative therapeutic options are urgently needed. Phage therapy is a future alternative to antibiotic treatment of bacterial infections. Their ability to co-evolve alongside bacterial adaptations enhances their effectiveness in combating antimicrobial resistance. Phages are also safe for the environment, which makes them appropriate for use in industrial, agricultural, and clinical settings.

This work aimed to isolate bacteriophages against MDR *Klebsiella* spp. and characterize those phages.

Several environmental and clinical *Klebsiella* strains were collected, and their antibiotic resistance patterns were examined.

Bacteriophages were isolated from soil and wastewater samples. Double Layer Agar (DLA) and Spot Test methods were employed for isolation and characterization of bacteriophages, host range determination, and to check their stability under different pH and temperature conditions.

The isolated bacteriophages showed lytic potential against several MDR *Klebsiella* strains. The phages remained stable under a range of pH and temperature conditions.

Future Implications: In the future, these phages will undergo investigation, including sequencing. The antibiofilm activity and phage-antibiotic synergy will also be studied to develop tailored phage-based treatment options for clinical use.

Keywords: Bacteriophages, multidrug-resistant bacteria, *Klebsiella* spp. phage-based treatment

PID:IRC_LSBP_025

Types of manuscript: Original Research Article
Multi-Omics Profiling Unveils UBE2C, MCM2, AURKA, and TP53 as Core Regulatory Hubs of Interconnected Oncogenic Networks in Women's Breast, Ovarian, and Endometrial Cancers
 Md. Abdullah¹, Ahidur Rahman¹, Md. Shafiqul Islam², Md. Ariful Islam⁴, Md. Ramjan Sheikh^{3*}

¹Department of Pharmacy, Pabna University of Science and Technology, Pabna-6600, Bangladesh;

²Department of Zoology, University of Rajshahi, Rajshahi-6205, Bangladesh

³Department of Biochemistry & Molecular Biology, Hajee Mohammad Danesh Science and Technology University, Dinajpur

⁴Scientific Officer, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka-1205, Bangladesh

*Correspondence should be addressed to Md. Ramjan Sheikh

rsheikh1996@universepg.com

Abstract

Uterine corpus endometrial cancers (UCEC), ovarian cancer (OV), and breast cancer (BRCA) are common among women and have established epidemiological links. While the molecular reasons for their co-occurrence remain unclear, women diagnosed with one often develop others. The main objective was to analyze hub genes and common differentially expressed genes (DEGs) by using a systems biology approach across these cancers to uncover shared oncogenic networks and potential clinical targets. Microarray datasets for breast (GSE10797), ovarian (GSE18520), and endometrial (GSE7305) cancers were obtained from GEO. Differentially expressed genes (DEGs) were identified using LIMMA with cutoffs of $|\log_2FC| > 1$ and $p < 0.01$. Shared DEGs across all three datasets were analyzed for protein-protein interactions (PPI) with STRING and Cytoscape, highlighting key hub genes. Methylation data from TCGA was analyzed using UALCAN and MEXPRESS. Immune infiltration correlations, particularly involving CD8⁺ T cells, were evaluated with TIMER 2.0. Functional enrichment analysis employed DAVID and Metascape, while drug-target predictions and pharmacokinetic evaluations were performed with DGIdb, DrugBank, and SwissADME. Thirty-eight conserved DEGs were identified, with UBE2C, MCM2, AURKA, and TP53 emerging as central upregulated hub genes ($p < 0.01$). Methylation analysis revealed cancer-specific patterns, with UBE2C hypermethylated in BRCA/OV and hypomethylated in UCEC; TP53 was hypermethylated across multiple cancers. Hub gene expression showed an inverse correlation with CD8⁺ T cell infiltration ($\rho = -0.32$ to -0.47), suggesting immune evasion. Functional enrichment linked these genes to cell cycle and DNA replication pathways. Drug prediction identified Pamiparib and Rucaparib as potential therapeutic agents. This multi-omics study identifies common molecular drivers across BRCA, OV, and UCEC, highlighting hub genes with diagnostic and therapeutic importance. These findings support the application of pan-cancer precision oncology and secondary cancer risk management strategies.

Keywords: Pan-cancer hub genes, multi-omics integration, gynecologic malignancies, precision oncology, immune infiltration, therapeutic targeting.

PID:IRC_LSBP_034

Molecular Characterization and Mutation Analysis of the ATP7B Gene in Bangladeshi Wilson Disease Patients

Hafizul Islam¹, Salma Binte Kashem¹, Md. Nadim Hossain¹, Fahim Alam Nobel¹, Mohammad Jhirul Islam¹, Mohammad Nasir Uddin¹ & Mohammad Kamruzzaman^{1*}

¹Department of Biochemistry and Molecular Biology, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh

Corresponding author: mkamruzzaman.bmb@mbstu.ac.bd

Abstract

Wilson disease (WD) is a rare autosomal recessive disorder caused by mutations in the *ATP7B* gene, leading to copper accumulation in vital organs. Early identification of pathogenic mutations is critical for diagnosis and treatment. To identify and characterize mutations in exons 5, 12, 14, and 15 of the *ATP7B* gene among clinically suspected Bangladeshi WD patients. Genomic DNA was extracted from blood samples of 15 clinically suspected WD patients. Exon-specific primers were used for PCR amplification, followed by agarose gel electrophoresis. Purified products were sequenced using the Sanger method with BigDye™ Terminator v3.1 chemistry, and sequence analysis was performed through alignment with the *ATP7B* reference genome. In silico tools were used to evaluate the functional impact of detected mutations. Sanger sequencing revealed key mutations in exon 5 (c.1621delG, c.1623A>T, c.1627T>G) and exon 15 (c.2331delC, c.2353_2354insT), all resulting in frameshift or missense effects. In silico analysis identified 311 missense variants across the four exons, of which 52 were classified as pathogenic or likely pathogenic, and 27 as potentially damaging. This study emphasizes the importance of molecular diagnostics in early WD detection. Identified variants may support improved patient management and provide a foundation for genetic counseling in Bangladesh.

Keywords: Wilson disease, *ATP7B* gene, Sanger sequencing, in-silico analysis

PID:IRC_LSBP_039

An Investigation on Stray Dogs' Health and Common Disorders with Their Associated Risk FactorsMd. Niamot Ali^a, Nabin Kumar Das^a, Md. Arafat Hossain^a, Dipak Das^a, Abdulla Al Mamun Bhuyan^{a*}*Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh***Abstract**

Free-roaming dogs, often referred to as stray dogs, are a global concern. Their population is on the rise, particularly in developing and underdeveloped countries, posing a significant risk of disease transmission. This study aims to provide a comprehensive understanding on the prevalence of common diseases and their associated risk factors in stray dogs. A cross-sectional study was conducted over a period (01.09.2024–01.02.2025), and SPSS-27 was used to analyze the data. The study reported that 44.8% of the dogs suffered from various diseases or disorders, 13.1% were vaccinated against rabies, and the overall body conditions were as follows: underweight 3.9%, ideal 92.9%, overweight 3%, and obese 0.2%. The prevalence of different common disorders like injury were 1.28%, lameness 8.14%, seizure 1.71%, cataract 0.43%, conjunctivitis 1.93%, CTVT 3.85%, mammary gland tumor 0.43%, glaucoma 0.21%, bone fracture 0.21%, wound 10.92% and external parasitic infestation like lice: 9.42%, flea: 13.46%, tick: 0.86%, mange 6.0%, myiasis 1.28%, regardless of age, sex, or body conditions. Male dogs showed significantly higher no of lameness ($p=0.025$), and wound (0.038), CTVT in females ($p=0.045$), conjunctivitis in local breeds ($p=0.008$), myiasis in puppies ($p<0.001$), cataract ($p<0.001$), fracture ($p=0.003$), wound ($p=0.038$) in adult dogs and mange in ideal body conditioned dogs ($p<0.001$). The findings of this study underscore the critical need for early preventive care strategies and risk factor awareness initiatives for veterinary practitioners and animal welfare activists to improve the health of stray dogs.

Keywords: *Stray Dog, Common Disorders, Epidemiology, Risk Factors*

PID:IRC_LSBP_058

***In vivo* Antidiabetic, antiobesity and organ protective potential study of two species of Selenicereus genus on Alloxan induced diabetic and diet-induced obese rat models**Md. Rabiul Hossain^{1*}, Md. Shafayet Hossain¹, Amzad Hasan¹, Rukyeya Yeasmin Mysha¹ & Pranto Das Gupta¹¹*Department of Pharmacy, University of Science and Technology Chittagong, Khulshi, Chittagong-4202, Bangladesh*

Corresponding author email: rabiul.hossain@ustc.ac.bd

Abstract

Diabetes mellitus is a chronic metabolic disorder marked by persistent hyperglycemia, often associated with dyslipidemia, obesity, and progressive organ damage such as nephropathy. Prolonged use of conventional drugs may lead to adverse effects, creating demand for safer, plant-derived alternatives. Red dragon fruit (*Selenicereus* spp.), valued for its nutritional and medicinal properties, has shown potential in modulating metabolic disturbances and protecting organs. This study evaluated the antidiabetic, antihyperlipidemic, and reno-protective effects of red dragon fruit extract in alloxan-induced diabetic, high-fat diet-induced hyperlipidemic, and potassium dichromate-induced nephrotoxic rat models. Diabetes was induced using alloxan monohydrate (120 mg/kg, i.p.), hyperlipidemia by high-fat diet, and nephrotoxicity by potassium dichromate. Rats were treated with red dragon fruit extract (200 and 400 mg/kg) for 14 days. Biochemical analyses included fasting blood glucose, total cholesterol (TC), triglycerides (TG), LDL, HDL, atherogenic index, cardiac risk index, serum urea, creatinine, and blood urea nitrogen (BUN). At 400 mg/kg, the extract reduced blood glucose by 10.98% compared to a 57.97% increase in untreated diabetic rats. Lipid parameters (TC, TG, LDL) improved significantly, HDL levels increased, and atherogenic and cardiac risk indices decreased, indicating cardiovascular benefits. In nephrotoxic models, serum urea, creatinine, and BUN were markedly reduced, suggesting renal protection. Red dragon fruit extract exhibits significant antidiabetic, antihyperlipidemic, and reno-protective effects, particularly at higher doses, supporting its potential as a natural therapeutic for managing diabetes-associated metabolic and organ complications.

Keywords: *Dragon Fruit, Diabetes, Hyperlipidemia, Nephrotoxicity, Lipid Profile*

PID:IRC_LSBP_065

Antibiotic Misuse and Antimicrobial Resistance Knowledge Among University Students in Bangladesh: Current Trends and Future Prospects

Md. Rimon Bhuiyan¹, Md. Niamot Ali¹, Nazmush Shayer Hiya¹, Asma Khatun¹, Sadia Binte Shafiq¹, Syeda Shamapika Ahmed Shimi¹, Md Muhtasim Munif Fahim², Imtiaj Hasan^{3,4*}

¹Department of Veterinary & Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh.

²Department of Statistics, University of Rajshahi, Rajshahi-6205, Bangladesh.

³Department of Microbiology, University of Rajshahi, Rajshahi-6205, Bangladesh.

⁴Department of Biochemistry and Molecular Biology, University of Rajshahi, Rajshahi 6205, Bangladesh.

Abstract

Background: Antimicrobial resistance (AMR) is an escalating global health threat to both human and animal populations. In developing countries, the misuse or overuse of antibiotics—often through self-medication—is a leading contributor. **Objectives:** This study aimed to assess the knowledge, attitude, and behavior related to antibiotic misuse and AMR among university students in Bangladesh. **Methodology:** A cross-sectional, door-to-door questionnaire-based survey was conducted from September 2024 to February 2025 among 398 students from various disciplines at the University of Rajshahi. Systematic random sampling was applied, and data were analyzed using SPSS 27 to explore associations with socio-demographic factors. **Principal Findings:** While 90.7% of students were familiar with antibiotics, only 64.07% and 63.32% were aware of antimicrobial drugs and AMR, respectively. Science students showed significantly higher AMR awareness ($p < 0.001$) than those from arts and commerce. About 46.33% practiced self-medication, with a higher rate among males ($p = 0.001$). Moreover, 40.25% used antibiotics irregularly and 45.57% stopped when symptoms improved. Arts students were more likely to stop antibiotics prematurely ($p = 0.001$). Additionally, 29.87% used antibiotics as preventive medicine ($p = 0.98$). **Conclusion:** Despite moderate awareness, the widespread misuse of antibiotics among university students highlights an urgent need for targeted educational interventions.

Keywords: Antibiotic misuse, antimicrobial resistance, self-medication

PID:IRC_LSBP_074

Understanding the Global Cancer Landscape: A Review of Trends, Risk Factors, and Interventions

Abdul Ali Bhuiyan^{1*}, Md Sohel Hossain¹, Md Imon Ahmed¹ & Tushar Ahmed¹

¹Department of Pharmacy, Faculty of Science, Pabna University of Science and Technology, Pabna -6600, Bangladesh.

Corresponding author email: alibhuiyan.pharm@pust.ac.bd

Abstract

Cancer is one of the major global health issues, causing millions of deaths annually. Its growing prevalence is increasingly linked to an aging population, rapid urbanization, and exposure to modifiable risk factors. This article explores current trends in cancer prevalence, associated risk factors, and prevention strategies. A comprehensive literature search was conducted using databases, including Google Scholar, ScienceDirect, PubMed, and official sources such as the World Health Organization (WHO) and the Global Cancer Observatory (GLOBOCAN). Approximately 200 relevant publications were initially found. After screening for quality, redundancy, and relevance, 140 articles were preferred for the final review. This finding shows that in recent years, cancer incidence and mortality rates have steadily been higher in males than in females. Between 2018 to 2022, male incidence was 210-222 per 100000 compared to 182.5 to 186.5 in females, while male mortality was 109.5 to 120 per million versus 75 to 84 in females. Lung cancer was one of the most common cancers worldwide and the leading cause of cancer deaths, accounting for about 11.5–12.5% of cases and 18–19% of deaths from 2018 to 2022. Lung, liver, stomach, breast, and colon cancers were the top five causes of cancer deaths. Cancer rates were much lower in children and adolescents, representing 1–2% of all cases, but increased sharply with age. Additionally, the article emphasizes current prevention strategies and global efforts to reduce the cancer burden. Recognizing these trends is essential for developing effective public health interventions and promoting early detection and treatment.

Keywords: prevalence, Lung cancer, Age groups, prevention strategies

PID:IRC_LSBP_077

An Assessment of Chemical and Biological Products Used in Aquaculture in Northern Bangladesh
Md. Tasin Nur Rahim^{1*}, Md Mahmudul Hasan², Tamanna Tasnim³, Fairuz Islam³, Md. Abidur Rahman¹ & Shahriar Ahmed Rabbi²

¹Faculty of Fisheries, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200

²Department of Chemistry, Dinajpur Government College, Dinajpur-5200

³Department of Chemistry, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200

*Corresponding Author Email: connect.tasin@gmail.com

Abstract

Aquaculture has been growing steadily in many parts of Bangladesh, with many farmers increasingly turning to chemical and biological products to improve fish health and boost production. However, when these substances are used without proper guidance, they can pose serious risks to the environment, public health, and long-term sustainability. This study aimed to examine the types of inputs farmers use, how often they use them, their reasons for doing so, and how much they understand about associated risks, particularly antibiotic resistance. Between May and July 2025, a structured questionnaire was used to interview 62 farmers from three districts (Rangpur, Dinajpur and Gaibandha) in northern Bangladesh. The survey result shows that, water and soil treatment products were the most commonly used, reported by 98.39% of respondents, with lime being a frequent choice. Other inputs included fertilizers (61.29%), antibiotics (96.77%), disinfectants (30.64%), feed additives (27.42%), probiotics (14.52%), and pesticides (11.29%). Notably, 83.33% of the farmers who used antibiotics did so without any disease diagnosis or fisheries expert advice, and 98.39% were unaware of the concept of antibiotic resistance. Furthermore, 85.48% did not follow any structured disease prevention protocols. Most farmers relied on information from retailers, and very few had knowledge of official regulations concerning input use. These results underscore a pressing need for farmer training programs, improved access to fisheries extension services and stricter oversight of chemical usage. Promoting responsible practices is crucial to ensuring sustainable aquaculture, protecting ecosystems, and reducing the risk of antimicrobial resistance.

Keywords: Aquaculture, Medicines, Antibiotic Resistance, Biological Products

PID:IRC_LSBP_083

Phytochemical screening, Antioxidant and Antibacterial Activities of Methanolic Extract of *Spirodela polyrhiza*
Abu Naser Md. Nayeem^{1*}, Mst. Nusrat Jahan Nisha², Md. Whaiduzzaman Murad² & Saubia Sultana Maisha².

¹ Lecturer, Department of Pharmacy, Varendra University, Rajshahi- 6204, Bangladesh.

Corresponding author email: nayeem.pharmacy@vu.edu.bd

Abstract: *Spirodela polyrhiza* also referred as giant duckweed is a perennial aquatic plant forming dense surface mats with smooth, round, flat fronds 0.5–1.0 cm wide with a green to reddish dorsal surface and a dark red ventral side.

In this investigation, the phosphomolybdate reduction assay and the DPPH radical scavenging assay were used to measure antioxidant activity while the Folin-Ciocalteu and aluminum chloride colorimetric methods were employed in phytochemical screening to evaluate the total phenolic content (TPC) and total flavonoid content (TFC) respectively. The disc diffusion method was used to investigate antibacterial activity against strains of two Gram-positive (*Staphylococcus aureus*, *Bacillus cereus*) and two Gram-negative (*Escherichia coli*, *Shigella boydii*) bacteria.

The extract showed strong antioxidant potential with DPPH radical scavenging activity ($IC_{50} = 51.88 \mu\text{g/mL}$) comparable to the standard Ascorbic acid ($IC_{50} = 38.18 \mu\text{g/mL}$) and a substantial total antioxidant capacity ranged from 187.50–333.33 $\mu\text{g CE/mg}$ as confirmed by the phosphomolybdate assay. Total phenolic content (TPC) ranged from 116.94 to 296.30 mg GAE/g and total flavonoid content (TFC) ranged from 187.48 to 280.17 mg CE/g extract suggesting significant levels of phenolic and flavonoid compounds from phytochemical screening. In tests of antibacterial activity, the highest zone of inhibition (15 mm) against *E. coli* was observed at 240 $\mu\text{g/disc}$, suggesting efficacy against Gram-negative pathogens.

These results suggest, it could serve as a sustainable source of natural compounds for pharmaceutical and nutraceutical applications. Further studies are needed to isolate specific bioactive constituents and verify their in vivo safety and efficacy.

Keyword: Antioxidant, Antibacterial, Phenolic, Flavonoid.

PID:IRC_LSBP_091

Green Synthesis of Silver Nanoparticles Using *Coleus amboinicus* (Mexican mint) to Control Multidrug Resistance Pathogen of Post-COVID Patient's Respiratory Tract Infection

Md. Zakariya Alam Bappi^{1,3}, Saharin Sultana^{1,3}, Md. Shahriar Mahmud^{1,3}, Borshon Karmoker Pranto^{1,3}, Md Minhajul Abedin^{1,3}, Kaniz Fatema^{1,3} & Shohan Ali^{2,3}, Professor Dr. Mohammad Abu Hena Mostofa Jamal^{1,3*}

¹Department of Biotechnology and Genetic Engineering, Faculty of Biological Sciences, Islamic University, Kushtia 7003 Bangladesh

²Department of Applied Chemistry and Chemical Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh

³Laboratory of Medical and Environmental Biotechnology, Faculty of Biological Sciences, Islamic University, Kushtia 7003 Bangladesh

*Corresponding author email: jamalbtg@gmail.com

Abstract

Biosynthesis of AgNPs using *Coleus amboinicus*, offers an eco-friendly approach with significant potential for biomedical applications due to their natural, non-toxic properties. *Coleus amboinicus* has proved therapeutic agent for its medicinal properties. This study aimed to biosynthesize AgNPs using *Coleus amboinicus* extract and control antibiotic-resistant respiratory bacteria extracted from several patients affected by COVID-19. *Coleus amboinicus* leaf extract was mixed with 5mM silver nitrate and stirred for 60 minutes to synthesize AgNPs which were identified by using UV-visible spectroscopy, FTIR, DLS, XRD, and TEM as well as assay Cytotoxicity and antioxidant activity. Antibiotic resistance respiratory tract pathogen was identified by 16srRNA sequencing from post COVID-19 condition and control using disk diffusion methods. Synthesis of silver nanoparticles was observed through a color transition and UV-visible spectroscopy showing peak at 434 nm. FTIR identified phytochemicals like alcohols, phenols, and alkenes. DLS analysis revealed a mean size of 53.84 nm, while XRD and TEM confirmed face-centered cubic crystals and spherical nanoparticles. The Brine Shrimp Lethality Assay (BSLA) showed low cytotoxicity with an LC50 of 1475 µg/mL. The DPPH assay demonstrated 75% antioxidant activity. The study isolated antibiotic-resistant respiratory pathogens, including *Escherichia coli*, *Staphylococcus aureus*, and *Staphylococcus arlettae*. The biosynthesized AgNPs inhibited these bacteria in a dose-dependent manner, with MIC values of 2 µg/mL for all isolates *S. aureus* and *E. coli*, and *S. arlettae*. These findings suggest that green synthesized silver nanoparticles effectively inhibited these antibiotic-resistant respiratory pathogens at varying doses. In the future, it could be a better, cheaper, and safer alternative to antibiotics.

Keyword: Silver nanoparticles, Covid-19, Respiratory tract infection, Antibiotic resistance.

PID:IRC_LSBP_095

Green Synthesis of Silver Nanoparticles Using *Coleus amboinicus* (Mexican mint) to Control Multidrug Resistance Pathogen of Post-COVID Patient's Respiratory Tract Infection

Md. Zakariya Alam Bappi^{1,3}, Apon Chandra Paul^{1,3}, Shohan Ali^{2,3}, Md. Minhajul Abedin^{1,3}, Borshon Karmoker Pranto^{1,3}, Md. Shahriar Mahmud^{1,3}, & Kaniz Fatema^{1,3}, Professor Dr. Mohammad Abu Hena Mostofa Jamal^{1,3*}

¹Department of Biotechnology and Genetic Engineering, Faculty of Biological Sciences, Islamic University, Kushtia 7003 Bangladesh

²Department of Applied Chemistry and Chemical Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh

³Laboratory of Medical and Environmental Biotechnology, Faculty of Biological Sciences, Islamic University, Kushtia 7003 Bangladesh

*Corresponding author email: jamalbtg@gmail.com

Background: Biosynthesis of AgNPs using *Coleus amboinicus*, offers an eco-friendly approach with significant potential for biomedical applications due to their natural, non-toxic properties. *Coleus amboinicus* has proved therapeutic agent for its medicinal properties. **Objective:** This study aimed to biosynthesize AgNPs using *Coleus amboinicus* extract and control antibiotic-resistant respiratory bacteria extracted from several patients affected by COVID-19. **Methods:** *Coleus amboinicus* leaf extract was mixed with 5mM silver nitrate and stirred for 60 minutes to synthesize AgNPs which were identified by using UV-visible spectroscopy, FTIR, DLS, XRD, and TEM as well as assay Cytotoxicity and antioxidant activity. Antibiotic resistance respiratory tract pathogen was identified by 16srRNA sequencing from post COVID 19 condition and control using disk diffusion methods. **Findings:** Synthesis of silver nanoparticles was observed through a color transition and UV visible spectroscopy showing peak at 434 nm. FTIR identified phytochemicals like alcohols, phenols, and alkenes. DLS analysis revealed a mean size of 53.84 nm, while XRD and TEM confirmed face-centered cubic crystals and spherical nanoparticles. The Brine Shrimp Lethality Assay (BSLA) showed low cytotoxicity with an LC50 of 1475 µg/mL. The DPPH assay demonstrated 75% antioxidant activity. The study isolated antibiotic-resistant respiratory pathogens, including *Escherichia coli*, *Staphylococcus aureus*, and *Staphylococcus arlettae*. The biosynthesized AgNPs inhibited these bacteria in a dose-dependent manner, with MIC values of 2 µg/mL for all isolates *S. aureus* and *E. coli*, and *S. arlettae*. **Implications:** These findings suggest that green synthesized silver nanoparticles effectively inhibited these antibiotic-resistant respiratory pathogens at varying doses. In the future, it could be a better, cheaper, and safer alternative to antibiotics.

Keyword: Silver nanoparticles, Covid-19, Respiratory tract infection, Antibiotic resistance.

PID:IRC_LSBP_107

Natural Compound-Based FLT3 Inhibition in Acute Myeloid Leukemia: A Comprehensive *In Silico* Strategy Using Molecular Docking, ADME, and MD Simulation

*Rezoanul Islam*², *Zubaer Hossen*¹, *MD Sazzad Hossain*¹, *Md. Naim Uddin Forhad*², *Md Jasim Fakir*², *Md. Rana Mia*², *Abdullah-Al Jubayer*¹, *Asura Khanam Lisa*¹, *Md. Faruk Hasan*³, *Md. Enamul Haque*^{1*}

¹*Department of Biotechnology and Genetic Engineering, Gopalganj Science and Technology University*

²*Department of Biochemistry and Molecular Biology, Gopalganj Science and Technology University, Bangladesh*

³*Department of Microbiology, University of Rajshahi, Bangladesh*

* Corresponding author. E-mail address: enamul.haque@gstu.edu.bd

Abstract

Acute Myeloid Leukemia (AML) with mutations in the FLT3 gene is a malignant blood cancer, for which current FLT3 inhibitors used in its treatment have significant side effects and drug-resistance problems. To effectively address this problem, our study aimed to identify relatively safe and effective FLT3 inhibitors among compounds collected from natural sources. We constructed a library of a total of 2792 phytocompounds collected from 19 medicinal plants. Then, we conducted virtual screening by docking to the active site of the FLT3 protein (PDB ID: 6JQR) and selected 15 compounds with the highest binding affinity. Among them, Asperglauclide, 17Beta-Hydroxywithanolide K, and Withanicandrin were the most notable. We then performed ADMET analysis (Absorption, Distribution, Metabolism, Excretion, and Toxicity) and molecular dynamics simulation (100 ns) of these compounds. ADMET analysis revealed that the selected compounds exhibited high GI absorption, sufficient water solubility, and no toxicity, with side effects comparable to those of Gilteritinib (FLT3 inhibitor). Molecular dynamics simulation RMSD, RMSF, RG, SASA, and Hydrogen bond analysis showed that Asperglauclide formed the most stable protein-ligand complex. The results of this study suggest that natural compounds, especially Asperglauclide, may be considered as potential alternative FLT3 inhibitors for AML treatment. Future in vitro and in vivo studies are needed to verify the efficacy of these compounds.

Keywords: *Acute Myeloid Leukemia, ADMET, Docking, FLT3 inhibitor, Molecular dynamics*

PID:IRC_LSBP_109

Nano-Science Phytotherapy: A Comparative In-Vitro Study of Antibacterial, Antioxidant, And Anti-Inflammatory Activities of *Glycyrrhiza Glabra* Extract and Its Silver Nanoparticle Formulation

A.H.M Mazbah Uddin^{1*}, *Mim Akter Brishti*¹, *Tamanna*¹ & *Sanjida Khandakar Konka*¹

¹*Department of pharmacy, Faculty of life Science, Mawlana Bhashani Science and Technology University, Tangail 1902, Bangladesh.*

*Corresponding author email: mazbahphar09@gmail.com

Abstract

Glycyrrhiza glabra is a well-established medicinal plant in Asia known for its diverse pharmacological activities. With growing interest in nanotechnology-based drug enhancement, combining plant extracts with silver nanoparticles (AgNPs) shows potential for improved therapeutic efficacy. **Objectives:** This study aims to evaluate and compare the **antibacterial, antioxidant, and anti-inflammatory** activities of methanolic extract of *G. glabra* and its AgNP formulation through in-vitro models. **Methodology:** Silver nanoparticles were synthesized by reducing silver nitrate with the methanolic extract and confirmed by color change and UV-Vis spectroscopy. Antibacterial activity was assessed using the well diffusion method against *Vibrio cholerae*. Antioxidant and anti-inflammatory activities were evaluated using the DPPH scavenging assay and egg albumin denaturation method, respectively. Standard drugs were used for comparison. Data were analyzed using one-way ANOVA, and IC₅₀ values were calculated. The AgNP formulation consistently showed superior activity. It exhibited a 14 mm inhibition zone vs. 12.4 mm for extract, and lower IC₅₀ values in antioxidant (75.64 vs. 97.71 µg/mL) and anti-inflammatory (286.91 vs. 320.08 µg/mL) tests. Future work will focus on compound isolation and activity validation through computer-aided drug design (CADD).

