Proceedings of the

YOUNG SCIENTISTS' CONFERENCE ON MULTIDISCIPLINARY RESEARCH

VIRTUAL INTERNATIONAL CONFERENCE

YSCMR 2024

Organized by,
The Young Scientists' Association
National Institute of Fundamental Studies, Sri Lanka.

YSCMR 2024

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"Collaborative Research for Achieving the UN Sustainable Development Goals (SDGs)"

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It brings immense pleasure to publish this volume, which represents the successful conclusion of the Young Scientists' Conference on Multidisciplinary Research (YSCMR)-2024, hosted by the Young Scientists' Association (NIFS-YSA), National Institute of Fundamental Studies. We would like to sincerely appreciate everyone who contributed to making this event an enormous success.

We are grateful to the Chairman Prof. Athula Sumathipala, Director Prof. Syril Wijesundara, Acting Director Prof. Gamini Senevirathne, Secretary to NIFS Ms. M.P.W. Shiromini, Editor-in-chief Prof. Nazrim Marikkar, Editorial committee members and Advisory committee of NIFS-YSA for their valuable guidance, encouragement, and support.

We want to express our gratitude for the enormous support that we received from the NIFS's Director's office, Science Education and Dissemination Unit (SEDU), Accountant and Accounts Division, and Administrative Division.

This kind of event would not be feasible to plan without financial support. Thus, we sincerely thank our silver sponsors, Altra Scientific Pvt Ltd and the Microbial Biotechnology program NIFS; our bronze sponsors, Microtech Biological Pvt Ltd, 8 Six Guard Security and Investigation Pvt Ltd, and Mr. Gamini Silva.

We would also like to express our sincere gratitude to all the reviewers and session chairs who contributed their expertise in evaluating the abstracts to maintain the conference's quality on par with the NIFS standards. We extend our sincere thanks to all authors, co-authors, and their supervisors for considering publishing their original findings at the conference.

Finally, our heartfelt appreciation goes to all colleagues who actively participated and readily contributed to multiple tasks during the conference.

MESSAGE FROM THE CHAIRMAN, NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

I am sending this message in my capacity as the Chairman of the National Institute of Fundamental Studies (NIFS), which is a premier research institution in Sri Lanka. Young Scientists' Association (YSA), which is comprised of postgraduate students, volunteers, and undergraduate students at the NIFS appears to me as a dedicated group of enthusiasts, running into their 6th year. This year, YSCMR-2024 has received 166 abstract submissions of which, 112 (63 for oral presentations and 49 for speed talks) have been selected for presentation in the conference.

This year's theme of the conference is "Collaborative Research for Achieving the UN Sustainable Development Goals (SDGs)". The Sustainable Development Goals are 17 global targets set by the United Nations in 2015 to address challenges like poverty, inequality, and climate change by 2030. Currently, Sri Lanka requires innovative R&D contributions to re-stabilise the economy, to ensure national security as well as sustainable development in strategically important areas.

Key points in collaborative research are;

- Interdisciplinary Approach: Collaborative research brings together diverse fields, enhancing the understanding of complex issues related to the SDGs, such as climate change, poverty, health, and well-being.
- Stakeholder Engagement: Involving local communities, government & non-governmental organizations, and private sectors ensures the research addresses real-world challenges and incorporates local knowledge and needs.
- Resource Sharing: Collaboration allows the pooling of resources—financial, technological, and human capital to maximize impact and efficiency in all kinds of research efforts.
- Innovative Solutions: Working together fosters creativity and innovation, leading to the development of sustainable technologies and practices that can effectively address SDG challenges.
- Capacity Building: Collaborative research enhances skills and knowledge among participants, particularly in developing regions, empowering communities to take action towards achieving the SDGs.
- Data Sharing: Collaborative work facilitates the sharing of data and best practices, allowing for more comprehensive analyses and informed decision-making in policy and practice.
- Policy Influence: Research collaborations can create a stronger voice for evidence-based policies, influencing governments and organizations to prioritize the SDGs.
- Monitoring and Evaluation: Joint initiatives can establish a more effective framework for tracking progress towards the SDGs, ensuring accountability and transparency in efforts.
- Global Partnerships: Collaboration fosters international cooperation, essential for addressing global challenges that transcend borders and coordinated action.
- Long-term Sustainability: Collaborative research promotes sustainable development by building networks and relationships that endure beyond individual projects, ensuring ongoing commitment to the SDGs.

These points highlight the importance of collaborative research in creating effective strategies and solutions for achieving the SDGs. I have no doubt this year's conference is going to offer very stimulating presentations and discussions. Please take everything possible away from this

conference and determine to be leading scientists not only for our nation but for the whole world. Knowledge is for people's benefit and has no boundaries. I would like to thank the organizing committee for asking me to share my thoughts. I would once again like to congratulate the organizing committee for the spirit and courage shown in holding this event.

Professor Athula Sumathipala
Chairman,
National Institute of Fundamental Studies,
Hanthana Road,
Kandy.

MESSAGE FROM THE DIRECTOR, NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

As the Director of the National Institute of Fundamental Studies (NIFS), I am delighted to welcome you to the Young Scientists' Conference on Multidisciplinary Research (YSCMR) 2024. This sixth conference promises to be an exciting platform for emerging researchers to share their innovative ideas and findings across a wide array of disciplines, including all basic sciences.

In today's rapidly evolving scientific landscape, interdisciplinary collaboration is a must. The convergence of research from diverse fields fosters creativity and drives groundbreaking advancements. I encourage all participants to engage actively, share insights, and learn from one another. This year too, we are especially proud to host an international virtual format, allowing a broader range of voices to contribute to discussions. I urge all participants to take full advantage of this unique opportunity to network and forge connections that will enhance their future endeavors. Your participation is crucial not only for your personal growth but also for the enrichment of the global research community. Together, we can inspire one another and advance our collective pursuit of knowledge.

Wishing you all a fruitful and inspiring conference!

Prof. Gamini Senevirathne
Acting Director,
National Institute of Fundamental Studies,
Hanthana Road,
Kandy.

MESSAGE FROM THE ADVISORY COMMITTEE, NIFS - YOUNG SCIENTISTS' ASSOCIATION

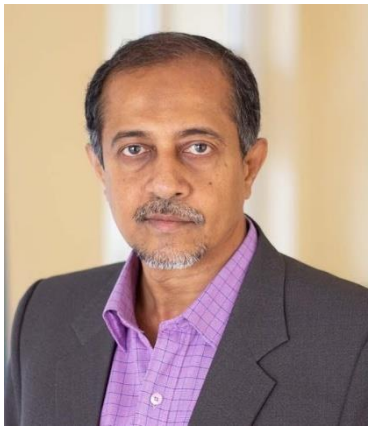
It is with great pleasure that I extend my warmest congratulations to the Young Scientists 'Association (YSA) for organizing the 2024 edition of the Young Scientists' Conference on Multidisciplinary Research (YSCMR). Since its establishment in 2018, the YSA has grown into a vibrant community that fosters the academic and professional development of early career researchers. This annual symposium has become a key platform for showcasing scientific innovations and collaborative research by budding scientists. The Proceedings of YSCMR 2024 capture the breadth and diversity of research undertaken by postgraduate students, undergraduates, and volunteers at NIFS and other institutes, embodying the interdisciplinary spirit of scientific inquiry. As the Advisor for this year's proceedings, I am proud of the dedication and enthusiasm demonstrated by all participants. The conference proceedings not only document high-quality research but also reflect the commitment of the YSA to promoting research excellence in Sri Lanka. This symposium also offers a unique opportunity for young researchers to engage in knowledge exchange, network with peers, and gain insights from established experts across various scientific fields. I am confident that the research presented this year will inspire new ideas and pave the way for future breakthroughs.

I congratulate all authors and contributors for their hard work, and I look forward to witnessing the continued success of the YSA and its role in shaping the future of science in Sri Lanka.

Best wishes for a successful and inspiring conference!

Dr. Lakmal Jayarathna
Advisor,
Young Scientists' Association
National Institute of Fundamental Studies,
Hanthana Road,
Kandy.

MESSAGE FROM THE EDITOR-IN-CHIEF, YSCMR 2024



It is a great pleasure for me to say a few words on the occasion of the Young Scientists' Conference on Multidisciplinary Research 2024 (YSCMR 2024). The Young Scientists' Association of NIFS (NIFS-YSA) has organized this research conference for the 6th consecutive year as a platform for young postgraduate students and early career scientists to disseminate their research findings in the fields of Biological Sciences, Physical Sciences, Chemical Sciences, Social Sciences, and Computer, Statistics, and Mathematical Sciences.

This yearly conference has continued to gain popularity among postgraduate research students and early career scientists. The growing number of abstract submissions bear testimony to this. Although we received 166 submissions, only 112 were selected for presentation at the conference based on the outcome of the double-blind peer review process. The conference tracks of YSCMR 2024 are arranged into five technical sessions to find common interests and create synergy among different scientific disciplines. I would like to take this opportunity to pass on my earnest gratitude to the conference organizing committee of YSCMR 2024 who contributed immensely to the success of this event. As the Editor-in-Chief for this year's event, I would like to convey my sincere gratitude to all associate editors and peer reviewers for their time and effort.

I sincerely hope that YSCMR 2024 will be a memorable scientific experience for all participants.

Prof. Nazrim Marikkar
Editor-in-Chief,
Young Scientists' Conference on Multidisciplinary Research 2024,
National Institute of Fundamental Studies,
Hanthana Road,
Kandy.

MESSAGE FROM THE CONFERENCE ORGANIZERS, YSCMR 2024

It is a great honor to convey this message on behalf of the organizing committee of the Young Scientists' Conference on Multidisciplinary Research 2024 (YSCMR-2024), organized by the Young Scientists' Association of the National Institute of Fundamental Studies (NIFS-YSA) for the 6th consecutive year. The NIFS-YSA was established in 2018 to inspire young scientists of the institute to enhance their knowledge, skills, leadership, and networking abilities in the field of research while maintaining a collaborative and vibrant working environment at the NIFS. Our membership comprises research assistants and volunteers committed to advancing research at the NIFS, while also engaging in team-building and academic activities. From its humble beginnings at the institutional level, YSCMR has grown steadily over the years, reaching the national level in 2020 and the international level in 2021. This year, YSCMR 2024 proudly marks its 6th consecutive research conference. With the theme of 'Collaborative Research for Achieving UN Sustainable Development Goals (SDG)', this year's conference featured five core research themes: Biological Sciences, Chemical Sciences, Physical Sciences, Social Sciences, and Computer, Mathematics, and Statistical Sciences. We received an overwhelming 166 abstracts, which were rigorously evaluated by a dedicated panel of reviewers through a double-blind process. Of these, 112 abstracts were accepted, 63 for oral presentations and 49 for speed talks. The presenters are expected to share their research findings in virtual mode, held across six parallel tracks, further highlighting research advancement in Sri Lanka and fostering an engaging platform for scholarly exchange. Organizing an event of this scale has posed many challenges, but the unyielding dedication and teamwork of our fellow research assistants and volunteers at NIFS ensured the success of YSCMR 2024. Their hard work truly demonstrated the power of teamwork and collaboration, for which we extend our deepest gratitude. We would also like to express our sincere appreciation to the Chairman of NIFS, the Director of NIFS, the Advisor of YSA, the Editor-in-Chief, and the Editorial Board members for their unwavering support and guidance throughout the organizing. Our gratitude also extends to the panel of reviewers, technical session chairs, and NIFS scientists, whose commitment to the scientific community played a crucial role in making this event a reality. Special thanks go to the Science Education and Dissemination Unit (SEDU) and the IT Division of NIFS for their invaluable support in organizing and managing the conference sessions. Finally, we would like to extend our heartfelt appreciation to our esteemed Keynote Speaker, Prof. I. M. Dharmadasa, for accepting our invitation and delivering insightful, timely addresses at this year's conference. We congratulate all the presenters of YSCMR 2024 and sincerely hope that this conference will provide a platform for networking, knowledge sharing, and collaborative research that will inspire young scientists worldwide. Thank you all for making YSCMR 2024 a remarkable success.

Aravinda Bandara & Thakshila Herath
Co-chairs, YSCMR-2024

Bhanuka Gunarathe & Sachini Jayasekara
Co-chairs, YSA-NIFS-2024

MESSAGE FROM THE KEYNOTE SPEAKERS, YSCMR 2024

As the keynote speaker at the 6th annual conference of the Young Scientists' Association (YSA) of the National Institute of Fundamental Studies (NIFS), Sri Lanka, I am pleased to convey this message. Reflecting on the early 1980s, I recall my time as a young Physics lecturer, eager to pursue research in solar energy conversion. A small group of academic staff and I frequently traveled to Colombo to discuss our interests with Professor Ciril Ponnamperuma, then Director of the Institute of Fundamental Studies (IFS). At that time, IFS operated from a modest property in Colombo. Ever since it relocated to Hantana in Kandy, it has been evolving into the well-established National Institute of Fundamental Studies (NIFS). Currently, NIFS stands as a leading research institute in fundamental studies, hosting various research centers where scientists engage in diverse scientific inquiries. While the primary focus remains on fundamental studies, many research projects are directly relevant to Sri Lanka's economic development. To meet these needs, NIFS actively disseminates new scientific knowledge to the public through its media unit and trains young scientists across different fields. I commend the NIFS staff for founding the YSA and organizing activities such as conferences, workshops, and seminars to foster and train young scientists while disseminating novel scientific knowledge. Our scientists must concentrate on applied research that significantly contributes to Sri Lanka's rapid development during this critical period. Accordingly, my keynote speech is titled "Solar Village Project for Sustainable Development to Reduce Poverty and Mitigate Climate Change," aligning seamlessly with YSA's conference theme, "Collaborative Research for Achieving UN Sustainable Development Goals. I encourage more young scientists to venture into entrepreneurship within these critical domains, thereby accelerating our nation's development.

I extend my best wishes to the YSA for a productive, successful, and enjoyable conference on 27th November 2024!

Prof. I.M. Dharmadasa
Professor Emeritus in Engineering Science,
Sheffield Hallam University,
Sheffield,
United Kingdom.

Adjunct Professor,
National Institute of Fundamental Studies,
Sri Lanka.

LIST OF ABSTRACTS

BIOLOGICAL SCIENCES

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Paper ID: CMT-001

Development of an image-based alternative method for soil plant analysis development (SPAD) reading

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Predominantly in plant science studies, determining the leaf chlorophyll content is vital, as it provides insight into the nitrogen status of a leaf, thereby reflecting the plant's health. The Soil Plant Analysis Development (SPAD) meter is often used to get rapid readings about leaf chlorophyll content, and it is also simple to use in field studies. However, some significant issues limit the study's accuracy: variation in SPAD reading through the leaf surface, dependence of accuracy on the measuring method, and inability to access the SPAD meter during some field applications. In this context, this study focused on developing a new digital image-based alternative method for accessing chlorophyll content through the leaf greenness value. Employing the tea (*Camellia sinensis* L.) TRI 2023 cultivar, SPAD values were measured at several spots on the leaf, encompassing the entire leaf surface, by a SPAD meter, and in parallel, digital images were taken with a smartphone camera (Realme C15) with a resolution of 3120 × 4160 pixels without interference from ambient light. A total of 56 leaves were used to measure the data. The greenness values of leaves were calculated using Python (version 3.11.4) with OpenCV. The Pearson correlation coefficient analysis between SPAD values and greenness values was done using R (version 4.4.0). The results revealed a significantly ($P<0.01$) negative, strong correlation ($r = -0.8967$) between the SPAD value and the image's greenness level. This higher level of correlation elucidated a robust relationship between leaf greenness value and SPAD readings, revealing a higher level of accuracy of this method. To get around the problems with the SPAD meter and create a new digital image-based method for measuring leaf chlorophyll content during field studies, this study came up with a way to access the SPAD value that is accurate, easy to use, and statistically significant.

Keywords: *Chlorophyll, leaf greenness value, leaf nitrogen, SPAD, tea*

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Paper ID: CMT-005

Analysis of the efficiency of wastewater treatment plants in selected board of investment (BOI) export processing zones in Sri Lanka

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Wastewater treatment plants play an important role in achieving several Sustainable Development Goals (SDGs). The efficiency of wastewater treatment is a key indicator of wastewater treatment plant function. In this study, the efficiency of wastewater treatment plants in selected BOI export zones was evaluated. The objectives were to analyze the efficiency of wastewater treatment plants in Katunayake (KEPZ), Biyagama (BEPZ), and Wathupitiwela (WEPZ) export processing zones, using water quality parameters and to determine whether the concentration of discharged effluent after the treatment, meets the general standards regulated by the Central Environmental Authority (CEA). Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Suspended Solids (TSS) of the water were analyzed during April and May 2024. The efficiency of treatment plants for each parameter was calculated. BOD efficiency was consistently high across all zones for both months. This indicates the treatment plants were effectively removing organic matter from the wastewater. The highest efficiency was observed in the WEPZ in May (98.2%). COD removal efficiency was also high, with values generally above 90% in all zones for both months, which indicates the effective reduction of chemical pollutants. BEPZ had the highest COD removal efficiency in May (96.3%), indicating an efficient and robust treatment process. TSS removal indicates a higher variability compared to BOD and COD. In April, WEPZ had a relatively low TSS removal efficiency (68%). However, this improved significantly in May (85.2%), indicating some applied corrective measures to the plant. KEPZ reported the most improvement in TSS removal from April (89.2%) to May (92.8%). All zones met the CEA standard for BOD in both April and May, except BEPZ in April. All zones met the CEA standard for COD and TSS in both months. So, the wastewater treatment plants in these zones effectively reduce major pollutants and promote environmental sustainability.

Keywords: *BOI zones, efficiency analyzing, environmental sustainability, wastewater treatment plant, water quality parameters*

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Biofilm biofertilizer increases drought tolerance in rice: an observational study

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Drought is becoming more acute with intensifying global climate change, and it severely limits rice production, resulting in significant economic losses. Search for alternative agricultural practices that increase crop productivity, especially in drought conditions is an urgent need. At present, eco-friendly biofilm biofertilizer (BFBF) practice seems to be a good candidate for this due to its potential to restore agroecosystems leading to improved soil quality and crop yields while cutting down chemical fertilizer (CF) use. The present study aimed to investigate the effect of BFBF on drought tolerance in rice by conducting a pot experiment (on variety At 314) having two fertilizer practices viz. (a) CF practice (340 kg NPK ha^{-1}, recommended by the Department of Agriculture, Sri Lanka) and (b) BFBF practice (225 kg NPK ha^{-1} + 2.5 L BFBF ha^{-1}) each with two water regimes i.e. (a) field capacity and (b) 65% field capacity in a completely randomized design with three replicates. During the reproductive stage of the plants, irrigation water was withheld until wilting (leaf rolling) was observed, and the percentage of rolled leaves per plant (PRLPP) was calculated. One-way ANOVA followed by Tukey's HSD test was performed for the mean comparison. The results showed that leaf rolling occurs two and three days after withholding irrigation water in the CF and BFBF practices, respectively. After four days, all the leaves of the CF practice rolled, whereas the PRLPP in the BFBF practice was significantly (p = 0.015) low by ca. 16% compared to the CF practice in the 65% field capacity. This indicates the potential of BFBF in increasing drought tolerance in rice, within the limitations of the study. Further research is recommended to investigate and confirm this using larger sample sizes, different rice varieties, and also in farmers' fields under different soil and climatic conditions.

Keywords: *BFBF, drought resistance, rice paddy*

Acknowledgment: *The authors are thankful to all the members of the microbial biotechnology unit of the National Institute of Fundamental Studies, for their support throughout the study*

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Survey on public opinions regarding the possibility of implementing human composting as an alternative green funeral technique in Sri Lanka

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The environmental impact of traditional burial practices caused the exploration of alternative green funeral techniques. Human composting (HC), an eco-friendly method, is gaining attention worldwide. This study aims to survey public opinions on the feasibility of implementing HC in Sri Lanka, a novel approach. The primary objective was to gauge public acceptance, perceived sustainability, and potential concerns regarding HC as an alternative funeral method in Sri Lanka. Data was collected through an online Google Form distributed across Sri Lanka, with 206 voluntary participants. The responses were statistically analyzed to identify trends. Of the 206 participants, 66% were female and 34% male, with 84.9% aged 18-24. A majority (90.6%) were undergraduates, and 54.7% were from the science field. The findings revealed that 70.7% of participants were open to the idea of human composting, and 62.3% viewed it as a sustainable and eco-friendly burial method. Primary concerns included hygiene and health safety (48.1%), lack of regulation (17.9%), and emotional closure (15.1%). Despite these concerns, 53.7% would consider human composting if legalized. The main reasons for rejection were a lack of clarity (49.1%), emotional closure (34%), and cost skepticism (32.1%). Motivations for acceptance included eco-friendliness and land crisis solution (72.6%), chemical-free and environmental safety (50.9%), and reduced carbon emissions (39.6%). Additionally, 52.8% believed HC aligns with Sri Lankan cultural and religious beliefs, and 61.3% supported its legalization. In conclusion, the survey indicates significant openness towards HC in the Sri Lankan community, with strong support for its sustainability benefits. However, concerns regarding hygiene, regulatory frameworks, and emotional aspects must be addressed to enhance public acceptance and implementation. This study has a potential bias due to the high percentage of young, science-field undergraduates, which may not fully represent the general population. Future research should focus on addressing these concerns and ensuring a more diverse sample.

Keywords: *Acceptance, concerns, environmental impact, green funeral techniques, human composting*

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Variation of GC profile of Ceylon cinnamon (*Cinnamomum zeylanicum* Blume) bark oil with the bark maturity

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Ceylon cinnamon, also known as "true cinnamon", is a type of spice derived from the inner bark of the cinnamon tree, which is native to Sri Lanka. Cinnamon bark oil (CBO) is derived from the bark of the cinnamon tree. Cinnamaldehyde, α-pinene, β- phellandrene, benzyl benzoate, β-linalool, and β-caryophyllene are some of the major chemical compounds commonly found in cinnamon bark oil. This study was carried out to evaluate the GC (Gas Chromatography) profile of CBO with the thickness of the dry bark as a factor to measure the maturity of the bark. Cinnamon bark samples were collected from the Galle district. Dry bark thickness was measured using Vernier caliper and CBOs were extracted by using hydro distillation by Clevenger apparatus. CBOs were analyzed by Gas Chromatography-Flame Ionization Detector (GC-FID) and Gas Chromatography-Mass Spectrometry (GC-MS). As per the GC-FID analysis data, percentages of cinnamaldehyde were increased and α-pinene, β-phellandrene, benzyl benzoate, β-linalool, and β-caryophyllene were decreased with the average thickness under 0.5 mm to 4.5 mm range of dry bark thickness. These dry bark thicknesses are related to a normal cultivated maturity range (2 to 5 years) of the cinnamon stems. Nevertheless, some exceptional cases were reported with more than 4.5 mm bark thickness values. In such instances, cinnamaldehyde values were decreased and α-pinene, β- phellandrene, benzyl benzoate, β-linalool, and β-caryophyllene values were increased. These heavy barks were collected from 5- 20 years old trees. Considering the above GC aroma profile, 2-5 years matured stems were recommended to prepare cinnamon quills with high-quality CBO with unique aroma and fragrance. Further, older stems are better suited for applications in food processing and the cosmetics industry. These findings provide valuable insights for optimizing CBO production, guiding both cultivation practices and product formulation based on desired aromatic characteristics.

Keywords: *α-pinene, β- phellandrene, benzyl benzoate, cinnamaldehyde, hydro distillation*

Acknowledgment: *This work was supported by the Industrial Technology Institute, Malabe, Sri Lanka.*

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Plastination studies using various resins and starch compounds

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Plastination is a preservation technique that involves the diffusion of polymers into anatomical specimens, resulting in durable plastinates. The Elnady technique is an innovative new method for plastination that uses glycerol for impregnation and corn starch for curing. This study investigated the potential of using various resins and starch compounds in the Elnady method to improve properties. Discarded chicken heart specimens were collected and fixed in formalin and dehydrated in pure acetone. Specimens were impregnated by immersing in resins, including glycerol, polyethylene glycol (PEG), and bee honey. Specimens were cured using various starches, including corn starch, rice flour, kurakkan flour, and kittul flour. Furthermore, the color, odor, dryness, and flexibility of the plastinated specimens were assessed qualitatively at room temperature. Glycerol-impregnated specimens were assessed for more than six months. Due to the hygroscopic nature of glycerol, glycerol-impregnated specimens were getting wet while preserving for months. It was the major drawback of using glycerol in the Elnady method. Specimens plastinated using PEG 200 and bee honey had a dry nature compared to glycerol-impregnated specimens. PEG 200 and bee honey-impregnated specimens were assessed for more than three months, and it was found that they were dry, flexible to dissect, and free from any offensive odor. Out of PEG 200 and bee honey, PEG 200 was found to be the best alternative for impregnation of specimens, because it preserved the color of the original specimens. After assessing the dryness of specimens that were cured with different starches, it was found that rice flour, kittul flour, and kurakkan flour could replace corn starch in the curing step. The study demonstrated that it is possible to replace standard chemicals and compounds used in the Elnady method with easily accessible materials and could overcome certain reported drawbacks.

Keywords: *Chicken cadaver, elnady technique, polymers, preservation*

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The effect of combined use of chemical fertilizers and poultry manure on the decomposition of banana crop residues under field conditions

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Nutrient availability in soil influences soil biological activities and the decomposition rate of organic materials. This study was conducted to evaluate the effect of the combined use of chemical fertilizers (CF) and poultry manure (PM) on the decomposition rate of banana crop residues based on litter type, depth of placement (DOP), and time of exposure to litter materials. Bananas have been cultivated for two years with six treatments comprised of different combinations of CF and PM applications arranged in three blocks in a completely randomized block design. Two rates of CF applications 75% and 100% of the site-specific recommendation used by the farm were combined with three application rates of PM as 0 kg, 2.5 kg, and 5 kg per plant. Litter bags (10×10 cm) were prepared with nylon mesh (1.41 mm openings) on the bottom and polyester clothing material on top. Two types of litter materials (banana leaves and pseudo-stems) were placed separately in 36 litter bags per plot and deposited on a surface at 7.5 cm depth. Three litter bags for each litter type from each depth were recovered three times over one and half months and weight loss of material was determined on a dry weight basis. Litter material type and time allowed for decomposition significantly affected litter decomposition (P<0.05). Banana pseudo-stems degraded more than banana leaves by 45 DAP. The DOP of litter materials and nutrient management strategy had no significant effect (P>0.05) on decomposition except at 17 DAP for pseudo-stems. With PM application, abundance of the culturable population of bacteria and cellulose decomposers significantly increased (P<0.1) while bulk density decreased significantly (P<0.1). In conclusion, the type of crop residue had more impact on the decomposition rate than the DOP or nutrient management strategy. The application of PM has initiated changes to soil properties, which should continue to be monitored.

Keywords: *Banana crop residues, decomposition, field study, litter bags, poultry manure application*

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Optimizing crop yields and climate resilience: A desk review on the role of digital agriculture in climate change mitigation

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Climate change is expected to significantly impact crop yields by altering temperature and water availability. Mitigation and adaptation measures aim to gradually offset these repercussions while sustaining development. In recent years, digital agriculture has become an increasingly important tool for promoting food production and environmental care. By leveraging these technologies, farmers can increase their yields, reduce the environmental impact, and improve overall efficiency. The scholarly literature available on digital agriculture technologies is scattered and does not contain sufficient empirical evidence, in terms of field investigations. The purpose of this review is to (a) assess the potential of digital agriculture technologies in mitigating the effects of climate change, and (b) identify the barriers that stand in the way of the widespread adoption of digital agriculture. To establish the study framework, a thorough evaluation of the existing literature was conducted. Studies aligned with the research objectives were searched on Google Scholar (2012-2023) using specified keywords. Out of 120 documents reviewed, 92 were found to be relevant and the findings from impactful journal papers were considered in this study. Digital agriculture technologies, such as precision agriculture and smart farming, have a great potential to boost agriculture productivity while reducing the environmental impact. The perfect combination of these technologies can enhance crop yield and quality while minimizing the environmental impact. In the global context, current adoption rates of digital agriculture are considered to be low due to various challenges including, high investment costs, small farm sizes, and the advanced ages of farmers. This method presents itself as a cost-effective strategy for building resilience in agriculture systems, and it is anticipated that it will achieve universal support within the agricultural community. In light of this, the incorporation of these technologies must be taken into consideration in both the current and the future agricultural strategies.

