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"Innovations in Sustainable Food Systems Towards One Health"

Faculty of Livestock, Fisheries and Nutrition

Wayamba University of Sri Lanka

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"Innovations in Sustainable Food Systems Towards One Health"

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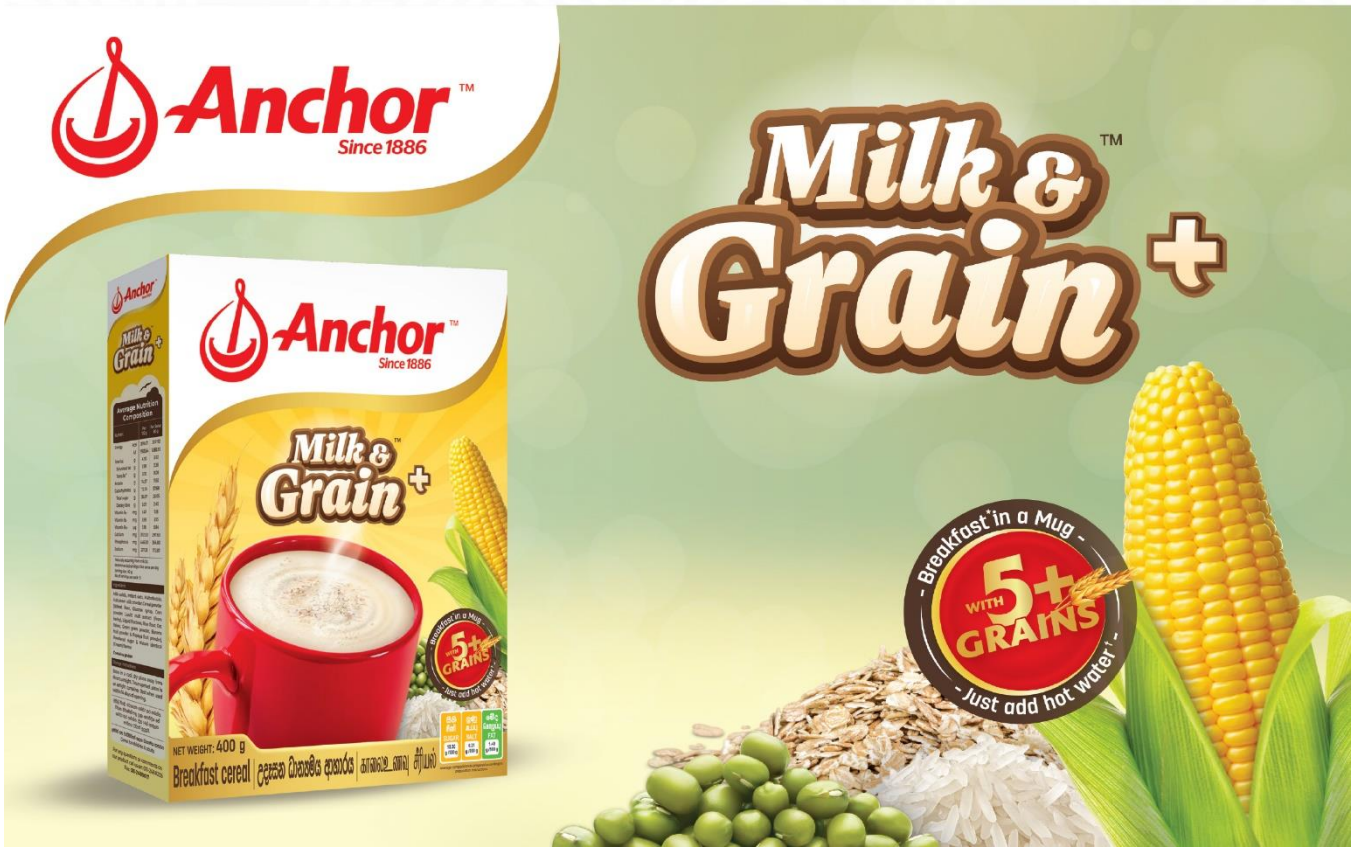

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UReS 2024

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FOREWORD

It is our great pleasure to welcome you to the e-proceedings of the Undergraduate Research Symposium (UReS- 2024) of the Faculty of Livestock, Fisheries & Nutrition-Wayamba University of Sri Lanka themed "Innovations in Sustainable Food Systems towards One Health". All the undergraduates of the faculty following the academic programs of BSc. in Food Production and Technology Management and BSc. in Food Science and Nutrition will be presenting their research findings upon completion of a fruitful hard work throughout a whole semester. This proceeding brings forth 200 abstracts under the disciplines of nutrition & dietetics, aquaculture and fisheries, food science and technology and livestock and avian sciences. UReS is an annual event of the faculty providing a golden opportunity for our undergraduates to exchange their experiences, innovations and skills with a wider scientific community to network with researchers, academics, entrepreneurs and industry.

These abstracts are the outcome of untiring involvement of undergraduate and academics both internal and external subject to review by the student's supervisor/s and the members of the editorial board. The faculty takes pride in appreciating the best research inventions through "Academic Research Excellence" and "Award for the Best Undergraduate Inventor", a way forward in promoting quality research in the future. Congratulations to all our undergraduates and a big thank you to all the authors and reviewers for their contribution. On behalf of the editorial committee my sincere thanks to Snr. Prof. Udith K. Jayasinghe, the Vice-Chancellor of the Wayamba University of Sri Lanka and Prof. Gamika A Prathapasinghe, the Dean of the Faculty of Livestock, Fisheries and Nutrition and the organizing committee for UReS 2024 headed by Dr. Nishanthan.

Sharmila Jayatilake (PhD)
Editor-in-Chief/UReS 2024
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

Table of Contents

Message from the Vice-Chancellor

I am pleased to extend my greetings to the 11th Undergraduate Research Symposium (UReS 2024), the annual research conference organized by the Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka.

Research is a dynamic need for a country to move forward, seeking a solid foundation for the challenges in new and innovative ways. On the other hand, research is an important aspect in the training of undergraduates for their future careers while developing planning, analytical, writing and presenting abilities of the students.

It is indeed a pleasure to see such a consecutive annual event which creates a platform for the young researchers to showcase their pioneering research and innovation, and I am sure that this symposium will mark the insightfulness of the faculty in a broader manner. I commend the relentless efforts and dedication of the Dean of the Faculty and the Organizing Committee and all other staff members who made this event a success with the limited resources, and I wish the faculty all success in this endeavor.

Finally, I also take this opportunity to wish the presenters at this symposium all success in their future careers as they take their experience into the broader world.

Snr. Prof. Udith K. Jayasinghe
Vice-Chancellor
Wayamba University of Sri Lanka

Message from the Dean

With immense pleasure, I extend my warm greetings to the Eleventh Undergraduate Research Symposium (UReS) 2024 of the Faculty of Livestock, Fisheries, and Nutrition. Undergraduate Research Symposium, the most prestigious annual event of the faculty, serves as a platform for final-year undergraduates to showcase their research innovations, inventions, and advanced academic skills. This symposium also provides a valuable opportunity for students to engage with researchers and academics from universities and industries, fostering knowledge exchange and collaboration.

The Eleventh UReS is themed "Innovations in Sustainable Food Systems towards One Health", emphasizing the critical role of research in creating resilient and sustainable food systems that contribute to human, animal, and environmental well-being. This year, more than 195 research papers will be presented across diverse fields, including Nutrition and dietetics, Aquaculture and Fisheries, Food Science and Technology, and Livestock and Avian Sciences.

Recognizing the significance of promoting scientific research and innovation, the faculty continues its tradition of acknowledging outstanding contributions. In addition to the "Best Student Inventor Award," we are proud to present the "Best Academic Researcher Award" once again, reinforcing our commitment to encouraging both students and academicians in their pursuit of research excellence.

On behalf of the Faculty, I congratulate all authors presenting their research today and express my sincere appreciation to their supervisors and collaborators. I also extend my heartfelt gratitude to the UReS 2024 organizing committee, academic and non-academic staff, sponsors, and all those whose dedication and hard work have made this event a success.

Prof Gamika A Prathapasinghe
Dean, Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

Message from the Coordinator

It is my pleasure to welcome you all to the Eleventh Undergraduate Research Symposium (UReS) 2024, themed "Innovations in Sustainable Food Systems towards One Health," organized by the Faculty of Livestock, Fisheries, and Nutrition, Wayamba University of Sri Lanka. UReS 2024 provides a valuable platform for final-year undergraduates to present their novel findings, innovations, and inventions to a distinguished scientific audience, fostering knowledge exchange and collaboration.

On behalf of the organising committee, I would like to express my sincere gratitude to Senior Professor Udith K. Jayasinghe, Vice-Chancellor, Wayamba University of Sri Lanka, and Professor Gamika A. Prathapasinghe, Dean, Faculty of Livestock, Fisheries & Nutrition, for their continuous support and guidance in organizing this event. I extend my heartfelt appreciation to Dr. Chaturangi Wickramaratne for accepting our invitation to deliver the keynote address and inspire the next generation of researchers. Additionally, I congratulate Professor G.A.P. Chandrasekara for being felicitated for research excellence and Ms. Kishanthini Kailavasan for winning the Best Student Inventor Award 2024/25.

I extend my deep appreciation to the academic staff of the faculty and external supervisors for their dedication in nurturing students' research interests and providing invaluable guidance. My sincere thanks also go to the esteemed panel of judges for accepting our invitation to evaluate the research presentations.

I would also like to acknowledge the generous contributions of our sponsors. Furthermore, I extend my profound gratitude to the UReS 2024 Organizing Committee, Dr. HACK Jayathilake, Director of the Information and Communication Centre, Makandura, and his team, the Senior Assistant Registrar, and all non-academic staff of the faculty for their unwavering support in making this event a success.

Finally, I deeply appreciate the hard work and dedication of the final-year students who are contributing to the dissemination of novel knowledge and technology through their research. I extend my congratulations to all presenters and wish the Eleventh UReS a resounding success.

Dr. G. Nishanthan Coordinator, UReS 2024
Faculty of Livestock, Fisheries and Nutrition
Wayamba University of Sri Lanka

Keynote Address
Scientific Innovation for Ecosystem Resilience in a Changing World

By

Dr. Chaturangi Wickramaratne

Researcher – Freshwater Ecology, International Water Management Institute (IWMI)

Environmental degradation continues to accelerate at an unprecedented rate, with wetland ecosystems experiencing some of the most severe losses globally. This keynote explores the critical intersection of scientific research and policy action needed to reverse these concerning trends.

Wetlands represent nature's multifunctional infrastructure, purifying water, sequestering carbon, supporting biodiversity, and providing flood protection. The intrinsic link between water and wetlands forms the foundation of these vital ecosystems, where hydrological processes determine their ecological character and functional capacity. Wetlands serve as crucial components of the water cycle, regulating water quantity and quality through filtration, storage, and gradual release, thereby supporting downstream water security and mitigating both flooding and drought impacts in our increasingly volatile climate. In urban and peri-urban settings, these water-wetland interconnections deliver additional benefits, including temperature regulation, recreation opportunities, and improved mental health for city dwellers increasingly disconnected from natural environments. The strategic protection and restoration of wetlands can address multiple water management challenges while enhancing climate resilience.

Yet despite their importance, wetlands face existential threats, with agricultural expansion representing the primary driver of wetland loss worldwide. Transforming our food production systems is therefore essential, with agroecological approaches offering promising pathways that can balance productivity with ecosystem integrity. However, robust monitoring frameworks are urgently needed to evaluate these approaches against comprehensive environmental, economic, and social justice metrics. Similarly, aquaculture's expanding footprint often damages sensitive wetland ecosystems through habitat conversion, pollution, and introduction of invasive species. Science must guide the development of innovative seafood farming practices that meet growing global demand while minimizing ecological impacts and supporting sustainable livelihoods in rural communities.

Emerging scientists stand at the forefront of this challenge, tasked with building the evidence base to address critical knowledge gaps in wetland science. Their work must encompass effective science communication and advocacy that translates complex ecological relationships into compelling narratives for decision-makers and the public alike. This presentation calls for a renewed commitment to interdisciplinary research that bridges science and policy, empowering communities to participate in wetland conservation while ensuring that scientific evidence informs transformative action toward sustainable development and a more harmonious relationship with these irreplaceable ecosystems.

Abstract Index

Department of Food Science and Technology

Department of Nutrition and Dietetics

Department of Aquaculture and Fisheries

Department of Livestock & Avian Sciences

Department of Food Science and Technology

Determination of physiochemical and functional properties of proteins extracted from agricultural residues and their effects on foods' properties

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The growing global demand has focused on alternative proteins derived from agricultural residues for sustainable food sources. This study investigates the physicochemical and functional properties of proteins extracted from underutilized agricultural residues, papaya seed, rice bran, and lentil waste having protein content 25.82±1.02%, 13.04±1.12%, 14.58±0.53%, respectively. The proteins were extracted using the alkaline method and tested for their fluid holding capacity, solubility, emulsifying properties, foaming properties, and antioxidant activity to evaluate their potential use as food ingredients. Extractable protein yields from papaya seed, rice bran, and lentil waste were 40.17±3.27%, 33.17±2.83% and 31.94±5.04%, respectively. Papaya seeds protein extract (PEP) demonstrated 81.26% N-protein and promising emulsifying ability (14.05±1.21m^2/g) and emulsifying stability (33.25±1.38%), suggesting its potential application in bakery product formulations and as emulsifiers. Moreover, PEP exhibited significant water holding capacity (3.73±0.28%) and oil holding capacity (2.91±0.17%), essential for improving texture, and stability in food matrices. Protein extracted from rice bran showed 78.59% N-protein and the highest foaming stability across the pH range, while protein extracted from lentil waste showed 74.31% N-protein and the highest foaming ability in acidic pH. PEP showed the highest DPPH scavenging rate of 61.48±2.65% followed by rice bran (44.41±4.43%), and lentil waste (22.73±4.31%) proteins. Texture analysis of pound cakes prepared using extracted protein revealed that protein incorporation influenced the structure of the cake and moisture retention, with the cake prepared from PEP shown to have the closest resemblance to cake made from egg in hardness (3.67±0.96), cohesiveness (0.55±0.14), gumminess (1.93±0.11), and chewiness (2.14±0.51). While the hardness of cake made form lentil waste (5.32±0.56) and rice bran protein (5.87±1.08) were higher than cake made from egg and PEP. These results concluded the potential of plant-based residues as a valuable protein source that can serve as a sustainable food ingredient, promoting waste valorization and reducing reliance on animal-based proteins.

Keywords: Agricultural residues, functional properties, plant-based protein, waste valorization

Evaluating jackfruit seed flour as a sustainable binder in chicken meatballs

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The application of plant-based binders in food products promotes sustainable food production and enhances dietary diversity. Jackfruit seeds, often discarded as waste, present a valuable source of protein, fiber, and essential minerals. This study aimed to evaluate the physicochemical and sensory properties of chicken meatballs prepared with jackfruit (*Artocarpus heterophyllus*) seed flour as an alternative binder to wheat flour. Five formulations were developed: the control had no flour, one formulation included 5% wheat flour, and the other three contained 3%, 5%, and 7% jackfruit seed flour. The physicochemical properties of the flours and the meatballs were analyzed. Both flours exhibited comparable bulk density, water holding capacity, and color, indicating similar physical properties. However, jackfruit seed flour resulted in higher weight gain during cooking, with the maximum gain (1.76%) observed at 7% inclusion. Additionally, meatballs containing 7% jackfruit seed flour demonstrated the highest protein content (18.61%), suggesting enhanced nutritional value. Jackfruit seed flour showed a lower water absorption capacity (116.66%) compared to wheat flour (150%), which led to reduced moisture content in the meatballs. All formulations demonstrated high lightness (L*) and low redness (a*) compared to the control. Sensory evaluation revealed that meatballs prepared with 5% jackfruit seed flour were the most preferred, indicating superior taste and texture compared to other formulations. Cost analysis highlighted the economic viability of using jackfruit seed flour as an alternative to wheat flour, promoting sustainable food production practices. Overall, jackfruit seed flour not only improved certain nutritional aspects but also received favorable sensory evaluations, making it a promising and cost-effective binder for chicken meatballs. This study highlights the potential of utilizing plant-based binders to enhance dietary diversity and sustainability in food production.

Keywords: Chicken meatballs, **j**ackfruit seed flour, physicochemical properties, sensory evaluation

Acknowledgement: The authors gratefully acknowledge the Wayamba University of Sri Lanka for providing the necessary facilities and resources for this study.

Effect of cinnamon bark and clove bud essential oils incorporated into a chitosan-based edible coating on improving quality indices and extending the shelf life of refrigerated yellowfin tuna (*Thunnus albacares*) steaks

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Ensuring quality and extending the shelf life of fish during refrigerated storage is economically feasible and important to achieve a higher market value. The shelf life of yellowfin tuna is reported to be 12 days under storage at 4°C. Edible coatings provide a new and safer alternative to chemical preservatives for improving fish preservation. The present study investigated the effect of cinnamon bark essential oil (CNO, *Cinnamomum zeylanicum*) and clove bud essential oil (CBO, *Syzygium aromaticum*) incorporated into a chitosan (Ch)-based edible coating on improving quality indices and extending the shelf life of yellowfin tuna (*Thunnus albacares*) steaks at 4°C. Chitosan was extracted from giant tiger prawns (*Penaeus monodon*) through demineralization, deproteinization, decoloration, and deacetylation. CNO and CBO were extracted via hydrodistillation. Fresh tuna steaks (80 g; 4×5×1.5cm) were divided into a control group and a treatment group, which was coated with Ch + CNO + CBO (2% w/v Ch + 1% v/v CNO + 1% v/v CBO) by immersion. The control and treated samples were analyzed at four-day intervals over 20 days for pH, total volatile basic nitrogen (TVB-N), trimethylamine (TMA), thiobarbituric acid reactive substances (TBARS) and total viable count (TVC). By day 20, the pH of the treated samples reached 6.96±0.02, compared to 7.06±0.03 in the control samples, from an initial pH of 6.19±0.06. The treatment effectively reduced TVB-N, TMA, and TBARS levels by 63.96%, 34.78%, and 38.10%, respectively, compared to the control. The control and treated samples exceeded the maximum recommended limit of 7.00 log CFU/g for TVC by day 12 and day 20, respectively. The results concluded that the combination of 2% w/v Ch + 1% v/v CNO + 1% v/v CBO effectively improved quality indices and extended the shelf life of yellowfin tuna steaks up to 33.33% at 4°C.

Keywords: Chitosan, cinnamon oil, clove oil, edible coating, yellowfin tuna

Acknowledgement: We gratefully acknowledge Lihini Seafood (Pvt.) Ltd., St. Jude Mawatha, Katuneriya, Sri Lanka, for providing the tuna samples and research facilities.

Identifying best practices to ensure the quality of TomEJC mango for export under sea freight

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TomEJC mangoes, a Sri Lankan cultivar, are in high demand internationally due to their flavor, aroma, color, and low fiber content. The TomEJC mango thrives in Sri Lanka's dry zone and is usually exported by air freight, taking about 15 days. Sea freight is a more economical option for larger volumes but has a longer transit time of 30 days, which poses challenges due to the mango's post-harvest behavior. This study aimed to identify gaps and recommend best practices for extending the shelf life of TomEJC mango during sea freight. The methodology involved collecting secondary data to identify gaps, best practices, and issues. Primary data were gathered through interviews with farmers, exporters, and officials in the value chain and cross-sectional studies to determine effective methods. It has been identified that there was a lack of good agricultural practices during the pre-harvest period, including improper irrigation, fertilizer use, and pest management. The correct maturity stage of harvesting has not been identified for extended shelf life. Malpractices at the harvest were noticed, such as improper harvesting methods, and de-sapping. Inadequate pack-house facilities, poor cold chain management transportation, and cold storage techniques resulted in the low shelf life of TomEJC mango during the post-harvest stage. A lack of understanding of sea freight export procedures for TomEJC was identified as a drawback. This study recommends proper bagging methods at the correct stage, pest, and fertilizer management as given by the Department of Agriculture, correct harvesting stage and de-sapping techniques, cleaning methods with minimal water use, and cold chain management. Additionally, it directed attention to the proper documentation procedure for TomEJC mangoes for export under sea freight. Further research is needed on new waxing materials for TomEJC mango, improving shelf life with 1-methylcyclopropene treatments and deciding time-temperature combinations for pest quarantine using Vapor Heat Treatment.

Keywords: Handling practices, post-harvest losses, pre-harvest management, TJC mango
Acknowledgment: This study was funded by the Food and Agriculture Organization.

Okra (*Abelmoschus esculentus* L.) mucilage as a fat replacer in chicken sausage: impact on physicochemical, textural and sensory properties

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Sausages are widely consumed comminuted meat products known for their high protein content, distinctive flavour, and convenience. Chicken sausages typically contain around 20% added fat, which plays a crucial role in emulsification, texture, and sensory appeal. However, excessive consumption of high-fat processed meats is linked to non-communicable diseases (NCDs), such as obesity and cardiovascular disorders. This study aimed to evaluate the feasibility of using okra (*Abelmoschus esculentus* L.) mucilage as a fat replacer in chicken sausages and its impact on physicochemical, textural, and sensory properties. Sausages were formulated with different levels of fat replacement (25%, 50%, 75%, and 100%) using okra mucilage, while a conventional sausage with 100% added fat served as the control. Sensory evaluation with 42 untrained panellists using a 7-point hedonic scale indicated that the 75% fat-replaced formulation had the highest acceptability. Sausages with okra mucilage had significantly higher moisture, ash, and carbohydrate content but lower fat levels, while crude protein remained unchanged (P>0.05). Cooking yield varied significantly, but emulsion stability showed no significant difference (P>0.05). Lightness (L*) values were significantly lower in okra mucilage-added sausages, while redness (a*) and yellowness (b*) remained unchanged. Texture analysis revealed no significant differences in hardness, cohesiveness, gumminess, or chewiness between the control and okra-added sausages. Gas chromatography analysis showed that sausages with fat replaced by okra mucilage had lower saturated, monounsaturated, and trans fats but higher polyunsaturated fatty acids. Additionally, pH, water activity, texture, colour, and microbial stability were monitored over 28 days. Findings suggest that okra mucilage is a promising fat replacer, with the 75% fat-replaced formulation offering a healthier alternative without compromising texture or stability.

Keywords: Comminuted meat products, fat replacement, non-communicable diseases, okra mucilage, physicochemical properties

Acknowledgement: Part of this study was conducted with the support of the Department of Chemical Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka.

Developing a carbonated fermented beverage from *Bacopa monnieri* (*lunuwila*) and evaluating its quality parameters

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This study aimed to develop a carbonated fermented beverage from *Bacopa monnieri* (*Lunuwila*) and evaluate its quality parameters along with its potential to enhance cognitive function. There is a lack of readily available, palatable, and scientifically supported functional beverages that effectively utilize the cognitive-enhancing properties of *Bacopa monnieri*, recognized for its nootropic properties in Ayurvedic medicine. It was chosen due to its abundance, ease of cultivation, and bioactive compounds, particularly bacosides, which are known to improve memory, learning ability, and cognitive function. The fermentation process with *Saccharomyces cerevisiae* lasts four weeks, followed by an additional four weeks of aging while gradually extracting bioactive compounds. The beverage was carbonated and canned. The properties of fermented beverage, including pH, titratable acidity, alcohol content, total soluble solids, and yeast mold count, were monitored weekly. Antioxidant capacity was evaluated through DPPH and FRAP assays, while total phenolic content was measured using the Folin-Ciocalteu method. Microbial stability was assessed through total yeast mold count and total colony count tests. The final product resulted in a pH of 3.61 ± 0.04, alcohol content of 12.30% (v/v), and total phenolic content of 2279.20 ± 390.81 GAE/L, indicating significant antioxidant potential. The glucose content of 35661.10±1045.45 ppm was determined by the High-Performance Liquid Chromatography method using a refractive index detector. The fermented beverage demonstrated 21.00 ± 0.57% free radical scavenging activity, possibly contribute to its neuroprotective effects. Sensory evaluation conducted with 60 untrained panellists (30 males and 30 females), showed 7.5 consumer acceptability on a 9-point hedonic scale, regardless of the inherent bitterness of *Bacopa monnieri*. This study highlights the potential of fermented beverages made from *Bacopa monnieri* as a natural cognitive enhancer, providing an innovative functional product that combines traditional herbal medicine with modern fermentation techniques. The findings emphasize the attainability of commercializing this beverage to promote cognitive health and mental well-being.

Keywords: *Bacopa monnieri*, cognitive enhancement, fermented beverage, neuroprotection
Acknowledgement: We gratefully acknowledge Mrs Nisansala Wijekoon, Makandura and Ceylon Beverages International for providing technical support and research facilitation.

Encapsulation of pomegranate (*Punica granatum* L.) peel extract treated orange (*Citrus sinensis*) peel powder composite to enhance the bioavailability of phenolic compounds

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Pomegranate (*Punica granatum* L.) is a significant source of phenolic compounds that are mostly concentrated in the fruit peels than inside edible part. This study aimed to improve the stability and bioavailability of phenolic compounds from pomegranate peel extract (PPE) by microencapsulating using orange peel powder (OPP) and maltodextrin as wall materials, as these phenolic compounds are highly susceptible to degradation during food processing and storage. The encapsulation was carried out using spray drying and freeze-drying techniques. The total phenolic content (TPC) of PPE was determined to be 13.67±3.31 mg GAE/g. OPP exhibited a composition of 34.27±4.72% crude fiber and 46.6±0.5 g/100g insoluble dietary fiber. These properties contributed to its film-forming capabilities and potential to act as an encapsulating agent. The highest encapsulation efficiency was 72.99±2.67%, with freeze-dried OPP/maltodextrin composite. X-ray diffraction (XRD) analysis confirmed that both freeze-dried and spray-dried powders exhibited crystalline and amorphous characteristics, with the freeze-dried powder had a higher crystallinity index (68%). Thermo gravimetric analysis (TGA) of freeze-dried and spray-dried microcapsules exhibited thermal stability up to 150°C. Scanning electron microscopy (SEM) revealed that spray dried microcapsules tend to be more spherical and freeze-dried microcapsules tend to be more irregular and flaky structure. The Fourier transform infra-red spectra (FTIR) of the microcapsules showed the broad peak at 3300 cm^{-1} suggesting the presence of O-H stretching due to hydrogen bonding between phenolic compounds and the wall materials (maltodextrin and OPP). Storage stability were conducted over a 45-day period, with the freeze-dried sample demonstrating the highest retention of TPC. These findings suggest that microcapsules offer potential applications in functional food development.

Keywords: Freeze dry, microencapsulation, orange peel powder, phenolic compounds, spray dry

Development of chitosan-based edible film incorporating curry leaf and green tea extracts to extend the refrigerated shelf life of chicken

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Biodegradable and antimicrobial packaging solutions are gaining popularity as a result of the growing demand for natural methods of food preservation. This study aims to develop a chitosan-based edible film incorporating curry leaf and green tea extracts to extend the refrigerated shelf life of chicken. The edible film was formulated by integrating different concentrations of 5,10,15% (w/v) of green tea extract (GTE) and 2,3,4% (w/v) of curry leaf extract (CLE). The film properties were determined by measuring mechanical properties including tensile strength and elongation of break and physical properties including density, thickness, opacity, water vapor permeability, moisture content and total soluble matter. Fourier transform infrared (FTIR) spectrometry was carried out to observe the potential modifications of the chitosan and incorporated extracts. Besides, total phenolic content, antioxidant activity and antimicrobial properties of the films were assessed. A shelf-life assessment was conducted including physicochemical parameters and microbial testing on the chicken samples wrapped with film and stored at 4°C±1. The results suggested that the film incorporating 15% GTE and 4% CLE (GTE15-CLE4) showed most effective results including highest density (1.6033± 0.015 gcm^{-3}), lowest water vapor permeability (0.0844±0.0005 $gmmm^{-2}d^{-1}kPa^{-1}$) at refrigerated (4°C±1) condition, lowest moisture content (21.26±0.497%) and highest inhibition zone for *Staphylococcus aureus* (19.70±0.02 mm) and *Salmonella spp.* (21.88±0.02 mm). The intensity changes of OH and N-H peaks in the FTIR spectra were suggested that some interactions occurred between chitosan and polyphenols from GTE and CLE. Consequently, the chicken wrapped with GTE15-CLE4 was preserved in good quality for more than 6 days compared to chicken wrapped with control film (CH). This research revealed that incorporation of GTE and CLE into chitosan film could be a viable solution for extending the refrigerated shelf life of chicken.

Keywords: Chitosan-based film, curry leaf extract, green tea extract, refrigerated chicken

Development of a meat analog using horsegram (*Macrotyloma uniflorum*) and chickpeas (*Cicer arietinum*) and evaluation of its digestibility and gastrointestinal fate in comparison to chicken nuggets

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Consumer interest in plant-based meat analogs has increased due to growing concerns about the environmental and health impacts of animal meat consumption. This study aimed to develop a meat analog using horsegram (28.4%), an underutilized legume with a superior nutritional profile, as the primary ingredient. Chickpeas (13%) were incorporated as a secondary ingredient, while carboxymethyl cellulose (CMC) functioned as a binding agent. Freeze structuring technique was used to develop the meat analog with a desirable texture profile. The research examined nutritional composition, textural attributes and gastrointestinal fate of the meat analog in comparison to commercially available chicken nuggets. *In vitro* digestion trials were conducted to analyze changes at different stages of digestion and to compare the bioavailability of proteins and lipids between the samples. The bioavailable protein and lipid fractions were quantified using formal titration and modified titration method respectively. Statistical analysis was performed using Minitab Statistical Software version 20. The meat analog's moisture% (36.37±1.64), ash% (3.64±0.56), and protein% (17.36±3.55) were not significantly different (P>0.05) compared to chicken nugget. However, fat% (21.33±1.03) and pH (6.60±0.06) exhibited significant differences (P<0.05). Textural parameters, including hardness, cohesiveness, gumminess, and chewiness, did not differ significantly between samples (P>0.05). Despite these similarities, the meat analog demonstrated a lower protein (13.32%) and lipid (2.10 mg/g) bioavailability compared to chicken nugget. The reduced lipid bioavailability may be attributed to the inhibitory effects of dietary fibers on digestion, while the lower protein bioavailability could be linked to the presence of antinutritional factors that hinder protein digestion. This concludes that while the meat analog closely mimics the chicken nugget, optimizing processing techniques is essential to enhance nutrient absorption.

Keywords: Bioavailability, freeze-structuring, *in-vitro* digestion, plant based meat analog

Extraction and encapsulation of carotenoids from canistel (*Pouteria campechiana*) fruit for food applications

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Canistel (*Pouteria campechiana*), an underutilized tropical fruit in Sri Lanka, is rich in carotenoids, responsible for its vibrant yellow color. This study focuses on the extraction and encapsulation of carotenoids from canistel and their application as a natural food colorant in jelly yoghurt production. Carotenoid extraction using ultrasonication showed that ethanol (95%) was an efficient solvent, yielding 264.20±28.37 μg/g of carotenoids when compared with acetone. Raw canistel contained 206.31±43.18 μg/g of carotenoids and dehydrated canistel contained 528.76±13.19 μg/g and freeze drying retained the highest carotenoid content (661.08±73.68 μg/g). Encapsulation using maltodextrin (M) and gum arabic (GM) in different ratios showed that 1:3 ratio of M to GM exhibited the highest encapsulation efficiency (51.23%), whereas the 3:1 ratio showed 48.76%, with no significant difference. The solubility test indicated that the 1:1 ratio had the highest solubility (55.27%), while the 3:1 ratio recorded 47.86% with no significant difference. Based on the visual perception of the dissolved color, the 3:1 ratio displayed superior characteristics, making it the preferred choice for further testing. Sensory evaluation of jelly yoghurt prepared with the encapsulated product and artificial colorant showed a significant difference in color and appearance (P<0.05), while taste, aroma, mouthfeel, and overall acceptability showed no significant difference (P>0.05). Stability analysis of jelly over 12 days showed decrease in lightness (L) by 10.22%, a gradual increase in redness (a) by 64.36%, and a significant decline in yellowness (b) by 76.20%. The encapsulated product was stored for a month at three temperatures 25, 35 and 45 °C. The decrease in L value (7.21%) and b value (9.82%) was lower at 25 °C. In conclusion, canistel derived carotenoids demonstrate strong potential as a natural colorant for food applications.

Keywords: Carotenoid, color, encapsulation, extraction, *Pouteria campechiana*

Granule morphology, physicochemical and functional properties of flour and starch extracted from two varieties of Sri Lankan *Colocasia esculenta* var. antiquorum corms

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Colocasia esculenta (*Dehi Gahala/ Cembu*) is identified as an underutilized root and tuber in Sri Lanka, which can contribute to dietary diversity and industrial applications. *Colocasia esculenta* var. antiquorum: *Sewala Ala (SA)* and *Thunmas Ala (TA)* are well known. However, only limited studies of this variety's starch and flour properties are available. This research aims to determine their potential for utilization in the food industry. The flour yield of SA (24.54±4.55%) was higher than TA (23.50±3.15 %). Proximate composition of flour showed significant differences except for fat and protein. The starch was extracted with water and alkaline extraction methods from corm and corm flour to find the optimum method. Starches were characterized by their functional groups using Fourier-transform infrared spectroscopy and by the morphological properties using scanning electron microscopy. X-ray diffraction analysis shows both starches were of the A-type. The least gelation concentration of both starches ranged from 6 - 8% (w/v) and can be used as additives to other gel-forming materials in food products. The gelatinization temperature of both is between 70 – 85^{o}C. The highest viscosity was recorded for SA starch (96.24 cP). Both varieties contained more amylopectin than amylose, 74.25% for SA and 82.45% for TA, which explains their high WAC. The best WAC (1.17±0.01 g/g) and OAC (1.12 g/g) were observed from TA. Methanolic extracts of flours have shown 5 – 7 mg GAE/100g of total phenolic content, 0.03 - 0.05 mg rutin equivalent/100g of total flavonoid content, and antioxidant activities ranged from 83.02 – 86.58% for the ability to reduce DPPH. This study suggests that flour and starch have characteristics that make them suitable for use as an ingredient in developing new products or as a substitute for conventional starch sources in industrial processes and to address food security challenges.

Keywords: Dietary diversity, food Security, gluten-free alternative, phytochemical

Development and physicochemical, nutritional, and sensory evaluation of crackers incorporated with canistel (*Pouteria campechiana*) fruit flour and rice flour

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Consumers prefer healthy snack options with various flavors and nutritional values. Industries are competing to introduce quality snack options with rice flour instead of traditional wheat flour. Canistel, locally known as *lawulu* (*Pouteria campechiana),* is an underutilized fruit rich in nutrients and antioxidants. It has less consumer acceptance due to its gummy texture. This study focused on developing a healthy snack cracker from canistel fruit flour and determining its physical, nutritional, and sensory properties. Canistel slices were dried, powdered, and sieved into fine flour. The prepared flour was combined with rice flour at the following ratios: 20:70, 25:65, and 30:60 (canistel flour: rice flour). These composite flour mixtures were then used for cracker preparation. Nutritional parameters such as moisture, ash, protein, fat, carbohydrates, and energy of canistel fruit flour were found to be 3.50±0.13%, 2.67±0.03%, 2.59±0.05, 4.67±0.07, 86.57±0.25%, and 398.64±0.20 Kcal/100g. For the crackers prepared with the 20:70 (canistel flour: rice flour) flour mixture, they were 2.37±0.07%, 2.88±0.03%, 5.04±3.83%, 11.77±1.26, 76.26±0.99%, and 436.86±6.53 Kcal/100g, respectively. Zn (mg/kg), Fe (mg/kg), Na (%), Mg (mg/kg), Ca (mg/kg), and K (%) of the canistel fruit flour were found to be 6.2, 18.3, 0.07, 542, 213, 01 and for the crackers they were 16.4, 10.1, 0.93, 393, 133, and 0.28 respectively. The vitamin C content of the canistel fruit flour and crackers was 22.5 mg/100g and 5 mg/100g, respectively. Total phenolic content of canistel fruit flour and crackers was 351.56 mg GAE/100g, 69.89 mg GAE/100g, and total flavonoid content was 46.43 mg QE/100g, 8.82 mg QE/100g, respectively. The results indicate crackers with canistel are a good source of many macro and micro-nutrients compared to traditional rice crackers. The crackers formulated with 20:70 canistel flour: rice flour . blend received the highest scores for sensory attributes, making it the most preferred product formulation.

Keywords: canistel, crackers, rice flour, underutilized fruit
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Development and quality evaluation of fermented pickle from radish *(Raphanus sativus)* and knol-khol *(Brassica oleraceae)* leaves

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Radish (*Raphanus sativus var.longipinnatus**)*** and knol-khol (*Brassica oleraceae var.gongylodes*) leaves are often discarded due to postharvest quality losses during long-distance transportation. This research was conducted to develop a fermented pickle from radish and knol-khol leaves and to evaluate the physiochemical, microbial, and sensory qualities of the product. Three treatments using leaves: roots ratio of 75:25 (radish only, knol-khol only, and a combination of both) were tested, and the best treatment was selected by a sensory evaluation (semi-trained panellists) using a seven-point hedonic scale. ABT-5 probiotic culture (0.0015%) was added to the best treatment, and the changes in physiochemical properties were compared. The pH, total soluble solids (TSS), and acidity were measured. The proximate composition (moisture, ash, crude protein, crude fat, crude fibre, and crude carbohydrate) was analysed for the selected product. Results were analysed using one-way ANOVA (P<0.05). Sensory data were analysed using the Friedman test. Accordingly, only the knol-khol-containing product ranked the best among the treatments. The total lactic acid bacteria count for wild fermented and probiotic-added treatment were $3x10^6$ CFU/g and $1x10^6$ CFU/g. YMC was within the safe level (1×10^3-$1X10^4$ CFU/g). The pH, TSS, and acidity were 3.90±0.08, 7.60±0.04, and 0.07±0.01%, respectively. Moisture, ash, crude protein, crude fat, crude fibre, and total carbohydrate contents were 89.00±0.61%, 1.80±0.28%, 0.42±0.01%, 2.40±0.03%, 5.50±0.17%, and 1.00±0.18%. Results revealed that a probiotic-rich fermented pickle could be prepared from knol-khol leaves while maintaining nutritional quality, microbiological safety, and sensory qualities.

Keywords*:* Fermentation, leafy-vegetables, probiotic

Development and characterization of proso millet-based composite flour: nutritional, functional, technological properties and suitability for gluten-free biscuits

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Consumers are becoming more aware of the role of nutrition in their health and wellness, and as a result, they are demanding healthier food options. This study focused to develop and characterize a proso millet-based composite flour as a healthier food option and assess its suitability for gluten-free biscuits. Proso millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*) and black-eyed cowpea (*Vigna unguiculata*) were blended in three proportions (60:20:20, 70:15:15, 80:10:10). The blends of composite flour were analysed for nutritional, functional, antioxidant properties and shelf stability. Proximate composition, physical properties (thickness, diameter, weight, spread ratio, colour parameter values, textural properties), sensory attributes and shelf stability were examined for the biscuits prepared using composite flour and wheat flour separately. Results indicated that carbohydrate and energy values were reduced while protein (up to 12.08±0.04) and fiber (up to 28.62±0.28) contents enhanced when increasing proso millet proportion, making them suitable for low-calorie diets. Functional properties such as water and oil absorption capacities (174.5±4.2, 136.47±0.5) indicated their suitability for bakery production. Results of antioxidant activities in composite flours showed significant DPPH radical scavenging capacities, total phenolic (mgGAE/g), flavonoid (mg rutin equivalent/g) and ferric reducing antioxidant power (µmol Fe2+/g). Superior protein (13.16±0.2) and fiber (31.36±0.82) contents were exhibited by composite flour biscuits compared to wheat flour biscuits. The sensory evaluation of prepared biscuits carried out by 30 semi-trained panellists confirmed that blend 02 (70:15:15) was the most preferred formulation with highest scores in appearance (7.57±1.22), aroma (7.23±1.22), mouthfeel (7.13±1.59) and overall acceptability (7.23±1.45) (P<0.05). During 28 days storage period, a minimal microbial growth and stable moisture levels ensured extended storage potential. Findings of this study demonstrated that proso millet-based composite flour can be used as a gluten-free alternative to conventional wheat flour for the development of nutritional and functional bakery products.