Keywords: *Glycyrrhiza glabra, Silver nanoparticles (AgNPs), Antibacterial activity, Antioxidant and anti-inflammatory assays*

PID:IRC_LSBP_111

Computational Exploration of Antidiabetic Phytochemicals from *Solanum sisymbriifolium* Fruit Extract Targeting Peroxisome Proliferator-Activated Receptor Gamma (PPAR- γ)

Montasir Ahmed¹, Shakila Akter Shilpy¹, Shaieqa Fairouz¹, Md. Faruk Hasan² & Biswanath Sikdar^{1*}

¹Genetic Engineering and Biotechnology Department and

²Microbiology Department, University of Rajshahi, Rajshahi 6205, Bangladesh

*Corresponding author email: biswa69@ru.ac.bd

Abstract

Type 2 diabetes mellitus (T2DM) is an expanding global metabolic disorder, closely linked to the epidemic of obesity is frequently managed by regulating the PPAR- γ , a critical moderator of glucose and lipid metabolism. This investigation mainly focused on in silico drug discovery strategy to identify potential phytochemicals from the fruit extract of *Solanum sisymbriifolium* for developing antidiabetic drugs. Gas Chromatography/Mass Spectrometry (GC/MS) was used to identify lead potential bioactive compounds in the fruit extract. The molecular docking was performed against PPAR- γ (PDB ID: 2QIU) with the following phytochemicals to assess binding affinity. In silico toxicity was predicted for the top compounds, and 100 ns molecular dynamics (MD) simulations were executed to confirm the structural stability and dynamic interaction of the protein-ligand complexes. To measure the in vitro antioxidant activity, the DPPH assay was utilized along with Butylated Hydroxytoluene (BHT) as a standard. The Brine Shrimp Lethality Assay (BSLA) was used to detect cytotoxicity at $25 \pm 2^\circ\text{C}$ in an oxygenated environment of the extract. We found the top three compounds, which include CID: 251377, CID: 585277, and CID: 22215462, exhibited the highest docking scores -7.3 , -7.1 , and -7.0 kcal/mol, respectively. All of these lead phytochemicals showed suitable drug-like properties. 100 ns MD simulations confirmed the structural stability and consistent interactions of the ligands with PPAR- γ . The DPPH assay disclosed significant antioxidant activity of the fruit extract, and BSLA also confirmed low toxicity, which favors the further safety profile. As the identified lead compounds revealed suitable in silico drug-like properties with structural stability in 100 ns MDS, these top phytochemicals could likely be used for developing sustainable antidiabetic drugs.

Keywords: T2DM, PPAR- γ , Molecular docking, Molecular Dynamics Simulation (MDS)

PID:IRC_LSBP_117

Phytochemical screening, Antioxidant and Antibacterial Activities of Methanolic Extract of *Spirodela polyrhiza*

Abu Naser Md. Nayeem^{1*}, Mst. Nusrat Jahan Nisha², Md. Whaiduzzaman Murad² & Saubia Sultana Maisha².

¹ Lecturer, Department of Pharmacy, Varendra University, Rajshahi- 6204, Bangladesh.

Corresponding author email: nayeem.pharmacy@vu.edu.bd

Abstract

Spirodela polyrhiza also referred as giant duckweed is a perennial aquatic plant forming dense surface mats with smooth, round, flat fronds 0.5–1.0 cm wide with a green to reddish dorsal surface and a dark red ventral side.

In this investigation, the phosphomolybdate reduction assay and the DPPH radical scavenging assay were used to measure antioxidant activity while the Folin-Ciocalteu and aluminum chloride colorimetric methods were employed in phytochemical screening to evaluate the total phenolic content (TPC) and total flavonoid content (TFC) respectively. The disc diffusion method was used to investigate antibacterial activity against strains of two Gram-positive (*Staphylococcus aureus*, *Bacillus cereus*) and two Gram-negative (*Escherichia coli*, *Shigella boydii*) bacteria.

The extract showed strong antioxidant potential with DPPH radical scavenging activity ($IC_{50} = 51.88 \mu\text{g/mL}$) comparable to the standard Ascorbic acid ($IC_{50} = 38.18 \mu\text{g/mL}$) and a substantial total antioxidant capacity ranged from 187.50–333.33 $\mu\text{g CE/mg}$ as confirmed by the phosphomolybdate assay. Total phenolic content (TPC) ranged from 116.94 to 296.30 mg GAE/g and total flavonoid content (TFC) ranged from 187.48 to 280.17 mg CE/g extract suggesting significant levels of phenolic and flavonoid compounds from phytochemical screening. In tests of antibacterial activity, the highest zone of inhibition (15 mm) against *E. coli* was observed at 240 $\mu\text{g/disc}$, suggesting efficacy against Gram-negative pathogens.

These results suggest, it could serve as a sustainable source of natural compounds for pharmaceutical and nutraceutical applications. Further studies are needed to isolate specific bioactive constituents and verify their in vivo safety and efficacy.

Keyword: Antioxidant, Antibacterial, Phenolic, Flavonoid.

PID:IRC_LSBP_121

Development of Biodegradable Electronics Using Mycelium Based Substrates

Mst. Saoda Ahmad^a, Mritteka Rahman Rupa^a, Moushifa Mim^a

^aDepartment of Biochemistry and Biotechnology, University of Barishal
Email: saodaahmad03@gmail.com

Abstract

The search for sustainable alternatives in the production of electronic devices has accelerated due to the growing amount of electronic waste and the environmental risks caused by non-biodegradable components. Fungal biomass is used to make mycelium-based products, which provide a renewable and biodegradable alternative. However, because of their weak mechanical qualities and uneven surfaces, their use in thin-film electronics is still restricted. This study combined graphene with fungal mycelium (*Ganoderma lucidum*) to create environmentally friendly, biodegradable electrical substrates using logical design techniques. Optimized culture and post-growth chemical treatments were used to improve the mycelium's mechanical and surface properties. To create graphene-based conductive layers on the treated mycelium foils, advanced manufacturing techniques such as laser ablation, spray coating, and inkjet printing were employed. Mycelium after treatment showed decreased surface roughness ($R_{rms} 2.7 \pm 0.7 \mu\text{m}$) and increased tensile strength (up to 24.5 MPa). Electrical conductivity was greatly enhanced by the use of graphene (up to $28.5 \times 10^4 \text{ S/cm}$), and traces maintained 92.5% functioning after 10,000 bending cycles. In composting settings, biodegradability studies revealed a 94.5% mass loss in 10 days, while thermal analysis verified resilience up to 250°C. Because graphene traces could be isolated using ethanol-triggered shellac dissolving, the method also showed that it was recyclable. The potential of mycelium-graphene composites as workable substrates for environmentally friendly electronics is highlighted by this work. Their improved functionality and compatibility with the environment represent a major step in the direction of lowering electronic waste and encouraging circular manufacturing techniques.

Keywords: *Mycelium-based substrate, biodegradable electronics, graphene, sustainable materials, e-waste reduction*

PID:IRC_LSBP_138

Metformin in Diabetes and COVID-19 (Omicron XBB): Renal Implications and Therapeutic Perspectives

Mst. Afroja Akter¹, Munna Kumar Podder^{1,2*}, Dr. Mohammad Shahangir Biswas^{2,3}, Md. Mahmudul Hasan², Saiful Islam Rayhan¹, Dr. Zinat Tamanna^{1,2}, Md. Nazmul Hossain¹, Rabeya Sultana Badhon¹, Mst. Mohona Khatun¹ & Md. Ashraful Sarker¹

¹Department of Biochemistry and Biotechnology, Khwaja Yunus Ali University, Sirajganj, Bangladesh |
²Department of Biochemistry and Molecular Biology, University of Rajshahi, Bangladesh | ³Department of Biochemistry and Biotechnology, University of Science & Technology Chittagong (USTC), Chittagong, Bangladesh
*Corresponding author email: munna.bcbt@kyau.edu.bd

Abstract

The emerging Omicron XBB sub-variant of SARS-CoV-2 has posed enormous difficulty in clinical management especially among co-morbid conditions like type 2 diabetes mellitus (T2DM). People living with diabetes are also at high risk of severe outcomes with COVID-19 complications, such as those associated with acute kidney injury (AKI), hospitalization, or even death. Metformin, which is an oral hypoglycemic agent, has become a new attraction for co-action.

Metformin may possess in glycemic control as well as inflammation reduction during SARS-CoV-2 infection and renal-related complications shown under diabetic patients during SARS-CoV-2 infections. The information needed to complete this review was acquired through the pertinent articles to be retrieved from Google scholar, Pub med, and Scopus about the renal implications of metformin in treating diabetic patients with COVID-19, particularly suffering under the effect of the Omicron XBB variant. Metformin possesses both anti-inflammatory as well as immune modulation activity through the activation of AMP-activated protein kinase (AMPK) and suppression of pro-inflammatory cytokines (e.g., IL-6, TNF- α). Multiple observational studies and limited number of randomized controlled tests (RCT) suggests that the metformin has been shown to mitigate against severity of illness, reduce ICU admissions. Therefore, this review will present a twofold advantage of metformin as far as glycemic control and immunomodulation are concerned in diabetic patients having Omicron XBB variant of COVID-19. But, further urgent RCTs need to be conducted to reaffirm these conclusions and also design variant-specific-renal-safe clinical protocols to validate its comprehensive therapeutic role in this context.

Key words: *Metformin, Diabetes, Omicron XBB, Renal Safety.*

PID:IRC_LSBP_146

Sleep Quality in Women with Endometriosis in BangladeshMuhammad Muztoba^a Mubashira Marzan^a Afsana Afrose^a Dr. Munima Haque^{a*}*a. Biotechnology program, Department of Mathematics and Natural Sciences, BRAC University, Kha 224 Merul Badda, Dhaka 1212. Bangladesh*

Corresponding Author: Dr. Munima Haque, Email: munima.haque@bracu.ac.bd

Abstract

Endometriosis is a chronic gynecological condition affecting approximately 10% of women of reproductive age worldwide. Despite its high prevalence and debilitating symptoms such as chronic pelvic pain, dysmenorrhea, and infertility, the condition often goes undiagnosed for years. Emerging evidence suggests a strong correlation between endometriosis and poor sleep quality, which can significantly impact a patient's overall health and well-being. However, no such studies have been conducted in Bangladesh. This research addresses a critical gap by exploring sleep quality in Bangladeshi women diagnosed with endometriosis. A cross-sectional descriptive study was conducted on June 20, 2024, at Kurmitola General Hospital in Dhaka, Bangladesh. A total of 125 reproductive-aged women (15–45 years), clinically diagnosed with endometriosis and confirmed by ultrasonography or laparoscopy, were recruited based on availability. Data were gathered using a structured questionnaire developed in consultation with three gynecologists, including demographic details, clinical symptoms, and the Pittsburgh Sleep Quality Index (PSQI). Data analysis was performed using SPSS version 27, employing independent t-tests, Chi-square tests, and, with a P-value < .05, considered statistically significant. Based on the data, a significant number of women with endometriosis experience poor sleep quality. The mean global PSQI (Pittsburgh Sleep Quality Index) score was 7.36 ± 3.68 , indicating overall poor sleep. Specific areas affected include increased sleep latency (mean = 2.18 ± 1.07) and reduced sleep duration and efficiency. Moreover, symptoms such as dyspareunia, dysmenorrhea, excessive bleeding, and pelvic pain were significantly associated with poor sleep quality ($p < 0.05$). These findings suggest a strong link between endometriosis-related symptoms and impaired sleep, highlighting the importance of addressing sleep disturbances in the clinical management of endometriosis. This study reveals a significant association between endometriosis and poor sleep quality among Bangladeshi women. The findings highlight the need to address sleep disturbances as part of the clinical management of endometriosis, alongside promoting lifestyle-based interventions.

Keywords: *Endometriosis, Sleep Quality, PSQI, Reproductive Health, Bangladesh, Quality of life*

PID:IRC_LSBP_149

Argemone ochroleuca* (Sweet) Mitigates Diabetic Nephropathy via NRF2 Activation and Suppression of the Polyol/ROS/AGE/NLRP3 Inflammatory Axis*Abstract**

Diabetic nephropathy (DN) is a progressive microvascular complication driven by hyperglycemia-induced oxidative stress and inflammation. The polyol pathway, ROS overproduction, AGE-RAGE signaling, and NLRP3 inflammasome activation play pivotal roles in DN pathogenesis. To evaluate the nephroprotective potential of *Argemone ochroleuca* (Sweet) hydroalcoholic extract (AOHA) in experimental diabetic nephropathy through NRF2 activation and attenuation of the polyol/ROS/AGE/NLRP3 axis. Streptozotocin-induced diabetic rats were treated with AOHA (100, 200, 400 mg/kg). Kidney function markers (BUN, creatinine, uric acid), oxidative stress parameters (SOD, GSH, MDA, TBARS), and inflammatory cytokines (IL-6, TGF- β , FOXO1) were measured. Histopathology of the kidney and immunohistochemistry were performed to assess NLRP3 expression. Western blotting was used to evaluate AGE and GSK3 β expression. *In vitro* assays on HEK293 cells under hyperglycemic conditions assessed cytotoxicity (MTT), ROS (DCFDA), apoptosis (Annexin V/PI), and NRF2/GLUT1 expression. Aldose reductase (ALR), sorbitol accumulation, and AGE formation were also evaluated. AOHA significantly reduced fasting glucose, HbA1c, and kidney injury markers. Antioxidant defences improved (\uparrow SOD, GSH), while MDA and TBARS decreased. AOHA upregulated NRF2 and suppressed AGE accumulation, IL-6, FOXO1, and NLRP3 expression. *In vitro*, AOHA restored cell viability, reduced ROS, and downregulated apoptosis and ALR activity. AGE inhibition and polyol pathway suppression were evident as well. AOHA confers nephroprotection in diabetic rats through NRF2-driven redox restoration and inhibition of the polyol–ROS–AGE–NLRP3 inflammatory cascade, supporting its therapeutic promise in diabetic nephropathy.

PID:IRC_LSBP_152

Evaluation of Adaptation and Genetic Diversity in Pumpkin (*Cucurbita moschata* Duch. ex Poir) Genotypes for Sustainable Utilization of Fallow Lands

Muhtasim Billah Sajid^{1*}, Tukir Ahamed²

¹ Lecturer, Department of Genetics and Plant Breeding, Habiganj Agricultural University, Bangladesh

² Lecturer, Department of Agricultural Economics, Habiganj Agricultural University, Bangladesh

*Corresponding author email: muhtasimbillahsajid@gmail.com

Abstract

Fallow lands with low fertility are often underutilized but offer potential for vegetable crops like pumpkin. This study was conducted at a fallow land near the Habiganj Agricultural University to evaluate the adaptation and genetic diversity of seventeen pumpkin genotypes using an RCBD model with 3 replications during the kharif season (2025). Nineteen qualitative and quantitative traits were recorded to estimate genetic parameters such as genotypic and phenotypic coefficients of variation (GCV, PCV), broad-sense heritability (h^2_b) and genetic gain (GA%). Analysis of variance revealed significant differences among the genotypes, indicating a substantial genetic variability suitable for selection. High GCV and PCV were observed for fruit yield per vine, β -carotene content and number of fruits per plant, suggesting these traits as reliable indicators for crop improvement. Traits like vine length (86.90%, 32.60%), days to first female flowering (82.15%, 35.88%), node number for first female flowering (88.50%, 71.79%), sex ratio (75.86%, 43.34%), fruit number per vine (81.55%, 79.52%), fruit weight (67.21%, 51.22%), flesh thickness (80.37%, 44.65%), fruit yield per vine (95.30%, 175.00%), ascorbic acid content (78.03%, 76.58%), crude fibre content (94.40%, 78.96%), and β -carotene content (93.66%, 101.45%) exhibited high heritability coupled with high genetic advance, highlighting the predominance of additive gene effects and the potential for effective selection. Among the tested genotypes, BARI Mistikumra-2 (G11) and Local Mistikumra (G17) showed superior adaptability and yield performance under marginal conditions. These findings highlight the availability of valuable genetic resources for breeding programs to improve pumpkin productivity and promote sustainable use of fallow lands.

Keywords: Pumpkin, genetic diversity, fallow lands, sustainable utilization

PID:IRC_LSBP_155

Effect of Different Feeding Rates on Growth, Survival, and Production of Grass Carp (*Ctenopharyngodon idella*) Fry in Nursery Pond

Md. Rajib Mia¹, Md. Abdus Samad^{1*}, Sraboni Akter¹, Rifa Tamanna Mona¹, Hasin Raihan Shakil¹ & Sayed Tofayel Ahmed¹

¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: samad1413@yahoo.com

Abstract

A sixty-day experiment (February 28 to April 28, 2025) was conducted to assess the effects of different feeding rates on growth, survival, and economic performance of grass carp (*Ctenopharyngodon idella*) fry in nursery ponds. In the study, feed was prepared based on three different rates of body weight: T₁ (7%), T₂ (9%), and T₃ (10%). Fry of 0.75 g in weight and 1.2 cm in length were stocked at a rate of 800/decimal in all the treatments, each with three replications. Water quality parameters such as temperature, dissolved oxygen, pH, transparency, and ammonia were within optimal ranges and showed no significant differences ($P > 0.05$) among treatments. Feeding rates significantly ($P < 0.05$) affected growth and survival. T₃ exhibited the best performance in terms of final weight (8.50 ± 0.46 g), weight gain (7.75 ± 0.35 g), average daily gain (0.19 ± 0.01 g/day), specific growth rate ($3.79 \pm 0.16\%$), length gain (9.30 ± 0.41 cm), survival rate ($89.8 \pm 1.2\%$) and total production (1506.88 ± 130.2 kg/ha), followed by T₂ and T₁. Cost-benefit ratio (CBR=1.65), total return (BDT 678,100±953.94), and net profit (BDT 267,000 ± 500.00) were also found highest in T₃. In conclusion, feeding grass carp fry at 10% of body weight is recommended for optimal growth, survival, production, and profitability in nursery pond systems. These findings may benefit small- and medium-scale aquaculture farmers by promoting sustainable nursery practices.

Keywords: grass carp, feeding rate, fry growth, survival, economic return

PID:IRC_LSBP_160

Uncovering the Bactericidal Potential of Extract and Multi-targeting Phytochemicals from *Mirabilis longiflora* L. Leaves against Multidrug-resistant *Pseudomonas aeruginosa* and *Bacillus cereus*

Nazia Islam Rafi^a, Sadia Israt^a, Nafis Fuad Shahir^a & Mashiar Rahman^{a*}

^a*Molecular and Cellular Biology Laboratory, Department of Genetic Engineering and Biotechnology, Jashore University of Science and Technology, Jashore 7408, Bangladesh.*
Correspondence E-mail: mm.rahman@just.edu.bd

Abstract

Mirabilis longiflora L. has traditionally been used in Bangladesh to treat various infectious diseases, but its effects on multidrug-resistant (MDR) bacteria have remained unidentified. Therefore, we aimed to determine the antibacterial activity of the methanol extract of *Mirabilis longiflora* L. leaves (MEMLL) against MDR *Pseudomonas aeruginosa* and MDR *Bacillus cereus* and recognize possible multitargeting antibacterial phytochemicals through *in silico* approaches targeting the **LasR and LpxC proteins** in MDR *Pseudomonas aeruginosa* and the FosB and PlcR proteins in MDR *Bacillus cereus*. **PPS, FT-IR, and GC-MS were used to profile the phytochemicals in MEMLL.** The antimicrobial activity of MEMLL was evaluated using *in vitro* agar-well diffusion, MIC, and MBC assays. Computational studies were applied to determine multi-targeting agents from GC-MS-annotated phytochemicals. MEMLL showed dose-dependent antibacterial activity and exposed the presence of 33 phytochemicals in GC-MS analysis. Among these, 6-Hydroxy-4,4,7a-trimethyl-5,6,7,7a-tetrahydrobenzofuran-2(4H)-one was identified as a potential antibacterial phytochemical as it exhibited **multi-modal and strong binding affinity towards LasR, LpxC, FosB, and PlcR, favorable pharmacokinetics, drug-likeness, and toxicity properties.** Finally, molecular dynamics (MD) simulations demonstrated the structural stability of 6-Hydroxy-4,4,7a-trimethyl-5,6,7,7a-tetrahydrobenzofuran-2(4H)-one **to the active pockets of LasR, LpxC, FosB, and PlcR.** **The results of this study offer scientific validation for the traditional use of *Mirabilis longiflora* L. in bacterial infection-related diseases. It also suggests that 6-Hydroxy-4,4,7a-trimethyl-5,6,7,7a-tetrahydrobenzofuran-2(4H)-one from *Mirabilis longiflora* L. might be responsible for the antibacterial activity and could act as a phytopharmacological lead for the development of LasR and LpxC inhibitors in MDR *Pseudomonas aeruginosa* and FosB and PlcR inhibitors in MDR *Bacillus cereus*.**

Key words: *Mirabilis longiflora*, MDR *Pseudomonas aeruginosa*, MDR *Bacillus cereus*, and Molecular dynamics simulation.

PID:IRC_LSBP_165

Exploring Molecular Signatures and Therapeutic Agents of type 2 diabetes and Parkinson's Disease

Dr. Shaila Haque^{*}, Nazia Zarin¹, Tasnim Hosen Tanha² & Mimuna Nishad³.

¹*Department of Biochemistry and Biotechnology, University of Barishal, Barishal-8254, Bangladesh.*

*Corresponding author Email: shaque@bu.ac.bd

Abstract

Type 2 Diabetes (T2D) and Parkinson's Disease (PD), though clinically distinct, share molecular mechanisms like mitochondrial dysfunction, oxidative stress, and chronic inflammation. Studies suggest T2D may increase PD risk by disrupting brain insulin signaling and promoting neurodegeneration. This study explores these overlapping pathways to identify therapeutic targets. To identify shared molecular signatures, regulatory elements, and therapeutic agents between T2D and PD using integrated transcriptomic and network-based analyses. We analyzed four RNA-SEQ datasets from the NCBI GEO database. DEGs were identified using GEO2R. Common DEGs (cDEGs) were processed via STRING and IMEx to construct PPI networks, visualized in Cytoscape. Hub genes were identified with CytoHubba. Functional enrichment (GO, KEGG) and regulatory analyses (TFs via JASPAR, miRNAs via TarBase) were performed using Enrichr, DAVID, and NetworkAnalyst. Drug-gene interactions were assessed to identify therapeutic candidates. PPI analysis identified key proteomic signatures, including: BUB1B, HJURP, BUB1, CDK1, KIF15, TOP2A, EXO1, CENPF, KIF14, and KIF11. Regulatory transcriptional signatures included FOXC1, GATA2, NFIC, FOXL1, YY1, MEF2A, CREB1, NFYA, E2F1, and TP53. Identified miRNA regulators included hsa-let-7f-5p, hsa-miR-16-5p, hsa-miR-124-3p, hsa-let-7a-5p, hsa-miR-103a-3p, hsa-let-7g-5p, hsa-let-7b-5p, hsa-let-7c-5p, and hsa-miR-26a-5p.

This study highlights common molecular and regulatory mechanisms in T2D and PD, suggesting dual-purpose biomarkers and drug targets. Further validation is needed to assess their clinical relevance.

Keywords: Transcriptomics, Neurodegeneration, Biomarkers, Therapeutics

PID:IRC_LSBP_170

Study of the Effects of *Coccinia grandis* and *Stevia rebaudiana* Leaves on Antidiabetic Potential in Swiss Albino Mice.: Nusrat Jahan Jim¹, Prof Dr. Md Imam Hossain^{1*}, Jisan Bin Habib & Joyasree Toppo¹.¹Department of Biotechnology and Genetic Engineering, Mawlana Bhashani Science and Technology University (MBSTU), Santosh-1902, Tangail, Bangladesh.

*Corresponding author e-mail: imubcmb@gmail.com

Abstract

Diabetes mellitus, a major global health concern, driving the search for affordable and practical treatment solutions. This study evaluates the antidiabetic potential of *Coccinia grandis* (Telakucha or ivy gourd) and *Stevia rebaudiana* (Stevia) in managing diabetes-related complications in Swiss albino mice.

Objectives

To assess the antidiabetic potential of *Coccinia grandis* and *Stevia rebaudiana* leaves in alloxan induced diabetic swiss albino mice and to evaluate diabetic-related liver function and lipogenic biochemical indices.

Methodology

Mice were administered alloxan monohydrate to induce diabetes and divided into five groups: normal, diabetic, and three treatment groups receiving either telakucha, stevia, or sugar solution (for comparison). Blood glucose was monitored during the treatment period and upon sacrifices, serum glucose and biochemical indices related to liver function and lipogenesis were monitored to evaluate the therapeutic effects of extracts.

Findings

Both Stevia and Telakucha resulted in decreased blood glucose levels with treatment, showing significant improvements compared to the diabetic control group. Cholesterol levels were significantly reduced in the Stevia-treated group (101.65±7.41 mg/dL), suggesting potential diabetic-induced lowering of lipogenic index in addition to glycemic control. In contrast, the Telakucha-treated group unexpectedly increased in cholesterol level (475.50±24.47 mg/dL), highlighting the need for further investigation. Liver function markers (GPT, GOT, and ALP) showed some remediation effects in both treatment groups though the differences were not always significant (p<0.05) and varied between extracts.

Implications

Coccinia grandis and *Stevia rebaudiana* demonstrate significant potential as natural remedies in modern healthcare for diabetes management and encouraging further research into their therapeutic applications.

keywords: Diabetes Mellitus, *Coccinia grandis* (Telakucha or ivy gourd), *Stevia rebaudiana* (stevia), Antidiabetic potential.

PID:IRC_LSBP_175

Sustainable Waste Management Approach Using Black Soldier Fly (BSF)Rajosree Das Srija¹, Hemadree Shekhor Roy Aurko & Shaila Siddiqua^{1*}¹Biotechnology and Genetic Engineering Discipline, Life Science School, Khulna University, Khulna-9208, Bangladesh.

Email: 210731@ku.ac.bd

Abstract

Waste management in developing countries faces major challenges due to rapid population growth, shifting lifestyles, and declining land availability. Common disposal methods—such as landfilling, open dumping, composting, and incineration—are often poorly managed, leading to environmental hazards. Landfilling releases toxic trace elements and greenhouse gases, contributing to pollution and public health risks. Although various biodegradable waste treatment methods are available, sustainability remains a critical issue. High moisture content, low calorific value, and high organic load further limit the efficiency of conventional technologies. This study explores the use of *Hermetia illucens* (Black Soldier Fly, BSF) as an innovative and sustainable waste management solution. It investigates the effectiveness of BSF larvae in converting organic waste into nutrient-rich biomass and evaluates the use of the larvae as a cost-effective, eco-friendly protein source for poultry. Beyond feed, BSF also offers opportunities to produce valuable products such as biofuel, biofertilizer, and chitin—a useful biopolymer. Compared to traditional waste management techniques, BSF larvae demonstrate higher conversion efficiency and produce biomass rich in protein and essential nutrients. Poultry fed with BSF larvae diets exhibit similar growth and meat quality as those fed with conventional feed, confirming the larvae's viability as a sustainable protein source. This insect-based technology provides an economical and environmentally friendly option for developing countries. The study compiles recent advancements in BSF rearing techniques and assesses their capacity to stabilize waste under various environmental conditions, supporting the potential for large-scale commercial adoption.

Keywords: Environmental pollution, Waste management, Black Soldier Fly (BSF), Poultry feed.

PID:IRC_LSBP_180

Quercetin Modulates The Anti-Arthritic Effects Of Indomethacin, Possibly Through Coxs And TNF-A Interaction Pathways

Rokibul Islam Chowdhury^{a,b,1}, Md. Sakib Al Hasan^{a,b,1}, Emon Mia^{a,b}, Raihan Chowdhury^{a,b}, Md. Showkot Akbor^{a,b}, Shoyaeb Ahammed^{a,b}, Md. Tahajul Islam^a, Md. Sabbir Hossain^{a,b}, Emílio Sousa Albuquerque^c, Irfan Aamer Ansari^d, Siddique Akber Ansari^e, Pedro Henrique de Sena Coutinho^c, Henrique Douglas Melo Coutinho^{c,*}, Muhammad Torequl Islam^{a,b,f,*}

^a Department of Pharmacy, Gopalganj Science and Technology University, Gopalganj 8100, Bangladesh

^b Bioinformatics and Drug Innovation Laboratory, BioLuster Research Center Ltd., Gopalganj 8100, Bangladesh

^c Laboratory of Microbiology and Molecular Biology (LMBM), Regional University of Cariri (URCA), Crato, Brazil

^d Department of Drug Science and Technology, University of Turin, Turin 10124, Italy

^e Department of Pharmaceutical Chemistry, College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia

^f Pharmacy Discipline, Khulna University, Khulna 9208, Bangladesh

*Corresponding author email: mti031124@gmail.com

Abstract

Introduction: Quercetin (QR) is a flavonoid compound with potent anti-oxidant and anti-inflammatory properties, commonly found in various fruits and vegetables.

Objective: This study aims to evaluate the synergistic anti-arthritic effects of QR in combination with indomethacin (INDO) in formaldehyde and turpentine oil-induced arthritis models in mice and to explore the underlying molecular mechanisms using *in vivo* and *in silico* approaches. **Methodology:** Arthritis was induced in 60 male Swiss albino mice, divided into 12 groups. The animals were treated with QR (12.5, 25, and 50 mg/kg), INDO (10 mg/kg), or a combination of QR-25 and INDO-10, all administered per orally. Paw licking and edema were recorded at various intervals. Molecular docking studies assessed the binding of QR and INDO to cyclooxygenase-1 (COX-1), COX-2, and tumor necrosis factor-alpha (TNF- α), while SwissADME and Protox-3.0 were used for drug-likeness, pharmacokinetics, and toxicity predictions.

Finding: QR significantly reduced paw edema and licking behavior in both models. QR-50 mg/kg showed the most substantial anti-arthritic effects, comparable to or surpassing INDO, especially in the late phase. The combination of QR and INDO exhibited enhanced efficacy, with a superior reduction in inflammation compared to either treatment alone. *In silico* docking revealed stronger binding affinities of QR (-8.5, -8.9, -8.7 kcal/mol) for COX-1, COX-2, and TNF- α compared to INDO. QR also showed better pharmacokinetic properties with lower toxicity. QR demonstrates significant anti-arthritic potential, both alone and in combination with INDO, through COX and TNF- α inter-action pathways.