Keywords: *Climate-smart agriculture, climate change, mitigation and adaptation efforts, precision agriculture, sustainable agriculture*

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Analysis of spatial variations in soil parameters under an oil palm cultivation at Culloden estate in Kalutara, Sri Lanka

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The impacts of oil palm plantations on soil properties were not extensively studied in Sri Lanka. Soil acidification is a major concern in oil palm soil. Therefore, the oil palm cultivation at Culloden estate in Neboda was selected as a suitable land to assess the variability of soil physical and chemical properties. The objectives of this study were to analyze the impacts of oil palm cultivation on selected properties of soil and to determine whether there is a significant difference in soil properties between the oil palm site and an abandoned grassland, considered as a reference site. The main hypothesis is that there will be a significant spatial difference in soil properties between the oil palm site and the reference grassland site. The selected plantation was divided into 3 sites S1, S2, and S3 to study the variability in soil parameters within the oil palm land. Three representative sampling points from each zone were selected. The reference sampling (R) was taken from the abandoned grassland. Each parameter was analyzed using standard methods. Soil pH, electrical conductivity, bulk density, porosity, organic matter content, nitrogen, and phosphorus contents indicated a significant spatial difference compared to the reference site ($p<0.05$, General Linear Model followed by Tukey's pair-wise comparison). Soil particle density was comparatively similar in the four sites. The emergence of three sub-clusters was observed in distance-based Redundancy Analysis (dbRDA). Sites 2 and 3, remained as one major cluster, while S1 and R emerged as the other two sub-clusters. Around 99.5% of the total variability was accounted for by the dbRDA axes. It can be identified that oil palm has an impact on soil properties, especially on the soil bulk density and porosity. In conclusion, the soil properties in the oil palm cultivation were significantly different from those at the reference site.

Keywords: *dbRDA, oil palm, soil properties, spatial variabilities, sustainable agriculture*

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Immune response and cutaneous lesions in bovine lumpy skin disease in Sri Lanka

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Lumpy skin disease (LSD) is a novel, notifiable infectious viral disease in cattle caused by lumpy skin disease virus, of the family Poxviridae. The disease has been a catastrophic threat to large, domesticated ruminants in Africa, the Middle East, Europe, and Asia, which causes severe economic losses in livestock. However, the hematological changes and the pathogenesis of cutaneous lesions in LSD remain obscure. Therefore, this study was conducted to determine the haematologic changes and the histopathological findings in cattle naturally infected with LSD, in Sri Lanka. The findings were compared with normal cattle. Blood and skin biopsies were collected from thirty LSD-infected cattle and normal cattle (n = 30/ group). Skin sections were fixed in 10% neutral buffered formalin, routinely processed, and wax embedded. These were then sectioned at 3 μm and stained with haematoxylin and eosin for histopathology, and azan-Mallory for collagenolysis. The number of macrophages per 0.2 mm^2 was counted. Conversely, a significant decrease in neutrophil count was observed in LSD-infected animals (17.22%) compared to the control (55%) ($p < 0.05$). Compared to the control, histopathology revealed a significant increase in collagenolysis, and macrophage counts in LSD-infected animals; an increase ($p < 0.0001$) in a number of macrophages per 0.2 mm2 in this collagenolytic amount of collagenolytic of the dermis was 799.87 in test group while 81.40 in the control group. An increase ($p < 0.0001$) in collagenolysis in the dermis of the LSD diseased skin in comparison with normal healthy skin. There were 25.24% collagenolytic areas observed in the test group while 1.44% area from the total area was observed in the control group. Furthermore, most macrophages were observed in close proximity to the collagenolytic areas. Thus, our findings demonstrate that macrophages and lymphocytes play a key role in the immunity against LSD infection and that the pathogenesis of LSD leads to immune-mediated cutaneous lesions.

Keywords: *Cattle, collagenolysis, haematology, histopathology, lymphocyte*

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Soursop (*Annona muricata*) peel extract as natural bioactive compound for enhanced sensory properties of sponge cake

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Due to sustainability concerns, the food industry is increasingly turning to natural bioactive compounds from fruit by-products as viable alternatives. This study investigated the phytochemical content, antioxidant activity, and *in vivo* acute toxicity of bioactive compounds extracted from *Annona muricata* peel (AMP) and their impact on the sensory properties of sponge cake. Natural bioactive compounds were extracted using 100% ethyl acetate by ultrasonication. Total phenolic content (TPC) and total flavonoid content (TFC) were determined using Folin-Ciocalteu's and Aluminum Chloride methods, while antioxidant activity was evaluated via DPPH assay and compared with butylated hydroxytoluene (BHT) at 50-250 µg/mL. Acute toxicity was assessed using Zebrafish (*Danio rerio*) embryos exposed to 50-800 µg/mL for 96 hours of post-fertilization (hpf). Additionally, sensory evaluation of sponge cake at 200 mg/kg assessed color, taste, odor, texture, and overall acceptability, compared with control and BHT-added samples. The results indicated that the TPC and TFC of AMP were 17±0 g GAE (gallic acid equivalent)/kg and 12±0 g QE (Quercetin equivalent)/kg, respectively. According to the DPPH assay, the IC_{50} of AMP was 206±1 µg/mL, which was significantly (p<0.05) lower compared to BHT (213±0 µg/mL). In toxicity assessment, the AMP exhibited the LC_{50} of 1087±1 µg/mL, which was significantly (p<0.05) higher than BHT (771±2 µg/mL). Both AMP and BHT-treated larvae showed a reduction in the heartbeat compared to the control larvae (166±1 bmp). However, the heartbeat was significantly (p<0.05) lower in BHT-treated larvae (144±1bmp) compared to AMP-treated larvae (160±0 bmp) at 200 µg/mL. All sensory attributes of AMP-added sponge cake showed significantly (p<0.05) higher scores than BHT-added sponge cake and no significant difference to control. AMP is demonstrated as an ideal source to extract bioactive compounds due to enhanced antioxidant activity, low toxicity, and unchanged sensory properties. Thus, it makes a promising alternative for extending the shelf-life of food products.

Keywords: *Acute toxicity, antioxidant activity, sensory evaluation, soursop peel extract*

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Effect of soil physicochemical parameters on survival of *Rhizophora mucronata* L. mangrove seedlings at model restoration site Kalpitiya, Sri Lanka

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Effects of soil physicochemical parameters and tidal frequencies on the early establishment and survival of mangrove seedlings and saplings are not widely studied in Sri Lanka. Thus, the purpose of this study was to ascertain the effect/s of the aforementioned conditions on the survival rate of *Rhizophora mucronata* mangrove seedlings/saplings. Further, the relationship between a few chosen soil physicochemical parameters and the survival rate of mangrove seedlings was investigated. The correlation analysis showed that soil salinity [Correlation coefficient of low tidal frequency zone (L) = 0.7917, correlation coefficient of moderate tidal frequency zone (M) = 0.9270, correlation coefficient of high tidal frequency zone (H) = 0.8875] and conductivity [(L) = 0.7898, (M) = 0.9242, (H) = 0.8905] were positively correlated with survival rates. Soil pH [(L) = -0.8523, (M) = -0.8745, (H) = -0.8998] and redox potential [(L) = -0.7316, (M) = -0.4037, (H) = -0.4225] were negatively correlated. However, in the low tidal zone, soil bulk density was negatively correlated with the survival of mangrove seedlings [(L) = -0.3320] whereas, soil bulk density was positively correlated with the survival of seedlings in moderate and high tidal frequency zones [(M) = 0.5427, (H) = 0.1621]. The results of the LASSO (Least Absolute Shrinkage and Selection Operator) analysis showed that the key factors influencing the survival rate of mangrove seedlings in each tidal zone were soil pH, conductivity, redox potential, and bulk density in the low tidal zone; redox potential and salinity in the moderate tidal zone; and redox potential, salinity, and conductivity in the high tidal zone. It would be advantageous to take tidal positioning and edaphic factors into account during mangrove restoration practices for successful restoration.

Keywords: *Correlation, edaphic factors, lasso, survival rate, tidal zone*

Acknowledgment: *financial assistance provided by the fspi-sedric project is greatly acknowledged.*

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Prevalence and associated factors of acute kidney injuries among snake bite victims who seek treatment from District Hospital Weeraketiya, Sri Lanka

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Snakebites are a significant public health concern in many tropical and subtropical regions, including Sri Lanka. Acute kidney injury (AKI) is a serious complication that may occur following snakebites, particularly in the Hambantota district, Sri Lanka. Understanding the prevalence and factors associated with AKI among snakebite victims is crucial for improving diagnosis, management, and outcomes in these patients. This study aimed to assess the prevalence and factors associated with AKI among snakebite victims, seeking treatment at the District Hospital Weeraketiya (DHW), Hambantota, Sri Lanka. A descriptive cross-sectional study was conducted (January to June 2024) among 152 consecutively selected adult (≥18 years) victims with clear signs of snake bites and willingness to participate. A researcher-developed pretested interviewer-administered structured questionnaire, including demographics (age, gender, marital status, occupation), comorbidities (Diabetes, Asthma, Hypertension), type of snake, and development of AKI; diagnosed by a physician was used for data collection. Data analysis was performed via descriptive statistics, including frequencies and percentages, and Fisher's-exact-tests through IBM SPSS (version 25). Ethical approval was obtained from the ethics review committee of KIU (KIU/ERC/24/070). Among the 152 participants, most were males (56%, n=85), aged 41-60 years (36%, n=55), married (66%, n=101), and engaged in farming (22%, n=34). The prevalence of AKI was 2.63% (n=3). None of the demographic variables showed a significant relationship with the development of AKI. Most snake bites occurred during the night (8.00 pm to 11.59 pm) (46%, n=70), and Hump-nosed Viper bites were common (56%, n=85). No significant association was seen between the time of bite and the type of snake with AKI. However, 6.5% of snake bite victims with diabetes showed a significant association (p=0.001) with the development of AKI. Our study found that only a minute percentage of snake bite victims who sought treatment from DHW developed AKI, with comorbidities like diabetes contributing to its development.

Keywords: *AKI, Hambantota, hump nosed viper, snake bites, Sri Lanka*

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Application of SYBR green-based real-time PCR for detecting Hepatitis B virus in clinical samples

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Hepatitis B virus (HBV), a DNA virus from the Hepadnaviridae family, remains a significant global health issue, affecting over 300 million people worldwide. It can cause both transient and chronic infections, often leading to liver inflammation. HBV is classified into eight genotypes (A to H), making accurate diagnosis and management essential, particularly for chronic infections. Various diagnostic methods, such as real-time PCR (rt-PCR), serological markers, and antigen testing, are routinely employed to detect and quantify HBV in clinical settings. This study aimed to establish and validate a laboratory-developed SYBR green-based rt-PCR assay for detecting the eight known HBV genotypes in clinical samples. Viral DNA was extracted using the Geneaid viral nucleic acid extraction kit. Primers were designed to target the HBV S gene. The SYBR green dye, which binds double-stranded DNA and emits fluorescence at 510 nm, was employed to detect amplification. The specificity of the amplification product was confirmed through melt curve analysis. Analytical specificity was assessed using a panel of DNA and cDNA from clinically relevant pathogens. Sensitivity was determined through serial dilutions (10^4 to 10^0 IU/mL) of HBV genomic DNA. The assay exhibited 100% analytical specificity and a detection limit of 10 IU/mL. Clinical sensitivity and specificity were evaluated using a panel of patient samples (n=59) and compared with a commercial kit. The assay demonstrated a clinical sensitivity of 85.19% (66.27% to 95.81%) and clinical specificity of 100% (89.11% to 100.00%). Precision studies revealed an interassay variability of 0.8%. Drawbacks such as less sample size posed challenges for statistical evaluation. In conclusion, this SYBR green-based rt-PCR assay is a sensitive, specific, and cost-effective method for detecting HBV genotypes. It offers a reliable alternative to commercial rt-PCR kits, supporting effective HBV infection management in clinical settings.

Keywords: *Clinical evaluation, Hepatitis B virus, SYBR Green-based real-time PCR. cost-effective*

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Prevalence of *Wolbachia* infection among wild *Aedes aegypti* mosquito population from selected sites in the Nugegoda MOH area

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A novel arboviral control uses bacterial endosymbiont *Wolbachia pipentis*, naturally absent from *Aedes aegypti*, to reduce the incidence of dengue. This study aimed to assess the prevalence of *Wolbachia*-infected *Ae. aegypti* in the Nugegoda Medical Officer of Health (MOH) area, following pilot releases by the World Mosquito Program (WMP) in June 2021. The objectives were to identify the presence of *Wolbachia* in the local mosquito population using strain-specific *wsp* primers and determine the percentage of *wMel* infected *Ae. aegypti*. Five high-dengue incidence sites within the Nugegoda MOH area were selected based on historical dengue incidence data provided by the local health authorities. Thirty mosquitoes from these sites were screened using *wsp*-specific primers under optimized PCR conditions. The frequency of *Wolbachia*-positive *Ae. aegypti* from each location were calculated to estimate its prevalence in the Nugegoda MOH. The overall *Wolbachia* infection rate was 36.67% (11/30). Among the 25 larvae screened for *w*Mel strain from two sites in Obeysekarapura and one site in Rajagiriya, 6 (24%) were positive for the *w*Mel strain. No *Wolbachia* was detected in the three samples from Nugegoda Town. All five samples (100%) from the Open University of Sri Lanka, Nawala, exhibited a different band length (370 bp) compared to the *w*Mel positive control, suggesting a different *Wolbachia* strain. The observed *Wolbachia* infection rate in the Nugegoda MOH area was lower than expected compared to post-release rates reported elsewhere, where infection rates have reached over 90% in Australia, 80% in Indonesia, and 70% in Brazil, within 2 years of release. The five *Wolbachia*-positive samples from the Open University indicated a strain similar to *w*AlbA found in *Ae. albopictus*, warranting further investigation. These findings suggest natural *Wolbachia* infections may occur in *Ae. aegypti* populations. Understanding the dynamics of this new strain could improve the development and implementation of *Wolbachia*-based control programs.

Keywords: *Dengue, Endosymbiotic bacteria, mosquito, PCR screening, vector control*

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Cloning of OsBBX6 gene to check its activity under salt and drought conditions

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Rice (*Oryza sativa L.)* as one of the major crops in the world, plays an important role in increasing food demand in the world. Drought and salinity conditions are the major abiotic stresses that lower the production of rice yield by reducing seed germination, crop yield, and plant life. Hence, the identification of the stress-tolerant mechanisms and respective stress-related regulatory elements is needed to develop salt and drought-tolerant rice varieties. Arabidopsis *BBX21* is a Zinc finger transcription factor that is involved in the abiotic stress regulation pathway. During this project, Arabidopsis *BBX21* gene, rice ortholog was identified as OsBBX6 from the rice genome. The present study was conducted to amplify the gene from the rice genome and clone it into a plant vector in order to test its activity in salt and drought stresses. By using bioinformatics tools, the protein sequence for *OsBBX6* gene for *Oryza sativa japonica* was downloaded from the rice genome annotation project database. A protein BLAST was performed and the correct *Oryza sativa indica* protein sequence (best hit) was identified. The best hit coding sequence (CDS) was used to design primers. Rice total RNA was isolated by TRIzol method and using isolated total RNA as the substrate cDNA was synthesized. In order to clone the *OsBBX6* gene the primer designing and cDNA synthesizing processes were successful. Further, research is in progress to clone the gene into a plant vector.

Keywords: *Abiotic stress, BBX21, Oryza sativa, OsBBX6*

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Assessment of zooplankton abundance and diversity in relation to reservoir water level: a study in the Magalla reservoir, Sri Lanka

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The study was conducted in the freshwater reservoir called Magalla which is subject towater level fluctuations in Sri Lanka. Therefore, the study aimed to check whether the water level affects the zooplankton abundance (individuals/L) and diversity. The data was collected monthly from May to December 2023 in four sampling sites. Site 1 withdomestic waste. Site 2 with soap and detergents. Site 3 with urban runoff. Site 4,was the reference site with minimum disturbances. Zooplankton in 1L of the sample was collected from 0.1 m - 0.5 m water depth using a plankton net with 300 µm mesh size, preserved by 5% formalin, and observed using a Sedgewick Rafter counting chamber. The daily water level was obtained from the irrigation office in Nikaweratiya.Shannon-Wiener Diversity Index (SWDI) and Pielou's Evenness Index (PEI) for diversity calculation. Kruskal-Wallis and Mann-Whitney U tests for abundance and diversity and Spearman's rank analysis for correlation analysis. During the study period,19 zooplankton species belonging to 5 groups were observed: 1 *Protozoa*, 2 *Ostracoda*, 3 *Cladocera*, 6 *Rotifera*, and 7 *Copepoda*. *Mesocyclops leuckarti, Diaptomus sp., Daphnia carinata,* and *Brachinous forficula* were the abundant species. The zooplankton abundance at sites 1, 2, and 3 as well as the SWDI of sites 1, and 3 significantly differed ($P < 0.05$), while the PEI at sites 1, 2, and 3 didn't differ significantly ($P > 0.05$) from the reference site. The highest abundance, SWDI, and PEIwere observed in August when the minimum monthly water level was recorded. The lowest abundance, SWDI, and PEI were observed in November when the highest monthly water level was recorded. Both abundance and SWDI exhibited a negative correlation with the water level. The present study reveals that the water level directly affects the abundance and diversity of zooplankton.

Keywords: *Abundance, diversity, freshwater, water level, zooplankton*

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Comparative analysis of phytochemicals, antioxidant activity, and cytotoxicity of a natural herbal remedy under varied temperatures

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The prevalence of chronic illnesses is sharply increasing worldwide. Roughly 74% of fatalities worldwide were estimated to be caused by non-communicable diseases by the World Health Organization. Traditionally, plants have been used worldwide to treat a wide range of diseases. Pranajeewa, a complex polyherbal formulation is made from several plant species known for their therapeutic qualities. This study aims to analyze *in-vitro* antioxidant activity and cytotoxicity of pranajeewa capsules and oils made at varied temperatures. Since temperature can significantly affect the stability, absorption, and bioactivity, it is crucial to explore how Pranajeewa performs under different temperature conditions. Pranajeewa powder with oil heated up to 60^0C (A), Pranajeewa oil heated up to 60^0C (B), and Pranajeewa oil heated up to 100^0C (C) were used for testing. Total phenolic content (TPC) and total flavonoid content (TFC) were assessed by the Folin Ciocalteu and Aluminum Chloride methods respectively. Antioxidant activity of the products was measured by 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2-azino-bis-3-ethylbenzthiazoline-6-sulphonic acid (ABTS) assays. *In-vitro* anticancer activity against the MCF-7 (Breast cancer) and HepG2 (Liver cancer) cell lines was evaluated by (3-(4, 5-dimethyl thiazole-2yl)-2, 5-diphenyl tetrazolium bromide) MTT assay. Sample (A) showed the highest TPC (25.10±2.67mg GAE/g), and TFC (8.13±0.87mg QE/g). The highest antioxidant activity was demonstrated in sample (A) by DPPH assay with an IC_{50} value of 0.723±0.067 mg/mL. ABTS assay showed >1 mg/mL IC_{50} value for all three samples. Furthermore, the highest cytotoxicity effect against MCF-7 and HepG2 cancer cell lines was observed in sample (A), with an IC_{50} value of 0.23±0.03 mg/mL and 0.36±0.05 mg/mL respectively. Overall, Sample A consistently showed superior results regarding both antioxidant capacity and cytotoxicity against cancer cells. These results suggest that the preparation temperature may impact the bioactivity, though other variables may also influence the results, necessitating further research.

Keywords: *Antioxidant, cytotoxicity, phytochemical, polyherbal formulation*

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Assessment of selected heavy metal accumulation in the fish muscle of *Oreochromis mossambicus*: a study on Beira lake and Ihalagama lake in the Western Province of Sri Lanka

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Fish is the most common way of providing essential nutrients and consumption of toxicheavy metals accumulated by fish can cause negative health impacts to humans. Concentrations of 03 heavy metals Cadmium, Chromium, and Nickel in muscles of prominent freshwater fish, *Oreochromis mossambicus* have been determined in this study. Samples were taken from two freshwater bodies in Sri Lanka namely, Beira Lake, Colombo, and Ihalagama Lake, Ragama. Fish muscle samples (n=15) from each lake have been obtained and dissected. After the digestion of (0.5g) of fish muscle, the concentrations of heavy metals were determined using the Atomic Absorption Spectrophotometry Method (Analyticjena, Model: novAA400P) utilizing a standard heavy metals series The data were analyzed using One-Way ANOVA followed by Tukey's pairwise comparison ($p<0.05$) in MINITAB 14.0. In Beira Lake, Cd accumulation ranged between 0.06 mg/L and 0.12 mg/L, while the fish samples of Ihalagama Lake ranged between 0.00 mg/L and 0.04 mg/L. With no significant difference between the two lakes. But considering the Cr accumulation in Beira Lake fish (0.43 mg/L) is significantly higher than the Ihalagama Lake (0.10 mg/L). Zn accumulation in the fish muscle of Beira Lake (0.05 mg/L/) is significantly higher than the Ihalagama Lake (0.00 mg/L). Among the three heavy metals, Chromium was found to be the most abundant in Beira Lake; exceeded the WHO limit of heavy metal accumulation (0.05mg/L). It concluded Beira Lake aquatic system is contaminated with various industrial wastes containing heavy metals, including, metal plating, fabrics, electroplating, dyeing, (Ni/Cd) batteries, PVC stabilization, detergents, and refined petroleum products. Therefore, it is recommended to continuous monitoring of water quality standards and accumulation ofheavy metals concentrations in water, sediments, and fish to safeguard the aquatic ecosystem.

Keywords: *Atomic absorption spectrophotometry, Beira Lake, Cd (Cadmium), Cr (Chromium),Ihalagama Lake, Ni (Nickel)*

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Analysis of generation and ionic composition of stemflow in selected urban-tree species in Maharagama, Sri Lanka

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This research discovered the process of stemflow generation and the relatedvariation in ionic composition in chosen urban tree species. The study focused on five urban tree species in Maharagama, Sri Lanka: *Schleichera oleosa*, *Madhuca longifolia*, *Mesua ferrea*, *Mitragyna parvifolia*, and *Cassia fistula*. The research spanned from 3rd December 2022 to 3rd April 2023 covering four months, encompassing the northeast monsoon and inter-monsoon seasons. The tree height, diameter at breast height, diameterof the canopy, and volume of the canopy were measured using standard techniques. Leaf shape, leaf arrangement, and canopy shape were used to identify tree architectural models. The site was selected based on how urban the area is. The selected location is directly facing an A-grade road in SriLankan Road System, the High-level Road. The trees are in the middle section of the city. The precipitation was measured in an open space and stemflow was collected using stem collars. Atomic Absorption Spectroscopy and Ion Chromatography were used to determine the cation and anion concentrations in the stemflow samples and in the direct precipitation. The findings showed a significant positive correlation between the generation of stemflow, and the amount of gross rainfall. While other morphological and tree architectural traits did not reveal any significant relationship with stemflow, diameter at breast height (R^2 = 0.88) and canopy volume (R^2 = 0.65) exhibited negative correlations with the average funnelling ratio of the chosen trees. According to the ionic composition investigation, all stemflow samples exhibited greater ioncontents than direct precipitation. The selected tree species accumulated anions and cations at various rates with *Cassia fistula* generating the lowststemflow and capturing the highest number of air pollutants. In conclusion,it is recommended to prioritize tree species that exhibit low stemflow production while demonstrating a higher capacity to capture atmospheric contaminants for urban landscaping.

Keywords: *Funnelling ratio, stemflow, urban environment, water quality*

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Enhancing efficiency and sustainability of bioremediation techniques for groundwater contaminants: current trends and future directions

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Bioremediation has evolved as an efficient resource to reduce groundwatercontamination by using biological agents such as microorganisms, fungi, and plants totransform the pollutants into harmless forms. This paper reviews present techniques ofbioremediation tailored for treating groundwater, with special attention to enhancing their efficiency and sustainability. A comprehensive literature search was conducted using Scopus, Web of Science, and Google Scholar, focusing on articles from 2010 to 2024. Keywords such as "bioremediation," "groundwater," "microbial consortia," "genetic engineering," and contaminants like hydrocarbons and heavy metals were usedto identify studies on bioremediation techniques for groundwater contamination. Important strategies include applying microbial consortia, which can exploit synergisticinteractions to enhance degradation across a wide range of contaminant mixtures and environmental conditions. Genetic engineering enables the construction of genetically modified organisms (GMOs) with improved metabolic pathways that degrade target pollutants and enhance rates of remediation under adverse conditions. Program bioremediation as a stand-alone technology can most often be combined with other complementary technologies such as In-situ chemical oxidation or pump-and-treat systems to achieve optimal treatment efficiency, either by priming the contaminants for microbial degradation or rapidly extracting them. Although successful case studies prove the efficacy of these approaches, challenges persist in the variability of soil and groundwater properties' compliance with regulations regarding GMO use, and finally, the lack of robust monitoring tools for assurance of treatment efficiency. Future research directions emphasize biofilm engineering and advanced molecular monitoringtechniques to enhance microbial attachment, assessment of metabolic pathways, and overall remediation optimization. This paper investigates the holistic framework that underscores bioremediation's potential as a sustainable strategy for addressing groundwater contamination and calls for comprehensive environmental and economic assessments.

Keywords: *Biofilm engineering, bioremediation, genetic engineering, in- situ chemical oxidation, microbial consortia*

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Prevalence of sarcopenia, malnutrition, and physical activity levels among ageing population in care homes in Polonnaruwa, Sri Lanka

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Sarcopenia and malnutrition are significant health issues among the ageing population, often leading to decreased physical activity and quality of life. Understanding their prevalence and associated physical activity levels in older people living in care homes is crucial for developing effective interventions. This study aims to (1) determine the prevalence of sarcopenia and malnutrition and (2) evaluate physical activity levels among older people in care homes in Polonnaruwa. A population-based cross-sectional study was conducted among older people aged 60 and above residing in care homes in the Polonnaruwa District, Sri Lanka. Of the 33 older people, 8 were excluded due to disabilities, resulting in 25 participants being included in the study. Sarcopenia was assessed using the Asian Working Group for Sarcopenia-2019 criteria, including the SARC-Calf questionnaire, handgrip strength, skeletal muscle mass index, and gait speed. Malnutrition was evaluated using the Mini Nutritional Assessment-Short Form, and physical activity levels were recorded using the International Physical Activity Questionnaire-Short Form. The prevalence rate of sarcopenia among older people was 60%, with 58.3% of men and 61.5% of women affected. Additionally, malnutrition was identified in 32% of participants, with an additional 24% at risk of developing malnutrition. Furthermore, 60% of participants were physically inactive due to limited mobility and reduced social interaction. A significant association ($P < 0.05$) was found between sarcopenia, physical activity levels, and nutritional status. Additionally, poor nutritional status among older care home residents was associated with dietary restrictions, limited availability of nutritious foods, monotonous diets, and religious dietary constraints. A high prevalence of sarcopenia and malnutrition was found in care homes in Polonnaruwa. Recommended interventions include personalized nutrient-rich meal plans, frequent small meals, hydration support, and culturally tailored diets. Personalized exercise programs with strength training, balance exercises, and aerobic activities would also be beneficial in preventing sarcopenia.

Keywords: *Ageing, malnutrition, nutritional status, physical activity, sarcopenia*

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Fourier transform infrared spectral characterization of creamed coconut and creamed coconut testa

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Creamed coconut (CC) and creamed coconut testa (CCT) are novel products meant to replace coconut milk in culinary uses. The aim of this study was to interpret FTIR spectra of creamed coconut (CC) and creamed coconut testa (CCT) products using their proximate composition. Samples of fresh coconut kernel and testa were prepared from de-husked, mature coconuts. Then, they were dried at 80 ^{o}C to reach a moisture content of less than 5% followed by grinding until thick creams of CC and CCT were formed. FTIR spectra of both samples were recorded following the KBr pellet method within the wavenumber range of 4000-500cm^{-1}. The proximate compositions were determined following the AOAC (2000) methods. The results of the proximate analysis showed significant ($p<0.05$) variations in fat, protein, carbohydrate, and crude fiber contents of both products except for ash and moisture contents. The contours of the FTIR spectra of both CC and CCT had approximately similar peak characteristics. The broad absorption peak in the 3380-3385cm^{-1} range indicated the presence of complex carbohydrates. The intensity of this peak for CC was higher than that of CCT denoting the existence of higher carbohydrates in CC (9.12%) than in CCT (7.89%). A sharp peak at 1748cm^{-1}, signalled the existence of lipid biomolecules. The intensity of this peak for CC was higher than that of CCT, indicating higher fat content for CC (68.32%) than CCT (65.63%). The blunt and weak peaks at 1547cm^{-1} and 1550cm^{-1} suggested the presence of protein, where CC (8.21%) was found to have higher protein content than CCT (8.11%). In conclusion, proximate compositional data of both products were found to correlate with their FTIR spectral characteristic bands corresponding to fat, protein, and carbohydrate contents.