Keywords: Biscuit, composite flour blends, formulation, low-calorie, millet

Citrus (*Citrus aurantifolia*) peel fibre: Extraction and evaluation of its physiochemical properties and the *in vitro* gastrointestinal behaviour

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Citrus peels, often discarded as waste, hold immense potential as a sustainable source of dietary fibre with functional food applications. This study focused on the extraction and evaluation of fibre from *Citrus aurantifolia* peel to assess its physicochemical properties and in vitro gastrointestinal behaviour. First, dietary fibre was extracted using three different methods, including acidic (1% citric acid with sonication, and heating + sonication assisted) and alkaline extraction methods. Heating (60 min) + sonication (60 min) with 1% citric acid exhibited the highest total dietary fibre (TDF) yield with significant variations across peel fractions. (Albedo: 66.11±4.49%, Flavedo: 64.98±7.82%, Pomace: 75.96±14.75%). As of physicochemical characterization, water-holding capacity (WHC), oil holding capacity (OHC) and water swelling capacity (WSC) were evaluated. According to the results insoluble dietary fibre (IDF) and TDF exhibited superior water-holding (WHC) and oil-holding capacities (OHC), whereas soluble dietary fibre (SDF) demonstrated the highest water swelling capacity (WSC) (15.85± 0.40 g/g). *In vitro* gastrointestinal studies highlighted promising results in bile salt absorption (0.05±0.003 mg/g) and cholesterol absorption (1.45±0.07 mg/g at pH 7) suggesting potential benefits for lipid metabolism, and glucose absorption of 9.99±0.01 mg/g important in glycaemic control. In addition, encapsulation trials using *Citrus aurantifolia* peel fibre as a prebiotic wall material for *Lactobacillus rhamnosus* yielded moderate viability (4.53 log CFU/g) during *in vitro* gastrointestinal (GI) conditions, failing to meet the probiotic threshold for efficacy, indicating the need for optimization. Moreover pectin extracted from *Citrus aurantifolia* peel was used to develop a functional marshmallow prototype, demonstrating acceptable textural and sensory attributes, overall acceptability to gelatine-based counterparts. These findings revealed the potential of *Citrus aurantifolia* peel fibre in functional food applications offering dual advantages of improving gastrointestinal health and waste management.

Keywords: Dietary fibre, functional properties, lime peel

Assessing consumer awareness and identifying gaps in food regulations pertaining to consumer protection in Sri Lanka

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The Food Act of 1980 is the primary legislation governing food safety in Sri Lanka. While existing food regulations provide a strong foundation for consumer protection, several shortcomings pose risks. Awareness and compliance with these regulations are crucial for ensuring food safety. This cross-sectional analysis was done to assess the present status of awareness of food consumer protection regulations among consumers and identification of gaps in food legal frameworks. Data from an online and in-person survey of 160 consumers from all districts of the Western province were collected to evaluate the level of awareness. Identification of gaps associated with food laws in Sri Lanka was conducted, followed by a comparative review of food legislation in three other national jurisdictions. Findings indicated that the regulation on colour coding for sugar levels in liquid had the highest (Mean rank: 16.56) awareness, while the regulation on prohibition of potassium bromate in flour had the least (Mean rank: 9.55). Awareness of all food regulations, except the prohibition of potassium bromate, was significantly associated with education level. In consumer compliance with food safety practices, checking expiry dates was the most common (Mean rank: 11.95), whereas checking labels for additives (INS numbers) had the lowest compliance (Mean rank: 4.72). Most compliance factors, except expiry date checks and packaging inspections, were significantly linked to education. Comparative analysis revealed major regulatory gaps in Sri Lanka's food laws. The Food Act lacks clarity in defining food, leading to legal ambiguities. Fragmented regulations, absence of laws for novel foods, online food services, and surplus food distribution, and the overburdening of public health inspectors weaken enforcement. Additionally, Sri Lanka lacks unified food advertising laws and clear food packaging regulations. Addressing these gaps through clearer legislation, stronger enforcement, and improved consumer education is crucial for consumer protection. Implementing reforms will enhance compliance, align Sri Lanka with international standards, and ensure food safety.

Keywords: Consumer awareness, Food Act, food regulations, Sri Lanka

Assessment of regulatory compliance, domestic market access, and policy gaps for small-scale food enterprises

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Small-scale food enterprises are important contributors to the Sri Lankan economy through employment generation, stimulation of innovation, and consequent economic growth. However, such establishments face serious challenges in regulatory compliance that negatively affect their market access and overall competitiveness. Hence, this study aimed to examine the levels of regulatory compliance among small-scale food enterprises in the Galle district, explore their level of satisfaction with market access in the country, and identify the policy gaps prevailing. With a mixed-methods approach, quantitative and qualitative data were collected through structured surveys administered to 100 stakeholders, including business owners, managers, and employees. Data analysis was done using descriptive and non-parametric statistical methods. The results from this analysis showed that compliance level varies across different regulatory domains with high adherence to packaging materials (78.8%) and premises registration (73%) and low compliance for flavouring substances (38%) and colour coding for sugar, salt, and fat (39.4%). Market access satisfaction levels were perceived to be moderate, with businesses admitting to great opportunities for growth (83.6%) but facing challenges characterized by unfair competition (49.4%) and government support (40.2%). A statistically significant positive correlation was found between compliance with regulations and satisfaction with market access (P=0.331, P=0.001) and perception of the regulatory framework (P=0.379, P=0.000). The study emphasizes the necessity of corrective measures such as increased awareness programs on regulations and other benefits, simplifying the licensing procedure, and more government support. If more synchronization is established between food regulations in Sri Lanka and international standardization, it would facilitate compliance, enhance domestic market access, and establish a justifiable, competitive, and sustainable food-industrial base. Elimination of these barriers would allow prosperity for small food enterprises, contributing positively to the national economy and food security.

Keywords: Codex standards, food industry, food regulations, food safety, survey

Physicochemical properties, heat stability and sensory quality of black soldier fly larvae oil

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With the rise in global population and increasing food demands, researchers are exploring alternative food sources, such as entomophagy—the consumption of edible insects, particularly the utilization of insect-derived proteins and lipids. Black soldier fly (*Hermetia illucens*) larvae (BSFL) are a promising alternative for future sustainable nutrient sources. Among edible insects, BSFL are particularly noteworthy for their ability to transform organic waste into nutrient-rich biomass. This study aimed to evaluate the physicochemical and functional properties of BSFL oil. The composition of oil was analysed using AOAC methods, while the fatty acid profile was determined by gas chromatography. The oxidative stability of the oil during heating and storage over 12 weeks was assessed by evaluating changes in free fatty acid (FFA) content. BSFL oil exhibited a viscosity of 45.37 mPa.s and a refractive index of 1.4562. The peroxide value was measured at 4.70 meq/kg, with a FFA content of 0.2169% and an iodine value of 63.09 g I_2/100 g of oil. Fatty acid profile analysis revealed that lauric acid (47.67%) was the predominant fatty acid, followed by myristic acid (20.29%), palmitic acid (8.06%), and caprylic acid (7.59%). Thermal stability testing demonstrated an increase in FFA content and color degradation across all oils; however, BSFL oil exhibited a higher rate of thermal oxidation compared to sunflower and coconut oils (P<0.05). Sensory evaluation, conducted with 30 untrained panelists, revealed that sunflower and coconut oils were preferred for their aroma, color, and overall acceptability than BSFL oil (P<0.05). However, chips fried in BSFL oil showed comparable crispiness scores. In conclusion, while sunflower oil and coconut oil were superior in terms of sensory attributes and thermal stability, BSFL oil shows potential as a sustainable alternative. Further improvements are required to enhance its sensory properties and oxidative stability for broader applicability.

Keywords: Black soldier fly larvae oil, fatty acid profile, frying stability, oxidative stability, sensory acceptability

Influence of growth media on yield, proximate composition, physiochemical properties, antioxidant profile and gingerol content of ginger (*Zingiber officinale*)

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Ginger (*Zingiber officinale*) is a highly sought-after spice recognized for its distinct aroma and health benefits with global demand, priority driven by its bioactive compounds and gingerol content. The chemical compounds of ginger rhizome can vary based on the cultivation media. This research investigates how different growth media influence the yield, proximate composition, antioxidant profile and gingerol content of ginger to evaluate its quality and suitability for export. Ginger was grown in three growth media: compost, fish-based enriched biochar (FBC), and green-based enriched biochar (GBC) fertilizers, with application rates of 1, 2.5 , and 5 tonnes per hectare, alongside a control medium without fertilizer. The results showed significant variation (P<0.05) across treatments compared to the control. Among the treatments, the highest yield (373.00 g) was recorded in the FBC medium at 2.5T, followed by GBC 5T (283.78%), while compost (121.67%) resulted in a moderate yield. The control treatment recorded the lowest yield (73.67g). The fish-based biochar is rich in nitrogen (2.27%), phosphorous (2.64%), and potassium (1.75%), providing essential nutrients for plant growth may resulted high yield. The proximate composition quality standards for dehydrated ginger powder includes moisture (8.5-16.5%), ash (5.1-9.3%), protein (10.3-15.0%), fiber (4.8-9.8%) and fat (8.4-12.0%) meet by FBC 5T and GBC 5T and having pleasant sweet taste. Notably, GBC 5 T fertilizer treatment exhibited the highest phenolic content (43.86 ±0.86 mg GAE/g), flavonoid content (9.69±0.57 mg RE/g) and FBC 5T exhibited highest values for FRAP assay (47.92±0.38 mmol TE/g). HPLC analysis of oleoresin revealed that gingerol content was high in GBC 5T (25.44%) and FBC 5T (18.75%) compared to other treatments. In conclusion, different growth media affect ginger's yield, composition, and bioactive content. Ginger grown in FBC 5T and GBC 5T fertilizer media give high yield and meets export quality standards.

Keywords: Bioactive compounds, export, gingerol, growth media, oleoresin

Inhibitory effects of selected herbal teas on starch digestibility

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Recent studies have highlighted the potential of herbal teas in regulating postprandial glucose release, offering promising dietary solutions for diabetes management. This study assessed the impact of various herbal teas, including *Moraiya koenigii* (curry leaves), *Moringa oleifera* (moringa), *Flueggea leucopyrus* (*katupila*), *Gymnema sylvestre* (*masbedda*), and *Cardiospermum halicacabum* (balloon vine), on the *in vitro* and *in vivo* digestibility of starch and their antioxidant potential. The antioxidant potential was evaluated using the Folin-Ciocalteu, ammonium molybdate, DPPH, and ferric reducing power assays. *In vitro* analysis examined the impact of these herbal teas on the digestibility of four starches for α-amylase and amyloglucosidase using the quantitative Benedict's test. *In vivo* investigations measured the effects of herbal teas on postprandial blood glucose levels in healthy adults. Findings showed the inhibitory effects of different herbal teas on starch digestibility, revealing distinct differences. *M.koenigii* and *F.leucopyrus* exhibited the highest phenolic content (52.28 and 45.53 mg GAE/g extract), reflecting strong antioxidant properties. *M.koenigii* and *M.oleifera* showed superior ferric reducing power (4.88 and 4.72 mmol Fe2+ /g extract) and high DPPH radical scavenging activity (82% and 77%), indicating potent hypoglycemic effects. The impact of herbal teas on starch digestion was studied to obtain dietary products formulation for hyperglycemia. *In vitro* analysis revealed that *M.oleifera* and *M.koenigii* exhibited significant inhibitory effects on α-amylase and amyloglucosidase, particularly in white rice flour, 10.23% and 6.53% respectively. Conversely, *F.leucopyrus* significantly (P<0.05) inhibited the digestibility of wheat flour by 8.01% compared to other herbal teas. *In vivo* results confirmed these findings, with *M.oleifera* and *M.koenigii* demonstrating substantial reductions in postprandial blood glucose levels following the consumption of white bread (50g carbohydrate equivalent). The study found that 1% tea infusions significantly reduced starch digestibility, suggesting potential for managing hyperglycemia. Further research is recommended to confirm these findings and assess risks of overconsumption.

Keywords: Antioxidant activity, herbal teas, hypoglycemic effect, postprandial blood glucose, starch digestibility

Effect of high melting fraction of cocoa butter for enhanced heat stability in dark chocolates using Sri Lankan cocoa varieties

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Chocolate's susceptibility to heat-induced melting limits its market potential, particularly in temperate summers and year-round in tropical climates. Prolonged heat exposure softens and degrades its structure, reducing appeal and sales. While heat-resistant chocolate (HRC) is emerging, conventional approaches, such as adding external fats, face consumer resistance due to a preference for pure cocoa butter. This study developed HRC by fractionating cocoa butter to alter its fat composition without external fats. Trinitario and Forastero cocoa beans were fermented, followed by standard processing. Extracted cocoa butter was centrifuged (13,000 rpm, 30 min) to separate fat fractions, and a portion was further crystallized to obtain crystallized and non-crystallized fat. Ten dark chocolate formulations incorporating different butter fractions were evaluated for heat resistance (penetrometer), breaking characteristics (snap tests at specific temperatures), and sensory properties. Trinitario cocoa exhibited superior pod and bean characteristics (P<0.05), yielding higher bean weight (110.98±28.88 g) than Forastero (95.19±29.94 g). Chocolates made with Trinitario normal fat and Forastero low-melting fat (separated by crystallization) had the highest (Penetrometer: 0.5±0.09) and lowest (Penetrometer: 0.11±0.16) heat resistance, respectively. Incorporating high-melting cocoa butter fractions significantly improved heat resistance (P<0.05) over low-melting fractions. Most chocolates made with Trinitario showed superior (P<0.05) or comparable heat resistance (Forastero high-crystalline and Trinitario high-crystalline) to their Forastero counterparts. Snap tests indicated consistent crystallinity across formulations, suggesting development of a common structure. However, chocolates made with Trinitario low-melting fat and Forastero low-melting fat (separated by crystallization) were the most sensitive to temperature changes for snap from 25°C to 28°C. These findings highlight high-melting cocoa butter fractions as a viable alternative for HRC. Trinitario cocoa demonstrated superior heat resistance, making it ideal for warm climates. Further research should explore Criollo variety and other chocolate types, such as milk and white chocolates.

Keywords: Cocoa butter, Forastero, fractionation, heat resistant chocolates, Trinitario

Comparative analysis of techno-functional properties of black soldier fly larvae protein

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The exploration of alternative protein sources is essential for sustainable food security. Insects, particularly black soldier fly larvae, offer a promising future source due to their low environmental impact and potential to efficiently meet the growing global protein demand. Therefore, this study aims to assess the selected techno-functional properties, including water- and oil-holding capacities, emulsification and foaming stability, as well as the nutritional composition of defatted black soldier fly larvae meal (BSFL-DP), alkaline extracted BSFL protein concentrate (BSFL-EP) in comparison to egg albumen powder (EAP), and collagen powder (CP). Comparative analysis revealed that EAP had the highest crude protein content (92%), followed by CP (90%), BSFL-EP (74%), and BSFL-DP (42%). This indicates that while BSFL-EP is lower in crude protein compared to EAP and CP, they still provide a substantial protein content suitable for various applications. In terms of crude fat, CP exhibited a higher content (2%) than EAP, BSFL-DP, and BSFL-EP. The emulsification capacity of BSFL-EP was higher, comparable to CP, and superior to BSFL meal and EAP. Emulsification stability, foaming capacity, and foaming stability exhibit no significant differences among the samples, indicating that BSFL protein can perform similarly to traditional proteins in these aspects. Bulk density was significantly higher ($P<0.05$) in BSFL-EP, which may affect its handling and application in food products. CIE L* color was higher in BSFL proteins, which may influence consumer acceptance and product formulation. Additionally, a cooked protein emulsion model was prepared using BSFL powder at varying concentrations. The results demonstrated a significant improvement in textural properties compared to the control sample, providing valuable insights into the potential applications of BSFL protein. Overall, the findings suggest that BSFL protein offers a sustainable and efficient alternative to traditional animal proteins, with competitive nutritional and functional properties that support its integration into diverse food systems.

Keywords: Black soldier fly larvae, nutritional composition, physiochemical characteristics, techno-functional properties

Evaluation of antimicrobial effectiveness of common Sri Lankan spice extracts compared to chemical preservatives

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Consumers increasingly seek foods with fewer chemical preservatives due to concerns about additives, prompting research into natural alternatives. This study evaluated the antimicrobial efficacy of ethanol and aqueous extracts from five Sri Lankan spices (cinnamon, clove, garcinia, ginger, and black pepper) compared to sodium benzoate and sodium metabisulphites. Ethanol and aqueous extracts were tested against *Bacillus subtilis* and *Saccharomyces cerevisiae* using agar well diffusion method and minimum inhibitory concentrations (MIC) were determined via microbroth dilution method. The most effective spice extract, ethanol extract of garcinia, was tested for its antimicrobial efficacy using a lettuce food matrix. Results indicated that garcinia ethanol extract showed the strongest antibacterial effect measured by diameter of inhibition zone (DIZ) with a 31.40±0.50 mm, but had a minimal yeast inhibition, while clove ethanol extract was most effective against yeast (DIZ 24.02±0.24 mm) with moderate antibacterial activity (DIZ 15.61±0.24 mm). Cinnamon showed moderate inhibition against both microorganisms, whereas black pepper and ginger had little to no effect. Compared to the most potent spice extracts (garcinia, clove and cinnamon) sodium benzoate and sodium metabisulphites were less efficacious against bacteria (P<0.05)**.** The MICs for garcinia against bacteria and clove against yeast were 8.41 mg/mL and 2.20 mg/mL, respectively. Additionally lettuce sample washed with garcinia extract infused water had promising bacterial reduction compared to wash with regular water without altering the visual appearance for one week storage. These findings support the potential of garcinia, clove, and cinnamon to serve as potential natural alternatives to chemical preservatives.

Keywords: Antimicrobial, ethanol extracts, spices, water extracts, well diffusion method

Development of a natural pigment-based real-time indicator for food spoilage detection

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The growing interest in smart packaging solutions has focused on utilizing naturally extracted compounds as colorimetric indicators to assess food freshness. This study aimed to develop a natural pigment-based indicator film using biopolymer materials for real-time food spoilage detection. Bacteriological agar, carrageenan, pectin, and sodium alginate were evaluated for their film-forming properties. Among them, bacteriological agar exhibited moderate water solubility (36.43±3.01%), the overall lowest opacity (0.23±0.01), and a near-neutral inherent pH (6.3±0.02), making it the most suitable base material. The indicator films were formulated with 0.8% (*w/v*) bacteriological agar, 1% (*v/v*) glycerine as the plasticizer, and 10% (*v/v*) concentrated natural pigments. The pigments were extracted from blue butterfly pea (*Clitoria ternatea*) flower, black grape (*Vitis vinifera*) skin, hibiscus *(Hibiscus rosa-sinensis)* flower, pomegranate *(Punica granatum)* arils, red cabbage (*Brassica oleracea* L. var. *capitata* f. *rubra*), and mulberry (*Morus alba* var. *indica)* fruits. The color stability, pH sensitivity, and response to volatile ammonia and acetic acid of the pigment-incorporated indicator films were examined using a chromameter. A one-month study confirmed that the colors of indicator films were stable over time ($P>0.05$). All the indicator films were responsive ($P>0.05$) to changes in food metrics, indicating significant differences in L*, a*, and b* color parameters. The blue butterfly pea extract incorporated film displayed greater color shifts upon exposure to acetic acid ($\Delta E = 14.00\pm0.46$) and ammonia ($\Delta E = 47.34\pm1.41$), depicting the sensitivity to pH. Shrimp spoilage experiments conducted with indicator films demonstrated that the blue butterfly film had the most pronounced color change ($\Delta E = 60.98\pm0.42$, from dark blue to teal) in response to total volatile basic nitrogen (TVB-N). The developed food-grade indicator films offer a promising, non-destructive, and visual method for food spoilage detection, enhancing food safety and shelf life monitoring under storage conditions.

Keywords: Biopolymers, food-grade, food spoilage, indicator film, natural pigments

Encapsulated probiotic *Lactobacillus rhamnosus* loaded beetroot leather: A study on sensory attributes, storage stability, bioactivity and digestive fate

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Plant based probiotic products have recently been developed for vegetarians, people with lactose intolerance and dairy allergy. The availability of anti-microbial and antioxidant properties in herbal based products reduces the viability of probiotics. Microencapsulation can be used to improve the probiotic survival in herbal products. This research focuses on the formulation of beetroot leather infused with free and encapsulated *Lactobacillus rhamnosus* GG (LGG) and characterization and sensory evaluation of the product. LGG was encapsulated with 50% maltodextrin (T1), 50% sucrose (T2) and 33% maltodextrin+17% sucrose (T3) respectively. Encapsulated probiotic demonstrating highest encapsulation efficiency was selected for leather formulation and subsequent sensory and storage stability, antioxidant and invitro survival analysis. Matrix T3 demonstrated a significantly high encapsulation efficiency of 69%, establishing it as the ideal option for leather development. Three leather formulations were developed with: unencapsulated probiotics (F1), encapsulated probiotics (F2), and a control formulation devoid of probiotics (F3). Remarkably, F2 showed a superior consumer acceptability among formulations. All three formulations exhibited significant reductions in pH, and lactic acid bacterial (LAB) counts. In contrast, titratable acidity (% citric acid) increased significantly over time. The estimated shelf life, determined by the available LGG count, was found to be 66.5 days for sample F1, whereas 104.9 days for sample F2. Antioxidant testing indicated that the total phenolic content and DPPH inhibition percentage of formulation F1 are significantly lower than those of the other formulations. However, no significant difference was observed in the FRAP values among the three formulations. In vitro analysis indicated that the cell viability of formulation F1 is significantly higher following gastric digestion compared to formulation F2, and this level of viability tends to remain consistent throughout the intestinal digestion process. This study highlights the possibility of effectively developing a beetroot leather loaded with encapsulated *Lactobacillus rhamnosus*.

Keywords: *Lactobacillus rhamnosus GG*, maltodextrin, microencapsulation, sucrose, vegetable leather

Microbiological and biochemical investigation of natural palm inflorescence saps from coconut, *kitul*, and palmyrah in Sri Lanka

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In Sri Lanka, fermented saps are primarily produced from coconut (*Cocos nucifera*), *kitul* (*Caryota urens*), and palmyrah (*Borassus flabellifer*), which are collected by tapping the unopened inflorescence. Fermentation begins in the earthen pots used for sap collection, with microbiological and biochemical changes significantly influencing sap quality. This study investigated the biochemical and microbiological changes occurring in coconut, *kitul*, and palmyrah sap during fermentation and analyzed their flavor profile. Physicochemical analysis included pH, Brix value, titratable acidity (TA), alcohol content (AC), total phenolic content (TPC), total carbohydrate content (TCC), specific gravity (SG), and total solid content (TSC). Standard methods were used to measure pH, Brix, TA, SG, and TSC, while AC was determined using an ebulliometer, TPC by the folin–ciocalteu method, and TCC by the phenol-sulfuric acid method. Microbiological analyses involved total yeast and mold count (TYMC), direct microscopic count (DMC), yeast identification via PCR and DNA sequencing (ITS4, ITS5 primers). The sugar utilization patterns of isolated yeast strains were also assessed using phenol red broth. Flavor analysis was conducted using GC-FID. Results showed a decrease in pH, Brix, SG, TSC, and TCC, while TA, TPC increased during fermentation period. AC, TYMC and DMC peaked before declining during this period. *Saccharomyces cerevisiae* strain YJM451 was the predominant yeast species in all saps. Considering the sugar utilization, the above yeast strain fermented sucrose, dextrose, maltose, galactose, fructose, and lactose and ribose, D-arabinose, and xylose were not utilized. Flavor profile analysis revealed high levels of ethyl acetate, ethyl propionate, and ethyl lactate in palmyrah sap; acetaldehyde, 3-methylbutanol, and ethyl lactate in *kitul* sap; and ethyl propionate, ethyl lactate, and ethyl dodecanoate in coconut sap, with ethyl lactate notably present in all three. These findings provide insights into fermentation dynamics, yeast diversity, and flavor development, highlighting the potential for utilizing underexploited palm saps in food industry.

Keywords: Inflorescence sap, fermentation, physicochemical properties, volatile compounds

Optimization of fatty acid content and physiochemical properties of coconut oil through binary blending with rice bran oil, flaxseed oil and palm oil

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In Sri Lanka, coconut oil is the second most important food product, after rice, in order of importance to the diet. It contains a high amount of saturated fatty acid (91.8%). Therefore, fatty acid ratios of coconut oil are not correlative with WHO recommendation levels. This research study was done to optimize the fatty acid contents and physicochemical characteristics of coconut oil (CO) through binary blending with rice bran oil (RBO), flaxseed oil (FO), and palm oil (PO). Commercially purchased CO was blended with RBO, FO, and PO in the ratios of 50:50, 60:40, and 70:30. Their performance was determined through deep frying brinjal at 160-180°C for 3 frying cycles. Key physiochemical parameters were tested, including peroxide value, free fatty acid value, color, viscosity, and fatty acid composition. Among all the blends, the CO: RBO (1:1) ranks the best due to a balanced fatty acid profile and thermal stability. The fatty acid ratio of saturated fatty acids to monounsaturated fatty acids to polyunsaturated fatty acids was 3.4:1.6:1, which is close to the recommended value of intake of 1:1.5:1 while ensuring thermal stability. This blend's peroxide value (14.72±0.13 meq O_2/kg), free fatty acid value (0.313±0.028%), viscosity (54.26± 0.056 mPas), lower lightness, and minimal changes of fatty acid composition (Gas chromatography) proved stability. The CO:FO (1:1) blend had the highest iodine value (83.3±1.83 I_2/100 g), indicating the highest unsaturation, while the CO: RBO (1:1) had a higher tocopherol content (397.5 ppm). The sensory characteristics of the French fries prepared in CO: RBO (1:1) and coconut oil were evaluated by 30 semi-trained panellists using a 5-point hedonic scale, showing the same acceptability (P<0.05). Blending coconut oil with rice bran oil can be applicable for optimizing fatty acid content and cooking performance.

Keywords: Blending, coconut oil, nutrition value, rice bran oil, thermal stability

Evaluation of proximate and mineral composition, physiochemical and functional properties of selected banana (*Musa spp.*) varieties in Sri Lanka: comparative analysis with ripening stages

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Bananas (*Musa spp*.) are a food crop that is very common in Sri Lanka and cultivated widely in many climatic areas. The nutritional and chemical content of bananas vary depending on the type, ripeness stage. The objective of this study was to evaluate the physiochemical, proximate, functional, and mineral content of bananas *Seeni* (ABB), *Ambul* (AAB), *Embun* (AAA), *Kolikuttu* (AAB*), Suwandel* (AAB), *Rath Kesel* (AAB), *Sudu Kochchi* (AAA), *Nethra-palam* (AAA) that were chosen at three levels of ripeness (R1: More green than yellow, R2: More yellow than green, R3: Fully yellow).Physiochemical properties analyzed were pulp-to-peel ratio, pH, titratable acidity, and Brix. Also, proximate and mineral composition were analyzed. Total flavonoid content (TFC), total phenolic content (TPC), and antioxidant activity analyzed as functional properties. The data were statistically analyzed using ANOVA with 0.05 significance level ($p<0.05$) to find the effect ripening stage on each of the parameters and to compare the varieties. Considering the proximate composition significantly reduce the crude protein, fat, fiber and total ash content among the ripening stages. When consider the mineral composition, significantly not change the potassium and magnesium level among ripening stages. But magnesium content significantly reduces from R1to R3 stages. When considering the physiochemical properties, brix value, pulp-to-peel ratio, and pH value significantly increase while reducing the titratable acidity. Significantly higher antioxidant activity, TFC and TPC showed in the R2 stage. Antioxidant activity, as measured by FRAP, was higher in *Kolikuttu* (11.898±0.129 mg µmol Fe^{2+}/100g), and TFC higher in *Kolikuttu* (9.353±0.159 mg RE/g), while *Embun* had the highest TPC level (196.200±3.581 mg GAE/100g) at R2 stage. These findings underscore the importance of both considering ripening phases and cultivar when evaluating nutritional and functional characteristics of bananas for the development of food products and dietary consumption.

Keywords: Antioxidant capacity, banana varieties, physicochemical properties, nutritional composition, ripening stages

Production of single-cell protein from banana (*Musa spp.*) peels: a sustainable approach to fruit waste utilization

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Single-cell proteins (SCP) are dried microbial biomass used as an alternative protein source. Banana is one of the mostly consumed fruit, and 30–40% of its weight consists of peels, which are typically discarded. This research investigates the potential of utilizing banana peel waste for the production of single-cell protein, thereby addressing a critical gap in sustainable protein production using banana waste.Two banana varieties, *Seeni* (ABB) and *Ambul* (AAB), were collected, dried, powdered, and subjected to proximate analysis. The *Ambul* variety, with a higher protein content (4.10±0.01%) than *Seeni* variety (3.51±0.03%), was selected for further study. Then the dried peel powder underwent pretreatment and peel extract was inoculated with 2 mL suspension of *Saccharomyces cerevisiae* followed by submerged fermentation at pH 5.5 and 32°C for 48 hours. SCP was harvested via centrifugation and evaluated for physical and physicochemical parameters. Then SCP was incorporated into biscuits at 0%, 5%, 7.5%, 10% levels and proximate tests and shelf life test were conducted for best accepted biscuit formulation. The resulting SCP exhibited a water absorption capacity of 1.80±0.04 mL/g, a dry cell weight of 11.05±0.09 g, a bulk density of 0.50±0.02 g/cm³, a crude protein content of 24.2%, and an average protein yield of 31.2%. Sensory evaluation indicated that biscuits containing 5% SCP were the most preferred, while proximate analysis of the 5% SCP-enriched biscuits showed a significant increase (P<0.05) in protein content (8.30±0.02%) compared to the control biscuits (4.47±0.33%). The accelerated shelf life of the biscuit was 10 weeks, while 25°C was the best storage temperature. This study demonstrates that banana peels can be considered a viable fruit waste substrate for producing SCP and banana peel-derived SCP is a sustainable protein supplement for food products, promoting waste valorization.

Keywords: Banana peel waste, single-cell protein, sustainable protein, submerged fermentation

Food colorants and consumer awareness on related food safety regulations: a study conducted in selected areas in Gampaha district

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Food colorants enhance the appearance of foods but can pose health risks when non-permitted or excessive synthetic colorants are used. Consumer awareness in this field plays a major role in strengthening food safety of a country. This study assesses the consumer awareness, trust, knowledge and evaluating the types of colorants present in selected confectioneries, snacks, and beverages. A descriptive survey was conducted via online for data collection. Data were collected from 96 respondents representing diverse socioeconomic backgrounds in the selected areas of Gampaha district. This study also identified synthetic colorants in sampled food products using thin-layer chromatography (TLC) and paper chromatography. Data were analyzed using Microsoft Excel and Statistical Package for Social Sciences for Windows (SPSS), incorporating descriptive statistics, cross tabulations and non-parametric tests. Survey results of individuals revealed that 64.6% had an average level of awareness, with the highest awareness observed among the business sector and bachelor's degree holders. Business sector employees exhibit stronger trust (42.7%) towards regulations. Knowledge on food safety perceptions on colorants was moderate (45.8%) across most sectors. Statistical analysis indicated no significant gender differences but found that education level significantly influenced awareness, trust, and knowledge ($P<0.05$). Media influence was notable, with 39% obtaining information from social media. Analysis of 30 unpacked food samples showed that 79% contained permitted synthetic colorants, 11% had unidentified synthetic additives, and 10% were free from synthetic colorants. The most detected synthetic colorants were Sunset Yellow, Tartrazine and Ponceau 4R, predominantly in snack products, confectioneries, and beverages. Consumer behaviour analysis indicated that individuals more often purchase unpacked food (26%) and unpacked beverages (16.7%). These findings highlight the need for improved consumer education, stricter regulatory enforcement, and increased transparency in food labelling.

Keywords: Awareness, food colorants, public health risk, safety regulations

The effect of different processing conditions on phytochemical availability in *Cissus quadrangularis* plant stems.

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Cissus quadrangularis, or the Veld grape, is a succulent, perennial climber of the family *Vitaceae*. This plant, identified by its unique quadrangular stem, is widely used in Ayurveda, Siddha, and Unani medical systems. The powder of this plant has recently been of interest in the food fortifications. This study aimed to evaluate the impact of different processing conditions on the phytochemical composition of *Cissus quadrangularis* stems and develop a fortified food product. Fresh tender stems were collected and subjected to dehydration (55ºC for 24 hours) and fermentation (5% brine for 48 hours). Total phenolic and flavonoid contents were determined in each sample to assess the phytochemical availability. The dehydrated samples had the highest content (0.84±0.01 mg/g GAE phenolic compounds and 13.91±0.01 mg/g rutin equivalent flavonoids), followed by fresh (0.246±0.01 mg/g GAE phenolic compounds and 5.72±0.01 mg/g rutin equivalent flavonoids) and fermented (0.066±0.01 mg/g GAE phenolic compounds and 2.4±0.01 mg/g rutin equivalent flavonoids). Following the results, an instant string-hopper mix was formulated by incorporating 4% dehydrated *Cissus quadrangularis* stem powder, making it a dietary source of bioactive compounds. The study emphasizes the significance of processing conditions in optimizing the phytochemical potentiality of *Cissus quadrangularis* and its applicability in functional foods. Sensory results showed good consumer acceptability. Phytochemical analysis revealed that the fortified product had high levels of phenolic (0.128 mg/g GAE) and flavonoid compounds (2.52 mg/g rutin equivalent). The findings contribute to the increasing interest in the utilization of traditional medicinal plants in modern food formulations. Future studies may explore long-term consumer acceptability, stability, and bioavailability in human subjects by *in-vitro* and *in-vivo* methods to further establish its health benefits.

Keywords: *Cissus quadrangularis*, fortified, phytochemical, traditional medicine

Comparison of fatty acid profile, *trans* fatty acids and health lipid indices of selected extruded, fried snacks and chips in Kurunegala district

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Fried snacks contain unhealthy fatty acids, such as saturated fatty acids (SFA) and *trans* fatty acids (TFA) linked to non-communicable diseases. This study aimed to provide the distribution of fatty acid profile, *trans* fat, and health lipid indices in sixteen selected types of chips, fried snacks (murukku), and extruded snacks that were collected from a local market in Kurunegala district. In this study, fat was extracted from samples using the Folch method, while the fatty acid composition and TFA contents were determined by gas chromatography-mass spectroscopy, using a highly polar 100 m capillary column. SFAs were more predominant than monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) in all snack samples. Lauric (0.51%-23.68%) and palmitic (15.11%-34.79%) acids were the most common SFAs in snack samples. In all snacks, the most abundant MUFA and PUFA were oleic acid (14.79%-40.65%) and linoleic acid (0.04%-26.65%), respectively. Extruded snack type 1 showed the highest TFA content (0.86±0.03%) and TFA ranged from 0.01-0.86 g/100 g in snacks. Linoelaidic acid was the most abundant TFA in snack types, with values ranging from 0.01% to 0.72%, followed by elaidic acid (0.01% 0.12%) and *trans*-palmitoleate (0.01% 0.03%). Based on dietary recommendations, the recommended PUFA/SFA ratio, Atherogenicity and Thrombogenicity indices were ≥ 0.4, <1, <1 respectively. Snacks showed a PUFA/SFA ratio between 0.002-1.01. Atherogenicity and thrombogenicity indices for snacks were 0.4-4.88 and 0.62-3.69. According to these findings, taro chip type 1 showed the good health lipid indices and zero industrial TFA complying with Sri Lankan standards.

Keywords: Atherogenicity indices, PUFA/SFA ratio, thrombogenicity indices, unhealthy lipids

Impact of spice oleoresin blends on color stability of refrigerated raw beef patties

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Natural preservatives are increasingly favored in the food industry due to consumer preference for clean-label products. This study investigated the impact of spice oleoresin blends on the color and storage stability of beef patties, emphasizing their potential as natural preservatives. Formulations of beef patties were prepared by incorporating different ratios of cinnamon (*Cinnamomum zeylanicum*), ginger (*Zingiber officinale*), and nutmeg (*Myristica fragrans*) oleoresins. The blends were formulated with the following compositional ratios: (1) a primary blend with a 5:5:2 ratio of cinnamon: ginger:nutmeg, (2) a binary blend with an equal 1:1 proportion of cinnamon and ginger, and (3) two additional blends with a 5:2 ratio of nutmeg to a ginger/cinnamon mixture.The study quantified total phenolic content, antioxidant activity, metmyoglobin content, and sensory evaluation to assess the antioxidant potential and consumer acceptability of oleoresin-treated beef patties. The Three-Blend formulation exhibited the highest (P<0.05) phenolic content at 15.09±0.45 mg GAE/g and demonstrated superior antioxidant activity, with DPPH radical scavenging activity of 57.62±1.82% and Ferric reducing antioxidant power of 645.62±22.55 μmol Fe^{2+}/g. The Three-Blend oleoresin formulation demonstrated remarkable efficacy in reducing metmyoglobin formation, with the control group showing a 42.39±2.20% metmyoglobin content by Day 8, compared to substantially lower levels in treated samples. Redness values declined across all samples, but oleoresin-treated patties maintained better color stability. A sensory evaluation involving 30 untrained panelists indicated that the oleoresin-treated patties were more appealing in color and overall acceptance, with the Three-Blend formulation receiving particular preference (P<0.05). The research conclusively demonstrates that spice oleoresin blends offer a promising natural alternative and effective method for enhancing beef patty color stability.

Keywords: Antioxidant activity, beef patties, color, metmyoglobin reducing activity, spice oleoresin

Physicochemical, sensory properties, stability, and market potential of a paste made from grated and dehydrated coconut

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Coconut (*Cocos nucifera* L.) is a tropical fruit valued for its nutritional benefits and diverse applications in the food industry. Coconut paste is a viscous paste made from grated and dehydrated coconut after passing through the colloid mill. This study aimed to evaluate the market potential of coconut paste by investigating its physicochemical, sensory properties, stability, and market comparison with tetra-packed coconut milk (CM) and coconut milk powder (CMP). Coconut paste samples were collected from a local producer. Results revealed that the coconut paste was characterized by a high-fat content (72.38%±3.41), protein content (6.523%±0.07), and fibre content (16.15%±1.71). The pH of the coconut paste demonstrated fluctuations over storage time, varying from an initial 6.18 to lower values (3.60) at elevated temperatures. Similarly, colour stability analyses revealed changes in lightness (L*), redness (a*), and yellowness (b*) values over time, with higher temperatures accelerating colour degradation. The water activity of coconut paste (0.205±<0.01) is significantly (P<0.05) lower than that of CM (0.787±<0.01), while its water solubility index (16.37%±0.25) is significantly (P<0.05) lower compared to CMP (42.276%±1.01), which may negatively impact consumer retention. The product's shelf life is relatively limited to 3 months compared to CM and CMP. A market comparison through sensory evaluation indicated that coconut paste has a more intense coconut aroma and flavour compared to the CM and CMP available in the market. Sensory analysis data revealed that all tested products received similar acceptance levels regarding overall quality and acceptability (P>0.05). Product acceptability was further assessed using a seven-point verbal hedonic scale. These findings revealed that coconut paste has a good potential to be a valuable product in the Sri Lankan market, offering both economic and nutritional benefits while addressing the issue of coconut meat wastage.