Future implications: Further studies are needed to explore its long-term therapeutic efficacy.

Keywords: Anti-arthritic effect, Cyclooxygenase-1, Pharmacok

PID:IRC_LSBP_185

Microplastic Abundance in Some Commonly Consumed Dried Fish in Bangladesh Sakib Hossain^{1*}, Pronob Datta², S M Minhazul Haque¹ & Md Zia Uddin³

¹Department of Biotechnology & Genetic Engineering, University of Development Alternative, Dhaka, Bangladesh.

²Department of Fisheries, University of Dhaka, Dhaka, Bangladesh.

³Institute of Food Science & Technology, Bangladesh Council of Science & Industrial Research, Dhaka, Bangladesh.

*Corresponding author email: sakibhossain1998bg@gmail.com

Abstract

Microplastic (MP) contamination in fish species is a newly emerging critical environmental issue due to the spread of plastic waste in the environment. Microplastic pollution has a detrimental effect on aquatic organisms and has become global environmental threat. Need to quantify human exposure to microplastics through dried fish. The current study demonstrates that dried fish from the Bay of Bengal contains a significant concentration of microplastics, which pose contamination risks to human nutrition, diets, and threaten human food safety. This study investigated and quantified microplastics in five commercially important fish species: Poa (*Otolithoides pama*), Gora Chela (*Securicula gora*), Koral (*Lates calcarifer*), Mola (*Amblypharyngodon mola*), and Cingri (*Palaemon karnafuliensis*). Collected under dry conditions from Cox's Bazar, Bay of Bengal. The dominant polymer, Polypropylene (34%), was identified using ATR-FTIR Micro-Raman-spectroscopy. According to shape, Fibers were the most prevalent type of microplastics identified in all samples (51.67%), followed by fragments (39.03%), films (6.69%), and pellets (2.6%). Considering the colors, red (35.31%) was the most abundant color in all samples, transparent (23.79%), blue (21.18%), black (6.69%), green (6.69%), and the lowest colors found were white and violet (2.6%). All the microplastics were present in the size range of < 0.5mm. It was identified among the dried fish samples that Gora Chela contained the highest number of microplastics. On the contrary, Mola and Cingri retained the lowest number of microplastics. The investigation's results reveal the widespread presence of microplastics in fish as a vector for human microplastic ingestion, necessitating stringent seafood safety policies in Bangladesh.

Keywords: Microplastics, Food Safety, Polypropylene, Dried Fish.

PID:IRC_LSBP_190

In Vitro and In Silico Analysis of Bactericidal Effects of *Eichhornia crassipes* L. Extracts and Phytocompounds Targeting Methicillin-Resistant *Staphylococcus aureus*
Sadia Israt^a, Nazia Islam Rafi^a, Nafis Fuad Shahir^a & Md. Mashiar Rahman^{a*}

^a*Molecular and Cellular Biology Laboratory (MCBL), Department of Genetic Engineering and Biotechnology, Jashore University of Science and Technology, Jashore, 7408, Bangladesh*

Correspondence, E-mail: mm.rahman@just.edu.bd

Abstract

Eichhornia crassipes has been traditionally used by tribal communities in Bangladesh, but its effects on methicillin-resistant *Staphylococcus aureus* (MRSA) remain unknown. This study aimed to assess the in vitro antibacterial potential of methanol, ethanol, and ethyl acetate extracts from the flowers and leaves of *E. crassipes* and to identify multi-target antibacterial phytocompounds in silico, focusing on the β -Lactamase and PBP2a proteins in MRSA, which are essential for its resistance. A total of 383 phytocompounds were metabolically annotated by GC-MS analysis. Molecular docking identified two key compounds, CID 4970 from flower extracts and CID 615944 from leaf extracts. These two hit phytocompounds exhibited strong multi-modal binding affinity toward β -Lactamase and PBP2a. Further analysis demonstrated that CID 4970 and CID 615944 possessed favorable pharmacokinetic and drug-like properties without toxicity, making them the best candidates. Molecular dynamics simulations confirmed the binding stability and multi-modal inhibitory activity of CID 4970 and CID 615944 within the active sites of β -Lactamase and PBP2a, solidifying their potential as lead compounds for developing inhibitors against these proteins. All extracts demonstrated dose-dependent antibacterial activity in agar well diffusion, MIC, and MBC assays, supporting the in-silico results. The study supports the traditional use of *E. crassipes* for treating infections and suggests that CID 4970 and CID 615944 could be promising leads for developing new anti-MRSA treatments.

Keywords: *Eichhornia crassipes*, MRSA, β -Lactamase, PBP2a.

PID:IRC_LSBP_195

Phytochemical screening, Antioxidant and Antibacterial Activities of Methanolic Extract of *Spirodela polyrhiza*
Abu Naser Md. Nayeem^{1*}, Mst. Nusrat Jahan Nisha², Md. Whaiduzzaman Murad² & Saubia Sultana Maisha².

¹ *Lecturer, Department of Pharmacy, Varendra University, Rajshahi- 6204, Bangladesh.*

Corresponding author email: nayeem.pharmacy@vu.edu.bd

Abstract: *Spirodela polyrhiza* also referred as giant duckweed is a perennial aquatic plant forming dense surface mats with smooth, round, flat fronds 0.5–1.0 cm wide with a green to reddish dorsal surface and a dark red ventral side. In this investigation, the phosphomolybdate reduction assay and the DPPH radical scavenging assay were used to measure antioxidant activity while the Folin-Ciocalteu and aluminum chloride colorimetric methods were employed in phytochemical screening to evaluate the total phenolic content (TPC) and total flavonoid content (TFC) respectively. The disc diffusion method was used to investigate antibacterial activity against strains of two Gram-positive (*Staphylococcus aureus*, *Bacillus cereus*) and two Gram-negative (*Escherichia coli*, *Shigella boydii*) bacteria.

The extract showed strong antioxidant potential with DPPH radical scavenging activity ($IC_{50} = 51.88 \mu\text{g/mL}$) comparable to the standard Ascorbic acid ($IC_{50} = 38.18 \mu\text{g/mL}$) and a substantial total antioxidant capacity ranged from 187.50–333.33 $\mu\text{g CE/mg}$ as confirmed by the phosphomolybdate assay. Total phenolic content (TPC) ranged from 116.94 to 296.30 mg GAE/g and total flavonoid content (TFC) ranged from 187.48 to 280.17 mg CE/g extract suggesting significant levels of phenolic and flavonoid compounds from phytochemical screening. In tests of antibacterial activity, the highest zone of inhibition (15 mm) against *E. coli* was observed at 240 $\mu\text{g/disc}$, suggesting efficacy against Gram-negative pathogens.

These results suggest, it could serve as a sustainable source of natural compounds for pharmaceutical and nutraceutical applications. Further studies are needed to isolate specific bioactive constituents and verify their in vivo safety and efficacy.

Keyword: *Antioxidant, Antibacterial, Phenolic, Flavonoid.*

PID:IRC_LSBP_200

***In Silico* and *In Vitro* Evaluation of *Solanum sisymbriifolium* Ethanolic Extract for Anti-Diarrheal Drug Discovery: Targeting Human DHFR (4DDR) via Bioactive GC–MS Compounds**

Shaieqa Fairouz¹, Shakila Akter Shilpy¹, Montasir Ahmed¹, Md. Faruk Hasan², Uzzal Kumar Acharjee¹, Md. Khalekuzzaman¹ & Biswanath Sikdar^{1*}

¹Genetic Engineering and Biotechnology Department and

²Microbiology Department, University of Rajshahi, Rajshahi 6205, Bangladesh

*Corresponding author email: biswa69@ru.ac.bd

Abstract

Introduction/Background: Diarrhea causes many deaths worldwide, especially in underdeveloped areas, urging the need for alternative therapeutics. Plant-derived phytochemicals from *Solanum sisymbriifolium* are a potential choice as it displays a range of bioactivity.

Objectives: This study aimed to identify anti-diarrheal candidates by targeting human dihydrofolate reductase (DHFR; PDB ID: 4DDR), a protein involved in gastrointestinal pathogenesis.

Methodology: 199 phytochemicals were identified via gas chromatography–mass spectrometry (GC-MS) from the ethanolic extract of *Solanum sisymbriifolium*. Molecular docking was performed to evaluate binding affinities against 4DDR. The top six ligands were further validated using 100 ns molecular dynamics (MD) simulations. DPPH and brine shrimp lethality assays (BSLA) were done to assess the antioxidant and cytotoxic properties of the extract, respectively. Toxicity profiling and STRING network analysis were also conducted to predict safety and biological relevance.

Findings: Among the docked ligands, four (CID: 6896117, 22215462, 22294575, 537293) formed stable complexes with docking scores ranging from -6.1 to -6.9 kcal/mol. MD simulations confirmed their structural stability, while *in vitro* assays indicated antioxidant potential and moderate cytotoxicity. Toxicity profiling supported their drug-like properties.

Future direction and/or implications: These findings imply that by blocking DHFR, certain compounds from *Solanum sisymbriifolium* may be effective for anti-diarrheal medications. To evaluate the safety and effectiveness of the treatment, more *in vivo* research is required.

Keywords: *Solanum sisymbriifolium*, DHFR (4DDR), Molecular docking, Anti-diarrheal

PID:IRC_LSBP_205

Isolation and Functional Profiling of Plant Growth-Promoting Nitrogen-Fixing Rhizobacteria from *Xylocarpus moluccensis*

Fatiha Islam Roshnee¹, Arifa Afrose Rimi¹, Shaikh Mufrad Rahaman Anim¹, Md. Morsaline Billah^{1*}, Anti Islam²

¹Biotechnology and Genetic Engineering Discipline, Life Science School, Khulna University, Khulna 9208, Bangladesh;

²Institute for Integrated Studies on the Sundarbans and Coastal Ecosystems (IISSE), Khulna University, Khulna, Bangladesh

*Corresponding Author mail: morsaline@bge.ku.ac.bd

Abstract

Nitrogen is a critical macronutrient for plant growth, yet atmospheric nitrogen (N₂) is inaccessible to most crops. While chemical fertilizers provide a short-term solution, their overuse leads to soil degradation and environmental harm. This study aimed to isolate, characterize, and molecularly identify native nitrogen-fixing rhizobacteria from the rhizosphere of *Xylocarpus moluccensis*, a mangrove species, with the goal of developing biofertilizers suited for saline-stressed coastal agriculture. Soil samples were collected from the rhizosphere of *X. moluccensis* in the Sundarbans, Khulna, Bangladesh. Bacterial strains were selectively isolated using Yeast Extract Mannitol Agar (YEMA) and Nitrogen-Free Burk's Medium. Ammonification tests were conducted to identify ammonia-producing strains. Indole-3-acetic acid (IAA) production was quantified to assess plant growth-promoting ability. Morphological, biochemical, and 16S rRNA molecular techniques were used for identification. A pot experiment was conducted with maize seedlings to evaluate the effect of bacterial inoculation on plant growth. Ten nitrogen-fixing bacterial strains were isolated, all capable of producing IAA. The RP-5 strain (*Rosellomorea aquimaris*) showed the highest IAA concentration (22.61 mg/mL). RP-5 and RP-6 (*Bacillus halotolerans*) significantly improved root and shoot development in maize compared to the control. This research offers a practical, nature-based solution to enhance crop productivity. The application of native nitrogen-fixing bacteria as biofertilizers can reduce chemical input, improve soil fertility, and boost plant resilience in saline environments.

Keywords: Nitrogen fixation, Ammonification, Indole-3-acetic acid, Rhizosphere, Biochemical test

PID:IRC_LSBP_210

Title: Anticancer Prospects of Selected Mangrove and Mangrove-associated Plants of Bangladesh

Shams Ara Khan^{1,2*}, Dr. Bishwajit Bakshi & Dr. Samir Kumar Sadhu¹

¹ Pharmacy Discipline, Life Science Faculty, Khulna University, Khulna, Bangladesh.

² Department of Pharmacy, Faculty of Life Science, Gopalganj Science and Technology University, Gopalganj, Bangladesh.

*Corresponding author email: shamsara07@gmail.com

Abstract

Background: Cancer is the second leading cause of death worldwide and a prominent health threat for today's human race. Scientists are always searching for a new remedy to permanently cure this devil disease. Different plant-derived metabolites have shown significant anticancer potential, along with fewer side effects and multipurpose applications. In many research works, scientists observed that mangrove and mangrove-associated plants of Bangladesh can be a promising source for anticancer research.

Objectives: This work aims to investigate the cytotoxic effects of seven selected mangrove and mangrove-associated plants, followed by the bioactive components' separation.

Methodology: Different parts of the selected plants were extracted with 96% ethanol. The extracts were screened for cytotoxic activity against healthy Vero cell line (Kidney epithelial cells of African green monkey) and HeLa cell line (Human cervical carcinoma cell) using the MTT (3-[4,5-dimethylthiazol-2-yl]-2,5 diphenyl tetrazolium bromide) assay. The cytotoxic extracts were subjected to phytochemical characterization by various chromatographic techniques.

Findings: None of the extracts were cytotoxic against the non-cancerous Vero cell lines. Four extracts (*Crinum viviparum* leaves, *Shirakiopsis indica* leaves and fruits, and *Merope angulate* leaves) showed cytotoxicity against HeLa cell lines (IC₅₀ 1.1–5 mg/mL), whereas six extracts (*Ficus microcarpa* leaves and bark, *Aegialitis rotundifolia* leaves, *Brownlowia tersa* leaves, *Thespesia populnea* leaves and fruits) presented no cytotoxicity (> 95% cells survived). The presence of different bioactive polyphenols in these cytotoxic extracts was evident by HPLC analysis.

Future implications: The results suggested that these plants can be an exciting source of interesting bioactive secondary metabolites possessing anticancer properties.

Keywords: Anticancer, MTT assay, HPLC, bioactive metabolites.

PID:IRC_LSBP_215

Biofilms: Mechanisms, Quorum Sensing, Antibiotic Resistance, and Implications in the Food Industry

Suvro Biswas¹, Montasir Ahmed², Proma Das², Israt Tamanna Niharika², Susmoy Chandra Das², Mst. Umme Shayla², Mohasana Akter Mita¹, Shovon Biswas³, Md. Robiul Hasan², Shahriar Zaman¹ & Md. Abu Saleh^{1*}

^{1,2} Department of Genetic Engineering and Biotechnology, Faculty of Biological Science, University of Rajshahi, Rajshahi-6205, Bangladesh

³ Department of Industrial & Production Engineering, Faculty of Mechanical Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

Corresponding author email: saleh@ru.ac.bd

Abstract

Microorganisms clustered together on surfaces are known as biofilms, which play a crucial role in bacterial infections. Bacteria produce biofilms in response to environmental stresses such as extreme pH and temperature, high concentrations of salt, high pressure, desiccation, ultraviolet radiation, inadequate nutrition, and antimicrobial substances. Biofilm formation requires several genes and proteins involved in adhesion, quorum sensing, cell wall development, stress response, and metabolism. Planktonic bacteria form biofilms through a complex process that involves several phases. Additionally, bacteria utilize signaling molecules to modulate gene expression during quorum sensing, which is essential for biofilm development. The microorganisms within biofilm employ a variety of strategies to resist to antibiotics. A critical component of biofilms is the extracellular matrix, which serves as an architectural scaffold and is responsible for the attachment of biofilm to the surface. Moreover, the ability of numerous bacteria to adhere to surfaces and form biofilms has significant implications in the food industry. This study aims to review the structural characteristics of biofilms, the molecular mechanisms and motivations behind biofilm formation, the genes and proteins required for biofilm development, the mechanisms of biofilm-related antibiotic resistance, the role of quorum sensing, the basic compositions and functions of extracellular polymeric substances, the characteristics of biofilm-forming bacteria, and the development of biofilms in various food industries.

Keywords: Biofilm · Quorum sensing · Food industry · Antibiotic resistance

PID:IRC_LSBP_220

Exploring Allelochemical Potential of *Blumea laciniata* (Roxb.) DC.

Tanzil Zahan¹, Sattyajit Biswas¹, Md. Mehedi Hasan¹, Mariya Ahmed¹, Niloy Saha¹ & Dr. A.M. Swaraz^{1*}

¹Laboratory of Functional Genomics and Biotechnology, Department of Genetic Engineering and Biotechnology, Jashore University of Science and Technology, Jashore-7408, Bangladesh

*Corresponding Author Email: a.m.swaraz@just.edu.bd

Abstract

Weeds are one of the major obstacles to crop production worldwide. Chemical herbicides, traditionally used to control weeds, pose serious health consequences. Various alternative weed-controlling approaches, including utilizing bioherbicides, are becoming popular due to their green production and non-health-hazard nature. Plants remain the easiest sources among all available sources of bioherbicides. Plant extractives are either directly utilized as bioherbicides or used as source materials to explore herbicidal lead compounds. These compounds are used in developing target-based bioherbicides. This study investigates the bioherbicidal potential of *Blumea laciniata* (Roxb.) DC. In this regard, allelopathic bioassays, phytochemical screenings, and *in silico* herbicidal activity of *Blumea laciniata* (Roxb.) DC were carried out. It was found that the plant exhibits a strong allelopathic effect against a broad spectrum of monocotyledonous and dicotyledonous plant species. The study further profiled the phytochemicals and obtained 150 compounds through GC-MS and HPLC analysis. Currently, the lead compounds assays of these compounds are being studied using *in silico* approaches for their potential use as bioherbicides.

Keywords: Bioherbicides; Allelochemical; Non-health-hazard; Bioassays.

PID:IRC_LSBP_225

Uncovering Deleterious SNPs Undermining the Stability of the NGF–TrkA Complex in Neurotrophin Signaling Pathway

Wakil Bin Ahmad Murad¹, Md Abul Bashar², Largess Barua³, Sudip Shill¹, Nayan Dash⁴, Sarmistha Mitra⁵, Zahed Bin Rahim^{1*}, Raju Dash^{5*}

¹Department of Pharmacy, BGC Trust University Bangladesh, Chittagong 4381, Bangladesh

²Department of Pharmacy, Faculty of Biological Sciences, Islamic University, Kushtia 7003, Bangladesh

³Department of Physiology, Jeonbuk National University, Jeonju 54907, Republic of Korea

⁴Department of Integrative Biotechnology, College of Biotechnology and Bioengineering, Sungkyunkwan University, Suwon, Gyeonggi-do 16419, Republic of Korea

⁵Department of New Biology, Daegu Gyeongbuk Institute of Science and Technology, Daegu 42988, Republic of Korea
Corresponding author email: zahed@bgctub.ac.bd and rajudash.bgctub@gmail.com

Abstract

Nerve Growth Factor (NGF) is one of the key neurotrophin that binds to its receptor tropomyosin-related kinase A (TrkA), serving in the nervous system as a crucial element that exerts neurotrophic functions (neural survival, differentiation, and signaling) and nociceptive functions. However, mutations in NGF causes genetic disease, called Hereditary Sensory and Autonomic Neuropathy Type V (HSAN V), which is a rare genetic disorder characterized by pain insensitivity. While recent analysis in our lab demonstrated that NGF^{R221W} mutation alters NGF dimerization and dynamic interaction with TrkA, it remains unclear that other variants also have similar or novel consequences. Therefore, the current study utilizes variants extracted from NCBI dbSNP database to identify the potential deleterious mutant that cause the painlessness disease HSAN V using several bioinformatics tools followed by molecular dynamics (MD) simulation. At first, 347 nsSNP were retrieved from NCBI dbSNP server, from which seven (R103Q, A210T, Q172R, G154S, V157M, T177I, R224W) SNPs were selected using 20 in-silico tools. Of these, three SNPs (Q172R, G154S, T177I) were located at highly conserved, functionally important residues in mature NGF sequence. When we conducted MD simulation, we found that these variants alter the conformational dynamics and motions of both NGF and TrkA as well as change the NGF-TrkA interaction profiles necessary for TrkA activation. This alteration reveals that the new variant may also be the cause of HSAN V, and offers new structural insight into how these mutations disrupt the functional dynamics of the NGF-TrkA complex.

Keywords: Hereditary sensory autonomic neuropathy V (HSAN V), nerve growth factor (NGF), tropomyosin-related kinase A (TrkA), molecular dynamics (MD) simulation.

PID:IRC_LSBP_230

In Silico and In Vivo Study of the Antiviral Properties of Beta-Tocopherol and Beta-Sitosterol from Brahmi Against White Spot Syndrome Virus (WSSV) in Shrimp (*Penaeus monodon*)**Zubaer Hossen¹, Niamul Haq¹, Md. Naim Uddin², Hindol Bagchi³, Mehedi Hasan¹, MD Sazzad Hossain¹, Md. Raichul Islam², Sohanur Rahman⁵, Abdullah-Al-Jubayer¹, Md. Faruk Hasan⁴, & Md Enamul Haque^{1*}**¹Department of Biotechnology and Genetic Engineering, Gopalganj Science and Technology University²Department of Biochemistry and Molecular Biology, Gopalganj Science and Technology University³Department of Biotechnology and Genetic Engineering, Khulna University, Bangladesh⁴Department of Microbiology, University of Rajshahi, Bangladesh⁵Department of Genetic Engineering and Biotechnology, Jashore University of Science and Technology* Corresponding author. E-mail address: enamul.haque@gstu.edu.bd**Abstract**

White spot syndrome virus (WSSV) is a serious threat to shrimp (*Penaeus monodon*) farming worldwide, causing 100% mortality in infected shrimp within 3-10 days. There is currently no effective antiviral treatment against this virus. The virus uses the VP28 trimer protein to interact with the shrimp PmRab7 receptor to enter host cells. To prevent this virus, we used the local Brahmi plant, which is known to have antiviral properties. Phytochemicals were first extracted from these plants using ethanol and methanol solvents, and their identity was confirmed by GC-MS analysis. The selected compounds were tested for efficacy by in silico docking with the VP28 viral protein. Beta-tocopherol and Beta-sitosterol were identified as the most effective compounds, with binding energies of -7.9 and -7.7 kcal/mol, respectively. Moreover, the stability and safety of these compounds were verified by pharmacokinetic, toxicity analysis, and molecular dynamics (MD) simulation. Later, in vivo experiments, the selected compounds were added to the shrimp diet. The infection rate was reduced by 22.2% and 27.8% with Beta-Tocopherol and Beta-Sitosterol, respectively, and the survival rate was 81.5% and 75.9%. In control, all shrimps died within 9 days. This study explored Beta-tocopherol and Beta-sitosterol as potential natural antiviral agents for WSSV. More research is needed to evaluate the efficacy of these compounds in developing potential drug molecules for sustainable shrimp farming.

Keywords: *In silico, in vivo analysis, VP28 Protein, White Spot Syndrome Virus (WSSV)*

PID: IRC_LSBO_232

Improving The Nutritional Status of Housemaids in Dhaka City by InterventionJannatul-Mawa-Samira¹, Puja Saha¹¹Department of Food and Nutrition, Faculty of Food and Nutrition, Akij College of Home Economics, Lalmatia, Dhaka-1205, Bangladesh.*Corresponding author email: zannatsamira987@gmail.com**Abstract**

Housemaids constitute a significant yet undervalued segment of the labor force in Dhaka City. Improving their nutritional status is a critical public health concern due to their long working hours and limited access to adequate nutrition. A research conducted in India, highlighted the prevalence of health problems among housemaids including malnutrition and related diseases, international journal of RCS state that 76.7% of housemaids were suffering from these diseases due to lack of awareness about nutrition, and limited access to healthy food options. This study aims to improve the nutritional status of housemaids in Dhaka city through targeted nutritional and lifestyle intervention. Underweight housemaids, aged between 20-50 years, were selected for this experimental study. The total sample size was 270(135 in the intervention group and 135 in the control group). Baseline, midline and endline data were gathered at the end of the 3-month intervention period, and analyzed using SPSS and Microsoft Excel. Before, intervention, the participants were found suffering from undernutrition, micronutrient deficiencies, irregular lack of nutritional education etc. After intervention, the difference was found to be highly significant ($p < 0.01$). Due to lack of hygiene practice it was found that at the baseline data only 10% were practiced hygiene. Hygiene practice has been improved with a large number among them. Data on food frequency showed the mean of carbohydrate is 258.57, protein-71.90 and fat-47.64 & nutritional knowledge was significantly increased in the intervention group ranging from 17.50% to 43.50%. The most drastic change was observed in fast food intake ranging from 43.50% to 8%. The study highlights the need to Conduct regular training sessions and awareness programs for housemaids to improve their knowledge about balanced diets, portion control, and healthy food choices within their budget. It also indicates the need to Ensuring access to affordable, nutrient-rich foods. The study will lead NGOs a easy way to detect malnutrition, weight-related issues early and provide timely interventions. The findings highlight the need to Educate employers on the importance of providing nutritious meals. It will contribute further research and follow-up studies.

Keywords: *Nutritional knowledge, underweight, intervention.*

Uralenol, Glycyrol, and Abyssinone II as Potent Inhibitors of Fibroblast Growth Factor Receptor 2 from Anti-Cancer Plants: A Deep Learning and Molecular Dynamics Approach

Md. Shahanur Prodhan¹, Muntasir Rahman Siam¹, Shu Shanta¹, Md. Sanowar Hossan¹, Md Majidul Islam Emon¹, Farhana Islam¹, Md Ekhtiar Rahman¹ & Alomgir Hossain^{1*}

¹Computational Biosciences and Chemistry Research Organization, Rajshahi-6205, Bangladesh

Corresponding author email: s1910861106@ru.ac.bd

Abstract

Background: Fibroblast Growth Factor Receptor 2 (FGFR2) is a critical target in cancer therapy due to its role in cell proliferation, differentiation, and oncogenic signaling. Aberrant FGFR2 activation is associated with various malignancies. **Objectives:** This study aims to identify potential FGFR2 inhibitors from a curated phytochemical library derived from anti-cancer medicinal plants using a combination of *in silico* techniques. **Methodology:** A total of 1,350 phytochemicals from 51 medicinal plants were screened using molecular docking (AutoDock Vina) to evaluate their binding affinity to FGFR2. The top candidates were further assessed using deep learning models to predict pIC₅₀ values. Pharmacokinetic and toxicity profiles were analyzed using ADME/T tools. Molecular Dynamics (MD) simulations were conducted to assess the stability of the protein–ligand complexes, along with PCA and free energy landscape analyses. **Findings:** Uralenol, Glycyrol, and Abyssinone II showed the highest docking scores and favorable pIC₅₀ predictions. ADME/T profiling confirmed their drug-likeness and low toxicity. MD simulations validated the complexes' structural stability, while PCA and free energy landscape analyses confirmed thermodynamic favorability and minimal conformational drift. **Implications:** These findings suggest that Uralenol, Glycyrol, and Abyssinone II are promising natural FGFR2 inhibitors. Their strong binding profiles and stable dynamics support their potential for further experimental validation and therapeutic development against FGFR2-related cancers.

Keywords: *FGFR2 inhibition, Molecular docking, Deep learning screening, Molecular dynamics simulation.*

Sub-Theme: Social Sciences & Global Impact

PID: IRC_SSGIP_004

TiO₂ Nanorod-Assisted Photodegradation of Methylene Blue and Amoxicillin under Sunlight Irradiation

Amena Jaman, Md. Sajib & Muhammed Shah Miran*

Department of Chemistry, University of Dhaka, Dhaka 1000, Bangladesh

***Corresponding author's email:** shahmiran@du.ac.bd

Abstract

Only about 1% of Earth's freshwater is accessible, and it's increasingly polluted by persistent organic pollutants (POPs) discharged from pharmaceuticals and textiles industries. Photocatalysis is the most promising and effective method among all advance oxidation processes (AOPs) for the removal of POPs. TiO₂ being the most common semiconductor and owing to a wide band gap (~3.2 eV for anatase), shows high activity under UV light. In this work, TiO₂ nanorod (TNR) was prepared by hydrothermal method from TiO₂ to be an effective photocatalyst under the exposure of sunlight. TNR was characterized by FT-IR spectroscopy, XRD, photoluminescence (PL) spectra, TG/DTA, and FE-SEM. FT-IR spectra confirms the presence of Ti-O bands. XRD analysis reveals relatively low crystallinity of TNR compared to TiO₂ indicating the formation of defects. A low intense peak of TNR in PL spectra indicates low recombination rate of charge carriers, which confirms the formation of oxygen vacancies or defect. Finally, FE-SEM analysis confirms the formation of rod-shaped TiO₂ with a smaller particle size of 25 nm. The photocatalytic activity of TNR was evaluated with methylene blue (MB) and amoxicillin (AMX). The performance of TNR was higher compared to TiO₂ under irradiation of sunlight. TNR showed 99% degradation of MB within 60 min under sunlight. Degradation of AMX by TiO₂ exhibits isosbestic point which is an indication of intermediate formation. In contrast, TNR showed effective performance without forming prominent intermediates and follows a uniform degradation. Therefore, the photocatalytic performance of TiO₂ towards persistent pollutants could be enhanced through modification of morphology by introducing defects such as nanorod.