Keywords: *Coconut kernel products, coconut testa, FTIR, proximate composition*

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PCR-based identification and HPLC profiling of microcystin production in selected cyanobacterial genera

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Cyanotoxins, especially microcystins (MC), pose serious health risks to humans and animals. Understanding their production mechanisms is essential for controlling their spread in freshwater systems. The study aimed to analyze the MC production in five freshwater cyanobacterial genera using high-performance liquid chromatography (HPLC) and conducted gene screening related to MC production via polymerase chain reaction (PCR). These strains were sourced from the culture collection of the Molecular Microbiology and Human Diseases Project (MM&HD) at the National Institute for Fundamental Studies; *Microcystis aeruginosa* (EF051239), *Fischerella* sp. A22 (OR727806), *Nostoc* sp. A13 (OR727808), *Pseudanabaena* sp. CMP3 (ON870364), and *Leptolyngbya* sp. CMP4 (ON870366) was grown in BG11 medium under controlled conditions, with a photon flux of 25 µmol m^{-2} s^{-1} and a photoperiod of 14 light:10 hours darkness. MC was extracted with 1 mL of 80% methanol, evaporated to dryness, and reconstituted in 1 mL of methanol. HPLC quantified the microcystin content in the cyanobacterial pellet extracts using a reference standard (SIGMA ALDRICH 33578). Genomic DNA was extracted from pure cultures using a modified cetyltrimethylammonium bromide method, and conventional PCR was performed to detect selected "*mcy*" genes (A, B, E, H, and T). The results indicated that *Microcystis aeruginosa* (0.982 ± 0.57 mg/L) and *Fischerella* sp. (0.8519 ± 0.14 mg/L) exhibited the highest toxin concentrations. There is a significant positive correlation ($p < 0.05$, $r = 0.9066$) between the presence of the selected "*mcy*" genes and the cyanotoxin production in cyanobacterial cells. None of the samples tested positive for the "*mcy*" T gene, but all species showed positive amplification for the "*mcy*" A and "*mcy*" H genes. *Pseudanabaena* and *Leptolyngbya* species isolated from the Mahapelessa hot springs only carried the "*mcy*" A and "*mcy*" H genes. However, toxin production in these organisms can vary due to different micro-environmental and molecular factors.

Keywords: *Cyanobacteria, cyanotoxin, high-performance liquidchromatography, microcystin, "mcy" gene cluster*

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Influence of land-use types on soil-dwelling collembolan communities: their role as bioindicators

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Collembola serves as key soil bioindicators, with their diversity reflecting different land-use types (LUTs). This study investigated the effect of various LUTs on collembolan communities and their potential as bioindicators. Sampling was carried out for three months across six LUTs in the Hanthana Mountain Range: secondary forest (SF > 30 years), restoring forest-1 (RF_1 ~ 30), restoring forest-2 (RF_2 ~ 2), enriched *Pinus* stand (EP ~ 20), *Pinus* stand (PS > 30) and open grassland (OG). Vegetation diversity, litter quantity, and soil micro-climatic parameters (temperature, pH, moisture, and C-content) were measured in three, 5 m² quadrats in each LUT. Collembolan abundance, species richness, evenness, and Shannon- Weiner Index (H) were calculated. Data was analyzed using ANOVA and correlation analysis. A total of 2,478 collembolans were identified into six species; *Protaphorura armata* (763), *Entomobrya nicoleti* (772), *Proisotoma minuta* (443), *Neanura* sp. (9), *Lepidocyrtus* sp. (487), and *Callyntrura* sp. (4). *Neanura* sp. was found only in SF and EP, while *Callyntrura* sp. was confined to EP. Collembolan abundance increased from PS < RF_2 < OG < SF < EP < RF_1, with significant differences between PS/RF_2/OG and SF and EP/RF_1, aligning with reported higher collembolan abundance during vegetation recovery period in restoring forests. Except for soil pH, all other parameters (temperature, moisture, C-content, litter quantity, and vegetation diversity) had significant differences across LUTs, with the latter four parameters showing positive mild correlations ($P<0.05$) with collembolan abundance and richness. Temperature showed a negative correlation with richness. Higher soil temperatures and lower moisture and litter in OG and RF_2 likely reduced collembolan richness and abundance. Recalcitrant pine needles in PS, combined with lower soil moisture and higher temperatures, may have created unfavorable conditions for collembolans. The findings underscore the importance of habitat quality and microclimatic conditions in supporting collembolan communities and their role as bioindicators.

Keywords*: Forest restoration, functional biodiversity, soil health, springtails*

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Sensory attributes and fatty acid profile of coconut testa oil: a comparative study of dry and wet processing methods

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Coconut testa (CT), the thin brown layer covering the coconut flesh, is a rich source of oil with significant nutritional and sensory properties. This study evaluates the fatty acid profile and sensory attributes of Coconut Testa Oil (CTO) extracted using a dry process and wet-centrifuge process, with the aim of determining the most suitable extraction method for high-quality CTO production. In the dry process, fresh CT peel was dehydrated and the oil was extracted using a screw press oil extracting machine. In the wet process, milk extracted from CT was chilled to separate fatty layer, followed by centrifugation at 4500 rpm for 20 minutes to isolate the cream layer, which was then subjected to a second centrifugation 4000 rpm for 30 minutes to separate the oil layer. The fatty acid profiles of the oils were analyzed on a gas chromatograph equipped with Flame Ionization Detector. Standard fatty acid methyl esters were used to identify fatty acid peaks. Sensory evaluation was conducted through a five-scale hedonic test with thirty semi-trained panelists assessing attributes of color, taste, texture, odor, and overall acceptance. To determine sensory acceptance, food samples (*Wade*) fried using three oils (dry process oil, wet process oil, and virgin coconut oil) were used. The dry processed oil had a significant advantage in the odor attribute, exhibiting a minimal rancid odor compared to the wet processed oil. Gas chromatographic analysis indicated that saturated fatty acids were predominant in the CTO obtained from both the dry process (85.57 %) and the wet process (86.46 %). Lauric acid (40.81%) was the most abundant fatty acid present in CTO from both methods. The dry process oil showed a higher content of beneficial unsaturated fatty acids (14.43%) compared to the wet process. In conclusion, findings suggest that the dry process is more suitable for producing high-quality CTO with greater consumer acceptance.

Keywords: *Coconut testa oil, dry processing, fatty acid profile, sensory evaluation, wet processing*

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Selected demographic data as potential diagnostic indicators of TB status in contact tracing: Kandy, Sri Lanka

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Tuberculosis (TB) remains a global health challenge. This study focuses on the demographic characteristics of contact tracing for TB patients in Kandy, Sri Lanka. The ethically approved study aims to differentiate between active TB (ATB) and latent TB (LTB) cases and assess the importance of contact tracing in managing the spread of TB. Current data from December 2022 to June 2024 at the Kandy Hospital Chest Clinic include 136 participants, among whom 20 had ATB, 62 had LTB, and 54 were contacts. Data on age, gender, Mantoux test results, and weight were collected through interviews and clinical assessments. Statistical methods included descriptive statistics, t-tests, ANOVA, chi-square tests, logistic regression, and the Wilcoxon Signed Ranks Test. Gender distribution showed 40.3% male and 59.7% female, with no significant association between gender and TB status. The mean age of participants was 37.3 years (SD = 20.72), ranging from 4-83 years, with significant differences observed across TB status groups. Mantoux test results varied significantly between TB statuses, with mean Mantoux results of 8.2 mm (SD = 1.18) for ATB, 15.3 mm (SD = 6.26) for LTB, and 0.14 mm (SD = 0.09) for contacts. Weight statistics indicated that ATB participants had a mean weight of 52.2 kg (SD = 15.63), while LTB participants had 51.6 kg (SD = 15.63), with no significant difference between the two groups. Logistic regression analysis identified age andMantoux test results as significant predictors of TB status. The odds ratios indicated that older age and higher Mantoux test results were associated with an increased likelihood of developing ATB. Weight was not a significant predictor in the logistic regression model. The findings indicate that age and Mantoux test results are critical factors in TB status determination. These results emphasize the importance of targeted public health interventions and effective contact tracing to manage TB in Kandy.

Keywords: *Contact tracing, demographics, Mycobacterium tuberculosis*

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Development and *In-silico* validation of a fusion PCR protocol for targeted amplification of BRCA1/2 variants in breast cancer

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Breast cancer is a leading cause of mortality among women worldwide. Early and rapid detection is important for effective treatment. This study developed primers and *In- silico-validated* fusion PCR technique for targeted amplification of breast cancer-associated variants in BRCA1 and BRCA2 genes, creating a single fused testing fragment to detect multiple cancer-predisposing genes. Primers were designed using Primer 3 Web and NCBI Primer-BLAST software, targeting specific mutations identified from a comprehensive literature review. *In-silico* validation of these primers was performed ensuring specificity andefficiency. The same methodology was conducted parallelly with two primer sets. The fusionof fragments was executed using SnapGene, incorporating manual optimization to maintain the melting temperature at 60°C. Resulted product sizes for Primer blast-designed primer sets were BRCA1- 178bp and BRCA2 – 451bp and SnapGene, had produced fused products with 629bp. Also, the product sizes for Primer 3 Web-designed primer sets were BRCA1- 210bp and BRCA2 – 230bp, and SnapGene, had produced fused products with 440bp. Gel electrophoresis stimulations confirmed the successful fusion of amplified BRCA1 and BRCA2 fragments displaying distinct bands corresponding to the expected fused product sizes. In conclusion, this approach has successfully amplified targeted regions of the BRCA1 and BRCA2 genes and precisely fused the amplified products. Both sets of primers have been successfully fused, confirming the reproducibility and reliability of the developed method. This approach enhances disease diagnosis by improving specificity, targeting only mutagenic gene sequences, and reducing the amplification of non-relevant regions. Fusing two or several mutagenic genes into a single fragment reduces cost and turnaround time comparedto whole genome sequencing, making it more rapid and suitable for routine clinical use, in a resource-limited setting. Future work should focus on validating this technique through wet lab PCR experiments and expanding the research scope with additional genes and biomarkers.

Keywords: *Breast cancer, diagnosis, fusion PCR, genetic analysis, in-silico*

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Investigation of different cultural media for enhanced growth of *Paramecium* sp. in aquaculture applications

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Paramecium sp. is a free-living unicellular organism, prominent in the aquatic environment. Currently, it is widely used in scientific research in aquaculture because of its ease of cultivation and rapid growth rate. Thus, this research was conducted to determine the effect of different culture media on the growth of *Paramecium* sp. and to identify the most efficient culture medium for the growth of *Paramecium* sp. *Paramecium* sp. was allowed to grow naturally in five different culture media using organic materials: dry banana leaf (T1), straw (T2), banana peel (T3), cabbage (T4), and areca nut peel (T5) all, under the same environmental conditions. *Paramecium* sp.cells were counted using a hemocytometer (cells per 1ml) over 4 weeks to evaluate thegrowth rates in different organic culture media. Initially, pH, dissolved oxygen (DO), temperature, and light intensity (LUX) were measured in the culture media to investigate the impact of changes in water quality on the growth of *Paramecium* sp. Allexperiments were conducted in triplicate. There was a significant difference in T3, which indicated the highest *Paramecium* sp. cell count of (50,336) as compared to the other culture media (T1-7,837, T2-6,964, T4-7,466, and T5-3,544). Parameters in T3 media were, pH (6.15 ± 0.16), temperature (31.63 ± 0.22 °C), LUX (68.88 ± 2.25 *lx*), dissolved oxygen (DO) (2.32 ± 1.06 ppm). One – way (ANOVA) with Tukey's HSD test revealed, no significant difference ($P > 0.05$), among the mean values of temperature, DO, and LUX in each culture medium, while significant difference was observed between the pH values in culture media ($P < 0.05$). The experiment concludedthat banana peel culture provides more effective conditions for the growth of *Paramecium* sp. compared to other selected culture media. This result forms a significant contribution to enhancing the retention of fish larvae in the aquaculture sector through the use of organic, low-cost culture media.

Keywords: *Banana peel, organic material, Paramecium sp. count, water quality*

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Anthropometric indices of late adolescents in Kopay Medical Officer of Health (MOH) area, Jaffna district

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Adolescence is a period of rapid growth and development, making adequate nutrition essential for physical, cognitive, and emotional health. The nutritional status of adolescents is a critical indicator of their overall health and development. This study aimed to determine the nutritional status of late adolescents (17-19 years) of Kopay Medical Officer of Health area, Jaffna district. A multistage cluster sampling was used. Measurements of height, weight, Mid Upper Arm Circumference (MUAC), waist circumference (WC), and hip circumference (HC) were taken. An interviewer-administered questionnaire was used to gather the socio-demographic background of the participants. Out of the total 70 adolescents, 32 were males (45.7%). The mean ages of the male and female adolescents were 17.73 (±0.8) and 18.35 (± 0.7) years respectively. 38.6% (n=27) of adolescents were underweight and 15.8% (n=6) were overweight or obese based on the Body Mass Index (BMI) for age. Mean WC, HC and waist-hip ratio (WHR) in males and females were 72.7 (±8.8) and 72.5 (±8.2); 90.5 (±7.6); 89.9 (±6.6) and 0.8 (±0.06) and 0.8 (±0.05) respectively. Prevalence of abdominal obesity was found in 6.25% of males and 5.25% of females based on WHR and WC. Malnutrition in terms of MUAC was found in 6.3% of males and 5.3% of females. The prevalence of underweight was higher (48%) (n=13) among adolescents with family income below Rs 10,000.00. The study revealed that the prevalence of underweight and overweight among the adolescents (17-19 years) in the Kopay MOH area where the prevalence of overweight and obesity among adolescents in the study was lower compared to the prevalence of underweight. It underscores the need to encourage the frequent monitoring of the nutritional status among adolescents. The study adds region-specific knowledge to the field of adolescent nutrition regarding the dual burden of malnutrition and the socio-economic factors influencing it.

Keywords*: Body mass index, malnutrition, nutritional status, obesity,underweight*

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Microhabitat preferences and morphological divergence in two sympatric species of lizards

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Niche partitioning is a fundamental ecological process that reduces competition for limited resources among co-occurring species, enabling coexistence. Ecological theory suggests that species evolve specific adaptations to effectively utilize their niches. The microhabitat preferences between two sympatric *Calotes* species, *C. calotes* and *C. versicolor* in a semi-urban habitat (i.e. home gardens) were investigated in this study. Twenty-five individuals representing each species were observed to collect data on their microhabitat preferences (e.g., height from the ground, light intensity, substrate type). Six morphometric measurements were also taken to examine phenotypic divergence between these two lizards that may facilitate the utilization of preferred microhabitats. To examine the level of microhabitat, used by the two species, Levin's standardized niche breadth was calculated, and the level of microhabitat overlap between the two species was determined by calculating Morisita's niche overlap index. Univariate t-tests for each morphometric measurement and a Principal Component Analysis (PCA) were conducted using all the morphometric measurements to determine the level of morphometric divergence between the two species. The results reveal that *C. calotes* prefers higher substrates with lower light intensity, while *C. versicolor* occupies lower substrates with higher light intensity and a chi-squared test of independence indicated a significant difference (chi-squared value-26.30, $P<0.00001$)in the use of substrates between the two species. Levin's standardized niche breadth values indicated that *C. versicolor* (0.2563) is a microhabitat specialist, while *C. calotes* (0.4015) is a microhabitat generalist. The Morisita's niche overlap index (0.1143), suggests a low overlap in the microhabitat use in the two species. The PCA revealed a clear separation of morphometric measurements between the two species with partial overlap. Univariate t-tests indicated that femur, tibia, foot, forearm, and hand lengths were significantly ($P<0.05$) greater in the more arboreal species *C. calotes*. These results signify how two co-occurring species partition their microhabitats and the underlying morphological adaptations to effectively utilize their niches.

Keywords: *Microhabitat, niche breadth, niche partitioning, phenotypicdivergence*

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Role of collembolans in litter decomposition

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This study investigated the potential role of collembolans in decomposing leaf litter of varying quality in six land-use types (LUTs) in Hanthana Mountain Range, Kandy *viz.*, secondary forest (SF > 30 years old), restoring forest-1 (RF1 ~ 30 years), restoring forest-2 (RF2 ~ 2 years), enriched *Pinus* stand (EP ~ 20 years), *Pinus* stand (PS > 30 years) and open grassland (OG). Twenty-four 15 cm² nylon litterbags (1 mm mesh), each containing 10 g of air-dried leaf litter in varying compositions, were placed in each LUT, and retrieved 6 at a time after 2, 4, 8, and 12 weeks. Collembolans were extracted from bags and their overall abundance, species richness, Shannon-Weiner diversity index (H), and evenness were calculated. The percentage mass loss (MS%) and decomposition rate of each litter sample were calculated using oven-dried samples. Data was analyzed using ANOVA and Pearson's correlation analysis. Eight collembolan species were identified; *Protaphorura armata*, *Entomobrya nicoleti, Proisotoma minuta, Lepidocyrtus* sp., *Callyntrura* sp., *Neanura* sp., *Sminthurus viridis, Paronellides* sp., of which the former four were present in all LUTs while others were habitat specialists. Across all sampling times, abundance, H, richness, decomposition rates, and MS% varied significantly between the LUTs. Except for the decomposition rate in the 4th week in SF and RF2, richness in OG, abundance, H, richness, and decomposition rate decreased over time in all LUTs. RF1 had the highest initial decomposition rate, while PS had the lowest. At the first sampling, RF1 (359) and EP (339) had the highest collembolan abundance, likely due to favorable conditions of high moisture and lower temperatures, while lower abundance in OG (72), PS (101), and RF2 (110) due to opposite conditions. Decomposition rates exhibited a significant positive correlation with collembolan abundance (r^2 = 0.411, P = 0.046), indicating their important role in decomposing organic matter.

Keywords: *Decomposition rates, ecological indices, land use types, springtails*

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The cytotoxic potential of *Pleiospermium alatum* against cancer cell lines

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Cancer, characterized by uncontrolled cell growth, affects many people globally. Breast cancer is the most common cancer among women globally, and cervical cancer is the second most prevalent in Sri Lanka. Current cancer therapies, including surgery, chemotherapy, and radiotherapy, often have significant drawbacks such as side effects and ineffectiveness. Hence, there is a need for novel anticancer medications with fewer side effects. Medicinal plants are a promising source of secondary metabolites that have anticancer properties. This study investigated the anticancer effects of water, hexane, chloroform, and methanol extracts of *Pleiospermium alatum* (Rutaceae) bark against the cancer cell lines MCF7 (breast) and HeLa (cervical). Cell viability was assessed using the MTT (3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide) assay, and the potential for colony formation was evaluated using a modified clonogenic assay. The MTT assay results indicated that *P. alatum* extracts have strong cellular inhibitory effects. The methanol extract showed the highest inhibitory effect with an IC_{50} value of <0.0625 mg/ml against the MCF7 cell line. Extracts significantly reduced colony development at all concentrations compared to the untreated control. Out of all extracts, the chloroform extract exhibited the best cell inhibitory effects on colony formation, with a survival fraction of 53.98% against MCF7, and the hexane extract showed the best inhibitory effects with a survival fraction of 65.97% against HeLa. *P. alatum*, a medicinal plant, has cytotoxic characteristics, making it a key bioactive component for therapeutic and health-promoting activities. It has the potential to be a useful adjuvant therapy for female cancer treatment. This work emphasizes *P. alatum* as a potential source for producing new therapeutic compounds to improve cancer therapy. Nevertheless, more research is underway with this plant in the laboratory.

Keywords: *Anticancer, clonogenic, HeLa, MCF7, MTT*

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Assessing the soil microbial biomass carbon status of *chena* cultivation systems in Mihintale, Sri Lanka

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Chena cultivation, considered one of the oldest forms of agricultural practices in Sri Lanka, is done for crop cultivation and it serves as a main economic pillar for rural communities. *Chena* cultivation systems in the Mihintale division are characterized by their originality and adherence to traditional practices and the systems exhibit variations in crop types and different management practices. Soil microbial biomass carbon (MBC) is part of soil organic carbon in live microbes, representing a significant carbon pool and a key indicator of soil microbial activity and soil health. *Chena* cultivation degrades native vegetation and is considered an unsustainable agriculture practice. Therefore, this study aims to assess the microbial biomass carbon of soils in *Chena* cultivation systems in the Mihintale division, Anuradhapura, Sri Lanka. Soil samples were collected from 16 predetermined sites to a depth of 0-15 cm across the *Chena* cultivation lands within the Mihintale division using a stratified random sampling method. Using standard protocols, soil samples were analyzed for soil moisture content, bulk density, MBC, soil pH, and electrical conductivity (EC). The results indicate a significant variation in soil MBC and EC across the different sites. The MBC varied within the range of 0.037% to 0.859% and most of the EC values were scattered within the range of 10.68 µS/cm to 47.90 µS/cm. Pearson correlation analysis revealed a significant negative correlation (correlation coefficient=-0.002) between MBC and EC which could be attributed to the potential inhibitory effect of higher salt concentrations on microbial activity. Similar studies have reported that the MBC for paddy soil ranges from 0.001% to 0.17% and for forest soil from 0.045 % to 0.823 %. The findings of this study are vital for sustainable soil management practices to maintain soil health and improve soil fertility and productivity in *Chena* cultivation systems.

Keywords: *Chena cultivation lands, electrical conductivity, microbial activity, soil health, soil organic carbon*

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Knowledge, attitude, practices about folic acid intake among pregnant mothers in medical officer of health (MOH) divisions in Kalutara district

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Folic acid is important to minimize fetal anomalies, the major cause of neonatal deaths. A descriptive cross-sectional study was conducted among pregnant mothers registered in all the 13 Medical Officers of Health (MOH) in Kalutara district. 364 participants were recruited using a stratified random sampling method via a pretested interview-based questionnaire. According to the results, many participants (58.9%) are aged 26-35 years. Out of the 364 participants, the majority were married (97%), Sinhalese (74.8%), and unemployed (60%). Out of 364, 33.7% of participants pass the advanced Level and 33.2% pass the Ordinary Level. Monthly income distribution shows that, 40.5% of participants earning Rs. 20,000-50,000. All participants were aware of folic acid, mainly from clinics/doctors (79.5%). The majority of the participants (54%) had obtained folic acid supplements before conception and only 13.4% of the participants had knowledge about the correct dosage. 58.6% of participants said that folic acid contained in fresh fruits and leafy greens (51.8%). 61.4% of participants take folic acid to prevent newborn abnormalities, and 99.2% of participants feel safe to obtain folic acid supplements during pregnancy. While 92.1% are like to learn more, and 9.6% of participant's folic acid is influenced by cultural beliefs. 42.2% of participants get folic a-rich foods in their meals when only they remember.76.2% take folic acid regularly as prescribed. Forgetfulness (46%), fear of side effects (13.2%), and morning sickness (19.7%) are common reasons for not taking folic acid regularly.17.5% of participants use reminders to take folic acid. 47.9% follow educational materials to gain knowledge about folic acid. Limitations occur in this research including language barrier among ethnicities, manual data entry, and large sample size. Most mothers have adequate knowledge and practices, but the knowledge, attitude, and practices differ according to the MOH division. Therefore, need targeted awareness programs, should improve antenatal care access, and promote food fortification.

Keywords: *Folic acid intake, neural tube defect, pregnancy*

Acknowledgment: *KIU, Battaramulla, Sri Lanka*

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Encapsulation of country borage leaf extract: bioactivity in fortified food models

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Plectranthus amboinicus, belonging to the Lamiaceae family, exhibits a diverse array of proven health-promoting properties, including antioxidant, anti-inflammatory, and analgesic activities. Consequently, the bioactive compounds extracted from these leaves hold significant promise for incorporation into functional foods and nutraceuticals aimed at reducing oxidative stress and mitigating the risks associated with prevalent chronic diseases. However, direct fortification into food products is often ineffective due to the degradation and loss of bioactivity during various food processing conditions and gastrointestinal digestion. The encapsulation technique offers a solution by preserving the integrity of these bioactives. Chitosan was chosen as the ideal encapsulant for its biocompatibility, biodegradability, and ability to protect bioactives while ensuring controlled and targeted delivery. In this study, *P. amboinicus* bioactives were extracted using solvent extraction with ethanol and encapsulated in a chitosan-tripolyphosphate (TPP) matrix. A food model, jelly, was fortified with both encapsulated and non-encapsulated extract, and their bioactivity retention was assessed under *in vitro* gastrointestinal digestion and dialysis conditions. The encapsulation efficiency and loading capacity were determined to be 76.38 ± 2.00% and 34.09 ± 1.70%, respectively. *In vitro* digestion studies revealed a significantly higher total phenolic content (TPC) ($p<0.05$) in simulated intestinal fluid (0.38 ± 0.04 mg/mL) and dialyzed fractions (0.94 ± 0.03 mg/mL) from the fortified encapsulated extract. Fourier-transform infrared (FT-IR) spectroscopy confirmed the successful encapsulation of the extract by detecting characteristic functional groups interacting with the chitosan-TPP matrix. This encapsulation technique suggests that targeted delivery of bioactive compounds can be achieved, thereby maximizing their potential in functional food applications.

Keywords: *Bioactive compounds, chitosan, in-vitro digestion, microencapsulation, plectranthus amboinicus*

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Surface phytoplankton assemblages and selected nutrient parameters of Unawatuna coastal waters, Sri Lanka

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Plankton communities are important bio-indicators of the ecological changes in aquatic ecosystems. The present study was conducted to determine the phytoplankton community structure in the surface coastal waters of the Unawatuna coast, which is one of the major tourist destinations in Sri Lanka. Monthly phytoplankton and water sampling were carried out from January to March 2024. At each sampling, three randomly placed transects were established from the coastline extending offshore, with three sampling points along each transect, approximately 1 km apart. Collected samples were analyzed to determine the nitrate-N, nitrite-N, ammonia-N, and orthophosphate concentrations, as well as chlorophyll-a, using standard methodologies in the laboratory. Under the light microscope, phytoplankton was identified to the most possible taxon, and enumeration was carried out using a Sedgewick rafter counting chamber. The results revealed 41 phytoplankton species that belong to the phylum Bacillariophyta (30 species) and Phylum Dinophyta (11 species). The average phytoplankton density was 751±106 cellsL^{-1} with no significant difference among the locations ($p>0.05$). Diatoms (85%) dominated the area, while *Navicula* spp. was the most abundant taxa, followed by *Chaetoceros* spp. The Shannon-Wiener diversity index (3.1±0.15), Simpson index of diversity (0.9±0.1), Margalef index (4.1±0.52), and evenness (0.82±0.04) data showed a significantly high phytoplankton diversity in Unawatuna coastal area. The phytoplankton community comprises both potential toxic dinoflagellate taxa (*i.e. Ceratium* spp., *Noctiluca scintillans, Protoperidinium* spp.) and toxic bloom-forming diatom taxa (*i.e. Asterionellopsis* sp., *Chaetoceros* spp, *Nitzchia* sp., etc). The mean nitrate-N, nitrite-N, ammonia-N, orthophosphate, and chlorophyll-a concentrations were 0.5±0.1 mgL^{-1}, 0.2±0.1 mgL^{-1}, 0.2±0.1 $mgL^{-}1$, 0.02±0.01 mgL^{-1} and 0.48±0.23 μgL^{-1} respectively. Neither parameter was significantly correlated with phytoplankton density ($p>0.05$). The outcomes highlight the diversity of phytoplankton communities in Unawatuna coastal waters, underlining the need for ongoing monitoring to detect potential environmental shifts due to nutrient inputs and harmful algal blooms.

Keywords: *Coastal waters, diatoms, dinoflagellates, diversity indices*

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Molecular docking identifies potential inhibitors of African swine fever virus E296R from *Brucea javanica*

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African swine fever (ASF) is a significant threat to domestic and wild pigs worldwide, with no commercial vaccine available. The African swine fever virus (ASFV) possesses a large double-stranded DNA (dsDNA) genome that encodes a Base Excision Repair (BER) protein, AP endonuclease (E296R), which is crucial for viral growth in swine macrophages. This study aims to explore the potential of chemical compounds from *Brucea javanica*, an Asian plant from the *Simaroubaceae* family known for its medicinal properties, including cancer treatment, antimicrobial activity, anti-inflammatory effects, and immune support, to inhibit the ASFV E296R protein. We conducted a comprehensive electronic search for natural compounds from *Brucea javanica* across various databases, including SCOPUS, PubMed, EMBASE, Elsevier, Web of Science, ResearchGate, ScienceDirect, Google, and Google Scholar, focusing on literature up to June 2024. This search identified 122 natural compounds, which we evaluated for pharmacokinetic properties using SwissADME, following Lipinski's rule of five to assess potential drug safety. This analysis revealed 20 viable drug candidates. We then performed virtual screenings using PyRx 8.0 to evaluate the binding affinities of these compounds in their 3D SDF forms. Compounds with binding affinities greater than -5 kcal/mol underwent further analysis through blind docking with CB-Dock2, resulting in binding affinities ranging from -5.7 to -8.7 kcal/mol. All 20 compounds interacted with amino acids in the E296R active site; however, Pityriacitrin, Bruceolline K, and Bruceolline M exhibited the strongest binding affinities of -8.7, -7.8, and -7.8 kcal/mol, respectively. Based on these binding energy scores, we recommend testing these compounds against ASFV to develop effective antiviral drugs.