Keywords: Coconut meat, coconut paste, market comparison, oily foods, shelf stable

Evaluating the changes in physicochemical and microbiological parameters of fresh lime juice stored in polypropylene, low-density polyethylene, and triple laminated aluminum foil under frozen condition

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Lime is widely used in the food and beverage industries, but its seasonal availability and storage challenges require alternative preservation methods. Freezing lime juice is an effective solution, but packaging material significantly impacts its quality during storage. This study aimed to evaluate the suitability of three packaging materials, Polypropylene (PP), Low-Density Polyethylene (LDPE), and Triple Laminated Aluminum (TLA) for maintaining the quality of frozen lime juice by assessing chemical, physical, microbial, and sensory parameters. Lime juice was extracted, packed into 5 ml packets of each packaging material, and stored at -18°C for two months. Chemical and physical parameters were assessed in 2, 4, and 8 weeks. Microbiological and sensory evaluations were done after two months. Permeability and accelerated shelf-life tests were conducted. Data were analyzed using repeated measures ANOVA. Significant differences were observed in lime juice, stored in different packaging types in terms of PH (P=0.005), total soluble solids (TSS) (P=0.000), titrable acidity (P= 0.000), and ascorbic acid content (P=0.003), but not in antioxidant activity (P=0.300) and total phenolic content (P=0.424). Lime juice stored in LDPE exhibited the lowest pH, while the highest TSS, titrable acidity, and ascorbic acid content were shown in TLA, PP, and PP respectively over time. The color was changed from YG 2C to YG 5D in the standard color chart after two months across all materials. Initially detected yeast and mold counts were reduced in all three packaging materials during storage time. PP received the highest preference for color and overall acceptability in sensory evaluation. The lowest water vapor permeability was observed in PP. In conclusion, PP is the most suitable packaging for maintaining chemical and sensory quality of frozen lime juice, while TLA is most effective for microbial stability and extending shelf-life.

Keywords: Lime, low-density polyethylene, polypropylene, triple laminated aluminum
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Development of a concentrated shot-type probiotic beverage from cheese whey through multi-strain fermentation

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Cheddar cheese production involves casein coagulation through the addition of starter cultures and rennet, leading to the separation of sweet whey. The disposal of whey poses environmental concerns, resource inefficiency, and economic loss in dairy processing plants. This study aimed to develop and evaluate a shot-type probiotic beverage using sweet whey, a disposal by-product of cheddar cheese production. The evaporation technique was used to evaluate the suitability of cheese whey while maintaining a temperature of 70°C. Four whey formulations were developed: liquid whey (LW) with 90.47% moisture, whey concentrate liquid (WCL) with 38.36% moisture removed, whey slurry (WS) with 69.32% moisture removed, and dried whey powder (DWP) with 90.63% moisture removed. The WS and DWP forms achieved a viscosity similar to WCL upon the addition of skim milk. Fermentation was conducted using probiotic cultures: *Bifidobacterium animalis* subsp. *lactis*, *Lactobacillus acidophilus*, *Lactobacillus delbrueckii* subsp. *bulgaricus*, and *Streptococcus thermophilus*. Fermentation dynamics, including pH, titratable acidity, and viscosity, were monitored to confirm the medium's suitability for probiotic cell viability. Among the four forms of whey, WS combined with skim milk was identified as the most suitable base for the beverage through sensory evaluation, owing to its optimal flow behavior, similar to a concentrated beverage. The developed concentrated whey beverage (CWB) retained more than 8 log CFU/mL during 21 days of refrigerated storage at 5°C, exceeding the minimum therapeutic dose for probiotic efficacy. Proximate analysis revealed that CWB exhibited higher nutrient density compared to LW and Fermented LW (FLW) beverages, with increases in ash (12.06%), protein (85.75%), and fat content (35%). Sensory evaluation indicated greater consumer acceptability for CWB over LW and FLW beverages. The physicochemical and microbiological quality assessments confirmed its stability and safety over 21 days. In conclusion, CWB serves as an excellent functional probiotic beverage, promoting sustainable utilization of dairy by-products.

Keywords: Concentrated, probiotics, shot-type beverage, sweet whey
Acknowledgement: Grateful to Milco (Pvt) Ltd for providing whey samples and dairy insights.

Development of white pepper from commercially available black pepper using mechanical, enzymatic, and microbial fermentation methods

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Traditional white pepper is produced from fully ripened *Piper nigrum* berries through microbial fermentation, a time-consuming and seasonal process that limits year-round production and exports. This study aimed to develop white pepper from commercially available black pepper using mechanical decortication, enzymatic treatment, and microbial fermentation to enhance processing efficiency, yield, and quality. Mature black pepper berries (>3.5 mm) were first separated by density using 6% and 10% salt solutions before decortication. Mechanical processing involved soaking (0.5–6 hours) before decortication, while enzymatic treatment used pectinase, protease, and their combination (500 ppm) for four days. Fermentation employed *Bacillus subtilis* for four days. After decortication, berries were dried at room temperature (32–35°C) for 2–3 days, categorized as fully, partially, or un-decorticated, and analyzed for color (L*, a*, b*), proximate composition, and odor. Results indicated that soaking time significantly affected white pepper yield ($P<0.05$), while density separation and its interaction with soaking time had no significant effect ($P>0.05$). Soaking time had a marginal impact ($P\approx0.07$) on the broken percentage. Enzymatic treatment significantly improved yield and whiteness ($P<0.05$) over other methods, with pectinase and its combination with protease yielding the highest whiteness and yield, though their effects were similar. *Bacillus subtilis* fermentation improved whiteness and yield ($P<0.05$) but caused an undesirable odor. Proximate analysis showed no significant differences in ethanol extract, volatile oil, ash content, crude fiber, and moisture ($P>0.05$). In conclusion, enzymatic and mechanical methods are viable alternatives to traditional fermentation, with enzymatic treatment offering the highest yield and whiteness without external odors, enabling year-round production to enhance export potential.

Keywords: *Bacillus subtilis*, color analysis, density separation, proximate composition, soaking period

Identification and characterization of major volatile compounds in spirits commonly available in Sri Lanka

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Volatile compounds in raw spirits influence the flavour, aroma, and sensory attributes of distilled alcoholic beverages. This study aimed to characterize 18 major volatile compounds and analyse three physicochemical properties (pH, alcoholic strength, and density) in five spirits commonly available in Sri Lanka: Extra Neutral Alcohol (ENA) from sugarcane molasses and maize, Rectified Spirit (RS) from sugarcane molasses, coconut spirit, and palmyrah spirit. Volatile analysis was conducted using Gas Chromatography with Flame Ionization Detection (GC-FID). ENA from sugarcane molasses contained only acetaldehyde and methanol, while ENA from maize included acetaldehyde, methanol, and 1-propanol. RS primarily contained methanol, acetaldehyde, and ethyl acetate. Coconut spirit exhibited a broader volatile profile, including acetaldehyde, 1-propanol, ethyl acetate, 2-methyl-1-propanol, 3-pentanol, 3-methyl butanol, and ethyl lactate. Palmyrah spirit, the most volatile-rich, contained these compounds along with unique volatiles such as linalool, 2-phenyl ethanol, ethyl octanoate, and ethyl dodecanoate. Statistical analysis revealed distinct volatile profiles, with ENA, RS, coconut, and palmyrah spirits forming separate clusters. Physicochemical results showed that ENA and RS had the highest alcohol strength (96.20±0.06% v/v), nearly neutral pH (6.70±0.1 and 7.57±0.21, respectively), and low density (0.806±0.001 g/cm³). Coconut and palmyrah spirits had lower alcohol strengths (73.17±0.06% and 79.97±0.06% v/v), acidic pH (3.53±0.15 and 4.00±0.1), and higher densities (0.859±0.001 and 0.878±0.001 g/cm³). One-way ANOVA with Tukey's test confirmed similarities between ENA and RS, while coconut and palmyrah spirits exhibited significant differences. These findings highlight ENA's suitability for neutral spirits, while coconut and palmyrah spirits serve as bases for traditional beverages. RS demonstrated intermediate characteristics, with high alcohol strength but elevated volatile content. Future studies should explore additional spirits, analyse a broader range of volatiles, and incorporate sensory evaluations for enhanced product differentiation.

Keywords: Coconut spirit, palmyrah spirit, volatile compounds

Development of a sauce using *Daucus carota* leaves

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The growing demand for high-quality, healthful diets has led the food industry to develop innovative products rich in bioactive compounds while prioritizing the efficient use of natural resources for sustainable development. This study was focused on developing a sauce using carrot (*Daucus carota)* leaves, which are often used as animal feed or discarded during harvesting. The sauce was subsequently subjected to assess physicochemical properties, content of bioactive compounds, antioxidant activity, shelf life, and consumer approval. Based on sensory analysis, the most acceptable composition (26.2% water, 6.9% sugar, 5.7% onion, 4.6% sweet potato flour, 4% vinegar, 2.9% salt, 2.3% ginger, 2.3% garlic, 2.3% chili powder, 2.3% liquid glucose, 0.5% spices, 0.1% sodium benzoate, and 0.1% citric acid) of the sauce was with 40% leaf extract. The final product contained 70.47 ± 1.28% moisture, 17.67 ± 1.18% carbohydrates, 5.14 ± 0.33% protein, 3.44 ± 0.13% ash, 2.63±0.49% fiber, and 0.65±0.03% fat. The sauce has relatively high total phenolic content (79.36±0.57 mg of GAE/g of sample) and % of inhibition of DPPH was 74.76±5.23%, and total flavonoid content was 1.06±0.11 mg of RE/g of sample. However, the chlorophyll (0.08 mg/g), carotenoid (12.28 mg/g), and vitamin C content (454.54 IU of vitamin C/L) were relatively lower than fresh leaves, likely due to thermal degradation during processing. Based on the accelerated shelf-life testing, the minimum shelf life of the sauce at 25°C was determined to be five weeks. The results showed that *D. carota* leaves can be used to produce value added products such as sauces with nutritional benefits and thus give value to this by-product of carrot cultivation.

Keywords: Agricultural waste, antioxidant activity, bioactive compounds, *Daucus carota*

A nutrient-dense bar using local underutilized seeds and quality evaluation: a sustainable approach to healthy snacking

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A Nutri bar is loaded with essential nutrients that provide additional health benefits beyond basic nutrition. This study aimed to develop a nutrient-dense bar using locally available, underutilized seeds to promote sustainability and reduce food waste while providing convenient, nutritious, healthy snack options. Nutri bars were prepared with local underutilized seeds, listed as, pumpkin, watermelon, winged bean, and tropical almond incorporated with popcorn and oats. Pumpkin and watermelon seeds were sourced from the Kandy marketplace and households, while tropical almond and winged bean seeds were obtained from home gardens. Two formulations (P1: popcorn-based; R1: puffed rice-based) were evaluated through sensory evaluation (n=30). The selected formulation was evaluated for functional properties, physical properties (AOAC, 2005), microbial quality, accelerated shelf-life, and sensory evaluation tests. The P1 formulation demonstrated acceptable sensory and favorable nutritional properties: 12.70±0.44% crude protein, 27.86±1.55% crude fiber, 11.19±1.45% crude fat, 39.62±0.01% of total carbohydrates and 365.71±0.01 Kcal/100g energy value. According to functional compound analysis, nutri bar reported a favorable antioxidant potential, with 91.70±0.11% of DPPH free radical scavenging activity, 121.03±6.41 mM Fe^{2+}/L of FRAP value, 3.89±0.20 mg GAE/g of total phenolics and. The mineral composition presented potassium (537.50±4.95 mg) and magnesium (168.00±0.00 mg) as dominant minerals, while vitamins E and niacin were indicated at 3.90± 0.99 mg and 3.90±0.42 mg. The total plate count (3.23×10^2±0.01 CFU/g) and yeast and mold count (2.64×10^2±0.04 CFU/g) tests were performed to confirm the safety of the product. Accelerated shelf-life testing of the product reported 16-week stability using the Q10 equation. This innovation revealed the development of a nutrient-dense bar with underutilized seeds to deliver a convenient snack rich in protein, fiber, and functional compounds, addressing healthy, nutritious dietary requirements and environmental sustainability.

Keywords: Functional foods, sustainable foods, underutilized seeds, waste utilization

Effectiveness of papaya seed powder as a novel bulk-forming laxative compared to psyllium husk and coconut powder

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Constipation is a prevalent gastrointestinal disorder characterized by infrequent bowel movements (less than three per week) and associated symptoms such as hard stools, straining, and incomplete evacuation. It poses a significant economic burden due to increased healthcare utilization and lost productivity. This study explored the potential of food industry by-product, papaya seed powder (PSP) as a novel bulk-forming laxative, comparing its efficacy with established laxatives such as psyllium husk (PH) and coconut powder (CP). The physical properties (bulk density, tapped density, compressibility index, flowability, hardness, morphology), chemical properties (proximate composition, water activity, dietary fiber content, antioxidant potential, saponin test) and functional properties (water-holding capacity [WHC], swelling indices) of these materials were analyzed. Results indicated that PSP had a dietary fiber content of 33.70%, WHC of 4.72 g water/g dry matter, and a swelling index that increased with pH, suggesting its potential as a bulk-forming agent. PH demonstrated the highest WHC (39.21 g water/g dry matter) and swelling index (3.75 mL/g at pH 7.4), while CP showed insoluble fiber content of 56.24%. Formulated tablets containing PSP, PH, and CP were evaluated for their physical, chemical, and functional properties. The tablet with high CP content showed the highest WHC (6.31g water/g dry matter) and tablet with high PH content exhibited the highest swelling index (9.30 mL/g at pH 7.4). High PSP-containing tablet showed highest number of phenolic compounds (32.01 mg GAE/g) highlighting the antioxidant potential of novel laxatives. The study sheds the light on the fact that PSP, with its moderate laxative properties and high bioactive content, could serve as a complementary ingredient in bulk-forming laxative formulations. Additionally, this research paves the way to support the sustainable utilization of by-products in healthcare products. Further *in vivo* studies are recommended to validate these findings and assess the physiological effects.

Keywords: Bulk, by-product**,** constipation, fiber, papaya

Development and characterization of cinnamon-infused instant black tea for instant beverage application

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During the production process, instant black tea has gained significant attention due to its convenience. Instant black tea undergoes degradation of volatile aroma compounds and bioactive compounds resulting in a reduction of antioxidant activity due to the high temperatures involved in spray drying. This study aims to compensate for the loss of antioxidant activity by infusing cinnamon (*Cinnamomum zeylanicum*) as a natural antioxidant source while addressing the growing demand for flavoured instant tea. Compared to previous studies where cinnamon infusion was added post-drying, this study introduces a novel approach by infusing cinnamon before drying. Cinnamon-infused instant black tea powders were prepared by infusing cinnamon at 3%, 5%, and 7% (w/v) levels into concentrated black tea extract (TSS = 15g/100g) followed by the addition of maltodextrin (12% w/v). This concentrate was spray-dried and the resulted powder was then analysed for physicochemical properties, antioxidant activity, and sensory attributes. Water activity and solubility were not significantly (P<0.05) affected, while moisture content, colour, pH, and titratable acidity were significantly (P<0.05) affected by cinnamon addition. The total phenolic content of instant black tea was significantly (P<0.05) increased with cinnamon infusion level from 14.01±0.06 to 16.21±0.03 g GAE/100g DM. Similarly, antioxidant activity, evaluated through DPPH scavenging activity (60.06± 0.09 to 66.39±0.18%), FRAP assay (23.42±0.28 to 26.88±0.07 $mmolL^{-1}$ Fe^{2+}, and total antioxidant activity (12.74±0.01 to 15.20±0.06 g AAE/100g DM), significantly (P<0.05) increased with cinnamon infusion level. Sensory evaluation revealed that, the 5% cinnamon-containing sample achieved the highest mean overall acceptability score (7.90±0.71). Results showed that infusing cinnamon into instant black tea enhances antioxidant activity while maintaining desirable physiochemical properties. Additionally, the 5% cinnamon-containing sample reflects consumer acceptance for instant beverage applications.

Keywords: antioxidant, cinnamon, flavoured tea, instant tea, spray drying

Effect of pomegranate peel powder on the quality of chicken sausage

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The increasing demand for pomegranate juice has led to a greater availability of pomegranate *(Punica granatum)* peel, a by-product with significant bioactive and nutritional potential. This study evaluates the effects of incorporating pomegranate peel powder (PPP) at 2.5% and 5% concentrations on the physicochemical, microbiological, and sensory properties of chicken sausages stored at -18±2°C over 12 days. Quality assessments were performed at four intervals (days 0, 4, 8, and 12) to evaluate pH stability, lipid oxidation, protein degradation, microbial growth, water activity, and sensory attributes. The initial pH values for the control, 2.5% PPP, and 5% PPP samples were 6.18±0.14, 5.87±0.13, and 5.54±0.17, respectively. Sausages containing PPP maintained significantly lower and more stable pH levels throughout storage. The 5% PPP treatment showed the most pronounced preservation effects, with a notable reduction in thiobarbituric acid reactive substances (TBARS) and total volatile basic nitrogen (TVB-N), indicating lower lipid oxidation and protein degradation. Microbiological analysis revealed a significant decrease in total plate counts, with the 5% PPP formulation demonstrating the strongest antibacterial effect. Additionally, treated samples especially those with 5% PPP exhibited more stable water activity, suggesting an extended shelf life. A dose-dependent trend was observed across all parameters, where higher PPP concentrations correlated with improved quality retention. However, sensory evaluation revealed that while the 5% concentration provided optimal preservation benefits, it negatively impacted taste and texture due to increased bitterness and firmer consistency. In contrast, the 2.5% concentration offered a better balance between preservation efficacy and consumer acceptability. These findings highlight the potential of pomegranate peel powder as a natural and sustainable preservative for processed meat products, offering a viable alternative to synthetic additives while adding value to an agricultural by-product.

Keywords: Antimicrobial properties, chicken sausage, natural preservative, pomegranate peel

Enhancing the protein profile of spread cheese through selected grains and egg powder fortification

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Cream cheese is a widely consumed dairy product with relatively low protein content and some essential amino acids compared to grains and eggs. To enhance the protein profile of cream cheese, egg powder and grain powder mix, consisting Soy beans (*Glycine max),* Cowpea (*Vigna unguiculata*), and Mung beans *(Vigna radiata)* which were selected based on their amino acid profiles were used. Sensory analysis conducted with a trained panel proved that fortification of cream cheese using roasted grain powder is better than unroasted grain powder in terms of sensory properties. Cream cheese fortified with 12.5% egg powder (EP) and 12.5% grain powder (GP) resulted acceptable sensory properties such as colour, aroma and taste and selected for further analysis. Higher fortification levels negatively affected sensory attributes of grain and egg powder fortified cream cheese. Proximate analysis confirmed fortification has significantly improved protein content compared to control (10.340%±0.234). The highest protein content was observed in EP (14.265%±1.120), followed by GP (13.448%±1.262). EP and GP resulted 37.959% and 30.058% protein enhancement respectively compared to control. Fat content remained stable while ash content increased in both fortified samples. Moisture content is highest in control (51.037%±1.095) followed by EP (41.283%±1.112) and GP (37.107%±0.576). GP has 1.070±1.002 amount of fiber while control and EP did not contain fiber. According to in vitro protein released study EP released 62.591% protein into gut stimulated environment within 6 hours. GP and control released 51.574% and 17.961% protein respectively into gut environment within 6 hours. According to the microbiological analysis fortification did not negatively affect the microbial quality, though total plate counts increased over four weeks of storage. These findings suggest moderate grain and egg powder fortification effectively enhances protein content of cream cheese while maintaining consumer acceptability.

Keywords: Amino acids, cream cheese, fortification

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Production and characterization of liquid smoke from lignocellulosic biomass using a home-scale pyrolysis reactor

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Lignocellulosic waste and by-products contribute to significant environmental challenges if not managed properly while the traditional smoking introduces toxic polycyclic aromatic hydrocarbons (PAHs) into food. This study aims to resolve these challenges by producing liquid smoke using a home-scale pyrolysis reactor from lignocellulosic biomass sources, namely low-quality cinnamon bark, cinnamon leaves, cinnamon wood, coconut leaves, and peanut shells. The pyrolysis was conducted at 380°C for 30 minutes. Liquid smoke samples were purified and analysed for their physiochemical and functional properties, including yield, color, pH, titratable acidity, total phenolic content, antioxidant activity and antimicrobial activity and also, they were compared with commercially available liquid smoke and established quality standard. The results indicated that the yield ranged from 21.91±0.79% to 40.69±1.0%, with cinnamon wood having the highest yield. Distillation significantly improved the overall quality of liquid smoke with the distilled samples showing a pH of 2.38±0.01 to 3.31±0.01, titratable acidity of 5.18±0.09% to 7.99±0.06 and total phenolic content ranged from 88.43±0.16 to 143.82±2.22mgGAE/g, significantly surpassing the commercial sample (23.60±0.06mgGAE/g). Antioxidant activity, measured using the DPPH assay, ranging from 92.31±0.20% to 94.99±0.29%. Antimicrobial activity against *Staphylococcus aureus* was notable, with inhibition zone of 2.00±0.00 to 3.20±0.14cm which was absent in the commercial sample. GC/MS analysis revealed that phenolic (e.g., guaiacol) and carbonyl compounds (e.g., 1-Hydroxy-2-butanone) were the predominant constituents in all liquid smoke samples, contributing to their flavor and functionality, with no PAHs detected, ensuring safety. Sensory evaluation revealed that cinnamon bark liquid smoke had high acceptability (6.49±1.29), with peanut shell smoke following closely (6.00±1.41). This study highlights that cinnamon low-quality bark liquid smoke is the best among the tested samples.

Keywords: Lignocellulosic biomass, liquid smoke, pyrolysis.

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Development of legume based food products using *Mucuna pruriens* and evaluating physicochemical properties and sensory acceptance

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Mucuna pruriens (velvet bean) is an underutilized legume locally available in Sri Lanka. Beyond its nutritional value, *M. pruriens* has a long history of traditional use in various cultures, serving as a food source, cover crop, and even a medicinal plant. It remains underutilized and commercially unavailable to a large extent. This underutilization represents a significant gap in the exploration of plant-based protein sources and limits the potential benefits that *M. pruriens* could offer to food security and human health. This study investigated the physicochemical properties of *M. pruriens* in the early maturity stage and fully matured dried beans and developed food products based on *M. pruriens*, contributing to the diversification of plant-based protein sources and increasing the utilization. Moisture content, crude protein, crude fat, crude fiber, and ash contents were determined by the method of AOAC (2000). Early maturity bean flour was prepared by removing the outer pod, drying the edible portion with the beans at 48^0 C for 06 hours, and grinding it into a fine powder (except for moisture analysis). Fully matured beans were similarly processed after pod removal and cleaning. Fully matured dried beans exhibited significantly lower (P<0.05) moisture content (13.98±0.36) compared to beans at early maturity (77.32±0.64). Similarly, ash content, crude fat, and crude fiber content were significantly reduced in fully matured dried beans (7.64±0.18, 1.91±0.10, 12.10±1.11 respectively) compared to beans in early maturity (12.73±0.11, 10.88±1.22, 17.63±0.78 respectively). But the protein content significantly decreased from 27.57±0.70 in early maturity to 16.61±0.45 when seeds were grown. Because some proteins break down into simpler nitrogenous compounds. The formulations of the samaposha mix (17.74±0.53% protein) and porridge (15.11±0.49% protein) were chosen based on overall acceptability, prioritizing higher velvet bean content for enhanced nutritional benefits.

Keywords: Formulation, maturity, protein, velvet beans

Antimicrobial coating with *Citrus maxima* peel and *Azadirachta indica* leaf extracts for anthracnose control in sour banana

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Anthracnose is a latent fungal infection in bananas caused by *Colletotrichum musae*, manifests in bananas as scars on the peel with sunken black or brown areas. In Sri Lanka, anthracnose is the major postharvest disease affecting bananas, causing significant annual yield loss. Sour bananas suffer the greatest impact by this, resulting notable economic losses. Although synthetic fungicides are often used to control, they pose severe risks to environment and human health. Aiming to develop a sustainable solution in controlling anthracnose in sour bananas, this study evaluated the *in vitro* and *in vivo* antifungal potential of four composite coatings formulated combining different ratios of *Citrus maxima* peel and *Azadirachta indica* leave extracts, along with glycerol and acetic acid (1% v/v). *In vivo* antifungal activity was evaluated by disease incidence and disease severity. The coating which consisted of 10% *Citrus maxima* peel extract, 30% *Azadirachta indica* leaf extract, 10% acetic acid (1% v/v) and 30% glycerol demonstrated the highest antifungal efficacy. Also, the highest *in vitro* antifungal efficacy, achieving 60.95%±1.63 fungistatic inhibition. During ambient storage, a significant reduction of the disease incidence (up to 34.70%±4.77) of sour banana samples which were dipped in fungal spore suspension was reported after 8 days compared to the control group (100.00%± 0.00) stored under same conditions. Disease severity results revealed that coating with high *Azadirachta indica* extract showed the lowest disease severity (6.35%±1.74) among all treated samples. It reduced the anthracnose lesions development, compared to the control, which exhibited 18.91%±5.63 lesion development. Overall, the findings underscore the potential of plant-based extracts as a sustainable disease controlling strategy in sour bananas, offering an eco-friendly approach that extends shelf life and maximizes profitability.

Keywords: Anthracnose, *Colletotrichum musae*, composite coatings, plant extracts, sour banana

Production of sugar crystals from *Caryota urens (Kithul)* sap

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The increasing demand for natural sweeteners has driven interest in efficiently producing sugar crystals from *Caryota urens* (*Kithul)* sap. This research focuses on developing a lab-scale functioning prototype for producing sugar crystals from *Caryota urens* sap, optimizing the production process, evaluating the microscopic structure, proximate composition, antioxidant, microbial, and sensory properties of the produced sugar crystals, and comparing them with commercial sweeteners. The manufacturing process involves sap collection, concentration, precipitation, filtration, temperature control, crystallization, centrifugation, and drying. The designed machine automates key steps such as evaporation, temperature regulation, and agitation, improving efficiency and consistency. Proximate analysis was conducted, and Antioxidant properties were evaluated using total phenolic content (TPC), total flavonoid content (TFC), and ferric reducing antioxidant power (FRAP) assays. Microbial safety was ensured through total plate count analysis. Sensory evaluation indicated that *Kithul* sugar crystals had desirable sensory attributes compared to brown sugar and commercially available *Kithul* sugar. Processing parameters were optimized with an initial Brix above 68°, a temperature range of 60–65°C, and a final Brix of 78°. Microscopic analysis confirmed uniform cubic crystals. Proximate composition analysis revealed moisture content of 0.902± 0.013%, ash content 1.048±0.224%, crude fat content 0.864±0.068%, crude protein content 0.155±0.023%, crude Fiber content 1.343±0.075%, and carbohydrate content 95.689± 0.165%. The FRAP value was 5.500±0.038 μmol Fe^{2+}/g, TPC was 0.695±0.013 GAE/g DW, and TFC was 0.695±0.013 mg RE/g DW. The total plate count was 2.777×10^3 CFU/mL. Sensory evaluation indicated that *Kithul* sugar crystals were preferred over commercially available *Kithul* sugar. These findings suggest *Kithul* sugar Crystals as promising natural sweetener with desirable attributes, offering a viable alternative to refined sugar. The automated system enhances scalability, efficiency, and commercialization potential.

Keywords: Antioxidant properties, *Kithul* (*Caryota urens*), natural sweeteners, proximate composition, sugar crystals

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Consumption of oral rehydration solutions and sports drink solutions among the sports community and formulation of a sports drink powder for rehydration

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Commercial sports drinks often contain artificial ingredients, conflicting with the growing consumer demand for natural products. Recent studies highlight consumer interest in innovative sports drinks products with natural ingredients, creating the need for healthier alternatives. This study started with a market survey, which identified three commercially available sports drink solutions (SDS). Among these, Product A had the highest carbohydrate content 7.30±0.14 g/100 mL, while Product B contained the highest sodium concentration 44.33 ±1.16 mg/100 mL. A questionnaire-based survey was then conducted among 85 national-level athletes, which revealed that 96.5% consumed oral rehydration solutions (ORS), while only 22.4% consumed commercially available SDS. The average daily consumption was 1180.72± 368.98 mL for ORS and 565.79±163.34 mL for SDS. Based on these findings, this research focused on the formulation of an SDS using king coconut water, beetroot juice, and pineapple juice. Through sensory analysis, a blend of 55 mL king coconut water, 25 mL pineapple juice, and 20 mL beetroot juice was selected for spray drying. The resulting powder was evaluated for its physicochemical properties, mineral content, antioxidant potential and microbiological safety. The powder exhibited 98.77±0.40% solubility and water activity of 0.119±0.001. Proximate analysis showed total ash (5.56±0.18), moisture (5.01±0.09%), protein (1.16± 0.07%), fat (0.78±0.04) and total carbohydrate content (83.22±2.26%). Sodium (24.29±0.37 mg/g) and potassium (24.86±0.38 mg/g) were significantly higher than other minerals. The powder was also reported with phytochemical compounds, such as total phenolic content (6.73 ±0.06 mg GAE/g), total flavonoid content (1.16±0.06 mg RE/g), total antioxidant capacity (149.06±3.50 mg AAE/g), and DPPH radical inhibition activity (50.18±3.00%). In conclusion, this sports drink powder may be a promising natural alternative for athletes, offering hydration and additional health benefits.

Keywords: Carbohydrate, oral rehydration solution, sodium, sports drink, spray drying

Evaluating the suitability of Cellulose Nanocrystals extracted from Corn Husk to Improve Barrier Properties of Sustainable Packaging

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The food industry is shifting away from petrochemical-based packaging towards sustainable alternatives, such as biodegradable packaging, due to environmental impacts. However, these biodegradable films exhibit poor barrier and mechanical properties. This research aims to study the ability of cellulose nanocrystals (CNCs) to improve the barrier and mechanical properties of seaweed-based biodegradable packaging films. A bi-layered film composed of agar and alginate was produced using a layer-by-layer casting technique incorporating CNCs extracted from corn husk using the sulfuric acid hydrolysis method. The first layer contained agar, cinnamon oil, glycerol, and tween 80, while the second layer contained sodium alginate, sorbitol and CNCs (0%, 0.2%,0.4%,0.6%,0.8% and 1%) with 1% $CaCl_2$ applied as a spray on the second layer. The bi-layer provides water barrier properties from the first layer, sealing ability from the second layer, and mechanical integrity from both. CNCs were characterized by XRD, SEM and FTIR analysis. The crystallinity index of CNCs was reported as 73.31%, which contributed to better barrier properties. The effect of CNC content on various properties of bi-layered films were tested, including mechanical properties, water vapor permeability, UV transmission, contact angle of water, and water solubility. Increasing the content of CNCs significantly enhanced UV-blocking properties (P<0.05), potentially preventing oxidative reactions in foods. Higher concentrations of CNCs increased the film's contact angle of water, indicating a reduction in the hydrophilic nature of the film significantly from 29.00 to 43.65 (P<0.05), while reducing water vapor permeability, with better performance at refrigerated temperatures compared to room temperature. The incorporation of CNCs decreased the water solubility of films, enhancing their functionality as food packaging material. However, films exhibited low tensile strength despite increased crystallinity, attributed to the high plasticizer content and possible weak interfacial adhesion between bi-layers. However, these values remain adequate for food packaging applications with limited mechanical stress required.

Keywords: Agar, Alginate, cellulose nanocrystals (CNCs), corn husk, sustainable packaging

Development of biodegradable cutlery from Manihot esculenta peel starch and *Citrus sinensis* peel powder as sustainable sources

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Single-use plastics are widely used in modern lifestyles due to convenience. However, excessive consumption has led to significant threats to ecosystems and human health. In response to this growing challenge, an innovative approach known as biodegradability has emerged. This study aims to develop biodegradable spoons as sustainable substitutes for plastic, utilizing food industrial waste, specifically, cassava peel starch and citrus peel powder, along with *Dawul Kurundu* leaf (*Neolitsea cassia*) extract as the natural binder. Ten different formulations were tested, from which three optimal ratios were selected for further evaluation based on functional properties. The moisture content of spoons ranged from 5.80±0.30% to 7.43±0.91%, while the water absorption of the spoons was from 35.45±3.48% to 43.64±3.66%, indicating higher concentrations of citrus peel powder influence on the hydrophilic properties of the final product. The color analysis revealed the L* ranging from 44.18±0.44 to 42.42±0.68, a* from 3.74±0.01 to 3.73±0.18, and b* from 13.27±0.71 to 12.11±0.69, with citrus peel powder playing a significant role in color as well. The highest hardness (26.68±6.28 N) and cohesiveness (0.75±0.03) were of ratio 07 (cassava peel starch 40%, citrus peel powder 60%), indicating the desired texture for spoons, whereas consumer acceptance evaluation also showed the highest acceptability for the same ratio. The biodegradability test demonstrated that all three cutlery samples of selected formulations completely degraded within two weeks, exhibiting a significantly faster degradation rate compared to other biodegradable spoons. According to the findings, ratio 07 was the best combination for the biodegradable cutlery formation. It was further evaluated for shelf-life analysis for two months, which revealed a gradual increase in yeast and mold counts within a safe storage limit. Overall, inexpensive plant-based raw materials and exceptionally low production costs make it a financially viable and environmentally sustainable alternative to other biodegradable spoons in the market.

Keywords: Biodegradable, Cassava peel, Citrus, Cutlery, Sustainable

Development of corn-cob cellulose based biodegradable film for sustainable packaging

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Non-biodegradable packaging methods are popular in worldwide industries, including higher demand in food sector. However, accumulation in landfills and water resources creates a significant environmental threat. This study aims to address this issue by developing a biodegradable composite film using corn-cob cellulose and tomato powder, enriched with antimicrobial and antioxidant properties. Three formulations were developed blending different ratios of cellulose and tomato, T1 (6:1), T2 (5:2) and T3 (4:3) respectively. The films were assessed based on the mechanical properties, moisture content, water solubility, water vapor permeability, FTIR analysis, antioxidant activity, XRD analysis, biodegradability and impact on fresh produce when used as a wrapping. The tensile strength ranged from 0.32 MP (T2) to 1.20 MPa (T1) and thicknesses varied from 0.154 to 0.181 mm. The moisture content showed no significant difference across treatments while the water solubility dramatically dropped with increasing tomato content (58.79% to 14.49%). Water vapor permeability indicated excellent moisture barrier properties in T3 (0.63×10^{-9} g m/Pa h m²) compared to T1 (1.16×10^{-9} g m/Pa h m²). The presence of hydroxyl, carbonyl and ester functional groups was verified by FTIR analysis, indicating polymer connection. Incorporation of more tomato powder has increased free radical scavenging activity, where T3 exhibited the maximum in DPPH antioxidant analysis. Biodegradability test demonstrated complete degradation of T1 in 25 days, while T2 and T3 exhibited slower degradation. The application of films in fresh produce showed a significant reduction in weight loss and improved colour stability during storage, compared to the control. Spoilage development was notably delayed in film-wrapped samples, indicating effective protection against oxidative and microbial deterioration. Overall, the findings suggest that cellulose-tomato composite films offer a promising biodegradable solution for fresh produce packing, with enhanced functional properties and a potential to extend the shelf life of fresh plant produce.

Keywords: Biodegradable, cellulose, composite films, corn-cob, tomato

Survivability of non-dairy probiotic strain microencapsulated using extra virgin coconut oil nano emulsion in coconut milk-based yogurt

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The functional food market is growing recently, with probiotic functional foods becoming more popular. This study explored using extra virgin coconut oil (EVCO) nano emulsion as a microencapsulation matrix to improve the survivability of non-dairy probiotic strains in coconut milk-based yogurt. The aim was to improve probiotic survival during processing and digestion. Microcapsules were produced from the microencapsulation of EVCO and symbiotic bacteria (maltodextrin with *Lactobacillus acidophilus and Bifidobacterium bifidum*) using the freeze-drying technique. The study focused on creating and characterizing EVCO Nano emulsion, encapsulating probiotic strains, and incorporating them into coconut milk-based yogurt, testing their survival, physicochemical, microbiological, and sensory properties. EVCO Nano emulsion had an average particle size of 960.6 nm and a zeta potential of -26.3 mV. Its microencapsulation efficiency was 74.84% for probiotics and 61.53% for EVCO. The emulsion was stable, with a pH of 6.39±0.09. The nanoemulsion, analyzed microscopically, showed stability, no phase separation, a pH of 6.39±0.09, and a viscosity of 126.97±7.57 Pas. Chemical composition analysis indicated that the moisture content of yogurt treatments ranged from 63.11% to 66.80%, with protein (1.85–1.86%), fat (5.82–6.39%), and ash (0.53–0.55%) levels comparable to dairy-based yogurts. The pH of the yogurt remained stable, ranging from 4.31 to 4.57, ensuring product quality. Sensory evaluation by a 30-member trained panel indicated that yogurt with microencapsulated probiotics scored higher in texture and overall acceptability compared to free-probiotic yogurt. Encapsulated probiotics maintained significantly higher viability ($P<0.05$), with final counts above 10^7 CFU/g after 14 days, while free probiotics declined below the therapeutic threshold by day 14. No yeast or mold was detected in yogurt samples during 1 to 7 days of storage. However, by day 14, yeast growth was observed in non-encapsulated probiotic treatments. The study suggests that EVCO nano emulsion is an effective microencapsulation matrix for protecting probiotic strains in yogurt, enhancing their viability compared to free cells.

Key words: Coconut yogurt, Microencapsulation, Nano emulsion, probiotic

Use of natural edible food colours as alternatives to synthetic colourants (E122, E102, E133) in *tutti frutti* production

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The widespread use of synthetic food colourants has been linked to serious health issues, including hyperactivity, allergies, and carcinogenicity. This study aimed to evaluate the effectiveness of natural edible food colours as alternatives to synthetic colourants (E122, E102, E133) in *tutti frutti* production, ensuring desirable colour, taste, and shelf life. Natural pigments, namely, betalains from *Beta vulgaris L.*, curcumin from *Curcuma longa*, and chlorophyll from *Sesbania grandiflora*, were extracted and incorporated into *tutti frutti*. The stability of these natural colourants was assessed under different processing conditions, including variations in acidity (5×10^{-5} to 2×10^{-3} mol/L), sugar concentration (50° to 75° Brix), and drying temperature (37 to 50°C). Colour retention was evaluated over a 30-day storage period under room temperature (27±2°C) and refrigeration (4°C). The results revealed that red-coloured tutti frutti exhibited the highest moisture content (12.26±0.58%), while the green coloured one had the lowest (9.47±0.85%). When considering colour stability, the highest colour intensity was observed at the acidity of 0.000513 mol/L, 64° Brix, and drying temperature of 45°C. Refrigerated samples retained better colour intensity over storage, with L*, a*, and b* values remaining more stable compared to room temperature storage. Shelf-life analysis revealed that yeast and mould counts in refrigerated samples were significantly lower (log CFU/g<2.5) than those stored at room temperature (log CFU/g>4.5) over four weeks. Sensory evaluation showed that natural-coloured samples had comparable scores to artificial-coloured samples in overall acceptability. When incorporated into baked products, natural-coloured *tutti frutti* retained acceptable colour properties, though minor degradation was observed. The findings support the feasibility of replacing synthetic food colourants with natural alternatives in *tutti frutti* production, promoting consumer health benefits and commercial viability.