Keywords: *Photodegradation, morphology, hydrothermal synthesis, persistent organic pollutants.*

PID: IRC_SSGIP_009

Gen-Z's Language of Protest: The Role of Memes and Satire in the Political Discourse of Bangladesh

Fahima Akter Rimi

Department of Folklore, Jatiya Kabi Kazi Nazrul Islam University

***Corresponding author's email:** fahima_21123204@jkkniu.edu.bd

Abstract

Satire has always served as a powerful medium for socio-political criticism and expression in society. Those who are constrained from expressing independent political thought have often relied on satirical approaches to voice their dissent. With the widespread availability of the internet, memes and satires have become the digital responses of the traditional folkloric satirical approach that express symbolic resistance against incompatible power structures, politics and public discontent. Gen Z's expression of this new genre of socio-political approach can now be introduced as a form of digital folklore. This research will be conducted by adopting thematic analysis method in qualitative research. The main goal is to analyze the linguistic, cultural, and political relevance of Gen Z humor; emerging as a theoretical study focused on a folkloric approach. Based on political events in Bangladesh from 2020 to 2025, more than 100 memes and satirical content spread on social media will be analyzed, and semi-structured interviews with young people aged 16 to 22 will be conducted to explore Gen Z's motivations, cultural references, and political consciousness. The research is theoretically grounded in Michel Foucault's 'Power and Discourse' theory, Henry Jenkins' 'Participatory Culture', and Linda Dege's concept of 'Modern Folklore'. It explores the power of digital satires that challenge existing socio-political power structures and serve as a 'subversive form' of folk resistance. The study aims to focus on the transformative potential of digital folklore in shaping democratic participation. It also can contribute to both folkloristic and socio-political discourse which will expand the practice of folklore in the future and encourage young researchers to explore this issue extensively.

Keywords: *Gen-Z, Humor, Politics, Digital Folklore.*

PID: IRC_SSGIP_013

Youth as Active Social Agents: A Qualitative Case Study of Student Initiated KIN School at Shahjalal University of Science and Technology, Sylhet, BangladeshG. H. Mohiuddin Ahmad Munna^{1*}, Foaisal Hosen Rabbi², Riya Banik Ahsi³ & Samia Rahman Miha⁴^{1,2,3,4} Department of Anthropology, ^{1,2,3} 4th year BSS (Hons.) Student, ⁴ 2nd year BSS (Hons.) Student, Shahjalal University of Science and Technology, Bangladesh

*Corresponding author email: mohiuddinmunna296@gmail.com

Abstract

Youth-led initiatives have become a key driving force of worldwide community development and social transformation. Recent research shows that young people can be powerful forces for social change. This study examines KIN School which is a free education program created and run entirely by students from Shahjalal University of Science and Technology (SUST) in Sylhet, Bangladesh. It particularly investigates the mechanisms, strategies and outcomes of student-led educational leadership as a model for sustainable social change. This research employed single case study approach and the data was collected through semi-structured interviews, classes and meetings were observed and school documents and volunteer journals were reviewed. The study used Critical Positive Youth Development (CPYD) theory from Gonzalez and Kokozos (2024) to explain how SUST students deal with power relationships can gather resources, and create lasting change while developing their own leadership skills. Findings show that student volunteers are act as creative problem-solvers who challenge traditional education systems, they develop new teaching methods, and create fair decision-making processes. The study identifies three main ways students create change. Firstly, they build new organizational structures through shared decision-making. Secondly, they gather resources by connecting with university, community, and online networks and finally, they create learning experiences that help both the children they teach and themselves grow as leaders. The findings also show why it is important to support student-led projects for sustainable social improvement. The study recommends that institutions can create better support systems for youth leadership in community development.

Keywords: *Youth-led initiatives, Educational leadership, Sustainable social change, Critical Positive Youth Development (CPYD).*

PID: IRC_SSGIP_016

A Study on the Socioeconomic and Institutional Factors Affecting Basic Healthcare Access in Rural BangladeshKarina Seddeka^{1*}*Department of Development Studies, Student, Khulna University, Khulna-9208, Bangladesh*

*Corresponding author email: brishtykarinaseddeka@gmail.com

Abstract

Bangladesh has made significant progress in increasing health coverage in recent years. But large disparities remain, particularly in low-income and rural areas. In this study, we explore the major determinants influencing the accessibility of basic healthcare services in rural Bangladesh. A structured questionnaire was used to collect data from 187 respondents in October 2024. Results indicate low access to healthcare as only 20.3% of respondents reported using BHUs in the last three episodes of illness. Availability of doctors and the affordability of services were two of the significant barriers identified. The responsiveness of hospital staff and perceived quality of care were also important influences. On logistic regression analysis, being explained that availability of doctors was associated with 2.56 times higher odds of visiting BHUs ($p = 0.042$) and those reporting that services were affordable, 2.88 times higher odds ($p = 0.032$). On the other hand, the access to necessary free medicines was found, in an unexpected manner, to be associated with a decrease in service utilization indicating self-medication or systemic constraints. The available of healthcare staff were also influential, though not always statistically significant. The results highlight that healthcare reform is necessary which must not only be the supply side (doctors and medicine) problem but also be the demand side (affordability and health education). This paper contributes to the emerging policy debate by highlighting actionable pathways that would guide and reinforce Bangladesh's journey to achieving universal health coverage.

Keywords: *Healthcare access, Affordability, Availability, BHUs.*

PID: IRC_SSGIP_019

Smart Mining of Urban Air: A Data-Driven Solution to Dust Pollution in Rapidly Growing CitiesMd. Helal Uddin^{1*}, Ridwan Al Mustavy¹, Mobashir Tajuare Partho¹, Marowa Jahan¹ &
Dr. Fatema Tuz Zohra².¹ *Department of CSE, Faculty of Science & Technology, American International University- Bangladesh, Bangladesh.*² *Department of Mathematics, Faculty of Science & Technology, American International University- Bangladesh, Bangladesh.*

*Corresponding Author Email: 23-50044-1@student.aiub.edu

Abstract

Urban dust pollution is a growing concern, especially in highly populated areas. This study examines factors affecting dust concentration using data mining techniques and statistical analysis. We collected responses from different urban locations in Bangladesh to understand perceptions of dust levels and their sources. Our findings reveal that road dust, vehicle emissions, and construction activities are the main contributors. Additionally, seasonal changes play a significant role, with higher dust levels observed during dry seasons. A chi-square test confirmed no relation between duration of residence and dust perception, while regression analysis showed a strong link between traffic density and dust concentration. The results suggest that improving urban policies, increasing greenery, and controlling emissions can reduce dust pollution. Real-time dust monitoring could also help communities take preventive measures. This research highlights the urgent need for data-driven solutions to enhance urban air quality and create healthier living environments.

Keywords: *Urban dust pollution, seasonal variation, statistical analysis, chi-square test.*

PID: IRC_SSGIP_023

Language Death, Identity Loss, and Minority Marginalization: A Socio-Cultural Analysis of the Kharia Language's Endangerment in BangladeshMeraz Hossen Cesti^{1*}¹ *BSS Student, Faculty of Social Sciences, Department of Sociology, University of Barishal, Barishal – 8254, Bangladesh*

E-mail: merazhossen.aip@gmail.com

Abstract

In the context of growing concerns over linguistic inequality and cultural erosion, this study explores the fate of one of Bangladesh's most endangered indigenous languages, the 'Kharia language'. The Kharia language, spoken by a small indigenous group in the tea garden region of Rajghat, Srimangal, is on the verge of extinction, with only two fluent speakers remaining. This study investigates the socio-cultural and structural dimensions of the endangerment of the Kharia language in Bangladesh, focusing on its implications for identity loss and minority marginalization. Using an exploratory design, this research adopts qualitative method, employing life-history interviews to gain in-depth insights into the experiences of linguistic minorities in Bangladesh. It applied thematic content analysis to analyze data. The analysis is grounded in theoretical frameworks such as Fishman's Reversing Language Shift, Bourdieu's linguistic capital, and Gramsci's theory of hegemony. Findings show that language is deeply intertwined with cultural heritage, traditional knowledge, and social identity, its decline signifies more than just a communication gap, it represents the systematic erosion of the Kharia community's cultural, social, and political presence. The study reveals how state-driven linguistic dominance, marginalizing education policies, and cultural assimilation drive language abandonment, thereby denying indigenous communities' equitable linguistic access and social inclusion. The study highlights that language death is both a result and a catalyst of broader socio-political exclusion. The findings stress the need for inclusive language policies, community-driven revitalization, and institutional recognition to address intersectional injustices faced by Bangladesh's linguistic minorities, fostering cultural resilience and social inclusion.

Key Words: *Kharia language, Linguistic endangerment, Identity loss, Minority marginalization*

PID: IRC_SSGIP_026

Sleep Deprivation and Academic Burnout among University Students: A Sociological Study of Urban Higher EducationMosaddek Billal^{1*}, Md. Hasan Al Banna & Farhana Yasmin²^{1,2} *Department of Sociology, Dhaka International University, Dhaka-1212, Bangladesh*

*Corresponding Author Email: mosaddik951@gmail.com

Abstract

Sleep deprivation has become an increasingly prevalent concern in higher education, often contributing to chronic academic burnout among students. In urban academic settings, where students are subjected to intensive academic demands, social pressure, and digital distractions, sleep quality is frequently compromised. This study investigates the sociological dimensions of sleep deprivation and its relationship with academic burnout among undergraduate students in Dhaka-based universities. The objective was to explore how sociocultural, economic, and institutional factors contribute to students' sleep behavior and subsequent psychological strain. A cross-sectional mixed-method approach was adopted involving a structured survey of 384 (using Cochran's formula) undergraduate students and 12 in-depth interviews across three public universities. Standardized instruments were employed: the Pittsburgh Sleep Quality Index (PSQI) and the Maslach Burnout Inventory-Student Survey (MBI-SS). Quantitative findings revealed that 71.2% of respondents experienced poor sleep quality, with significant associations between sleep deprivation and emotional exhaustion ($p < 0.01$). Qualitative analysis highlighted recurring themes of performance anxiety, pressure from family expectations, and a pervasive culture of productivity that normalized sleep neglect. Students often adopted maladaptive coping mechanisms, including excessive caffeine intake and overnight study routines, further aggravating their mental and physical health. The findings underscore how academic burnout is not solely an individual issue but deeply embedded in structural and cultural expectations within the education system. The study calls for institutional reforms, including sleep hygiene education, flexible academic schedules, and culturally responsive mental health support to alleviate burnout and promote student well-being.

Keywords: *Sleep deprivation, Academic burnout, Student well-being, Sociological analysis.*

PID: IRC_SSGIP_029

Reimagining Palli Janapad: Designing Aspirations of Rurality with User-Centered Vertical Housing Solutions in Rangpur

Rafia Sharmin Farnia*

Department of Architecture, Hajee Mohammad Danesh Science & Technology University, Dinajpur-5200, Bangladesh

Corresponding Author Email :rafia.1707209@std.hstu.ac.bd@gmail.com

Abstract

Around the world, saving farmland while keeping up with rising housing needs is a big challenge, especially in farming-based countries like Bangladesh. Rural housing is changing, with people moving from large traditional homes to smaller, modern ones. This shift, influenced by changing socio-economic conditions and aspirations, is particularly evident in regions like Rangpur. This study critically revisits the action research project "Palli Janapad Housing" located in Rangpur, a vertical rural housing initiative originally intended to address farmland loss and livelihood improvement. Field observations, however, reveal that the current design has overlooked the aspirational spatial needs of rural inhabitants, resulting in limited community acceptance and low occupancy by actual rural residents. To address this gap, the study adopts a Design Science Research (DSR) methodology combining field surveys, semi-structured interviews, and short-term observations, focusing on the lived experiences of residents in "Palli Janapad Housing" and adjacent villages. The outcome is a set of user-centered design considerations related to residential units, communal areas, and livelihood-supporting spaces that reflect the evolving needs and aspirations of rural residents, allowing designers, planners, and policy makers to create different solutions and match the requirements expressed by future users. The revised "Palli janapad housing" aims not to present a final solution but to open up new dialogue on aspiration-driven multistoried rural futures in rapidly transforming agrarian societies like Bangladesh.

Keywords: *Housing aspirations, Livelihood improvement, Vertical village*

PID: IRC_SSGIP_036

A Strategic Impact Assessment of Barind Multipurpose Development Authority's Role in Sustainability, Socio-Economic, and Environmental Reformation in High Barind TractSihab Bin Toriq^{1*}, Mahadi Hasan², Md. Mahfuz Al Maruf³ & Mehedi Hasan Utsob³¹*Notre Dame College, Dhaka, Bangladesh*²*Ritsumeikan Asia Pacific University, Oita, Japan*³*Rajshahi Collegiate School, Rajshahi, Bangladesh*

*Corresponding author email: shihabtoriq2021@gmail.com

Abstract

The High Barind Tract, notoriously vulnerable to extreme drought and disasters, has experienced a significant shift in socio-economic conditions over the past four decades. Once synonymous with water scarcity, food insecurity, and poverty, the paradigm shift happened when Barind Multipurpose Development Authority played the role of changemaker to mitigate ecological and economic stagnation for High Barind Tract, transforming it into a powerhouse of agro-economic opportunity. This study illustrates BMDA's strategic importance in bringing sustainability, agricultural productivity, socio-economic development, and environmental revival in the High Barind tract. Using a hybrid approach, including household surveys, personal interviews, report study, and remote sensing data, this research assesses the long-term impact of BMDA's initiatives on irrigation efficiency, crop diversification, poverty alleviation, and environmental restoration. However, challenges such as groundwater level depletion in certain zones persist. Our findings emphasize that BMDA's critical role is in the metamorphosis of High Barind Tract from an extreme drought prone region to a more resilient and sustainable atmosphere for agricultural advancement and socio-economic freedom, as 1,000-hectare increase in irrigated area is associated with a 50-ton crop production increase annually through DTW implementation. This research showcases regional development models suitable for arid and semi-arid regions, offering insights and strategies for policymakers and development planners.

Keywords: *BMDA, High Barind Tract, Transformation Analysis, Impact*

PID: IRC_SSGIP_038

Exploring Student Engagement in Campus Sustainability Practices: A Case Study on University of Rajshahi

Tarif Hosen*, Firuz Sadaf Opee

¹ *Department of Political Science, Faculty of Social Science, University of Rajshahi, Rajshahi-6205, Bangladesh.*¹ *Department of Political Science, Faculty of Social Science, University of Rajshahi, Rajshahi-6205, Bangladesh.*

* Corresponding author Email: tarifxpm@gmail.com

Abstract:

This study explores the influencing factors of student engagement in sustainability activities of the University of Rajshahi in Bangladesh, using a mixed method case study. The research, which involved 200 students and interviews with administration staff, finds a significant discrepancy between students' high levels of support for sustainability and their engagement with sustainability-related actions. Although 87.1% of the students had a good knowledge of the sustainability issue and they felt a high responsibility about it (mean score = 1.59 scale 1–5) the most important obstacle in being involved in a project was the lack of information related to the existing programs (mentioned more than 40 times) and the lack of facilities. There were major institutional difficulties identified in the qualitative findings like absence of formal cooperation between the students and the administration, perennial lack of maintenance staff on campus and fewer review meetings. This "value-action gap" reflects that, more than student apathy, structural problems restrict volunteerism. The study suggests the need for open communication between students and administration, specific modes of communication regarding sustainability projects, and an expansion of the role of student organizations. Such institutional changes would help to narrow the gap between students' sustainability values and environmental behaviour on campus and offer a model for effecting similar change in other new universities in developing countries.

Keywords: *Campus sustainability, Campus environmental practice, Value-action gap, Environmental behavior, University sustainable programs*

PID: IRC_SSGIP_041

Local Politics in Transition: Changes in Grassroots Power After the July 2024 Revolution in Bangladesh

Tasfia Islam^{1*}, Mabruk Al Islam²

¹ *Department of History, Jahangirnagar University, Savar, Dhaka-1342, Email: tasfia.stu20192@juniv.edu*

² *Government and politics, Jahangirnagar University, Savar, Dhaka-1342, Email: mabrukalislam1999@gmail.com*

Abstract

In July 2024, citizens in Bangladesh united to protest the equitable employment conditions in the government. The use of violence by the authorities aggravated the situation, causing an even greater protest as the movement became a call that could not be ignored. The unprecedented withdrawal of power by the Sheikh Hasina government was the outcome of this anger and hope wave that making the beginning of a new era in the politics of the nation. The paper points out how July 2024 Revolution reshaped local politics in Bangladesh by focusing the changes in central government control, increase of youth and civil society participation, and the occurrence of political violence. It is interested in how such forces redesigned local political life structure and behavior nation-wide. To understand the complex dynamics of transformation, the study is planned on the base of a qualitative research with semi-structured interviews and surveys. Primary data will be collected among the local citizens, political workers, and civil society members of Nilphamari district whereas secondary sources will consist of media reports, official documents and similar academic literature to provide an objective and critically-thinking analysis. The study reveals a major shift in political power after July 2024. The long time neutral opposition forces including BNP and Jamaat-e-Islami have re-entered the local politics arena when the ruling party administration left the scene. The absence of ruling party leaders has opened up space for new voices and leadership that shows how national transformations can work quickly to realignment grass-roots political power and participation.

Key Words: *July Revolution 2024, Grassroot Power, Political Transition, Ruling Party.*

PID: IRC_SSGIP_048

Socio-Cultural Analysis of the Oraon Community of Malanpara in Rajshahi, Bangladesh

Taslina Tariq^{1*}

¹ *MA in History and Asian Studies (MAHAS), Department of History and Philosophy, North South University (NSU), Dhaka-1229, Bangladesh.*

*Corresponding author email: taslimatariqmunia@gmail.com

Abstract

Bangladesh is considered an ethno-linguistically diverse country. The Oraon community is an ethnic minority community of Bangladesh, and some Oraon settlements can be found in the Barind region of the country. The paper aims to explore the socio-cultural conditions of the Oraon community in Malanpara village, Rajshahi. The key objective of the paper is to assess the social structure and norms, rites related to health, birth, death, and marriage, as well as evolving practices and festivals among the Oraon residents. The data were collected through field survey and in-depth interview with one member from each Oraon family residing in Malanpara village of Godagari Upazila. The results reveal that the community has faced ethno-religious discrimination, but the traditional Panchayet social system has helped the community navigate their aspirations. Traditional healers, livestock rearing, rituals, festivals, labor hiring practices, and beliefs surrounding loans are integral to their identity. Occupational shifts have influenced changes in traditional practices. The findings highlight the essential socio-cultural elements shaping the community's ethnic identity.

Keywords: *Socio-cultural conditions, rituals, festivals, traditional healer, ethnic minority, Bangladesh*

PID: IRC_SSGIP_054

Socio-economic and Environmental Impacts of Tourism: A Case Study of Moheshkhali and Teknaf in Cox's Bazar, Bangladesh.

Tufail Ahmed Tufa^{1*}, Dr. Latifur Rahman Sarker & Dr. Chandan Roy¹

^{*1}*Department of Geography and Environmental Studies, Faculty of Geoscience, University of Rajshahi, Rajshahi-6205, Bangladesh. Email: tufailahmedtufa10@gmail.com*

¹*Department of Geography and Environmental Studies, Faculty of Geoscience, University of Rajshahi, Rajshahi-6205, Bangladesh.*

Abstract

Bangladesh's social and economic landscape is undergoing a significant shift due to a steady influx of tourism, particularly in areas such as Maheshkhali and Teknaf, which are both culturally rich and ecologically sensitive, like Cox's Bazar. This study investigates the dual impacts of tourism its potential advantages and hazards through extensive fieldwork, encompassing structured surveys, direct observations, spatial analysis utilising GIS, and statistical techniques such as SPSS and KoboToolbox. Over 90% of respondents saw tourism as a driver of economic growth and infrastructure improvement. However, over 75% of Maheshkhali respondents and 60% of Teknaf respondents expressed concern about the worsening state of the environment, including noise, water, and air pollution. More than half of those interviewed believe that the rise of tourism has damaged rather than preserved local customs, raising concerns about the preservation of cultural assets. The emergence of jobs and expanding markets are two important economic gains, but they are not distributed fairly and usually come at the price of ecological and cultural sustainability. A balanced, community-focused tourism strategy that integrates eco-friendly activities, effective waste management, and long-term conservation plans is urgently needed, according to the report. In addition to offering factual support for the complex effects of tourism, this study offers useful suggestions for decision-makers who want to encourage sustainable coastal growth.

Keywords: *Sustainable tourism, Coastal development, socioeconomic change, environmental degradation, and GIS study.*

Sub-Theme: Technology, Engineering & Industry 4.0

PID: IRC_TEIP_124

Automatic Multifunctional Seed Sowing Machine

Rownak Abrar Nihal^{1*}, G I I Izaz Abdullah¹, Ziaul Hoda Jony¹, Sumaiya Mubasshera¹, Md. Mahfuz Rahman¹, Md Nur Alam Mondal², & Md. Mahbub Hasan³

¹Department of Mechanical Engineering, Faculty of Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur -5200, Bangladesh.

³Department of Electrical and Electronics Engineering, Faculty of Computer Science and Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur -5200, Bangladesh

*Email: - abarnihal4@gmail.com

Abstract

Agriculture is the backbone of our economy. In traditional seed sowing, farmers burn fossil fuels to run IC Engines for seeding, planting and irrigating land. This causes air, water and sound pollution. Our machine runs on dual mode charging, both field-based solar energy and grid electricity which reduce dependency on fossil fuels. It contains five 12V DC motors, an Arduino Uno microcontroller and motor drivers for steering the machine and rotating the seed drums, plough for digging the plant, and a water pump to irrigate the field enabling precise and automated seed sowing. We have integrated a 12 V battery and a 10 W solar panel for continuous and uninterrupted operation in the field. Additionally, it is equipped with an LED light to facilitate easy maneuvering at night. It protects our farmers from the excessive temperature of the sun, since it can be remotely controlled via Bluetooth with the help of smartphone. The application of this machine can be implemented for various crops and different sizes of seeds at a time, also variations in the space between seeds while planting can be varied as per requirement. It is a cost-effective solution for farmers to sow multiple seed with the help of single device at a time, saves time and effort of the farmers and helps eco-friendly farming practice.

Keywords: *Automated Agriculture, Renewable Energy, Seed Sowing Mechanism, Bluetooth & Microcontroller.*

PID: IRC_TEIP_008

Investigating the Impact of Image Pre-processing Methodologies on Deep Learning Performance for Wheat Leaf Disease Diagnosis

Zahara Tasnim^{1*}, Sakib Imtiaz² & Md. Ashikuzzaman Ashik³

¹Department of Agronomy & Agricultural Extension, University of Rajshahi, Rajshahi-6205, Bangladesh.

²Department of Computer Science and Engineering, Ahsania Mission University of Science & Technology, Rajshahi-6206, Bangladesh.

³Department of Computer Science and Engineering, Varendra University, Rajshahi-6204, Bangladesh.

*Corresponding author email: tasnimzahara79@gmail.com

Abstract

Wheat production faces persistent threats from diverse foliar diseases, amplifying the necessity for reliable and scalable disease diagnosis within modern agriculture. Addressing this challenge, our study offers a comprehensive evaluation of machine learning methodologies for multi-class wheat leaf disease classification utilizing the Five Crop Diseases Dataset curated from Kaggle. The key objective is to assess and compare the predictive performance of ten leading pre-trained deep learning models (e.g., Xception, InceptionV3, ResNet50, VGG19, and MobileNetV2) against a custom-built convolutional neural network (CNN) architecture. The experimental design employs a robust dataset of RGB wheat leaf images, methodically partitioned into training, validation, and testing subsets. Various image pre-processing techniques, including segmentation, Contrast Limited Adaptive Histogram Equalization (CLAHE), Gaussian Blur, their combinations, and the absence of pre-processing, were systematically applied and evaluated. Despite the sophistication of CLAHE and Gaussian Blur, results reveal that the highest model accuracy of 99% test accuracy was achieved with the custom CNN trained on segmented, RGB images, outperforming all state-of-the-art reference models and pre-processing configurations. These findings underscore the critical importance of precise image pre-processing and custom model design, while indicating that advanced enhancement methods may not universally benefit classification outcomes. This work establishes a foundation for effectively deploying custom deep learning solutions in real-time, field-based wheat disease detection, and paves the way for future research on lightweight, accessible, and scalable agricultural diagnostic frameworks.

Keywords: *Wheat leaf disease classification, Custom Convolutional Neural Network (CNN), image pre-processing, deep learning models.*

PID: IRC_TEIP_011

Catalytic Conversion of Hemicellulose to Furfural: Synthesis, Characterization, and Industrial ApplicationsAbdullah Al Mamun¹, Tanvir Muslim^{1*} & Swapan Kumer Ray²¹*Department of Chemistry, University of Dhaka, Dhaka-1000, Bangladesh*²*Fiber and Polymer Research Division, Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka, Bangladesh***Corresponding Author email: tmuslim@du.ac.bd***Abstract**

In this work, three new nanostructured catalysts for the extraction of furfural from hemicellulose are synthesized and characterized: V₂O₅-ZrO₂, Al₂O₃-La₂O₃-V₂O₅, and TiO₂-SiO₂-La₂O₃. Effective nanoscale fabrication was demonstrated by the average particle sizes of 58 nm, 49 nm, and 65 nm for the corresponding catalysts as determined by scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS). Through the use of UV-vis spectroscopy, the optical band gap energies were determined to be 1.41 eV, 1.77 eV, and 1.50 eV, indicating high photocatalytic activity. By observing distinctive peaks at 700 cm⁻¹, 455 cm⁻¹, and 498 cm⁻¹, FTIR analysis verified the existence of functional groups. To establish catalyst stability and crystallinity, further structural and compositional confirmation was carried out using Raman spectroscopy, X-ray diffraction (XRD), and thermogravimetric analysis (TGA). Furfural was effectively extracted from 4 g of hemicellulose using these catalysts, producing about 1.30 ml. High-Performance Liquid Chromatography (HPLC), Proton Nuclear Magnetic Resonance (¹H NMR), and Gas Chromatography–Mass Spectrometry (GC-MS) were used to confirm the extracted product. A useful platform chemical generated from biomass, furfural has great potential as a sustainable precursor to biodiesel and other bio-based chemicals and fuels. These results highlight the potential of customized nano-catalysts in biomass valorization, offering a productive path toward applications using renewable energy.

Keywords: *Hemicellulose, Furfural, Catalyst characterization, Biomass valorization*

PID: IRC_TEIP_018

SnakeAI190: A Hybrid Deep Learning Model Approach for Snake Identification and Toxicity CategorizationAkash Mojumdar¹, K M Tanvir Anjum^{2*}, Tania Akhter³, Rubaiya Saimin⁴ & Rasel Debbarma⁵¹*Department of Environmental Science, Stamford University Bangladesh, Dhaka-1217, Bangladesh.*²*Department of Computer Science and Engineering, Shanto-Mariam University of Creative Technology, Dhaka-1230, Bangladesh.*³*Department of Anthropology, Texas State University, San Marcos, Texas, USA.*⁴*Department of Computer Science and Engineering, University of Rajshahi, Rajshahi -6000, Bangladesh.*⁵*Tipra Para, Satchari National Park, Chunarughat, Habiganj, Bangladesh.***Corresponding author email: tanvirmp20@gmail.com***Abstract**

Snakebite remains a significant health and safety concern in Bangladesh, where misidentification, lack of public awareness and misconceptions often lead to delayed treatment. Both medical treatment and snake conservation depend on accurate snake identification and toxicity Type. We propose SnakeAI190, a hybrid deep learning model developed to identify snake species and toxicity class, as a solution to this challenge. A dataset was developed through field surveys with 22 snake species (7054 images) from Bangladesh, and the performance of three pre-trained models, such as VGG19, ResNet50, and DenseNet121, is compared. In addition to evaluating individual models, we developed a novel hybrid deep learning architecture called SnakeAI190 which combines f VGG19, ResNet50, and DenseNet121 with Softmax classification layer and feature extraction features. Every model was trained with a 0.001 learning rate and 10 epochs using a transfer learning approach. 80% of the dataset has been utilized for training, while 20% was used for testing. The ROC-AUC curve, accuracy, explainable AI, and confusion matrix were applied to evaluate the model's performance. SnakeAI190 assessed height performance with 89% training accuracy and 91% testing accuracy in species identification. When categorizing toxicity, the model's performance 89% accuracy in testing and 90% accuracy in training. The ROC-AUC scores were 0.99 for non-venomous snakes, 0.97 for semi-venomous, and 0.98 for venomous species. These findings indicate that SnakeAI190 can be a useful tool for accurate snake identification and toxicity assessment, supporting with medical treatment as well as conservation efforts for snakes in Bangladesh.

Keywords: *SnakeAI190, Deep learning, dentification, Snake and toxicity*

PID: IRC_TEIP_024

Multi-model LSTM Neural Network for Short-Term Traffic Flow ForecastingMd Abdulla Hasan¹* & Zaffar Abdullah¹,*¹Department of Information and Communication Engineering, Daffodil International University, Dhaka-1216, Bangladesh.*

*Corresponding author email: abdulla242-50-058@diu.edu.bd

Abstract

Effective traffic management and infrastructure planning require accurate short-term traffic flow prediction, but most of the current models lack accuracy and flexibility for different traffic situations. To solve these problems, this paper suggests a multi model Long Short-Term Memory (LSTM) neural network, which would allow increasing accuracy of the predictions as well as being responsive in real time. The model architecture, combined with optimized LSTM layers, includes further activation and dropout mechanisms, optimized experimentally to consider a variety of traffic situations. This is indicated in the comprehensive assessments whereby the multi model LSTM model has proved to effectively reduce the occurrence of errors in predictions when compared to the traditional methods, with maximum relative errors being 1.05 at road sections and 1.14 at the intersections. Although the computation time using the proposed multi model LSTM is slightly more than that of the standard LSTM models, the accuracy and robustness achieved with the proposed multi model LSTM model are much better, prompting strong suitability of the proposed multi model LSTM model to be utilized in real-world application of short-term traffic flow prediction under varying weather conditions in urban traffic.