Keywords: *African swine fever virus, antiviral, Brucea javanica, docking, E296R*

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Feasibility of using buccal swab derived DNA for qPCR-based gene dose analysis: impact of DNA integrity on assay performance

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Molecular assays like multiplex qPCR are increasingly used to detect gene dosage changes, such as deletions and duplications. Typically, these analyses use DNA extracted from blood samples. However, blood collection can be distressing for children with neuropsychiatric phenotypes. As a result, less invasive specimens, such as buccal swabs, are preferred for DNA extraction when testing these patients. This study evaluated the quality and integrity of DNA extracted from buccal swabs (DNA_{buccal}) compared to blood samples (DNA_{blood}) on the performance of a multiplex qPCR assay optimized to detect 22q11.2 microdeletions. Initially, DNA was extracted from fresh buccal swabs (n=14) and blood samples (n=6) of healthy individuals using the *QIAamp DNA Blood Mini Kit* (*Qiagen*, Germany). The DNA samples were quantified using the *Nanodrop* (*Thermo Fisher Scientific*, UK) while DNA integrity was examined by running a 1% agarose gel. DNA_{buccal} exhibited concentrations of less than 25 ng/µl, while DNA_{blood} ranged between 18 ng/µl and 48 ng/µl. The purity was higher in DNA_{blood} (1.92-1.95) compared to DNA_{buccal} (1.51-2.07). Additionally, DNA_{buccal} always produced smears in the agarose gel, with or without an identifiable high molecular weight genomic DNA band, whereas blood-derived DNA consistently showed a clear high molecular weight band without smears. Further, DNA_{buccal} produced highly deviated gene dose values (0.08 to 0.18) when tested for a target gene, normalized using the concentration of a control gene using qPCR, unlike blood-derived DNA which had gene dosage values around 1.0 (0.85-1.11) implying the absence of deletions/duplications. The results indicated that DNA_{buccal} is degraded, with lower concentrations and purity compared to $DNA_{blood.}$ The observed deviation in qPCR results with DNA_{buccal} is likely to stem from DNA degradation. Thus, improved buccal cell collection techniques that use effective preservation buffers are needed to preserve DNA integrity so that the unique requirements of vulnerable populations can be accommodated.

Keywords: *Buccal cell collection, DNA degradation, DNA extraction, DNA quality, preserve DNA*

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Seasonal variations and the effect of monsoonal periods on sedimentology of Negombo lagoon

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This study examines seasonal variations in the sedimentological properties of Negombo Lagoon during the Second Inter-Monsoon (SIM) and North East Monsoon (NEM) periods. Sediment samples from 40 sites were analyzed for soil moisture content (SMC), grain size distribution (D50), sand type, sorting, skewness, and organic matter content (OMC) using GRADISTAT and ArcGIS software. Hydrodynamic parameters influencing sediment characteristics were assessed through sea level measurements and published data. The average SMC during SIM was 17.75 ± 5.41%, peaking at 28.98% in the north, while during NEM, it averaged 16.32 ± 4.27%, peaking at 26.64% near river outflows, indicating notable seasonal differences. D50 results revealed finer sediments in SIM (0.21-0.44 mm) and coarser sediments in NEM (1.8-3.4 mm). Sediment types shifted from medium and fine sands in SIM to a mix of fine, medium, and sporadically coarse sands in NEM, predominantly well-sorted. In SIM, skewness ranged from symmetrical to very coarsely skewed, whereas in NEM, it was mainly symmetrical. OMC was higher in NEM (7.62%) compared to SIM (6.32%), with both grain size and OMC showing strong negative relationships. Hydrodynamic factors, such as water exchange and residence time, significantly influenced sediment characteristics. During NEM, reduced freshwater flux (less than 50 m^3/s) and increased residence time (up to 5.6 days) facilitated the settling of suspended particles and the transport of coarser sediments. Conversely, SIM had high freshwater discharge rates (93.5 to 150 m^3/s) and shorter residence times (2.23 to 3.54 days), promoting fine particle deposition and limiting coarse sediment mobility. The Coriolis Effect, tidal oscillations, and lagoon mouth morphology also impacted sediment dynamics. This study highlights the importance of seasonal monsoonal variations for effective lagoon management and environmental conservation.

Keywords: *Coriolis effect, grain size distribution, hydrodynamic parameters, organic matter content, seasonal variations*

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Probiotic fungal-bacterial biofilms as cell factories for postbiotics production

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Postbiotics bioactive compounds like enzymes, organic acids, peptides, short-chain fatty acids, etc. produced by probiotic microorganisms offer health benefits including enhanced immune function, anti-inflammatory effects, improved gut barrier function, and potential protection against pathogens and certain chronic diseases. The study aimed to develop *in-vitro* biofilms to optimize and enhance the production of beneficial postbiotics for various biotechnological applications. A fungal-bacterial biofilm was produced using four probiotic bacterial strains viz. *Bacillus subtilis, Bacillus clausii, Lactobacillus sporogenesis* and *Lactobacillus reuteri*, and one fungal strain i.e. *Aspergillus niger*. Once the biofilm development was confirmed under light microscope, the exuded biochemicals were extracted using a heating and ultrasonication method. The biofilm exudates were separated and analyzed using Liquid Chromatography–Mass Spectrometry (LC-MS), and identified using NIST mass spectral library database (National Institute of Standards and Technology, Gaithersburg, MD, USA). Results revealed that there were diverse bioactive compounds in the biofilm exudates. Five bioactive compounds i.e. Hesperidin, Sucrose octabenzoate, Naringin, Terbutaline, and Nonahexacontanoic were identified in the first 25% of the LC-MS spectrum with a match factor of 999 and probability of 100% when compared with the NIST library. The biochemicals have the potential to be used as antioxidants, cosmetic products, anti-cancers, bronchodilators, and anti-fungal, respectively. It can be concluded from these results that the biofilms developed *in-vitro* have a promising potential to be used as "microbial cell factories" for enhanced production of diverse postbiotics. Further research is needed to develop more productive biofilm formulations in terms of the diversity and quantity of the postbiotic products produced.

Keywords: *Biofilms, gut microbiota, LC-MS, postbiotics, probiotics*

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Modern BFBF-based bio-organo-mineral fertilizer practice maintains major nutrient availability in organic rice soil

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Availability of major nutrients nitrogen (N), phosphorus (P), and potassium (K) at sufficient rates in the soil ensures optimal crop yield and quality. Organic fertilizers with their slower nutrient release and the requirement of bulky quantities make them challenging to use for annual crops like rice (*Oryza sativa* L.) compared to chemical fertilizers. This study assessed the effectiveness of Biofilm biofertilizer (BFBF)-based bio-organo-mineral fertilizer (BOMF) for the major nutrient availability in organic rice soil. Field experiments were conducted in *Anuradhapura*, *Polonnaruwa*, *Ampara*, and *Puttalam* during the 2023/2024 wet season. Three treatments *viz*. (a) BOMF practice (500 kg BOMF/ha + 2.5 L BFBF/ha), (b) chemical fertilizer (CF) practice (340 kg NPK/ha), and (c) control (no fertilizers) were applied to experimental plots, each 100 m^2 arranged in randomized complete block design with three replicates in each location. Soil moisture, pH, and available N, P, and K were measured at the 50% flowering stage of the crop using a portable soil meter. Crop yields were recorded at the harvest. After confirming the normal distribution of the data, one-way ANOVA followed by Tukey's HSD test was done. Pearson correlation analysis was performed to reveal the interactions between the parameters. Results revealed that crop yields were comparable between the two fertilization practices. The BOMF practice was found to maintain soil available N, P, and K comparable to the CF practice. Soil moisture was significantly correlated with available N (r = 0.775, p = 0.014), P (r = 0.779, p = 0.013), and K (r = 0.774, p = 0.014) only in the BOMF practice suggesting that optimizing soil moisture can enhance nutrient availability. It can be concluded that the eco-friendly BOMF practice with manageable organic fertilizer rates can sustain soil nutrient levels and achieve yields comparable to conventional CF practice.

Keywords: *Biofilm biofertilizer*, *organic agriculture*, *rice*, *soil fertility*

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Estimating the soil organic carbon content and other selected properties in *Katupotha* dry zone forest systems, Mihintale, Sri Lanka

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Tropical Dry Zone Forests are renowned for their ecological resilience and biodiversity, playing a crucial role in supporting local communities and ecosystem services. *Katupotha* forest profoundly stands as a significant archaeological treasure in Sri Lanka's historical legacy. Characterized by diverse vegetation and unique ecological dynamics, these forests exemplify the delicate balance between anthropogenic and natural habitats in the dry zone of Sri Lanka. Total Organic Carbon in forest soil is a vital indicator of soil quality, reflecting soil fertility and carbon sequestration potential, a key to Climate change mitigation. Also, limited baseline information is available on the soil carbon of dry zone forests. This study has aimed to assess the current Total Organic Carbon (TOC) of the *Katupotha* tropical dry zone forest systems, Mihintale, Sri Lanka. Soil samples were collected from 30 predetermined locations of the forest from two depths, surface (0 – 15 cm) and subsurface (15 – 30 cm) soil layers, using the Stratified Random Sampling technique. Soil pH, Electrical conductivity (EC), Bulk density, Soil moisture content, and TOC were analyzed using standard protocols. The findings showed that the TOC and soil moisture varied significantly throughout the sites. TOC varied from 3.905% to 0.585% mean 1.762%) and Soil moisture ranged from 30.915% to 5.310% (mean 14.36%). pH ranged from 5.03 to 9.52 (mean 6.77) and EC from 0.184 µS/cm to 165.100 µS/cm (mean 30.065 µS/cm). Bulk density varied from 0.437 g/cm^3 to 1.307 g/cm^3 (mean 0.802 g/cm^3). The results were analyzed using Pearson Correlation analysis. Accordingly, TOC was positively correlated with soil moisture in both surface (r=0.219) and subsurface (r=0.199) levels. Descriptive analysis revealed a significant variation in the distribution of TOC and Soil moisture (coefficient of variation, 169.20 and 100.84 respectively). The findings of this study provide useful information for future forest conservation and management practices and climate change mitigation projects in Sri Lanka.

Keywords: *Carbon sequestration, climate change, ecosystem services, soil moisture content, total organic carbon*

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Innovative CRISPR/Cas9 strategy targeting the allosteric site of phosphofructokinase-1 enzyme for cancer therapy

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Cancer is one of the deadliest diseases, ranking as the second leading cause of death worldwide. Cancer cells rely on aerobic glycolysis to meet their energy demands, exhibiting increased glucose uptake compared to normal cells and converting glucose to lactate even in the presence of high oxygen levels and functioning mitochondria. This process is known as the Warburg effect. Consequently, reducing glycolysis by downregulating glycolytic enzymes in cancer cells could slow their proliferation. This research study aims to downregulate the enzyme Phosphofructokinase-1 (PFK-1) by using CRISPR/Cas9 technology to knock out its regulatory domain, thereby decreasing the binding of Fructose-2,6-Bisphosphate, a key allosteric activator of PFK-1. Lowering PFK-1 activity could reduce the glycolytic rate and proliferation of cancer cells compared to normal cells, as the truncated protein may retain sufficient catalytic activity for normal cell function. This approach is potentially safer than completely knocking out PFK-1, offering a broader application to various cancer types while minimizing side effects. To achieve this, a specific sgRNA was designed using bioinformatics tools to create a double-strand break (DSB) at exon 13 of PFK-1. A suitable donor template for repairing the DSB via the Homology Directed Repair (HDR) pathway was also designed. The recombinant plasmid containing the engineered sgRNA was transfected into MCF-7 cells along with the donor template using PEI-mediated transfection. PEI forms complexes with DNA (polyplexes), facilitating cellular uptake through endocytosis. PEI: DNA ratios of 1:2 and 1:4 were tested, and most MCF-7 cells remained viable after transfection, indicating low toxicity. Consequently, a 1:2 ratio was selected for downstream experiments. After puromycin selection, the cells will undergo clonal expansion and subsequent analysis to confirm genetic modification. Cell proliferation assays will then be conducted to evaluate the impact of the modified gene function.

Keywords: *Aerobic glycolysis, donor template, sgRNA, tumor proliferation, warburg effect*

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Assessment of sugarcane growth using UAV-derived multispectral imaging and machine learning models

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Sri Lanka's sugarcane industry plays a vital role in the nation's economy, but decision-making in breeding is often hindered by limited growth data, mainly due to the extensive scale of cultivation. To address this, an innovative approach using Unmanned Aerial Vehicle (UAV) imagery was explored to monitor plant growth over large areas efficiently. The study was conducted at Lanka Sugar Company (Pvt) Ltd in Pelwatte, using twelve experimental plots planted with the SL 96 128 sugarcane variety. Six months post-planting, UAVs equipped with multispectral sensors captured images, and the height of 144 sugarcane plants was measured manually for validation. Digital Elevation Models (DEM) were generated using QGIS, and orthomosaic maps were created with Agisoft software. A Crop Surface Model (CSM) was then developed from these DEMs to estimate plant heights. The accuracy of UAV-derived heights was validated against manual measurements, showing a strong correlation with a Pearson correlation coefficient of 0.87. To refine height predictions, three machine learning models Simple Linear Regression, Support Vector Regression, and Random Forest Regression were employed. The Random Forest Regression model achieved the highest accuracy, with an R-squared value of 81.22% and a Root Mean Square Error (RMSE) of 3.354 cm. These results demonstrate the potential of combining multispectral UAV imagery with machine learning to accurately estimate sugarcane plant heights, offering a valuable tool for agricultural monitoring. This method provides efficient data collection over large areas and enhances decision-making in crop management and breeding, promising improved precision and efficiency in large-scale sugarcane cultivation.

Keywords: *Crop surface model, rowth monitoring, digital elevation models, multispectral sensors, UAV imagery*

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Eco-friendly biofilm biofertilizer practice enhances endophytes and secondary metabolites in tea cultivation

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As the world's second-most consumed beverage after water, tea (*Camellia sinensis* (L.) O. Kuntze) possess unique sensory and medicinal benefits, attributed to its rich profile of secondary metabolites (SM). Tea cultivation mainly relies on chemical fertilisers (CF), which, when overused, degrade agroecosystems and reduce quality of the harvest. As an eco-friendly alternative to CF, biofilm biofertilizer (BFBF) was introduced for tea showing its potential to increase endophytes and SM in preliminary studies. The present study investigates this further by comparing two fertiliser practices i.e. (a) 100% CF (T750 and U709, as recommended by Tea Research Institute, Sri Lanka), and (b) BFBF (50% CF + 2.5 L BFBF ha^{-1}) in a field experiment conducted in Elpitiya, Sri Lanka. Fifteen leaf samples were collected from each plot and analyzed for total phenolic content (TPC), total flavonoids content (TFC), and caffeine contents using modified Folin-Ciocalteu assay, aluminium chloride colorimetric assay, and dichloromethane extraction method, respectively. Both plant and soil samples were analyzed for total bacteria and diazotrophs contents. One-way ANOVA followed by Tukey's HSD test was performed to compare the means by considering 0.1 as the probability level for statistical significance. Results revealed that the BFBF practice increased soil total bacteria (p = 0.038), soil diazotrophs (p = 0.067), endophytic diazotrophs (p = 0.065), and caffeine (p = 0.011) contents compared to the 100% CF practice. Endophytic total bacteria, TPC, and TFC were comparable in both BFBF and CF practices. These results suggest that the BFBF is capable of reducing the CF use in tea cultivation while increasing endophytes and SM production in tea, within the limitations of the study.

Keywords: *Caffeine, eco-friendly fertilisers, endophytes, sustainable agriculture*

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Assessment of phytoplankton diversity in relation to water quality parameters: a study on Modara coastal area in Sri Lanka

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This study explores how water quality impacts phytoplankton diversity and abundance in the Modara coastal area. The research encompasses three distinct sites namely, Kelani River mouth, Crow Island Beach Park, and Modera Fishery Harbor in Sri Lanka and sampling was conducted from July 2023 to March 2024. The water quality parameters, including pH, dissolved oxygen, salinity, and temperature, were measured using a pH meter, dissolved oxygen meter, and salinity meter, during monthly sampling conducted at 7.00 – 9.00 am. Phytoplanktons were collected using 50µm net and preserved using 5 % Lugol's solution. Phytoplankton identification and analysis were performed in the laboratory using standard keys and guidelines. The harbor area exhibits the highest mean values for dissolved oxygen (DO), pH, temperature, and salinity, with measurements of 7.280±0.13, 7.689± 0.14, 29.575±0.33, and 6.732±1.22, respectively. The Kelani River mouth area showed the highest conductivity at 38.94 µS/cm and Crow Island Beach Park showed 25.85 µS/cm and 20.70 µS/cm in harbor areas. During the study period, 30 plankton species belonging to seven (7) classes namely: seven (7) from Bacillariophyceae, nine (9) from Chlorophyceae, four (4) from Cyanophyceae, (1) from Euglenophyceae, Protoflorideae, Rhoymeniophycidae respectively, (5) from Zygnematophyceae were observed. In the phytoplankton assemblage of the area, diatoms constitute a predominant component, representing 60.04% of the relative abundance and the other most abundance species are Fragilaria sp. 26.54%, Ankistrodesmus sp. 3.90%. The Shannon Wiener diversity index was employed to assess phytoplankton community diversity. The observed Shannon Wiener diversity index in Crow Island Beach Park, Kelani River mouth, and harbor area were 1.42, 0.79, and 0.50 respectively. Crow Island Beach Park showed the highest abundance in December, while the Kelani River mouth had the highest species richness in July. This study underscores the significant impact of water quality parameters—particularly salinity, dissolved oxygen, and nutrient levels—on phytoplankton distribution and abundance in the Modara coastal area, aiding the management and conservation of coastal ecosystems against urban and industrial runoff.

Keywords: *Abundance, Crow Island, Kelani river, Shannon Wiener*

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The design and development of a prototype hydroponic drawer unit for urban agriculture in Sri Lanka

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Innovative methods and techniques for vegetable production are urgently needed due to challenges such as decreased soil fertility, adverse climate changes, a shrinking rural workforce, and soil pollution and degradation. Despite its global aspirations, Sri Lanka continues to face persistent food insecurity, particularly in urban areas. This study explores the integration of urban agriculture into indoor residential architecture as a potential solution to these challenges. The primary objective is to assess the viability and effectiveness of incorporating urban agriculture into residential design in Sri Lanka. The research begins with a literature review to understand the global context of urban agriculture and specific initiatives in Sri Lanka. Following, a prototype hydroponic drawer unit was developed using insights gathered from expert interviews and design processes. The unit addresses key aspects of indoor farming, including water management through hydroponic systems and plant nutrient optimization. The layered unit structure was designed to ensure compactness and ease of use, incorporating efficient hydroponic systems, essential grow lights, and durable materials for long-term functionality. A testing phase was conducted to monitor plant growth, water consumption, and environmental conditions, providing insights into system performance. Results indicated that the hydroponic drawer unit is suitable for various leafy greens, with plants exhibiting healthy growth within residential settings. However, the study also identified challenges such as balancing water circulation, the dimensions of the space in between the drawers, and managing humidity levels in an enclosed space. Future research could explore automation, IoT integration, and the potential scalability of the hydroponic drawer unit as these findings emphasize the importance of sustainable and adaptable designs for promoting food self-sufficiency in dense urban environments.

Keywords: *Food security, residential architecture, sustainable development, Sri Lanka, urban agriculture*

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Biofilm exudates reactivate viable but non-culturable bacteria and fungi

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In response to stresses, microbes become dormant and show a low level of metabolic activity, which is known as a viable but non-culturable (VBNC) state. The metabolic activity of VBNC microbes has been hypothesized to be triggered by biofilm exudates (BFEx), which contain biochemicals exuded from developed fungal-bacterial biofilms. The present study was designed to evaluate this property in mineral-associated microbes. Serpentine, feldspar, and Eppawala rock phosphate (ERP) mineral samples were collected from Ussangoda, Kaikawala, and Eppawala, respectively. Mineral samples were crushed, sieved, and suspended in solutions, followed by mixing and serial dilution. The diluted mineral suspensions were inoculated onto Nutrient Agar and Potato Dextrose Agar plates using two treatments: one with the addition of sterile BFEx (10 µL) and one without BFEx, each with three replicates. The enumeration was performed to assess the total bacteria and fungi in each treatment. The difference between the counts with and without BFEx was used as a proxy for the VBNC count. The data were analyzed using a one-way Analysis of Variance test, and the means were separated using Tukey's honestly significant difference test. The results showed that the total number of VBNC bacteria was greater than the total number of VBNC fungi for each mineral type. On average, the serpentine, ERP, and feldspar minerals consisted of significant amounts of VBNC bacteria with, 72%, 54%, and 45%, and for VBNC fungi with 43%, 64%, and 25%, respectively. The serpentine had significantly higher VBNC bacterial counts ($p < 0.05$) compared to the other two minerals. However, VBNC fungal counts demonstrated no significant differences across tested mineral types. In conclusion, the findings suggest that BFEx more effectively reactivates mineral-associated VBNC bacteria and fungi. Further research is necessary, using more advanced methods, to reveal the underlying mechanisms of VBNC in mineral-associated microbes.

Keywords: *Biochemicals, biofilms, enumeration, minerals, VBNC*

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Effect of core relaxation on the photoionization angular distribution of spin-orbit split components of the Xe 3d subshell

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The spin-orbit interaction splits the Xe 3d subshell into the $3d_{5/2}$ and $3d_{3/2}$ components. The angular distribution asymmetry parameter of the photoionization of these components is sensitive to both relativistic and core relaxation effects. The term 'core relaxation' refers to the rearrangement of electrons in the residual core that occurs after photoionization. This is modeled using the Relativistic Random Phase Approximation with Relaxation (RRPA-R). RRPA-R incorporates relaxation by calculating final wave functions using the resulting potential from the relaxed residual core while RRPA only uses the potential from the unrelaxed ground state atom. The inclusion of core relaxation provides a smoother plot for the angular distribution asymmetry parameter of Xe $3d_{5/2}$ and $3d_{3/2}$ subshells near their thresholds which agrees better with the experimental results. Therefore, the Spin-Orbit Interaction Activated Interchannel Coupling (SOIAIC) effect is also modeled better in RRPA-R. This can be seen by comparing the small hump at around 703 eV in the asymmetry variation of Xe $3d_{5/2}$ to the secondary hump produced in RRPA at around 706 eV. RRPA-R produces a secondary peak that is shallower and smoother than the primary peak nearer to the $3d_{5/2}$ threshold. This agrees better with the experimental variation than RRPA results. The modified central potential due to the relaxed electron configuration leads to these screening effects, while SOIAIC arises from cross-section mixing in heavier atoms. The Xe 3d subshells were chosen in this research as they are the smallest subshells visibly exhibiting SOIAIC effects. Core relaxation and interchannel coupling qualitatively change the asymmetry variation near the threshold, beyond reducing cross-sections. Understanding these effects is vital for modeling atomic structures and electron behaviors, especially in heavier atoms.

Keywords: *Asymmetry parameter, interchannel coupling, near-threshold energy, RRPA-R, SOIAIC*

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Development of a sensor-based liquid Hydrogen storage tank

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Onboard hydrogen storage in automobiles is crucial for a hydrogen-based economy, but technical difficulties and increased clean energy violations pose challenges in achieving this goal. Still, the safe and effective storehouse of LH_2 presents significant engineering challenges due to its cryogenic nature, low boiling point (-253°C), and high flammability. The focus is on expediting the transition of hydrogen fuel in the automobile industry to a low-cost, sustainable, and low-carbon transportation system, thereby reducing emissions and promoting economic growth. Experimental confirmation was conducted through tests bluffing colorful functional conditions, including thermal cycling and pressure oscillations. Results demonstrate that the detector-grounded tank effectively maintains optimal storehouse conditions while mollifying the threat of leaks and other safety hazards. The study highlights the importance of continuous monitoring of tank performance criteria, integrating an IoT frame for remote monitoring and data analytics to prevent implicit failures. This visionary approach allows for the early discovery of anomalies, furnishing a fresh subcaste of safety in LH_2 running and storehouse. The developed technology advances the range of storage, and quick refueling reduces emissions and ensures energy security. Thus, this further underscores the importance of creating hydrogen fuel tanks to break down further barriers to advancing hydrogen fuel cell technology and expediting clean, sustainable transportation in the future. Sensor Technology, Fiber optical detectors were employed due to their resistance to electromagnetic hindrance and capability to serve in cryogenic temperatures. Experimental confirmation shows that the tank passed rigorous testing, including thermal Cycling Tests and Pressure Tests to elaborate the various parametric behaviors. The IoT-enabled system handled real-time cautions for any detected anomalies, significantly perfecting response times in implicit exigency scripts. Collaboration among industry stakeholders, government, and research institutions is necessary to unlock innovation and bring these developments to the market.

Keywords: *Automobile industry, fuel, liquid hydrogen, storage tank*

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Total magnetic energy analysis of ferromagnetic thin films with face-centered cubic structure using the fourth order perturbed Heisenberg Hamiltonian

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Ferromagnetic films are essential components in magnetic memory and microwave devices, where the orientation of easy and hard magnetic directions is critical. This study investigates the total magnetic energy of ferromagnetic thin films with face- centred cubic (fcc) structure and two spin layers using the fourth-order perturbed Heisenberg Hamiltonian. Previous models have employed various theoretical approaches, including Monte Carlo simulations, the Ising model, first principles band structure theory, and the Korringa-Kohn-Rostoker Green's function method, to describe the magnetic properties of ferromagnetic films. Our approach considers all relevant magnetic energy terms, such as spin dipole interaction, spin exchange interaction, second and fourth-order magnetic anisotropy constants, stress-induced anisotropy, and demagnetization factors. The study presents 3D plots of energy versus azimuthal angle and spin exchange interaction, using MATLAB for simulations. For fcc (001) structured films, with parameters Z 0 =4, Z 1 =4, Z 2 =0, 9.0336 and, the energy plots reveal distinct minima and maxima. Specifically, with parameters and, energy maxima occur at J/ω = 21, 34, 43, 55, 68, and 93, with a major maximum around J/ω = 34. Conversely, for and, the energy maxima appear at J/ω = 2, 14, 39, 43, and 48, with a major maximum at J/ω = 14. The total magnetic energy remains in the order of 10 35 for both cases. This consistent energy order suggests that interchanging the spin layers does not change the total magnetic energy significantly. This comprehensive analysis enhances the understanding of magnetic properties in fcc-structured ferromagnetic films, offering insights for optimizing their applications in advanced magnetics devices.

Keywords: *Fourth order perturbed Heisenberg Hamiltonian, magnetic anisotropy constant, magnetic thin films, spin exchange interaction.*

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The effect of a thin ZnS passivation layer on q-dot $AgBiS_2$ for enhancing the solar cell performance

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Quantum dot solar cells fabricated with innovative ternary semiconductor materials are emerging as a viable alternative to thin-film solar cells made from CdS and CdTe. Among them, $AgBiS_2$, a non-toxic ternary semiconductor material with a high absorption coefficient, mobility, and configurable band gap, is the forefront material. Coating a wide band gap material such as ZnS on quantum dots notably impacts their performance. In this study, $AgBiS_2$ quantum dots were prepared on a TiO_2 mesoporous layer using the successive ionic layer adsorption and reaction (SILAR) method, and solar cell performance was observed by coating a ZnS layer between the $TiO_2/AgBiS_2$ q-dot interface and the $AgBiS_2$/polysulfide electrolyte interface. The formation of $AgBiS_2$ and ZnS can be confirmed by XRD, EDS, and TEM analysis. The cell configuration FTO/m-$TiO_2/AgBiS_2$/polysulfide electrolyte/Cu_2S-brass without a ZnS layer demonstrated an efficiency of 0.59%. One SILAR cycle at the $TiO_2/AgBiS_2$ interface and two SILAR cycles at the $AgBiS_2$/polysulfide electrolyte interface give the best ZnS coating efficiency of 0.7% and 0.8%, respectively. Using an optimal ZnS layer in the FTO/m-TiO_2/ZnS(I)/$AgBiS_2$/ZnS(II)/polysulfide electrolyte/Cu_2S-brass configuration boosts efficiency to 0.94%. UV-Vis spectra of the FTO/m-TiO_2/ZnS(I)/$AgBiS_2$ cell configuration indicated an increase in light absorption after the first SILAR cycle, followed by a decrease in absorbance with subsequent cycles of $AgBiS_2$. For the $TiO_2/AgBiS_2$/ZnS(II) configuration, UV-Vis spectra indicated that ZnS coating enhanced the light absorption properties of $AgBiS_2$ quantum dots and induced a slight blue shift in the absorption peak after the first and second SILAR cycles. Subsequent coating of ZnS leads to the red-shift of absorption peak while decreasing the light absorption by $AgBiS_2$. Optimizing the number of ZnS cycles at both the $TiO_2/AgBiS_2$ q-dot and $AgBiS_2$/polysulfide electrolyte interfaces can enhance solar cell efficiency and the efficiency can be further improved by incorporating optimal ZnS layers within the FTO/m-TiO_2/ZnS/$AgBiS_2$/ZnS/polysulfide electrolyte/Cu_2S-brass cell configuration.