Keywords: Betalains, chlorophyll, curcumin, natural food colours, *tutti frutti*

Evaluation of food safety knowledge, attitudes and practices of street food vendors in Mawathagama area in Kurunegala district

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This study determined the food safety situation of street food by analyzing the KAP of street food vendors. A quantitative descriptive cross-sectional study was conducted among 264 street food vendors through structured questionnaire from January to March, 2025 in Mawathagama, Kurunegala district. Majority of the street food vendors were male (92.86%), age between 35-44 years (34.21%), married (83.83%), had primary education (46.99%), experience of 5-9 years (32.71%). In addition to that, utmost had no any training on food safety (93.61%), and food preparation- preservation (89.47%). The knowledge and practice score of "≥50 to<75" was for highest proportion of street food vendors amounting 57.89% and 47.7% respectively. The attitude score "≥67 to <83" was recorded for the highest number of street food vendors (70.3%). Moreover, the mean KAP score was 71.94±10.21, 73.89±7.37 and 55.37±15.08 respectively. However, the knowledge score had a moderate-strength of positive correlation with attitudes score (r=0.342, P<0.01) and practice score (r = 0.389, P<0.01); having the regression equation, y= 0.25* x + 56.12 and y = 0.57* x + 14.01 respectively. The similar correlation was observed between attitudes and practices score (r = 0.328, P<0.01) with the regression, y = 0.67* + 5.81. In the regard, a regular basis training on basics of food safety and contemporary education on food safety at initial stage of education could be imposed to improve the KAP on food safety among street food vendors.

Keywords: Attitudes, food safety, knowledge, street food vendors

Department of Nutrition and Dietetics

Comparative study on the effect of herbal supplementation on metabolic syndrome management: A randomized, single-blind, placebo-controlled intervention

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Metabolic Syndrome (MetS) is a group of conditions, including central obesity, dyslipidemia, hypertension, and insulin resistance, that raise the risk of type 2 diabetes and heart disease. Herbal treatments are increasingly studied for managing MetS, offering benefits like weight control, improved lipid levels, reduced inflammation, and better blood sugar regulation. This study evaluated the effectiveness of a Garcinia-based herbal supplement in managing MetS by assessing its impact on insulin sensitivity with biochemical and inflammatory markers, along with its safety profile over 12 weeks. A randomized, placebo-controlled clinical trial was conducted on 100 overweight or obese adults with MetS. Participants were randomly assigned to receive either the herbal sup

plement or a placebo (4.5 g/day) for 12 weeks. Anthropometric measurements (body weight, Body Mass Index (BMI), waist and hip circumferences, waist-to-hip ratio), body composition (visceral fat, fat percentage), biochemical markers (fasting blood glucose, lipid profile, liver enzymes, renal function, and C-reactive protein), and dietary intake (24-hour recalls) were assessed at baseline and post-intervention. After 3 months, 81 participants completed the study (treatment group, n=35, placebo group, n=46). The treatment group showed significant reductions in waist circumference **(**88.1 ± 9.93 cm, p<0.0001), hip circumference (104.5 ± 9.96 cm, *P* <0.0001), fasting blood glucose (102.3±17.57 mg/dL, *P*=0.03), triglycerides (132.06 ±73.69 mg/dL, *P*=0.03), and triglyceride-glucose index (TyG-index) (8.71±0.58, *P*=0.01), suggesting improved insulin sensitivity. The placebo group exhibited improvement in waist circumference **(**88.3±7.06 cm, *P*=0.013), hip circumference (102.89±7.06 cm, *P* =0.027), and HDL levels (48.64 ±11.49 mg/dL, *P*=0.03). However, the reduction in the TyG index was not significant in the placebo group. Liver and kidney function markers, along with CRP values, remained within normal ranges, ensuring the safety of the supplements. In conclusion, Garcinia-based herbal supplementation improved insulin sensitivity in overweight or obese individuals while maintaining a favorable safety profile.

Key words: Herbal supplementation, insulin sensitivity, metabolic syndrome, obesity

Validation of a photographic food atlas for food portion estimation in 24-hour dietary recalls of adolescent girls

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A 24-hour recall (24HR) is a more convenient, cost-effective method of dietary assessment that places a lower burden on respondents compared to a Weighed Food Record (WFR) - the gold standard method of dietary assessment. However, its accuracy depends on correct portion size estimation, which is a key challenge. Using a photographic food atlas can overcome the disadvantages of 24HR method. This study aimed to validate 24HR using a food atlas to estimate the portion size against WFR among adolescent girls. Thirty adolescent girls (aged 10-18 years) participated in the study. WFR was conducted by one enumerator, followed by 24HR using food atlas on the following day on the same respondent by a different enumerator. Energy and nutrient intake were determined using FoodBase 2000 software. A significant ($P< 0.05$) positive correlations were found between 24HR and WFR for energy (r=0.93), carbohydrates (r=0.78), protein (r=0.90), fat (r=0.96), fiber (r=0.88), cholesterol (r=0.76), iron (r=0.69), and folate (r=0.98). In conclusion, 24HR satisfactorily estimated the intake of energy, macronutrients and several micronutrients in adolescent girls when estimating the portion size using the photographic food atlas.

Keywords: Adolescent girls, photographic food atlas, validation, weighed diet dairy, 24-hour recall

Exploring the ergogenic potential of dietary nitrate supplementation: the impact of beetroot juice on athletic performance and endurance

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Beetroot is a rich dietary source of inorganic nitrate. Nitric oxide enhances athletic performance by improving mitochondrial efficiency and promoting vasodilation, thereby reducing oxygen cost during submaximal exercise. The objective of this study was to evaluate the impact of beetroot juice supplementation on VO_2 max among university athletes. A single-blind comparative intervention study was conducted with 22 athletes (aged 23.95±1.16 years) and divided them into two groups. Both groups had comparable baseline VO_2 max, anthropometric measurements, blood pressure measurements, and body composition measurements. The higher concentrated group consumed 250 mL of beetroot juice made from 0.076 kg of raw beetroot per 100 mL of water daily for 14 days, while the lower concentrated group received 250 mL of beetroot juice prepared from 0.002 kg of raw beetroot per 100 mL of water daily for the same period. VO_2 max was evaluated using the Cooper test before and after the intervention. Additional parameters, including anthropometric measurements, blood pressure measurements and body composition data were also recorded at the baseline and post-intervention. Supplementation with higher concentrated beetroot juice demonstrated a significant improvement in VO_2 max (22.52±9.90 mL/kg/min to 28.77±12.67 mL/kg/min, P=0.0006). Similarly, the group that consumed lower concentrated beetroot juice also showed a significant improvement in VO_2 max (18.50±7.92 mL/kg/min to 26.42±9.51 mL/kg/min, P=0.002). However, after a three-weeks of flush over period, no significant improvement in VO_2 max had remained (P=0.672). The other parameters showed no significant changes in either group. In conclusion, the supplementation with beetroot juice, both in concentrated and diluted forms, significantly improves VO_2 max, indicating enhanced aerobic capacity.

Keywords: Beetroot juice, cooper test, exercise efficiency, sports nutrition, VO_2 max

Comprehensive nutritional analysis of high-performance athletes: integrating dietary and hydration status, biochemical status, anthropometric and body composition for the individualized performance enhancement

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Sri Lanka has paid relatively less attention on maintaining overall health status of "high-performance pool athletes," who have achieved remarkable success in recent years. Therefore, this research aims to analyse the overall health status of Sri Lankan high performance athletes accords with the parameters which their performance depends on. Dietary, hydration, anthropometric, body composition, bio-chemical and sleep quality data were taken by 3-day and 24-hour dietary recalls, questionnaires and from pathology reports taken by professionals. Dietary data were analysed using the software "FoodBase2000". Para-athletes' body fat was taken from 7 site skinfold method. The mean Body Mass Index (BMI) of the population was 21.2±5.2 (n=125). The mean body fat percentage for males and females were 10.93±5.4 (n=74) and 22±6.6 (n=50), respectively, both falling within normal ranges. The average daily energy intake was 2556±937.2 Kcal/day (n=122), with macronutrient contributions as follows: carbohydrate 59±9.6% per day (n=122), protein 14±3.3% per day (n=122), and fat 26±8.8% per day (n=116). Based on dietary recommendations, distribution of macronutrients is adequate overall in the population and micronutrient intake was sufficient except iron intake which was 18.21±17.26mg/day and was insufficient in 70% participants. Considering biochemical analysis, low serum vitamin D was observed in 58% of participants (mean serum level of 40.89 ± 38.92 ng/mL) and liver enzyme elevation could be observed in 18.4% from the population and TAG/HDL index was higher for around 4% of the population and had led to insulin resistance. Other biochemical parameters have shown optimal results. Mean hydration intake per day was 4.58±1.4 (n=31). Mean sleep quality was inappropriate for 55% of athletes. In conclusion, Sri Lankan high-performance athletes' distribution of macronutrient as percentages and micronutrients were adequate except iron intake and shows adequacy in hydration intakes and inadequate sleep quality in most of the athletes and eventually all those relates to the overall health status related to sub-optimal anthropometric, body composition and bio-chemical parameters.

Keywords: High-performance, nutrition, sleep, body composition

Drivers of fruit and vegetable consumption among adult women with low income in the Sinhala communities in Sri Lanka

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Non-communicable diseases (NCDs) account for more than 83% of deaths in Sri Lanka. Maintaining a nutritious diet throughout the life can help to prevent NCDs and reduce the risk of malnutrition. The recommended daily fruit and vegetable (F&V) consumption is 400g, which is approximately five servings of F&V per day for adults. However, F&V consumption is far below recommendations among Sri Lankan adults. This study aimed to identify the drivers of F&V consumption among adult women with low income in the Sinhala communities in Sri Lanka. A qualitative study using Focus Group Discussions (FGDs) was conducted in the *Siwalipura*, *Kuliyapitiya*, *Panwewa*, and *Pothuwewa* areas. Participants were chosen considering the low monthly household income. A FGD guide was used to gather the information, covering the topics of nutritional awareness, acquisition, preparation, allocation, consumption patterns, barriers, and suggestions for improving F&V consumption. Data analysis was done using NVivo software using the thematic analysis. The findings revealed that while women were aware of some health benefits of F&V consumption, their knowledge of recommended intake was limited. High prices and limited availability were the primary barriers of F&V consumption. When allocating foods among family members, priority was given to preferences and gender of the family members. Children's preferences was the primary factor influencing the acquisition and preparation of F&V at household. Children's preferences also affect the consumption patterns of adult women. Participants suggested that increasing the availability and supply of F&V would help to improve the consumption of F&V. In conclusion, high prices, limited availability and children's food preferences were identified as the main barriers contributing to the low consumption of F&V among adult women.

Keywords: Adult women, barriers, focus group discussions, fruit and vegetable

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Status of psychological well-being of secondary school children in a rural setting in Sri Lanka

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Emotional and behavioural problems in children are a public health concern in developing countries. Psychological health influences how people think, feel, and act in response to life situations, affecting stress management and decision-making. Untreated psychological problems can lead to school failure, family conflicts, drug abuse, violence, and even suicide. This study aimed to investigate the status of psychological wellbeing, and its association with socio-demographic factors among secondary school students. The Strengths and Difficulties Questionnaire (SDQ) was used to measure psychopathology symptoms. School-based cross-sectional study was conducted among 135 secondary school students (48.9% boys) aged 12-14 years from November 2024 to February 2025 in Giriulla educational zone, Kurunagala. The mean age of the study sample was 12.5±0.6 years. According to the domains of SDQ, 77.8% were normal for total difficulties with 88.8% of participants were normal for emotional symptoms, 80% for conduct problems, 81.5% for hyperactivity, 81.5% for peer problems, whereas 92.6% were normal for prosocial behaviours**.** Borderline and abnormal cases were 6.6% and 4.4% for emotional symptoms, 11.2% and 8.8% for conduct problems, 9.56% and 8.8% for hyperactivity, 16.9% and 1.47% for peer problems, and 2.96% and 4.44% for prosocial behaviours**,** respectively. Girls had significantly higher mean scores for emotional problems (mean=3.18, SD=2.27, *P*=0.002) than boys. The categorization of children based on the total difficulties score (normal/ borderline/ abnormal) was not associated with the Body Mass Index (BMI) of students, the parents' educational level or the mother's occupation. In conclusion, most participants were within the normal range of psychological well-being. The highest abnormal results were noted in relation to both hyperactivity and conduct problems.

Keywords: Behavioural problems, psychological well-being, secondary school students, strengths and difficulties questionnaire

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Dietary intake patterns of individuals with type 2 diabetes mellitus

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Glycaemic control is the central focus of managing Type 2 diabetes mellitus (T2DM). Lifestyle modification is the feasible and sustainable approach of achieving the proper glycaemic control. Diet is an integral part of the lifestyle modification. Previous findings on the dietary intake patterns of T2DM in Sri Lanka are scare. Therefore, the current study intended to explore the dietary intake patterns of individuals with T2DM. A cross-sectional study was conducted with hundred and sixty-four (*n*=164) individuals with T2DM attending the Diabetic Clinics of District and Base Hospitals of North Western Province. Details of general lifestyle pattern, disease and medication history was collected using a general lifestyle questionnaire. Anthropometric measurements were taken following the standard methods. Fasting plasma glucose and glycated haemoglobin values were extracted from their clinical records. Dietary intake was assessed using a 3-day estimated diet diary. T2DM were in the age range of 25-70 years with average diabetes duration of 12.5 years (SD 5.2). Almost all T2DM were on oral hypoglycaemic drugs. The mean energy intake among participants was 1737 kcal (SD=534), with 66%, 22% and 11% of energy derived from carbohydrate, fats, and protein respectively. Nearly twenty-five percentage of (25%) T2DM were skipping meals, 46% were not following the regular meals, 32% were not taking a snack between the major meals. Only 7% of T2DM has consumed the recommended number of daily vegetable servings (3-5). About 52% of T2DM did not consume a single serving of a fruit per day. Significant deviations from dietary guidelines were observed, with 65% of participants exceeding the recommended carbohydrate intake and 73% remained below the recommended protein intake. Majority of T2DM had low dietary diversity score and medium food variety score. This study highlights significant gaps in the dietary pattern of individuals with T2DM. These findings emphasize the need for targeted nutrition education and tailored dietary interventions in achieving the proper glycaemic control and prevent complications.

Key words: Dietary guidelines, dietary intake patterns, glycaemic control, type 2 diabetes mellitus

Effects of time-restricted eating on cardiometabolic risk markers in evening chronotype shift workers

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Time-restricted eating (TRE) is a chrononutrition intervention that aligns food intake with circadian rhythms, potentially improving metabolic health. Evening chronotype shift workers, who naturally prefer later sleep and meal times, often experience circadian misalignment, due to irregular work schedules, increasing their risk of cardiometabolic disorders. This randomized controlled trial examined the effects of different TRE windows (10-hour, 12-hour, and 14-hour) compared to a control group following unrestricted eating, evaluating cardiometabolic risk markers. Shift workers, identified as evening chronotypes via the Munich Chronotype Questionnaire (MCTQ) and 104 participants completed the intervention (10hr TRE: n=19; 12hr TRE: n=27; 14hr TRE: n=33; control: n=25). Anthropometric (height, weight, waist and hip circumference, body composition), biochemical (fasting glucose and lipid profile), clinical (blood pressure), and dietary (24-hour diet recall) data were collected at baseline and post-intervention. Adherence to the TRE was monitored via a diet diary mobile app. After 8 weeks, significant reductions were observed in weight (10hr TRE:1.55 kg $P<0.001$; 12 hr TRE: 0.63 kg $P=0.006$), waist circumference (10hr TRE: 2.9 cm $P=0.035$; 14 hr TRE:1.5 cm $P=0.008$), visceral fat level (10hr TRE: 0.37 $P=0.005$), muscle mass (10 TRE: 0.67 kg $P=0.001$), total cholesterol (12hr TRE:0.26 mmol/L $P=0.023$), HDL-C (10hr TRE: 0.34 mmol/L $P=0.043$), systolic blood pressure (12hr TRE: 5.2Hgmm $P=0.033$), and diastolic blood pressure (14 TRE: 6.7 Hgmm $P= 0.001$). Compared to the control group, 10-hour TRE group exhibited significant reductions in weight (1.70 kg $P<0.001$), visceral fat level (0.49 $P=0.001$), and fat mass (0.92 kg $P=0.002$). The 12-hour TRE group showed significant reductions in weight (0.78 kg $P=0.023$), BMI (0.36 kgm^{-2} $P=0.013$), visceral fat level (0.27 $P=0.036$), and total cholesterol (0.48 mmol/L $P=0.008$). In conclusion, both 10-hour, 12-hour TRE windows significantly improved several cardiometabolic risk markers, while the 14-hour TRE window showed no significant effect. These findings highlight the potential benefits of shorter eating windows in reducing cardiometabolic risks among evening chronotype shift workers.

Keywords: Chrononutrition, circadian misalignment, evening chronotype, shift work

Effect of *Osbekia octandra* (Heen bovitiya) herbal drink on blood lipids in adults with overweight and obesity

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Obesity and overweight are major global health concerns associated with dyslipidemia and increased cardiovascular risk. Herbal remedies containing bioactive compounds are gaining attention for their potential role in lipid management. *Osbekia octandra* (*Heen Bovitiya*), a medicinal plant traditionally used in Sri Lanka for its hepatoprotective and lipid-lowering properties, has been investigated for its metabolic health benefits. This study aimed to evaluate the effects of *O. octandra* supplementation on anthropometric measures and fasting blood lipids in overweight and obese adults. A single-blind randomized controlled trial was conducted with 24 overweight/obese participants (ages 25–55 years). The treatment group (n=14, age±SEM:33± 2.5 years) consumed a herbal drink containing 15 g of *O. octandra* leaves, four days per week for five weeks, while the control group (n=10, age±SEM:25.8±0.2 years) received a placebo. Anthropometric parameters (weight, height, waist circumference, and body fat) and fasting lipid markers (total cholesterol [TC], LDL-C, HDL-C, triglycerides [TAG]) were assessed at baseline and study completion. Independent t-tests revealed a significant reduction in waist circumference (Treatment group change±SEM: -1±0.3 cm vs. Control group change±SEM: 0.2±0.2 cm, *P*=0.04) in the treatment group compared to the control. Additionally, trends toward reductions in body fat (Treatment group change±SEM:
-0.79±2.44 kg vs. Control group change±SEM: 0.02±8.64 kg, *P*=0.060) and fasting triglycerides (Treatment group change±SEM: -0.07±0.24 mmHg vs. Control group change± SEM: 0.14±0.23 mmHg, *P* = 0.541) were observed. However, a marginal reduction in HDL-C (Treatment group change±SEM: -0.19±0.61 mmHg vs. Control group change±SEM: 0.03 ± 0.06 mmHg, *P*=0.054**)** was noted, warranting further investigation. *O. octandra* supplementation resulted in a significant reduction in waist circumference, suggesting potential benefits in addressing central obesity. In conclusion, the observed trends in body fat and lipid profile changes indicate its potential role in metabolic health management. Further studies with longer intervention periods are recommended to confirm these findings and assess the clinical relevance of *O. octandra* in obesity and lipid regulation.

Keywords: Obesity, overweight, dyslipidemia, cardiovascular risk, herbal medicine, *Osbekia octandra*, *Heen Bovitiya*, lipid management, metabolic health

Development of an educational booklet for women affected with hyperglycaemia in pregnancy

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Hyperglycaemia in pregnancy (HIP) is a significant public health concern in Sri Lanka. HIP is associated with adverse foetal and maternal outcomes including pre-term birth, macrosomia, foetal hypoglycaemia, respiratory distress syndrome, miscarriages, pre-eclampsia, cesarian sections and increased risk of developing type 2 diabetes. Knowledge and skills of managing HIP through lifestyle modification is vital for adhering to proper self-management practices. Self-management of HIP ensures the proper glycaemic control and improve pregnancy outcomes. This study aimed to develop an educational booklet to enhance self-management practices among women affected with HIP. The development process consisted of three phases as content identification, booklet development, and validation. A literature survey, findings of the previous study on HIP management and an online questionnaire were used to identify the contents. An online questionnaire was distributed among health professionals of the HIP management team (n=33) including dietitians, endocrinologists, obstetricians, general physicians, nutritionist, nurses, and midwives. Based on the responses, key findings of the previous study and literature survey, educational booklet was developed in English Language. Contents were mainly focussed on the description of HIP, self-blood glucose monitoring, dietary management of HIP, importance of physical activity and weight management throughout the pregnancy. Also, self-monitoring daily trackers for blood glucose, dietary intake, physical activity and weight gain were included. Sample meal plans for HIP mothers were prepared and incorporated to the booklet considering the pre-pregnancy BMI and HIP management strategy. It is expected that this educational booklet will empower women affected with hyperglycaemia in pregnancy to adopt better self-management practices, improve their confidence in glycaemic control, and reduce the risk of maternal and foetal complications.

Keywords: Educational booklet, hyperglycaemia in pregnancy, lifestyle modification, self-management

Dietary intake, anthropometric indices, sports nutrition knowledge, sleep quality and cardiovascular endurance among national level athletes, Sri Lanka

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National-level athletes require optimal physical conditioning and proper nutrition for their performance and wellbeing. Optimum performance is influenced by multiple factors including dietary intake (DI), sports nutrition knowledge (SNK), sleep quality (SQ), anthropometric indices (AI) and cardiovascular endurance (CE). However, current status and interplay between those factors remain explored within Sri Lankan context. Therefore, present study is intended to investigate the associations of DI, AI, SQ, SNK and CE among national-level athletes in Sri Lanka. A cross-sectional analytical study was conducted with sixty-five (n=65) national-level athletes from Institute of Sports Medicine, Sri Lanka. DI, SQ and SNK were evaluated using a 3-day diet diary, Pittsburgh Sleep Quality Index (PSQI) and Nutrition for Sports Knowledge Questionnaire (NSKQ), respectively. Anthropometric measurements were taken following the standard methods. CE was measured using Beep test. Mean age, BMI, body fat (%) and VO_2 max of the participants were 26.6 ± 1.3 years, 24.1 ± 3 kg/m^2, 25 ± 3% and 51.9±6.6 ml/kg/min, respectively. Athletes' mean daily energy intake was 3225 kcal ± 969. Nearly 60% of athletes were unable to meet the recommended daily energy requirement. The mean NSKQ score of the participants was 44.0 ± 10.2, which is below the adequate score of 75%. Mean PSQI was among athletes was 5 ± 3 and 26% of them had poor quality of sleep. Nearly 34% of the athletes had lower CE indicated by VO_2 max. CE was positively associated with DI (r = 0.41, *P* =0.001), intakes of carbohydrate (r = 0.43, *P* =0.001), protein (r = 0.26, *P* =0.037) and nutrition knowledge (r = 0.3, *P* =0.018). Conversely, CE exhibited a negative correlation with body fat (%) (r = -0.46, *P* =0.001). In conclusion, CE of the athletes showed positive associations with DI and SNK and negative association with percentage of body fat.

Keywords: Athletes, cardiovascular endurance, dietary intake, sleep quality, sports nutrition knowledge

Drivers of healthy diet and perceptions about nutrition among adults in Sinhala communities in Sri Lanka

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Diet and nutrition play a vital role in maintaining adult health, preventing diseases, and ensuring overall well-being. However, Sri Lanka faces a dual burden of malnutrition, with both rising under-nutrition and over-nutrition among adults. This study aimed to investigate drivers of diet and nutrition of adults in Sinhala speaking community. The data were collected using four Focus Group Discussions (FGDs) from 33 adults in age between 20-50 years conducted in Rideegama, Bibila, Neluwa and Wattala areas. The FGDs guide covered questions on perceptions of malnutrition, food security, a healthy diet, factors influencing food access, barriers to a nutritious diet, coping strategies for food shortages, and the role of government and community support and suggestions to improve food security. The qualitative data were extracted by content analysis. The identified factors were categorized into four themes; individual knowledge, attitudes and practices, house hold food security, nutritional health outcomes and contextual and environmental factors. It was found that most participants had a limited understanding of food security and malnutrition but a good awareness of a healthy diet. Food taboos, religious practices and perceived health benefits and poverty influenced their dietary choices. Rural households faced higher food prices and lower quality (lower-grade produce and deteriorated perishable) foods than urban areas. Agriculture practices (low productivity, climate vulnerability and insufficient support services), limited market access during economic crisis and malnutrition remains major concerns. The main suggestions of the participants to improve the health and nutrition situation were strengthening nutrition education through awareness programs, expanding self-employment opportunities, introducing modern agricultural techniques for young generation. In conclusion, economic crisis, agricultural practices, limited market access, high food prices, lack of knowledge of food security and nutrition, preference for unhealthy food options, low consumption of healthy foods and cultural influences on diet may influence healthy and nutrition of adults in Sinhala speaking community.

Keywords: Adults, focus group discussions, healthy diet and nutrition, malnutrition

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Exploring the use of creative content in nutrition promotion among adolescents in Sri Lanka

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Eating healthy during adolescence is crucial for future health since adolescence is a vital period for developing habits, growth, and behaviour. Poor diets, including inadequate fruit and vegetable consumption among adolescents, have resulted in nutritional problems such as micronutrient deficiencies and being underweight and overweight at a young age, among other health issues. In this backdrop, this study focused on developing and validating a package of creative content to help adolescents learn about healthy dietary choices, concentrating on fruit and vegetable consumption and promoting good food processing and preservation practices. A package of creative content, including posters, banners, a series of social media-targeted videos, and a board game, was developed. Afterward, the developed creative content was evaluated by a series of experts. The experts represented diverse fields, including clinical dietetics, community health, public health nutrition, extension communication, and adolescent education. The experts reviewed and scored all the creative content using a four-point Likert scale questionnaire that evaluated themes including attractiveness, purpose, age suitability, message clarity, and behaviour change potential. The validation revealed varying levels of validity: the videos (0.94) and the board game (0.86) received the highest Content Validity Index (CVI), while the poster (0.44) and the set of banners (0.73) received lower CVIs. The results indicate the value of interactive forms in adolescent nutrition education, indicating room for further improvement. In conclusion, education-based creative content development for adolescents should focus on adding interactive components to static materials, increasing visual appeal and originality, and including behavioural modification theories. Moreover, real-world testing in school settings will help assess the practical impact of these educational tools on positive adolescent dietary behaviours.

Keywords: Behavioral change, creative contents, adolescents, nutrition education

Acknowledgment: This study was funded by World Vision Lanka

Modification and determination of acceptability of Waya One-Dish Meals (ODMs) for primary school children

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Ensuring optimal nutrition for primary school children is crucial for their growth, cognitive development, and overall well-being. Dietary inadequacies and poor meal choices often contribute to nutrient deficiencies among children aged 5 to 10 years. One-Dish Meals (ODMs) offer a practical and innovative solution by incorporating essential nutrients in a single serving, ensuring balanced intake. This study aimed to design nutritionally balanced ODMs for primary school children and to assess their sensorial attributes and acceptability. A 24-hour dietary recall was conducted with 20 participants to assess the current food and nutrient intake of primary school children. Additionally, individual interviews were conducted with 15 mothers to evaluate their knowledge about child nutrition guidelines. Previously developed Waya ODMs for University students were modified in alignment with child nutrition requirements. Sensory evaluations were conducted for 10 meals, that each tested by 50 untrained university students for appearance, color, aroma, salty taste, oily taste, savory taste, overall meal quality, texture, overall meal experience, and willingness to consume. Three meals were evaluated by 41 primary school children for appearance, aroma and taste. The estimated daily energy and macronutrient intakes of primary school children, based on 24-hour dietary recalls, were 1515 ± 307 kcal, 40±9 g of protein, 38±14 g of fat, and 271±60 g of carbohydrates. The mean energy and macronutrient content per serving of the one-dish meals were 386±36 kcal, 48±8 g of carbohydrates, 1 ±3 g of protein, and 15±2 g of fat. The sensory evaluation of ODMs by primary school children indicated a high score for tested 3 meals and were Waya Chickpea Delight, Waya Pumkinasia Patch and Waya Veggie Burst. In conclusion, the positive acceptance of developed ODMs by primary school children indicates the possibility of introducing cost effective, nutritious, balanced meals to school meal programs.

Keywords: Nutrients intake, one-dish meals, primary school children, sensory evaluation

Modified Waya One – Dish Meals (ODMs) for pregnant and lactating mothers

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Proper maternal nutrition during pregnancy and lactation is crucial for supporting the health and development of both mother and the child. However, many mothers in Sri Lanka experience significant challenges in meeting their daily energy and nutritional requirements due to time constraints, financial limitations, and lack of attention to meal preparation. This study aimed to modify Waya One Dish Meals (ODMs) prepared for university students and to assess sensory characteristics and acceptability by pregnant and lactating mothers. Dietary assessment was done using 24-hour dietary recalls from 30 pregnant and lactating mothers to assess their food consumption patterns and daily energy and nutrient intake. Waya ODMs were modified in line with nutritional requirements of pregnant and lactating mothers. Meals included all the essential food groups and provided approximately 525 kcal per serving. Sensory evaluations were conducted in two phases: in the first phase 50 untrained university students were used and 20 pregnant and lactating mothers were used in the second phase. The sensory evaluation used a 7-point hedonic scale to assess attributes such as appearance, aroma, taste, overall meal quality, texture, experience, and willingness to consume. Results of the sensory evaluation showed that Waya Veggie Burst received the highest mean score which was 2.1 among pregnant and lactating mothers. During pregnancy, women require an extra 300 calories daily, emphasizing a balanced diet with 60 g of protein, 45-64% carbohydrates, and 20-35% healthy fats. During lactation, an additional 500 kcal is recommended. Notably, modified ODMs can meet these increased energy and nutrient needs effectively. The acceptance of ODMs was high among pregnant and lactating mothers. The potential of introducing the modified ODMs to pregnant and lactating mothers in Sri Lanka is warranted to achieve their nutritional goals and to maintain a healthy population.

Keywords: Energy intake, maternal nutrition, one-dish meals, pregnancy and lactation, sensory attributes

Drivers of diet and knowledge, attitudes and practices regarding nutrition of adolescents in the Tamil communities in Sri Lanka

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Adolescence is a critical period of rapid growth and development. The dietary habits of adolescents are influenced by various factors. Understanding these influencing factors is essential for developing effective nutrition interventions. This study aimed to determine the factors that drive diet as well as the knowledge, attitudes, and practices regarding nutrition among adolescents in the Tamil communities in Sri Lanka. A qualitative study was conducted in three selected areas (*Chavakachcheri, Kalpitiya,* and *Vaharai*) in Sri Lanka, using Focus Group Discussions (FGDs). Four FGDs were conducted with adolescents aged 14 to 16 years, including both boys and girls. Data were analysed thematically using NVivo software. The factors were identified under the six main themes: (i) socio-economic and cultural context (ii) contextual and environmental factors (iii) household food security (iv) social and peer influences, (v) individual knowledge, attitudes, and practices, and (vi) nutritional and health outcomes. The findings indicated that family dynamics mainly influenced adolescents' diets. Mothers were the primary decision-makers regarding food choices and meal preparation at home, considering factors such as time availability, nutritional awareness, and cultural practices within the household. Economic challenges at home and the limited availability of fruits and vegetables in local markets were identified as barriers to healthy eating among adolescents. Adolescents' dietary behaviours were positively influenced by school meal programs and nutrition education, while media exposure and peer pressure negatively impacted their dietary behaviours. Although adolescents have some knowledge of healthy eating, their food preferences were primarily driven by taste. Adolescents were aware of the short-term impacts of unhealthy eating, but their understanding of long-term health risks was limited. In conclusion, the adolescents' diets were influenced by several socio-economic, and cultural factors, parental characteristics, media, peers, and the physical food environment. These results suggest the need for focused nutrition education and policy interventions to promote healthy eating habits among adolescents in Tamil communities in Sri Lanka.

Keywords: Adolescents, dietary behaviours, nutrition, Tamil communities

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Adolescents' view on seeking nutrition information: motivators, sources and role of technology

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Adolescence, the transition between childhood and adulthood, is marked by rapid physical, mental, and emotional changes, making proper nutrition essential for growth and long-term health. Poor eating habits during adolescence can often contribute to health issues such as obesity, cardiovascular disease, and nutrient deficiencies. Despite the importance of a balanced diet, adherence to dietary guidelines remains low, partly due to limited nutrition information seeking on adolescent nutrition. Hence, there is limited research on nutrition information-seeking behavior among adolescents and comprehensive exploration of what motivates them and what sources they rely on. To address this gap, this study examined the key motivators and sources influencing adolescents' nutrition information-seeking behaviour in Sri Lanka, with a focus on the role of technology. Using a qualitative approach, eight in-depth interviews were conducted with adolescent girls aged 13–16 years from Kurunegala and Kuliyapitiya areas. The interviews explored their motivations, preferred sources of information, and attitudes toward using technology for nutrition knowledge. Findings revealed that family, school, and academic subjects are the primary motivators for adolescents to seek nutrition information, while smartphones serve as their main source of information access nowadays. Additionally, teachers and school curricula significantly contribute to shaping their knowledge of nutrition and related topics. The study concluded that family, teachers, and school environments play crucial roles in influencing adolescents' nutrition knowledge, while technology, particularly smartphones, has a significant impact on their food choices. These findings highlight the need for integrating technology-based nutrition education into school programmes and encouraging family involvement to improve adolescent dietary behaviours.

Keywords: Adolescents, motivators, nutrition information-seeking, nutrition sources, technology

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The effect of dietary nitrate supplementation from Beetroot juice on blood pressure regulation in pre-hypertensive and stage 1 hypertensive individuals: A single-blind dose dependent comparative intervention study

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Hypertension is a significant global health concern, particularly in low- and middle-income countries like Sri Lanka, where it has the potential to contribute to several comorbidities, imposing a substantial burden on the healthcare budget. Dietary nitrates from vegetables such as beetroot, spinach, and radishes aid hypertension management by converting to nitric oxide, which promotes vasodilation and lowers blood pressure. This study aimed to assess the efficacy of beetroot juice supplementation in reducing blood pressure among hypertensive individuals. A single-blind, comparative dose-dependent intervention study was conducted with 22 pre-hypertensive or stage 1 hypertensive individuals. The study excluded individuals with comorbidities and those on anti-hypertensive medications**.** The higher-dose intervention group received 0.25 L of beetroot juice prepared from 190 g of ground beetroot daily for 14 consecutive days, while the lower-dose intervention group received 0.25 L of beetroot juice prepared from 3.8 g of ground beetroot. Blood pressure measurements were taken at baseline and post-intervention, with three repeated readings taken each time to ensure accuracy. The higher-dose intervention group demonstrated a statistically significant reduction in systolic blood pressure (from 138 ±12 mmHg at baseline to 124.09 ± 6.3 mmHg post-intervention; $P < 0.0006$) and diastolic blood pressure (from 85±7 mmHg at baseline to 76.5±4.2 mmHg post-intervention; $P=0.001$). In contrast, the lower-dose intervention group showed no significant changes in systolic blood pressure (baseline: 136.6±6.4 mmHg; post-intervention: 136.3±7.8 mmHg; $P=0.7031$) and diastolic blood pressure (baseline: 89±7 mmHg; post-intervention: 83.1 ± 6.4 mmHg; $P=0.534$). This study concludes that the dietary supplementation of beetroot juice at higher concentration (190 g of beetroot/250 mL) effectively reduces blood pressure after 14 days of treatment within the selected study sample.

Keywords: Beetroot juice, diastolic blood pressure, heart rate, hypertension, systolic blood pressure

Food literacy level of secondary school students in North Western Province, Sri Lanka

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Food literacy education empowers adolescents to navigate modern food systems, promoting sustainable and healthy food choices. However, the use of empirical tools to measure the food literacy levels of school children in Sri Lanka is still elusive. Hence, this study assessed food literacy levels among Sri Lankan secondary students (grades 7–9) using a validated 25-item food literacy tool that measured components of food related to knowledge, attitudes, and practices. This cross-sectional study included 130 students from three schools in the Giriulla Educational Zone. Data analysis revealed that food literacy scores ranged from 46.4 to 88%, with a mean score of 70%. Food literacy levels of students were categorized as low (below 67), moderate (67 to 78), and high (above 78), based on cutoff points identified in a previous study ranking 31% of students in the low category, 47% in the moderate category, and 22% in the high category. While students demonstrated strong theoretical knowledge, practical application remained weak, impacting real-life food choices and behaviours. Statistical analyses revealed significant socio-demographic influences, with no significant difference in food literacy scores between males and females ($P=0.518$). Parental education, occupation, and school type notably impacted food literacy. It was evident that food literacy education in Sri Lankan secondary schools covers basic topics but reveals gaps in practical application. Moderate literacy levels, with females outperforming males, highlight disparities in knowledge, attitudes, and practices with gendered differences. Targeted interventions, including model school gardens and cooking programmes that guide hands-on food-related practices, and healthy canteen policies with reinvented school food environments, are essential to bridge this gap. Thereby, strengthening food literacy will foster sustainable food systems, empowering youth to make food healthier choices in the long run.

Keywords: Food literacy, secondary schools, adolescence, knowledge, attitudes.

Antioxidant activities of Millet based instant beverage mixes

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Finger millet *(Eleusine coracana)* and foxtail millet *(Setaria italica)* are popular millets types in Sri Lanka. Millets are gluten-free cereals and are rich in dietary fibre and several phytochemicals including phenolic compounds. There is a renewed interest in millet based novel food products due to their exceptional nutritional value and potential usage as functional foods. The aims of the present work were to develop finger millet and foxtail millet based instant dried beverage mixes and to determine their antioxidant properties. Germinated and non-germinated millet grains were used to prepare instant beverage mixes from each millet type. The consumer acceptability for beverage mixes was determined by sensory evaluation using 50 untrained participants. Physical and rehydration properties of beverage mixes were determined using standard procedures. The soluble and bound phenolic extracts of dried mixes were examined for their Total Phenolic Content (TPC) and Total Flavonoid Content (TFC). Antioxidant activities were measured using reducing power (RP), 2,2-diphenyl-1-picrylhydrazyl (DPPH) Radical Scavenging Activity (DRSA), and Ferrous Ion Chelating Ability (FICA). Non-germinated finger millet beverage mix was the most preferred beverage whereas non-germinated foxtail millet was that of the least preferred. The highest rehydration properties were reported for germinated dried mixes of two millet types while favourable physical properties were reported for the finger millet beverage mixes. TPC of soluble and bound extract of beverage mixes were ranged from 154.79 to 21.84 and 45.32 to 11.02 mg of ferulic acid equivalent/g of dry matter respectively. Antioxidant activities of soluble and bound phenolic extracts of finger millet beverage mixes were higher than that of foxtail millet. In conclusion, instant beverage mixes prepared using finger millet and foxtail millet has a considerable phenolic content and antioxidant activities and thus may play an important role in the wellness management.

Keywords: Bound phenolics, finger millet, foxtail millet, germination, sensory

The needs assessment of establishing Nutrition Promotion Groups (NPGs) in state universities in Sri Lanka

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University students are at a critical stage where proper nutrition is essential for cognitive function and overall well-being. However, many Sri Lankan university students struggle to maintain healthy dietary habits due to limited nutrition knowledge. This cross-sectional descriptive study aimed to assess the need for establishing Nutrition Promotion Groups (NPGs) by evaluating students' current nutrition knowledge, dietary practices, and willingness to establish and be a member of the NPG. A self-administered online questionnaire was used to assess dietary patterns, nutrition knowledge, and willingness to establish and participate in NPG activities. The questionnaire included 20 nutrition knowledge-assessing questions and sections on assessing dietary habits and willingness to establish NPGs and participate in the activities conducted through NPGs. A total of 200 undergraduates aged 20 to 28 years, with a mean age of 24.8±2.7 years, were recruited from seven Sri Lankan state universities. Data was analysed using Microsoft Excel 2019 and SPSS 26.0. The findings of dietary patterns revealed that 86% of students had changed their dietary habits after entering university, 91.5% followed a non-vegetarian diet, 69% skipped at least one meal per day, and 26% consumed fast food and soft drinks daily. Further, results showed that 52% of students had moderate-level nutrition knowledge. Among the participants, 87.5% expressed their willingness to have NPGs in their universities and join NPG activities. More than half (55%) of the students preferred to engage in activities on virtual platforms. The study highlighted the need for establishing NPGs in the universities due to unhealthy dietary patterns, inadequate nutrition knowledge, and the majority of participants' willingness to get the service while being a participant of the NPGs. The inadequacy of nutritional knowledge among university students across the universities reinforces the need for structured university-based NPGs to improve their nutrition knowledge, promote healthier dietary choices, and enhance overall well-being.