Keywords: *Short-Term Traffic Flow Prediction; Recurrent Neural Network (RNN); Long Short-Term Memory (LSTM); Multi Model LSTM*

PID: IRC_TEIP_029

Numerical Simulation of Vehicle Noise Propagation around Large-Scale Urban Structures using FDTD and FEM MethodsPalash Kumar Das¹, Ifat Jahan Soma¹ & Shahariar Ryehan²*¹Department of Mathematics, Hajee Mohammad Danesh Science and Technology University, Bangladesh**²Department of Engineering, Aix-Marseille University, France*

*Corresponding author email: kumar.pkmath@gmail.com

Abstract

In urban areas, vehicle noise has a significant impact on environmental quality and public health, especially near historical and valuable sites. In this study, we numerically analyzed how vehicle noise propagates and reflects around a large building, such as a museum or a government building. We used the Finite Difference Time Domain (FDTD) method in MATLAB and the Finite Element Method (FEM) in COMSOL Multiphysics to determine the dynamics of sound wave propagation and reflection.

The real building geometry was imported using a 3D STL model, which ensures realistic modeling of sound reflection and shadow zones. A moving source was defined as the sound source according to the vehicle's trajectory. By observing the changes in sound pressure (Sound Pressure Level – SPL) from different heights and directions, it was found that a significant acoustic shadow zone is created behind the building, where the sound intensity is significantly reduced.

Although the FDTD method can visualize the time-dependent wave propagation at high resolution, the FEM method provides greater accuracy for complex boundary and material properties. The study demonstrates that the combined use of the two methods can play an effective role in urban noise control and architectural noise protection design.

Keywords: *Urban noise pollution, Vehicle noise analysis, Building sound reflection, FDTD method, FEM method, Sound shadow zone, MATLAB sound simulation COMSOL acoustics*

PID: IRC_TEIP_039

Green Solvents: A Sustainable Alternatives for Safer Chemical Processing
Md. Shaifur Rahman Apu^{1*}, Md. Motiur Rahman Tuhin & Md. Shakibul Hasan¹,¹*Department of Applied Chemistry and Chemical Engineering, Faculty of Engineering, University of Rajshahi, Rajshahi -6205, Bangladesh.*

*Corresponding author email: Shaifurrahmanopu@gmail.com

Abstract

A green solvent is a safe and eco-friendly liquid that can be used in chemical processes to reduce the harmful impacts on humans and the environment. Most industries still rely markedly on toxic solvents, which lead to environmental and health damage. Toxic solvents cause around 2 million deaths and 53 million disabilities globally each year due to cancer, organ failure, and chemical exposure. Common solvents like benzene and trichloroethylene are linked to leukemia, kidney cancer, and nervous system damage. This study presents reliable approach for replacing hazardous solvents with safer and more eco-friendly alternatives. The goal of this study is to explore reliable green solvents—like ionic liquids, deep eutectic solvents, bio-based alcohol, and super-critical CO₂—for chemical processes. The methodology consists of reviewing recent resources and identifying solvent properties like biodegradability, toxicity, reusability, and cost. Some bio-based solvents like ethanol and ethyl lactate can match all those criteria for being a green solvent. Deep eutectic solvents are biodegradable and easy to prepare, offering wide applications in industries. The study aims to show that using green solvents can minimize industrial pollution, protect workers, and improve environmental quality.

Keywords: *Green solvents, Deep eutectic solvents, Bio-based solvents, Sustainability*

PID: IRC_TEIP_059

Hybrid CNN-BiLSTM-GRU Deep Learning Model for Human Activity Recognition (HAR) in Patient Monitoring Using PAMAP2 DatasetSubrata Kumer Paul^{1,2*}, Dewan Nafiul Islam Noor¹, Rakhi Rani Paul^{1,2} & Md Ekramul Hamid²¹*Department of Computer Science and Engineering (CSE), Bangladesh Army University of Engineering & Technology (BAUET), Qadirabad Cantonment, Dayarampur, Natore, 6431, Bangladesh*²*Department of Computer Science & Engineering (CSE), Rajshahi University, Rajshahi, 6205, Bangladesh*

*Corresponding author email: sksubrata96@gmail.com

Abstract

Continuous Human Activity Recognition (HAR) is becoming increasingly essential in modern healthcare, where timely monitoring of patients' daily movements can prevent accidents, support rehabilitation, and enhance independent living—especially for elderly or vulnerable individuals. However, accurately recognizing complex and varied human activities in real time remains a challenging task due to noisy sensor data, diverse motion patterns, and the need for efficient models deployable on resource-limited devices. To address these challenges, this study proposes a hybrid deep learning framework that combines Convolutional Neural Networks (CNN), Bidirectional Long Short-Term Memory (BiLSTM), and Gated Recurrent Units (GRU). The hybrid model aims to achieve high-precision classification of daily activities by effectively extracting spatial features (CNN), modeling bidirectional temporal relationships (BiLSTM), and improving sequential data processing (GRU). Experiments were conducted using the PAMAP2 dataset, which records 18 distinct activities from 9 subjects with wearable sensors. After careful preprocessing and hyperparameter tuning, the model achieved an impressive accuracy of 99.15%, outperforming existing HAR methods. This robust performance demonstrates its potential for real-time patient monitoring, elderly fall detection, smart home applications, rehabilitation progress tracking, and occupational safety. Future improvements include integrating an attention mechanism for feature prioritization, leveraging transfer learning for scalability, applying multi-sensor fusion for richer input data, and optimizing the architecture for lightweight deployment on edge devices. Overall, the study contributes an effective, adaptable solution for reliable HAR, advancing proactive patient care and smart health systems.

Keywords: *Human Activity Recognition, Hybrid Deep Learning, Patient Monitoring, PAMAP2 Dataset*

PID: IRC_TEIP_062

Design and Implementation of a Smart Vacuum Cleaner Robot Using Arduino and Sensor-Based Navigation for Clean Environments.Helal Uddin^{1*}, KH. Nazmul Ahshan², Md. Alamgir Hossain³ & Md. Mujtuba Rafid⁴

Department of Mechanical Engineering,^{1,2,3} Hajee Mohammad Danesh Science and Technology University, Bangladesh
Department of Electronics and Communication Engineering,⁴ Hajee Mohammad Danesh Science and Technology University, Bangladesh

*Corresponding author email: mohammadhelal247@gmail.com

Abstract

Health and productivity depend on a clean environment, and it is of great essence because of the high concentration of people in medical colleges, hospitals, dormitories, university campus areas, classrooms, and halls. Health issues that have risen due to garbage and pollutants in addition to the growing need to have excellent cleaning technologies have also enhanced the necessity of automated systems that minimize human interference and are safer. Human-operated manual vacuum cleaners are labor-intensive, ineffective in large or dangerous spaces, and dangerous for your health. Traditional cleaning techniques are insufficient in circumstances like disease outbreaks, where little contact is necessary, necessitating independent alternatives to successfully maintain hygiene. The goal of this project is to use Arduino to design and build a smart vacuum cleaner robot that can efficiently clean university buildings and similar spaces on its own. This will eliminate the need for manual cleaning, lower health risks, and ensure thorough cleaning. The robot will have an Arduino Uno as its microcontroller, motor driver, ultrasonic sensor though the robot will follow 5-volts but whose DC gear motors have wheels run on 12 volts. We used a 1200mAh 3s lithium-ion battery, we reduced the voltage of 12-volts to 5-volts by using a buck-converter and fed it into the electronic circuit. Obstacle detection can be made by using the ultrasonic sensor for autonomous navigation (forward, backward, 0 to 180 degrees turning). The prototype was experimented at the field of 120x20 inches to check the cleaning efficiency, absence of obstacles, and the battery operation. With 100% detection accuracy of obstacles in the test at the range of 0- 200 cm, we are designed a wheel with a 65 mm diameter, which can clean an area up to 2.26 square meters in 1 minute at the speed of 120 rpm. The robot can perform a good clearance of debris and pollutants without the occurrence of a collision. The robot has low user costs, so it is fully user-friendly, and its price is acceptable as a solution to automated cleaning with minimal health hazards and labor costs. Its effectiveness demonstrates the possibility of autonomous systems in enhancing the levels of hygiene and efficiency in public and educational areas.

Keywords: Vacuum Cleaner, Robot, Autonomous system, SolidWorks, Obstacle, Arduino uno, Ultrasonic sensor.

PID: IRC_TEIP_064

A Study On The Factors Influencing The Adoption Of Fintech On Remittance In An Emerging Economy By Using Technology Adaptation Model

Rafiqul Islam Shohad^{1*} & Salma Jahan²
^{1,2} Department of Accounting, University of Dhaka, Dhaka-1000, Bangladesh
*Corresponding Author: shohadislam7@gmail.com

Abstract

Since 2011, the mobile financial service sector in Bangladesh has witnessed significant growth due to the adoption of financial technology (FinTech), reshaping the global financial landscape and expanding access to financial services worldwide. The COVID-19 pandemic further underscored the role of technology in promoting digital financial services and financial inclusion, particularly during social distancing measures. This thesis explores the implications of FinTech on remittance services, with a focus on developing economies like Bangladesh. The study's literature review and theoretical framework delve into FinTech's impact, adoption factors, and theoretical concepts like the newly vulnerable markets theory and the Technology Acceptance Model. The study investigates the integration of remittance technologies and network effects, while also analyzing factors influencing FinTech implementation through the 3D framework. The research aims to contribute to the understanding of FinTech's role in financial inclusion, particularly in the context of remittances and their adoption in Bangladesh. Hypotheses, rooted in the Technology Acceptance Model, explore the relationships between perceived usefulness, ease of use, and actual FinTech usage for remittances. The findings highlight that ease of use significantly and positively influences actual usage, while perceived usefulness does not have a significant impact. In conclusion, the thesis enriches our comprehension of FinTech's potential in emerging markets, particularly in the realm of remittance services. It underscores the importance of user-centric design and emphasizes the need for further research to guide policymakers and regulators toward sustainable FinTech practices.

Keywords: Financial Technology (FinTech), Developing Economies, Providers of Remittance services, Financial Inclusion

PID: IRC_TEIP_067

A Comprehensive Efficiency Study of T-Shirt Production Lines: Applying the Kilbridge-Wester Balancing Method

Md. Ariful Haque¹, Md. Abu Bakar Siddiq², Avijeet Saha Tonmoy³, Nowshad Hossain Rakib⁴ & Suneet Malakar^{5*}

^{1,2,3,4,5}Department of Industrial & Production Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh.

*E-mail: suneetmalakar01@gmail.com⁵

Abstract

Line balancing is an essential production strategy in the context of manufacturing as a whole. However, many textile companies still have parallel assembly line systems. This is both unproductive and costly in the modern era of global competition. This research aims to improve the workstation assignment of a T-shirt production line servicing an international brand to enhance their operational effectiveness. This is achieved by the Kilbridge-Wester method, which balances workloads across workstations in a systematic approach to decrease idle time and improve line efficiency. This research was limited to performing detailed standard minute value and efficiency calculations for 24 distinct manufacturing operations, creating precedence networks, and industry benchmarking. With 20 machines and 22 operators, the facility was arranged in parallel assembly lines which resulted in 48% efficiency with a daily production of 1,050 units as opposed to a 1,870-unit target. This research achieved 69.4% line efficiency, and operational efficiency was improved by 44.6% using the Kilbridge-Wester method. Daily production capacity was increased to 1,846 units, which is a 75.8% increase. This modification lowered labor costs by 4,320 TK, a daily cost saving of 13.6% while productivity per worker increased by 103.8%. The optimized arrangement now only requires 19 workstations instead of the previously used 22, increasing the overall Equipment Effectiveness from 43.2% to 62.5%. These operational improvements stem from strategically perpetual line balancing retention, alongside methodical workforce reallocations, yielding a sustainable return on investment and fostering a comprehensive, enduring garment manufacture model of resilient competitive advantage.

Keywords: *Line balancing, Kilbridge-Wester method, Production efficiency, Textile manufacturing*

PID: IRC_TEIP_069

Solar Powered Insect Eliminator

Mst. Shamim Ara Ema^{1*} & Deedhity Dhara¹

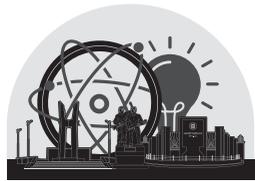
¹ Department of Industrial & Production Engineering & Technology (RUET), Rajshahi-6204, Bangladesh

*Corresponding author email: shamimaema61001@gmail.com

Abstract

Now a days, farmers are facing challenges when they try to control pest using insecticides. They use chemical to eliminate insecticides but it is costly and harmful for environment. So, by solving this problem, thought to use the product name "Solar powered insect eliminator " which is eco-friendly, portable, rechargeable, effective etc. For using this product, analyzed the current state of insect control method, explored technologies, established some methodologies etc. Data was collected by using survey from customers and then Kano model was utilized from customer requirements. Data was collected from other companies and compared those companies features with the analyzing product. Quality function development model is developed by comparison to customer requirements and technical requirements. The survey has conducted by 139 responses for the product and most of the respondents, 59.7% are farmers. QFD is analyzed by customer requirements and the important features such as protection grid was 12.6%, adjustable stand was 16.9%, battery backup was 16.9% l, materials weight was 17.7% and customers has given more importance to the weight of material. We developed the device that targets harmful insects while minimizing risks to farmers. This innovative device offers eco-friendly, portable and efficient pest control solution. Overall, this product aims to improve crops yield through sustainable technology.

Keywords: *Insecticides, Eliminator, Portable, Sustainable*



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PID:IRC_3MT_005

Method of Earning Livelihood According to Islamic Viewpoint: A Theoretical AnalysisDr. Joynul Abadin^{1*}¹*Department of Islamic studies, University of Rajshahi, Bangladesh.*

*Corresponding author email: joynulabadin88@gmail.com

Abstract

Islam is a complete way of life that provides clear guidance for every aspect of human existence. Earning a livelihood is an essential part of life, which must be conducted in accordance with the commands of Allah. Islamic Shari'ah has clearly defined the boundaries between what is lawful (halal) and unlawful (haram), and it guides people towards earning through legitimate and ethical means. The Prophet Muhammad (peace be upon him) and the previous prophets were themselves engaged in self-earned professions, setting practical examples for humanity. This research analyzes, in the light of Islam, the lawful and unlawful methods of earning a livelihood, along with their significance and impact. Lawful earnings such as agriculture, business, and labor-based professions are encouraged in Islam; on the other hand, earning through interest, bribery, gambling, and deceit is strictly forbidden. The causes for increase in sustenance have been identified as God-consciousness (taqwa), sincerity (ikhlas), seeking forgiveness (istighfar), and maintaining kinship ties, whereas disbelief (kufr), extravagance, and arrogance have been identified as causes for its reduction. In modern society, the inclination towards materialism and luxury is blurring the boundaries between halal and haram. On one hand, many people are earning through unlawful means; on the other hand, many are living in idleness and unemployment. In this context, the proper earning methods prescribed by Islam can play a crucial role in establishing economic balance, self-respect, and morality in society. This thesis serves as a valuable guideline toward that goal.

Keyword: *Islamic livelihood, Islamic economic ethics, Shari'ah-based income ethics, Prophetic model of earning, Islamic financial morality*

PID:IRC_3MT_007

Eco-Art Of Varendra Landscape

Tasmiah Husnaina Ara*

1Department of Ceramics and sculpture, Faculty of Fine Arts, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: t.h.aara102870@gmail.com

Abstract

This thesis explores the concept of eco-art within the cultural and environmental context of the Varendra landscape in northwestern Bangladesh. Drawing upon the region's rich heritage of terracotta, indigenous clay practices and ecological consciousness, the study investigates how art can respond to and engage with environmental degradation, climate change, and soil erosion. Varendra boasts a rich cultural and environmental heritage that has long influenced artistic traditions. The study investigates how contemporary artists engage with natural elements, ecological themes and environmental activism to create works that both celebrate and critique human-nature relationships. Through a combination of visual analysis, field studies, and interviews with local artists, the research uncovers a growing movement that blends indigenous knowledge, sustainability, and creative expression. It focuses on artistic traditions such as *tepa putul* and folk pottery, relief work, tiles positioning them not merely as cultural artifacts but as ecological statements rooted in land-based wisdom. By reinterpreting these forms through contemporary eco-art approaches, the study creates a visual dialogue between past and present, nature and culture, decay and renewal. The work reflects on how traditional practices can be adapted to confront contemporary environmental issues while preserving cultural identity. This research contributes to the broader discourse on ecological art by proposing a site-specific model where regional artistic practice becomes a tool for environmental reflection, resistance, and regeneration. Through this model, the thesis argues for the potential of place-based eco-art to foster deeper connections between communities and their ecological environments.

Keywords: *Eco-art, Varendra region, Terracotta, Cultural Ecology*

PID:IRC_3MT_009

Current Practices and Challenges of Classroom Management and Its Relationship with Students' Learning Outcomes: A Mixed-Method Study in Bangladeshi Primary Schools.
Fawzia Rahman

School of Education, Master's student, University of Birmingham, Birmingham- B15 2TT, United Kingdom.

Abstract

Classroom management is a vital aspect of effective teaching and learning because it fosters an environment that encourages student engagement and academic success. In the context of primary schools in Bangladesh, where resources and infrastructure are limited, implementing more effective classroom management practices becomes even more crucial. The objectives of this study are to find out and explicate the currently practiced classroom management techniques of the urban and rural primary schools in Bangladesh. Next, it also aims to discuss the issues faced by the teachers in applying these strategies in an appropriate manner. This mixed-methods study examines the relationship between classroom management techniques and student learning outcomes in overcrowded primary schools in Bangladesh. Data were gathered through virtual classroom observations via Zoom and the CLASS tool, in-depth interviews with teachers, and analysis of student test records. Five classrooms were observed, and the data were examined through triangulation methods. The findings suggest that we have an uneven student-teacher ratio. The average ratio of 1:40, with some classes reaching 1:50, prevents effective teaching. Managing large classes poses a significant challenge, making it difficult for teachers to provide individualised attention and support to meet the diverse learning needs of their students. Teachers experience considerable stress in maintaining discipline and promoting inclusivity, which adversely affects student learning outcomes. The study highlights the need for improved classroom management strategies, enhanced teacher support, effective technology integration, and policy reforms to enhance the learning environment in Bangladeshi primary schools.

PID:IRC_3MT_013

Exploring the Metacognitive Awareness and Its Relationship with Learning Performance among Foreign Language Learners
Kazi Rabeya Khatun^{1*}

¹*Department of Educational Psychology & Guidance, Institute of Education & Research, University of Dhaka, Dhaka-1000, Bangladesh*

*Corresponding author email: kazirabeyakhatun0@gmail.com

Abstract

Bilingualism and multilingualism are pivotal elements in modern education. As individuals adopt the role of global citizens, acquiring additional languages has become integral to formal, non-formal, and informal education. Metacognition, the ability to recognize and regulate one's cognitive processes, plays a critical role in language learning. Existing research demonstrates that metacognitive awareness (MA) is a strong predictor of success in learning languages, however, there is limited empirical data on the MA of language learners in Bangladesh. The purpose of this study was to examine MA and its relationship to foreign language learning performance among Bangladeshi learners. A convergent-parallel mixed-methods design was employed with a quantitative survey ($n = 100$) using a revised 19-item Metacognitive Awareness Inventory (MAI) and qualitative in-depth interviews ($n = 8$). Survey participants were selected from public and private language institutes in Dhaka, representing diverse foreign languages. Quantitative analysis revealed moderate-to-high overall MA. A Pearson correlation identified a weak but significant positive relationship between MA and academic performance ($r = .205$, $p = .041$). Qualitative findings supported these trends, with participants demonstrating strong information management, and persistent debugging behaviors, with comparatively limited self-evaluation. These findings offer a comprehensive profile of metacognitive strengths and limitations among foreign language learners. They also highlight areas for targeted research, such as longitudinal tracking of metacognitive development, the influence of language modality. Future studies are encouraged to examine intervention effects on metacognitive regulation and to compare patterns across linguistic and educational settings. Overall, the findings increase understanding of metacognitive profiles in multilingual contexts.

Keywords: *metacognitive awareness, self-regulated learning, foreign language learning, academic performance*

PID:IRC_3MT_019

Grief in Academia: Understanding the Role of Loss on the Academic Experience & Peer Interaction of University Students in Bangladesh

Tasmin Rashid

Institute of Education & Research, University of Dhaka, Dhaka-1100, Bangladesh
Corresponding Author Email: tasmindu98@gmail.com

Grief profoundly affects the emotional, cognitive, and social well-being of university students, especially during the critical phase of emerging adulthood. In Bangladesh, home to over one million university students, grief remains an underexamined academic challenge. This study explores how bereavement shapes students' academic engagement, peer relationships, and expectations of institutional support.

Using an exploratory sequential mixed-method design, Phase 01 involved interviews with twelve bereaved students, identifying six key domains: academic disruption, emotional expression, faculty dynamics, peer support, coping strategies, and institutional expectations. Phase 02 surveyed 108 students to validate these patterns statistically.

Findings reveal grief produces two academic pathways: disruption and resilience, shaped by relational closeness, gendered coping, faculty responses, and peer support. Students described emotional withdrawal and academic decline, while others transformed grief into motivation. Peer relationships alternated between isolation and recovery support. Only 18.5% sought institutional help, citing discomfort and distrust, yet strong calls for sensitive policies, counseling services, and grief-specific frameworks were expressed.

This study introduces a culturally grounded model of grief in South Asian academia, advocating institutional recognition of grief as a collective structural issue.

Keywords: *Grief, University Students, Academic Engagement, Bangladesh*

PID:IRC_3MT_023

Study on effects of sanitized egg marketing in relation to improve public health practices

Md zaminur Rahman^{1*}, Fariya Haque Barsha¹

Department of poultry science, Animal production, Gono Bishwabidyalay

Abstract

Table eggs are a rich in protein and essential nutrients source and eggs industry growing rapidly. Market eggs are easily become contaminated, especially from dirt on their shells, heightening the risk of microbial contamination. A key concern is *Staphylococcus aureus*; a pathogen poses significant health and food safety risks. A cross-sectional study has conducted to assess the physicochemical and microbial quality of eggs from 10 commercial layer farms, 10 retail shops, and 10 supermarkets under fresh, sanitized, and unsanitized conditions. A total of 300 eggs were collected, with 100 from each source. *Staphylococcus aureus* isolated and confirmed by routine microbiological technique, antibiotic susceptibility was tested through disc diffusion method. Additionally, PCR was employed to detect resistance genes (*mecA*, *blaTEM*, *tetA*, *vanA*, *vanC*) and the enterotoxin gene (*seb*). *S. aureus* was found in 59% of fresh egg at farm level samples, 52% of unsanitized egg sample from retail shop and 10% of sanitized egg collected from super shop. Molecular analysis revealed that 46.55% isolates from farm level, 40.38% isolates from retail level and 20% isolates from super shop level were positive for the *nuc* gene. High resistance rates were observed to cephalosporins, β -lactams, and lincosamides, with notable sensitivity to fluoroquinolones. Correlation analysis showed significant associations between resistance patterns and antibiotic efficacy. Multidrug resistance in fresh egg isolates was 60.41% at farm of unsanitized and 66.66% of sanitized isolates classified as multidrug-resistant. The study reveals high levels of *S. aureus* and multidrug resistance in unsanitized eggs in Bangladesh, emphasizing the need for better food safety practices. Improved handling, cold storage, and treatment of table eggs are crucial for reducing the risk of antibiotic-resistant infections and ensuring consumer safety

Keywords: *Staphylococcus aureus*, Antibiotic resistance, Molecular analysis, Multidrug resistance.

PID:IRC_3MT_029

GC-MS Based Phytochemical Profiling and COX-2 Targeted Molecular Docking of *Citrus grandis* (L.) Leaf Extract: An *In Silico* Evaluation of Anti-Inflammatory and Pharmacokinetic Properties

Md. Borhan Uddin¹ & Md. Shahadat Hossain^{1*}

¹*Department of Genetic Engineering And Biotechnology, Faculty of Biological Science, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: shahadatgeb@ru.ac.bd

Abstract

The search for safe and effective anti-inflammatory agents is a continuing challenge in drug discovery, particularly for targeting Cyclooxygenase-2 (COX-2), a central enzyme involved in inflammation and pain signaling. In this study, a comprehensive *in silico* approach was employed to investigate the anti-inflammatory potential of *Citrus grandis* (L.) leaf extract. Gas chromatography-mass spectrometry (GC-MS) analysis revealed a diverse phytochemical profile comprising 224 bioactive compounds. Molecular docking studies against COX-2 (PDB ID: 5IKR) identified three lead compounds viz., ATTB, IEI, and HF-TNB with high binding affinities (–8.0 to –8.9 kcal/mol), forming stable interactions with key catalytic residues including PRO153, VAL46, LEU152, and CYS41. Pharmacokinetic profiling using SwissADME and toxicity prediction via ProTox-II confirmed that all selected compounds exhibited favorable drug-likeness, low gastrointestinal absorption, absence of blood-brain barrier permeability and acceptable toxicity margins (LD₅₀: 250–1000 mg/kg). Among these, HF-TNB demonstrated the most balanced profile in terms of binding potency, pharmacokinetics, synthetic accessibility and safety. This study provides compelling computational evidence for the anti-inflammatory efficacy of *C. grandis* (L.) phytochemicals, highlighting their potential as novel plant-derived COX-2 inhibitors. The findings lay a promising foundation for further preclinical validation and development of next-generation anti-inflammatory therapeutics from natural sources.

Keywords: *Citrus grandis*, GC-MS analysis, Molecular docking, COX-2 inhibition

PID:IRC_3MT_031

Pesticide Residues and Heavy Metals Analysis in the Water, Soil and Some Indigenous Fish Species of Bangshi River, Savar, Dhaka, Bangladesh

Md. Mahedi Hasan^{1*}, Md. Mansurul Haque², Aysha Akter Metu¹ & Md. Jahangir Alam²

¹*Laboratory of Fishery and Limnology, Department of Zoology, Faculty of Biological Science, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh.* ²*Agrochemical and Environmental Research Division (AERD), Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE), Ganakbari, Savar, Dhaka-1349, Bangladesh.* *Corresponding author email: mahedi.jucm@gmail.com

Abstract

Heavy metal (HMs) contamination in aquatic environments is of critical concern due to the toxicity of metals and their accumulation in aquatic habitats. The present study was conducted to assess the level of pollution of water, soil, and eight fish species (*Colisa fasciatus*, *Ompok pabda*, *Heteropneustes fossilis*, *Anabas testudineus*, *Channa punctatus*, *Puntius sophore*, *Mustacembelus armatus*, and *Mystus vittatus*) by seven heavy metals (Cd, Cr, Pb, Zn, Cu, Fe, and Mn) and five pesticides (DDT, Chlorpyrifos, Carbaryl, Cypermethrin, and Diazinon) in the Bangshi River at Savar, Dhaka. The seasonal distribution of HMs in water, sediment, and fish was determined by using an Atomic Absorption Spectrophotometer (AAS). During summer and winter seasons the concentrations of Cd, Cr, Pb, Zn, Cu, Fe, and Mn in water samples were in the range of 0.08-0.12, 1.70-2.54, 0.77-1.04, 1.46-1.70, 0.10-0.14, 3.07-3.59, and 0.16-0.22 ppm, respectively, and in soil samples were in the range of 3.87-5.0, 979.82-923.96, 34.6-41.33, 2.55-3.29, 98.22-108.91, 2.36-2.85, and 0.73-0.85 ppm, respectively. In fish samples, Fe was the highest in all species, while Cd had the lowest level of accumulation in the tail part. Levels of pesticides such as chlorpyrifos and cypermethrin found in water, soil, and fish samples were 0.42 and 1.14 ppm, 0.19 and 0.83 ppm, 0.03 and 0.24 ppm, respectively. The studied water and soil samples are not completely safe for humans, but the fish are still safe. This study helps to formulate concrete guidelines for the policymakers to ameliorate river pollution and restore the original health of the river.

Keywords: Heavy metals (HMs), Pesticides, Bangshi River and Indigenous Fish.

PID:IRC_3MT_039

Comparison of Drought Stress Responses in Eight Potato Varieties from Bangladesh: Focusing on Drought Responsive and Carbon Partitioning Gene Expression

Md. Toufiq Hasan¹, Sabina Yasmin¹, Md. Shahidul Haque¹ & Fahmida Khatun^{1*}

¹Institute of Biotechnology, Bangladesh Agricultural University, Mymensingh-2202

*Corresponding author email: fahmida.meem@bau.edu.bd

Abstract

Drought is a major abiotic stress that negatively impacts crop production globally; potato cultivation is no exception. Different levels of drought severely hamper the production of tubers in potatoes. To assess the drought tolerance potential, our experiment was conducted on eight popular Bangladeshi potato varieties: BARI Alu-13, BARI Alu-29, BARI Alu-72, BARI Alu-73, BARI Alu-79, BARI Alu-100, Shil Alu, and Lal Pakri. Among these, Shil Alu and Lal Pakri are local varieties, while the others are high-yielding varieties developed by BARI. BARI Alu-72 and BARI Alu-73 have been developed as drought and heat-tolerant varieties. The study employed a completely randomized design (CRD) with three replications, exposing the varieties to three levels of treatment: control (80-85% field capacity, FC), moderate (60-65% FC), and severe (40-45% FC) drought stress. Among the morphological traits, tuber mass was the most critical, and Shil Alu exhibited the lowest reduction in tuber mass, with decreases of 17.61% under moderate stress and 26.81% under severe stress. In contrast, the tuber mass of BARI Alu-100 declined by 33.58% under moderate stress and 62.53% under severe stress. Under severe drought stress, the tuber mass production of BARI Alu-79 and BARI Alu-13 was also low. To substantiate the findings, biochemical parameters related to the antioxidant pathway were studied. The drought-responsive *ER24* and carbon-partitioning genes *Stin8*, *Stin6*, and *Sus3* were further studied. Overall, the genes *Stin8*, *Sus3*, and *ER24* exhibited upregulation in response to drought stress, whereas *Stin6* showed downregulation. Analysis using the PCA biplot and the CDSRI, which combined morphological, biochemical, and gene expression data, identified Shil Alu, BARI Alu-72, and BARI Alu-73 as the most promising varieties, suggesting they may be suitable for cultivation in drought-prone areas.