Keywords: *Quantum dots solar cell*

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Wavelet transformation-based heart rate variability analysis

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Heart rate variability (HRV) is the variation in the consecutive heart beats which reflects the electrical activity of the heart. Analyzing HRV offers insight into the functioning of the Autonomic Nervous System (ANS). This research study focuses on using Wavelet Transform techniques for HRV feature extraction to analyze the cardiac sympathovagal balance. Specifically, two types of wavelets transform, Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT) were applied at different stages of the analysis. Multi-resolution analysis of wavelet transformation offers several benefits when analyzing HRV. In this study, R-peak detection was performed using DWT methods with Maximal Overlap Discrete Wavelet Transform (MODWT) and CWT was applied to the signal representing the durations between consecutive R waves of the Electrocardiograph (ECG) to generate spectrograms. The High-Frequency (HF), Low-Frequency (LF), and Very-Low-Frequency (VLF) components of HRV which fall between 0.003 and 0.4Hz were extracted and analyzed for power estimation. The LF/HF ratio, representing the signal's variance or power as a function of frequency, was used to assess sympatho-vagal balance, which determines the balance between Sympathetic Nervous System (SNS) and Parasympathetic Nervous System (PNS). The study utilized ECG data from the PhysioNet database, which included 42 patients with arrhythmia and 18 patients with normal sinus rhythm. Arrhythmia refers to an irregular heart rate or rhythm. The results indicated that the patients with arrhythmia had a lower LF/HF ratio compared to those with normal sinus rhythm subjects. The study found that in most arrhythmia patients, the power of the HF band was comparatively higher than that of the LF band, while in nearly all patients with normal sinus rhythm, the LF band showed greater power than the HF band. These results suggest that in patients with irregular heart rhythms, the parasympathetic nervous system tends to dominate the Autonomic Nervous System (ANS). Conversely, in patients without arrhythmia, the sympathetic nervous system is more dominant.

Keywords: *Arrhythmia, heart rate variability, LF/HF ratio, sympatho- vagal balance, wavelet transform*

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Impact of thermoelectric panels on energy harvesting and thermal management of a rechargeable battery pack

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With the exponential rise in the adoption of electric vehicles (EVs) globally, it is imperative to extend the recharge intervals of the battery pack. Rechargeable lithium-ion battery packs, commonly used in EVs, generate heat during operation. This heat can degrade performance and reduce the lifespan of the battery unless properly managed. The novelty of this work is, that we aim to extend recharge intervals of the battery by trickle charging from thermoelectric (TE) panels attached to the battery pack using the waste heat. The TE panel employed in this study is TEC1-12706 module, composed of bismuth telluride (Bi_2Ti_3) based semiconductors. These panels are integrated into the battery surface using thermal paste, where they harness the thermal gradient between the battery and the ambient environment. These panels will convert waste heat from the battery pack into electricity, providing an additional charge, and extending the recharge intervals. It is also important to maintain the temperature of a battery pack below 45°C in order to maintain the health of the rechargeable battery cells. The primary objective of this research is to monitor and maintain the cooling efficiency of the battery pack, after attaching the TE panels. The heat dissipation rate for the battery pack and heat dissipation rate after attaching the TE panels was calculated after measuring the necessary parameters experimentally. Algebraic expressions were derived to model the heat losses before and after the attachment of TE panels. The results indicate that integrating TE panels with the battery pack only slightly reduced the heat dissipation rate from 2.8 J s^{-1} to 2.5 J s^{-1}, still maintaining sufficient cooling. This suggests that the energy can be safely harvested from the battery pack using TE panels while maintaining the battery pack within the safe temperature range.

Keywords: *Electric vehicles, heat dissipation rate, rechargeable lithium-ion battery pack, thermoelectric panels, waste heat*

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Study of radial velocities of selected bright stars using spectral analysis from a 45 cm telescope

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This study presents a comprehensive approach to measuring the radial velocities of four bright stars using Charged Coupled Device (CCD) imaging, spectroscopy, and the IRAF (Image Reduction and Analysis Facility) astronomy data reduction package. The primary objective of this research is to determine the radial velocities of selected bright stars and compare these values with those listed in star catalogs. The stars HD 39853, Rigel, Sirius, and Capella were observed using high-resolution spectroscopy in the wavelength region from 6300 Å to 6700 Å with the Gravitational-wave Optical Transient Observer (GOTO) 45 cm Cassegrain Telescope equipped with a Monk-Gillison type spectrograph at the Arthur C. Clarke Institute. The data were processed using IRAF to detect Doppler shifts in the stars' spectral lines using inbuilt tasks in the program. The obtained radial velocities for HD 39853, Rigel, Sirius, and Capella using the RVIDLINES task in IRAF were 80.73 km s−1, 16.89 km s−1, -0.29 km s−1, and 24.85 km s−1 respectively. The radial velocity of HD 39853 obtained from the FXCOR task in IRAF was 78.19 ± 0.04 km s−1 with a 0.783 correlation peak. These results will enhance our understanding of the movements and the potential planetary systems of the selected stars and help determine the presence of any undetected companions. Additionally, this research will demonstrate the use of IRAF software for analyzing spectroscopic data. This thesis will hold significance for researchers investigating stellar motion.

Keywords: *FXCOR, IRAF, RVIDLINES, spectroscopy*

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Investigating superhump variations and mass ratios in SU Ursae Majoris Stars using TESS data

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SU Ursae Majoris (SU UMa) stars are a type of dwarf nova, which is a non-magnetic cataclysmic variable binary system. These systems consist of a white dwarf (primary star), a red dwarf (secondary star), and an accretion disk around the white dwarf. SU UMa systems exhibit two types of outbursts: normal outbursts and significantly longer-lasting superoutbursts. During a superoutburst, a periodically modulated phenomenon called superhumps appears due to the apsidal precession of the accretion disk. This study investigates the mass ratios between the primary white dwarf (M1) and secondary red dwarf (M2) stars using the superhumps period. We use data from the Transiting Exoplanet Survey Satellite (TESS), despite its primary mission for exoplanet detection. Traditionally, such studies have relied on ground-based data, but TESS data offers more accurate results due to its free from atmospheric effects and light pollution. To isolate the superhumps in the TESS data light curve, the Locally Weighted Scatterplot Smoothing method was employed. The Lomb-Scargle periodogram was then used to estimate the superhump periods of each system. O-C (Observed minus Calculated) diagram was utilized to identify variations in the superhump period. Three distinct stages of periods within the superoutburst were identified: Stage A, Stage B, and Stage C. Stage A superhumps, only affected by the precession of the disk (purely dynamical no other effects) as described by previous studies, were used to estimate the mass ratios of our SU UMa sample. Our results demonstrate good accuracy when compared with mass ratio values derived from other methods published in previous studies. Although the primary mission of TESS is the discovery of exoplanets, we conclude that the long-term variability in TESS data (specifically the SAP flux light curves) used in this research can be effectively employed to accurately estimate mass ratios in SU UMa dwarf nova systems.

Keywords: *Accretion disk, mass ratios, SU ursae majoris, superhumps period, TESS*

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Tidal dynamics and lagoon flushing in Lankapatuna lagoon, Sri Lanka: implications for coastal ecology

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Efficient water exchange between lagoons and the ocean is vital for managing coastal ecosystems, influenced by tidal and sub-tidal oscillations. This study evaluates tidal choking effects and tidal responses in Lankapatuna Lagoon, focusing on lagoon flushing across different monsoon seasons. Tide poles and pressure sensors were installed at the lagoon's mouth, middle, and head to monitor tidal fluctuations in 2022 and 2023, using data from the Trincomalee Sea Level Station for open sea level. In 2022, tidal fluctuations ranged from 60 cm in the open sea to 14 cm at the lagoon mouth and 6 cm at the head, with the tidal choking coefficient indicating a nearly 90% reduction compared to the open sea, ranging from 0.23 to 0.41 and a maximum flood tide speed of 259 cm/s. In 2023, the first inter-monsoon showed a decrease in tidal range from 30 cm in the open sea to 13 cm at the mouth and 6 cm at the head, with a 2-hour phase lag, while the lagoon mouth's partial closure during the southwest monsoon led to significant reductions in tidal range and phase lags of up to 6 hours. By the second inter-monsoon, minimal tidal exchange occurred, with atmospheric effects measuring just 6 cm. The breach of the sandbar in October and the closure of the lagoon mouth from August to September caused tidal oscillations to cease due to insufficient flux. The study highlights significant tidal choking effects in Lagoon, resulting in notable amplitude reductions and phase lags. These factors impact lagoon flushing and sediment dynamics, emphasizing the need for effective management strategies to mitigate tidal choking's adverse effects on coastal ecosystems. Tidal choking can lead to habitat degradation and threaten biodiversity, making management imperative. Additionally, disrupted sediment dynamics may alter water quality and increase erosion vulnerability, affecting local communities and marine life.

Keywords: *Monsoon, phase lag, tidal fluctuation*

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Enhancing the photovoltaic performance of solid-state dye-sensitized solar cells by incorporating functionalized multi-walled carbon nanotubes

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Dye-sensitized solar cells (DSSCs) are a cost-effective and environmentally friendly alternative to conventional solar cells; however, the use of liquid electrolytes limits their commercialization due to issues like leakage and evaporation, affecting long-term stability. Solid-state DSSCs (ssDSSCs), which replace liquid electrolytes with solid-state hole transport materials, address these concerns but suffer from reduced efficiency. This study investigates the fabrication of ssDSSCs using copper(I) iodide (CuI) as a low-cost hole transport material, aiming to improve their efficiency by incorporating functionalized multi-walled carbon nanotubes (F-MWCNTs). Before incorporation, MWCNTs were functionalized with carboxyl groups to enhance their dispersion and interaction with the TiO_2 layer. Characterization techniques such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, and scanning electron microscopy (SEM) confirmed the successful functionalization of MWCNTs and their suitability for use in ssDSSCs. Furthermore, tetrahydrothiophene (THT) was introduced as a crystal growth inhibitor in CuI to optimize its layer morphology, as evidenced by SEM analysis and current-voltage data. The fabricated ITO/c-TiO_2/p-TiO_2-F-MWCNTs/Dye/CuI-THT/Pt/ITO ssDSSC showed significant enhancement in performance. The compact TiO_2 layer (c-TiO_2) served as an electron-blocking layer, reducing short-circuit issues. The device incorporating 0.03 wt% F-MWCNTs in the photoanode achieved a photocurrent density of 2.013 mA/cm², an open-circuit voltage of 475.4 mV, and a power conversion efficiency of 0.444%, representing a marked improvement over the 0.182% efficiency of the control device without F-MWCNTs.

Keywords: *CuI,* multi-walled carbon nanotubes, *photovoltaic, SSDSSC*

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Estimating the crustal thickness beneath Pallekale broadband seismic station in Sri Lanka using receiver function analysis

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Sri Lanka was a part of East Gondwana alongside Madagascar, India, and Antarctica, during the Late Jurassic period. Sri Lanka is composed of four major lithotectonic units called, the Highland Complex (HC), the Vijayan Comple (VC), the Wanni Complex (WC), and the Kadugannawa Complex (KC). Pallekale (PALK) seismic station, located in the Highland Complex of central Sri Lanka, is an IRIS (Incorporated Research Institutions for Seismology) station operating since 2000. This study investigates the crustal properties of Sri Lanka using the receiver functions calculated from teleseismic earthquake data recorded at the PALK station from 2020 to 2024. The receiver function analysis method is based on the principle of seismic wave conversion. The H- κ stacking technique was used to determine the crustal thickness and the ratio between P-wave velocity and S-wave velocity (Vp/Vs ratio) of the crust using the calculated receiver functions. The results reveal that the crust beneath the PALK station is 38 km thick and a Vp/Vs ratio is 1.70. This Vp/Vs ratio corresponds to a Poisson's ratio of approximately 0.24, which is lower compared to the global average for Precambrian shields. However, other high-grade terrains of Gondwana region like South India, Antarctica, and East Africa show similar Poisson's ratios, ranging between 0.24 to 0.26. These results support the Sri Lanka-Gondwana linkage. Additionally, Poisson's ratio can be used to distinguish between felsic and mafic rocks. A low Poisson's ratios suggest a felsic crustal composition with SiO_2-rich rocks.

Keywords: *Crustal thickness, Gondwana, H- κ stacking, Poisson's ratio, Sri Lanka*

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Computing the harmonic-measure distribution function of two unequal discs connected with a common line segment

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A key notion in potential theory that is intimately tied to the idea of Brownian motion and is used to describe the geometry of a domain is the harmonic measure distribution function, which is also known as the h-function $h(r)$. This function represents the probability that a Brownian walker starting at the basepoint z_0 inside the domain (an open connected set) Ω first hits the boundary of the domain within the distance r of z_0, before it hits anywhere else in the boundary $\partial\Omega$. This function is non-decreasing, right-continuous, and always lies in the unit interval [0,1]. Moreover, this function is piecewise-defined and will always be zero for $r < d$, where d is the shortest distance between the basepoint z_0 and the boundary $\partial\Omega$. However, this function will attain the value 1 only for domains with bounded boundaries. The objective of this abstract is to explain the computation of the h-function $h(r)$ of an unbounded domain Ω formed by deleting two dissimilar discs $|z| \leq 1$ and $|z - 1.755| \leq 0.055$ along with a common line segment [1,1.7]. To compute this h-function, we use the method of conformal transformations, the construction of a potential function, and the solution of a particular Dirichlet problem. Moreover, to obtain the h-function formula, we first find the conformal map $F(\zeta)$ that transforms the interior of the unit disc to our target domain Ω. Second, we use the classical Cayley map $R(\zeta)$ to transplant the unit disc to the lower halfplane. Third, we define a potential function $W(\zeta)$ in terms of the logarithmic function of $R(\zeta)$ along with some other term as the imaginary part of $W(\zeta)$ is harmonic and solves our Dirichlet problem in the unit disc. Hence, the h-function is given by $\mathrm{Im}[W(\zeta_0)]$, where ζ_0 is the preimage of the basepoint z_0.

Keywords: *Conformal map, harmonic measure, harmonic function, h-function.*

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Leg prosthesis socket: designing a system for improved gait

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This paper examines the comfort of the prosthesis socket of transtibial amputees. The traditional sockets made in Sri Lanka are unable to provide the proper comfort for the amputees while using the prosthesis during their day-to-day activities due to the volume variation of the stump. This paper evaluates the volume fluctuations of the stump and the reasons for the cause.3D scanning of the stump was done using Einscan Pro+ 3D scanner, and by following a timeline as follows: Two scans were taken upon arrival of the amputee with a 5min resting period. Then the amputee was directed to do physical activities for 15 minutes. After that the amputee was seated with the socket doffed, and four more scans were acquired with 7-minute intervals. This procedure was repeated for four days which resulted in 24 scans in total. The results of the scans showed a pattern in the variation in volume at several phases. After engaging in physical activities, the volume of the stump had a significant reduction. Resting after engaging in an activity resulted in an increase in the volume. Prolonged sitting caused a variation in the volume of the stump. This may have been caused by Edema, fluid redistribution, or soft tissue compression. This paper concludes that the volume of the stump varies throughout the day. Therefore, a traditional socket cannot give the proper comfort to the amputee. The best method would be studying the volume variation and coming up with an average volume for the stump to design the socket. This can be performed using 3D scanning.

Keywords: *Amputee, 3D scanning, socket, transtibial, volume fluctuations*

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Water quality of the treated water samples from effluent treatment plants of two main hospitals in Kurunegala, Sri Lanka

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The health services play a pivotal role in augmenting human longevity and life expectancy. However, the concurrent expansion of healthcare facilities has precipitated a proportional increase in clinical effluent generation. Improper management of clinical wastewater may expose health and safety hazards to the health workers, the public, and the environment as well. This study compares the clinical wastewater management approaches at Hospital 1 with Hospital 2. Effluent samples from both hospitals' treatment facilities were subjected to comprehensive physicochemical analysis, examining critical parameters including Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD5/L), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), pH at ambient temperature, and Electrical Conductivity (EC). These parameters were evaluated against the ambient water quality standards established by the Central Environmental Authority (CEA), Sri Lanka. When analyzing the all-mean values according to the relevant parameters in each effluent treatment plant of the hospitals, Hospital 1 treated water can be recommended for 'commercial use' in comparison to Hospital 2 treated water according to the CEA criteria. However, neither facility's treated effluent meets potability standards without additional purification processes. It is advised that a variety of physical, chemical, and biological characteristics be utilized to evaluate the quality of treated water at both Hospital 1 and Hospital 2, as only a few of the key criteria (6) have been considered in the current investigation. This preliminary research serves as a foundation for more extensive future investigations. In alignment with World Health Organization (WHO) and CEA guidelines for optimal clinical waste management, it is imperative to implement standardized protocols utilizing contemporary instrumentation subject to regular calibration and monitoring. Continuous surveillance of physicochemical and biological parameters in water treatment facilities remains crucial for maintaining environmental compliance and public health standards.

Keywords: *Ambient water quality standards (CEA), commercial use, effluent treatment plants, hospital wastewater, physicochemical parameters*

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Unveiling bioactive wonders of *Kalanchoe pinnata* (Lam.) Pers., *Portulaca oleracea L.* and *Morinda citrifolia L.*

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Plants with medicinal values are rich in secondary metabolites. This study assesses selected bioactivities of traditional medicinal plants *Kalanchoe pinnata* (Akkapana), *Portulaca oleracea* (Gendapala) leaves, and, *Morinda citrifolia* (Ahu) which are highly regarded for their health benefits. The plant materials were collected, cleaned, air dried, ground, and extracted using methanol by sonication and subjected to bioassays. The antioxidant potential was determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and Ferric Reducing Antioxidant Power (FRAP) assays. In the DPPH assay, *K. pinnata* showed an IC_{50} value of 12.97 ± 0.82 mg L^{-1} compared to the positive control: ascorbic acid (3.17 ± 0.47 mg L^{-1}). Meanwhile, *P. oleracea* and *M. citrifolia* showed IC_{50} values of 527.61 ± 4.68 mg L^{-1} and 552.51 ± 5.13 mg L^{-1} respectively. In the FRAP assay, *K. pinnata* showed a reducing power of 0.783 µmol dm^{-3} of $FeSO_4$ g^{-1} which was lower than the positive control; trolox (12.07 ± 0.30 µmol dm^{-3} of $FeSO_4$ g^{-1}). Only *K. pinnata* displayed α-amylase inhibitory potential with an IC_{50} value of 127.50 ± 8.64 mg L^{-1} compared to positive control: acarbose (45.99 ± 3.97 mg L^{-1}). *K. pinnata*, *P. oleracea* and *M. citrifolia* showed, percentage lipase inhibitions of 43.61 ± 1.53%, 35.81 ± 0.70%, and 33.40 ± 0.70% at 1000 mg L^{-1} respectively compared to the positive control: orlistat (100.00%). In the brine shrimp lethality assay only *M. citrifolia* exhibited an LC_{50} value of 474.08 ± 45.86 mg L^{-1} compared to positive control: $K_2Cr_2O_7$ (LC_{50} 35.16 ± 0.10 mg L^{-1}). In phytotoxicity assay, *P. oleracea* displayed a root inhibition with an IC_{50} value of 818.53 ± 21.88 mg L^{-1} compared to positive control: abscisic acid (0.29 ± 0.10 mg L^{-1}). In conclusion, among the three extracts *K. pinnata* exhibited higher antioxidant and α-amylase inhibitory potentials. Future directions of this study include chromatographic separation of the crude extracts to obtain bioactive compounds.

Keywords: *α-Amylase, antioxidant, cytotoxicity, lipase, phytotoxicity*

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Bioactivity studies of *Eugenia uniflora* L. and *Vitex negundo* L.

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Plants have been used to treat various ailments since ancient times. *Eugenia uniflora* (Suriname cherry) is used to treat low blood pressure. *Vitex negundo* (Sudu Nika) is used to treat asthma. This study was carried out to determine selected bioactivities of methanolic extract of *E. uniflora* leaves, *V. negundo* leaves, and stem. The dried, and ground samples were extracted into methanol using sonication. Extracts obtained were screened for antioxidant activity against *2,2'-diphenyl-1-picrylhdrazyl* (DPPH) and ferric reducing antioxidant power (FRAP) assays, cytotoxicity against brine shrimps, phytotoxicity against lettuce seeds, and inhibitory activity against α-amylase enzyme. The highest DPPH scavenging ability was shown by *E. uniflora* (IC_{50} 13.00 ± 1.47 mg L^{-1}) compared with the positive control: ascorbic acid (IC_{50} 7.67 ± 0.47 mg L^{-1}). *V. negundo* leaves and stem showed IC_{50} values of 174.54 ± 4.63 mg L^{-1}, and 41.19 ± 2.24 mg l^{-1} respectively. The highest activity in the FRAP assay was shown by *V. negundo* stem (6.63 µmol $dm^{-3}FeSO_4$ /g) which was lower than the positive control: Trolox (12.07 ± 0.30 µmol $dm^{-3}FeSO_4$ /g). *E. uniflora* and *V. negundo* leaves showed 0.61 µmol $dm^{-3}FeSO_4$ /g and 2.10 µmol $dm^{-3}FeSO_4$ /g respectively. In the brine shrimp lethality assay, only *V. negundo* leaves and stem showed LC_{50} values of 47.21 ± 15.81 mg L^{-1} and 527.91 ± 11.43 mg L^{-1} respectively, compared to the positive control: $K_2Cr_2O_7$ (LC_{50} 35.16 mg L^{-1}). None of the extracts showed phytotoxicity. In the α-amylase inhibitory assay, the highest percentage inhibition was shown by *E. uniflora* (53.89 ± 2.35%) for 1000 mg L^{-1} compared with the positive control: acarbose (IC_{50} 45.99 ± 3.97 mg L^{-1}) and *V. negundo* leaves and stem showed 8.94 ± 3.27%, 13.73 ± 4.35% respectively. The results demonstrated that all extracts exhibited antioxidant potential while displaying weak phytotoxicity. The study demonstrates the potentialities of extracts for further product development.

Keywords: *α-Amylase, antioxidant activity, bioactivities, cytotoxicity, phytotoxicity*

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Nature's hidden potentials: bioactivity assessments of *Commelina benghalensis*, *Erythrina variegata* L. and *Symplocos cochinchinensis*

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Nature offers a rich abundance of bioactive compounds with diverse medicinal benefits. *Commelina benghalensis*, *Erythrina variegata L.*, and *Symplocos cochinchinensis* are ayurvedic medicinal plants in Sri Lanka, which are used to treat various ailments such as intestinal worms, cholesterol imbalance *etc*. The objective of this study was to evaluate the bioactivities of methanolic extracts of the plants. Leaves of plants were collected from the Central Province of Sri Lanka. They were cleaned, air-dried, and powdered using a grinder and extracted into methanol by sonicating for 30 minutes. The crude extracts were evaluated for antioxidant activity using 2,2-diphenyl-2-picrylhyrdazyl (DPPH) radical scavenging assay and Ferric Reducing Antioxidant Power (FRAP), α-amylase inhibitory, cytotoxicity against brine shrimp lethality and phytotoxicity against lettuce seed germination. In DPPH radical scavenging, the extract of *C. benghalensis* showed the highest activity (IC_{50} = 28.26 ± 2.74 mg L^{-1}), when compared to the extract of *E. variegata* and *S. cochinchinensis*, which displayed IC_{50} values 53.64 ± 5.38 mg L^{-1} and 35.29 ± 3.34 mg L^{-1} respectively, where the IC_{50} of positive control ascorbic acid was 1.97 ± 0.06 mg L^{-1}. In the FRAP assay, positive control trolox showed a reducing potential of 12.07 ± 0.30 µmol dm^{-3} of 1 g of $FeSO_4$. FRAP values of *C. benghalensis, E. variegata L.* and *S. cochinchinensis* were obtained as 2.741 µmol dm^{-3}, 2.367 µmol $dm^{-3,}$ and 3.430 µmol dm^{-3} of $FeSO_4$ respectively. *S. cochinchinensis*, *C. benghalensis*, *E. variegata* L. showed 594.66 mg L^{-1}, 6647.52 mg L^{-1} and 26903 mg L^{-1} cytotoxicity compared to the positive control $K_2Cr_2O_7$ (LC_{50} = 35.16 mg L^{-1}). None of the extracts showed α-amylase inhibitory activity or phytotoxicity. In conclusion, *C. benghalensis* leaf extract shows strong antioxidant potential, weak root inhibition, and reduced brine shrimp lethality, indicating its therapeutic promise and the need for further research into its bioactive compounds.

Keywords: *α-Amylase, antioxidant, cytotoxicity, phytotoxicity*

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Bioactivity of methanolic leaf extracts of *Pterocarpus marsupium* and *Sauropus androgynus*

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This study determines the bioactivities of the leaves of three abundantly distributed plants in Sri Lanka. Healthy leaves of *Sauropus androgynus* ('Japan Batu') and *Pterocarpus marsupium* ('Gammalu') were collected from the Central Province of Sri Lanka. Plant samples were cleaned, air-dried, and ground into a fine powder. Extracts were obtained using methanol by sonication. The antioxidant potential of crude extract was tested by 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and Ferric Reducing Antioxidant Power (FRAP), cytotoxicity by brine shrimp lethality, phytotoxicity by the lettuce seed germination and, α-amylase inhibitory assays. Results of the DPPH radical scavenging assay revealed that the extracts *S. androgynus* have strong antioxidant activity (IC_{50} of 38.12 ± 0.03 mg L^{-1}) and *P. marsupium* has moderate antioxidant activity (IC_{50} 166.01 ± 0.02 mg L^{-1}) in comparison with the positive control: ascorbic acid (IC_{50} 1.97 ± 0.02 mg L^{-1}). For FRAP assay, none of the crude extracts resulted in high FRAP values (0.42-0.38 µmol of $FeSO_4$/mg of the sample) compared to the positive control trolox (12.07 ± 0.03 µmol of $FeSO_4$/mg of the sample). *Sauropus androgynus* and *P. marsupium* showed weak lethality against brine shrimps with LC_{50} of 1900.74 and 1685.80 mg L^{-1}, respectively as compared to the positive control $K_2Cr_2O_7$ (LC_{50} 35.16 mg L^{-1}). The IC_{50} for percentage root and shoot inhibition of both plant extracts were above 1000 mg L^{-1} than the positive control, abscisic acid (shoot: 0.99 and root: 1.11 mg L^{-1}) indicating the weak phytotoxicity of these plants. Further, none of the extracts showed enzyme inhibitory activity against the *α*-amylase. In summary, *S. androgynus* leaf extract showed strong and *P. marsupium* leaf extract showed moderate antioxidant potential with respect to DPPH assay.

Keywords: *Antioxidant activity, cytotoxicity, enzyme inhibitory activity, phytotoxicity*

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In vitro antioxidant, cytotoxic, and phytotoxic potential of some Sri Lankan medicinal plants

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This study aims to determine the antioxidant potential, cytotoxicity, and phytotoxicity of medicinally important *Alpinia calcarata* rhizome ('Araththa'), *Sida alnifolia* leaves ('Babila') and *Tinospora cordifolia* stem ('Rasakinda'). Firstly, these plants were collected, cleaned, air-dried, and ground into fine powders. They were extracted into methanol by sonication and evaporated to dryness. The crude extracts were tested for antioxidant activity by the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, phytotoxicity by the lettuce seed germination assay, and cytotoxicity by brine shrimp lethality assay. The results of the DPPH radical scavenging assay showed that *A. calcarata* exhibited a strong antioxidant potential with an IC_{50} of 34.53 mg L^{-1} followed by *T. cordifolia* (IC_{50} 130.47 mg L^{-1}) and *S. alnifolia* (179.23 mg L^{-1}) compared to positive control ascorbic acid IC_{50} 1.90 ± 0.01 mg L^{-1}. For the brine shrimp lethality assay positive control $K_2Cr_2O_7$ showed LC_{50} of 34.40 ± 0.30 mg L^{-1} whereas *A. calcarata* and *T. cordifolia* resulted in moderate cytotoxicity with LC_{50} of 249.99 mg L^{-1} and 275.57 mg L^{-1} respectively. The root elongation inhibition resulted in the lettuce seed assay can be aligned as *T. cordifolia* (IC_{50} 172.46 mg L^{-1}), *A. calcarata* (IC_{50} 635.02 mg L^{-1}) and *S. alnifolia* (IC_{50} 1322.83 mg L^{-1}). Whereas, their shoot elongation inhibition can be aligned as *S. alnifolia* (IC_{50} 193.35 mg L^{-1}), *A. calcarata* (IC_{50} 420.17 mg L^{-1}), and *T. cordifolia* (IC_{50} 1317.52 mg L^{-1}). However, none of them showed strong root or shoot elongation inhibition potentials as positive control; abscisic acid which resulted IC_{50} 1.46 ± 0.19 mg L^{-1} and 1.85 ± 0.31 mg L^{-1} for root and shoot elongation inhibitions respectively. Based on these findings, it can be concluded that *A. calcarata* rhizome extract contains a remarkable antioxidant potential and moderate cytotoxicity similar to *T. cordifoli. T. cordifolia* and *S. alnifolia* extracts have moderate phytotoxicity against root and shoot elongation respectively.