Keywords: Dietary habits, knowledge, nutrition promotion groups, university students

Assessment of Irritable Bowel Syndrome (IBS)-like symptoms and dietary habits in endometriosis patients for improving dietary management

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Endometriosis is a chronic gynecological condition affecting 10% of women of reproductive age globally. Many women with endometriosis experience gastrointestinal symptoms resembling Irritable Bowel Syndrome (IBS), making diagnosis and management challenging. Both conditions share similar symptoms such as abdominal pain, bloating and altered bowel habits. While dietary habits are known to influence symptom severity, limited research explores the overlap between these conditions, particularly regarding diet. This cross-sectional study aimed to assess the percentage of IBS-like symptoms in endometriosis patients, examine their dietary habits, and explore how diet contributes to symptom management. Thirty-five endometriosis patients were recruited with ethical approval from Wayamba University of Sri Lanka and De Soysa Maternity Hospital, Colombo. Data were collected using a pre-tested semi-structured questionnaire covering socio-demographics, dietary habits, the Rome IV criteria, the Bristol Stool Form Scale for IBS-like symptoms, and the Visual Analog Scale for symptom severity. The results revealed that 42.9% of participants experienced IBS-like symptoms, with 56.3% of them having the most common subtype, diarrhoea-predominant (IBS-D). More than half (52.8%) of the participants consumed high-Fermentable Oligosaccharides, Disaccharides, Monosaccharides, and Polyols (FODMAP) foods, which can worsen gastrointestinal symptoms. The Spearman rank correlation test showed significant associations between dietary habits and IBS-like symptoms, including abdominal pain (P = 0.001), bloating (P=0.049), vomiting (P=0.016) and mental well-being (P=0.013). Inconclusion, this study highlights the association between dietary habits and IBS-like symptoms in endometriosis patients.

Keywords: Dietary habits, endometriosis, high FODMAP diet, IBS-like symptoms

Antioxidant and physical characteristics of rice-based functional beverage for chronic gastritis management

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Chronic gastritis is a common medical condition caused by the persistent inflammation of the stomach lining lasting for at least three months. Dietary modifications play a significant role in alleviating gastritis symptoms and preventing complications. In this study, the antioxidant properties, physical properties, rehydration properties, and alpha amylase inhibitory activity of whole grain rice-based beverage prepared for management of chronic gastritis were investigated. The soluble and bound phenolic extracts of the beverage prepared from whole grain rice *(Oryza sativa*) were analyzed for total phenolic content (TPC) and total flavonoid content (TFC). Antioxidant activities were evaluated using the reducing power (RP), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (DRSA), and ferrous ion chelation ability (FICA). The inhibitory activity of soluble phenolics on α-amylase enzyme was investigated. The physical properties of the dried beverage mix, namely, density, fluidity, porosity, cohesiveness, and interstitial air, were assessed. Furthermore, rehydration properties, such as wetting, dispersibility, and solubility, were determined using standard procedures. The soluble phenolic of the beverage exhibited the highest TPC, TFC, and antioxidant activities compared to that of bound phenolic. The TPC of soluble and bound extracts were 1.94 and 0.71 ferulic acid equi mg/g, respectively and TFC of soluble and bound extracts were 0.65 and 0.07 catechin equi mg/g respectively. DRSA, RP and FICA of soluble and bound extracts were 2.29, and 1.55 trolox equi mg/g, 8.03, and 2.26 ascorbic acid equi mg/g, 14.57 and 2.11EDTA equi mg/g respectively. The soluble phenolic extract (0.04 FAEmg/ml) demonstrated 40 % inhibition of α-amylase activity, whereas the standard inhibitor, acarbose (0.05 mg/mL) showed 89 % inhibition. Whole grain rice based beverage mix demonstrated a considerable antioxidant potential. Thus, rice based beverage may serve as a potential source of functional food ingredients in health promotion and of gastritis management.

Keywords: Antioxidant activity, bulk density, α-amylase enzyme, phenolic compounds, whole grains

Impact of a dietary guideline booklet on the nutrition status of pregnant mothers

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Despite the availability of several nutrition interventions, maternal nutritional problems remain public health concerns in Sri Lanka. This study aimed to determine the impact of a dietary guidelines booklet on the nutrition status of pregnant mothers. Fifty pregnant mothers in the second trimester attending Maternal and Child Health (MCH) clinics in the Pannala Medical Officer of Health (MOH) area were recruited as the intervention group, while fifty second-trimester mothers attending MCH clinics in the Kuliyapitiya-West MOH area were the control group. The intervention group received a dietary guidelines booklet, and the control group did not receive it. Baseline socio-demographics, nutrition knowledge, anthropometric measurements, haemoglobin and dietary information were collected. At the end of the intervention (last clinic visit), all the information except socio-demographic data was collected. Nutritional status was analysed using pre-pregnancy Body Mass Index (BMI), weight gain during pregnancy, dietary intake, and Hb levels. The nutrient intake was analysed using Food-Base 2000. The differences within groups and between two groups were calculated using dependent and independent t-tests, respectively, with SPSS version 26.0. At baseline, there were no significant differences in socio-demographic and nutritional status between the intervention and control groups. At the end, the mean weight gain (12.2 ± 14.2 kg) in the intervention group was higher than in the control group (9.7 ± 5.4 kg). At the end, 74% of the intervention group and 44% of the control group achieved normal haemoglobin levels. Dietary nutrient intake improved in the intervention group compared to the control group: protein (65.9 g vs. 62.5 g), calcium (687.4 mg vs. 642.2 mg), folic acid (189.6 µg vs. 177.6 µg), and vitamin C (62.0 mg vs. 48.0 mg). Nutritional knowledge in the intervention group improved from baseline (14.2 ± 3.2) to the end of the intervention (18.9±1.7). This study concluded that the dietary guidelines booklet could help to improve the nutrition status of pregnant mothers.

Keywords: Dietary patterns, nutrient intake, nutritional status, pregnancy, weight gai

Knowledge, attitudes, and behaviour of Sri Lankan housewives regarding aflatoxin contaminations in food products

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Aflatoxin contamination in food can cause serious health risks. However, public awareness and preventive behaviour on contaminations remain inadequate. This study aimed to assess the Knowledge, Attitudes, and Behaviours (KAB) of Sri Lankan housewives regarding aflatoxins and to examine the factors affecting the level of knowledge, attitudes, and behaviours using structural equation modelling (SEM). Data were collected through an interviewer-administered telephone-based pre-tested questionnaire from a sample of 397 housewives. SEM analysis revealed that education level was the strongest predictor of knowledge (β=0.235 P<0.001), and attitudes (β=0.254 P<0.001) whereas income, age, ethnicity, and area of living had no significant effect. Knowledge had a strong positive influence on the attitudes (β = 0.734, P< 0.001). Among knowledge indicators, recognition of aflatoxins (β=0.874) and aflatoxin related health risks (β=0.805) showed the highest contributions. Attitudes strongly influenced the importance of aflatoxin awareness (β=0.990) and willingness to pay for aflatoxin-free foods (β = 0.982). Among behaviour indicators, hygiene after scraping (β=0.907) was the strongest predictor, while food storage practices had the least influence (β=0.048). Model fit indices indicated a moderate fit (CFI=0.952, RMSEA=0.097). The findings highlight the crucial role of knowledge of housewives in shaping attitudes and behaviours, regarding aflatoxin contaminations. This study sheds light on the need of educational interventions and behaviour-driven strategies to enhance aflatoxin risk mitigation. Further research should explore socio-cultural and environmental factors to refine predictive models and intervention strategies.

Keywords: Aflatoxins, attitudes, behaviours, knowledge, structural equation modelling

Association between Dietary Inflammatory Index and Irritable Bowel Syndrome symptom severity among Sri Lankan undergraduates

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Irritable Bowel Syndrome (IBS) is a common functional gastrointestinal disorder prevalent among university students, a population often subject to stress and dietary irregularities. Diet-induced inflammation is hypothesized to play a role in IBS pathophysiology, and Dietary Inflammatory Index (DII) is used to assess the inflammatory potential of dietary intake. This study aimed to determine the prevalence of self-reported IBS and examine the relationship between DII and IBS symptom severity among Sri Lankan undergraduates. In this cross-sectional study, 380 Sri Lankan undergraduates were surveyed online in two phases. Phase I used the Rome IV criteria and Bristol Stool Scale to identify the presence of IBS. Those with IBS (n=56) participated in Phase II, completing a validated 58-item Food Frequency Questionnaire. The DII was calculated with z-score standardization. The IBS-Symptom Severity Scale (IBS-SSS) and IBS-Quality of Life (IBS-QOL) questionnaire were used to assess symptom severity and quality of life, respectively. The prevalence of self-reported IBS among Sri Lankan undergraduates was 15%, with subtype distribution as follows: IBS-Constipation (52%), IBS-Diarrhea (16%), IBS-Mix (25%), and IBS-Unexplained (7%). The individual DII ranged from +1 to +3, indicating a predominantly pro-inflammatory dietary pattern among participants. A statistically significant moderate positive correlation was observed between DII and IBS symptom severity (r=0.374, *P*=0.005), and mean IBS-SSS scores increased across DII quartiles, with the highest scores in the fourth quartile (180.00± 45.1) compared to the first quartile (129.40±48.3). A weak positive correlation was found between DII and IBS-QOL (r = 0.159, *P*=0.241), though this was not statistically significant. In conclusion, IBS affects a substantial proportion of undergraduates, and the findings suggest that a pro-inflammatory diet may worsen IBS severity. Emphasizing anti-inflammatory dietary components while limiting pro-inflammatory factors presents a promising strategy for managing IBS.

Keywords: Dietary Inflammatory Index, Irritable Bowel Syndrome, IBS Symptom Severity Scale (IBS-SSS), inflammation, undergraduates

Awareness, beliefs, and use of non- nutritive sweeteners among university students in Sri Lanka

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When the obesity and obesity-related metabolic abnormalities are on the rise, the usage of Non-Nutritive Sweeteners (NNS) as a strategy for calorie reduction is also gaining widespread. The long-term health implications of NNS consumption remain argumentative, leading to consumer confusion. Thus, more understanding on pattern of use and views of consumers of NNS is crucial. This study aimed to explore the awareness, beliefs, and use of NNS among university students. A cross-sectional survey was conducted participating 411 university students using a validated, self-administered questionnaire distributed via an online survey platform. Students studying nutrition/dietetics, medical/veterinary, and food science were excluded. Among the study participants 87.6 % students (n=411) did not have prior knowledge regarding NNS. Among students with prior knowledge (n=185), only 23 students were aware on recent developed concerns on aspartame and their potential cancer risk. Majority students of prior knowledge on NNS displayed moderately belief regarding the undesired long-term health effects of NNS. There were 40 students who consumed NNS daily either in food preparation or through other ready to eat food or beverages. Structural Equation modelling revealed age has a positive significant impact on awareness (β=1.401, P=0.001) but no impact on beliefs and use. Health concerns as maintaining a healthy diet positively influences awareness (β= 1.377, P=0.001) and beliefs (β =0.471, P=0.024), with a no significant effect on use. Awareness strongly influences beliefs (β=0.841) and significantly indirectly influences use (β=0.183), while beliefs directly increase use (β=0.218) with no indirect effects. In conclusion, even if university students are not well-informed about NNS, awareness has a significant impact on their beliefs and understanding as they get older.

Keywords: Awareness, beliefs, Non-Nutritive Sweeteners (NNS), university students, use

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Drivers of fruit and vegetable consumption among estate workers in Sri Lanka

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Fruits and Vegetables (F&V) are vital components of a healthy diet, providing essential nutrients such as vitamins, minerals and dietary fiber, which help to prevent chronic diseases and support overall well-being. Despite the well-documented benefits of F&V, estate workers in Sri Lanka face unique barriers for F&V consumption. The aim of this study was to identify the drivers of F&V consumption of estate communities. Four Focus Group Discussions (FGDs) were carried out in *Deniyaya* area recruiting adult female estate workers aged 30–60 years. Data were analyzed using NVivo software using seven main themes, named as nutritional awareness, acquisition, preparation, food allocation, consumption patterns, barriers of consumption and recommendations to improve F&V intake. Findings revealed that while participants were aware of the health benefits of F&V such as disease prevention, a significant gap existed regarding the awareness of recommended intake. Key challenges included time limitation due to work and family responsibilities, the influence of gender on household food distribution and limited access to affordable markets. Preparation practices were influenced by time, cooking skills and lack of storage facilities. Children's nutritional needs were prioritized when making decision of F and V consumption at household level. Seasonal availability, social factors such as peer influences and personal preferences were associated with the consumption patterns of F&V. Barriers to F&V consumption mentioned by the participants included economic hardship, limited market access, time constraints of preparation, and environmental challenges such as crop destruction by wildlife. Suggested solutions by the participants were nutrition education programs, community gardens and improve infrastructure to enhance the access to F&V. In conclusion, this study revealed that the time availability, cooking skills, food preference, nutritional needs of the family members, storage facilities and prices of foods were the main drives of F & V consumption in estate workers in Sri Lanka. This study underscores the need for multi-faceted interventions to promote F&V consumption among estate workers.

Keywords: Fruit and vegetable consumption, estate workers, drivers, dietary practices

Development of nutrition promotion materials for university students in Sri Lanka

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University students often face significant challenges in maintaining healthy dietary habits due to busy schedules, limited access to nutritious foods, and reliance on convenience meals. This study aimed to assess the dietary patterns, nutritional knowledge and key barriers to healthy eating among undergraduates at five state universities in Sri Lanka and develop targeted nutrition promotion materials. A cross-sectional online survey was conducted among 462 undergraduates to evaluate their food choices, meal patterns, and awareness of healthy eating. Findings revealed that 65.4% of students regularly skipped meals, with breakfast being the most commonly missed (72.8%). Additionally, only 35% consumed the recommended daily servings of vegetables, while fruit intake was even lower; 15.6% consumed fast food daily, and 15.7% lacked awareness of balanced diets. Inadequate healthy food options on campus further contributed to poor dietary habits. These inappropriate dietary behaviours can increase the risk of developing non-communicable diseases (NCDs) like obesity, diabetes, and cardiovascular diseases, which are becoming prevalent among young adults in Sri Lanka. Based on these issues, multimedia-based nutrition promotion materials were developed and disseminated through a WhatsApp channel named NutriHub, supported by printed educational materials in university canteens. All materials were designed based on the 2021 updated version of Food-Based Dietary Guidelines (FBDGs) for Sri Lankans. The WhatsApp channel-based nutrition promotion incorporated cognitive and adult learning principles, using interactive quizzes, visual tools, and multimedia content to encourage healthier eating. Post-intervention feedback, based on quiz responses, indicated improved nutrition awareness and dietary decisions among university students. The study underscores the importance of developing culturally relevant, accessible nutrition awareness/educational materials to improve students' dietary habits and overall well-being. These findings contribute to sustainable nutrition promotion strategies aligned with the United Nations Sustainable Development Goals (SDGs), particularly in fostering good health, quality education, and responsible consumption.

Keywords: Dietary habits, nutrition promotion, university students, WhatsApp channel

Drivers of fruit and vegetable consumption among adult women in the Tamil communities in Sri Lanka

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Fruits and Vegetables (F&V) are widely recognized as essential components of a healthy diet, and adequate consumption can help to reduce the risk of non-communicable diseases. The recommended daily intake of F & V is 400g per day for adults. However, F & V consumption among Sri Lankan adults is reported to be well below the recommendation. This study aimed to identify the drivers of F & V consumption among adult women in Tamil communities in Sri Lanka. A qualitative research approach was employed, conducting four Focus Group Discussions (FGDs) in selected areas in Mullaitivu (*Chemmalai, Kokkuthoduvai, and Mulliyawalai*) and Colombo (*Siwalipura*) with participants aged 20–50 years. Data were analyzed using *NVivo* software, focusing on five main themes named as, nutritional awareness, acquisition, preparation, allocation, and consumption patterns of F&V. Nutrition awareness was high regarding the benefits of F & V intake among the participants. Acquisition was driven by individual factors such as price, physical factors like quality and shelf life of F & V, peers influence and socio-cultural factors such as religious practices. Preparation was influenced by time availability, cooking skills, family preferences, and festival food preparations. Household food allocation was driven by family members' nutritional needs and preferences. Consumption patterns were shaped by personal taste preferences, the availability of F & V in home gardens, seasonal availability, social media and traditional advice from elders. In conclusion, key factors influencing F & V consumption among Tamil adult women in Sri Lanka include prices of F&V, family preferences, nutritional needs of the family members and the time availability. These findings underscore the need for targeted strategies, such as enhancing affordability, improving market access, and promoting home gardening to support greater F&V consumption.

Keywords: Adult women, drivers, focus group discussions, fruit and vegetable, Sri Lankan Tamil communities

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Assessment of drivers affecting adolescents' diet and nutrition in Sinhala community

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Adolescence is the period of development that begins at puberty and ends at adulthood. Rapid physical, mental, emotional and social development takes place during this period. Adopting healthy behavioral patterns is a major challenge during the adolescent period. This study aimed to identify the key factors influencing adolescents' diet and nutrition of the Sinhala community. Data were collected using four Focus Group Discussions (FGDs) with 31 participants aged between 15 and 16 years, conducted in Rideegama, Neluwa, Bibila and Wattala areas. The content were analyzed using the template analysis technique using NVivo 12 software using thematic analysis. The majority of participants had a good understanding of a balanced diet. However, many participants often preferred fast food over home cooked meals due to taste, convenience, personal preference and peer influences. Nutrition education was received through school lessons, parents, social media platforms, healthcare professionals and community programs. Cultural beliefs (food taboos, traditional norms) and family dynamics (parental preference, child-centered choices) have influenced their food preferences. Social media trends and peer influence also shaped adolescents' dietary choices by promoting fast food consumption. Furthermore, economic struggles have impacted food selection by limiting access to nutritious options. Participants recognized the importance of a balanced diet for growth, development and overall health. In conclusion, peer pressure, social media trends, cultural beliefs, family dynamics and economic factors influence adolescent dietary practices and nutrition.

Keywords: Adolescents, diet and nutrition, factors, focus group discussions

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An analysis of national policies, programmes & interventions on child hunger, malnutrition & food insecurity in Sri Lanka

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Sri Lanka has struggled to make significant progress in reducing child malnutrition in recent years. Despite the numerous, policies, programmes and interventions, the rates of underweight, stunting, and wasting among children have remained stubbornly high, with only marginal improvements seen over the past decade. Therefore, it is evident that a gap exists between the current policies and programmes implemented. In this milieu, this research aims to analyze existing literature, policies and programmes to identify gaps and weaknesses while evaluating the effectiveness of these policies, programmes and interventions. The study encompassed a comprehensive review of the literature published on child hunger, malnutrition food insecurity, a review and analysis of nutrition-related policies, and a series of Key Informant Interviews (KIIs) with stakeholders related to nutrition-related policymaking in Sri Lanka. The literature review highlighted that child malnutrition and food insecurity looming at large and the situation became worse over the last few years. The policy review revealed significant gaps, including unclear implementation strategies, lack of measurable indicators, and inadequate robust linkages to broader goals in policy implementation. Furthermore, the KIIs emphasized challenges including the lack of evidence-based policy analysis, limited data availability, inadequate implementation strategies, coordination issues, weak alignment of implementation with broader goals, and resource constraints. This research underscores the urgent need for a comprehensive reassessment of Sri Lanka's nutrition policies and programmes. The identified gaps and challenges highlight the necessity for evidence-based policymaking, improved data collection and surveillance systems, enhanced coordination among stakeholders with multisectoral partnerships, and ample resource allocation. By addressing these systemic bottlenecks, Sri Lanka can develop effective strategies to combat child malnutrition and food insecurity, ultimately improving the health and well-being of its population.

Keywords: Child malnutrition, food insecurity, nutrition policy, stunting, wasting

Acknowledgement: This study was funded by World Vision Lanka.

Knowledge, attitudes and practices related to vitamin D in young adults in rural Sri Lankan settings

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The human body can synthesize vitamin D in the skin through sun exposure. It is crucial for maintaining bone and muscle health, immune function, and preventing chronic diseases. However, vitamin D deficiency is highly prevalent in Sri Lanka and many other countries, irrespective of sunlight availability. Currently, the Knowledge, Attitudes and Practices (KAP) related to vitamin D in young adults in Sri Lankan rural settings are unknown. This study aimed to assess the KAP related to vitamin D in young adults in rural Sri Lankan settings. A cross-sectional study was conducted among 120 young adults from three selected grama niladhari divisions in the Pannala Divisional Secretariat. Data were collected using an interviewer-administered questionnaire. Descriptive statistics and the Chi-square test were used to analyze data using SPSS software. The findings of this study revealed that the study population's knowledge related to vitamin D was poor (mean knowledge score: 42.1±13.3). However, attitudes toward vitamin D were generally positive (mean attitude score: 79.6±8.9), and practices were moderate (mean practice score: 65.6±8.5). Significant associations were observed between education level and knowledge scores (P=0.037), demonstrating that higher education levels have been linked with better knowledge about vitamin D. Age was significantly associated with attitude scores (P<0.001), indicating that older participants had more positive attitudes regarding vitamin D. Gender was significantly associated with practice scores (P<0.001), revealing that males were engaged in more vitamin D related practices than females. In conclusion, this study discovered that many young adults in Sri Lankan rural settings exhibited poor knowledge, good attitudes and moderate practices related to vitamin D.

Keywords: Attitudes, knowledge, practices, vitamin D, young adults

Effects of *Osbeckia octandra* (Heen bovitiya) Herbal drink on Cardiometabolic Risk Markers in adults with Overweight or Obesity

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Cardiometabolic disorders, including type 2 diabetes, hypertension, and insulin resistance, pose a major global public health challenge. The increasing interest in herbal medicine highlights the need for scientific validation of traditional remedies for cardiometabolic health. *Osbeckia octandra* (Heen Bovitiya), an endemic medicinal plant in Sri Lanka, is traditionally valued for its hepatoprotective, anti-inflammatory, and potential hypoglycemic properties. This single-blind randomized controlled trial evaluated the effects of *O. octandra* herbal drink on key cardiometabolic risk markers; fasting blood glucose level (FBG), blood pressure (BP), and central obesity, in overweight or obese adults aged 25-60 years. Total Phenolic Contents (TPC) of *O. octandra* mature leaves were calculated as 4543 mg Gallic acid equivalents (GAE)/100 g dry weight (DW) of leaves. The treatment group (n=14, mean age ± SD: 33.7± 9.3) consumed a standardized herbal drink prepared containing 15g of *O. octandra* leaves per person while the control group (n=10, mean age±SD: 25.8±0.6) received a placebo, four times per week for five weeks. Anthropometric (weight, height, waist, and hip circumferences), biochemical (FBG), clinical (BP), and dietary (24-hour diet recall) markers were assessed at pre- and post-intervention to determine potential metabolic improvements. The results demonstrated statistically significant reductions in systolic blood pressure (Treatment group change ± SEM: -9.1±2.8 mmHg vs. Control group change ± SEM: 3.4±1.3 mmHg, P=0.01), waist circumference (Treatment group change ± SEM: -1 ± 0.3 cm vs. Control group change ± SEM: 0.2 ± 0.2 cm, P=0.04) and hip circumference (Treatment group change ±SEM: -0.6±5.6 cm vs. Control group change ±SEM: 0.5 ± 3.8 cm, P=0.02) from baseline to post-intervention between the two groups. A trend toward reduction in FBG was observed in the treatment group compared to the control group. These findings indicate that *Osbeckia octandra* may have potential benefits for cardiometabolic health, highlighting the need for further long-term studies.

Keywords: Blood pressure, glycaemic control, obesity, *Osbeckia octandra*

Cinnamon as a functional ingredient for innovating wellness-focused foods

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Cinnamon, a traditional spice is widely recognised for its flavour and bioactivities that may ensure wellness and offer potential for functional food innovation. The study aimed to determine the possibility of incorporating cinnamon into everyday foods such as peanut butter, butter cake, and wine biscuits to develop innovative foods and assess the impact of antioxidant activities that are crucial for promoting wellness. Export-quality *Cinnamomum zeylanicum*, bark was processed into a fine powder and was incorporated into peanut butter, butter cake and wine biscuits at different concentrations. A sensory evaluation involving 50 untrained panelists was conducted to identify the most preferred cinnamon concentration of each product. Phenolic extracts obtained from cinnamon-incorporated foods were studied for their total phenolic content (TPC), total flavonoid content (TFC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (DRSA), ferrous ion chelating activity (FICA) and reducing power (RP) against the control food. The results revealed that cinnamon incorporation significantly increased the TPC in wine biscuits from 31.7 to 42.7 and 61.1 to 67.5 µg ferulic acid equivalents /g dry weight in soluble and bound phenolic extracts, respectively. Peanut butter showed the highest TPC (64.47 to 77.44 µg ferulic acid equivalents/g dry weight). The cinnamon incorporation significantly increased TFC in wine biscuits, peanut butter and butter cake from 3.94 to 8.65, 8.97 to 16.78, and 5.02 to 6.95 µg catechin equivalents/g dry weight respectively in soluble extracts. Furthermore, the values of DRSA, RP and FICA were significantly increased in cinnamon-incorporated foods. Coumarin content estimation for wine biscuits, peanut butter, and butter cake was 33.84µ g, 0.04 mg, and 22 µg per serving respectively. These values were within the tolerable daily intake of 0.1 mg/kg body weight. This study concludes that the incorporation cinnamon in common foods effectively enhances its antioxidant properties, demonstrating its potential for developing healthy foods that may contribute to wellness maintaining consumer acceptability and safety.

Keywords: Bioactive properties, cinnamon, functional ingredients, phenolic content, wellness

Level of engagement in nutrition promotion activities of Mother Supportive Groups (MSGs) in nutritionally vulnerable areas in Sri Lanka

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Although Mother Support Groups (MSGs) have been introduced as a community-based nutrition intervention since 2002 to promote nutritional status among nutritionally vulnerable groups, maternal and child nutritional problems remain a significant public health issue in Sri Lanka. Further, no study has been conducted to evaluate the level of engagement in nutrition promotion activities, especially in districts with high prevalence of nutrition problems. Therefore, this study was conducted to identify the nutrition promotion activities, average number of participants, and methods of conducting each activity and to identify the factors influencing engagement in nutrition promotion activities and identify challenges in the engagement of those activities. A cross-sectional study was employed across four nutritionally vulnerable districts, selecting two MSGs from each district. Data collection was conducted through a pre-tested interviewer-administered structured questionnaire and focus group discussions (FGDs). Collected data from the questionnaire were analysed using descriptive analysis, and FGD information was analysed using thematic analysis with NVivo software. Results showed that nutrition promotion activities conducted by MSGs included breastfeeding support activity, widely attended, with 80% of mothers participating in thought group discussions and demonstrations; nutrition education on food groups and healthy eating, engaging 75% of participants through interactive discussions and dissemination of printed materials; cooking demonstrations for healthy meal preparation, with 70% participation, conducted through live workshops; and growth monitoring awareness sessions, with 75% of participants, conducted through group discussion. However, economic constraints, cultural food preferences, and limited resources were the factors influencing the planning of the nutrition promotion activities of MSGs. Lack of financial resources, infrastructure inadequacies, inconsistent attendance, and cultural resistance were challenges faced by MSGs when conducting nutrition promotion activities. The study highlights the need for specific programmes to make MSGs more effective in nutrition promotion activities among nutritionally vulnerable communities. The findings provided useful information to help policymakers create better community-based nutrition programmes.

Keywords: Community engagement, food security, mother support groups, nutrition promotion, public health intervention

Drivers of nutritious diet among estate adults and adolescents in Sri Lanka: A qualitative study

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Diet and nutrition play a vital role in the health and development of individuals across all age groups. This study aimed to identify the drivers of nutritious diets among adolescents and adults in the estate sector in Sri Lanka. Three Focus Group Discussions (FGDs) were conducted in the *Watawala* area with adult men and women aged 20-60 years and adolescent girls aged 14-16 years. Data were analyzed using NVivo software, focusing on six main themes named as contextual & environmental factors, socio-economic & cultural factors, individual knowledge, attitudes & practices, household food security, social media & peer influence, and nutrition & health outcomes. Contextual and environmental factors such as limited access to protein-rich foods, lack of land for agriculture restricted food availability and affordability. There are varying levels of nutritional awareness regarding healthy eating. However, preferences for fast food, limited understanding of balanced diets, and misconceptions about certain foods negatively influence food choices. Nutritional outcomes revealed high malnutrition rates, especially among children and pregnant mothers, contributing to stunted growth, and non-communicable diseases. Social and peer influences shaped dietary practices through social media advertisements. Socio-economic factors such as high food prices, income and the ongoing economic crisis further restricted the access to nutritious foods. It led families to prioritize children's nutritional needs while relying on coping strategies such as buying food in smaller quantities, reducing the frequency of meals and reduce the animal origin food consumption. Due to cultural beliefs, animal origin foods were avoided on festival days. In conclusion, the diets of estate adolescents and adults were shaped by limited accessibility to protein-rich foods, limited land availability for agriculture, high food prices, reduced meal frequency, and the influence of social media advertisements. The findings highlighted the need for focused nutrition education, policy interventions and better access to affordable nutritious foods to improve dietary practices in estate communities in Sri Lanka.

Keywords: Dietary practices, Sri Lankan estate sector, food security, focus group discussions

Acknowledgement: This study was funded by World Vision Lanka

Parent's view on seeking nutrition information for their children: motivators, sources, and role of technology

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Adolescence marks an age of physical, cognitive, and emotional growth, requiring adequate and well-balanced nutrition. During this time, parental involvement is crucial in shaping children's dietary practices, habits, and nutrition-related knowledge. There is limited research on nutrition information-seeking behavior by parents in helping adolescents and thorough investigation of what motivates and what sources parents rely on when comes to their children's diet, nutrition, and health. Therefore, this study explored parents' perspectives on seeking nutrition information for their adolescent children, especially focusing on female adolescents, and parents' motivators, preferred sources, and the role of technology in nutrition information-seeking behavior. A qualitative approach was adopted, employing in-depth interviews with eight mothers of female adolescents (ages 14–16 years) from Kuliyapitiya and Kurunegala. Data were transcribed, translated where necessary, and thematically analyzed using NVivo software. Findings indicate that health concerns and academic performance drive parents to seek nutrition information. While healthcare professionals remain the most trusted source, YouTube short videos are widely used due to their accessibility. However, parents were largely unaware of nutrition-specific information and the use of digital technology such as apps and were worried about social media's negative influence. Most parents restrict digital access from their children, because of their negative beliefs towards technology, but they showed interest in smartphone-based diet tracking applications when introduced, suggesting that lack of awareness hinders the adoption of digital tools for nutrition education. The study highlights the need for credible, accessible, and engaging digital nutrition resources to support parental decision-making. While parents rely on both traditional and digital sources, credibility remains a key challenge. Integrating technology into school-based nutrition programmes may enhance knowledge dissemination and improve parental awareness. Government initiatives, such as dedicated educational YouTube or Facebook pages, could serve as effective platforms to promote nutrition education and nutrition information sharing.

Keywords: Parents, motivators, nutrition information-seeking, nutrition sources, technology

Impact of maternal anaemia in the third trimester of pregnancy on maternal and birth outcomes

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Anaemia is an important global health problem affecting women of reproductive age, including 38% of all pregnant women. The majority of mothers with reported anemia are in the third trimester of pregnancy. Anaemia during pregnancy is a key contributor to maternal mortality and poor birth outcomes. In Sri Lanka, the prevalence of anaemia among pregnant women was 15%. This study aimed to assess the impact of maternal anaemia in the third trimester of pregnancy on maternal and birth outcomes. This ongoing study followed 20 third-trimester pregnant women from the Polpithigama Medical Officer of Health division, Kurunegala district, over three months until delivery. Data collection included socioeconomic information, pre-pregnancy BMI, weight gain, hemoglobin levels, dietary assessment (24-hour recall, food frequency questionnaire), fatigue levels, and birth weight outcomes. No significant associations were found between anaemia and socioeconomic factors such as birth interval, gravidity, maternal age, education, income level, and family type. Among anaemic women, 40% were underweight, 40% had normal BMI, and 20% were obese. Nutrient intake of calcium, zinc, iron, vitamin A, vitamin C, vitamin B_{12}, and folate was significantly lower than the recommended dietary allowance. While adequate consumption of cereals, legumes, vegetables, fruits, and nuts was observed, intake of meat, eggs, and dairy products was insufficient. Low birth weight was observed in 40% of anaemic mothers, compared to 26.7% of non-anaemic mothers. Fatigue was reported slightly more in non-anaemic mothers (26.7%) than anaemic mothers (20.0%). The odds ratio for experiencing fatigue among anaemic mothers was 0.68 (95% CI: 0.131-2.554) compared to non-anaemic mothers, while the odds ratio for delivering low birth weight infants among anaemic mothers was 1.83 (95% CI: 0.065-4.562) compared to non-anaemic mothers. Preliminary findings suggest that maternal anaemia in the third trimester may be associated with an increased risk of low birth weight and nutritional deficiencies, though further analysis is required to establish significant correlations. As this study is ongoing, additional data will further elucidate the impact of maternal anaemia on maternal and birth outcomes.

Keywords: Birth outcomes, fatigue, low birth weight, maternal anaemia, nutrition, pregnancy, third trimester

Knowledge, Attitude and Practices on complementary feeding among employed mothers in Kegalle District

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Complementary feeding (CF) is a critical window for rapid changes in nutritional requirements, subsequent impact of infant growth and development and long-term health. Employed mothers often face challenges in ensuring the proper deliver of CF. However, knowledge, attitudes and practices (KAP) of CF among Sri Lankan employed mothers is not much studied. Therefore, the present study aimed to assess the KAP of CF among group of employed mothers in Kegalle District. A cross-sectional, descriptive study was conducted using an interviewer-administered questionnaire to collect KAP of hundred (*n*=100) employed mothers with an infant of 6 to 12-month-old from MCH clinics of Kegalle District. A scoring protocol was developed and implemented based on Infant and Young Child Feeding Guideline (IYCFG) of Sri Lanka to allocate score for each question of KAP. Descriptive statistics were derived and chi-square test was performed to assess the associations between KAP. Majority of mothers were age range of 30-39 years engaged in state sector employments. Mean component scores for knowledge, attitudes and practices were 64 (SD=13), 89 (SD=8) and 71 (SD=13) respectively. Majority (77%) of mothers knew the correct time of introducing the complementary feeding, importance of modifying feeding practices during an illness of infant (55%) and importance of iron-rich foods (78%). Nearly 54% of mothers agreed that proper complementary feeding practices affect later health and nutritional status of infants. Nearly 69% of mothers followed proper feeding schedule. However, only 58% of mothers introduced to animal-origin foods at the right time to infants. In conclusion, majority of employed mothers had accurate and updated knowledge on CF and had correct attitudes towards CF. They followed the appropriate practices of proper timing of CF, feeding during illness, hygienic practices and avoiding salt and sugar for CF.

Keywords: Attitudes, complementary feeding, infants, knowledge, practices

Estimated Aflatoxin exposure levels among Sri Lankans

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Aflatoxins are mycotoxins and secondary metabolites produced mainly by *Aspergillus* species and demonstrate carcinogenic, teratogenic, and mutagenic effects. The four major types of aflatoxins B1, B2, G1, and G2 cause significant health risks, while aflatoxin B1 being the most toxic type. The International Agency for Research on Cancer (IARC) classifies aflatoxin B1 as a Group 1 carcinogen. This study aimed to estimate consumption of potential aflatoxin contaminating foods and to develop a model for assessing aflatoxin exposure levels among Sri Lankans. A dietary survey was conducted using Food Frequency Questionnaire (FFQ) and 24-hour dietary recall among 100 individuals representing 25 Districts in Sri Lanka. Database of aflatoxin levels in food items was established using published information. Data were analysed using IBM SPSS version 23. Twenty food items were selected for risk assessment based on the Margin of Exposure (MOE). Statistical analysis revealed that there was no significant correlation (P >0.05) between daily food intake and aflatoxin exposure level in 5 food items: banana, black pepper, dried fish, egg, and wheat flour. However, chili powder exhibited a strong positive correlation with aflatoxin exposure level (R=0.972), while parboiled rice was the source for highest mean aflatoxin exposure level (4.53) and the greatest associated health risk. Furthermore, no significant difference was observed in aflatoxin exposure levels between males and females (P >0.05). The study demonstrated a strong significant positive correlation between daily food intake and aflatoxin exposure levels of chilli, cardamom, tea, biscuits, coconut milk, turmeric, parboiled rice, and cloves among Sri Lankans. Cinnamon, milk powder, coconut *Sambol*, coconut oil, dhal, cumin and curry powder have moderately significant correlation between daily intake and aflatoxin exposure level, emphasizing the urgent need for strong food safety regulation and monitoring network and public awareness programs to mitigate aflatoxin related health risks.

Keywords: Aflatoxin, aflatoxin exposure level, carcinogenic, margin of exposure

Effect of intermittent fasting on weight loss and metabolic markers in adults with overweight and obesity: a randomized controlled trial

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Intermittent fasting (IF) has emerged as a promising dietary approach for weight management and metabolic health improvement. Alternate day fasting (ADF), a type of IF, involves fasting on alternate days or two to three days per week, interspersed with regular intake on feeding days. This study aimed to evaluate the effects of ADF combined with calorie restriction on weight loss, body composition, and biochemical parameters compared to a daily calorie restriction (DCR) approach. A randomized controlled trial was conducted with 20 overweight and obese adults, randomly assigned to two groups: the ADF with calorie restriction and physical activity group (n=10, mean age±SD; 38.9±12.46 years) and the DCR with physical activity group (n=10, mean age±SD; 41.0±13.37 years). Assessments included anthropometric measurements (height, weight, waist circumference, body composition), biochemical parameters (fasting glucose, lipid profile), clinical assessment (blood pressure), dietary intake (24-hour recall), and physical activity recall, measured at baseline and post-intervention. After eight weeks, significant higher reductions were observed in weight (-2.25 vs. -0.41 kg, P=0.001), BMI (-0.84 vs. -0.17 kg/m², P=0.002), fat mass (-1.96 vs. -0.45 kg, P=0.002), and waist circumference (-3.09 vs. -0.46 cm, P=0.011) in the ADF group compared to the DCR group. No significant changes were found in fasting blood sugar and lipid profile between the two groups. However, the DCR group exhibited a significant reduction in diastolic blood pressure (-11.3 vs. -3.5 mmHg, P=0.023). In conclusion, these findings suggest that ADF with calorie restriction significantly improves weight loss and body composition in overweight and obese adults. While both interventions contributed to metabolic improvements, DCR demonstrated a more pronounced effect on diastolic blood pressure. Further research with larger sample sizes and longer durations is warranted to explore the long-term effects of these dietary strategies.