Keywords: Drought tolerance, Gene expression, Biochemical responses, Carbon-partitioning genes.

PID:IRC_3MT_042

Whole Genome Analysis of Multidrug-Resistant *Escherichia coli* Isolates from Poultry in Noakhali, Bangladesh, and Their Public Health Significance

Nurun Nahar Akter¹, Israt Jahan Asha¹, Md. Adnan Munim¹, & Dr. Shipan Das Gupta^{1*}

¹Department of Biotechnology and Genetic Engineering, Noakhali Science and Technology University

*Corresponding author email:shipongeb@gmail.com

Abstract

Antibiotic resistance genes (ARGs) in poultry bacteria pose a significant threat to both poultry production and human health. Multidrug-resistant (MDR) strains of *E. coli* are particularly alarming for their potential for zoonotic transmission and quick acquisition of resistance. This study examined the antibiotic resistance profiles, virulence factors, and zoonotic potential of *E. coli* isolates from broiler and layer chickens in Noakhali, Bangladesh. Of 77 isolates, 24 were tested for antibiotic sensitivity and categorized by their Multiple Antibiotic Resistance Index (MARI), with two isolates (eco_nstu_001 and eco_nstu_002) exhibiting the highest MARI value of 0.82 selected for whole-genome sequencing. Using the Comprehensive Antibiotic Resistance Database (CARD), approximately 58 resistance genes were identified in both strains. Study both strains represent MDR phenotypes driven by chromosomal efflux pumps and plasmid-encoded resistance genes such as *tet(A)*, *tet(M)*, *FloR*, and *AAC(3)-IID*, conferring resistance to tetracyclines, phenicols, and aminoglycosides. Efflux systems and regulatory gene mutations contributed to resistance against multiple antibiotic classes like fluoroquinolones. 0.914 and 0.926 pathogenicity scores indicated a high potential for human infection, supported by virulence factors related to adhesion, biofilm formation, and immune evasion, and similarities to clinical strains. Comparative genomic analysis of 80 *E. coli* strains revealed that the study isolates originated from distinct ancestral lineages and showed significant genetic diversity. Unique genes related to metabolism and stress response reflected adaptability to different environments. Mobile genetic elements (MGEs) were key drivers of genetic variation and environmental adaptation. These results underscore the urgent need for routine antimicrobial resistance monitoring and control measures in poultry farming in Bangladesh to prevent the dissemination of MDR bacteria, thereby protecting both animal and public health.

Keywords: *Escherichia coli*, Poultry, Whole-genome sequencing, Multidrug resistance

PID:IRC_3MT_047

Occurrence of Multidrug-resistant Bacteria from Rhizosphere and Bulk Soil of Tomato Crop Fields

Ronja Parvin & Farzana Ashrafi Neela*

Environmental Microbiology Laboratory, Department of Botany, Faculty of Biological Science, University of Rajshahi, Rajshahi – 6205, Bangladesh.

*Corresponding author email: farzaneelabot@ru.ac.bd

Abstract

This study is the first in Bangladesh to identify and characterize the culturable multidrug-resistant bacteria from rhizosphere and bulk soil of Tomato field. Soil samples were collected from four sites of Nowhata and Katakali, Rajshahi, respectively. The study was carried out between March 2023 to January 2024. The isolation and viable count were done from soil samples by agar dilution method using nutrient agar supplemented with 32 and 64 µg/ml tetracycline (TC). The multidrug resistance profile of TC-resistant bacteria was determined by disk diffusion method using Meropenem, Colistin, Kanamycin, Erythromycin, Ampicillin, and Ciprofloxacin. Multidrug-resistant isolates were identified by 16S rRNA gene analysis. A total of 48 TC resistant isolates with various phenotypic characteristics were isolated from four sites of bulk soil and rhizosphere soil of tomato field, respectively. Among them, 58.33% isolates were resistant to Colistin followed by Ampicillin (35.42%), Kanamycin (22.92%), Erythromycin (16.67%) and Meropenem (10.42%). However, all TC-resistant isolates were susceptible to Ciprofloxacin. A total of 20 multidrug-resistant bacteria were identified, these were *Chryseobacterium flavum*, 4 strains of *Acinetobacter calcoaceticus*, *Novosphingobium panipatense*, 2 strains of *Bacillus anthracis*, *Paracoccus speluncae*, 3 strains of *Bacillus* sp., *Bacillus cereus*, 2 strains of *Staphylococcus hominis*, *Macrocooides bohemicum*, *Brevundimonas diminuta*, *Brevundimonas* sp., *Staphylococcus haemolyticus* and *Bacillus thuringiensis*. In this study, we also isolated clinically relevant superbug *Acinetobacter calcoaceticus* strain BOTRUEML127, which totally showed resistance to 9 antibiotics. Multidrug-resistant soil bacteria indicate a risk of severe infection if these isolates are transmitted to humans via the food chain.

Keywords: *Agricultural soil, Agro-ecosystem, Bacteria, Multidrug resistance, Food safety*

PID:IRC_3MT_051

Effect N, P, K, S, Zn & B on the growth and yield of cabbage.

Professor Dr. Md. Saiful Islam*, Sadbir Ahmed, Sakila Khatun, Md. Amir Hamja, Mohammad Eftekhari Alam, Md. Saidul Islam

¹*Department of Crop Science and Technology, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh***Corresponding author email:** saifulcst@ru.ac.bd

Cabbage (*Brassica oleracea* L.) plays a vital role in Bangladesh's vegetable economy, yet its productivity is often hindered by imbalanced fertilizer use. A field experiment was conducted to reduce the yield gap at the Soil Science Farm, Department of Crop Science and Technology, University of Rajshahi, between 6 November 2022 and 4 March 2023. The objective of carrying out the research was to determine the collective influence of macro- and micronutrients that are essential to cabbage growth and development: N, P, K, S, Zn, and B. The experiment was done using a Randomized Complete Block Design (RCBD) with seven fertilizer treatments and three replications by measuring the growth parameters of a plant, i.e., plant height, no. of leaves, length of leaves at 30 days, 45 days, 60 days after transplanting (DAT), and final yield data. Of all the treatments, the NPKS (T5) combination markedly enhanced the growth of the plants and presented the best yield of 66.96 tons/ha, which is in sharp contrast with that of the unfertilized control. Further improvements were only minor when Zn and B were added, although not as effective. These results demonstrate the effectiveness of balanced fertilization, particularly the important role of sulfur, in maximizing cabbage productivity. The research can serve as a good guide to sustainable nutrient management approaches, promising a more efficient, cost-effective, and eco-friendly production of cabbage in the future.

KeyWords: *Cabbage; Growth & yield; Fertilizer Dose*

PID:IRC_3MT_058

Introduction of Bakery Yeast (*Saccharomyces cerevisiae*) on Fermented Carbon Organics (FCO) Preparation and It's Efficacy on Plankton Production in Biofloc SystemSudipta Rani Ray¹ and Md. Al-Amin Sarker^{1*}¹*Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding Author: maa_sarker@yahoo.com

Abstract

An experiment was conducted to investigate the effect of bakery yeast on total suspended solids (TSS) and its impact on plankton production in a biofloc system over 30 days through two sequential trials. In the first trial, three yeast treatments: 0% (T₁), 1% (T₂), and 2% (T₃), were applied with a basal dose of molasses (5 g/L), raw salt (0.5 g/L), and probiotic (0.75 g/L) in 5-liter containers, each replicated three times. The aim was to assess the influence of bakery yeast on Fermented Carbon Organics (FCO) formation. Results revealed that the T₃ treatment (2% yeast) were produced the significantly higher TSS (620.80 ± 1.47 mg/L) and biofloc volume (66.97 ± 0.15 mL/L) than other (P < 0.05). All water quality parameters remained favorable for floc formation. Based on the first trial, a second trial was designed using three selected TSS doses-30 mL/L (Dose-1), 60 mL/L (Dose-2), and 90 mL/L (Dose-3), to determine their effects on plankton productivity in mini biofloc pots. The highest phytoplankton (2.888 × 10⁵ ± 4.73 individuals/L) and zooplankton (804.67 ± 5.51 individuals/L) densities were recorded in Dose-3, with significant differences among treatments (P < 0.05). All water quality parameters remained within optimal ranges for supporting plankton production. The results suggest that 2% bakery yeast enhances biofloc formation, which significantly supports plankton abundance, making it a potential additive for improved performance in biofloc-based aquaculture system.

Keywords: *Biofloc system, Bakery yeast, Fermented carbon organics (FCO), Total suspended solids (TSS), Plankton production*

PID:IRC_3MT_061

Genetic Analysis and Selection of Terminal Heat Stress Tolerant Transgressive Segregants in F₃ Generation of WheatYousuf Islam^{1*}, Md. Sultan Ahmed¹ & G. H. M. Sagor¹¹*Plant Molecular Genetics Laboratory, Department of Genetics & Plant Breeding, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

*Correspondence: hyousuf.1702054@bau.edu.bd

Abstract

Wheat (*Triticum aestivum* L.) is crucial for global food security, and the increasing demand for wheat is anticipated to rise by 26% by 2050 in developing countries, such as Bangladesh. However, it is challenged by elevated temperatures during critical reproductive stages. This study aims to investigate the genetic basis of terminal heat stress tolerance in wheat, focusing on identifying high-yielding, heat-tolerant segregants in the F₃ generation. This research evaluated a hundred F₃ lines with five parental genotypes subjected to terminal heat stress. Significant variation was observed among the studied characters. In cross combinations of F₃ lines, BARI Gom-33 × BARI Gom-25 showed superior performance on all the traits over other crosses and parental genotypes, except for tillering capacity. Traits such as yield per plant, tillering capacity, spikelet length, and straw weight exhibited high genetic variability. Notably, grains per spike demonstrated moderate heritability with a moderate genetic advance as a percentage of the mean, making it an ideal candidate for selection in early segregating generations. Transgressive segregants were observed in the evaluated lines, which outperformed their corresponding parents in all characteristics. Cluster I demonstrated superior performance across most traits among the four clusters. The selection index highlighted F10F32, F10F31, and B6F31 as top-performing lines, excelling in yield-related traits such as grains per spike, straw weight, and yield per plant. In addition to the top performers, F10F32, F10F31, I8F31, B6F31, and H10F31 can also be further utilized to advance the development of tolerant breeding lines.

Keywords: *Wheat (Triticum aestivum L.), terminal heat stress, F₃ population, transgressive segregants*

PID:IRC_3MT_065

Enrichment of The Arbitration Act 2001 Through Judicial Interpretations: A Journey of Two Decades
Md. Abdur Rahim^{1*}

¹Lecturer, School of Law, Chittagong Independent University, 12 Jamal Khan Road, Chattogram, Bangladesh.
Corresponding author email: marahim1099@gmail.com

Abstract

While the enactment of the Arbitration Act 2001 flagged a pivotal transition from the prior Act of 1940 by aligning with global standards like the New York Convention 1958 and the UNCITRAL Model Law 1985, it is still beset with limitations like the ambiguities regarding the interim relief in foreign-seated arbitrations, the absence of public policy definition, and so on. Therefore, from the very outset of the Act's journey, some significant issues regarding its interpretation arose, which have drawn the attention of the judiciary and ultimately resulted in the enrichment of the Act. Against this backdrop, this study will investigate how judicial interpretations of the Act over the last two decades have contributed to its enrichment and to what extent these interpretations align with international arbitration standards and emerging global trends. This being the case, the study intends to follow a qualitative methodology in reaching its finding that the judicial interpretations of the Act over the last two decades have significantly enriched the Act by allowing interim relief in foreign arbitration, minimizing court intervention, strengthening enforcement mechanisms of foreign awards, and conceptualizing public policy. Furthermore, a comparative evaluation with the Model Law and other jurisdictions such as the UK, Singapore, and India reveals that these judicial developments align with the Model Law and the trends of these jurisdictions except in the case of public policy, where Bangladeshi courts failed to consider the subsequent Model Law developments and the codification of these countries, particularly Singapore and India. Therefore, drawing lessons from the global best practices, the study offers some proposals for further strengthening the arbitration regime in Bangladesh, which will ultimately boost the arbitration practice in Bangladesh.

Keywords: *Arbitration Act 2001, Bangladesh Arbitration law, Judicial Interpretation, Judicial Activism*

PID:IRC_3MT_069

Demand Potential of Water Transport for Urban Mobility in Kamrangirchar, Dhaka
Yeasir Mohammad Amin^{1*}

¹Student (MURP), Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh

*Corresponding author email: yeasir.amin108@gmail.com

Abstract

The capital city of Bangladesh, Dhaka, is situated along a network of four major rivers. It was once renowned for its vibrant water-based transportation. However, over time, the city's mobility system has shifted towards land transport, leading to chronic traffic congestion and growing environmental concerns. This study aims to assess the demand potential for sustainable urban water transport in Kamrangirchar, Dhaka, a densely populated mixed-use residential-industrial area. This study utilizes a mixed-methods approach, combining both qualitative and quantitative analyses, where field surveys for SP and RP method and direct observations to assess existing condition was used for data collection. Data was analyzed to assess the existing water transport infrastructure and commuter preferences for comparison. Results from the study indicate that while there is a water transport network that exists, it remains underutilized although water-based transport demonstrates notable advantages. That is in terms of cost-effectiveness and reduced travel time compared to existing road-based alternatives. The study also reveals a perception gap that many users view water transport as slower, and more expensive, which limits its broader applicability. The study tries to conclude that strategic interventions such as improvements in infrastructure, service quality and targeted public awareness are essential to shift perception and promote water transport as a viable, sustainable urban mobility solution in Dhaka.

Keywords: *Inland waterways, Sustainable urban mobility, Transportation demand, Urban water transport*

PID:IRC_3MT_077

Comparison of Earthquake Performance in 15 Story Reinforced Concrete Structures With And Without Passive Seismic Response Control Systems Using Pushover Analysis Method

Ishrat Zerin Shifa^{1*}, Md. Al-Amin¹,

Department of Civil Engineering, Faculty of Civil Engineering, Bangladesh Army University of Science and Technology (BAUST), Saidpur Cantonment, Nilphamari-5310, Bangladesh.

Corresponding author email: ishratshifa2021@gmail.com

Abstract

Bangladesh is situated in an earthquake-prone area, and earthquake-resistant design is a major concern of structural engineering. In this thesis, comparative seismic performance evaluation of a 15-storey reinforced cement concrete (RCC) structure modeled with and without passive seismic response control systems is presented, as per the Bangladesh National Building Code (BNBC) 2020. A Lead Rubber Bearing (LRB) pad was added at the base of the structure as a passive seismic response control system. Equivalent Lateral Force (ELF) procedure and nonlinear static (pushover) analysis methods were applied using SAP2000, and nonlinear hinge properties were assigned based on FEMA 356 guidelines. Both fixed-based and base-isolated models were subjected to the identical loading across four seismic zones of Bangladesh. The fixed-base structure experienced smaller deformations, increasing with the height of the structure due to the fixed foundation. The base-isolated structure showed greater deformation, more evenly distributed, reducing localized damage. Base isolation improved overall seismic performance. ELF analysis is used for designing a structure, while pushover analysis determines failure mechanisms and performance levels. The base-isolated structure consistently achieved the IO performance level for all seismic zones, with minimum damage. This study validates that base isolation noticeably enhances seismic performance and reduces vulnerability in seismically active regions like Bangladesh.

Keywords: Reinforced Cement Concrete (RCC), Base Isolation, Lead Rubber Bearing (LRB), Passive Seismic Response Control System, Pushover Analysis, Equivalent Lateral Force (ELF), FEMA 356, SAP2000, Seismic Performance, Bangladesh National Building Code (BNBC) 2020, Immediate Occupancy (IO), Earthquake Zones of Bangladesh.

PID:IRC_3MT_081

Geospatial Estimation of Corrected SPT-N Values Using Optimal Semi-Variogram Modeling in GIS: A Case Study of Bashundhara City

Md. Nur Alam^{1*}, Md. Shakib Hossen², Dipankkar Poddar³, Md. Mahabub Rahman⁴

¹ Research Scholar at Department of Civil Engineering, Hajee Mohammad Danesh Science and Technology University, Bangladesh, e-mail: mdnuralam.hstu.ce@gmail.com

² Research Scholar at Department of Civil Engineering, Hajee Mohammad Danesh Science and Technology University, Bangladesh, e-mail: shakibhosen111@gmail.com

³ Research Scholar at Department of Civil Engineering, Hajee Mohammad Danesh Science and Technology University, Bangladesh, e-mail: dipankkar720@gmail.com

⁴ Lecturer, Department of Civil Engineering, Hajee Mohammad Danesh Science and Technology University, Bangladesh, e-mail: mmr.civil@hstu.ac.bd

*Corresponding Author

Abstract:

This investigation aims to determine the corrected Standard Penetration Number (SPT-N_c) and generate thematic maps of SPT-N_c using the most suitable semi-variogram model for Bashundhara City. This investigation is conducted based on the findings of 95 standard penetration tests (SPTs). Five SPTs were conducted in each borehole at depths of 3, 6, 9, 12, and 15m, measured from the ground surface. To assess the accurate SPT-N values, a variety of criteria were taken into consideration, including the unit weight, the groundwater table, overburden pressure, and other correction factors. The SPT-N_c at 3, 6, 9, 12, and 15m was then estimated using the Microsoft spreadsheet. The final product is a set of themed GIS maps of the city, each hue representing a different number for the SPT-N_c. Ordinary kriging interpolation was utilized to generate thematic maps for different depths. To create the best possible map, six different selected semi-variogram models are applied. The exponential and stable model shows the highest accuracy, with a sill-to-nugget ratio of zero, which was considered the best semi-variogram model. Since clay is present at shallow depths, the SPT-N_c of the region at 3m and 6m depths was less than 4 and 36, respectively. For 73.23% of the whole area, the predicted SPT-N_c for depths of 9 meters was 27- 38. For 12m the value of SPT-N_c was increased due to the reduction of clay content, and it was up to 55.8. Fifteen-meter depth depicts the highest value of SPT-N_c, and 57.76% of the area shows values 48-55.

Keywords: Corrected SPT-N (SPT-N_c), Semi-Variogram Model, GIS Mapping, Ordinary Kriging Interpolation.

Sub-Theme: Technology, Engineering & Industry 4.0

PID:IRC_3MT_085

Towards an AI-Driven Framework for Effective Sleep Disorder Prediction Analyzing Clinical and Behavioral Insights

Najma Akter Lopa*, Sultan Mahamud Opu, Sourav Roy & Pankaj Bhowmik

Department of Computer Science and Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh

Corresponding Author Email: najmalopa510@gmail.com

Abstract

Sleep disorders are rapidly increasing as a critical public health concern, often linked to cardiovascular disease, metabolic disorders, and reduced quality of life. In this study, we propose a comprehensible, tree-driven machine learning framework enhanced with explainable artificial intelligence to predict sleep disorders using clinical and behavioral data collected from an open-source data repository. In the preprocessing phase, label encoding and one-hot encoding are performed to convert categorical variables into numerical representations. We addressed key data analytics challenges using various statistical methods, including outlier management with the Z-score test, feature skewness and kurtosis analysis, feature correlation assessment via the Pearson correlation technique, feature importance evaluation with the Random Forest Classifier, and a Z-test to determine the p-value of sleep-disorder related features and using the Z-score to classify any data point with $|Z| > 3$ or $|Z| < -3$ as an outlier. Random Forest and Z-test analysis identified 'Physical Activity' as a key feature, showing a significant positive correlation ($r = +0.43$) with sleep disorders ($p = 1.96 \times 10^{-11}$). Four tree-based classifiers—Decision Tree, Random Forest, Gradient Boosting, and Extra Trees yielded improved prediction calibration through methodical grid search improvement. Among these, the Gradient Boosting demonstrated the highest performance with an accuracy of 95.89%. Further validation using permutation-based testing yielded an accuracy of 97.33%, and 95% Bootstrap confidence intervals for model accuracy (0.9041~1.0000). To conclude, we believe the proposed framework demonstrates potential as an AI-driven decision support system for the diagnosis of sleep disorders, thereby contributing meaningfully to the advancement of automation in clinical healthcare practices.

Keywords: *Sleep Disorder, Machine Learning, Explainable Artificial Intelligence, Disease Diagnosis.*

PID:IRC_3MT_087

Analyzing the Determinants of Financial Wellbeing among University Students in Bangladesh

Md Shalah Uddin Khan^{1*}, Reajmin Sultana¹

¹ *Department of Business Administration General, Bangladesh University of Professionals, Mirpur Cantonment, Dhaka-1216.*

Email: khanshalauddin@gmail.com

Assistant Professor, Department of Business Administration General, Bangladesh University of Professionals, Mirpur Cantonment, Dhaka-1216.

Abstract

With a focus on four fundamental variables—financial literacy, locus of control, financial behavior, and financial self-efficacy—this study explores the major factors that influence financial wellbeing among Bangladeshi university students in an effort to close a knowledge gap on how these factors affect student financial wellbeing in a developing nation. The central objective of this research is to analyze the determinants of financial wellbeing among university students in Bangladesh by the variables of financial literacy, locus of control, financial behavior and financial self-efficacy. A structured questionnaire was given to likely 1000 university students as part of a purposeful sampling strategy, and 242 valid replies were obtained. For both measurement and structural model evaluations, constructs were evaluated using validated scales and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS4 and SPSS 25. The findings show that financial wellbeing is significantly enhanced by financial activity and financial literacy. Financial self-efficacy and locus of control, however, were not discovered to be statistically significant predictors. The model's explanatory strength is moderate, accounting for about 33.8% of the variance in financial wellbeing. The results emphasize the necessity of focused financial education initiatives that emphasize information and behaviors that can be put into practice rather than merely psychological characteristics. Initiatives that improve financial literacy and promote responsible financial behavior among students should be given top priority by academic institutions, lawmakers and financial institutions.

Keywords: *Financial Literacy, Locus of Control, Financial Behavior, Financial Self-Efficacy.*

PID:IRC_3MT_091

Carbon Accounting and Business Strategy: Implications for Sustainability Reporting and Environmental Accountability

Oboni Sultana

Department of Management Information Systems, Begum Rokeya University, Rangpur, Rangpur-5404, Rangpur, Bangladesh

Email: oboni.12022064@student.brur.ac.bd.

Abstract

This study aims to explore the emerging paradigm of carbon accounting—also referred to as carbon cost management—and its implications for corporate sustainability reporting, strategic decision-making, and financial disclosures in the context of global climate change (GCC)

A qualitative research approach was adopted, utilizing an extensive literature review and analysis of current practices. The paper examines three theoretical frameworks—instrumental, social-political, and normative—as applied to sustainability reporting. It also reviews the four key GHG accounting methods recommended by the IPCC and the European Renewable Energy Council.

Carbon accounting is found to play a critical role in integrating environmental costs into mainstream financial reporting. However, challenges such as the lack of standardized international accounting protocols for carbon emissions and the inconsistent recognition of carbon-related liabilities create substantial barriers. The study highlights the valuation of carbon as a traded asset and its implications for business transparency and strategic adaptation.

The findings stress the importance of integrating carbon-related costs into core business strategies. Companies are encouraged to disclose environmental expenditures in financial statements and align regulatory, operational, and strategic functions with sustainability goals.

The absence of universally accepted standards for measuring and reporting carbon liabilities remains a key limitation. Future research should focus on developing standardized frameworks and expanding the integration of Clean Development Mechanisms (CDMs) and Certified Emission Reductions (CERs) into supply chain and business models.

This study uniquely bridges carbon accounting theory with actionable strategic frameworks, offering interdisciplinary insights to improve environmental accountability and corporate eco-efficiency.

Keywords: Carbon Accounting, Global Climate Change(GCC), Green House Gas(GHG), Sustainable Development, Clean Development Mechanisms (CDM), Certified Emission Reductions (CERs).

PID: IRC_3MT_095

Assessment of Microplastic contamination in the Water and Fish samples of the Barnoi River, Northwestern Bangladesh

Rifa Tamanna Mona¹, Md. Mahfuzur Rahman¹ and Md. Abu Sayed Jewel^{1*},

¹Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshai-6205, Bangladesh.

*Corresponding author email: abujewel75@gmail.com

Abstract

Microplastic (MPs) contamination in aquatic ecosystems is an escalating global threat. This study focused to determine the abundance & characteristics of MPs in environmental matrices of the Barnoi River, Rajshahi, NW Bangladesh. Water and Fish Samples were collected from February to April, 2025 from the River and were analyzed using density separation & oxidative digestion (Fenton's reagent), followed by fluorescence microscopy for MPs identification. Results showed MPs concentrations in water ranging from 0.33 - 56 particles/L. Among 142 individuals from three freshwater fish species (*Puntius ticto*, *Sperata seenghala*, & *Mystus cavasius*), Omnivorous fish *Tengra sp.* exhibited the highest (4.57±2.15 MPs/Fish), Carnivorous fish *Sperata seenghala* (4.36±1.89 MPs/Fish) and Planktivore fish *Puti* showed the lowest (3.45±1.44 MPs/Fish) abundance of MPs. Fragment (63.2%) and Fiber (61%) shape was dominant in water and Fish respectively. In terms of size, 2–3 mm was most prevalent (29.4%) in water, for fish different size pattern observed such as Puti (0-1mm), Tengra (2-3mm) and Ayer (3-4mm) due to their feeding behavior and distinct mouth gap. Color analysis showed transparent (29%) and red (19.7%) was most abundant in surface water and Blue (26%), Black (31%) and Red (28%) are consumed mostly corresponding to Puti, Ayer and Tengra. The findings highlight urgent need for improved plastic waste management, public awareness also offers scientific evidence to guide policymaker for freshwater conservation. By supporting SDGs such as Clean Water & Sanitation (SDG 6), Life Below Water (SDG 14), Good Health & Well-being (SDG 3), this research contributes to sustainable environmental and public health protection.

Keywords: Fish & water, Microplastics ingestion, Fragment & Fiber, Abundance, fluorescence microscopy

PID: IRC_3MT_098

Aquarium Fisheries in Rajshahi City Corporation- A Study on Current Trend and Practices.¹Kazi Naima Aktar* and ¹A.B.M. Mohsin¹*Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: mohsin.ru@rugmail.com

Abstract

Aquarium fisheries represent an expanding sector of ornamental aquaculture, offering significant potential for recreational, educational, and small-scale commercial development. This study aimed to evaluate the current status of aquarium fisheries in Rajshahi district, Bangladesh, with specific objectives to document species diversity and conservation status, assess the availability of feeds, medicines, and accessories, and identify challenges and preferences among sellers and aquarists. The study was conducted over a six-month period from December 2024 to May 2025. Data were collected through structured questionnaires and interviews across eight aquarium shops in the district. A total of 56 varieties belonging to 22 species under 13 families and 8 orders were recorded. Most species were categorized as *Least Concern*, though population trends were largely unknown. Fish prices ranged from 40 BDT/pair (mixed guppy) to 7000 BDT/pair (feather fin), and were sourced locally, nationally, and internationally. Disease was the leading cause of mortality (71%), with white spot and fungal infections most prevalent (57%). Six types of packed feeds were in use, and rock salt was the most commonly used medicine. All shopkeepers used heaters during winter. Setup costs ranged from 300 to 10,000 BDT. Among aquarists, 71% were students, and 57% kept aquariums as a hobby, mainly due to fish coloration (47%). Goldfish were the most preferred species (40%). Most aquarists spent 10–30 minutes daily, with water pollution being the most reported issue. Based on these findings, the study recommends improving local production, ensuring quality supplies, enforcing import quarantine, promoting water quality management, and providing training for sustainable aquarium practices.

Keywords: *Aquarium fisheries, Ornamental aquaculture, Species diversity, Fish health management, Aquarist preferences*

PID: IRC_3MT_102

Present Status and Decline Causes of Fish Diversity in the Old Brahmaputra River, Mymensingh District, Bangladesh.Dr. Md. Abdur Razzaq Joadder^{1*}, Sraboni Akter¹¹*Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: raz2006_ru@yahoo.com

Abstract

The Old Brahmaputra River is one of the most important river systems of Bangladesh. Although the river was once abundant in fish diversity, it has drastically declined due to both man-made and natural factors. This study aimed to investigate the present status and causes of fish diversity reduction and fishing gear used in the Old Brahmaputra River under Mymensingh district. Data were collected from December 2024 to April 2025 through questionnaire, interview, and direct observation methods. A total of 49 fish species under 8 orders and 20 families were recorded. Cypriniformes was the leading order consisting of 36.73% of the total catch, followed by the Siluriformes (24.49%), Perciformes (18.36%), Synbranchiformes (8.16%), Osteoglossiformes (4.08%), and Clupeiformes (4.08%). Among 49 species, 35% were common, 33% were less common, 14% were abundant, and 18% were rare. The study revealed that there is less fish diversity in this river than previously stated. Nearly one third of the total fishes (16) were ranked as threatened to extinction (33%) under three categories: vulnerable (17%), endangered (14%) and critically endangered (2%). In total, 10 types of fishing gear were identified under 4 major categories. The abundance of freshwater fishes decreases gradually due to siltation, overfishing, and the introduction of alien invasive species. Further natural fish breeding has been severely disrupted due to unplanned and unregulated sand extraction from the river using diesel-powered machines. To ensure the effective conservation of existing fisheries resources, minimising human-induced impacts, implementing fisheries law, and establishing and managing fish sanctuaries are highly recommended.