Keywords: *Alpinia calcarata, DPPH, Sida alnifolia, Tinospora cordifolia*

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Antioxidant, antidiabetic and cytotoxic activities of methanolic extracts of *Zingiber officinale* and *Zingiber zerumbet*

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Plants belonging to the Zingiberaceae family have long been used in traditional medicine practices and as spices. As such, the current study aimed to determine the bioactivities of methanolic extracts of *Zingiber officinale* (common ginger) and *Zingiber zerumbet* (wild ginger) rhizomes and to assess their potential as pharmaceutical and agricultural sources in related developments. Fresh rhizomes were collected in Kandy district, Sri Lanka. They were air-dried and ground to powder. The powdered samples were extracted in methanol by sonication for 30 minutes. This process was carried out twice and then the filtrates were combined and evaporated to dryness on a rotary evaporator. The extracts were screened for their antioxidant activity by the *2,2-diphenyl-1-picrylhydrazyl* (DPPH) radical scavenging method, enzyme inhibitory activity against *α*-amylase, *α*-glucosidase, and lipase, cytotoxicity by the brine shrimp lethality assay, and phytotoxicity by the lettuce seed germination bioassay. The results showed the IC_{50} = 29.80±2.06 mg L^{-1} value of *Z. officinale* is significantly higher than the positive control ascorbic acid with IC_{50} = 3.47±0.45 mg L^{-1}. *Z. zerumbet* exhibited weak activity against DPPH radical scavenging assay since not detecting 50% of inhibition within the tested concentration range. For enzyme inhibition, *Z. zerumbet* showed percentage *α*-glucosidase inhibition of 100% for 1000 mg L^{-1}, more effective than *Z. officinale* which showed percentage inhibitions of 60% at 1000 mg L^{-1}. However, their IC_{50} values were higher compared to the positive control: acarbose with IC_{50}=8.87±1.21 mg L^{-1}. Both extracts exhibited remarkable results for brine shrimp lethality, with LC_{50} values of 15.34±2.06 mg L^{-1} for *Z. zerumbet* and 48.06±3.34 mg L^{-1} for *Z. officinale*, respectively, against the positive control, atropine, LC_{50} = 88.60±8.11 mg L^{-1}. No positive activity results were observed for the *α*-amylase, lipase and phytotoxicity bioactivity studies. The findings indicate that *Z. officinale* displayed potent antioxidant capacity, while *Z. zerumbet* exhibited good *α*-glucosidase inhibitory activity. Both extracts demonstrated notable cytotoxic effects, with *Z. zerumbet* showing enhanced efficacy in this regard. These results suggest *Z. zerumbet* as a potential candidate for antidiabetic and anticancer therapies, while *Z. officinale* may be better suited for antioxidant-based applications.

Keywords: *Antioxidant activity, cytotoxicity, α-glucosidase, Zingiber officinale, Zingiber zerumbe*

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Evaluation of the bioactive potential of *Argyreia populifolia* leaves extract: assessing antioxidant, cytotoxic and phytotoxic properties

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Argyreia populifolia (Girithilla) is a flowering plant belonging to the Convolvulaceae family and native to the tropical regions of South Asia. Mainly the plant is traditionally utilized in various folk medicines and agricultural applications. The leaves of *A. populifolia* are known for their rich composition of bioactive compounds which have garnered scientific interest for their potential therapeutic applications. The collected fresh leaves were air-dried and powdered. The ground powder sample was extracted into the methanol by using a sonicator for 30 minutes at three intervals. The resulting solution was evaporated using a rotary evaporator to obtain the crude extract. This crude extract was subjected to several assays to evaluate its biological activities including antioxidant properties against DPPH (2,2-Diphenyl-1-picrylhydrazyl) radicals, cytotoxic activity against *Artemia salina* (brine shrimps) and phytotoxic activity against to lettuce seeds germination across a concentration range of 1000 mg L^{-1} – 31.25 mg L^{-1}. DPPH radical scavenging assay for *A. populifolia* revealed IC_{50} value of 4.31 ± 2.60 mg L^{-1} is higher, compared to the positive control of ascorbic acid value of 1.97 ± 0.06 mg L^{-1}. The cytotoxic activity was tested using the brine shrimp lethality assay, revealing an LC_{50} value of 176.98 ± 9.73 mg L^{-1}, significantly higher than the positive control of $K_2Cr_2O_7$, with an LC_{50} of 35.16 mg L^{-1}. Phytotoxicity was evaluated using lettuce seed germination, where the root and shoot inhibition IC_{50} values were 4.46 ± 2.79 mg L^{-1} and 2.48 ± 1.89 mg L^{-1} respectively compared to the positive control of abscisic acid, with IC_{50} values of 0.29 ± 8.00 mg L^{-1} for root and 0.25 ± 8.09 mg L^{-1} for shoot inhibition. These results demonstrate that the extract of *Argyreia populifolia* possesses significant and remarkable antioxidant properties, high potential cytotoxicity properties, and phytotoxicity properties of root and shoot.

Keywords: *Cytotoxicity,* DPPH, *germination, phytotoxicity, radical*

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In vitro bioactive potential of leaf extracts from *Hyptis capitata*, Plectranthus *zaterhendi* and *Bauhinia variegata*

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The exploration of medicinal plants for bioactive compounds is crucial due to their potential therapeutic applications in treating various health conditions. This study investigated some bioactivities of leaf extracts of three plant species from Sri Lanka, *Hyptis capitata* ('Knobweed'), *Plectranthus zatarhendi* ('Iriweriya'), and *Bauhinia variegata* ('Koboleela'), collected from the Central Province. After shade drying, grinding, and extraction into methanol, the extracts were tested for bioassays: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging and FRAP (Ferric Reducing Antioxidant Power) assays for antioxidants, α-amylase and lipase assays for antidiabetic and antiobesity effects, and brine shrimp lethality for cytotoxicity. *H. capitata* exhibited the strongest antioxidant activity (IC_{50} 11.36 ± 0.15 mg L^{-1}) in the DPPH assay, compared to the positive control ascorbic acid (IC_{50} 1.97 ± 0.02 mg L^{-1}). *P. zatarhendi* and *B. variegata* displayed moderate antioxidant effects with IC_{50} 169.69 ± 3.39 mg L^{-1} and 204.34 ± 2.04 mg L^{-1}, respectively. The results of the FRAP assay corroborated these findings, with *H. capitata* recording the highest value (1.62 ± 0.02 μmol FeSO4 /mg), followed by *P. zatarhendi* (0.427 ± 0.01 μmol $FeSO_4$ /mg) and *B. variegata* (0.799 ± 0.01 μmol $FeSO_4$ /mg). The positive control, Trolox, showed a value of 12.07 ± 0.03 μmol $FeSO_4$/mg. *B. variegata* demonstrated strong α-amylase inhibitory activity (IC_{50} 52.35 ± 3.31 mg L^{-1}), almost similar to the positive control acarbose (IC_{50} 45.99 ± 3.97 mg L^{-1}) and moderate lipase inhibition (IC_{50} 150.75 ± 5.26 mg L^{-1}), compared to the positive control Orlistat (IC_{50} of 3.05±1.71 mg L^{-1}). *P. zatarhendi* showed weak activity in both assays (IC_{50} 675.46 ± 12.13 mg L^{-1} for α-amylase and IC_{50} 901.27 ± 15.53 mg L^{-1} for lipase). *H. capitata* exhibited IC_{50} > 1000 mg L^{-1} in both enzyme inhibitory assays. *P. zatarhendi* exhibited notable cytotoxicity (LC_{50} 311.00 mg L^{-1}), compared to the positive control $K_2Cr_2O_7$ (LC_{50} 35.16 mg L^{-1}), whereas *B. variegata* showed lower cytotoxicity (LC_{50} 809.65 mg L^{-1}). *H. capitata* exhibited weak cytotoxic effects. Overall, these findings highlight the potential of these plant species as sources of bioactive compounds for antioxidant, antidiabetic, and antiobesity therapeutic applications, emphasizing the need for further investigation into their specific chemical constituents.

Keywords: *Antidiabetic, antioxidant, B. variegata, H. capitata, P. zatarhendi*

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Life cycle assessment of a wastewater treatment plant (WWTP) in Sri Lanka

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Wastewater treatment plays a crucial role in mitigating environmental pollution, ensuring compliance with regulations, and safeguarding public health. Despite its benefits, the Wastewater Treatment Plant (WWTP) can introduce adverse effects due to chemical usage, high energy consumption, waste generation, and greenhouse gas emissions. Even though the environmental impact of the wastewater treatment processes has been assessed across the globe, it was not well explored within Sri Lanka. Thus, this study aims to assess the environmental impact of wastewater treatment techniques, by conducting a Life Cycle Assessment on a public wastewater treatment plant using ReCiPe method. The chosen plant utilizes an Anoxic-oxic (A/O) system with Polyacrylamide (PAM) flocculation and chlorine disinfection. The LCA results indicated that electricity consumption has the highest environmental impact across all 18 midpoint categories, with more than 75% contribution in most categories. The oxic zone of the A/O process, requiring significant energy for aeration, emerged as the primary contributor to these impacts. PAM usage influenced the Marine eutrophication category, while chlorine impacted the ionizing radiation category. Further analysis revealed that more than 70% of the impact in the A/O process is due to aeration energy consumption. The study underscores the importance of transitioning to renewable energy sources and exploring eco-friendly biological treatment methods to minimize environmental impacts. The findings highlight the need for mindful chemical selection and process optimization in industrial wastewater treatment. In conclusion, this research provides a fundamental understanding of environmental impacts in wastewater treatment, emphasizing the significance of renewable energy and sustainable practices. This study would be further developed to create a framework to assist Sri Lankan manufacturing industries in making informed decisions regarding wastewater treatment technologies, ultimately contributing to environmental sustainability and compliance with regulatory standards.

Keywords: *Anoxic-oxic system, environmental impact potential, environmental sustainability, industrial wastewater, wastewater treatment process*

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The study on investigating the effect of using leather waste in place of clay materials in molded rubber sole

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Leather is a strong, flexible, and durable material that is commonly used during the manufacturing of shoe uppers and insole materials. During the leather-cutting process for shoe upper manufacturing large amounts of cutting waste are generated. This solid waste of leather such as trimmings and scraps is usually discarded into landfills and it takes a long time to degrade. The idea was to add valuation to leather waste by replacing it with Clay. Raw materials of the clay extraction process impact the imbalance of biodiversity and ecosystem and can highly affect unfavorable health concerns. The study focuses on the use of leather cutting waste as a replacement for clay in the shoe sole compound formulation. The compound mixing involved two roll mills and vulcanization was followed by compression moulding method. Ground and sieved through 30 mesh (particle size < 0.595 mm) Leather cutting waste (Moisture content < 3%) was used as a replacement for clay dosage where systematically changed in increments of 0 %, 10 %, 20 %, and 30 % by weight percentage. The results revealed an increase in leather cutting waste as a replacement for clay led to a reduction in physio-mechanical properties such as Hardness, Tensile Strength, Elongation at the break, simultaneously specific gravity, 300 % Modulus, Tension set, Tear strength, Abrasion Resistance showed an increasing trend. According to the Scanning Electron Microscopy images indication leather waste is consistently incorporated within the rubber matrix. The rubber-leather composite consists of 20 % weight of leather cutting waste as a replacement for clay and exhibits significantly superior performance. This can be due to the inherent properties of leather-cutting waste that promote strong intermolecular interactions and greater compatibility with polymer base and clay. Rubber-leather composite consisting of 20 % replacement can be applied during the manufacturing of moulded sole which has commercial benefits plus a greater contribution to saving utilization of clay material while ensuring environmental sustainability.

Keywords: *Clay fillers, rubber compounding, rubber -leather composite, shoe sole, solid waste.*

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Synthesis and structure elucidation of boron-incorporated ZSM-5 zeolites using TEABr as a structure-directing agent

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Advancements in the porous structure and framework composition of ZSM-5 zeolites have gained substantial performance benefits for numerous industrial processes. This study investigates the influence of boron incorporation on the structural properties, crystallinity, and morphology of ZSM-5 zeolites, aiming to elucidate its impact on the overall performance of the material in industrial applications. The adjustability of framework composition can be achieved by the isomorphous substitution of heteroatoms into the zeolite structure. In this study, boro-alumino ZSM-5 zeolites were successfully synthesized by varying the Al: B ratio with a molar composition of 1 SiO_2: 0.0088 Al_2O_3: 0.255 Na_2O: 0.256 TEABr: 182 H_2O, at 453 K. Structure elucidation was carried out using advanced characterization techniques such as XRD, SEM, FTIR spectroscopy, and Raman spectroscopy. The XRD peak pattern and characteristic FT-IR inter-tetrahedral vibration of a five-membered ring at 540 cm^{-1} confirms the formation of ZSM-5 zeolites. SEM images emphasize the formation of ZSM-5 crystals with cuboidal morphology under the influence of TEABr. The presence of FTIR bands at 900 cm^{-1} and 1212 cm^{-1}, attributed to BO_3 and O-Si-O-B vibrations, respectively, in conjunction with a Raman shift at 1493 cm^{-1} corresponding to the Si-O-B bond, confirms the successful incorporation of boron into the aluminosilicate matrix. An increase in boron proportion is accompanied by a reduction in the intensity of the band at 1371 cm^{-1}, suggesting a distortion of the O-Al-O linkage. SEM and XRD analysis revealed that boron introduction does not alter the zeotype, however, it can impact the overall crystallinity of the synthesized material, in which excessive incorporation of boron disrupts the aluminosilicate framework, inhibiting the nucleation and growth of crystalline phases. These findings provide insights into the delicate balance between boron incorporation and preserving the structural integrity of ZSM-5 zeolites for potential applications.

Keywords: *Aluminosilicate, composition, inter-tetrahedral vibration, isomorphous substitution, morphology*

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Exploring the influence of boiling on the physicochemical properties of Bamboo (*Bamboo vulgaris*) shoots and extract for Bamboo shoot beer development

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Bamboo (*Bamboo vulgaris*) is valued for its diverse applications, ranging from construction materials to various food products. The production of bamboo shoot beer was successfully achieved using bamboo shoots as the primary ingredient. In this process, boiling was employed as a pretreatment method to prepare the bamboo shoots for fermentation. The boiling process is used as a pre-treatment for reducing cyanide levels in bamboo shoots. This study examines the impact of boiling on the physicochemical characteristics of bamboo shoots and extracts, as primary ingredients in bamboo shoot beer production. Fresh premature *Bambusa vulgaris* shoots were collected from the Kamburupitiya area, Matara district, Southern Province, Sri Lanka. Fresh premature *Bambusa vulgaris* shoots were peeled, washed, and boiled at 100 °C for 1hr and ground to create an extract. The extract was boiled at 90 °C for 10 min. The study followed standard methods for both physicochemical and chemical analysis. Boiling bamboo shoots increased($p<0.05$) moisture content significantly from 85.62±0.00% to 88.38±0.00% and crude fat from 1±0.00% to 1.06±0.00%. Crude fiber showed a slight increase ($p<0.05$) from 0.91±0.00% to 1.01±0.00%. Raw bamboo shoots had higher crude protein at 8.75±0.00 % compared to 5.25±0.01% in boiled shoots, with total mineral content decreasing significantly from 1.17±0.00% to 0.69±0.00 %. Carbohydrates increased significantly($p<0.05$) from 2.58% to 3.60%. Fresh bamboo shoot extract showed 0.22±0.00% fat, increasing($p<0.05$) to 0.3±0.00% after boiling, with consistent fiber at 0.92± 0.00 % and 0.95±0.0 %, respectively. Crude protein decreased slightly($p>0.05$) from 3.62± 0.02% in raw extract to 3.47± 0.00% in boiled extract, while total mineral content increased significantly($p<0.05$) from 0.63% ± 0.00 to 1.07±0.00%. Total sugar content increased($p<0.05$) significantly from 3.85±0.02% to 4.23±0.02%, with no detectable alcohol. Boiling increased pH from 6.23 to 6.81 and Brix value from 3.5 to 4, with specific density rising from 1.08 g/mL to 1.13 g/mL. The boiling process was found to effectively reduce the cyanide content in bamboo shoot extract. This reduction was confirmed through the use of the silver nitrate titration method. The boiling process effectively eliminates cyanide content in bamboo shoot extract while retaining and even enhancing both chemical and physicochemical properties such as moisture, crude fat, total sugars, and specific density. These results indicate that bamboo shoot extract is a nutritionally rich ingredient which suitable for beer production.

Keywords: *Bamboo shoot extract, boiling, brix value, premature bamboo shoots, proximate analysis*

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Phytochemical and antibacterial analysis of *Abelmoschus moschatus*

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The discovery of novel antibiotic drugs is crucial to face the increasing bacterial resistance towards antibiotics. *Abelmoschus moschatus* (Musk Mallow) is a medicinal plant used in Ayurvedic medicine to treat diseases ranging from asthma to stomach cancer. Past studies have found that the leaves and seeds of *A. moschatus* show broad-spectrum antibacterial activity against common, pathogenic bacteria. However, there is little research on the antibacterial activity of the stems of *A. moschatus*. This was a comparative study of the phytochemical and antibacterial properties of extracts of *A. moschatus* leaves and stems to determine if the *A. moschatus* stems showed appreciable antibacterial activity against common pathogenic bacteria; gram-positive *Staphylococcus aureus* (NTCC 29213), and gram-negative *Escherichia coli* (NTCC 25922). Hexane, ethyl acetate, and methanol were used to sequentially extract bioactive compounds from the stems and leaves. The plant extracts were subjected to a qualitative phytochemical analysis followed by an antibacterial activity analysis using the EUCAST disc diffusion method. Phytochemical screening results indicated that the *A. moschatus* leaf extracts contained the highest number of the phytochemicals tested. Disc diffusion assay results showed ethyl acetate extracts of *A. moschatus* stem had the highest diameter of zone of inhibition against both *E. coli* ($8.67 \times 10^{-3} \pm 1.15 \times 10^{-3}$ m) and *S. aureus* ($8.00 \times 10^{-3} \pm 1.00 \times 10^{-3}$ m). In contrast, the ethyl acetate extracts of *A. moschatus* leaves showed the lowest diameter of zone of inhibition against *E. coli* ($6.67 \times 10^{-3} \pm 5.80 \times 10^{-4}$ m) and *S. aureus* ($6.67 \times 10^{-3} \pm 5.80 \times 10^{-4}$ m). Further, *A. moschatus* extracts were more potent against *S. aureus* than *E. coli*. In conclusion, *A. moschatus* stem extracts show a higher antibacterial effect than the leaf extracts and suggest that they have the potential to be a source of novel antibacterial drugs.

Keywords: *Antimicrobial resistance, disc diffusion assay, medicinal plants, natural products*

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Evaluation of biological potentials of *Achyranthes aspera L.*, *Santalum album L.* and *Withania somnifera L.*

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Plants have been the major source of drugs to treat different kinds of diseases like cancers and diabetes in traditional medicine. *Achyranthes aspera*, *Santalum album* L and, *Withania somnifera* are commonly used medicinal plants in Sri Lanka. This study evaluates the biological activities of outlined plants. Plants were collected from the Central province of Sri Lanka. The leaves were air-dried, ground, and extracted with 100% methanol by sonicating for 30 minutes. The plant extracts were assessed for antioxidant activity using 2,2-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging assay, Ferric Reducing Antioxidant Power (FRAP) assay, enzyme inhibitory activity against α-amylase, brine shrimp lethality assay and phototoxicity against germination of lettuce seeds. All the bioassays were conducted within the concentration range of 31.25-1000 mg L^{-1}. Among the plant extracts, *A. aspera* demonstrated the highest DPPH radical scavenging ability (IC_{50} = 194.84 ± 7.004 mg L^{-1}), followed by *S. album* (IC_{50} = 199.93 ± 2.27 mg L^{-1}) and *W. somnifera* (IC_{50} = 927.13 ± 10.9 mg L^{-1}). However, the values obtained were higher than the positive control ascorbic acid IC_{50} value (1.97 ± 0.06 mg L^{-1}). In the FRAP assay, all the extracts showed lower FRAP values compared to the positive control; trolox (12.07 ± 0.30 µmol dm^{-3} of $FeSO_4$/g). In the brine shrimp lethality assay, only *S. album* showed lethality with an LC_{50} value of 509.281 ± 0.89 mg L^{-1} which was higher than the positive control $K_2Cr_2O_7$ (LC_{50} 35.16 mg L^{-1}). None of the plant extracts showed α-amylase inhibitory activity and phytotoxicity within the tested concentration range. In conclusion, *A. aspera* exhibited the highest antioxidant activity in the DPPH assay, though less potent than ascorbic acid. All extracts showed lower ferric-reducing power and α-amylase inhibitory activity. Only *S. album* demonstrated cytotoxicity in the brine shrimp assay, albeit weaker than the positive control.

Keywords*: α-Amylase, cytotoxicity, DPPH, FRAP, phytotoxicity*

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Incorporation of microcrystalline cellulose (MCC) modified eugenol into natural rubber latex glove compound

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In recent decades, there has been significant interest in renewable, biodegradable polymers to mitigate the environmental impact of synthetic materials. Cellulose, a versatile macromolecule, offers vast mechanical, chemical, and physical properties through various modifications, making it a promising sustainable material. Clove oil, containing eugenol (EUG), enhances polymer properties and hygiene. Natural rubber, widely used for its excellent physical and chemical properties, serves numerous industrial and household applications. This study aims to develop a novel, eco-friendly natural rubber latex glove compound (NRLGC) by incorporating microcrystalline cellulose (MCC) and eugenol (EUG) to achieve long-term antimicrobial activity and enhanced mechanical properties. To address the volatility of eugenol, it was chemically bound to MCC through thiol-ene click reaction and thiol-alkyl bromide chemical reactions. MCC was initially treated with thioglycolic acid, incorporating a thiol group confirmed by FTIR analysis. Thiolated MCC (thiol-MCC) was then combined with eugenol under UV light reacting the allylic double bond with the thiol group of thiol-MCC using azobisisobutyronitrile (AIBN) as a photoinitiator. Before the thiol-alkyl bromide reaction, EUG was brominated using HBr. Additionally, brominated eugenol was reacted with thiol-MCC in the presence of potassium carbonate (K_2CO_3), confirmed by FTIR spectroscopy. These modified compounds were used as an ingredient for a natural rubber latex glove compound. MCC-incorporated compounds showed a decrement in tensile and tear strengths while thiol-MCC and thiol-MCC-EUG incorporated latex sheets showed enhanced mechanical properties, demonstrating the potential for improved performance and durability in natural rubber products. Future research should explore the long-term durability and biodegradability of the modified latex gloves to confirm their suitability for widespread use. Additionally, optimizing the concentration of thiol-MCC and thiol-MCC-EUG compounds could further enhance mechanical properties. Implementing these findings in industrial applications could lead to the development of more durable and antimicrobial rubber products, benefiting various sectors such as healthcare and food packaging.

Keywords: *Eugenol, natural rubber latex, thiol-alkyl halide reaction, thiol-ene click reaction*

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Revolutionizing cement production: zeolite-based materials for sustainable practices, CO_2 reduction, and enhanced mechanical properties

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The detrimental effects of carbon dioxide (CO_2) emissions, particularly their contribution to climate change and global warming, necessitate immediate action to lower industry-wide carbon footprints. The cement industry, essential for global infrastructure, is a major contributor to CO_2 emissions, accounting for approximately 8% globally. The production of ordinary Portland cement (OPC) involves the calcination of limestone at 1500°C, producing clinker, releasing a significant amount of CO_2 and extensive heat, which solely rely on fossil fuel combustion, further exacerbating environmental impacts. Clinker provides the key binding properties needed for cement to harden and gain strength when mixed with water. However, clinker production alone generates more than half of the industry's CO_2 emissions, making it highly carbon-intensive. To address these challenges, pozzolanic supplementary cementitious materials (P-SCMs), such as fly ash, slag, and particularly aluminosilicate zeolites, present a promising solution. Zeolites, minerals known for their high porosity and adsorption properties, can partially replace cement clinker by up to 40% of the total volume, reducing total CO_2 emissions by approximately 30% during production and curing stages. This focus extends to the physiochemical properties of zeolites that facilitate effective adsorption. Additionally, zeolites in their catalytic industrial by-product form, offer greener alternatives to raw materials and aid in sustainable energy usage and waste management, and are known to reduce energy consumption in cement kilns by up to 15%. Such considerations which rely on factors such as zeolite type, dosage, and mix design, contribute to the overall role of both natural and synthetic zeolites in fostering eco-friendly practices throughout the production process, noting that specific blends with distinct ratios can improve the cement's long-term mechanical durability by increasing its resistance to external chemical attacks, thus, making this study a thorough examination of the potential of zeolitic materials to promote sustainable practices in the cement industry.

Keywords: *Adsorption, aluminosilicate, cement, environment, sustainability*

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Comparative study of the nutritional value of different egg types (chicken eggs, turkey eggs, quail eggs) available in Sri Lanka

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Eggs are considered the most low-cost, highly nutritious, and bioavailable dietary protein source hence widely consumed worldwide. Different views exist in the Sri Lankan society regarding the nutritional value of eggs. Therefore, the objective of the present work was to conduct a comparative study of the nutritional value of commercial chicken eggs, village chicken eggs, turkey eggs, and quail eggs. Proximate analysis and the fatty acid composition of these categories of eggs were determined. The fatty acid profile was determined according to the SLS 313 Part 4 -Section 2: 2017 (FD/TM/7.2/007). Proximate composition was determined according to the methods described in AOAC. Results showed that turkey eggs have the highest fat content (14.87 ± 0.14%), highest caloric value (7812.95 ± 58.03 kJ kg^{-1}), highest saturated fatty acid (SFA) content (41.81 ± 0.79%), highest mono-unsaturated fatty acids (MUFA) content (51.79 ± 1.88%) and lowest polyunsaturated fatty acids (PUFA) content (3.04 ± 0.45%). Quail eggs (13.20 ± 0.18%) had the highest protein content, PUFA content (16.01 ± 1.43%), and lowest SFA content (34.55 ± 1.10%). Oleic acid was the most abundant fatty acid in these categories of eggs. The caloric value of village chicken eggs (6955.87 ± 133.07 kJ kg^{-1}) was higher than that of commercial chicken eggs (6142.83 ± 170.15 kJ kg^{-1}) while the contents of macronutrients (carbohydrate, protein, fat) were similar. Quail eggs can be considered a well-balanced source of proteins, and fat, suitable fatty acid composition with a high percentage of MUFA and PUFA and comparatively high caloric value. However, the nutritional composition of a hen's diet, breeds, age, and environmental factors such as temperature, housing, and stress levels impose an impact on the fatty acid content and fat content. Therefore, insufficient data on feeding practices, breed, and age were the limitations of the present study.

Keywords: *Chicken eggs, fatty acid composition, proximate composition, quail eggs, turkey eggs*

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A novel carbon-based electrochemical sensor for fenobucarb detection

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The excessive application of carbamate pesticides showed relatively high toxicity due to inhibiting the acetylcholinesterase enzyme in the neutral system of insects. This study explores the potential of using a pencil led electrode to detect fenobucarb, a carbamate insecticide of environmental concern, through cyclic voltammetry (CV) and differential pulse voltammetry (DPV). In this research, bare HB-grade pencil lead was employed for the detection of fenobucarb. The pencil lead electrode, serving as the working electrode, was selected for its simplicity, cost-effectiveness, and easy accessibility, making it suitable for electrochemical sensing applications. The alkaline hydrolysis of fenobucarb results in the formation of 2-sec-butyl phenol, a more readily oxidizable compound than the parent pesticide, and can be electrochemically detected under more favorable conditions. Notably, fenobucarb itself does not generate a detectable signal at the electrode using DPV within the potential range of +0.3 to +0.85 V. Investigations into optimal conditions for quantitative hydrolysis revealed that a 0.1 M NaOH concentration is adequate for complete hydrolysis of fenobucarb. Additionally, the optimal measurement conditions were established at pH 7, with a scan rate of 100 mV s^{-1}, resulting in a limit of detection (LOD) and quantification (LOQ) of 46.15 mg l^{-1} and 153.14 mg l^{-1} for CV, and 8.29 mg l^{-1} and 27.63 mg l^{-1} for DPV, respectively. These findings demonstrate that both CV and DPV methods are effective for detecting fenobucarb, with DPV showing superior sensitivity. The electrode developed has proven efficient in detecting fenobucarb, and future work will focus on modifying the bare electrode to further enhance sensitivity and conduct additional characterization.

Keywords*: Cyclic voltammetry, differential pulse voltammetry, pencil lead electrode*

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Development of glaze for red clay-based cookware

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For millennia, red clay cookware has been a mainstay in kitchens due to its attractive aesthetic, environment-sustainable production, and familiar taste of foods. However, cookware manufacturers must innovate to remain competitive in the market. A glaze can significantly enrich the functionality, durability, cover deformations and enhance the resilience of the clay cookware to thermal shock. Traditional cooking in unglazed clayware allows moisture absorption and mineral leaching, enhancing flavor and texture. The developed glaze merges these benefits with durability. It meets contemporary standards and appeals to health-conscious consumers, potentially establishing a new category of innovative glazed clay cookware in Sri Lanka. Ceramic-glazed cookware on the other hand prevents moisture transfer and simplifies cleaning, while offering thermal shock resistance and aesthetic appeal, affecting both cooking processes and food profiles. This study develops a specialized glaze for Sri Lankan red clay cookware, incorporating natural minerals such as quartz, feldspar, calcite, dolomite, zinc oxide, and ferrous oxide. The milled raw materials were sieved, and the physical and chemical properties of the slurries were optimized to meet the required standards. The raw materials were characterized by X-ray diffraction (XRD) analysis. The thermal expansion coefficient of the glaze (α_{glaze} = 5.73×10^{-6} at 500 °C) and the body (α_{body} = 5.35×10^{-6} at 500 °C) were closely matched. The quality and the durability of the final product were ensured by determining the water absorption, peel-off, freezer safety, spalling, outdoor leaving, dishwasher proof, alkali proof, acid proof, and boiling waterproof tests. The robustness and suitability of the developed glaze for practical applications were confirmed.