Keywords: Intermittent fasting, alternate day fasting, calorie restriction, weight loss, body composition, metabolic health

Soleus muscle activation and its role in improving insulin sensitivity: investigating the impact of Soleus Push-Ups on glycaemic control in sedentary individuals

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Soleus push-ups are low-intensity, seated exercise techniques that selectively activate the soleus muscle, which has a greater predominance of low oxidative fibres (type 1 slow-twitch) in the calf. Soleus push-ups have demonstrated an increase in local oxidative metabolism improving systemic glucose regulation in controlled settings but their application in overweight or obese sedentary individuals in workplace environments remains underexplored. This study aimed to evaluate the impact of a structured soleus push-up intervention on insulin sensitivity in overweight or obese sedentary individuals over 6 weeks using the Triglyceride-Glucose (TyG) index method. A controlled clinical intervention was conducted with overweight or obese individuals who worked as office workers and security staff. Participants (n=20, male: female=1:1) were divided into either an intervention or control group. The intervention group performed 30 minutes of structured soleus push-ups daily for 6 weeks, tracked by an app, which provided records of time and a rough estimation of daily push-up counts. The control group remained the same but received general dietary guidelines. Insulin sensitivity was assessed at baseline and post-intervention using the TyG index, body composition and biochemical parameters. Paired t-tests and independent t-tests were conducted for statistical analysis. The intervention group demonstrated statistically significant reductions in post-intervention fasting blood glucose (95.6±8.29mg/dl; P=0.0008), fasting triglycerides (83.5±25.20 mg/dL; P=0.0003), TyG index (3.58±0.14; P=0.0004), fat mass (20.56±6.42kg; P=0.027), VLDL (18.1±7.2mg/dL) while HDL increased significantly (46.61±2.42mg/dL; P=0.0012). Conversely, the control group experienced a significant increase in the TyG index (3.75±0.20; P=0.016) and fasting blood glucose (103.8±12.96 mg/dL; P=0.02). In conclusion, structured soleus push-ups significantly improve insulin sensitivity, lipid profiles, glycaemic control and reduce fat mass in sedentary overweight, obese individuals over six weeks. Findings suggest this simple exercise could be a feasible intervention for metabolic health improvement for sedentary overweight and obese individuals.

Keywords: Glycaemic control, insulin resistance, sedentary, Soleus Push-Ups, obesity

Intake of nutrients and diet quality of secondary school children in Giriulla educational zone in Kurunegala district

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Adolescence is a critical period characterized by rapid physical and biological changes. Few studies in Sri Lanka have examined school children's diet quality using diet indices. The present study aimed to assess the dietary intakes and diet quality of secondary school children in Giriulla education zone in Kurunegala district. A cross-sectional study was conducted using 70 randomly selected students (54.3% boys) aged 12-14 years from purposively selected schools. Dietary intake data were collected from 24-hour dietary recall. Anthropometric measurements were taken to calculate the Body Mass Index (BMI). The Dietary Diversity Score (DDS) was calculated considering 10 food groups described by the Food and Agricultural Organization. Food Variety Score (FVS) was determined by counting individual food items consumed over the last 24 hours. The mean DDS was 5.1 (SD 1.3), and about 60% of participants had adequate dietary diversity (Minimum Dietary Diversity Score for Women; MDD-W ≥ 5). The mean FVS was 8.8 (SD 2.1). Proportions of adolescents who consumed different food groups over 24 hours were: grains, white roots and tubers, plantain (100%); pulses (86.3%); nuts and seeds (2.5%); dairy (57.5%); meat, poultry and fish (85%); eggs (23.8%); dark green leafy vegetables (37.5%); vitamin-A rich fruits and vegetables (27.5%); other vegetables (50%); other fruits (36.3%). The mean intake of calcium (450 mg), vitamin B_6 (0.69 mg), vitamin B_{12} (1.4 µg), and folate (158 µg) of the study population were below the Estimated Average Requirement (EAR). In conclusion, 60% of the adolescents studied meet the minimum dietary diversity requirement. However there are notable gaps in the consumption of most food groups, such as nuts and seeds, eggs, dark green leafy vegetables, and critical micronutrients like calcium, vitamin B_6, vitamin B_{12}, and folate. Inadequate micronutrient intake remains a concern for their overall diet quality.

Keywords: Diet quality, Food Variety Score, adolescence, Minimum Dietary Diversity for Women.

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Drivers of adult women's dietary patterns and nutrition in Tamil communities of Sri Lanka

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Adopting a healthy diet and maintaining proper nutrition are crucial for adults' overall well-being, especially in resource-constrained settings. This study aimed to explore the perceived factors influencing the diet and nutrition of adult women in the Tamil community in Sri Lanka. Four Focus Group Discussions (FGDs) were conducted across three districts namely Jaffna, Batticaloa, and Puttalam recruiting adult females aged 20 to 60 years. *NVivo* software was used to analyse the data using 5 themes named as socio-cultural & economic context, household food security, contextual and environmental factors, individual Knowledge, Attitudes and Practices (KAP) and nutritional and health outcomes. The findings revealed that religious practices and high foods price were the major drivers of dietary practices. Dietary restrictions due to religious believes considerably shaped food choices. Many participants adhered to fasting practices and avoid certain foods during fasting time. Economic constraints, including inflation, income instability, limited access to nutritious foods led households to rely on cheaper and less nutritious food options. Additionally, food security was threatened by irregular income and high food prices, leading families to adopt coping strategies such as reducing meal portion sizes and relying on less expensive protein sources. Individual KAP towards nutrition were influenced by community-level interventions and personal beliefs. Barriers such as time constraints for food preparation and limited nutrition education continued to pose challenges. In conclusion, this study highlighted the impact of religious believes, high food prices, income instability and less time availability as the major drivers of dietary practices of adult women in the Tamil community in Sri Lanka. Addressing these challenges through targeted policy interventions and nutrition education is crucial for promoting healthier eating habits among Tamil communities in Sri Lanka.

Keywords: Adult women's diet, food security, nutrition, Tamil community.

Acknowledgement: This study was funded by World Vision Lanka.

Factors affecting the complementary feeding practices among employed mothers: A qualitative study

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The first thousand days of a child's life is vital for healthy growth and development. Complementary feeding (CF) is the practice of providing solid foods and liquids in addition to breast milk when an infant reaches six months of age. Ensuring the proper delivery of CF by the employed mothers is a challenge. As the mother's employment status can affect the CF and nutritional status of infants in short and long terms, this has to be considered as a social perspective. Therefore, the present study is aimed to explore factors influencing the CF among group of employed mothers with infants aged between 6-12 months in Pannala and Kuliyapitiya areas. A qualitative approach was used to explore factors affecting CF practices. Seven focus group discussions were conducted including thirty-five (n=35) working mothers until the data saturation reached. Discussions were recorded, and non-verbal cues were noted. The recordings were transcribed and analysed using NVivo15 software. Data were analysed using deductive thematic approach, identifying four themes and seventeen sub-themes from the participants. Factors affecting the CF practices include individual factors (age, education and employment status, income and knowledge of mothers, limited time availability for CF), social factors (cultural norms, family support, influence of peers and relatives), physical environmental factors (food availability and market access, home environment, work place facilities, health care system) and macro system (Government and workplace policies, printed and digital media). The findings highlight the complexities of complementary feeding (CF) practices among employed mothers. Work pressures often led to early CF initiation and reliance on simple foods like mashed rice or formula, while economic challenges limited access to diverse, nutrient-rich foods. Mothers sought information from clinic-provided books, social media, family, and peers, though traditional beliefs sometimes conflicted with modern guidelines. Workplace policies, such as short maternity leave, further impacted feeding practices. These findings underline the need for targeted education and workplace support to improve complementary feeding practices outcomes.

Keywords: Barriers, complementary feeding, employed mothers, factors, infants

Factors affecting the complementary feeding practices among employed mothers: A qualitative study

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The first thousand days of a child's life is vital for healthy growth and development. Complementary feeding (CF) is the practice of providing solid foods and liquids in addition to breast milk when an infant reaches six months of age. Ensuring the proper delivery of CF by the employed mothers is a challenge. As the mother's employment status can affect the CF and nutritional status of infants in short and long terms, this has to be considered as a social perspective. Therefore, the present study is aimed to explore factors influencing the CF among group of employed mothers with infants aged between 6-12 months in Pannala and Kuliyapitiya areas. A qualitative approach was used to explore factors affecting CF practices. Seven focus group discussions were conducted including thirty-five (n=35) working mothers until the data saturation reached. Discussions were recorded, and non-verbal cues were noted. The recordings were transcribed and analysed using NVivo15 software. Data were analysed using deductive thematic approach, identifying four themes and seventeen sub-themes from the participants. Factors affecting the CF practices include individual factors (age, education and employment status, income and knowledge of mothers, limited time availability for CF), social factors (cultural norms, family support, influence of peers and relatives), physical environmental factors (food availability and market access, home environment, work place facilities, health care system) and macro system (Government and workplace policies, printed and digital media). The findings highlight the complexities of complementary feeding (CF) practices among employed mothers. Work pressures often led to early CF initiation and reliance on simple foods like mashed rice or formula, while economic challenges limited access to diverse, nutrient-rich foods. Mothers sought information from clinic-provided books, social media, family, and peers, though traditional beliefs sometimes conflicted with modern guidelines. Workplace policies, such as short maternity leave, further impacted feeding practices. These findings underline the need for targeted education and workplace support to improve complementary feeding practices outcomes.

Keywords: Barriers, complementary feeding, employed mothers, factors, infants

Leveraging artificial intelligence for personalized diet planning: Developing an AI-based platform for nutritional guidance

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The global prevalence of non-communicable diseases such as diabetes, and cardiovascular diseases is rising, necessitating the need for personalized dietary interventions. However, conventional methods for dietary assessment like 24-hour dietary recalls and physical activity diaries are time-consuming, based on estimations, rely on memory, and may not accurately reflect dietary behaviours, thus compromising the efficacy of nutritional consultations. This study aimed to develop a digital nutrition tool leveraging artificial intelligence for assisting nutrition professionals in estimating caloric consumption, calculating total daily energy expenditure, and generating personalized diet plans. A digital tool development approach was adopted, utilizing AI-driven image recognition technology for meal calorie analysis of uploaded food images. A concise version of the International Physical Activity Questionnaire (IPAQ) was incorporated for energy expenditure calculations. Novel AI models including Deep-Seek, Chat-GPT, Claude-AI, and Gemini were integrated for generating personalized diet plans accommodating user preferences. For determining precise calorie calculations, a nutritional database specifically for a list of common Sri Lankan food items was created and integrated into the system. The tool was iteratively refined and tested with diverse meal types and user activity profiles to ensure accuracy and reliability. This study successfully developed a user-friendly digital tool accessible at https://edietetics.com/, designed for professional use to provide personalized nutritional guidance. Tool's usability was evaluated by 32 nutrition professionals after it was developed. Evaluation revealed that 96.9% accepted the tool as clear and user-friendly for their daily professional use, and it significantly reduced time for their daily tasks. All professionals (100%) reported that the tool effectively reduced the burden of manual calculations. In conclusion, by leveraging AI technologies, this tool significantly reduces the manual burden of dietary assessment methods while enhancing data accuracy. Consequently, it enables dietitians to provide more efficient and personalized nutritional care, thereby resulting in improved health outcomes.

Keywords: Artificial Intelligence, calorie counting, diet planning, digital dietetics.

Understanding the nutrient gaps of a typical Sri Lankan household through diet affordability through the Cost of the Diet modelling

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The affordability of a nutritious diet is a growing concern in the current economic climate in Sri Lanka, where food inflation and income disparities have significantly impacted household dietary choices. This study applies the renowned Cost of the Diet (CotD) software, a linear programming tool, to assess the cost and affordability of the two dietary patterns -an energy-only diet and a nutritious diet- for a standard Sri Lankan household. The analysis utilizes secondary price data from Hector Kobbekaduwa Agrarian Research and Training Institute and food expenditure data from the Household Income and Expenditure Survey, adjusted to 2023. Results indicated that the average cost of an energy-only diet is LKR 451 per household per day, with the highest cost in Kegalle (LKR 488/day) and the lowest in Hambantota (LKR 391/day). In contrast, the nutritious diet costs significantly higher at LKR 1,069 per household per day, with Polonnaruwa recording the highest cost (LKR 1,198/day) and Trincomalee the lowest (LKR 993/day). Seasonal analysis highlights price fluctuations affecting diet affordability, with the cost of a nutritious diet being highest in Polonnaruwa across all seasons except the *Maha* harvesting season due to the inclusion of items like fish, beef liver and wheat flour in the modelled diet suggested by the CotD. The study identifies economic barriers as a key factor in the non-affordability of a nutritious diet, with many households unable to meet essential nutritional needs. Limitations of the CotD software, include overestimation of nutrient needs and unrealistic dietary assumptions. The findings emphasize the need for targeted food security policies, cash transfer programmes, and nutrition-sensitive interventions to bridge the affordability gap and improve access to nutrient-rich foods. This research provides crucial insights for policymakers in developing strategies to enhance food security and combat malnutrition in Sri Lanka.

Keywords: Cost of the diet, food affordability, malnutrition, nutrient gap

Reversing insulin resistance by losing weight: A behavioural approach to improving metabolic health

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Weight gain is a major contributor to metabolic health deterioration, whereas weight loss has been shown to improve insulin sensitivity. This study evaluates the impact of weight loss on measures of insulin resistance, focusing on the role of body fat reduction in reversing insulin resistance among adults. A total of 20 overweight or obese men and women were recruited through convenience sampling. Anthropometric, biochemical, clinical, and dietary data were collected from each participant. Questionnaires and dietary intake assessments were conducted, and the Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality. Individual weight-loss barriers were identified, and personalized strategies were provided to support participants in achieving their goals. Participants were divided into two groups based on weight change after the intervention as those who lost weight and those who either gained weight or maintained their initial weight. Fasting triglyceride and blood glucose levels were measured to calculate the Triglyceride-Glucose (TyG) Index, a recognized marker of insulin resistance. The TyG Index was assessed at baseline and post-intervention, and changes were analyzed to determine statistical significance in insulin sensitivity. Participants in the weight loss group showed a notable reduction in insulin resistance, with the TyG Index decreasing from 8.74± 4.95 to 8.41±0.7. Whereas those who gained weight experienced a significant increase, with the TyG Index rising from 8.64±0.04 to 8.92±0.15. Furthermore, significant differences were observed in total cholesterol (P=0.023), low-density lipoprotein (P=0.023), and very low-density lipoprotein (P=0.022) levels between the groups. This study demonstrated that successful weight loss is strongly associated with reduction of insulin resistance, and favourable lipid profile changes. The primary determinant of enhanced insulin sensitivity was weight reduction, while weight gain was significantly correlated with a decline in metabolic health.

Keywords: Insulin sensitivity, metabolic health, obesity, weight loss

Coconut consumption and risk of developing cardiovascular diseases; case control study

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Cardiovascular diseases (CVD) is the leading cause of death in Sri Lanka. Diet has a definite role in the management and prevention of CVD. Coconut is the major source of dietary fat in Sri Lanka. Therefore, this study intended to explore the potential association between coconut consumption and the risk of CVD. A case control study was designed with of thirty-three (n=33) individuals with the history of first myocardial infarction (MI) or stroke as cases and forty (n=40) individuals without known history of CVD and other chronic diseases as controls. Information on general lifestyle pattern and disease history were collected. Anthropometry, body composition and blood pressure were measured. Dietary intake was assessed with single 24-hr recall and 165-item semi-quantitative food frequency questionnaire. Dietary data were analysed using FoodBase 2000. Cases and controls were compared for their anthropometry, body composition, blood pressure and dietary intake using independent *t*-test and chi square test. Logistic regression was used to predict the CVD status using total dietary fat intake and coconut fat as the independent variables. Total energy intake, energy from carbohydrates, energy from fat and proteins, micro nutrient intake, coconut milk and coconut scrapping intake were not significantly different among two groups. Coconut oil consumption was significantly ($P<0.05$) higher among controls (15.5 ± 10.4 mL/day) compared to the cases (10.5±8.7 mL/day). A positive association was found between CVD status and total fat intake (OR=1.04, CI 95% 1.00–1.08, $P=0.025$). No significant association was observed between CVD with the intake of trans fatty acids (TFA), saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids. It can be concluded that, no association was observed between coconut fat intake and CVD in the present study. Further research is needed to explore the potential role of coconut-based products in cardiovascular health.

Keywords: Cardiovascular diseases, coconut consumption, fat intake, risk factors

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A novel hydroxyapatite extraction protocol for sustainable bone tissue engineering: development and characterization of fish waste-derived scaffolds

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Bone fractures remain a significant global health challenge, necessitating effective and biocompatible treatment solutions. While artificial bone grafts are widely used, they pose critical limitations such as stress shielding, non-biodegradability, and susceptibility to infections. Consequently, natural alternatives like hydroxyapatite (HA) and collagen have garnered attention due to their superior biocompatibility, biodegradability, and osteoconductive properties. This study investigates the potential of fish waste-derived biomaterials for bone tissue engineering by optimizing hydroxyapatite extraction from Yellowfin tuna (*Thunnus albacares*) processing waste. Given that Sri Lanka's fish export industry generates over 50% of its total yield as waste, repurposing these by-products aligns with sustainable waste management practices while offering a cost-effective alternative for biomedical applications. The research involves the extraction and characterization of HA from fish bones and collagen from fish skin, followed by the fabrication of bone scaffolds using biomedical-grade polylactic acid (PLA) via 3D printing. Five distinct scaffold types were developed by incorporating HA and collagen coatings. Characterization of HA was conducted through particle size analysis, attenuated total reflectance Fourier-transform infrared spectroscopy (ATR-FTIR), and X-ray diffraction (XRD) to determine its physicochemical properties. Biocompatibility assessments were performed using cellular adhesion and proliferation assays, including MTT and scanning electron microscopy (SEM) imaging. The results demonstrated that the modified hydroxyapatite extraction process yielded optimally sized particles with enhanced biocompatibility, supporting cellular attachment and proliferation. This study presents a novel, sustainable approach to utilizing fish waste in biomedical applications, offering a promising alternative to conventional bone graft materials. The findings contribute to advancing the field of bone tissue engineering while addressing environmental concerns related to fish waste disposal. Future research should focus on scaling up production and evaluating clinical applicability to further integrate these bio-based scaffolds into regenerative medicine.

Keywords: Bone tissue engineering, collagen, hydroxyapatite, scaffold

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Seaweed-derived carrageenan as a natural emulsifier: evaluating its functional properties with discarded fish oil from the fish canning industry

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The food industry is undergoing a major transformation to replace chemically synthesized functional ingredients with plant-based or naturally derived alternatives. This shift is driven by increasing consumer demand for healthier, environmentally sustainable, and ethically produced food products. Among the emerging natural ingredients, plant-derived emulsifiers have garnered significant interest for their potential application in food formulations. However, a major challenge in this field is the absence of standardized methodologies for evaluating and comparing the functional performance of emulsifiers under conditions relevant to food processing. This study addresses this gap by investigating the emulsifying properties of carrageenan extracted from *Kappaphycus alvarezii*, focusing on its emulsion stability index (ESI%) and emulsifying capacity. To evaluate the effectiveness of carrageenan as an emulsifier, experimental analyses were conducted using fish oil extracted from the wastewater generated during mackerel fish canning. The proximate composition of the discarded water was analyzed to assess its suitability for oil extraction. Emulsions were prepared using fish oil and distilled water, and their stability and droplet morphology were examined using light microscopy. The study also assessed carrageenan's ability to facilitate emulsion formation during homogenization and its capacity to prevent droplet aggregation under varying environmental conditions. The findings provide critical insights into the functionality of carrageenan as a natural emulsifier, demonstrating its potential for enhancing emulsion stability in food applications. By establishing a systematic approach to evaluating emulsifier performance, this research contributes to the development of sustainable alternatives to synthetic emulsifiers, offering practical applications for the food industry. These results serve as a foundation for further studies aimed at optimizing carrageenan-based emulsifiers for use in diverse food formulations.

Keywords: Carrageenan, emulsifying capacity, fish canning, fish oil

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Optimization of fish oil extraction from yellowfin tuna by-products: comparative evaluation of Bligh and Dyer and wet reduction methods

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Yellowfin tuna (*Thunnus albacares*) is a widely consumed pelagic fish, with its processing generating substantial by-products, including skin, head, belly, eyeballs, and black muscle. These by-products contribute to 20–35% solid waste and 20–35% liquid waste, posing environmental and economic challenges. Despite their high lipid content, the potential for efficient fish oil extraction from these by-products remains underutilized. This study aims to optimize a cost-effective extraction method for fish oil from yellowfin tuna processing waste, evaluating the efficiency of different extraction techniques. The Bligh and Dyer method, using a 1:1 (v/v) chloroform-methanol solvent mixture, was applied to all by-products. Among them, the head yielded the highest fish oil content, prompting further investigation using wet reduction methods. Two wet reduction processes—steaming and autoclaving—were employed to optimize fish oil recovery from tuna heads. The steaming method was evaluated under varying sample-to-water weight ratios (1:0.5, 1:1, 1:1.5) and different steaming durations (20, 40, 60, 80, and 100 minutes). Two-way ANOVA analysis revealed that the optimal extraction conditions involved a 1:1 (w/w) head-to-water ratio, yielding 5.85% fish oil, while steaming duration had no significant impact on yield. The autoclave method was also tested with the same sample-to-water ratios, with the highest yield (5.23%) observed at a 1:1 ratio. Comparative analysis demonstrated that the Bligh and Dyer method achieved the highest fish oil yield from the head, making it the most efficient extraction technique among those evaluated. These findings highlight the potential of utilizing tuna processing by-products for value-added product development, contributing to waste reduction and sustainable resource utilization in the seafood industry. The study provides critical insights for optimizing fish oil extraction methods, offering practical applications for industrial-scale processing and promoting a more circular economy in fisheries.

Keywords: By-products, extraction, fish oil

AI-powered fish freshness assessment app: a deep learning approach using eye characteristics for non-invasive quality evaluation

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Ensuring fish quality is paramount for food safety, regulatory compliance, and market competitiveness, with freshness being a crucial determinant of consumer acceptance and economic value. Conventional fish quality assessment methods, such as histamine analysis and human sensory evaluation, are often invasive, resource-intensive, and susceptible to subjectivity, necessitating the development of a more objective, cost-effective, and scalable approach. This study explores the application of deep learning for automated fish freshness assessment by analyzing eye characteristics as predictive biomarkers of quality. A total of 5,000 high-resolution eye images of *Thunnus albacares* (Yellowfin tuna) and *Thunnus obesus* (Bigeye tuna) were systematically collected at a commercial fish processing facility, alongside corresponding histamine levels and muscle quality grades. Key ocular attributes, including clarity, shape, and color, were extracted through Python-based Exploratory Data Analysis, followed by Pearson correlation analysis to evaluate their association with biochemical freshness indicators. The Xception deep learning model was employed for feature extraction and classification using supervised learning techniques. Empirical results revealed a strong correlation ($r = 0.876$, $p<0.001$) between eye characteristics and histamine concentrations, validating the reliability of ocular biomarkers for fish freshness prediction. Conversely, conventional color grading exhibited a negligible correlation ($r = 0.013$, $P>0.05$), highlighting its inadequacy as a predictive metric. Model evaluation, conducted using an 80:20 training-to-testing dataset split, demonstrated exceptional classification performance, achieving 100% accuracy, precision, and recall. While the proposed method presents a transformative advancement in non-invasive fish quality assessment, further refinement with an expanded, multi-species dataset is recommended to enhance model generalizability and real-world applicability. This study establishes a foundational framework for the integration of artificial intelligence in seafood quality assurance, offering a scalable, real-time, and objective alternative to conventional evaluation methodologies.

Keywords: Deep learning, Fish eye detection, Histamine
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Fuel consumption dynamics in selected multi-day fishing vessels: the role of gear type and target species in Sri Lanka

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Fuel consumption is a major operational cost in Sri Lanka's multi-day boat fisheries, directly affecting economic sustainability and environmental conservation. However, limited comprehensive analyses of fuel efficiency determinants hinder the development of optimized resource management strategies. This study systematically examines the factors influencing fuel consumption rates and efficiency among multi-day fishing vessels operating at Negombo, Dikowita, and Dodanduwa, aiming to enhance operational efficiency and mitigate ecological impact. At Dodanduwa, fishermen use traditional large boats targeting small tunas migrating 2–3 nautical miles from the coast. A total of 258 vessels were surveyed, collecting detailed operational data, fuel usage patterns, and economic parameters. Statistical analyses included Pearson correlation tests to assess variable interrelationships, Bray-Curtis transformed principal covariate analysis (PCoA) for multidimensional scaling, Ward's clustering to classify vessel similarities, and a surface generalized linear model (GLM) to identify operational variations. Additionally, a Cobb-Douglas stochastic frontier analysis quantified technical efficiency. Results revealed significant collinearity among operational variables (P=0.000), with distinct vessel clustering patterns. The estimated technical inefficiency parameter (γ = 0.98; corrected γ = 0.965) underscored widespread inefficiencies, with a mean efficiency score of 0.902 at a 10% significance level. Efficiency improved with increased trip distance and fuel consumption, while target fish catch showed an inverse relationship. Skipper experience and vessel length reduced inefficiency, whereas engine horsepower, fishing distance, and vessel speed increased it. These findings highlight the urgent need for targeted interventions to optimize fuel consumption in Sri Lanka's multi-day fisheries. Implementing energy-efficient fishing gear (e.g., purse seines), improved vessel maintenance, and optimized route planning can enhance economic returns while lowering carbon emissions. This study provides a foundation for policymakers to develop evidence-based strategies balancing economic viability with sustainable marine resource utilization.

Keywords: Boat size, fishing efficiency, fishing gear, fuel consumption, operational cost

Enhancing the nutritional profile of yogurt through fish oil incorporation

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Fish oil is rich in essential nutrients, such as omega-3 fatty acids which offer significant health benefits, including brain health, improved cardiovascular function, eye health, and anti-inflammatory properties. However, incorporation of omega-3 fatty acids into food products remains a challenge due to oxidation and undesirable sensory attributes. This study aimed to develop fish oil incorporated yoghurt emulsified with gelatine and xanthan gum, while masking its fishy odour and taste with cinnamon and cardamom extracts. This study evaluated three fish oil incorporation levels, including 0.33%, 0.50%, and 0.67% w/w per 100 g of yogurt. The results of sensory evaluation, performing with non-trained panellist showed that the sample with 0.33% fish oil (T_1) had the highest overall acceptability score (6.32 ± 0.83), significantly outperforming the 0.67% sample (T_3). Proximate analysis revealed that fat, protein, ash, and moisture contents were within acceptable limits, with T_3 exhibiting the significant highest fat content (4.53±0.19%) and moisture content (82.85±0.88) (P<0.05). Over 14-day period at 4°C, physicochemical analysis showed that all three samples maintained stable pH, titratable acidity, minimal syneresis except for T_1 & T_4, which displayed some instability. Texture attributes remained acceptable for all samples. Colorimetric analysis confirmed no significant difference among three different formulations (P>0.05). Lipid oxidation assessed, through peroxide and p-anisidine values, remained within acceptable limits for T_1 & T_4, indicating effective oxidative stability whereas the T_2 & T_3 samples showed minor deviation from the acceptable levels. Microbiological analysis confirmed that yeast, mold, and aerobic microbial counts were within safety standards during 14 days storage at 4°C, with T_3 showing highest count. In conclusion, this study successfully developed a fish oil incorporated yoghurt with consumer acceptability and optimal nutritional quality. The formulation with 0.33% fish oil exhibited the best sensory attributes, while maintaining physicochemical and microbial stability.

Keywords: Omega-3, fish oil, yogurt fortification, sensory evaluation, nutritional profile

Ecological and livelihood impacts of bridge construction on artisanal fisheries in Pannai Lagoon, Jaffna, Sri Lanka

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The construction of bridges in coastal and lagoon environments has far-reaching ecological and socioeconomic consequences, particularly for communities that rely on artisanal fishing. Infrastructure developments can alter hydrodynamic conditions, disrupt sediment transport, and impact water quality, ultimately affecting local livelihoods. This study examines the environmental and socioeconomic implications of the Pannai Bridge construction on the Jaffna Lagoon, a vital resource for artisanal fishing communities in northern Sri Lanka. Using an integrated Geographic Information System (GIS)-based approach, field assessments, and hydrological monitoring, this research investigates changes in water flow, sedimentation, and depth variations. Water quality parameters, including dissolved oxygen, conductivity, salinity, pH, and nutrient levels, were systematically measured to assess ecological impacts. Findings indicate that restricted water circulation has exacerbated sediment accumulation, leading to depth reduction and obstructed fish migration pathways. Time-series GIS analyses from 2010 to 2025 reveal a progressive increase in siltation, severely affecting navigation and fishing activities. A socioeconomic survey of 104 fishermen highlights a decline in fish availability, increased operational hardships, and rising maintenance costs due to boats frequently getting trapped in sedimented areas. Fishermen report extended fishing hours and diminishing incomes, underscoring the urgent need for adaptive management strategies. Potential mitigation measures, including dredging, artificial water flow enhancement, and community-led interventions, are explored as sustainable solutions. This study underscores the critical need for infrastructure planning that balances economic development with ecological sustainability. By integrating scientific assessments with community-driven insights, policymakers, environmental managers, and fisheries stakeholders can implement strategies that minimize ecological disturbances while safeguarding the livelihoods of artisanal fishing communities. The findings contribute to a broader understanding of how bridge construction influences coastal ecosystems and provide a foundation for sustainable infrastructure development in similar environments worldwide.

Keywords: Artisanal fisheries, bridge construction, environmental monitoring, GIS, sedimentation
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Assessment of food safety in the shrimp value chain of Sri Lanka: A multi-stakeholder analysis

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Shrimp is a popular seafood, but maintaining food safety throughout the value chain is crucial for ensuring product quality and consumer health. In Sri Lanka, inconsistencies in food safety practices have raised concerns about hygiene and quality standards. This study assesses food safety within the shrimp value chain, focusing on product quality and microbial safety. The research involved mapping the shrimp value chain and conducting surveys with key stakeholders. Shrimp samples were collected from local markets, supermarkets, and exporters for quality assessment using the Quality Index Method (QIM), internal temperature measurements, and microbial analyses such as Total Plate Count (TPC) and Yeast and Mold Count (YMC). The findings revealed that the shrimp value chain in Sri Lanka comprises a diverse array of stakeholders, each with varying levels of concern regarding food safety. Export-oriented processing companies prioritize food safety, whereas hatcheries, farms, and local distributors exhibit minimal focus. Significant temperature control discrepancies were identified (P<0.05, ANOVA), with processing plants maintaining optimal storage conditions (2.19±0.38 °C), while supermarkets (18.32±0.70 °C) and local markets (26.71±4.11 °C) exceeded permissible limits. Microbial analysis further underscored these disparities: processing facilities demonstrated acceptable TPC (2.65 log CFU/g), while local markets and supermarkets exhibited elevated microbial loads (4.82 log CFU/g and 3.94 log CFU/g, respectively). YMC followed a similar trend, with local markets (3.75 log CFU/g) and supermarkets (3.18 log CFU/g) surpassing processing plants (1.47 log CFU/g). Sensory evaluations further revealed superior freshness in shrimp from export-focused facilities (P<0.05, Friedman). The findings underscore critical gaps in Sri Lanka's shrimp value chain, revealing that enhanced food safety protocols, standardized cold-chain management, and systemic interventions are urgently required across all stakeholders, particularly in domestic markets to align practices with international standards and ensure the safety and quality of shrimp products for both export and local consumption.

Keywords: Food safety, quality assessment, shrimp, value chain

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A green solution for the textile industry: Eco-friendly dye extracts from mangrove *Rhizophora mucronata* and mangrove associate *Thespesia populnea*

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The rapid growth of the textile industry has led to environmental pollution caused by synthetic dyes. Green developments such as extracting natural dyes are therefore important to minimize the impact of synthetic fabric dye. This research investigates natural dye extraction from *Rhizophora mucronata* bark and *Thespesia populnea* fruit. Both fermentation and heat extraction were practiced and heat extraction was selected. Further investigations were done to evaluate the best temperature (60, 70, 80 °C) and pH (3, 7, 12). Fabrics pretreated with alum were used. The dyeing process was performed with only extracted dye and with dye+ standard fixing chemicals. The color strength was determined and fabrics were evaluated for color fastness to light, rubbing, water, and wash. *R. mucronata* and *T. populnea* yielded light yellow to light brown and light orange to light brown colours respectively, under different temperature and pH values. *T. populnea* had the highest color strength at pH 3, but temperature had no effect on color strength. *R. mucronata* dye strength was not significantly affected by temperature and pH, though the highest color strength was achieved at pH 3. Dyed fabric had excellent fastness on wet and dry rubbing, water, and moderate fastness to light and wash for both *R. mucronata* and *T. populnea*. This study confirmed the potential to use the two selected species for natural dye extraction through aqueous extraction. However, further research and development to explore natural mordants for fabric pre-treatment is recommended.

Keywords: Color fastness and strength, mangrove, natural dye, textile industry

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Formulation, characterization, and sensory evaluation of seaweed incorporated liquid body soap

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Sri Lanka has a rich diversity of seaweeds, yet they remain underutilized, mainly dried and exported. Seaweeds contain bioactive compounds that make them valuable in skincare. *Eucheuma cottonii* and *Gracilaria verrucosa* are red algae commonly used in cosmetics for their antimicrobial, and moisturizing properties. This study aimed to formulate a liquid body soap incorporating *E. cottonii* and *G. verrucosa* extracts using ethanolic extraction. The methodology involved extracting seaweed bioactive compounds and saponification. Liquid soaps with 5%, 10%, 15%, and 20% seaweed extract were formulated. The physicochemical properties of the formulations were analyzed, including pH, viscosity, foam stability, total alkali content, and Total Fatty Matter (TMF). The pH of all formulations ranged from 8.29±0.01 to 8.67±0.02, meeting the Sri Lanka Standards Institution (SLS) requirement (7.5–9.5). All formulations exhibited low viscosity compared to the Indonesian National Standard (SNI): 400–4000 cps. Foam stability values for all formulations were within the acceptable range except 10% *E. cottonii* and 10% *G. verrucosa*. (SNI-2017:60%–90%). TMF and total alkali content met standard requirements in all soap formulations (TMF: SLS minimum 15%; total alkali: International Organization for Standardization (ISO) <2%). Sensory evaluation results showed that the most preferred formulation contained 10% *E. cottonii* and 10% *G. verrucosa* extract, with a blue color and My Sky fragrance. The liquid soap with 10% *E. cottonii* and 10% *G. verrucosa* extract had the highest sensory attributes and desirable physicochemical properties except for viscosity & foam stability according to Sri Lankan and international standards. Based on the results, 10% *E. cottonii* and 10% *G. verrucosa* supplemented liquid body soap formulation have the potential for commercial production in the future after a few adjustments to increase the viscosity and slightly reduce the foam stability.

Keywords: *Euchema* extraction, *Gracilaria*, soap, physicochemical properties, sensory evaluation.

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Taxonomy and habitat occupancy of barnacles (subphylum crustacea, sub class Cirripedia infraclass Thoracica) in selected coastal area of Sri Lanka

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Barnacles are highly specialized organisms frequently seen in diverse shallow coastal habitats. Their last comprehensive assessment in Sri Lanka dates back to 1906. Therefore, a study was conducted to determine the species diversity and habitat occupancy in rocky, sandy, and muddy shores, as well as lagoons, estuaries, mangroves and harbours. Field surveys were conducted along the southern, western, northwestern, northern and eastern coasts of Sri Lanka, covering 81 locations. Specimens were collected by scuba diving and beachcombing, with habitat, substrate type and GPS coordinates recorded. Quadrat sampling was conducted in triplicates for each site when colonies of barnacles were detected. Species were identified through published keys and taxonomy was verified through the World Registry of Marine Species. Current study identified 16 species from 10 genera and 5 families. This includes eight species hitherto not recorded in Sri Lanka: *Chthamalus malayensis*, *Amphibalanus venustus*, *Amphibalanus reticulatus*, *Balanus trigonus*, *Amphibalanus variegatus*, *Lepas indica*, *Semibalanus balanoides*, and *Amphibalanus eburneus*. Habitats where barnacles were detected includes rocky shores, coral reefs, mangroves, estuaries and lagoons, underwater concreted areas in harbours, floating objects and crustacean exoskeletons. Beached barnacles were found attached to rubble, gastropod and bivalve shells, and marine waste. Species-specific trends revealed that *C. malayensis* predominantly occupies rocks and rubble, *Amphibalanus amphitrite* thrives on cement structures, gastropods, and coral/algae, while *S. balanoides* was most abundant on mangroves and gastropods. Amongst the recorded species *A. amphitrite* was seen in 56.25% locations investigated, at a mean density of 139.49±22.49 m^{-2}. This study updates the barnacle diversity and taxonomy in Sri Lanka and also revealed occupied habitats. Future research includes expanding the study to other coastal areas and investigations on barnacles associated with corals, sponges, turtles and marine mammals.

Keywords: Substrate type, marine biofouling, WoRMS-based taxonomy

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Bioactive compounds, antioxidant capacity and physiochemical properties of selected edible aquatic plant flowers across selected locations in Sri Lanka

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Bioactive compounds playing significant role in protecting human health. While plants are valuable sources of these compounds, underutilized edible aquatic plant flowers have the potential to become primary sources. This study evaluated the total phenolic content (TPC), total flavonoid content (TFC), and total antioxidant capacity (TAC) of the flower parts of nine aquatic plant species found in the North Central and North Western provinces of Sri Lanka. The species analyzed were *Nymphaea nouchali*, *Nymphaea pubescens*, *Nymphaea rubra*, *Nymphaea* sp. (Hybrid), *Nelumbo nucifera*, *Aponogeton crispus*, *Pontederia hastata*, *Lasia spinosa*, and *Ipomoea aquatica*. TPC was measured using the Folin-Ciocalteu assay, TFC was determined using the aluminium chloride assay, and TAC was assessed using the ferrous-reducing power assay. Additionally, physicochemical properties, including moisture, ash, crude protein, crude fat, crude fiber, and carbohydrate content, were analyzed using AOAC methods. The results indicated *Nymphaea pubescens* exhibited the highest TPC (34.26±0.73 mg GAE/g), while *N. pubescens* also recorded the highest TFC (55.45±1.67 mg Rutin/g) among the aquatic flowers. However, *Hibiscus sinensis* demonstrated a higher flavonoid content (134.92±5.82 mg Rutin/g). The highest TAC was observed in *N. nouchali* (247.20±0.81 mg Trolox/g). A positive correlation was found between TPC and TAC (r = 0.889) and between TFC and TAC (r = 0.446). Among the physicochemical properties, the highest ash and crude protein contents were recorded in *L. spinosa* (12.65 ± 0.02% and 4.23 ± 0.26%, respectively). The highest moisture and crude fat contents were found in *P. hastata* (92.11±0.18% and 9.02±0.33%, respectively). The highest crude fiber content was recorded in *N. nucifera* (26.27±0.16%), while the highest carbohydrate content was found in *N. pubescens* (61.25±0.19%). These findings suggest that edible aquatic plant flowers are rich in bioactive compounds and nutrients, with potential applications in both food and pharmaceuticals.