Key words: *Fish diversity, Old Brahmaputra River, Biodiversity conservation Present Status of PID:*

PID: IRC_3MT_104

Aqua-Medicines Applied in Freshwater Aquaculture of Tanore and Mohanpur Upazilas under Rajshahi District, BangladeshJoyeta Das¹ & Dr. Md. Abdur Razzaq Joadder^{1*}¹*Department of Fisheries, Faculty of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.*

*Corresponding author email: raz2006_ru@yahoo.com

Abstract

A study was carried out on the extent to which chemical inputs were applied in aquaculture practices in the Tanore and Mohanpur upazilas of the district of Rajshahi in Bangladesh. This study also demonstrated that the local farmers were using a wide range of chemicals for different purposes in the production of fish, thereby justifying their dependence on the use of these chemicals and the attendant risks. Subsequently during the critical pond preparation stage most farmers also apply lime, common salt, urea, TSP, potash, ZEO-3, Aqua-4, sumithion and rotenone, during the pond preparation stage (Rota plus). For controlling soil and water health, the use of Deltamethrin, Rota Plus, Gash wash, Gas tablet and Zeolite is common. For the control of disease, lime emerged as a universal cure, with salt (used by 73% of farmers) and timsen (42%) recognized as major players. Antibiotics such as renamycin and oxytetracycline are applied during disease outbreaks which cause concerns for health and environmental effects. In addition, growth-promoting supplements, art from vitamins and minerals, to commercial products such as Amana fish vita (67%) and Charger gel (62%). To tackle the problem of the contents of dissolved oxygen, products like Oxy fill (72%) and oxymore (62%) are usually used. But those findings raised important issues: over-dosing, ignorance towards chemical hazards and uncontrolled use of the same threaten the sustainability of the environment, aggravate the problem of antibiotic resistance, and have implications for food security. These findings highlight the line between agrochemicals and farmer exposurerequiring crafted farmer education, strong regulatory controls, and sustainable alternatives. By promoting sustainable aquaculture chemical use, we can safeguard our environment and public health, and help protect our communities and ecosystems into the future.

Keywords: *Aquaculture, Chemical inputs, Antibiotic resistance, Sustainable alternatives.*

PID: IRC_3MT_106

Carbon Accounting and Business Strategy: Implications for Sustainability Reporting and Environmental Accountability
Oboni Sultana*Department of Management Information Systems, Begum Rokeya University, Rangpur, Rangpur-5404, Rangpur, Bangladesh*
Email: oboni.12022064@student.brur.ac.bd.**Abstract**

This study aims to explore the emerging paradigm of carbon accounting—also referred to as carbon cost management—and its implications for corporate sustainability reporting, strategic decision-making, and financial disclosures in the context of global climate change (GCC). A qualitative research approach was adopted, utilizing an extensive literature review and analysis of current practices. The paper examines three theoretical frameworks—instrumental, social-political, and normative—as applied to sustainability reporting. It also reviews the four key GHG accounting methods recommended by the IPCC and the European Renewable Energy Council. Carbon accounting is found to play a critical role in integrating environmental costs into mainstream financial reporting. However, challenges such as the lack of standardized international accounting protocols for carbon emissions and the inconsistent recognition of carbon-related liabilities create substantial barriers. The study highlights the valuation of carbon as a traded asset and its implications for business transparency and strategic adaptation. The findings stress the importance of integrating carbon-related costs into core business strategies. Companies are encouraged to disclose environmental expenditures in financial statements and align regulatory, operational, and strategic functions with sustainability goals. The absence of universally accepted standards for measuring and reporting carbon liabilities remains a key limitation. Future research should focus on developing standardized frameworks and expanding the integration of Clean Development Mechanisms (CDMs) and Certified Emission Reductions (CERs) into supply chain and business models. This study uniquely bridges carbon accounting theory with actionable strategic frameworks, offering interdisciplinary insights to improve environmental accountability and corporate eco-efficiency.

Keywords: *Carbon Accounting, Global Climate Change (GCC), Green House Gas (GHG), Sustainable Development, Clean Development Mechanisms (CDM), Certified Emission Reductions (CERs).*

PID: IRC_3MT_106

Climate Change, salinity Intrusion and Public Health: Emerging Challenges in Gabura Union, Satkhira
Amrita Biswas Reya¹¹*Post graduate, Dept. Of Anthropology, Jagannath University, Dhaka -1100*

*Corresponding author email: amritabiswasreya22@gmail.com

Abstract

Climate change is currently one of the most critical global crises, threatening human life, livelihoods and healthcare systems. In case the coastal regions of Bangladesh, salinity intrusion and scarcity of safe drinking water have become increasingly severe. This study aims to explore the physical and mental impacts of salinity on the residents of Gabura Union in Syamnagar Upazilla, Satkhira district. A qualitative research approach was adopted with data collected from a sample of 55 participants across three villages (Gabura, Chakbara, Khalishabunia) using Key Informant Interviews (5), In Depth Interviews (25), Case Studies (15), Informal Group Discussion (10). The research is guided by the theoretical lens of medical pluralism to understand how communities combine biomedical treatment, traditional practices and community support in managing health challenges. The findings reveal that salinity and water scarcity have significantly contributed to a rise in skin diseases, reproductive health issues, and gynecological problems. These health challenges are further linked to increasing rates of child marriage (63.63%) and domestic violence against women (27.27%). Notably, 96.36% of respondents reported symptoms of skin diseases. The study concludes that urgent interventions are needed, including access to safe water, improved health care services and infrastructural development. The overall conditions related to health, communication and water access indicate that the community remains in an extremely vulnerable state, demanding immediate attention and policy action.

Keywords: *Climate change, Salinity intrusion, Reproductive health, Domestic violence*

PID: IRC_ACHO_006**The Divine Mirror: A Reflection of Human Duality and Spiritual Presence in William Blake's Poetry**
AHMAD HISHAM¹

¹ *Department of English, University of Rajshahi*
Corresponding author email: ah.the007@gmail.com

Abstract

William Blake's "The Divine Image" serves as a metaphysical reflection on the interconnection of human virtue and divine essence. By dignifying Mercy, Pity, Peace, and Love to the sacred state, Blake expounds that these four virtues are the representation of the divine qualities of God and the innate moral and spiritual values of the humanity. Through a visionary synthesis of spirituality and ethics, the poem blears the boundary between the human and the divine and offers the readers to recognize moral consciousness as a sacred reflection of eternal truths. However, Blake's counterpart poem, "A Divine Image", projects a darker shadow, which reveals how the absence or corruption of these virtues gives rise to cruelty, fear, and the distortions of experience. And these poems together illustrate the duality of human nature showing both its capacity for divine reflection and moral fallibility. This paper argues that Blake's poetic framework transforms virtue into a spiritual language and also positions humanity as both the image and vessel of the divine. Ultimately, "The Divine Image" emerges as a hymn to the sacred dignity of humanity, while "A Divine Image" warns of the consequences of losing touch with this inner divinity.

Keywords: *Metaphysical reflection, Divine essence, Spiritual values, Duality of human nature, Sacred dignity of humanity*

PID:IRC_ACHO_008**The Kitchen as a Diasporic Space to Navigate Hybridity: A Study on Edward Lee from *Culinary Food Wars***
Azra Mahjabin Nirjhor^{1*}

English Literature and Cultural Studies, Bangladesh University of Professionals
Corresponding author email: azranirjhor019@gmail.com

Abstract

In an era of globalization and migration, culinary practices have emerged as a vital ground for examining cultural identity and hybridity. As diasporic communities navigate complex tensions between cultural preservation and adaptation, culinary innovation appears as a powerful language of cultural expression. This research aims to explore the concept of cultural identity through culinary hybridity in Edward Lee's dishes, as featured in *Culinary Class Wars*. Focusing on the culinary spaces, the research examines the ways in which the migrant chef articulates and reconstructs cultural identity via gastronomic practices. To get a decisive answer, the research employs a qualitative method based on content and multimodal analysis of culinary performances in professional kitchens, especially in the dishes of Edward Lee, using Stuart Hall's framework of cultural identity as its theoretical foundation. The findings of the paper portray how culinary innovations can represent the amalgamation of cultural heritage and contemporary adaptation that reflect the complexities of diasporic experience and existence. The creative blending and reinvention of traditional ingredients can be seen as a representation of migrant identity. The findings can contribute to an interdisciplinary understanding of cultural hybridity and migrant identity. It can also offer a new methodological approach for studying cultural identity and can provide insights relevant to culinary education and migrant community studies in a globalized context.

Keywords: *identity, hybridity, culinary, fusion*



PID: IRC_ACHO_009

Visualizing the City: Ottoman Miniatures as Narratives of Urban Evolution and Social Changes.

Dr. Suraiya Akhter

Professor, Department of Islamic History and Culture, University of Dhaka

Abstract

Ottoman miniature paintings serve as vivid visual narratives that bear the transformation of Ottoman urban centers across the early and classical periods from 15th to 17th centuries. Avoiding European-style of single-point perspective, they depict cityscapes, harbors, and campaigns in expansive bird's-eye views that produce multiple viewpoints into a single frame, offering both architectural detail and social context. Nasuh's topographical miniatures of Istanbul and other contested cities are celebrated for combining certain accuracy with abstraction, merging urban layout, built environment, and public space into coherent visual descriptions. These miniatures function not merely as artistic illustrations but as documentary media commissioned by the Ottoman court to record military expeditions, infrastructure developments, and civic pageantry. Unlike Persian or Mughal traditions that emphasized aesthetic beauty more than practicality, Ottoman miniatures often prioritized factual representation detailing urban topography, architectural landmarks, and ceremonial life in ways that reflect both spatial and social dimensions of cities. By analyzing a selection of miniatures alongside contemporary scholarship, this overview explores how these works visualized urban evolution. The main objective of this article is to trace the architectural expansions, the emergence of new civic spaces, and shifts in social life through a conventional yet expressive pictorial vocabulary. Finally, it will explore how Ottoman miniatures emerged as dynamic artefacts at the intersection of cartography, historiography, and visual art. Through this process, the social changes will be identified and reimagined to understand the contemporary Ottoman history with a richly layered narrative form.

Key words: *Visualization, Ottoman Miniature, Urban space, Social Changes*

PID: IRC_ACHO_011

Unhomed Women and the Struggle for Space in Kamala Das's Poetry

Farjana Rahman Shathil*

Department of English, Metropolitan University, Sylhet-3100, Bangladesh.

Corresponding author email: r.farjana9080@gmail.com

Abstract

This paper focuses on the silent pain of women who never truly find a home in all their lives. They are not homeless but in their house they feel like strangers. In childhood, they grew up in their father's house but again and again, they are told this is not their real home. One day they must leave. When they go to their husband's home, they try to build a new life. They give love, care and everything belongs to them but there also they feel like strangers. Their days are full of work but their hearts are empty. There is no space for their voice, their feelings or rest. This paper shows how Kamala Das wrote this silence. This study reads a few of her poems closely to understand how she shows the struggle of unhomed women. The paper reveals that in Das's poetry women often live in places where they have no voice or no space. They carry their pain quietly. This paper also shows that through her poem Kamala Das not only speaks about her personal life but also for many women in our society. This study hopes to help readers see how her poetry gives meaning to the inner world of women who are still searching for a space they can truly call home.

Keywords: *Unhomed, Home, Space, Silent pain*



PID: IRC_ACHO_015

Bhramarāṣṭakam: A Comprehensive Study of a Lesser-Known Sanskrit Poem
Gaurab Chawdhury*

¹*Under-graduate student, Department of Sanskrit, University of Dhaka*
Email: gaurabdu100@gmail.com

Abstract

A vast number of literary works were composed in Sanskrit literature. *Bhramarāṣṭakam* is one of the lesser-known Sanskrit poems of them. Although the poem was written in a simple poetic style, scholars did not devote attention to analyzing and illuminating it. Therefore, this beautiful poem has been neglected for a long time. This article presents a comprehensive study of the *Bhramarāṣṭakam*, exploring its title, authorship, commentary, poetic genre, rasa, literary style (rīti), alaṃkāra, metre (chanda), and influence on Bengali literature, as well as its symbolic meanings and moral messages. The text of *Bhramarāṣṭakam* is analyzed from the perspective of Sanskrit poetics and determines its rasa, rīti, alaṃkāra, chanda, etc. After that, to identify its influence on Bengali literature, the comparative analysis method has been applied. Overall, this work is done by following the qualitative research method. Though the poem contains only eight verses, the use of various alaṃkāras and chandas can be found. The poem has a unique feature of describing various human sufferings through the symbol of the bumblebee (bhramara). Dasi (1294: 84-87) translated the entire poem into poetic Bengali during the early phase of modern Bengali literature, and Tagore (1965: 98) quoted a verse of it in his literary work. This highlights the influence of *Bhramarāṣṭakam* on Bengali literature. This article aims to inspire researchers to uncover the characteristics of similar types of lesser-known literary works in the future.

Keywords: *Bhramarāṣṭakam, Mukta-kavya, poetics, manuscript.*

PID: IRC_ACHO_020

The Rise of Secularism and Approaches to the Muslim World
Kawsar Mia

Post Graduate student, Department of Islamic History & Culture, Jagannath University, Dhaka-1100
*Corresponding Author's E-mail: kawsarmia03475@gmail.com

Abstract

Secularism is an ideology that rejects religion, or the belief that religion should not be the part of the affairs of the state or part of public education. While secularism emerged as the principle of separation of church and state in the later part of the 18th century, it came into view in the intellectual domain much earlier. Though it came into practice officially in the Muslim world, more precisely, Turkey in the early 20th century, still there is lack of sufficient literature, concerning its various forms, antagonism with the principles of Islam, how the term has been evolved as a political ideology, and how it has been viewed so far in the Muslim world. The study's objectives were met by using a qualitative methodology. Primary data can be found in the holy Qur'an, in government documents, and reports. Secondary data was gathered from scholarly literature, such as books, articles, and newspapers. This approach facilitates a comprehensive analysis of the Secularism's historical evolution, factors, and conflict with Islamic ideology. It also figures out how the term has been viewed or practiced until now the Muslim world. The results show that secularism is considered as a general laicization, a loosening of bonds with religion and liberation from Church authority and dependence, a break with religious tradition, as well as driving religion out of social and national life. Conversely, Islam itself is the complete code of human life. It always maintains a series of unique features including unity, truthfulness, humanity, universality, interminability, adjustment, simplicity, sympathy, and equality. Every Muslims always bear in mind that they are from Allah who is the master of the universe and responsible to him for their every works. However, in the Muslim world, secularism has been viewed based on three different approaches – the radical or extremist approach, moderate or liberal approaches, and the Islamic revivalist approach. In this context, the contrast between worldly and afterlife orientations, as well as warnings against mere worldly pleasures, take centre stage. As such, this study provides a deep insight into how Islam understands and interprets secularism. This result will be a guideline for educationalists and counselors. In future study, developing a personality scale integrated with belief and practice will be beneficial to Muslim communities.

PID: IRC_ACHO_022

From Nāgas to Dementors: Indian Mythological Echoes in the World of *Harry Potter*

Md. Bulbul Ahmed

Lecturer, Department of English, Comilla University, Cumilla-3506
Email: bulbul@cou.ac.bd Mobile: 01828271112

Abstract:

This article explores the Indian folkloric and mythical resonance found in J. K. Rowling's *Harry Potter* series, framing the novels as an enriched ground for transcultural mythopoeia. Though Rowling's magical world primarily adopts and synthesizes elements from Western-European folkloric traditions, several magical figures and ideas can be traced back to the Indian mythical framework dated back to *Ramayana*, adding symbolic depth and a sense of universality. For instance, Nagini, one of Voldemort's Horcruxes, mirrors the *Nāga* from Indian mythology—a serpent being capable of shifting shapes into various forms and often associated with deception, dark magic and danger. Horcruxes or the idea of splitting one's soul into fragments to evade death and attain near-immortality resonate the Asuric tradition in Indian myth, where *asuras* hide their souls in different inanimate objects to protect their worldly bodies from death and destruction. Dumbledore's Phoenix, known for its healing and regenerative power, parallels *Garuda*—the divine mount of Lord Vishnu—or *Garula* in Buddhist lore, and in both traditions, their natural nemesis is a serpent-like *Nāga* figure. Moreover, The Dementors of *Harry Potter* universe echo the *Preta*, The Deathly Hallows resembles the tripartite metaphysics of karma, rebirth, and renunciation, and the Patronus charm reflects the concept of *Atman* in Hindu philosophy that dispels darkness and evokes enlightenment or *moksha*. By highlighting elements of Indian mythology, the paper aims to reinterpret *Harry Potter* within a transcultural mythological framework, deepening its symbolic meaning and broadening the range of possible interpretations.

Keywords: *Harry Potter, Indian Folklore, Transcultural Mythopoeia, Comparative Mythology*

PID: IRC_ACHO_024

Soil and Soul: A Comparative Study of Nature, Rural Life and Emotional Landscape in the Verses of Seamus Heaney and Jasim Uddin.Md. Mahmudunnabi Sourov¹*

¹Undergraduate Student, Department of English Language and Literature, City University, Birulia, Savar, Dhaka.

*Corresponding author email: mdmahmudunnabisourov@gmail.com

Abstract:

Seamus Heaney from Ireland and Jasim Uddin from Bangladesh are from very different places but the poems of both poets show the thematic similarities. They deeply explore rural life, nature and emotional suffering in their poetry. Their poems also reflect deep human emotions like sorrow, grief, loss and love rooted in village life. While both poets have been individually studied in their own literary contexts, no comparative research has explored the shared emotional depth and rural imagery in their works. This research seeks to fill that gap by analyzing their works. The aim of this research is to understand how both poets use nature, rural life and emotional depth to share deeper thoughts about life, family and identity. Following qualitative, textual and comparative methods in this study, the selected poems by the poets have been examined as primary resources. The poems were read closely to find the themes, tones and feelings. The study looks at how they use natural imagery and rural settings not just for beauty but as a way to express personal pain and cultural identity. Seamus Heaney's voice is quiet, reflective and full of memory while Jasim Uddin's tone is emotional, traditional and socially engaged. Although having the differences in style and background, both poets connect through their portrayal of deep human feelings. The findings show both similar points and differences in their poetic style and message. This comparative study helps us understand how poetry can reveal cultural values along with deep human feelings.

Keywords: *Comparative Study, Nature, Rural Life, Emotional Sufferings.*

PID: IRC_ACHO_025

Language of Climate Crisis: Analyzing Environmental Metaphors in Contemporary South Asian English Poetry

Md. Sadiq Al Muksit^{1*} & Rumana Das²

¹*Department of English, Postgraduate Student, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh.*

²*Department of English, Postgraduate Student, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh
s.a.muksit05@gmail.com

Abstract

This paper explores how new South Asian poetry written in English responds to environmental loss and global warming. Natural imagery is used by South Asian writers like those writing from India, Bangladesh, and Sri Lanka to represent their environmental as well as cultural and emotional problems. In a close textual analysis, this work considers how metaphors of water, land, forest, and urban devastation are used to represent the profound impact of environmental change within the region. Through ecocriticism and metaphor theory, the paper delves into deeper significations that are inherent to poetry's verbal texture as well as those that postcolonial regional history gives to how nature manifests within poetry. Rather than present nature as being abstract to human living, these poets demonstrate how environmental concerns are entangled with identity, memory, and societal conditions. By focusing on place and metaphor simultaneously, the paper shows how poetry can address similarities of environmental change between a range of cultures and histories. The paper not just offers a literary strategy but also undertakes pedagogical applications of such metaphors and shows one classroom model to teach literature and ecology with identifications of metaphors. Finally, an effort is made to illustrate how poetry can be made to shed light upon ecological questions as well as contribute to environmental research as well as studies of literature.

Keywords: *Ecocriticism, Metaphor theory, Postcolonial ecopoetry, Ecopedagogy*

PID: IRC_ACHO_027

Dehumanization of Human Beings Due to Two World Wars: A Historical Perspective.

Md. Sumon Shekh¹

¹ *Department of Islamic History & Culture, Islamic University
sumon261235@gmail.com*

Abstract

This article exposes the period of the First and Second World War. The paper presents the dehumanization policies of human beings due to two world wars in a historical perspective. If we analyse the period from the end of the WWI to WWII, we will be able to understand that the World War II was the final phase of the World War I. In these period there are many crisis in the world and great depression which were the symbol of dehumanization activities. They were the largest military conflicts in human history. Both wars involved military alliances between different groups of countries. The world warring nations were divided into two groups namely 'The Central Powers' and 'The Allied Powers'. Within the two wars the First World war was especially heinous because of the genocide of Jewish people perpetrated by the Nazis. Between the two wars the World War II was the largest conflict in human history and devastated Europe, Asia, North Africa, and large portions of the Pacific. The two conflicts merged into a single global struggle during which a coalition of Allied powers defeated a coalition of Axis states. This text uses a largely narrative approach, interspersed with a separate section on economic, psychological, and demographic aspects of the conflict to describe the origins, course, and consequences of the war. Beside it will reveal the terrible incidents which were responsible for dehumanization policy of human being due to two world wars.

PID:IRC_ACHO_028

Philosophical Thought And Technology: Ethical Challenges In Social Transformation

Monem Shahariar Shown^{1*}, Shakil Mia & Akir Hossen Sumon.

¹*Department of Philosophy, Faculty of Arts and Humanities, University of Chittagong, Hathazari -4330, Bangladesh.*

*Corresponding author email: monemshahariarshown3040@gmail.com

Abstract:

Unprecedented advances in technology are profoundly changing social structures. As a result, philosophical questions are continually posed as a moral challenge to social transformation. This research paper explores the ethical challenges of social change by analyzing the practical relationship between philosophical thought and technology and how technology is influencing AI data surveillance, social justice, privacy, and human values in the analysis of ethical frameworks by important principles such as deontological ethics, utilitarianism, and pragmatism through scientific, philosophical, and mixed methods. Advances in technology are making practical life easier on the one hand, as well as creating a new level of moral and decisional crisis. By analyzing these crises from a philosophical point of view, this article proposes how to take positive steps in the integrated activities of policymakers, technologists, and citizens for the welfare of society by coordinating the progress and proper use of technology. The study also includes an analysis of some of the ethical conflicts that are becoming more complex over time due to the overuse and misuse of technology in today's technology-driven world. Therefore, this paper aims to create a synthetic register of the critical aspects of social transportation that can be valued ethically. This article is just a hypothetical approach.

Keyword: *artificial intelligence (ai), utilitarianism, pragmatism,*

PID:IRC_ACHO_030

Reconstructing Theatre: Deaf Theatre as a Catalyst for Inclusive and Democratic Performance

Mourushi Monjusha

Department of English, Faculty of Arts and Humanities, Jahangirnagar University, Savar, Dhaka, Bangladesh.

Abstract

Deaf Theatre is an innovative form of performance where deaf actors use sign language, facial movement and visual storytelling instead of verbal expressions. It challenges conventional theatre by establishing room for Deaf identity, communication and acceptance. The study examines how Deaf Theatre is reconstructing the theatre discipline by highlighting the Deaf community through promoting the use of sign language as performance and questioning the primacy of spoken language in stagecraft. The research relies on Augusto Boal's *Theatre of the Oppressed* and Dwight Conquergood's "performance ethnography". Boal views theatre as an instrument of liberation saying that it is "a weapon and it is the people who should wield it." Conquergood views performance as "giving voice to the voiceless." These theoretical frameworks were used to support the argument. Results revealed that Deaf Theatre expands the area of performance through non-verbal cues, rhythm and enacted feelings. It was found that sign language is both a tool for communication and a rich and creative medium of embodied expression. These performances deconstruct ableist ideologies, foster inclusivity and unite Deaf and hearing communities. They reject the notion that only voice holds power and expands narrative horizons. Deaf Theatre paves the way for inclusive theatre practices and Deaf-led pedagogy. It can remould the drama education and presentation with more diversity and equity. Its concepts may take mainstream theatre toward broader sensory and communicative inclusivity. Through centering Deaf voices, Deaf Theatre motivates social progress and makes theatre a more democratic and liberating space for all.

Keywords: *Deaf Theatre, inclusivity, sign language*



PID:IRC_ACHO_032

Tanguar Haor and the Ethics of Aesthetic Engagement: A Philosophical Reflection on Nature and Environmental Crisis
Mst. Atiya Ibnat^{a*}

^a *Department of Philosophy, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh-2222, Bangladesh.*

*Corresponding author email: atiyaibnat2018@gmail.com

Abstract

Tanguar Haor is a large wetland in northeastern Bangladesh. It is well known for its natural beauty, rich wildlife, and importance to local communities. This paper explores how the beauty of Tanguar Haor can help people care more about nature and the environment. Using ideas from environmental philosophy, the study explains how people's emotional connection to nature can lead to stronger efforts to protect it. Tanguar Haor changes with the seasons. In the rainy season, it becomes a large water body full of birds and fish. In the dry season, green islands appear. These changes, along with its cultural and spiritual value, make it a special place. However, the wetland is under threat. Climate change, pollution, tree cutting, too much fishing, and unplanned tourism are harming both its environment and its beauty. This study suggests that we need to protect nature not just because it is useful to us, but because it has value on its own. The beauty of places like Tanguar Haor can make people more aware of environmental problems and more willing to take action. By including beauty and emotional value in environmental planning, we can encourage better care for nature. In conclusion, saving Tanguar Haor is not just about protecting plants and animals. It is also about keeping the natural beauty and peace that it gives to people. This can help build a stronger connection between humans and nature and support long-term conservation.

Keywords: Tanguar Haor, nature's beauty, environmental ethics, conservation, climate change, Bangladesh

PID:IRC_ACHO_033

The Architecture of Colonial Guilt: Unheard Cries and Unspoken Lust at the Battleground of the Marabar Caves
Nafisa Islam¹

¹*Department of English, University of Rajshahi*

*Corresponding author email: izarin083@gmail.com

Abstract

In *A Passage to India*, E.M. Forster's Marabar Caves are more than natural formations - they are emotional battlegrounds where the guilt, fear, and repressed desires of both colonizer and colonized erupt. This paper argues that the caves function as psychological chambers that destabilize colonial authority by triggering internal crises in both Adela Quested and Mrs. Moore. Using postcolonial theory and psychoanalysis, the paper examines how Adela's imagined assault stems from repressed sexual and racial anxieties, while Mrs. Moore's breakdown reflects the emotional burden of confronting imperial injustice. The caves' echo - repetitive yet hollow - embodies the silenced voices of the colonized and symbolizes the futility of colonial communication. This paper contends that the empire is not only a structure of political domination, but also a site of deeply buried emotional chaos and the Marabar Caves are its most honest mirror.

Keywords: *Marabar Caves, colonial guilt, repression, Adela Quested, Mrs. Moore, psychoanalysis, postcolonialism, echo, emotional colonialism*

PID:IRC_ACHO_034

Literature as Mirror Neurons: How Fiction Shapes Human Empathy and Behaviour in a Fragmented World

Naharun Nesa Toma

*Department of English, Rajshahi University, Rajshahi – 6205, Bangladesh***Abstract**

In today's emotionally fractured and fragmented society, literature continues to be a potent tool for promoting empathy and changing people's behaviour. This study examines how fiction allows readers to emotionally reflect the experience of others using the neuroscientist Marco Iacoboni's metaphor of 'mirror science'. Similar to mirror neurones, literature stimulates readers' imaginations to experience characters' inner lives, fostering moral and emotional development. By closely examining Leo Tolstoy's *Anna Karenina*, the study explores how Tolstoy challenges readers to face themes of love, remorse, and social expectations by evoking moral conflict and profound psychological realism. Similarly, Toni Morrison uses narrative empathy to humanise historical grief in her book *Beloved*, drawing readers into the horrific history of slavery. Collectively, these works demonstrate how fiction allows for common emotional experiences across cultural and temporal borders. This study presents literature as an essential instrument for social cohesion and emotional healing by fusing literary analysis with cognitive and neuroscientific understandings. The sub-theme "Arts, Culture & Humanities" is appropriate for this writing, which highlights the transformational and significant ways in which storytelling continues to influence human awareness.

Keywords: *Literature, Empathy, Mirror Neurons, Arts and Humanities*

PID:IRC_ACHO_036

Linguistic Identity Crisis among Students in English-Medium Schools in Urban BangladeshNaiem Al Amin^{1*}, Farzana Noor Misty²*¹Institute of Skills Development and Continuing Education (ISDCE), State University of Bangladesh, Dhaka-1461, Bangladesh**²Institution of Educational Development, BRAC University, Dhaka 1212, Bangladesh***Corresponding author email: naim.alamin1@gmail.com***Abstract**

The paper explores how the English-medium education influences the linguistic and cultural identity of students in Dhaka, Bangladesh, and how it affects their linguistic proficiency and cultural affiliation in the English dominated schooling environment. The emergence of English-medium schooling in Bangladesh, particularly in urban regions has raised issues concerning the transformation of socio linguistic identity of the students in such settings. The dominance of English has influenced students' indigenous linguistic repertoires and cultural affiliations. This study is qualitative and quantitative in its data collection strategies because it embraces both qualitative and quantitative research designs. Samples involved 170 participants comprising students, educators, parents, and school administrators participating through surveys, focus group discussions (FGDs), and semi-structured interviews of 10 English-medium schools in Dhaka. The results shed light on the immense influence that English-medium education has on the linguistic identity of students who are significantly disoriented towards the English linguistic hegemony. The pedagogical context seems to propagate an ascendant elitist ideology, whereby learners become disengaged with their local Bangla language and cultural practices. Interestingly, students have adopted a number of coping strategies and language behavior in navigating the conflict between linguistic identity and the Bangla cultural upbringing. Besides, the study highlights the intertwining nature of language, identity, and power in the case of English medium institutions. This study raises the concern that a balance between advancing English skills that will enable students to better integrate into a globalized world with maintaining the cultural and linguistic identity of the students should be achieved.