Keywords: *Characterization, clay, raw materials*

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Quantification of cholesterol content in milk and milk products in Sri Lanka using gas chromatography

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This study presents a novel gas chromatography methodology specifically tailored for the quantification of the cholesterol content of milk and milk products pertinent to the Sri Lankan diet. Direct saponification with 60% KOH in an alcoholic medium, extraction of liberated cholesterol into n-hexane, and quantification by gas chromatography-flame ionization detector (GC-FID) was done. With 10.00 - 200.00 mg kg^{-1} cholesterol standard series, the FID response was linearly correlated to standard concentrations with a coefficient of determination greater than 0.995. Cholesterol was detected around 17 minutes. Repeatability (3.75%) was within the satisfactory range. Limits of detection (LOD) ranged from 0.1 to 1.4 mg kg^{-1}, while limits of quantification (LOQ) ranged from 0.2 to 4.3 mg kg^{-1} across different matrices on a wet matter basis. The average recoveries for the lower and higher levels of cholesterol content were 91% and 94%, respectively. Total fat percentages were determined according to the Sri Lanka Standard methods. Considering the cow's, goat's, and buffalo's milk, the total fat percentage was not significantly different from each other ($p < 0.05$). The cholesterol content of goat's milk was significantly different from both cow's and buffalo's milk ($p > 0.05$) and there was no significant difference between cow's and buffalo's milk ($p < 0.05$). Cholesterol content (mg kg^{-1}) in cow's milk, buffalo's milk, goat's milk, cow's milk curd, buffalo's milk curd, milk powder, yoghurt, and butter were 1.1±0.3, 1.1±0.3, 1.6±0.4, 1.3±0.3, 1.4±0.4, 8.3±2.0, 0.9±0.2, and 20.7±2.2, respectively, while total fat percent by mass were 3.5±1.4, 4.3±1.2, 5.2±1.8, 5.2±1.2, 6.3±2.3, 26.9±0.7, 3.0±0.1, and 81.6±1.1. All samples showed a positive correlation between total fat percentage and cholesterol content. The overall results demonstrated that the developed GC-FID method is a reliable and accurate method for the quantification of cholesterol in milk and milk products.

Keywords: *Correlation, GC-FID, method validation, total fat percentage*

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Process performance study and analysis of spray dryer system in an industrial soap manufacturing process

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The soap manufacturing industry continuously strives to optimize processes to enhance product quality, reduce costs, and improve energy efficiency. Traditional optimization methods often involve extensive trial and error, which can be both time-consuming and resource-intensive. With the advent of machine learning, there are now opportunities to predict and control key process parameters more efficiently, leading to more sustainable manufacturing practices. This study aims to develop and evaluate machine learning models to predict crucial parameters in an industrial-scale soap manufacturing process, focusing on the outlet flow rate and outlet moisture content of the base soap mixture from a spray dryer system. Data collected from an industrial soap manufacturing plant were used to train and test various machine learning algorithms, including FNN, ANN, PLS, and Ridge Regression. The models were trained using input features such as pump frequency, steam pressure, feed temperature, and feed moisture content. Performance evaluation was based on the RMSE of the predictions. The FNN model demonstrated the best predictive performance, achieving the lowest RMSE for both outlet flow rate and outlet moisture content. The study examined the impact of varying operational parameters, such as pump frequency and feed temperature, on the system's performance. It was found that optimizing these parameters significantly enhanced the drying process's efficiency and reduced the moisture content in the final product. The relationship between pump frequency and outlet moisture content revealed an optimal range where moisture content was minimized, beyond which further increases in pump frequency had little effect. This research highlights the potential of ML to revolutionize industrial processes by improving efficiency and sustainability. The successful development and validation of ML models, particularly the FNN model, provide accurate predictions and valuable insights for process optimization. Future work could explore additional variables and advanced ML techniques to enhance predictive accuracy and process control.

Keywords: *Process optimization, soap manufacturing, spray drying, machine learning, simulation*

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In vitro antioxidant activity of methanolic bark extracts of *Stereospermum suaveolens*

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Existing literature has shown that medicinal plants could be promising sources of effective antioxidants. *Stereospermum suaveolens* barks are widely used by traditional practitioners as an analgesic, antidyspeptic, and liver stimulant, and to treat wound healing, asthma, and semen debility. Based on the existing literature, there is a lack of scientific reports regarding the antioxidant properties of this particular plant. The aim of this study was to evaluate the antioxidant capacity of methanolic extracts of the bark of *S. suaveolens*. The methanolic bark extracts (7.81–250 µg/mL) were tested for antioxidant activity using the Ferric ion reducing assay (FRAP) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays using L-Ascorbic acid as the positive control. The FRAP assay showed that the reducing power of the bark extracts increased with concentration, reaching an absorbance of 0.451 ± 0.02 at 250 µg/mL, while L-ascorbic acid reached 0.741 ± 0.00 at 125 µg/mL. The DPPH assay depicted that the percentage radical scavenging activity of bark extracts and L-Ascorbic acid were increased with concentration and reached 95.98 % and 87.34 % respectively at the concentration of 250 µg/mL. IC50 value of bark extracts and L-Ascorbic were 5.46 ± 0.56 µg/mL and 2.82 ± 0.23 µg/mL respectively, which depicted the antioxidant activity of L-Ascorbic acid was greater than the bark extracts (P value = 0.0147). Based on the findings of this study the methanolic bark extracts of *S. suaveolens* have demonstrated significant antioxidant activity. Hence, the plant is the appropriate source for the development of a potent antioxidant drug candidate in the future drug development process. However, extensive research is needed to be performed to confirm the effect through the isolation of target compounds.

Keywords: *Antioxidant activity, bark extracts, DPPH, FRAP, Stereospermum suaveolens*

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Potent antioxidative fractions from the activity-guided fractionation of *Stereospermum suaveolens* leaf extracts

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Antioxidants protect the body from harmful oxidation reactions by interacting with free radicals and other reactive oxygen species, thus preventing the oxidation process. Consequently, diseases associated with free radicals can be prevented through antioxidant therapy and current research is increasingly focused on discovering naturally occurring antioxidants, especially those derived from plants. This study focused on evaluating the antioxidant activity of the column chromatographic fractions of *Stereospermum suaveolens* (Patala) leaf. Crude leaf extract was derived using Methanol as a solvent and the residue was loaded into a silica column by using dry loading method. As the mobile phase, a gradient solvent system was used. All fractions were subjected to Thin Layer Chromatography and tested for antioxidant activity using a 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay at 200 µg/mL concentration; L-Ascorbic acid was used as standard. The column resulted in nine fractions from the leaf extract (F_1L to F_9L). The third (F_3L) and fifth (F_5L) fractions possessed high antioxidant activities with the percentage radical scavenging activity of 71.74 % and 69.95 % respectively, whereas other fractions showed weak antioxidant activities. However, the standard L-Ascorbic acid exhibited the highest antioxidant activity compared to leaf fractions (92.83 %). The study found that the majority of the leaf fractions exhibited antioxidant activity, suggesting that further research is warranted to isolate the specific compound responsible for the antioxidant activity.

Keywords: *Bioactive fractions, column chromatography, DPPH, L-Ascorbic acid, radical scavenging assay*

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Comparative analysis of nutritional composition and FTIR spectral characteristics of *Terminalia catappa* L. seed kernels

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Terminalia catappa L., commonly known as "Kottamba" is an underutilized plant species with promising potential. This study explored the nutritional composition and FTIR characterization of the seed kernels from two cultivars, namely Purple and Yellow. FTIR spectral data were collected using the KBr pellet method, extending from 4000 – 500 cm^{-1}. Seed kernels from each cultivar were extracted sequentially with hexane, ethyl acetate, and methanol. Hexane and ethyl acetate are excellent nonpolar and low-polar solvents to extract both nonpolar and low-polar compounds. Proximate analysis indicated significant differences in fat, ash, moisture, and carbohydrate (excluding protein) contents between the cultivars, with both showing higher levels of fat and protein. The primary components were fat (60.36% to 66.25%), followed by protein (25.22% to 25.95%). FTIR analysis showed the different organic functional groups in the biomolecules present in the samples. The peak features of the FTIR spectral patterns of the two extracts were quite similar. A sharp peak in 1749 – 1752 cm^{-1}, refers to the existence of lipid biomolecules. In methanol, a broad peak at 3393 – 3418 cm^{-1} was caused by the O-H stretching vibrations of polar molecules. The FTIR data further confirm that the seed kernel has a high oil content along with proteins and carbohydrates in alignment with the results of the proximate analysis. The distinctive differences in the FTIR spectra have been confirmed by Principal Component Analysis (PCA), which exhibited 98% and 1% variance along principal component 1 and principal component 2, making up 99% of the total variance. This comprehensive investigation of *Terminalia catappa* L. seed kernels enhance our understanding of their nutritional composition and provides valuable insights for potential applications in the food industry, paving the way for future research and development.

Keywords: *FTIR spectra, nutritional composition, PCA, proximate analysis, Terminalia catappa* L.

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Exploring the diverse selected bioactivities of *Terminalia catappa L.*, *Plectranthus amboinicus,* and *Cedrus deodara* plants extracts

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Sri Lanka possesses vast biodiversity, which encompasses a range of natural resources and medicinal plants with several therapeutic potentials. In this study, methanol extracts from *Cedrus deodara* (dewadara in Sinhala), *Plectranthus amboinicus* (kapparawalliya in Sinhala), and *Terminalia catappa L.* (kottamba in Sinhala) were screened for bioactivities. Fresh mature leaves of these plants were collected from the central province of Sri Lanka, then air-dried, powdered, and extracted into methanol by sonication. The crude extracts were assessed for antioxidant activity using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, ferric reducing antioxidant power (FRAP) assay, antidiabetic activity by α-amylase inhibitory assay, phytotoxicity using lettuce seed germination assay, and their cytotoxicity was screened by a log concentration series (1000 mgL^{-1}- 31.25 mgL^{-1}) brine shrimp lethality assay. In the DPPH radical scavenging assay, *Terminalia catappa L*. demonstrated exceptional antioxidant potential, with an IC_{50} value of 7.36 ± 0.24 mgL^{-1}. This performance is noteworthy when compared to the IC_{50} value of the positive control, Ascorbic acid, which stands at 1.97 ± 0.06 mgL^{-1}. Meanwhile, *Cedrus deodara*, *Plectranthus amboinicus* showed IC_{50} values of 47.36 ± 18.62 mgL^{-1} and 227.04 ± 72.52 mgL^{-1}, respectively. In the FRAP assay positive control; Trolox (12.07 ± 0.30 µmol $FeSO_4$/mg) and FRAP values of *Cedrus deodara*, *Plectranthus amboinicus*, and *Terminalia catappa L.* were 0.977 $\mu moldm^{-3}$ of $FeSO_4$, 0.239 $\mu moldm^{-3}$ of $FeSO_4$, and 1.025 $\mu moldm^{-3}$ of $FeSO_4$, respectively. In the α-amylase inhibitory assay, the extract of *Terminalia catappa L.* leaves exhibited high anti-diabetic activity with an IC_{50} of 391.11 ± 4.34 mgL^{-1} compared to other extracts, while the positive control: Acarbose had an IC_{50} of 45.991 ± 3.97 mgL^{-1}. According to the root inhibition, selected plant extracts displayed weak root inhibition properties. In the phytotoxicity assay, only *P. amboinicus* displayed a shoot inhibition with an IC_{50} value of 15.07 mgL^{-1} compared to the positive control, Abscisic acid (0.25 mgL^{-1}). In the brine shrimp lethality assay, only *Plectranthus amboinicus* exhibited toxicity, with an LC_{50} value of 68.92 mgL^{-1}. This was markedly higher than the LC_{50} of the positive control, $K_2Cr_2O_7$, which stood at 35.16 mgL^{-1}. The findings resulted in the crude extract of *Terminalia catappa L*. having remarkable antioxidant qualities, while the leaves of *Plectranthus amboinicus* have a high potential for suppressing shoot growth.

Keywords: *α-Amylase, cytotoxicity, DPPH, FRAP, phytotoxicity*

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Senna auriculata encapsulated layered double hydroxide as a controlled-release drug delivery system with antioxidant and anti-inflammatory activities

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Senna auriculata is a Fabacean plant that has significant antioxidant and anti-inflammatory activities. Layered Double Hydroxide (LDH) emerges as a suitable carrier to deliver the extract protectively. The objective of this study was to develop a slow-release drug delivery system by incorporating the methanolic extract of *S. auriculata* leaf into LDH. The LDH was synthesized through the co-precipitation method using a 2:1 ratio of Mg-Al. The synthesis of *S. auriculata* encapsulated LDH (SA-LDH) proceeded using water as the medium. The antioxidant and anti-inflammatory activities of SA - LDH were determined for 20, 40, and 60-minute time intervals using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay and egg albumin denaturation assay, respectively. The SA-LDH appeared as octahedral and platelet-like structures in SEM images. FT-IR spectrum confirmed the encapsulation. The SA-LDH encapsulated percentage was calculated as 68%. Furthermore, the kinetics of SA-LDH were analyzed using UV-visible spectroscopy at 420 nm at pH 4.5, 6.5, and 7.4 for 5 hours. SA-LDH showed an increased release within the first hour due to the release of loosely bound phytochemicals. After the first phase, the de-intercalation occurred maintaining the sustained release. The Zeroth order and the Korsmeyer-Peppas model most suitably described SA-LDH kinetics. Ascorbic acid and diclofenac are used as positive controls for antioxidant assay and anti-inflammatory assay, respectively. The leaf extract and ascorbic acid exhibited IC_{50} values of 0.46 (±0.05) mg ml^{-1} and 0.11 (±0.02) mg ml^{-1} respectively while SA-LDH showed IC_{50} values of 0.74 (±0.16) mg ml^{-1} at 60 minutes for antioxidant assay. The Diclofenac, leaf extract, and SA-LDH showed IC_{50} values of 0.47 (±0.25) mg ml^{-1}, 0.58 (±0.43) mg ml^{-1}, and 1.13 (±0.35) mg ml^{-1} at 60 minutes, respectively for the anti-inflammatory assay. The successfully encapsulated SA-LDH performed sustained release kinetics leading to a promising drug delivery system with potential antioxidant and anti-inflammatory activities compared to the standards.

Keywords: *Drug carrier, egg albumin assay, drug-releasing kinetics, radical scavenging assay*

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Determination of bioactivity potential of *Acronychia pedunculata, Alpinia calcarata* Roscoe, and *Bacopa monnieri* grown in Sri Lanka

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Medicinal plants have increasingly gained attention for their plethora of pharmacological effects owing to the presence of bioactive compounds and employed in herbal healthcare practices. This study investigated three selected medicinal plants grown in Sri Lanka *in vitro* to assess their bioactive compounds, antioxidative, anti-hyperglycemic, anti-obesity properties, and plant extract toxicity. Dried powdered samples of medicinal plants, namely *Acronychia pedunculata*, *Alpinia calcarata* Roscoe, and *Bacopa monnieri*, were extracted with 100% methanol via ultrasonication, followed by evaporation to obtain crude extracts. The extracts were evaluated for their total phenolic content (TPC), total flavonoid content (TFC), ferric-reducing antioxidant power (FRAP), DPPH radical scavenging activity, α-amylase, α-glucosidase, lipase inhibitory activities, and brine shrimp lethality using standard assays. Among plant extracts, *A.pedunculata* possessed the highest TPC (69.07 ± 4.35 mg GAE/g) and *B.monnieri* possessed the highest TFC (1.39 ± 0.085 mg CE/g) values. Furthermore, *B.monnieri* exhibited the highest activity in the FRAP assay (2259.1 ± 73.5 mmol $FeSO_4$/g) which was lower than the positive control trolox (13447.00 ± 19.80 mmol FeSO4/g). In the DPPH radical scavenging assay also, the extract showed the highest activity [1]among the extracts with an IC_{50} value of 484.5 ± 22.6 mgL^{-1}. However, it was higher than the positive control ascorbic acid (IC_{50} = 3.46 ± 0.45 mgL^{-1}). Furthermore, *A.pedunculata* exhibited potential inhibitory activity against α-amylase. The IC_{50} value obtained for *A. pedunculata* was 592.1 ± 72.2 mgL^{-1}, which is significantly higher than the positive control acarbose, with an IC_{50} of 8.51 ± 0.67 mgL^{-1}. Two extracts showed significant α-glucosidase inhibitory activity at a concentration of 1000 mgL^{-1}, in which the *A.pedunculata* extract showed 57% inhibition and *A.calcarata* extract showed 56% inhibition, respectively. None of the extracts showed lipase inhibitory activity or brine shrimp lethality. Based on these findings, all three medicinal plants studied have the potential to be developed as ingredients in functional food and as alternative remedies for managing non-communicable diseases.

Keywords: *Antioxidant activity, bioactivities, medicinal plants*

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Bioactivity studies of *Nyctanthes arbor-tristis*. Linn. flowers as potential sources of traditional medicine

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Sri Lanka is a country with a diverse variety of fragrant flowers, many of which possess medicinal properties. *Nyctanthes arbor-tristis* Linn (Sepalika) is used as an antidiabetic, anti-leishmanial, antimicrobial, and immunostimulant. This study aimed to explore the selected biological activities of its flowers extracted into water and methanol. Flowers were collected from Peradeniya, Sri Lanka. The methanol extract (ME) was obtained by sonicating the air-dried powdered flowers with methanol and dried using a rotary evaporator. The water extraction (WE) was obtained by hot water filtration and freeze-dried. Their antioxidant potential was tested using 2,2-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging and ferric-reducing antioxidant power (FRAP) assays. Enzyme inhibitory potential was tested against α-amylase and lipase enzymes. Cytotoxicity with brine shrimp lethality assay. The results of the DPPH assay revealed that WE has a stronger antioxidant potential with an IC_{50} of 5.15±0.26 mg L^{-1} which had no significant difference with the positive control, ascorbic acid (IC_{50} 1.97±0.06 mg L^{-1}). ME resulted in a moderate radical scavenging activity (IC_{50} 122.22±6.21 mg L^{-1}). According to FRAP values, WE resulted in a FRAP value of 2.31±0.03 µmol $FeSO_4$/mg of the sample, whereas, ME resulted in 1.34±0.02 µmol $FeSO_4$/mg of the sample. However, they were significantly lower than the positive control, trolox (12.07±0.30 µmol $FeSO_4$/mg of the sample). In the α-amylase assay, WE resulted in a percentage inhibition of 52.63±0.05% whereas ME resulted 6.81±0.09% at 1000 mg L^{-1}. When compared with the positive control, acarbose which resulted in 100±0.00% inhibition at 1000 mg L^{-1}, WE showed a moderate α-amylase inhibition which is stronger than the ME at the tested concentration. However, cytotoxicity in brine shrimp assay and lipase inhibition were not detected. In the case of lipase inhibition, the flower colour, which matched that of the indicator, significantly influenced the outcomes, resulting in negative results. In conclusion, WE of Sepalika flowers demonstrated, higher antioxidant potential and α-amylase inhibitory potential than ME, suggesting its potential for future research applications.

Keywords: *α-Amylase inhibition, antioxidant potential, methanol extract, Sepalika flowers, water extract*

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Comparative study of the bioactivity of methanolic leaf extracts from *Anacardium occidentale* L. and *Morus alba* L.

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Exploring medicinal plants for bioactive compounds is vital due to their potential health benefits. This study explored the selected bioactivities of leaf extracts from *Anacardium occidentale* ('cashew') and *Morus alba* ('white mulberry') collected from the Central Province, of Sri Lanka. The leaves were dried, ground, and extracted with methanol. The extracts were tested for antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant Power (FRAP) assays, antidiabetic activity via α-amylase inhibition, and anti-obesity potential through lipase inhibition. Additionally, cytotoxicity was tested using the brine shrimp lethality assay and phytotoxicity by lettuce seed germination assay. *A. occidentale* showed strong antioxidant activity, with an IC_{50} of 7.78 ± 0.08 mg L^{-1} in the DPPH assay and a FRAP value of 3.53 ± 0.01 μmol $FeSO_4$/mg, compared to the positive control's ascorbic acid and Trolox, which had IC_{50} values of 1.97 ± 0.02 mg L^{-1} and 12.07 ± 0.03 μmol $FeSO_4$/mg, respectively. *M. alba* had moderate antioxidant effects, with an IC_{50} of 189.52 ± 5.26 mg L^{-1} in the DPPH assay and a FRAP value of 0.62 ± 0.01 μmol $FeSO_4$/mg. *A. occidentale* was excellent in inhibiting α-amylase (IC_{50} of 6.79 ± 0.24 mg L^{-1}), surpassing the positive control acarbose (IC_{50} 45.99 ± 3.97 mg L^{-1}), while *M. alba* had weak α-amylase inhibition. Both extracts demonstrated weak lipase inhibition, compared to Orlistat (IC_{50} 3.05 ± 1.71 mg L^{-1}). *A. occidentale* extract exhibited weak cytotoxicity and phytotoxicity, whereas *M. alba* showed considerable cytotoxicity (LC_{50} 637.78 mg L^{-1}) and phytotoxicity (IC_{50} 584.06 mg L^{-1} for shoot inhibition and 780.55 mg L^{-1} for root inhibition). Results of this study indicated that *A. occidentale* leaf extract shows promising antioxidant properties, as well as excellent antidiabetic properties with low toxicity, suggesting the need of special attention for future investigations, including the isolation and characterization of chemical compounds.

Keywords: *A. occidentale, antidiabetic activity, antioxidant activity, M. alba*

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Synthesis and characterization of Fe (III), Co (II), Ni (II), and Cu (II) complexes with L-phenylalanine-salicylaldehyde Schiff base to mimic bioinorganic complexes

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Synthesis and characterization of biomimetic ligands and investigation of their metal coordination behavior have become one of vital areas of research in bioinorganic chemistry. Schiff bases, formed from amino acids and carbonyl compounds resemble biological molecules and can act as enzyme mimics, DNA binders, and catalysts, particularly when complexed with transition metals. Despite extensive studies on Schiff base metal complexes, the L-phenylalanine-salicylaldehyde Schiff base is underexplored, and this research aims to investigate this compound and its metal complexes. A method for synthesizing a Schiff base ligand from L-phenylalanine and salicylaldehyde has been developed. The Schiff base, along with its Fe(III), Co(II), Ni(II), and Cu(II) metal complexes, were synthesized. The stoichiometry of ligand binding to metal ions was determined using Job's method, revealing a 1:2 metal-to-ligand ratio in all complexes. Characterization of the synthesized compounds was conducted using UV-Vis and FT-IR spectroscopy. Maximum absorption bands were observed at 490 nm, 530 nm, 744 nm, and 630 nm for Fe(III), Co(II), Ni(II), and Cu(II) complexes respectively for d-d transitions, indicating the octahedral geometry. For the Schiff base, major IR peaks were observed at 3100-3600 cm^{-1} for −O−H stretching and, at 1575 cm^{-1} and 1603 cm^{-1} for −C=O and −C=N stretching respectively. Shifting of these peaks in metal complexes indicated metal-ligand complexation. Spectroscopic analysis indicated the successful formation of the Schiff base and its complexation to metal ions through the carbonyl, azomethine, and phenolate groups. The findings highlighted the potential of this Schiff base for biomimetic applications.

Keywords: *Biomimetic ligands, FT-IR, spectroscopy, UV-Vis*

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Antioxidant, toxicity, and enzyme-inhibitory potential of *Annona muricata, Persea americana* and *Phyllanthus acidus*

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Medicinal plants have been utilized traditionally for treating various ailments. There is a lack of comprehensive scientific validation of their therapeutic properties and safety. This study aims to evaluate the biological activities (antioxidant, enzyme inhibitory, cytotoxic, and phytotoxic) of methanolic extracts from locally (Kandy, Sri Lanka) abundant medicinal plants *Annona muricata* (Soursop), *Persea Americana* (Avocado), and *Phyllanthus acidus* (Star Gooseberry). Plant materials were obtained, dried, powdered, and extracted using methanol. Antioxidant activity was assessed by the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, enzyme inhibitory activity was evaluated against α-amylase and lipase by spectrophotometric methods, cytotoxicity was evaluated by the brine shrimp lethality assay, and phytotoxicity was evaluated by the lettuce seed germination assay. Data were analyzed using ANOVA and IC_{50} values were calculated. *A. muricata* exhibited the highest crude extract yield (17.55 g/100g dry weight) and potent antioxidant activity (IC_{50}= 5.61 mg L^{-1}), comparable to ascorbic acid (IC_{50} 3.46 mg L^{-1}). *P. acidus* showed moderate α-amylase activity (32.83% inhibition at 1000 mg L^{-1}) and lipase inhibitory activity (IC_{50}= 488.31 mg L^{-1}). All extracts displayed potent cytotoxicity in the brine shrimp assay, with *P. americana* (LC_{50}= 9.00 mg L^{-1}) and *P. acidus* (LC_{50}= 21.11 mg L^{-1}) showing significant effects comparable to atropine (LC_{50}=88.6 mg L^{-1}). *P. americana* extract demonstrated weak phytotoxic and allelopathic effects, inhibiting lettuce seed root (IC_{50}= 433.60 mg L^{-1}) and shoot growth. The findings reveal that *A. muricata* exhibits potent antioxidant and cytotoxic activities, *P. acidus* possesses enzyme-inhibitory properties, and *P. americana* has allelopathic effects. These activities could be attributed to the presence of bioactive compounds like polyketides, phenolics, and flavonoids. Further research is recommended to isolate and characterize the specific bioactive compounds responsible for the observed activities and investigate *in vivo* pharmacokinetics, safety, and efficacy through cell culture models, animal studies, and field trials for potential therapeutic and agricultural applications.

Keywords: *Allelopathy, bioactive compounds, pharmacology*

COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

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Confidence intervals for robust versions of the Lorenz curve using influence functions

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In many nations, the Lorenz curve and the related Gini coefficient are frequently used to compare income inequality. They are also widely used in the fields of biology, chemistry, health, and social studies. The Lorenz curve is especially susceptible to outliers, which are unavoidable in income distributions because it depends on the population mean. In order to get around this problem, we look at three robust versions of the Lorenz curve, which are based on the sample quantiles that Prendergast et al. (2016) introduced. $L_1(p) = p\, x_{\frac{p}{2}}/x_{0.5}$, $L_2(p) = p\, x_{\frac{p}{2}}/x_{1-p/2}$ and $L_3(p) = 2p\, \frac{x_{p/2}}{(x_{p/2} + x_{1-p/2})}$ are three variations of the Lorenz curve, where x_p is the sample p^{th} quantile. In this study, we focus on obtaining the confidence intervals for these robust versions using influence functions (IC) because IC functions have bounded influence functions, which guarantee that a small amount of contamination can only have a limited effect on the asymptotic bias of estimators of these quantiles. Pareto, Weibull, Dagum, and Exponential distributions are employed. One reason for this decision is the frequency of positive skewness in income data, which indicates a bias in the distribution toward higher income values. Using R software, four samples with 200 data each were created for the simulation study and run at the specified contamination point, z = 1. To compare the relative performances of different confidence intervals for quantile inequality curves in terms of average interval length, extensive simulation studies are carried out. The simulation results showed that the best way to understand social income inequality is to use the $L_2(p)$ confidence interval. In future studies, we aim to compute and compare the performances of confidence intervals by using the Bootstrap method.

Keywords: *Income distribution, influence functions, outliers, robust forms, sample quantiles*

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Statistical review of regression and correlational analysis of adopting technological innovations in Sri Lankan manufacturing industry

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Technology is widely used worldwide, and innovative technologies have been adopted by Sri Lankan manufacturers in apparel, food and beverage, rubber, and steel while being used in equipment, solvents, procedures and processes, human skills, and theoretical and practical knowledge. They don't need to be complex but should be novel and able to be implemented in the manufacturing industry for achievements in a competitive environment. Relationships between several technological components, identified as independent and dependent variables of 5 technological innovation adoptions in 3 manufacturing organizations with varied sample sizes, were compared to accept or reject the hypotheses developed based on the 'THIO' framework. These dependent variables were sectioned into three categories as hypotheses for process efficiency, organizational profit gain, and stakeholder satisfaction. Independent variables were categorized as techno-ware, physical facility equipment, human-ware, human capital and capabilities, and organ-ware, an organizational framework for positive outcomes. 10 questions for SAP were accepted with 0.73 Cronbach's alpha. The correlation between dependent variables and organ-ware had a perfect positive correlation of 1. GRS (Global Recycle Standards) with 12 questions was accepted with Cronbach alpha 0.74. Human-ware had a substantial positive correlation with dependent variables. CNC (Computer Numerical Control) technology with 12 questions was accepted with Cronbach alpha 0.81. Techno-ware had a very strong correlation with productivity and process efficiency with a correlation of 1. Also, organ-ware and organizational profit correlation is 1. The Labelling machine had Cronbach's alpha of 0.86. Techno-ware and productivity had a correlation of 1 and the least correlations were found between human-ware, organ-ware, and productivity. TPM had Cornbrash's alpha of 0.73 for 15 questions. TPM pillars had a positive correlation. 9 hypotheses for SAP, 10 for GRS, 3 for TPM 12 for CNC button profiling, and 11 for labelling machines were accepted. Also, p values between independent and dependent variables are lower than the acceptance level of 0.05 and greater than 0.