Keywords: Aquatic plant flowers, antioxidant capacity, bioactive compounds

Assessing the impact of shrimp farm effluents on coastal hypoxia in Sri Lanka: implications for sustainable aquaculture management

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The marine environment of Sri Lanka, situated in the northern Indian Ocean within the Bay of Bengal Large Marine Ecosystem (BOBLME), is particularly susceptible to hypoxia. This vulnerability is driven by a combination of anthropogenic pollution, naturally occurring oxygen minimum zones, and seasonal variability associated with monsoons and the inter-annual Indian Ocean Dipole. Among the contributing factors, intensive shrimp aquaculture has emerged as a significant source of nutrient-rich effluents, which can degrade water quality and exacerbate hypoxic conditions in coastal ecosystems. This study assesses the impact of shrimp farm effluents on hypoxia in the Puttalam coastal region of Sri Lanka and explores strategies for sustainable aquaculture management. Between October 2024 and March 2025, water samples were collected from ponds, outlets, outer canals and main canal/lagoon areas in relation to four categories defined by NAQDA: A (well-managed ponds with recommended facilities and practices) to D (least managed ponds without recommended facilities and practices). Key physicochemical parameters, including dissolved oxygen (DO), nitrate, phosphate, total dissolved solids (TDS), salinity, pH, and temperature, were measured using the Aqua TROLL 600 device. Data analysis revealed elevated concentrations of nitrate, phosphate, and TDS in main canals and lagoon areas compared to ponds and outlets, indicating pollutant dispersion. While DO levels generally remained above hypoxic thresholds, localized oxygen depletion near ponds and outlets highlights a potential risk. These findings highlight the need for continuous water quality monitoring and improved wastewater management strategies. The enforcement of Best Management Practices (BMPs), particularly for Category D farms lacking adequate treatment systems, is crucial to mitigating environmental risks. This study provides a baseline assessment of the ecological impacts of shrimp farming in Sri Lanka and offers insights into sustainable aquaculture practices that can minimize hypoxia risks while preserving coastal ecosystems.

Keywords: Coastal lagoons, eutrophication, marine hypoxia, nutrient pollution

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Microbial remediation of nitrate and phosphate in food-based industrial wastewater

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Water pollution caused by food-based industrial wastewater presents a significant environmental challenge due to its high nitrate and phosphate content. Conventional treatment methods are often costly and unsustainable, necessitating eco-friendly alternatives. This study investigates the potential of bacterial isolates for the bioremediation of nitrate and phosphate from industrial effluents. The methodology involved collecting wastewater samples from a food processing industry discharge site, cultured and purified bacterial isolates, and conducting bioremediation studies for nitrate and phosphate. For phosphate removal, equalized bacterial suspensions were introduced into 5 ppm phosphate solutions and incubated at 28°C for six days. Phosphate concentrations were analyzed using the Ascorbic Acid Method. Similarly, nitrate removal studies were conducted using 50 ppm nitrate solutions, where analysis were performed via the Sodium Salicylate Method. The most effective isolates were further tested at different concentrations (3, 5, 7 ppm for phosphate, 25, 50, 75 ppm for nitrate) to optimize degradation kinetics. Among 23 isolates tested, two isolates, (A and B) demonstrated significant pollutant removal efficiency compared to the control (P<0.05). Isolate B recorded 61.39±0.15% phosphate removal, and isolate A recorded 65.53±0.24% nitrate removal at six days of incubation. Optimization studies revealed that both isolates and concentration significantly affected removal efficiency (P<0.05). Both isolates showed higher bioremediation efficiencies at lowest initial concentrations. These findings highlight the potential utilization of isolate A and B for microbial remediation of nitrate and phosphate, as an eco-friendly solution for treating food-based industrial wastewater. Future studies are in progress.

Keywords: Industrial effluent, microbial remediation, food-based wastewater, wastewater treatment

Natural food items selectivity by *Catla catla* in fry to fingerling rearing cages in Usgala Siyambalangamuwa reservoir, Sri Lanka

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Fry to fingerling rearing is encouraged in floating cages in perennial reservoirs with the involvement of fisheries organizations in Sri Lanka. The main source of natural food in cages are plankton. Supplementary feeding is performed to compensate the nutrients requirement. This research was carried out to understand the natural food selectivity and preference of fry in fry to fingerling rearing cages. Fish in cages were sampled from the age at 27 days to 67 days at 10 days intervals using a hand net. Three water samples collected outside the cages were filtered through 50µm net parallel to fish sampling. Fish were preserved in 10% formaldehyde and filtered water samples were preserved in Lugol's solution. Total length and weight, gut length and weight of fish were measured in the laboratory. Plankton in water and gut were identified up to the genus level. Abundance of plankton were estimated with a Sedgwick-Rafter cell. Relative gut length for each date were estimated. Cluster analysis was performed to test the similarity of food items in environment and gut. Morisita-Horn, and Pianka's food niche overlap indices and Ivlev's electivity index were calculated for each sampling occasion. Relative gut length of fry changed from carnivore range (0.55) to omnivore range (2.44) between 47 to 57 days. Phytoplankton were dominated in the reservoir and ranged from 97.65% to 98.94%. Total number of 36 phytoplankton and 09 zooplankton genera were reported from samples. *Aulacoseira* sp. was the dominant species in the environment and gut content but no preference according to Ivlev's index. Morisita-horn and Pianka's indices were showed complete overlap of food niche among all occasions. Although, plankton diversity was similar among sampling occasions, Ivlev's index showed the low active selectivity for food items during first three occasions. Results of the present study highlighted the need for site-specific feed formulations for fry rearing cages in reservoirs based on natural food availability.

Keywords: Food niche overlap, Ivlev's electivity index, Morisita-Horn index, Pianka's index, plankton diversity

Occurrence and abundance of microplastics in *Oreochromis mossambicus*: A study from the Anawilundawa mangrove restoration site and its feeding canals

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Microplastics (MPs) have become a pervasive environmental concern, with aquatic ecosystems being particularly vulnerable to their impacts. This study investigated the occurrence and abundance of MPs in *Oreochromis mossambicus* sourced from Anawilundawa Natural Regeneration of Mangrove site and its feeding canals; Dutch canal, Anawilundawa freshwater tank and shrimp farm outflows, Sri Lanka. Five fish were collected from each location and MPs were extracted in gut and muscles separately, by digestion (30% KOH at 60 °C, 24hr; 150ppm, 24hr) followed by density separation (NaCl) and filtration through 0.45 µm Nitrocellulose filter papers. MPs in water and sediment were extracted from each location by following digestion (30% H_2O_2 at 60 °C), density separation (NaCl) and filtration (0.45 µm). The extracted MPs were analysed by stereo-microscope based on the shape and colour. The highest and lowest average values of MPs in *O. mossambicus* were recorded in the fish obtained from Dutch canal (2.78±0.297 MPs Particles/g) and Anawilundawa Tank (0.38±0.027 MPs Particles/g) respectively. All the recorded MPs in *O. mossambicus* were fiber in shape and blue colour (50.8%) was the dominant colour recorded, followed by transparent (29.6%), red (12.7%), black (5.9%) and green (0.8%). Highest MPs in sediment was recorded from Restoration site (622.5±43.8 MPs Particles/Kg) and for water samples, the highest MPs was recorded from Dutch Cannel (2.71±0.087 MPs Particles/g). In water and sediments, MPs by shape and the most dominant colour was black (32.6%), followed by blue (22%), red (20.5%), transparent (16%) and green (7.3%). This study emphasizes the importance of effective waste management and monitoring to address ecological and health risks related to MPs pollution.

Keywords: Density separation, digestion, mangrove, microplastic, restoration

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Under-eye patches from seaweed: optimized carrageenan extraction and formulation

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The increasing demand for sustainable and natural cosmetic products has driven research into marine-derived biomaterials for skincare applications. This study focuses on developing biodegradable under-eye patches using carrageenan extracted from seaweed, combined with vitamin C and coffee bean extract. These bioactive components were chosen for their hydrating, firming, and antioxidant properties, providing an effective solution for under-eye concerns such as puffiness, dark circles, and fine lines. Carrageenan, known for its gelling, thickening, and stabilizing properties, formed the structural base of the patches, while coffee extract, rich in caffeine and antioxidants, enhanced microcirculation and reduced swelling. Vitamin C was incorporated for its role in collagen synthesis, pigmentation reduction, and oxidative stress protection. To optimize carrageenan extraction, three methods were tested by varying calcium hydroxide and potassium chloride concentrations (0.15%:3.50%, 0.2%:2.5%, and 0.3%:1.5%), while maintaining constant pH, temperature, sample weight, and extraction time. A 25 g sample of seaweed yielded 7.43 g, 7.54 g, and 6.45 g of carrageenan, respectively. The viscosity of the extracted carrageenan at 50°C was 89.76 cP, 42.66 cP, and 30.22 cP. The extracted carrageenan was then blended with water, coffee extract, gelatin, ascorbic acid, glycerin, essential oils, and preservatives, followed by heating and molding into gel sheets. The developed patches were evaluated for pH stability, swelling index, solubility, shrinkage, and skin moisturizing effects. Carrageenan from all extraction methods successfully formed stable patches, with glutaraldehyde identified as the most effective cross-linking agent. This study highlights the potential of marine-derived polymers in sustainable cosmetics, demonstrating an optimized carrageenan extraction protocol. Future research should explore long-term stability, consumer acceptance, and scalability for commercial applications.

Keywords: Carrageenan, extraction, eye patch, hydrogel, viscosity

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Genetic diversity assessment of hatchery broodstock in giant freshwater prawn culture-based fisheries in Sri Lanka: implications for sustainable breeding practices

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The introduction of high-value aquaculture species, such as the giant freshwater prawn (GFP) (*Macrobrachium rosenbergii*), has significantly boosted the economic development of rural fishing communities in Sri Lanka by enhancing the profitability of culture-based fisheries (CBF). However, breeding and stocking programs led by the National Aquaculture Development Authority (NAQDA) have been implemented without comprehensive genetic assessments, raising concerns over potential genetic erosion. Recent morphological and color pattern variations observed in hatchery stocks have intensified these concerns. This study is the first molecular-level investigation into the genetic variation of GFP broodstock populations in Sri Lanka, using mitochondrial DNA cytochrome oxidase subunit I (mtDNA COI) to assess genetic diversity. A total of 16 broodstock individuals were sampled from four hatcheries: Pambala (North Central Province), Kahandamodara (Southern Province), Kallarawa (Eastern Province), and a private hatchery in Negombo. Nine samples underwent sequence analysis, generating 567 bp trimmed sequences, which were compared to reference sequences from GenBank. The results showed near-identical nucleotide composition across all samples, with only a single variable site identified in the Pambala population. The nucleotide diversity (0.00039) indicated extremely low genetic variability within the hatcheries. Phylogenetic analysis revealed that the hatchery samples clustered within a single clade, closely related to populations from Bangladesh and China, suggesting a narrow genetic base. These findings indicate a high risk of inbreeding and reduced adaptive potential, urging immediate management actions to enhance genetic diversity. Phenotypic variations are likely linked to environmental factors rather than genetic differences. This study highlights the need for informed broodstock management strategies, including genetic monitoring and the introduction of genetically diverse stocks, to ensure the long-term sustainability and resilience of the GFP aquaculture sector in Sri Lanka.

Keywords: COI, genetic diversity, giant freshwater prawn

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Valorization of fish skin waste for wound healing: development and characterization of aloe vera-infused tuna collagen dressing

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Wound healing is a multifaceted biological process essential for restoring skin integrity following injury. However, the natural healing process is often slow and requires external support through advanced wound dressings. Fish collagen-based wound dressings have emerged as a promising alternative to conventional bovine and porcine collagen dressings, which are associated with ethical, religious, and disease transmission concerns. This study aims to develop and characterize an innovative wound healing substitute by incorporating tuna-derived collagen with bioactive compounds from *Aloe vera* (AV) to enhance biocompatibility and therapeutic efficacy. Two preparation methods were employed under different temperature conditions (4 °C and 16 °C) to assess their impact on the physicochemical properties, microstructure, chemical composition, and thermodynamic stability of the composite. Self-assembled and homogenized collagen sponges were fabricated using the freeze-drying technique and characterized using Fourier Transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimetry (DSC), and Thermogravimetric Analysis (TGA) to evaluate intermolecular interactions and thermal behaviour. Scanning Electron Microscopy (SEM) was utilized to examine the porous architecture of the sponges, while in vitro studies were conducted to assess fibroblast cell attachment, morphology, and viability. Results indicate that the incorporation of AV enhanced the hydrophilicity of the collagen matrix, reduced pore size, and increased porosity—key factors in promoting cellular adhesion and proliferation. Among the tested conditions, the self-assembled collagen sponge prepared at 4 °C exhibited the highest cell viability, demonstrating its potential as an effective biomaterial for wound healing and tissue regeneration applications. This study underscores the potential of marine-derived collagen composites in biomedical applications, offering a sustainable and biocompatible alternative to conventional wound dressings.

Keywords: Aloe vera, biocompatibility, collagen sponge, wound healing

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Development and optimization of a protein-fortified beverage from the muscle protein of *Penaeus indicus*: Functional characterization and nutritional benefits

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Protein-fortified functional beverages are specially formulated to provide high-quality protein while offering additional health benefits beyond basic hydration and nutrition. These beverages are commonly targeted to athletes, health-conscious consumers, and fitness enthusiasts to support muscle recovery, enhance endurance, and promote overall well-being. Factors such as diminishing food resources, rising environmental concerns, growing global population, and an expanding middle class with greater spending power are driving a gradual shift from animal-based to plant-based proteins. But, the presence of antinutrients, such as lectins and protease inhibitors; protective compounds evolved in seeds, impairs protein digestibility, limiting the broader application of plant proteins in the food industry. This study aimed to develop and optimize a protein-fortified Ready-to-drink (RTD) beverage from *Penaeus indicus* (Indian white prawn). Indian white prawn is an excellent seafood source of protein and essential nutrients, offering a sustainable alternative to traditional protein sources, focusing on functional properties and nutritional benefits. The beverage was formulated with different proportions of fresh shrimp meat (6, 7.5, 9 g/100ml) and evaluated for its physicochemical, nutritional, and sensory attributes. Results showed that the 7.5 g/100ml formulation exhibited the most promising sensory profile, with high scores in appearance, color, texture, odor, taste, after-taste, and overall acceptability. This formulation also exhibited a good balance of color, titratable acidity, viscosity, total soluble solids, density, and water activity. Nutritional analysis revealed that higher protein concentrations increased crude protein and ash content, while moisture content decreased. The 7.5 g/100ml formulation demonstrated a favorable nutritional composition with a crude protein content of 12.80%. This study highlights the potential of *P. indicus* shrimp as a valuable source of protein-fortified beverages, offering a nutritious and sensory-acceptable option for consumers. Further research could explore this shrimp-based beverage's long-term stability and potential health benefits.

Keywords: Functional properties, nutritional composition, *Penaeus indicus*, protein ready-to-drink beverage, sensory evaluation

Evolutionary convergence and divergence of selected toll like receptor genes in freshwater and marine species

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Aquatic animals rely predominantly on their innate immune system due to the underdeveloped adaptive immunity. Toll-like receptors (TLRs), key components of the innate immune system, recognize pathogen-associated molecular patterns (PAMPs) and initiate immune responses. Given the limited understanding of how TLR genes evolve differently in freshwater and marine environments, this study aims to explore the evolutionary convergence and divergence of TLRs in both marine and freshwater species. A set of freshwater and marine species was selected, and TLR1, TLR2, and TLR3 were considered for the analysis based on data availability from publicly accessible genomic databases (National Center for Biotechnology Information, FishCODE). Multiple sequence alignment, phylogenetic analysis, genetic distance calculation, and haplotype analysis were conducted to assess the evolutionary patterns of these genes across the selected species. According to the genetic distance calculation, TLR 1 showed higher sequence variation in freshwater species (0.79) compared to the marine species (0.78). In contrast, TLR 2 exhibited greater genetic variation in marine species (0.82) than in freshwater species (0.68). TLR3 was found to be the most conserved gene across both habitats, with a genetic diversity of 0.54, compared to TLR1 (0.80) and TLR2 (0.79). Haplotype analysis showed unique TLR1 haplotypes in freshwater species and greater TLR2 diversity in marine species. Phylogenetic analysis revealed higher divergence for TLR1 among freshwater species, which may be due to the environmental pressure, while TLR2 showed more dispersed clustering in marine species, suggesting a distinct microbial environment. TLR 3 is most conserved in both habitats according to haplotype and phylogenetic analyses. This may be due to the location of the endosome membrane, where it is less exposed to the pathogens. The findings indicate that different evolutionary processes influence TLR genes in different aquatic habitats, which may have an effect on immune system adaptations in freshwater and marine organisms.

Keywords: Aquatic species, evolutionary divergence, innate immunity, Toll-like receptors (TLRs)

The efficacy of *Ipomoea aquatica* derived phenolic compounds as an antimicrobial agent against different pathogenic bacteria

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Ipomoea aquatica (water spinach), is a semi-aquatic plant widely consumed in Asia for its nutritional and medicinal properties. This study investigates the antimicrobial efficacy of phenolic compounds derived from leaves and stems of *I. aquatica* against pathogenic bacteria, including fish pathogens and foodborne pathogens. Phenolic compounds were extracted from the leaves and stems of the plant using an 80% ethanol as solvent, quantified using the Folin-Ciocalteu assay, and their antimicrobial activity was evaluated using the agar well diffusion method at a concentration of 5 mg/mL of leaf and stem extracts against foodborne pathogens such as *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus* and the fish pathogens such as *Vibrio* spp (three species as Vp1, Vp2, Vp3) and *Staphylococcus* sp. Phenolic compound yield of leaf extract was 12.76±0.63 mg GAE/g and stem extract was 13.10±0.45 mg GAE/g. The results showed that leaf extract exhibited significantly higher (P<0.001) antimicrobial activity compared to stem extract, with mean inhibition zone diameter for the leaf extract as 10.66±0.57 mm, 10.33±0.57 mm, 11.33±0.57 mm, 10.33±0.57 mm respectively for Vp1, Vp2, Vp3 and *Staphylococcus* sp. Furthermore, leaf extract showed 10.33±0.57 mm, 10±0 mm and 13.66±1.52 mm inhibition zone diameter against *S. aureus, E. coli* and *S. typhi* respectively. Stem extract showed antimicrobial activity only against two *Vibrio* species (Vp1 and Vp3) with mean inhibition zone of 11±0 mm and 10±0 mm. The positive controls (Erythromycin and Azithromycin) showed the highest antimicrobial activity with zone of inhibition above 13mm for all tested bacteria, while the negative control (ethanol) showed no activity for all tested bacteria. The antimicrobial efficacy varied depending on the bacterial species with *S. typhi* being more susceptible than others for the leaf extract. These findings highlight the potential of *I. aquatica* as a source of natural antimicrobial agents, particularly for applications in food industry and aquaculture.

Keywords: Antimicrobials, fish pathogens, foodborne pathogens, *Ipomoea aquatica*, phenolics
Acknowledgement: This study was funded by Wildlife and Nature Protection Society (WNPS)

Mitigating postharvest losses in coastal fisheries: a quantitative assessment of economic and supply chain impacts in Jaffna, Sri Lanka

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Postharvest losses (PHLs) in the fisheries sector present a significant challenge to food security, economic stability, and resource sustainability, particularly in coastal economies. Despite their far-reaching implications, comprehensive assessments of PHLs in Sri Lanka's fisheries sector remain scarce. This study systematically quantifies the extent of losses, identifies underlying causes, and evaluates the economic consequences of PHLs along the coastal fisheries market chain in Jaffna, Northern Sri Lanka. Data were collected from five major landing sites: Myliddy, Kakkaithevu, Chavakkadu, Thondaimanaru, and Valalai, using structured interviews, direct observations, and quantitative assessments. Findings revealed that total PHLs averaged 52.85 kg per metric ton (kg/MT), comprising physical losses (10.61 kg/MT), quality degradation (18.75 kg/MT), market force-induced losses (23.70 kg/MT), and nutritional depletion (2.84 kg/MT), leading to an estimated economic loss of $121.92 per metric ton. Species-specific analysis showed that sardine (53.34 kg/MT) and milkfish (50.95 kg/MT) suffered the highest losses, whereas emperor fish (31.57 kg/MT) experienced the lowest. The highest postharvest loss rate (35.38%) was recorded at landing sites, primarily due to poor handling and inadequate storage facilities, while the lowest loss rate (1.67%) was observed during transportation. Key contributing factors included inefficient handling practices, lack of cold storage infrastructure, transportation delays, and price fluctuations, exacerbating market force losses. Furthermore, seasonal overproduction and weak value chain coordination intensified losses. Financially, these inefficiencies undermine the profitability of fishers, traders, and retailers, threatening the economic resilience of the sector. This study underscores the urgent need for targeted interventions, including improved postharvest handling techniques, enhanced cold chain infrastructure, and market stabilization strategies. The adoption of advanced preservation technologies, enforcement of regulatory frameworks, and increased stakeholder awareness could play a pivotal role in minimizing PHLs, fostering sustainable fisheries management, and enhancing the livelihoods of coastal communities.

Keywords: Coastal fisheries, economic losses, fish market chain, Jaffna, nutritional losses

Microalgal diversity and abundance in Negombo coastal waters: ecological insights and species distribution

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Microalgae are microscopic, photosynthetic organisms that play a critical role as primary producers in aquatic ecosystems and hold significant economic potential due to their rich biochemical composition, including lipids, proteins, and bioactive compounds. While extensive global research has explored marine microalgae diversity and ecological dynamics, studies in Sri Lanka remain limited. This study aims to bridge this knowledge gap by assessing the diversity, abundance, and potential commercial applications of microalgae in the coastal waters of Negombo. Water samples were collected alongside key physicochemical parameters, and microalgae species were identified to the genus and species levels, followed by diversity and abundance analyses using standard ecological indices. The findings revealed that Bacillariophyceae was the dominant class, constituting 99% of the total microalgal community, with Dinophyceae making up the remainder. A total of 19 species from 15 genera across 15 families were identified. The dominant genera within Bacillariophyceae included *Chaetoceros*, *Biddulphia*, *Cerataulina*, *Navicula*, *Rhizosolenia*, and *Coscinodiscus*, while *Tripos* and *Dinophysis* represented the Dinophyceae class. The total recorded microalgal abundance was 3.9×10^4 cells/L, with *Chaetoceros lorenzianus* emerging as the most abundant species, followed by *Rhizosolenia sp.* and *Cerataulina pelagica*. Diversity indices, including the Shannon-Wiener Index (H' = 2.24), Simpson's Index (D = 0.88), and Evenness Index (J' = 0.82), indicated a moderate to high diversity with an even species distribution. Water quality parameters were within normal ranges, suggesting a stable environment for microalgal growth. Notably, several identified species hold commercial significance, highlighting their potential for applications in aquaculture, nutraceuticals, and biofuel production. However, due to weather-related constraints, the sampling period was relatively short, limiting the scope of this study. A more extensive, long-term investigation is recommended to capture seasonal and environmental variations, providing a comprehensive understanding of microalgal diversity and its ecological and commercial implications in Sri Lankan coastal waters.

Keywords: Abundance, diversity, marine microalgae, Negombo

Characterising the Diets of *Terebralia palustris* (Gastropoda: Potamididae) in Puttalam Lagoon through stomach content analysis

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The mangrove gastropod *Terebralia palustris* plays a vital role in nutrient recycling within mangrove ecosystems. Despite its ecological significance, limited research has been conducted on dietary habits and contribution to mangrove primary productivity. This study aimed to bridge this gap by characterising the dietary composition of *T. palustris* through stomach content analysis. Specimens were collected from Puttalam lagoon, where *T. palustris* is abundant. The digestive tracts of collected specimens (n=5) were preserved and analyzed to characterise the dietary components. Gut contents were characterised into five major feed types based on morphology: filamentous algae, green algae, diatoms, leaf materials, and detritus. The presence of these feed types was recorded across three gut locations: oesophagus, intestine, and digestive gland. Statistical analysis using Kruskal-Wallis test revealed significant differences in the occurrence of green algae ($H = 7.311$, $P<0.05$) and diatoms ($H = 6.615$, $P<0.05$) across the three gut locations. However, no significant differences were observed for filamentous algae ($H = 0.277$, $P>0.05$), leaf materials ($H = 2.191$, $P>0.05$), and detritus ($H = 1.858$, $P>0.05$). The proximate composition analysis of pooled gut samples revealed 14.15% ash, 5.26% crude protein and 2.65% crude fat, with a moisture content of 71.74%. Crude fiber was recorded as 2.92%. These findings highlight the dietary flexibility of *T. palustris* and provide valuable insights into its role in nutrient cycling within mangrove ecosystems. Further research using molecular techniques such as gut microbiome analysis is recommended to enhance our understanding of its dietary habits and ecological contributions.

Keywords: Diet, feeding behaviour, mangrove ecosystem, stomach content, *Terebralia palustris*

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Exploring red algae *Kappaphycus alvarezii* as a novel ingredient in ice cream cone development

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Kappaphycus alvarezii, a red algae, is a widely utilized seaweed in food industry due to its nutritional profile. This study evaluates the use of *K. alvarezii* as a novel ingredient in the development of ice cream cones. Ice cream cones were prepared by substituting wheat flour with seaweed powder at levels of 10%, 20%, and 30% in comparison with a control sample. The physicochemical characteristics, structural integrity, nutritional profile, and consumer acceptability of the enhanced cone were examined. The proximate composition analysis reveals that the addition of seaweed powder significantly increased crude protein (6.74±0.06), fiber (4.51±0.20), and ash (4.91±0.28) content while reducing fat (4.88±0.50) and carbohydrate (73.80±0.46) levels compared to the control (P<0.05). The incorporation of seaweed powder into the ice cream cone resulted in a noticeable reduction in ice cream permeability, making the cone more resistant to sogging. Sensory evaluation conducted using a 7-point hedonic scale with un-trained panel indicated that the cone with 20% seaweed powder maintained good consumer acceptability in terms of taste, texture, and overall appeal. Furthermore, the addition of 20% seaweed powder combined with cocoa powder significantly increased consumer acceptance compared to the ice cream cone with 20% seaweed powder alone (P<0.05). Texture analysis confirmed that the addition of seaweed powder significantly increased the hardness and crispness of the cones, contributing to the desired eating experience (P<0.05). Microbial analysis indicated that the ice cream cones met safety standards remaining within acceptable limits. Additionally, the results showed that the incorporation of seaweed powder up to 30% in the cone formulation significantly reduced the L value, resulting in a slightly darker color. These findings suggest that *K. alvarezii* can be effectively utilized as a sustainable alternative ingredient in ice cream cone development replacing wheat, thus improving nutritional quality.

Keywords: Ice cream cone, *Kappaphycus alvarezii*, Seaweed powder

Extraction and characterization of chitosan from edible bivalve's shells and screening their water purification capacity

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Chitin is abundant in nature, primarily found in crustaceans and molluscs. Chitosan, a biopolymer derived from chitin through deacetylation, is widely used in different industries. Each year, large quantities of edible bivalve shells are discarded, raising environmental concerns. This study aimed to extract chitosan from discarded edible bivalve's shells and evaluate its potential as a natural water purification agent. Chitosan was extracted from discarded *Anadara granosa, Geloina coaxans, Meretrix casta*, and *Perna perna* shells using standard methodology involved demineralization, deproteinization, and deacetylation steps and characterized using Fourier-transform infrared spectroscopy (FTIR). The water purification potential of extracted chitosan samples was assessed by evaluating turbidity reduction at 24hour settling times by measuring absorbance at 650 nm using spectrophotometer. Total plate count before and after the treatments with chitosan and Alum were assessed. The percentage yield of chitosan was different with species. *M. casta* was shown highest chitosan yield (35.88%) followed by *A. granosa* (32.22%), *G. coaxans* (24.48%), and *P. perna* (19.20%). Based on the FTIR analysis all derived chitosan from four bivalves shown structural similarity and differences to the reference graphs. Total bacterial count after 24hour of treating with chitosan derived from *A. granosa* was 223.33×10^6 CFU/ml±23.09 followed by *M. casta* (216.00×10^6 CFU/ml±5.29), *G. coaxans* (205.00×10^6 CFU/ml±78.61) and *P. perna* (104.00×10^6 CFU/ml±9.53). Alum treatment shown 95.66×10^6 CFU/ml±12.09 following 24hour treatment. *P. perna* based treatment group showed significantly higher ($p>0.05$) water purification capacity with 89.00%±0.78 water clearing percentage compared to the control and 61% of total bacteria reduction percentage compared to the other treatment groups and control. This study successfully extracted chitosan from discarded bivalve shells and demonstrated its potential as an eco-friendly water purification agent, with *P. perna* showing the highest efficacy.

Keywords: Bivalves, Characterization, chitosan, FTIR, water purification

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Assessment of the status of fisheries in the Mullaitivu fisheries division of Sri Lanka

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Fisheries are crucial to the livelihoods of Sri Lanka's coastal communities, especially in the Mullaitivu Fisheries Division. Despite access to productive marine resources, challenges such as outdated technologies, inadequate post-harvest handling, and limited infrastructure result in poor fish quality and economic losses. This study assesses the current state of fisheries, identifies key gaps, and offers recommendations for improving efficiency and sustainability. Data were collected from nine landing sites in Mullaitivu Town and Mullaitivu North through a mixed-methods approach, including surveys, interviews, focus group discussions, and on-site observations. Statistical analyses, such as descriptive statistics, independent-sample t-tests, one-way ANOVA, Pearson correlation, and regression analysis, were performed for data interpretation. Key findings show that 65.9% of respondents have secondary education, and 84.1% hold multiple fishing roles. Catch per Unit Effort (CPUE) varies significantly across fishing methods ($P<0.05$), with modern techniques, including gill nets and purse seines, yielding higher CPUE compared to traditional methods like hook hand lines. However, CPUE differences between Mullaitivu Town and Mullaitivu North were not significant ($P>0.05$). Fishermen's income is significantly higher during the peak season (LKR 48529.41±11494.93) compared to the off-season (LKR 13235.29±12694.00, $P<0.05$). Experience positively correlates with CPUE and income ($r = 0.527$, $P<0.01$). Key challenges include illegal fishing by Indian trawlers (46.4%), climate change (18%), and inadequate cold storage facilities (92%). Price analysis indicated that *Scaridae* and *Penaeus monodon* are the most valuable species ($P<0.001$). The findings highlight the need for enhanced fishing practices, infrastructure development, and regulatory measures. Recommendations include adopting modern fishing technologies, improving cold storage, addressing illegal fishing, and promoting diversification into aquaculture and fish processing for long-term sustainability.

Keywords: Catch Per Unit Effort (CPUE), fisheries management, Mullaitivu, price analysis

Development of a functional seafood spread incorporating processed sea cucumber powder and mackerel meat

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Sea cucumbers are a highly valued marine commodity in global seafood markets, with Sri Lanka playing a key role in exporting processed *bêche-de-mer*. The economic value of processed sea cucumbers depends on species and quality, with high-grade species commanding strong demand, while medium and low-grade species face lower commercial value. *Bohadschia vitiensis* (brown sandfish) is a medium-value species, often discarded due to processing defects. This study aimed to develop a ready-to-eat seafood spread incorporating processed sea cucumber powder to enhance its economic potential and reduce waste. Processed *B. vitiensis* samples were sourced from a reputed Sri Lankan Sea cucumber exporter, while mackerel fish and other ingredients were obtained from supermarkets. The study tested formulations with varying proportions of sea cucumber powder (25%, 50%, 75%, and 100%) and mackerel meat, assessing sensory acceptability and texture. Initial evaluations (n=15) identified the best combination as 25% sea cucumber powder and 50% mackerel meat. Three optimized formulations were further tested using a semi-trained sensory panel (n=30) at Wayamba University of Sri Lanka. The best formulation, 25% sea cucumber powder and 10% mackerel meat, received significantly higher sensory scores ($P \leq 0.05$, Friedman). Proximate analysis of the final product showed moisture (30.09±1.21%), ash (4.22±1.26%), crude protein (21.03±1.42%), crude fat (22.40±0.29%), and crude fiber (16.31±0.79%). Microbial analysis confirmed safety, with coliforms and *Staphylococcus aureus* absent and total plate count (1.6×10^2 CFU/g) within safe limits. The cost-benefit analysis revealed that 100 g of seafood spread costs approximately 5 USD, demonstrating economic feasibility. This study highlights the potential for value-added sea cucumber products, promoting sustainability and improved marketability.

Keywords: Mackerel, sea cucumber, seafood spread, value addition

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A comparison of total ecosystem carbon stocks in natural and restored mangroves and abandoned shrimp ponds in Pubudugama accelerated natural regeneration of mangroves site, Sri Lanka

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Mangroves are vital blue carbon ecosystems that sequester atmospheric carbon, mitigating climate change. However, large extents of mangroves are destroyed for development. Today, there are attempts to restore mangroves in Pubudugama in Northwestern Province of Sri Lanka which is currently undergoing an accelerated natural regeneration in abandoned shrimp ponds. A study was conducted to determine the Total Ecosystem Carbon Stocks (TECS) in natural mangroves, degraded and areas restored in 2019 and 2024 with 3 replicates of five 7m subplots in each strata. Soil samples were collected up to one meter depth. Soil carbon was determined through loss on ignition and vegetation biomass was estimated using allometric equations. The TECS levels in natural, degraded and 2019 and 2024 restoration sites were 860±201, 443.8±122.6, 625±174 and 571±266 Mg/ha respectively, with no significant between strata difference. A significantly higher Total Organic Carbon level (568.0±92.6 Mg/ha) in natural mangroves was recorded compared to the lowest (409.1±31.6 Mg/ha) in area restored in 2019. However, a significantly higher above ground carbon content (123.2±39.4 Mg/ha) and a below ground carbon content (92.3±30.0 Mg/ha) was recorded for area restored in 2019. Degraded area only contained soil carbon while all forms of carbon were present in the natural strata. The results highlight the carbon potential of mangroves in Pubudugama area and the merit of restoration, in terms of rebuilding lost carbon stocks. Results also indicate the need to restore degraded sites to stop further degradation of soil carbon.

Keywords: Above-ground biomass, below-ground biomass, mangroves, total organic carbon

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Optimization of liquid fertilizer production from shrimp shell waste through bio-based carbon fermentation

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Shrimp processing generates significant organic waste (50% to 65%), creating environmental and disposal challenges. This study developed a liquid biofertilizer using shrimp shells and head waste through bio-based carbon fermentation to address this issue. Three formulations were tested: T1 (50% shrimp head), T2 (50% shrimp shell), and T3 (50% 1:1 mixture of both). Each formulation was combined with rice polish (25%), sugar (12.5%), and overripe banana (12.5%) in a fixed ratio (4:2:1:1). After three weeks of anaerobic fermentation, the pH ranged from 5.5 to 7.5, and the temperature remained under 35 °C. Extraction yield and nitrogen (N), phosphorus (P), and potassium (K) contents were analyzed. A hydroponic field trial using *Echinodorus decumbens* assessed plant response to 0.5% and 1% fertilizer concentrations. Results showed T1 had the highest extraction yield (131.67±12.58 mL), followed by T3 (101.67±7.64 mL) and T2 (75.00±5.00 mL). T1 exhibited significantly higher N (3.78±0.03%) and K (2.22±0.03%) compared to T2 and T3, with no significant difference in phosphorus. N and K values were similar between T2 and T3 ($P<0.05$, ANOVA). Treatments T1 (based on highest nutrient value) and T3 (based on natural occurrence) were tested in field trials. Field trials at 1% concentration caused plant death, likely due to nitrogen toxicity. At 0.5%, T1 showed a significantly higher number of root (4.6±0.5) and leaf (5.5±0.76) development compared to T3 ($P<0.05$, t-test). Based on these findings, T1 is recommended as an effective fertilizer at a 0.5% concentration. This study suggests that shrimp-waste-derived fertilizers are viable organic alternatives, with further optimization needed for improved efficacy.

Keywords: Shrimp waste, biofertilizer, fermentation, NPK analysis, hydroponics

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Smart system for real-time water quality monitoring in aquaculture

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Water quality is a crucial determinant in aquaculture, since inadequate water conditions can result in higher fish mortality, disease outbreaks, and economic losses. In aquaculture farms, measuring the water quality parameters individually and manual data recording is time-consuming and tedious. Therefore, a smart system was developed for real-time water quality data acquisition and remote monitoring in aquaculture by integrating multiple sensors and wireless communication technologies. The two components in the system are the sensing module including pH (PH-4502C), temperature (DS18B20), and TDS (TDS V1.0) sensors and the master control module including an ESP32 microcontroller, a 16x2 LCD screen, a micro-USB power input, and a GSM module with GPS functionality. This setup enables remote alerts via SMS notifications whenever water quality parameters exceed critical thresholds, ensuring prompt action can be taken to address potential issues in the aquaculture system. Developed system using Arduino IDE with the C language displays the data on the LCD screen and wirelessly transmitted to remote monitoring devices via Wi-Fi and Bluetooth using the Blynk IoT platform. The data logging feature allows users to analyze historical trends in water quality over time by continuously measuring parameters such as temperature, TDS, and pH values. Although the salinity sensor is not included in this smart system, the salinity values in the water were estimated based on the TDS sensor data using a conversion factor. The system's performance was validated against commercial water quality monitoring devices in both laboratory and field environments. The results exhibited no significant differences between the device and laboratory measurements ($P>0.05$). The mean difference ± standard deviation for temperature, TDS, and pH readings were 0.001±0.08, 0.363±2.89, and 0.003±0.03, respectively, confirming the accuracy and reliability of the system. The developed system is designed to be a cost-effective, energy-efficient, and real-time decision-making alternative to expensive commercial monitoring solutions.

Keywords: Arduino, aquaculture, water quality, wireless communication

Development of nutritious cookies enriched with low-value sea cucumbers

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Sea cucumbers are widely consumed as a seafood delicacy, particularly in East Asian markets. However, in Sri Lanka, local consumption remains minimal despite the presence of a well-established sea cucumber fishery primarily focused on export. *Stichopus naso,* a lower-valued sea cucumber, is often rejected due to its poor processing. This study aims to develop a nutritious cookie enriched with *S. naso* as a value-added product to reduce waste, enhance utilization, and promote local consumption. *S. naso* samples (n=250) with processing defects were collected from a reputed exporter in Sri Lanka. Eight initial cookie compositions were developed by incorporating varying levels of dried sea cucumber powder (SCP) (i.e., T1:0% (control), T2:10%, T3:20%, T4:30%, T5:40%, T6:50%, T7:60%, and T8:70%; w/w%), and three compositions were selected through texture and an initial sensory analysis for the final sensory analysis to determine the best composition. The best formulation among the three compositions was identified through a sensory evaluation conducted with a semi-trained panel (n=30). The initial microbial qualities and cost-benefit analysis were conducted for the selected cookie composition. Proximate composition was analysed for both the selected cookie and the maximum SCP-incorporated cookie. T3 (20%) was the best composition, reporting significantly higher sensory scores than the other two compositions ($P \leq 0.05$, Friedman). The moisture, crude ash, crude protein, crude fiber, and crude fat content of the selected best cookie (T3) were reported as 2.17±0.37%, 2.19±0.17%, 12.70±0.03%, 2.45±0.15% and 20.83±0.13%, respectively. The initial microbial qualities of the selected best cookie were within the safe limit for human consumption. The protein content of the maximum SCP-incorporated cookie (70%) was significantly higher than that of the selected best cookie (20%) ($P<0.05$). The results showed that the selected best cookie is nutritionally rich and microbially safe and has the potential to increase local consumption.

Keywords: Cookie, proximate composition, sea cucumber, value-added

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A Mobile Driven Management System for Streamlined Shrimp Hatchery Operations

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Shrimp farming plays a crucial role in global aquaculture, driving economic growth and ensuring food security. However, the industry faces challenges in managing hatchery operations efficiently, particularly in regions like Sri Lanka, where traditional manual methods of data recording and management often result in inefficiencies, inaccuracies, and limited scalability. To overcome these challenges, this research presents AquaHub, a comprehensive mobile and web-based shrimp hatchery management system aimed at streamline operations, improving data accuracy, and promote sustainable practices. AquaHub integrates modern technologies, including React JS and Tailwind CSS for the frontend, Node JS for the backend, and MongoDB for database management, incorporating intuitive modules for real-time data entry, schedule monitoring, feed and water quality management, employee registration, messaging, and report generation, all accessible through a centralized dashboard enabling hatchery personnel to make informed decisions, optimize production, and improve operational efficiency. The development of AquaHub followed a structured methodology, including requirement analysis, system design, iterative development, rigorous testing, and user-centric deployment. Field surveys and stakeholder interviews conducted in key shrimp farming regions of Sri Lanka Chilaw, Puttalam, and Ambakandawila provided critical insights into the needs and challenges of hatchery operations. The system was validated through user acceptance testing, ensuring its functionality, usability, and alignment with user requirements. AquaHub represents a significant step forward in leveraging technology to address the gaps in shrimp hatchery management. By providing a unified platform for data management, communication, and decision-making, AquaHub not only enhances productivity but also supports sustainability goals in the aquaculture industry. AquaHub offering a scalable and efficient model for shrimp hatchery management that can be adapted to other regions and aquaculture sectors and ensured the creation of a reliable and effective tool for improving hatchery management practices. This time-saving benefit allows operators to focus more on the critical larval production process, enhancing overall efficiency and productivity.