Keywords: *Linguistic Identity, English-Medium Education, Sociolinguistics, Cultural Shift*

PID:IRC_ACHO_037

Tracing Dystopia in Utopia: Reading Veronica Roth's *Divergent* Series

Naimah Mubassira*

Department of English, Faculty of Arts, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Corresponding author email: naimahmubassira017@gmail.com

Abstract

This paper aims to explore the interaction between utopia and dystopia in Veronica Roth's *Divergent* series which investigates how the utopian ideals of a strictly factionalized society collapse into a dystopian structure. Instead of dealing with the issue of dystopia directly, Veronica Roth cocoons the issue with concepts like peace and perfect systematic society only to slowly eclose in a broken, disordered reality. This paper traces the ideological underpinnings of the factions and their contributions to social order, showing how the very pursuit of an ideal society ironically fosters systemic oppression, inequality, and rebellion. Using a utopian/dystopian critique, the study deconstructs the socio-political frameworks that underpin Roth's fictional world and analyzes how the protagonist challenges the dystopian decree through acts of rebellion. The analysis stives to reveal that Roth's series does not merely narrate a dystopian journey but criticizes the foundational concepts of utopia itself. The paper argues that *Divergent* serves as a microcosm reflecting contemporary anxieties about structural determinism and personal agency. The study aims to contribute to young adult dystopian literature by examining the fragile boundary between utopia and dystopia.

Keywords: *Utopia, Dystopia, Young Adult Literature, Rebellion*

PID:IRC_ACHO_040

The Literary Interpretations of the oppressed and Their Role in Social Media

Nusrat Jahan Nipa, Monira Islam

Department of English, Green University of Bangladesh

Corresponding author email: nusratjahannipa1345@gmail.com

Abstract

This research mainly explores how literature has historically reflected oppressed individuals and groups, and how these interpretations have provided to social awareness and transforms. By examining a range of literary works from different time and regions and theory. The study takeaways how writers give their voice to overlook the communities, challenge oppressed power calamities through the conceptions of Sigmund Freud's "concept of repression", "The unconscious and resistance" and inspire compassion to the readers. The study explores how literature serves both a mirror and a critique of societal power dynamics. Freud's ideas offer an important overview for understanding how literature reveals repressed social truths, enabling reader to construct with uncomfortable realities about inequality, violence and systemic oppression. The study explores that the authors consciously or unconsciously use the character or narrative development to reveals the difference between id, ego, superego. By doing this both the writer and the reader, allowing oppressed or suppressed narratives to emerge and challenge controlling structures. Furthermore, the paper argues that the storytelling may play a critical role in shaping cultural awareness and driving social progress. The research concludes that the literary framework of the oppressed not only reflect historic conditions but also actively participate in shaping public discussion and powering reform. As such literature informed by mental or emotional tensions, is a mighty force for social change.

Keywords: Oppressed, The concept of repression, Id, Ego, Superego, Emotional tensions.



PID:IRC_ACHO_042

**‘Inheritance of the Womb: Generational Trauma and The Elusive Self amid Social Transition in Saadawi's
The Well of Life.’**

Quazi Tasnim Sharmin*

Student, Department of English, University of Rajshahi.
e-mail: quazitasnim21120@gmail.com

Abstract

Across generations, the female body has been vessel and battleground carrying the silent weight of inherited trauma, externally managed responsibility, and unspoken loss. In patriarchal societies, the womb becomes something than biological; it is where pain is passed on like heritage and where identity is shattered before it is shaped. Nawal El Sadaawi's novella *The Well of Life*, captures this haunting legacy through the story of Ain, a girl whose life is lived through cycles of silence, servitude, unspoken wounds and un-lived identity which is transmitted generationally. The article delves into the intergenerational transmission of trauma and its psychological symbolism and the elusiveness of feminine selfhood within the contexts of social change and the pattern of the cycle. It employs literary analysis on the basis of trauma theory, feminist theory, and postcolonial gender studies. The study illustrates that Ain's bodily estrangement, her forced maternity, and losing the child thereafter repeat the intergenerational trauma. The looping narrative form and metaphoric expressions of the novella capture the repetitious search for self against the pressure of systemic erasure. The article contributes to feminist literary and trauma studies through the recovering of otherwise less explored text and the validation of its enduring contemporaneity to gender discourse.

Keywords: *Trauma, Identity, Intergenerational transmission, Gender studies.*

PID:IRC_ACHO_044

**Rediscovering The Lost Stars: Sadhana Sen Bose (1914–1973) and Madhu Bose (1900–1979) – A Study of
Their Lives and Cinematic Contributions***Ragib Shahriyar Saiket**

Department of Film and Television, Jagannath University, Dhaka, Bangladesh
Author's email: shahriyarragib13013@gmail.com

Abstract

Among the talented individuals in the hundred-year history of Bengali cinema, the contributions of director, actor, and theater personality Madhu Bose and his wife, actress and dancer Sadhana Bose, are especially noteworthy. They played a significant role in the worlds of film, theater, and cultural practice during the first half of the twentieth century. This study aims to uncover unexplored chapters of Bengali cinema by examining their colorful lives, artistic language, and film work. The research will focus on four main questions: What were their personal and artistic journeys like? How can their contributions to cinema be critically assessed? How were their artistic expressions influenced by the socio-political context of their era? And why did they fade into obscurity despite their prominence? This qualitative research will analyze their autobiographies, Amar Jibon (1960) and Shilpir Atmakotha (1963), along with their films and artistic works as primary sources. Secondary sources will include film magazines, old newspapers, memoirs, and archival materials. The study will primarily utilize textual analysis and descriptive methods, and, if necessary, include interviews with contemporary film analysts and researchers. The investigation will explore the development of parallel trends in Bengali cinema history, examine the highs and lows of Sadhana Bose and Madhu Bose's lives and careers, analyze their artistic language, and provide a historical evaluation—highlighting a missing chapter in Bengali cinema.

Keywords: *Bengali Cinema, Sadhana Bose, Madhu Bose, Cultural Heritage.*

PID:IRC_ACHO_046

Grief as the Price of Knowledge and Sensitivity: A Monograph on Shakespeare's *Hamlet*
Rezwana Hasan Chowdhury

*Department of English, Faculty of Arts, Begum Rokeya University, Rangpur,
Rangpur-5404, Bangladesh.*

Abstract

William Shakespeare's *Hamlet* can be considered one of the most groundbreaking tragedies in English literature till today. The theme that feels all-consuming of all is the suffering that Hamlet himself encounters on account of his knowledge and sensitivity. Both the knowledge of harsh reality and the knowledge that his intellectually stimulated mind provides him with the mixture of super sensitivity act as a source of immense pain and inescapable tragedy rather than being a way to liberation. Knowledge or perception does not provide clarity or peace but rather leads to restlessness and the eventual doom of the tormented prince. This coexistence of the burden of knowledge wrapped in sensitivity and the excruciating suffering makes *Hamlet* relevant and relatable even today. This monograph will particularly examine the inevitability of suffering in *Hamlet* that basically begins with the curse associated with knowledge and sensitivity and which is mostly and mainly felt in the play's central figure—Prince Hamlet himself.

Keywords: *Psychoanalysis, Procrastination, Knowledge, Suffering.*

PID: IRC_ACHO_048



Aging Hero, Human-AI Relationship, and Existential Crisis in Post-human Narrative *A.I. Rising* (2018)

Sadia Siddika¹, Md. Al Amin Rari²

Department of English, University of Delhi, India

Corresponding Author's Mail: research.alamin1999@gmail.com

Abstract

Artificial intelligence is an essential component of science fiction movies in the era of the Fourth Industrial Revolution. Robots, Computers, Mobile Phones, and other technological tools play the main characters in movies nowadays and represent human-AI relationships, gender, race, existential crisis, advancement, and so on. Nowadays, AI plays a vital role in different aspects of society, including human emotion. The movie *A.I. Rising* is one of the representations of post-human narratives in which we see the relationship between a Human being and AI. This research focuses on the use of artificial intelligence in the Movie *A.I. Rising* (2018) in a Post-human setting. *A.I. Rising* (2018) is a Sci-Fi movie directed by Lazar Bodroza. The setting of this movie is a dystopian future where humanity has reached advanced technology. Through the point of view of post-humanism and science fiction prototyping, this research paper focuses on four main aspects: the role of aging hero in a technological setting, the complexities in Human-AI relationships, the hybridization of identity, and the existential dilemmas arising from the human dependency on technology and the unusual relationship between humans and AI.

Keywords: *Artificial Intelligence, Prototype, Hybridization, Isolation*



Lychee Honey-Mediated Sustainable Synthesis of Maghemite Nanoparticles: A Novel Approach for Potential Cancer Hyperthermia Applications

Authors: *A.Shoshi¹, S.H. Chaity¹, S. Islam¹, A.K. Bhuiya¹*

¹Department of Materials Science and Engineering, University of Rajshahi, Rajshahi-6205, Bangladesh

Abstract : This project presents an eco-friendly synthesis of maghemite ($\gamma\text{-Fe}_2\text{O}_3$) nanoparticles using Lychee honey as a natural reducing and stabilizing agent. This green synthesis approach avoids the toxic chemicals traditionally used, promoting sustainability in nanoparticle production. Characterization of the synthesized nanoparticles was conducted using multiple techniques: Fourier Transform Infrared Spectroscopy (FTIR) identified functional groups that aid stability; Differential Thermal Analysis-Thermogravimetric Analysis (DTA-TGA) evaluated thermal properties; Ultraviolet-Visible (UV-Vis) Spectroscopy examined optical attributes; Field Emission Scanning Electron Microscopy (FESEM) provided insights into particle morphology; and Vibrating Sample Magnetometry (VSM) revealed superparamagnetic behavior, suggesting the nanoparticles potential in biomedical applications, specifically in cancer hyperthermia therapy. The project demonstrates the effectiveness of Lychee honey in producing stable, uniform maghemite nanoparticles with promising magnetic properties suitable for medical use. Future research will focus on performing hyperthermia tests, refining synthesis conditions, and functionalizing the nanoparticle surface for targeted cancer treatment. This work supports the viability of using green chemistry in advanced material synthesis, marking a significant step toward environmentally conscious methods in biomedical nanotechnology.

Keywords: Targeted cancer therapy, Lychee honey, Green synthesis, Maghemite nanoparticles, Biomedical applications,.



Linguistic Identity Crisis among Students in English-Medium Schools in Urban Bangladesh

Naiem Al Amin^{1*}, Farzana Noor Misty²

¹Institute of Skills Development and Continuing Education (ISDCE), State University of Bangladesh, Dhaka-1461, Bangladesh

² Institution of Educational Development, BRAC University, Dhaka 1212, Bangladesh

*Corresponding author email: naim.alamin1@gmail.com

The paper explores how the English-medium education influences the linguistic and cultural identity of students in Dhaka, Bangladesh, and how it affects their linguistic proficiency and cultural affiliation in the English dominated schooling environment. The emergence of English-medium schooling in Bangladesh, particularly in urban regions has raised issues concerning the transformation of socio linguistic identity of the students in such settings. The dominance of English has influenced students' indigenous linguistic repertoires and cultural affiliations. This study is qualitative and quantitative in its data collection strategies because it embraces both qualitative and quantitative research designs. Samples involved 170 participants comprising students, educators, parents, and school administrators participating through surveys, focus group discussions (FGDs), and semi-structured interviews of 10 English-medium schools in Dhaka. The results shed light on the immense influence that English-medium education has on the linguistic identity of students who are significantly disoriented towards the English linguistic hegemony. The pedagogical context seems to propagate an ascendant elitist ideology, whereby learners become disengaged with their local Bangla language and cultural practices. Interestingly, students have adopted a number of coping strategies and language behavior in navigating the conflict between linguistic identity and the Bangla cultural upbringing. Besides, the study highlights the intertwining nature of language, identity, and power in the case of English medium institutions. This study raises the concern that a balance between advancing English skills that will enable students to better integrate into a globalized world with maintaining the cultural and linguistic identity of the students should be achieved.

Keywords: *Linguistic Identity, English-Medium Education, Sociolinguistics, Cultural Shift*



Income-Driven Coping and Consumer Shifts: Analyzing Behavioural Responses to Fish Price Hikes in Bangladesh

S. M. Mehedi Hasan^{1*}, Md. Shahria Ahmed Arzu², Atik Hasan², Md. Abdul Wakil Shahan¹, Mst. Tamanna Akter³, Md. Hasinur Rahman Hemal⁴, Jannatul Mahfuza Misty⁴, Mushfiqur Rahman⁵, Md Mehedi Hasan⁶

¹*Department of Marketing, University of Rajshahi, Rajshahi-6205, Bangladesh*

²*Department of Economics, University of Rajshahi, Rajshahi-6205, Bangladesh*

³*Department of Accounting and Information Systems, University of Rajshahi, Rajshahi-6205, Bangladesh*

⁴*Department of Public Administration, University of Rajshahi, Rajshahi-6205, Bangladesh*

⁵*Department of Management Studies, University of Rajshahi, Rajshahi-6205, Bangladesh*

⁶*Institute of Business Administration, University of Rajshahi, Rajshahi-6205, Bangladesh*

***Corresponding author email: s2110635126@ru.ac.bd**

Abstract:

Price hikes can affect the purchasing behavior of consumers. In this study, we examined 810 respondents from 27 districts of Bangladesh, selected through a multistage sampling to ensure representation from rural and urban areas of all divisions of the country, and analyzed their fish consumption pattern, attitude and perceptions in response to price hike and associated issues. Our results revealed that 82% of respondent consumers, including 49.9 rural and 50.1% urban consumers, perceived an increment in fish price, of which, fish consumption pattern of 86% was affected. Income and number of household members significantly impacted the consumers' vulnerability to fish price hikes (multiple logistic regression: both $p < 0.01$). Coping strategies were related to income levels ($\chi^2 = 11.21$, $p < 0.05$), where households with lower income were prone to switching to alternative protein sources, and higher income households reduced their consumption quantity. Nevertheless, no difference emerged between rural and urban areas in the impact of price hike. This study explored how consumers responded to fish price hikes based on their income levels and place of residence. The differences in behaviour should be carefully considered while designing nutrition programs to make sure that everyone can access affordable, protein-rich foods and maintain a healthy diet regardless of their backgrounds.

Keywords: *Fish Price Hike; Consumer Behavior; Rural-Urban Comparison; Coping Strategies*



Design and Structural Analysis of a Sustainable Waste Transporting Machine Using SolidWorks

Helal Uddin^{1*}, Md. Ashikur Jaman Sakib & KH. Nazmul Ahshan¹,

¹Department of Mechanical Engineering, Faculty of Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.

E-mail: mohammadhelal247@gmail.com

Abstract

Indiscriminate disposal of waste in river and canal systems due to public ignorance is a global environmental problem resulting in water and ecosystem pollution. In this study, a garbage collection machine was developed with the aim of cleaning water bodies. We are developing an efficient, lightweight machine for collecting garbage from water bodies in the study, which will reduce water and environmental pollution and help in significant waste management. The frame of the machine was designed with SolidWorks software and made of aluminum steel bars (32 x 32 x 2.8 mm). It measured 1100 mm (height), 780 mm (width), and 1300 mm (length). The structural soundness was supported by SolidWorks simulation. The emphasis on strength and portability makes it ideal for use in a variety of aquatic environments. The simulations revealed that under operational conditions, the frame has structural strength that maintains its shape over time. The aluminum steel design provides lightness and durability for efficient waste management. Preliminary design studies confirm the effectiveness of open surface rivers and canals with different flow conditions. This device is a widespread way to clean water bodies around the world, reducing pollution and protecting aquatic ecosystems. Field testing is an effective way to see how well something works in real life. It supports sustainable waste management policies and public awareness campaigns to prevent people from throwing things away in the wrong way.

Keywords: Environmental & Water pollution, Garbage collection, SolidWorks, Finite element analysis, Structural analysis



Air Conditioner Condensate as A Sustainable Solution to Urban Groundwater Stress

Sabrina Mohammad Amin¹, Yeasir Mohammad Amin^{2*} & Lutfun Nahar Lopa²

¹*Student (MSGED), Master's in GIS for Environment and Development, Department of Geography and Environment, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh*

²*Student (MURP), Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh*

**Corresponding author email: yeasir.amin108@gmail.com*

Dhaka is going through considerable water stress due to rapid population growth and unplanned infrastructure adding to unregulated groundwater depletion. At the same time, Air conditioning units, found in more than 50% of buildings, produce significant amounts of condensate water, which is often overlooked. This study explores the potential of utilizing air conditioner (AC) condensate to address both urban water scarcity and address urban health concerns. Mixed methods were used. Field surveys were conducted in buildings of different uses to estimate AC condensate yield and collected water samples for usability testing against national standards. The spatial trends of groundwater depletion in Dhaka were analyzed using GIS based on secondary data on groundwater level. Results reveal that a 2-ton AC unit can produce 20–30 liters of water per day during peak summer months. Lab results suggest the water has potential for both potable and non-potable uses. GIS analysis revealed groundwater levels declining from 20 to over 70 meters. It is also verified that still water from AC condensate is contributor to mosquito breeding. AC condensate can be used safely for various purposes, including potable reuse, which will create an alternative source and avoid public health issues due to mosquito breeding. This needs to be integrated into urban policy and practices at building scale to develop reuse systems that can boost water resilience. More research should focus on quality monitoring, economic viability, and scalable implementation models.

Keywords: *Air Conditioner Condensate, Groundwater Stress, Urban Water Management, Water Reuse*



Analyzing the Roots of Secularism: Approaches and Political Impacts on Governance and Policy in Muslim Societies

Kawsar Mia¹, Dr. Abdul Momen²

¹Student, Department of Islamic History & Culture, Jagannath University, Dhaka-1100, Bangladesh

²Associate Professor, Department of Islamic History and Culture, Jagannath University, Dhaka-1100, Bangladesh

¹<https://orcid.org/0009-0001-5692-3555>, ²<https://orcid.org/0000-0001-8001-9825>

Corresponding Author: Kawsar Mia E-mail: b180104019@ihc.jnu.ac.bd

Abstract

This research investigates what historical events led Europe to seek an unforeseen idea like Secularism during the Middle Ages and how it approaches the Muslim-majority societies. The research methodology employs a qualitative, comparative approach through secondary literature, including historical records, political treaties, and contemporary analyses, such as books, scholarly articles, and newspapers, to trace the roots of secularism and its impacts on governance and legitimacy in the Muslim world. Research findings showed that overall conditions in Europe during the Middle Ages were not at all pleasant. All the departments of the state were massively dominated by religious bodies, and freedom from religious persecution was being sought on the western side of the Mediterranean. In the wake of these persecutions, several significant events took place in Europe, including the European Renaissance, the Reformation, the Age of Enlightenment, and the French Revolution. These significant events opened up a path of liberation, from which the idea of Secularism originated. Although it was an established subject of a distinct political discourse in the late 18th or the early 19th century by reason of a series of historical events, it was first adopted as a state political doctrine in the early 20th century in the Muslim world, notably in Turkey, in virtue chiefly of Atatürk's reform policy. This study has put forth a hypothesis about the historical origins of secularism and also showed how competing interpretations of secular authority affect governance structures, political legitimacy, and policymaking. By doing so, it bridges political history, comparative politics, and policy analysis, offering new insights on the emergence of Secularism and its political impacts in the Muslim World.



Combating Human Trafficking in Bangladesh: An Appraisal of the PSHT Act 2012

Mohammd Moin Uddin Chowdory

LL.B. (Hon's), LL.M., Department of Law, University of Rajshahi.

Abstract: Human trafficking remains a grave concern for Bangladesh, a nation characterized by economic underdevelopment and high population density. A large segment of its economically vulnerable population becomes easy prey for traffickers seeking to exploit their hardship. To address this pressing issue, the Parliament of Bangladesh enacted the Prevention and Suppression of Human Trafficking Act, 2012 (PSHT Act). This paper presents a critical examination of the Act's key provisions, evaluating its potential effectiveness in combating human trafficking, and offers recommendations for enhancing the existing legal framework.



Digital Policing in Bangladesh: Assessing the Capability to Counter Cybercrime and Security Threats

Mohammad Moin Uddin Chowdory

LL.B. (Hon's), LL.M., Department of Law, University of Rajshahi.

Abstract

The rapid growth of the internet has transformed human interaction, enabling communication, information exchange, and economic development. However, it has also introduced cyber threats that challenge security and privacy. In Bangladesh, a developing country advancing its 'Digital Bangladesh' vision, cybercrime presents significant challenges. This study adopts a mixed-methods approach, combining secondary data from government reports and cybersecurity agencies with qualitative insights, to evaluate the preparedness of Bangladesh Police in addressing cyber threats. The analysis reveals critical gaps in technical capacity, legal frameworks, manpower, and strategic coordination, providing a deeper understanding of the factors hindering effective cybercrime response. The study identifies missing elements in training, resource allocation, and legislative support that limit polices' effectiveness. Based on these findings, recommendations include the adoption of advanced cyber tools, human resource development, legal reforms, public-private collaboration, and international partnerships. This research offers a comprehensive assessment and deeper insights into strengthening Bangladesh's resilience against cybercrime while highlighting areas for further investigation and policy development.

Keywords: Cybercrime, Digital Policing, Bangladesh, Law Enforcement



Floating People in Rajshahi City: Livelihood Pattern and Rehabilitation

Suman Bala^{1*}, Rabiul Islam & Koushik Ferdoush Dipto¹

¹*BSS, Department of Social Work, University of Rajshahi, Rajshahi-6205, Bangladesh.*

**Corresponding Author Email: s2110844118@ru.ac.bd*

¹*Professor, Department of Social Work, University of Rajshahi, Rajshahi-6205, Bangladesh.*

¹*BSS, Department of Social Work, University of Rajshahi, Rajshahi-6205, Bangladesh.*

Abstract

Floating people (homeless, street people, beggars, detached from family) are a matter of great concern all over the world especially in developing countries. Bangladesh is recognized as developing country having a large number of floating people. Floating people— most of them migrated from rural villages to urban and lives in a slum, railway station, bus stand and footpaths are a concern in Bangladeshi city areas like Dhaka, Chattogram, Rajshahi. They are to face various challenges to lead their life. The aims of this study are to explore livelihood pattern and rehabilitation of floating people in Rajshahi city. Following qualitative approach, this study conducted In-depth Interviews(IDIs), Key Informative Interviews(KIIs) Focus Group Discussion(FGDs) to collect data from Rajshahi city. Results shows that the floating people don't get any secured shelter and enough food. Therefore, they suffer from malnutrition and other health issues. Besides, they have limited access to education and job sectors. That's why they involve in unethical activities (e.g. stealing, teasing, kidnaping, substance abuses, prostitution, drug trafficking) which have negative impact on society. This study argues that the floating people leads a miserable life. Their life always remains between hope and uncertainty. This study suggest that some initiatives should be taken through community leaders, NGOs, and the Government to rehabilitate them so that they can lead safe and secured life.

Keyword: Floating people, Livelihood pattern, Rehabilitation, Bangladesh



Smart Manufacturing for Waste Reduction: Leveraging Industry 4.0 Data Analytics for Environmental Sustainability.

Helal Uddin^{1*}, Fahim Al Mahmud²

¹*Department of Mechanical Engineering, Faculty of Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.*

²*Department of Statistics, Faculty of Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.*

Email: mohammadhelal247@gmail.com

Industrial waste, leftover materials and chemical residues constitute a major environmental challenge in Bangladesh where the textile industry annually produces some 400,000 tons of fabric waste that is a significant source of pollution. Manufacturing 4.0 technologies are making possible advanced manufacturing systems that are able to optimize production and reduce waste, using technologies such as those supported on data analytics and the Internet of Things (IoT). The objectives of the proposed manager is to proposes to build machine-learning based predictive analytics framework for minimizing textile production waste, evaluate the developed framework using a practical context in Bangladesh and finally observe the environmental and socio-economic impact caused by the approach. The design employed a mixed-methods case study. Data were collected from a medium-sized textile dye-house in Dhaka from January to March 2025, with IoT tracked measurements on fabric consumption, machine productivity, and wastewater output (n = 1,000 production cycles). Python generates a Random Forest regression model to predict waste, while simulation is carried out through a digital twin to optimize production parameters. The model obtained a mean absolute error of 5.4 %, and was able to accurately predict the pattern of waste. Application of the optimized parameters resulted in 20% less fabric waste (from 500 to 400 kg/day), 15% less use of water in dyeing (from 10,000 to 8,500 liters/day) and 10% lower CO₂ emission (0.5 tons/day). The greatest waste reduction was observed at the urban area, due to better cutting technique. These findings highlight the opportunities provided by Industry 4.0 analytics for sustainable manufacturing towards UN SDG 12. Additional investigation is also required on low-cost IoT deployment and policy enablers, to achieve widespread adoption and impactful change sustainably in developing economies.

Keywords: Smart Manufacturing, Waste Reduction, Predictive Analytics, Environmental Sustainability

The Literary Interpretations of the oppressed and Their Role in Social Media

Nusrat Jahan Nipa¹, Monira Islam

*Department of English, Green University of Bangladesh
Corresponding author email: nusratjahannipa1345@gmail.com*

Abstract: This research mainly explores how literature has historically reflected oppressed individuals and groups, and how these interpretations have provided to social awareness and transforms. By examining a range of literary works from different time and regions and theory. The study takeaways how writers give their voice to overlook the communities, challenge oppressed power calamities through the conceptions of Sigmund Freud's "concept of repression", "The unconscious and resistance" and inspire compassion to the readers. The study explores how literature serves both a mirror and a critique of societal power dynamics. Freud's ideas offer an important overview for understanding how literature reveals repressed social truths, enabling reader to construct with uncomfortable realities about inequality, violence and systemic oppression. The study explores that the authors consciously or unconsciously use the character or narrative development to reveals the difference between id, ego, superego. By doing this both the writer and the reader, allowing oppressed or suppressed narratives to emerge and challenge controlling structures. Furthermore, the paper argues that the storytelling may play a critical role in shaping cultural awareness and driving social progress. The research concludes that the literary framework of the oppressed not only reflect historic conditions but also actively participate in shaping public discussion and powering reform. As such literature informed by mental or emotional tensions, is a mighty force for social change.

Keywords: Oppressed, The concept of repression, Id, Ego, Superego, Emotional tensions.



Digital Technology Adoption in Social Entrepreneurship: A Systematic Literature Review Of Barriers and Facilitators

Sourav Roy Chowdhury^{1*} & Md Akash Hawladar¹

¹*Business Administration Discipline, Management and Business Administration School, Khulna University, Khulna-9208, Bangladesh*

*Corresponding author email: sourav102753@gmail.com

Introduction: This investigates how social enterprises adopt digital technologies and the factors that influence this process. Although digitization has the potential to substantially improve operational efficiency and societal impact, many social entrepreneurs face challenges in implementing such technologies.

Objective: The main objective of this study is to systematically review existing literature to identify barriers and facilitators influencing digital technology adoption in social enterprises. Additionally, it seeks to identify research gaps and offer perspectives that facilitate social innovation driven by technology.

Methodology: This study employs a systematic literature review (SLR) guided by the PICO framework to focus on social entrepreneurship and digital adoption. A Boolean search was conducted in Scopus and Web of Science for studies published between 2000 and 2025. Articles were evaluated with specific inclusion and exclusion criteria using the PRISMA 2020 methodology. To visualize keyword co-occurrence, citation clusters, and research trends, VOSviewer was used for meta-analysis. Thematic analysis was then used to identify important barriers, facilitators, and research gaps.

Findings: The review recognized barriers such as scarce resources, expertise deficits, organizational resistance, poor infrastructure, and regulatory constraints. Facilitators included leadership commitment, partnerships, supportive policies, and mission alignment. Successful adoption usually depends on collaborative, ecosystem-based strategies for implementation.

Implications: The results contribute to multidisciplinary knowledge for social entrepreneurs, technological firms, and legislators. Through the elimination of barriers and the use of facilitators, social enterprises can use digital technology to increase productivity, reach a wider audience, and bring long-lasting social transformation.

Key Words: *Digital Technology Adoption, Social Entrepreneurship, Barriers and Facilitators, Systematic Literature Review (SLR).*

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 - ✓ জরুরী প্রয়োজনে মেয়াদপূর্তির আগেই আংশিক মুনাফাসহ টাকা তুলে নেয়ার সুবিধা
- বিধি মোতাবেক মুদায়ম হতে কর কর্তব্যযোগ্য



জনতা ব্যাংক পিএলসি.

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নিবন্ধন নম্বর: ৯-২৬৬/২০২৫

বৈধতা: ১৯ জুলাই ২০৩০ পর্যন্ত

স্বীকৃতি প্রদানকারী সংস্থা: জাতীয় বিজ্ঞান ও প্রযুক্তি জাদুঘর, বাংলাদেশ



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Theme

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