Keywords: *Qualitative, quantitative, reliability*

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Optimizing stock price forecasting on the Colombo Stock Exchange with clustering-augmented long and short term memory models

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Due to its superiority in modeling non-linear relationships, deep learning (DL) algorithms such as Long Short-Term Memory (LSTM) are being employed increasingly in financial forecasting, especially in stock market prediction. When compared to other traditional time series architectures and Recurrent Neural Networks (RNNs), long-term dependencies can be captured by LSTM, which also minimizes the vanishing gradient problem and allows for more accurate temporal modeling. However, forecasting stock prices on the Colombo Stock Exchange (CSE) remains challenging due to market volatility and diverse stock behaviors. This study incorporates clustering as a critical pre-processing step to enhance the effectiveness of the LSTM model by grouping stocks with similar patterns, which has not yet been extensively utilized in Sri Lanka. Clustering reduces noise and variance within each cluster, enhancing the model's prediction capability. Two benchmark methodologies for similarity computation were used: The Euclidean distance (EUD) method and the dynamic time warping (DTW) method. The Logistic Weighted Dynamic Time Warping (LWDTW) similarity measure was used to optimize clustering by calculating distance matrices while considering return observation relative value. The distance matrices were computed using CSE daily closing stock price data from January 2006 to December 2018. The LSTM model with and without clustering augmentation was thoroughly compared. Combining the LWDTW method with the clustering-enhanced LSTM model showed remarkable predicting abilities, with the highest R^2 value of 0.9788 and the lowest RMSE of 0.01130. Additionally, it achieved an 82% hit ratio and a Sharpe ratio of 1.73, indicating strong predictive performance and favorable risk-adjusted returns. Clustering improves the scalability of the model by segmenting the data, which makes it easier to expand to larger financial markets. These results imply that the use of clustering methods and DL models can improve decision-making and result in a more accurate evaluation of CSE stock values forecast.

Keywords: *Financial markets, deep learning algorithms, distance matrices, logistic weighted dynamic time warping, similarity measures*

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Exploring the efficiency of the modified differential transform method for solving ordinary differential equations

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Differential equations are indispensable in fields such as physics, engineering, biology, and economics, but certain classes of ordinary differential equations (ODEs) and partial differential equations (PDEs) present significant challenges to solve. This study focuses on applying the Modified Differential Transform Method (MDTM) to solve various ODEs using a Python implementation. MDTM is a semi-analytical technique that transforms differential equations into algebraic equations making it easier to solve. The main goal is to demonstrate that MDTM is effective in solving both linear and non-linear ODEs. The methodology involves applying MDTM to a third-order linear differential equation, a pollution model of interconnected lakes, and the Lane-Emden equation, fundamental in astrophysics for modeling the structure of polytropic stars. To validate our approach, results from MDTM were compared with those from the Runge-Kutta (RK) method, a well-known numerical technique. Building on the foundational work presented in Martin Braun's "Differential Equations and Their Applications", which focuses on traditional methods, our study introduces MDTM as a flexible and computationally efficient alternative. The results show that the Python implementation of MDTM provides accurate solutions for a variety of differential equations. For the third-order linear differential equation, MDTM showed an excellent match between the exact solution, confirming its accuracy. MDTM effectively handled system complexity in the pollution model, providing accurate pollutant concentration approximations over time. Solving the Lane-Emden equation highlighted MDTM's capability in addressing non-linear boundary value problems. This study successfully implements MDTM in Python, which provides an adaptable computing environment. Furthermore, the robustness of MDTM and its potential benefits in accuracy and efficiency are shown by the comparison with the RK approach. The result validates MDTM's reliability and contributes to the growing body of knowledge on numerical methods for solving differential equations, emphasizing its broad applicability and potential for further exploration in scientific computing and applied fields.

Keywords: *Differential equations, la204ne-Emden equation, numerical methods, pollution model, runge-kutta method*

SOCIAL SCIENCES

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Sleep quality among patients with type 2 diabetes mellitus at Army Hospital in Colombo, Sri Lanka: a cross-sectional study

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Patients with Diabetes Mellitus (DM) often suffer from reduced quality of life due to various clinical effects, including sleep quality. These patients encounter sleep and wakefulness challenges because of physiological imbalances and comorbid sleep disorders. Poor sleep quality among individuals with Type 2 DM (T2DM) negatively impacts glycaemic control, further complicating the management of the disease. Therefore, this study aimed to assess the sleep quality among patients with T2DM at Army Hospital in Colombo, Sri Lanka. A descriptive cross-sectional study was conducted among randomly selected 422 voluntarily consented patients with T2DM. The data were collected using a validated Pittsburgh Sleep Quality Index (PSQI) questionnaire. The sleep quality was categorized based on the global PSQI scores ranging from 0-21, where a score of 5 or greater indicated poor sleep quality. Data were analyzed using descriptive statistics via IBM SPSS version 25. The ethical approval was obtained from the Ethics Review Committee of KIU (KIU_ERC_24_004). The mean age, height, and weight of the participants were 47±15 years, 160.36±9.878 cm, and 62.55±12.875 kg, respectively. Majority of the participants were male (n=265, 63%), Sinhala (n=350, 83%) and married (n=336, 80%). In addition, nearly half of the participants had fasting blood sugar (FBS) >130 mg/dl (51%, n=214). The average number of minutes to fall asleep each night was 33±51.60 minutes and the average hours of sleep per night was 6±1.5 hours. The mean global PSQI score was 7.25±3.36, where most of the participants (67%, n=283) indicated poor quality of sleep (PSQI>5). The data indicates that most of the participants with T2DM showed poor quality of sleep. These findings emphasize the need for healthcare providers to include sleep quality assessments and interventions as part of the routine management for patients with T2DM to improve their overall health outcomes.

Keywords: *Diabetes mellitus, PSQI, sleep quality, Sri Lanka*

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Urban acoustic pollution and its socio-environmental consequences in Shudhdha Nagaraya in Sri Lanka

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As global attention to noise pollution rises as a critical environmental and health concern, this study investigates Shudhdha Nagaraya in Anuradhapura, Sri Lanka, an area recognized for its rich historical and religious significance, to better understand the implications of noise pollution in such a culturally important setting. The study aims to evaluate residents' awareness of noise pollution through a structured survey that includes both closed and open-ended questions, identify primary noise sources and their impacts across demographic groups, and explore the effects on daily activities and health. Data were collected from 150 respondents, representing diverse age groups, genders, and socioeconomic backgrounds and a descriptive statistical analysis method revealed that loudspeakers and automobiles are the main sources of noise pollution, with females reporting a higher sensitivity to construction-related noise. The survey also indicated that younger individuals tend to engage more directly with noise sources, while older respondents prefer formal complaint methods. The results highlight that noise levels already surpass acceptable thresholds, revealing that the area is vulnerable to escalating noise issues if the main causes are unaddressed. Based on these findings, policy interventions such as regulating loudspeaker usage, enforcing vehicle noise control, and launching public education programs of noise reduction measures are recommended to mitigate impacts. The study emphasizes the importance of targeted noise management strategies to protect the area's cultural and environmental integrity. Future research should assess long-term health impacts, such as cardiovascular and hearing issues associated with chronic noise exposure, and evaluate the effectiveness of various noise mitigation measures, including public awareness campaigns and technological solutions, to refine policies and enhance noise management practices.

Keywords: *Anuradhapura, community awareness, effects of noise, mitigation, noise pollution*

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Optimizing firm performance by setting key performance indicators (KPIs): assessing the case of agri-food processing sector in Sri Lanka

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Key Performance Indicators (KPIs) can be applied across the organizational structure of a firm to improve its operational efficiency by way of enhancing resource utilization, product quality, supply chain management, etc. These improvements are very much dependent on the optimization of the decision-making process. On the justification that KPIs were either not well developed, and if exist, they remain heavily underutilized in the agri-food processing sector (AFPS) in Sri Lanka, this study was directed to assess the current state of KPI implementation in performance management systems (PMSs) within the AFPS and to explore ways to optimize future strategies based on KPIs. It examines how digitalization can enhance PMSs, driving greater efficiency and optimization. A series of semi-structured interviews, directed by a pre-piloted Structured Interview Guide were carried out with the top-level managers of firms belonging to the AFPS (n=10) through an 'Online Video Conferencing Platform'. The data, collected as qualitative attitudinal statements, were analyzed using the methodology of Thematic Analysis, where the audio-recorded interviews were transcribed into text files and coded subsequently using the MAXQDA software. The codes converged into five themes: (1) Agri-Food Production, (2) Company Performance, (3) Digitalization of KPIs, (4) Sustainable Decision-Making, and (5) Performance Evaluation. Ten sub-themes were derived from the categories developed from 120 codes, providing a structured and logical link between the data and the overarching themes. The findings reveal that, despite a general awareness of the importance of KPIs, significant gaps remain in their practical application within organizational structures. Most firms lack a systematic approach to monitor the critical success factors and underscore the need of a sector-wide integrated Digital Monitoring System. Introduction or update of existing poorly running systems is warranted to enhance performance insights across the agri-food supply and value chains and to provide real-time, data-driven policy directives for sector improvement.

Keywords: *Agri-food processing sector, digital monitoring, key performance indicators (kpis), performance evaluation, stakeholder perceptions*

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Association of general self-efficacy and research skills among undergraduates who are studying in the Colombo district universities of Sri Lanka

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Research productivity and publication rates in Sri Lanka are lower than in other South Asian countries. Existing research recommends improving research productivity, yet specific directions remain in question. General self-efficacy is the individual's belief in their ability to perform difficult endeavors while facilitating goal-setting and persistence in encountering barriers, found to have a relationship with academic motivation and reducing statistical anxiety in research. This could be used to increase research productivity. However, the attention directed toward the association of general self-efficacy and research skills is limited. Therefore, this study aimed to evaluate whether general self-efficacy contributes to the research skills among undergraduates involved in undergraduate research, studying in the Colombo district universities of Sri Lanka. The study was descriptive and cross-sectional. The questionnaire was distributed through convenience sampling, which was better suited for cost and time-effectiveness and a Google form was accessible by scanning a Quick Response (QR) code which further protected participant's confidentiality. Participants were recruited through physical confrontation at nearby outdoor universities. As the general self-efficacy scale has already been validated in Sri Lanka, reliability was analyzed for the research skills questionnaire. Data was analyzed using regression analysis and demonstrated that general self-efficacy significantly explained the variances in the dependent variable of research skills. Drawn attention to general self-efficacy as a strong indication of research skills, could be used to identify capabilities and potential in students towards the research field and address issues in research skills through designing motivation and science support programs as it could enhance self-efficacy along with the skills. Promoting mentoring, tutoring, and counseling programs for undergraduates would assist in maintaining self-efficacy, which works as a stress buffer to continue the individual's performance for the demanding tasks of improving research skills, ultimately increasing the quality, productivity of research, and publication rate in Sri Lanka.

Keywords: *General-self efficacy, research skills, Sri Lanka, undergraduate research*

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Exploring the political evolution of Sri Lanka through postage stamps (1935-1972)

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Postage stamps have historically served as a means of communication and as a reflection of national identity. Under British colonial rule, Ceylon's stamps featured British monarchs, symbolizing colonial authority. In 1935, pictorial stamps began highlighting local landscapes and products. After gaining independence in 1948, stamps gradually moved away from British symbols, increasingly reflecting national identity. The transition to a republic in 1972 and the renaming of Ceylon to Sri Lanka further emphasized national pride and cultural heritage. Despite their historical significance, few studies have examined stamps as artifacts to explore the country's political evolution. This study aims to investigate the role of philately in highlighting the significant political influences shaping Sri Lanka's national identity, addressing the research question: "How do stamps issued in Sri Lanka between 1935 and 1972 reflect the country's political evolution?" Utilizing the principal author's stamp archive of 320 stamps from this period as primary data, the research adopts a mixed-methods approach, primarily incorporating semiotic content analysis. This method critically examines the visual elements of stamps, such as national symbols, political leaders, and landscapes, and aligns them with the historical and socio-political contexts of their issuance. The findings reveal that stamps, as a form of mass media, highlight key political and social developments. Specifically, stamps from the colonial period (1935–1948) predominantly reflect British influence and commemorate significant historical events under colonial rule. In contrast, stamps from the post-independence period (1948-1972) emphasize nationalistic themes, key political leaders, and milestones in the establishment of Sri Lanka as an independent republic. The findings affirm that stamps can be used as a visual medium for understanding a country's political evolution and shaping its national identity. This research contributes to the understanding of the political development of other colonized countries with similar historical trajectories through philatelic analysis.

Keywords: *Ceylon, national identity, postage stamps, semiotics, visual reading*

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Optimizing Sri Lanka's floriculture industry for global success: assessing export challenges faced by the floriculture exporters in Western Province

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Sri Lanka's Western Province boasts significant floriculture export potential due to its favorable climate and infrastructure. However, unlike previous broad industry studies, this research investigates specific export barriers faced by the Western Province exporters. This knowledge gap hinders the development of targeted strategies to capitalize on the region's export potential fully. Employing a quantitative approach, a structured questionnaire was administered to all registered Western Province floriculture exporters (n=51). Hence, the data were gathered from the entire Western Province floriculture grower population. Data collection utilized a combination of online and telephone surveys and was analyzed using SPSS V21. The study employed descriptive statistical measures to identify financial limitations, logistical and transportation issues, customer relations challenges, and political/government and procedural barriers as the most significant obstacles. Despite these challenges, exporters actively employ various mitigation strategies. Building strong relationships with buyers, maintaining high-quality control, adopting technology, incorporating sustainable practices, and investing in employee training were frequently adopted approaches. These strategies were perceived as generally effective, with quality control, logistics management, technology adoption, sustainability, and employee training receiving the highest marks. These findings offer valuable insights for policymakers, industry stakeholders, and future research. Policymakers can tailor support programs (i.e. financial aid, infrastructure upgrades, and streamlined export processes) to address the identified barriers. Industry groups can develop training programs to address skill gaps and promote technology adoption. Future research opportunities include comparative studies with other floriculture regions to explore similarities and differences in export barriers and mitigation strategies. Ultimately, this research aims to contribute to a more robust floriculture export sector in Sri Lanka's Western Province.

Keywords: *Exporter perceptions, export barriers, floriculture exports, mitigation strategies, Western Province*

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Biodiversity literacy of university students: a pilot study on the distance learners of The Open University of Sri Lanka

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Harnessing a positive relationship with biodiversity among university students is crucial for a sustainable future, as they are the future decision-makers. Many socio-economic factors can affect this relationship between students and biodiversity. This study examines how university students' knowledge, attitudes, and behavior towards biodiversity varies with their education and socio-economic status. An online survey was conducted for a cohort of 166 randomly selected students of the Faculty of Natural Sciences, The Open University of Sri Lanka. The study instrument was designed to obtain participants' demographic characteristics and their knowledge (8 questions), attitudes (6 questions), and behavior (5 questions) toward biodiversity. Closed-ended questions with a 5-point Likert scale were incorporated into the instrument. The responses were analyzed using Analysis of Variance and sample t-tests via JASP 0.18.3 software. Most respondents (74.7%) were female and aged 19-25 (74.1%). Over 86% were undergraduates, with 78.3% reported that their studies include biodiversity-related content, while 76.5% identified their exposure to biodiversity-related content to be 'high'. Further, 62.7% of the respondents were unemployed, and 68.1% had monthly incomes of less than 10,000 LKR. Findings showed that knowledge significantly increased with education level ($p = 0.043$) and exposure to biodiversity-related content ($p = 0.042$). Also, the level of behavior increased significantly with exposure to biodiversity-related content in the program of study ($p = 0.001$). None of the other variables showed a significantly different relationship ($p > 0.05$). This study explains that education levels and exposure to biodiversity discussions enhance students' awareness and engagement with nature. It is noteworthy that attitudes towards biodiversity were mostly positive regardless of educational background or other demographic factors. In conclusion, this study highlights the importance of integrating biodiversity content into educational programs to foster better awareness and engagement among future leaders.

Keywords: *Attitude, biodiversity, literacy, OUSL, knowledge*

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Perception towards social support among patients with type 2 diabetes mellitus attending a selected general hospital, Sri Lanka

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Diabetes mellitus is a chronic metabolic disorder characterized by elevated levels of blood glucose (hyperglycemia) and type 2 diabetes mellitus (T2DM) is one of the most prevalent chronic diseases worldwide, accounting for over 95% of all diabetes cases. Social support from family and friends plays a crucial role in facilitating diabetes self-management behaviors among patients with T2DM. Therefore, this study aimed to assess the perception of social support among patients with T2DM attending a diabetic and endocrine clinic at a selected general hospital, in Sri Lanka. The study was conducted as a descriptive cross-sectional study among 316 patients with T2DM using simple random sampling. Data was collected by using an interviewer-administered questionnaire including a Multidimensional Scale of Perceived Social Support (MSPSS). Ethical clearance was obtained from the Ethics Review Committee of KIU, and data was analyzed using SPSS version 25. Descriptive statistics such as frequencies, mean and standard deviations were used to describe the characteristics of the sample and the chi-square test was used to describe associations between variables. The mean age of this population was 59.93 $\pm$ 30.03. Among participants, the majority were females (53.3%), Sinhalese (85.4%), Buddhists (83.3%), married (75%) and employed (52%). The majority of 49.7% had a medium level of perceived social support. Respectively 7.3% had a low level of perceived social support and 43% had a high level of perceived social support according to the scale. Age and marital status were significantly associated with all the subscales of social support while ethnicity, educational status, and employment status were significantly associated with different subscales in total scale. According to the study results, perception towards social support was moderate to high in this population, and that indicates participants are receiving good social support. Furthermore, improving social support and supporting systems will be beneficial in approaching holistic patient care for successfully managing T2DM and other chronic disease conditions.

Keywords: *Patients, perception, social support, T2DM*

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Evaluating consumer awareness and perceptions of harmful chemicals in cosmetics: a survey study in Sri Lanka

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The cosmetic industry in Sri Lanka plays a crucial role in enhancing personal care and well-being. Despite its growth, concerns about the presence of harmful chemicals in cosmetics have raised significant issues related to consumer health and product safety. This study investigates consumer awareness of harmful chemicals in cosmetics and their impact on purchasing behavior. A cross-sectional survey involving 336 participants (University students and the public) was conducted using an online structured questionnaire, analyzing both qualitative and quantitative data. Quantitative results revealed that only 11.5% of participants had a basic understanding of harmful chemicals, and just 2.9% possessed detailed knowledge about specific substances. Commonly purchased products included face/body soaps, toothpaste, shampoos, makeup, and sun protection items. Purchasing patterns indicated that 53.5% bought products every six months and 26.2% every three months, with over half not consulting a doctor prior to purchase. Brand recognition was the primary quality indicator for 77.7% of respondents, while 75.4% regularly repurchased the same brands. Ethical factors like cruelty-free practices influenced 23.4% of purchases. Label reading habits were minimal, with only 26.7% checking expiry dates, 28.6% inspecting for prohibited chemicals, and 9.8% focusing on certified safety. Qualitative feedback revealed widespread concerns about harmful chemicals and difficulties in accessing reliable information. Approximately 61.9% experienced adverse effects such as rashes and pigmentation from certain brands, but only 57.6% reported these issues to manufacturers or regulatory bodies. Major barriers to lodging complaints included lack of awareness (33.4%), procedural unfamiliarity (41.4%), and difficulty contacting authorities (17.8%). Of those who complained, only 9.6% received satisfactory responses. The study underscores a significant gap between consumer awareness and knowledge of harmful chemicals, with brand recognition often prioritized over safety considerations. Enhancing consumer education and developing an effective complaint mechanism is critical for fostering a safer cosmetic industry.

Keywords: *Consumer health, cosmetic industry, product safety, purchasing behavior, safety considerations*

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Factors affecting purchase intention of green products among university students in Sri Lanka

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The concern with green practices arises from the fact that global environmental problems have resulted from unsustainable business activities. Thus, researching purchase intentions toward green products is essential for both industry and academia. Despite extensive behavioral studies, few focus on green product purchase intentions. Empirical literature highlights the need for further investigation to provide additional evidence in this area. This research intends to address this gap by focusing on understanding Sri Lankan university students as young educated consumers who can enhance the knowledge of society. The Morgan table was used to determine the sample size of 200 students that will be used to represent the annual intake of Sri Lankan universities. They were selected using a convenient sampling technique. A comprehensive literature review was conducted to identify the variables for the study using the most recent studies in this area. Amongst, purchase intention toward green products was selected as the dependent variable while environmental attitudes, product attributes, social influence, personal experience, and environmental knowledge were identified as independent variables. Accordingly, the necessary hypotheses were derived. Then, primary data were collected from the university students in Sri Lanka using a survey-based questionnaire and received a 60% response rate. The analysis was continued with quantitative techniques using the statistical software IBM SPSS 25. Accordingly, the statistical tests related to normality, reliability, and validity were done hence; they were proved in the collected data. Then, the correlation analysis showed significant relationships between the dependent variable and each independent variable. But, further analyzing data, the regression model showed positive and significant relationships between purchase intention toward green products with only environmental knowledge and product attributes while environmental attitudes, personal experience, and social influence were insignificant. The findings of the study provide recommendations on how university students can enhance their green product purchase intentions and prospects for future research.

Keywords: *Environmental knowledge, product attributes, quantitative, regression, spss 25*

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Nurses' knowledge, attitudes, practices and associated factors on nutritional management of diabetes mellitus at base hospital Warakapola, Sri Lanka

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Diabetes mellitus (DM), a major cause of mortality globally, arises from inadequate insulin production by the pancreas or when the body cannot effectively use the insulin it produces. Effective management includes dietary therapy, exercise, monitoring, pharmaceutical therapy, and patient education, with adequate nutritional management being critical for establishing glycemic control. The study aimed to assess nurses' knowledge, attitudes, and practices (KAP) about the nutritional management of DM at Base Hospital (BH) Warakapola in Sri Lanka. A descriptive cross-sectional study was conducted among all the nurses(N=200) working at BH Warakapola. Data were collected using a self-administered, pre-tested questionnaire and analyzed with SPSS v25.0. The study received ERC approval from KIU(KIU/ERC/24/040). Among 200 participants, the majority were female (94%), married (94%), Diploma holders (71.5%), and aged between 35-40 (37%), with a mean age of 38 years. Nurses worked mainly in medical wards (15.5%), and maternity units (13%), and most had over 10 years of experience (67%). Significantly 61% had a loved one with diabetes and 3% (n=6) had diabetes themselves. The majority (59.5%) had a moderate level of knowledge, with a mean score of 14.41 out of 20, and 94.5% had a good level of attitude, with a mean score of 60.99 out of 72. Practice levels of the majority were moderate (76.5%), with a mean score of 33.62 out of 56. Significant associations were found between knowledge levels and factors such as gender(p=0.045), existing training in nutrition (p=0.042), and working ward (p=0.001), and between practice levels and existing training in nutrition(p=0.013) and working ward (p=0.01). In conclusion, while nurses at BH Warakapola possess moderate knowledge and good attitudes toward the nutritional management of diabetes, their practices remain only moderate. Hence targeted educational programs and standardized protocols to bridge the gap between knowledge and practice and enhance nursing practices are recommended to improve diabetes management and patient outcomes.

Keywords: *Attitudes, diabetes nutritional management, knowledge, nurses, practices*

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Comprehensive survey on public awareness of microplastic and alternative solutions for plastic

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Plastic pollution is one of the rising environmental concerns, particularly in coastal areas, posing serious threats to aquatic life and human health. This study aims to investigate public perception about awareness of microplastics (MP) and alternatives for plastic in the Galle and Matara districts of Sri Lanka. Information was gathered from individuals (211) in public places through pretested structured questionnaires based on awareness about alternatives to plastic, awareness, and issues about MP. The results revealed that 64.45% of the respondents were clueless about the term "microplastic. whereas only 6.64% were very familiar with it. However, 93.84% recognize MP as an environmental problem, while 94.31% strongly agree they can enter the food chain but only 1.4% consider possible MP contaminations while purchasing products. On the other hand, 76.8% disagree that the current regulations are enough to address the problems created by MP. 96.2% are aware of alternatives for plastics, and many of them (28.6%) suggested that paper can be used as a replacement, however only 17.06% of the respondents actively seek products with less plastic packaging when purchasing. The majority (90%) of respondents are willing to switch to alternatives. The main challenge that exists is the limited availability of the alternatives, indicated by 40% of the respondents. Nevertheless, 89% of the respondents believe that a considerable reduction of MP pollution can be achieved through plastic alternatives. The research raises awareness about MP pollution among the general public and plastic alternatives. A better level of understanding of MP pollution and proactive action can help ensure less MP pollution. Increasing the availability of alternatives in the market, and improved regulations will change the public attitudes.

Keywords: *Microplastics, human health, plastic alternatives, public awareness*

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Unveiling nurses' attitudes on digital technologies in nursing education and practice among nurses at Colombo South Teaching Hospital (CSTH), Sri Lanka

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Education and health care are transforming rapidly with digital technologies globally. As a result, nursing education and practice have also been transformed by digital technologies. Therefore, it is essential to assess nurses' attitudes towards using digital technologies in education and clinical practice. This study aimed to determine the attitudes of nurses toward utilizing digital health technologies in education and practice. A descriptive cross-sectional study was conducted among 274 nurses using simple random sampling. Data were collected utilizing a pre-tested, self-administered questionnaire developed through an extensive literature review. A five-point Likert scale consisting of 16 items was used to assess their attitudes. Higher scores on the scale preferred higher favorability indicating favorable (> 71%), moderately favorable (41%-70%), and unfavorable (< 40%). Data were analyzed using descriptive statistics in SPSS version 26. Ethical approval was obtained from the relevant authorities. The majority (n=234, 85.4%) were female and 62.4% of them (n=171) belonged to the 20-30 age category. More than half (67.2%, n=184) had experience between 1-5 years and 65% of them (n=178) had a basic nursing diploma as their highest professional qualification. The majority (78%, n=214) had a favorable attitude, 22% (n=60) had moderately favorable attitudes and none of them expressed unfavorable attitudes towards using digital health technologies in education and practice. Moreover, 79% believed that digital technology is essential for the advancement of the nursing profession and 66% believed that it increases motivation for higher education. Overall, nurses expressed a favorable attitude toward using digital health technologies. This reflects their readiness and openness to embrace technology revealing the possibility to integrate digital technologies into clinical practice and education. Therefore, nursing educators, policymakers, and digital health implementers would pay attention to developing strategies and integrating digital technologies into nursing education and clinical practice for better outcomes.

Keywords: *Digital technology, education, nursing, practice*

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Effectiveness of public-private producer partnership society-oriented (4PS) model on the level of adoption of good agricultural practices by tea smallholders' in Ratnapura district

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The Sri Lankan tea industry, primarily reliant on smallholder farmers, faces challenges in adopting Good Agricultural Practices (GAPs) which are vital for improving productivity and sustainability. The Tea Small Holdings Development Authority (TSHDA) has implemented initiatives to support these farmers, yet low technology adoption and limited resources persist, particularly in the Ratnapura district. This study aims to assess the effectiveness of the Public Private Producer Partnership society-oriented (4PS) model in enhancing the adoption of GAP among smallholders in the Ratnapura district. A mixed-methods approach was employed involving surveys, interviews, and observations of 100 tea smallholders engaged with the 4PS model across five representative villages in the Ratnapura district. Cluster sampling was utilized to identify the participants. Data analysis included; descriptive statistics, reliability testing with Cronbach's alpha, and ordinal logistic regression to evaluate the relationship between adoption levels and the factors. Accordingly, 78% of farmers demonstrated high adoption of GAPs, with significant positive correlations identified between agricultural practices such as harvesting, pruning, shade, weed, and fertilizer management and adoption levels. The ordinal logistic regression analysis revealed that above mentioned practices significantly influenced the effectiveness of the 4PS model while factors like the degree of partnership and access to resources had no significant impact. The study underscores the positive impact of the 4PS model on promoting the adoption of GAP among tea smallholders, suggesting that focused training and support can improve sustainability within the tea sector. Addressing barriers such as language and literacy is crucial for further enhancing the effectiveness of farmer organizations.

Keywords: *Farmer organization, GAP, productivity, sustainability, tea industry*

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