Keywords: AquaHub, database, hatchery management, mobile, shrimp

Evaluating the performance of chitosan-based edible films for sustainable food packaging: influence of food composition and storage conditions

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The growing environmental concerns associated with petroleum-based synthetic food packaging have intensified the search for sustainable alternatives. Chitosan-based edible films offer a biodegradable and antimicrobial solution, yet their practical application remains limited due to their variable performance in response to food composition and storage conditions. This study addresses this research gap by systematically evaluating the physicochemical and functional properties of chitosan-based edible films in contact with fish-based foods of differing moisture content under varying storage conditions. Chitosan was extracted from giant freshwater prawn shell waste and used to develop edible films. Key film characteristics, including thickness, tensile strength, grammage, swelling power, biodegradability, and antimicrobial efficacy, were assessed using standard ASTM methodologies. Initial evaluations confirmed that the films exhibit non-swelling behavior, controlled degradability, and antimicrobial effectiveness, making them suitable for food packaging applications. To examine their stability and performance over time, chitosan films were tested under controlled storage conditions: 10 days at 4°C for fresh fish fillets and 30 days at -20°C for fish nuggets. Film weight variations and microbial activity were monitored throughout the study. The results reveal that food composition and storage conditions significantly influence the performance of chitosan-based films. High-moisture foods induce initial swelling, which stabilizes over time, while the films demonstrate superior bacterial growth inhibition compared to conventional plastic packaging. However, they degrade more rapidly in high-moisture environments, highlighting the need for tailored applications. This research advances the understanding of chitosan-based edible films in food packaging by demonstrating their potential as a sustainable alternative to synthetic materials. The findings underscore the importance of customized film formulations based on food properties and storage requirements, providing valuable insights for future advancements in biodegradable food packaging technologies.

Keywords: Antimicrobial efficiency, chitosan based-edible film, degradability, non-swelling, storage conditions

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Occurrence of microplastics in selected edible fish species sourced from North Western Province Sri Lanka

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Microplastics (MPs) have emerged as one of the most pervasive pollutants globally, posing potential risks to both aquatic biota and human health. Despite extensive studies on microplastics in soil, water, and sediments, research on their occurrence in edible aquatic species remains limited. This study aims to evaluate microplastic contamination in common wild-caught edible fish species, namely *Gerres oyena*, *Oreochromis mossambicus*, *Caranx ignobilis*, *Mugil cephalus*, *Chanos chanos*, *Tenulosa toli*, and an *Arias sp*., sourced from North Western Province, Sri Lanka. Fish samples were collected from the Anawilundawa Natural Regeneration of Mangrove (ANRM) site, Chilaw fish market, Puttalam fish market, and Mundal lagoon. Microplastic particles were extracted by organic matter digestion (30% KOH), followed by filtration (0.45 µm). The extracted MPs were characterized based on type, length, and color observing through stereomicroscope. The abundance of MPs in *Arias sp*., *M. cephalus*, *C. chanos* and *T. toli* were recorded as 1.25±0.51, 0.08±0.03, 0.06±0.01, and 0.09±0.01 MPs/g respectively. The highest quantities of MPs were found in *G. oyena* collected from the ANRM site (1.63±0.96 MPs/g). There were no statistically significant differences in MPs between same species from different sampling areas (P>0.05). MPs contamination among different fish species within the same location is significantly different (P<0.05). Fibrous microplastics were the predominant type, with blue (49%) and red (37%) being the most frequently observed colours in both muscles and guts of fish. The results of this study showed that MP pollution in wild-caught edible fish species from coastal waters in North Western province Sri Lanka, highlighting the proper management of plastic wastes.

Keywords: Carnivores, microplastics, omnivores, planktivores

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Estimation & characterization of microplastic contamination in cultured and wild-caught shrimps in Sri Lanka

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Microplastic pollution is a major global environmental concern, especially in aquatic ecosystems. As such, fish and other edible aquatic animals are considered as one of the major sources of microplastics in human diet. Present study investigated the presence of microplastics in shrimps collected from two different shrimp trawling grounds; Negombo and Mannar and a commercial shrimp farm at Ambakandawila. *Penaeus monodon, Litopenaeus vannamei, Penaeus indicus* and *Penaeus semisulcatus* were in the samples (weight range: 1.08 - to 27.42 g). Ten individuals per species obtained from each site, were measured for total length & weight. Weight of the gills and intestines were measured after dissection. Tissues were digested (30% KOH, 150 RPM, 24 hours) and decanted through 0.45µm-nitrocellulose membrane filters. Microplastics were identified and quantified based on its shape & color using stereomicroscope and verified through the hot needle test. Controls were maintained accordingly. Only fiber shaped microplastics were identified from shrimps. Mean number of microplastics in *P. monodon* and *P. indicus* reported 1.12±0.24 pieces/g and 1.03±0.24 pieces/g respectively while *P. semiculcatus* from Mannar reported 0.62±0.41 pieces/g. Farmed shrimps *P. monodon* and *L. vannamei* reported 3.62 ±1.75 pieces/g and 5.45±2.11 pieces/g respectively. Among three sites Negombo samples consists of small shrimps reported significantly higher number of microplastics ($P<0.05$, Kruskal-Wallis test). In total, white/transparent microplstics were the dominant in color (52.13%) followed by blue (38.35%), black (3.87%), red (3.14%), green (2.25%), orange (0.18%) and brown (0.09%). White/transparent color particles were significantly higher in Negombo (58.66%) and Mannar (51.45%) samples while blue color (62.79%) dominated in farmed shrimps ($P<0.05$, ANOVA). According to the results, samples collected from marine environments reported high contamination than farmed shrimps. Higher availability of microplastics were reported from smaller shrimps than larger shrimps.

Keywords: Aquaculture farm, natural sites, microplastic, shrimp, hot needle method, shrimp trawling grounds

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Optimizing microalgal lipid extraction: a time and energy efficient alternative to the Bligh and Dyer method for sustainable bioresource utilization

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Microalgae are a promising and sustainable alternative to fish oil due to their rapid cultivation, reliable lipid yields, and abundance in marine environments. However, commercial-scale lipid extraction remains limited by energy-intensive, time-consuming conventional methods such as the Bligh and Dyer technique. Addressing this challenge, this study aims to develop a more efficient lipid extraction protocol that optimizes time and energy consumption while maintaining high lipid recovery rates. Pure cultures of *Chlorella vulgaris*, *Chaetoceros calcitrans*, and *Nannochloropsis oculata* were harvested via centrifugation. A portion of the biomass was dried at 60 °C until a constant weight was achieved, while the remaining biomass was retained in its wet state. Both wet and dry samples underwent microwave-assisted cell lysis before lipid extraction using the Bligh and Dyer method. The total lipid yield was quantified, followed by fatty acid methyl ester (FAME) derivatization using the BF_3 method and gas chromatography-flame ionization detection (GC-FID) for fatty acid profiling. Lipid yields from wet biomass were 14.1%, 19.8%, and 15.5% for *C. vulgaris*, *N. oculata*, and *C. calcitrans*, respectively, while dry biomass yielded 18.2%, 31.0%, and 12.9%. Despite yield variations, statistical analysis indicated no significant differences between wet and dry extraction. Notably, wet biomass extraction favored monounsaturated and polyunsaturated fatty acids in *C. vulgaris* and *C. calcitrans*, whereas *N. oculata* exhibited a higher proportion of saturated fatty acids. These differences suggest that microalgal cell wall composition influences lipid recovery and fatty acid distribution. This study demonstrates that a modified Bligh and Dyer method using wet biomass is a viable, time-efficient, and energy-conserving alternative for microalgal lipid extraction. The findings provide a foundation for optimizing microalgal lipid recovery for commercial applications, contributing to sustainable marine bioresource development.

Keywords: Bligh and Dyer method, fatty acids, lipid extraction, microalgae

Antioxidant properties of crude fucoidan derived from selected seaweed species collected from Sri Lankan cost

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Fucoidan, a sulphated polysaccharide found in the cell walls of brown seaweeds, possesses bioactive properties, including antioxidant activity. Antioxidants neutralize free radicals and prevent oxidative stress and are widely used in cosmetic and pharmaceutical applications. Investigating antioxidant characteristics in Sri Lankan seaweed varieties, is important in future cosmetic industries. This study focused on the extraction, characterization, and antioxidant capacity assessment of fucoidan from *Sargassum polycystum, Gracilaria corticata, Acanthophora spicifera,* and *Kappaphycus alvarezii*. Fucoidan was extracted from using a conventional method involving blending fresh seaweeds, heating at 40 °C for 2 hours, and extraction with 96% ethanol, followed by freeze-drying and structural characterization by FTIR spectroscopy. Antioxidant properties were assessed using the Ferric Reducing Antioxidant Power (FRAP) assay with Trolox as the standard. UV absorption (100–400 nm) was measured to evaluate the UV-protective potential of the extracted fucoidan. Fucoidan yield varied among seaweed species: *S. polycystum* had the highest yield (1.35%±0.02), followed by *K. alvarezii* (0.70%±0.02), *A. spicifera* (0.44%±0.01), and *G. corticata* (0.43%±0.02). The FRAP assay showed significant antioxidant differences, with *S. polycystum* having the highest amount (29.62 mg/g DW), while the other species showed lower values (3.14 mg/g DW for *K. alvarezii*, 1.22 mg/g DW for *A. spicifera*, and 0.51 mg/g DW for *G. corticata*). UV absorption analysis of fucoidan extracts showed strong absorbance in both the UVA (315–400 nm) and UVB (280–315 nm) regions, with the highest absorbance observed in *S. polycystum*. These results suggest the potential of extracted fucoidan as a natural UV-protective compound. Strong UVA and UVB absorption suggest effectiveness in reducing skin aging, oxidative stress, and preventing skin burns. Findings highlight the potential of fucoidan from these seaweeds for use in the cosmetic industry as a natural UV-protective and antioxidant agent.

Keywords: Antioxidant properties, fucoidan, FRAP assay, seaweed, UV absorption

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Valorization of food industry byproducts: development and optimization of a nutrient-dense whey and fresh water prawn-based heat-and-drink soup

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Food waste remains a pressing global challenge, necessitating innovative strategies for its sustainable utilization. This study explores the development of a nutrient-dense, ready-to-consume "heat-and-drink" soup incorporating whey, a protein-rich byproduct of cheese production, and soft-shelled Giant Freshwater Prawn (GFP) flesh, which is frequently discarded due to perceived inferior quality. Additionally, surplus ripe tomatoes, often wasted despite their nutritional value, were integrated to enhance flavor while contributing to waste reduction. This research aligns with the zero-waste concept, emphasizing resource optimization in food processing. Six distinct soup formulations were developed by varying the proportions of whey, tomato pulp, and a thickening agent. Comprehensive nutritional and physicochemical analyses were conducted to evaluate moisture content, ash, fat, fiber, protein, pH, viscosity, total soluble solids, and titratable acidity. A 9-point hedonic sensory evaluation was performed with 30 trained panelists to assess key sensory attributes, including appearance, texture, aroma, color, flavor, aftertaste, and overall acceptability. Sensory data were analyzed using the Friedman test. Among the tested formulations, the variant containing whey and tomato pulp in an 80:20 ratio with 0.1% thickening agent demonstrated the highest sensory acceptability and superior nutritional properties (moisture: 90.61±0.12%, protein: 8±0.00%, pH: 4.47, viscosity: 11.15 mPas). The optimized formulation was hot-filled under aseptic conditions in glass bottles with screw caps, and shelf-life stability was assessed. This study highlights the potential of upcycling food industry byproducts into value-added functional foods, demonstrating a viable model for reducing waste while promoting sustainable nutrition. Furthermore, the development of innovative, eco-friendly food products could contribute to rural economic development by fostering sustainable culinary tourism and local enterprise opportunities. The findings underscore the importance of integrating circular economy principles into food production to address both environmental and socio-economic challenges.

Keywords: Giant freshwater prawn, house-hold level, tomato, whey, zero waste

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Assessment of microplastic contamination in table salt of Sri Lanka and remedial measures

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Since sea salt is produced by the evaporation seawater, a significant amount of Microplastics (MPs) could accumulate. This study investigates the contamination status and characteristics of microplastics isolated from sea salt in Sri Lanka, as well as a low-cost remediation technique. Samples included 6 powdered salt brands, 5 crystal salt brands, water from Puttalam Lagoon, and raw salt. In this study, 100 g of salt was digested with 30% H_2O_2, followed by dissolving in 800 ml of filtered distilled water, and filtration through 0.45-micron filter papers. A clay-based filtering system was used to test the efficacy of microplastic removal by filtering 800 ml of saltwater samples. Visual identification of microplastics was performed using a stereo microscope with a hot needle test. Complete extraction of nylon, polypropylene, and polystyrene was confirmed by 100% recovery, ensuring the efficiency of the microplastic extraction process. All the experiments were conducted in triplicates, with appropriate controls maintained throughout. Statistical analysis was performed using, Microsoft Excel and SPSS. The results showed that all tested samples were contaminated with microplastics. The average microplastic concentrations in powder, crystal, and raw salt were 751.30±122.09, 424.67±108.09, and 1456.67±142.95 microplastics items/kg respectively, while seawater recorded 1.51±0.05 microplastics items/L. Powdered salt exhibited significantly higher microplastic contamination compared to crystal salt (Mann-Whitney U test, $P<0.001$). The distribution of microplastic colours was as follows: 71.24% transparent, 12.74% blue, 5.00% white, 4.07% black, 2.81% red, 1.75% yellow, 1.39% green, 0.43% pink, 0.51% brown, and 0.06% orange. The shape distribution of microplastics was dominated by 94.76% fiber, 3.49% fragment, 1.34% foam, and 0.41% film. Based on these results, the estimated microplastic ingestion per person through salt is 1,241.53 microplastic items per year. The discovered low-cost clay-based filter systems effectively removed 87% of microplastics. This technology could serve as one of the effective methods for removing microplastics during salt processing for consumption, thereby helping to minimize microplastic ingestion rates.

Keywords: Crystal salt, microplastics, raw salt, remediation

Long-term assessment of marine debris accumulation and stakeholder perceptions in the Negombo estuary, Sri Lanka: a comparative study (2017 - 2024)

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Marine debris poses a significant threat to coastal and estuarine ecosystems, impacting biodiversity, fisheries, and human livelihoods. The Negombo Estuary, one of Sri Lanka's most ecologically and economically important water bodies, is particularly vulnerable to pollution due to rapid urbanization, intensive fishing activities, high population density, and inflowing waterways. While marine debris research in Sri Lanka has gained attention, most studies have been short-term, lacking long-term assessments that account for seasonal and environmental variations. This study provides a comparative analysis of debris accumulation and stakeholder perceptions in the Negombo Estuary and adjacent coastal areas over three time points: 2017, 2021, and 2024. Field sampling followed NOAA protocols across 12 estuarine and 4 coastal sites, while floating debris was quantified using a plankton net method. Debris density, composition, and distribution patterns were analyzed alongside a community perception survey conducted with 100 respondents. Results indicate that plastic polymers were the dominant debris type, with the highest accumulation observed in the channel segment of the estuary. Floating debris was also most abundant in this zone, highlighting the influence of hydrodynamic processes. Despite growing awareness of environmental impacts among local stakeholders, survey responses showed only a marginal increase in concern over time. The majority of respondents identified human activities as the primary contributor to pollution and emphasized the need for increased awareness campaigns to mitigate debris accumulation. This study highlights the necessity of long-term monitoring and community-driven management strategies to address marine debris challenges in the Negombo Estuary.

Keywords: Community awareness, marine debris, Negombo estuary, polymer

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Abundance of macro litter and microplastic in water and sediment in Negombo estuary, Sri Lanka

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Plastic pollution at macro and micro levels has become a significant environmental concern in coastal ecosystems. Plastic deposition significantly impacts the Negombo Estuary in Sri Lanka, affecting its ecological and economic value. This study examines the amount, distribution, and sources of macro litter and the abundance of microplastics (MPs) in water and sediments at Negombo Estuary. Samples were collected from November 2024 to February 2025 sampling 21 locations in 17 GN divisions. Standard OSPAR protocol was followed to assess macro litter, categorizing litter by type, source, and recording counts and weight with brand identification where possible. For MP analysis, 30 L surface water and 400 g sediment were taken, followed by digestion, density separation, filtration, and stereomicroscopic identification. By weight, the highest macro litter polluter in urban areas was the beverage industry (0.2758 Kg/m²), while by count, it was the food industry (0.17 litter/m²). Coca-Cola products were the most recorded in macro-litter. MPs data were analyzed using the Kruskal-Wallis test and Spearman Correlation. MPs size ranging from 200 µm to 5 mm were assessed. MPs levels varied significantly across sites (P<0.05), with the highest concentration at Location18 (Dungalpitiya GN division, vegetated area) (1.20±0.15 MP/L) and Location 3 (Bandarawaththa West GN division, semi-vegetated area with significant anthropogenic influenced) (340.03±249.14 MP/Kg dry weight) from surface water and sediment samples, respectively. In sediment, fragments were the most common MP by shape (35.80%), while fibers (67.53%) dominated in water. Blue was the most common color of the MPs in both sediment (32.81%) and water (41.50%). No correlation identified between MPs with TS, and TDS. This study highlights chronic pollution macro litter and MPs in the Negombo estuary, urging immediate community-adoptable waste management and awareness.

Keywords: Negombo estuary, OSPAR, plastic pollution, water quality

Valorization of food industry byproducts: biodegradable intelligent packaging film from chitosan and red cabbage for monitoring freshness of selected food items under different storage conditions

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Ensuring the freshness and quality of fish in supermarkets is essential for consumer health and satisfaction. Despite refrigeration, spoilage can occur due to temperature fluctuations, power failures, or microbial contamination, which are often undetectable through visual inspection alone. Consumers rely primarily on appearance when purchasing fish, without the ability to assess critical indicators such as odor and texture, increasing the risk of buying spoiled products. Intelligent packaging films offer a real-time solution by visually indicating spoilage-related pH changes. However, most commercially available intelligent films are petroleum-based, raising environmental concerns due to their non-biodegradable properties. This study explores the development of a biodegradable intelligent packaging film using chitosan extracted from shellfish waste and pH-sensitive anthocyanins from red cabbage (*Brassica oleracea*). Chitosan, a biopolymer with excellent film-forming properties, lacks inherent pH sensitivity; thus, red cabbage extract was incorporated as a colorimetric pH indicator. Two films were developed using mechanically and chemically extracted anthocyanins, and their effectiveness in detecting fish spoilage was tested on tuna (*Thunnus spp.*) fillets. The films exhibited a distinct color shift from dark purple to blue-green at pH 8, signaling spoilage. Fourier-transform infrared spectroscopy (FT-IR) and X-ray diffraction (XRD) characterized the films' structural properties, while color variation at different pH levels was quantified using a Konica Minolta Chromameter CR-400. The results confirm the films' potential as effective visual indicators for detecting fish spoilage, with broader applications for perishable food products. This study advances sustainable food packaging technology by utilizing food industry waste to develop eco-friendly intelligent packaging solutions, addressing food safety and waste management challenges. The findings provide valuable insights for future research and commercialization of biodegradable smart packaging in the food industry.

Keywords: Anthocyanin, Chitosan, Fish spoilage, Intelligent film
Acknowledgement: This study was funded by the Australian Centre for International Agricultural Research (Grant number: ACIAR/2018/157)

Microbial quality of edible bivalves in Negombo fish market for human consumption

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Bivalves are a popular seafood due to high nutritional levels and taste. Bivalves are prone to microbial contamination due to their filter-feeding nature. This study evaluated the microbial quality of three edible bivalves *Meretrix casta, Crassostrea madrasensis,* and *Geloina coaxans* collected from the Negombo fish market, Sri Lanka. Current research estimated the aerobic plate count (APC), total coliforms, faecal coliforms, *Escherichia coli* and *Vibrio spp.* in collected samples based on Sri Lankan Standards (SLS) for edible bivalves (FOOD ACT No.26 of 1980). *C. madrasensis* (6.212×10^6 CFU/g) *and G. coaxans* (4.621×10^6 CFU/g) reported significantly higher APC values than *M. casta* (4.182×10^5 CFU/g) ($P<0.01$, ANOVA). APC of *C. madrasensis* and *G. coaxans* were higher than the SLS standards. All three bivalve species were contaminated by *Coliform* spp. Most Probable Number (MPN) value for Coliform was reported by *G. coaxans* (156.7 MPN/100g) followed by *C. madrasensis* (153.3 MPN/100g), while *M. casta* was recorded the lowest value (140 MPN/100g). There were no significant difference in MPN values among three species ($P>0.913$, ANOVA). Faecal coliform contamination was reported from all species ranging from 65 MPN/100g to 130 MPN/100g and no significant difference among species ($P>0.233$, ANOVA) and were below the FAO standards (230 MPN/100g). Although, *E. coli* was not detected, the presence of *Klebsiella spp.* belongs to faecal coliform group was confirmed in all bivalves. Total *Vibrio* density in each bivalve species were reported more than 1100 MPN/100g. This study revealed that the level of APC was higher than the SLS standards in *C. madrasensis* and *G. coaxans* and contamination of *Klebsiella spp.* and *Vibrio spp*. in all samples. Further analysis are required to confirm the presence and the density of *V. cholera* and *V. parahaemolyticus* in samples. Results of this research revealed the potential food safety issues encountered with the studied bivalve species.

Keywords: *Coliform spp*., *Klebsiella spp.*, microbial contamination, total plate count, *Vibrio spp.*

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Impact of Socio-demographic, economic, health and lifestyle factors on consumption of dairy products in Eastern province of Sri Lanka

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This cross-sectional study aimed to examine the socio-demographic, economic, health, and lifestyle factors influencing dairy product consumption in the Eastern Province of Sri Lanka. Additionally, it sought to understand consumer behavior and identify the barriers and enablers to the dairy intake. A total of 388 respondents from urban and rural areas were selected using a simple random sampling technique, and data were collected through a structured questionnaire with an online survey. The data were analyzed using descriptive and inferential statistical methods, including chi-square tests, ANOVA, and linear regression. The results showed that higher-income consumers, urban residents, families with children, and larger households tend to spend significantly more on dairy products than lower-income consumers, rural residents, families without children and smaller household *(P<0.05)* while middle-aged individuals (31-60 years) and full-time employed respondents were recorded as the primary consumers. Affordability constraints among lower-income groups and health concerns impact 57.2% of respondents limiting the dairy consumption significantly. Awareness of nutritional benefits of dairy products positively influences purchasing behavior, with 60.1% of respondents recognizing its benefits. However, price sensitivity remains a major obstacle, with 69.6% of respondents agreeing that price affects their dairy consumption. Additionally, 47.4% of consumers prefer full-fat dairy products, and health conditions do not significantly alter dairy product's preferences. This study emphasized the need for targeted interventions, including affordability programs for low-income groups, educational campaigns on dairy's health benefits, and improved access to lactose-free products. These findings offer valuable insights for policymakers and stakeholders to enhance dairy consumption and promote better regional nutritional outcomes.

Keywords: Dairy consumption, economic barriers, nutritional awareness, socio-demographic factors

Exploring the potential of coconut (*Cocos nucifera*) milk in the development of processed cheese hybrids: Insights into sensory and physicochemical properties

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Replacing a portion of traditional cheese with coconut milk can offer a more affordable, yet nutritious, alternative to dairy-based cheeses. This study aimed to develop a processed cheese hybrid by incorporating coconut milk and evaluating its sensory and physicochemical properties. Based on preliminary trials, two formulations were selected, combining semi-hard cheese and coconut milk in ratios of 50%:30% and 45%:35%, respectively. A well-structured questionnaire, incorporating a 9-point hedonic scale, the Just About Right (JAR) test, and the Check-All-That-Apply (CATA) test, was administered to 30 untrained panellists to assess consumer acceptability. Multivariate statistical analysis was conducted using XLSTAT software. For texture and physicochemical analysis, a texture analyser (TX-700) was employed, following the guidelines established by the AOAC (2000 and 2005) methods. The sample with 30% coconut milk incorporation exhibited significantly higher scores for organoleptic properties (P<0.05). The proximate analysis of the 30% coconut milk sample contained a moisture content of 64.28±0.82%, protein (11.45±0.56%), fat (18.76±0.96%), ash (2.75±0.04%), fibre (0.68±0.13%) and free fatty acids (FFA) (0.85±0.14%).Textural properties showed a hardness of 2.31±0.21N, cohesiveness of 0.90±0.16N, gumminess of 2.05±0.47N, and chewiness of 2.00±0.55N. Colour parameters yielded values of L* (lightness) 74.8±0.90, a* (redness) 1.1±0.08, and b* (yellowness) 14.17±0.27. The results demonstrated that coconut milk is a viable and effective alternative for preserving the sensory and physicochemical properties of processed cheese hybrids, offering a promising approach for the development of affordable and nutritious hybrid dairy products.

Keywords: Coconut milk, processed cheese hybrids, physiochemical properties, sensory properties, texture

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Potential of *Musa balbisiana* at two maturity stages as a feed supplement for livestock: Nutritional composition and physical properties of pelleted feed

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Musa balbisiana, locally known as '*ati kesel*' is an important plant found in Asian countries and is recognized for its phytochemical and pharmacological properties. It holds a significant potential as a non-conventional feed resource for livestock in tropical regions. This study aimed to explore the possibilities of formulating pellets and assess the nutritional composition and physical properties of pelleted feed made from aerial parts of the *M. balbisiana* at two different maturity stages, after removing the banana bunch (ARB) and vegetative stage (VS). The proximate analysis was performed following the AOAC methods. The physical properties, such as bulk density, water absorption, and pellet hardness, were assessed using a texture analyzer-TXT2 with a blade probe. Palatability trials were carried out with cattle, goats, horses, and elephants to determine feed acceptability. The data showed that the crude protein content was 3.8±0.13% (ARB) and 5.4±0.13% (VS), crude fiber was 50.8±1.92% (ARB) and 42.6±1.42% (VS), ash was 6.3±0.11% (ARB) and 8.5±1.40% (VS), moisture was 13.8±1.27% (ARB) and 7.6±0.36% (VS), and crude fat was 2.8±0.01% (ARB) and 2.1±0.11% (VS). The results showed that younger *M. balbisiana* plants had higher protein content ($P<0.05$), whereas mature plants had higher moisture levels and crude fat content ($P<0.05$). The hardness (ARB-31.8±1.24N, VS-28.28±1.98N), cohesiveness (ARB-0.2±0.02, VS-0.1±0.05), gumminess (ARB-4.9±0.27N, VS-2.8±0.24N), and chewiness (ARB-4.9±0.36N, VS-3.8±0.30N) were also measured. Antioxidant properties were assessed using the DPPH radical scavenging method (100.7 ppm). These findings highlight the potential of *M. balbisiana* as a sustainable livestock feed ingredient, with further studies recommended on optimizing processing techniques for enhanced nutritional retention and storage.

Keywords: Livestock feed, *Musa balbisiana,* nutritional composition, pelleted feed

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Nutritional and technological properties of hybrid fresh cheese spread incorporated with red rice powder (*Oryza sativa* L.)

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Red rice is incorporated into food formulations as a natural source of nutrients and phytochemicals, including calcium, zinc, magnesium, antioxidants, and dietary fibre, presenting particular interest as an ingredient for functional foods. This study aimed to develop a hybrid fresh cheese spread by incorporating red rice powder into traditional halloumi cheese. Three different formulations were developed using halloumi cheese as the base ingredient, with cheese-to-red rice ratios of 45:25, 50:20, and 55:15, respectively. The developed formulations were analysed for their nutritional, technological, sensory, and physicochemical properties, and their storage stability was evaluated by assessing variations in technological and physicochemical properties over time. Among the formulations, the 55:15 cheese-to-red rice ratio exhibited the highest crude protein (19.93±0.17%, $P<0.05$), TSS (40.70±1.04%, $P<0.05$), and crude fat (15.90±0.22%, $P>0.05$). Conversely, the formulation with the highest red rice powder content exhibited the highest crude fibre level (2.85±0.06%, $P<0.05$). Textural analysis revealed that higher cheese content softened the texture, whereas a higher red rice content enhanced firmness ($P<0.05$). Colour variations in lightness (L^*) and redness (a^*) were significantly influenced by red rice powder inclusion ($P<0.05$). During the 14-day storage period, all formulations exhibited a significant decrease in pH and moisture ($P<0.05$), while titratable acidity and hardness increased significantly ($P<0.05$). Sensory evaluation with 30 untrained panellists, using a 9-point hedonic scale, indicated that the 55:15 cheese-to-red rice formulation received the highest overall acceptability. The findings of this study indicate that red rice powder can be successfully incorporated into a hybrid cheese spread without compromising sensory acceptability. Furthermore, its ratio significantly impacts nutritional and technological properties, highlighting the potential of locally available red rice in developing nutritious and cost-effective hybrid fresh cheese spreads.

Keywords: Red rice, fresh cheese spread, halloumi, hybrid cheese

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Development of ready-to-eat moist puppy food using locally sourced ingredients

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The early life stage of dogs requires careful nutritional management for their optimum growth and development. The Sri Lankan pet food market is largely dominated by imported products. The opportunity to offer premium pet food made with locally sourced ingredients will be advantageous. Therefore, this study was conducted to formulate a locally sourced, palatable, nutritionally balanced, and cost-effective moist puppy food. To formulate the food, carbohydrate sources, protein sources, fat sources, vitamin premixes and other additives were selected as ingredients. The formulated moist puppy food was hermetically sealed in cans and subjected to retorting. The nutritional composition of the formulated diet was analyzed. The colour and texture of the formulated feed were evaluated using a colourimeter and texture analyzer respectfully. The pH and microbiological quality of the formulated food were also analyzed. The palatability of the formulated feed was evaluated using a two-bowl test. The proximate analysis indicated that the formulated moist food complies with the AAFCO nutrients (moisture, crude fat, crude fiber) and energy guideline recommendations but crude protein content (38.4% on dry matter basis) exceeded the maximum crude protein recommendations (30% on dry matter basis) set by AAFCO. A significant growth (P<0.05) of total viable bacteria and notable increase (P<0.05) in pH of the formulated feed were observed over 21 days of storage period. The pH and total plate count of the formulated feed remained within the acceptable range as referenced in the literature (pH<6.5 and total plate count $<1\times10^6$ CFU/g). According to the findings, it can be concluded that formulating puppy moist food by utilizing locally available feed ingredients is possible and cost-effective. Significant bacterial growth and pH increase indicated a limited storage life of the newly formulated feed suggesting further studies on storage life should be assessed.

Keywords: Cost-effective**,** local ingredients, moist-puppy food

Textural properties of blends from various plant-based ingredients for processed cheese hybrid formulations

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The rising demand for plant-based alternatives in the dairy industry has led to the development of processed cheese hybrids, which incorporate plant-based ingredients into traditional cheese formulations. This study evaluated the textural properties, pH, viscosity, and colour of hybrid cheese formulations made by blending semi-hard and fresh cheeses with various plant-based pulps, including dhal, coconut, rice, chickpea, green gram, cowpea, and horse gram. The objective of this study was to assess the impact of these ingredients on the blend characteristics of cheese hybrids. Hybrid cheese formulations were prepared by blending different proportions of plant-based pulps with fresh or semi-hard cheeses, followed by standard cheese-making processes. The pH was measured using a digital pH meter, and viscosity was assessed with a digital viscometer (Model: NDJ-5S), colour was analyzed using a colourimeter (Model: CR-400) (*L**, *a**, *b** values), and texture was evaluated through texture profile analysis (Model: TX2-700) (hardness, cohesiveness, chewiness, and springiness). Statistical analysis was conducted using SPSS software to determine significant differences among treatments. The results showed significant differences ($P<0.05$) in pH, viscosity, and texture between the cheese types (semi-hard vs. fresh) in the blends, whereas the colour parameters (*L**, *a**, *b**) did not vary significantly between them. Among the plant-based pulps, significant differences were observed in colour ($P<0.05$), while texture, viscosity, and pH remained largely unchanged ($P>0.05$). These findings suggest that the choice of base cheese influences the final textural and physicochemical properties of hybrid formulations while plant-based pulps primarily affect blend characteristics.

Keywords: Cheese hybrid blends, colour, fresh cheese, plant-based ingredients, semi-hard cheese, texture

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Physicochemical characterization of a goat and cow milk blended yoghurt supplemented with probiotics and coconut (*Cocos nucifera)* treacle

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There is a growing consumer demand for functional dairy products that combine nutritional benefits with natural ingredients. Goat milk, which is known for its higher digestibility and unique composition, present a promising alternative to traditional cow milk-based yoghurt. Blending goat and cow milk may improve sensory acceptance in addition to the functional and nutritional properties of the milk base. The current research aimed to evaluate the impact of the *Lacticaseibacillus rhamnosus* GG (LGG) and coconut (*Cocos nucifera*) treacle (CT) on physicochemical properties (pH, titratable acidity, texture, color and syneresis) of a probiotic yoghurt made of goat milk-cow milk blend and stored over 21 days of refrigerated (4-7 °C) storage. A pilot study was performed by incorporating different treacle levels (2%, 5%, 10% and 15%) to determine the most preferable incorporation level of treacle for consumers. Since the 10% incorporation level received the highest preference, it was selected for the development of experimental yoghurt formulations. Four formulations of yoghurt: (1) Yoghurt fermented with conventional yoghurt starters (CYS) which served as the control, (2) Yoghurt fermented with CYS and supplemented with CT, (3) Yoghurt fermented with a combination of CYS and LGG, and (4) Yoghurt fermented with a combination of CYS and LGG and supplemented with CT were prepared. Products were analyzed in weekly intervals. Redness (*a**), yellowness (*b**), chroma *(C*)* and total soluble solids were increased while pH, lightness *(L*),* and whiteness index were decreased by the addition of CT (P<0.05). The pH of the products decreased over time while syneresis, titratable acidity, color and hardness increased over time. The lowest lactose percentage was recorded in the treatment in which both LGG and treacle were supplemented (2.25±0.07). Results conclude that the addition of coconut treacle improves the physicochemical properties of yoghurt prepared from a goat and cow milk blend.

Keywords: Coconut treacle, goat milk, *Lacticaseibacillus rhamnosus* GG, yoghurt

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Assessment of handling practices of raw cow's milk and identification of major constraints in clean milk production in and around Welimada, Sri Lanka

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Handling raw cow's milk is a critical aspect of dairy farming in Sri Lanka, particularly in rural areas such as Welimada, where traditional practices are prevalent; however, poor handling techniques and various production constraints can significantly affect milk quality and public health. This study was conducted to assess the handling practices of fresh cow's milk and identify major constraints affecting clean milk production in and around Welimada, Sri Lanka. Data were collected from 32 small-scale dairy farmers using in-person interviews and on-site observations through a convenient sampling method. Descriptive statistics were used to analyse milking and hygiene practices, while pair-wise ranking was applied to identify and prioritize key constraints. The study results revealed that 96.8% of the farmers practice hand milking and only 3.1% practice machine milking. The milking frequency was twice daily (56.2%) and once daily (43.7%). Most farmers (90.6%) cleaned the milking area before milking, and about (9.37%) did not follow proper cleaning protocols. There was a significant difference ($P<0.05$) between farmers who washed their hands before milking (87.5%) and those who did not (12.5%). Additionally, all dairy farmers washed udders and teats before milking, and all the farmers checked mastitis before milking. The use of stainless-steel containers (90.6%) for milk storage was dominant, while plastic containers were rarely used (9.3%). The most critical constraints affecting milk quality included a lack of milk storage facilities, limited knowledge of hygienic practices, financial constraints, and inadequate cooling facilities. The findings suggest that poor milk handling practices increase the risk of contamination, highlighting the urgent need for farmer training programs, improved infrastructure, and policy interventions to enhance clean milk production in the region.

Keywords: Clean milk production, milk handling practices, milk quality, raw cow's milk and small-scale farmers

Effect of a custom low-cost mineral mixture on cattle whole tract digestibility

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This study investigated the effects of a custom low-cost mineral mixture on cattle whole tract digestibility, with the goal of providing a cost-effective and efficient alternative to commercial mineral mixtures commonly used in dairy farming. A total of 18 cattle were randomly assigned to three treatment groups namely the control (fed with 50 g of the standard mineral mixture), treatment 1 (fed with 50 g of the custom mineral mixture), and treatment 2 (fed with 75 g of the custom mineral mixture). The trial duration was four weeks, including a three-week adaptation phase and a one-week sample collection period. The digestibility of dry matter, organic matter, crude protein, crude fat, and crude fiber was measured using acid insoluble ash (AIA) as an indicator. The results showed significant improvements in dry matter digestibility in treatment 1 and treatment 2 compared to the control group ($P<0.05$). Organic matter digestibility was also significantly higher in treatment 2 compared to both treatment 1 and the control ($P<0.05$). However, crude protein digestibility did not show significant differences among the groups ($P>0.05$). Crude fat digestibility was significantly higher in treatment 2 compared to treatment 1 and the control group ($P<0.05$). Crude fiber digestibility did not show significant differences between treatments ($P>0.05$). These findings suggest that incorporating a custom mineral mixture, particularly at a higher dosage, can effectively improve nutrient absorption and enhance cattle performance. Moreover, as the custom mineral mixture is formulated using locally available and affordable ingredients, it presents a viable and cost-effective alternative to commercial supplements, reducing feed costs while maintaining productivity.

Keywords: Cattle, digestibility, mineral mixture, whole tract, nutrient absorption

Acknowledgement: This research was conducted with the support of the National Livestock Development Board (NLDB), Sri Lanka.

Effect of back-slopping as a conventional curd making method on quality attributes of Buffalo milk curd

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Buffalo curd *(Meekiri*) is an authentic and one of the most popular dairy products in Sri Lanka for centuries. Curd preparation at the cottage level mostly uses a portion of previously prepared curd (*Muhum*) for fermentation, known as back-slopping. This study aimed to investigate the effect of back-slopping on microbial, physicochemical, and organoleptic properties of buffalo milk curd up to six batches of back-slopping. The first curd batch (CC) was prepared using a commercial starter culture, White-Daily 80® (Chr. Hansen, Denmark) consisting of a blend of mesophilic and thermophilic bacteria. Subsequent batches were prepared by inoculating 5% (w/v) of the previously prepared curd. Microbial counts, pH decline, syneresis, colour, texture, moisture, lactose content, and sensory properties were analyzed in every batch. Total mesophilic and lactobacilli counts were highest in the 3rd back-slopping (BS3). Mesophiles were the predominant type of microorganisms in all batches compared to lactobacilli. The first back-slopping (BS1) had the highest mean hardness, chewiness, and gumminess in textural parameters although the highest mean cohesiveness was observed in back-sloping 6 (BS6). The lowest lactose content was reported in BS3 (1.67±0.14%) and was significantly lower than that in all other batches (P<0.05). The lowest mean syneresis (25.51±8.90%) and the moisture content (70.08±0.63%) were also found in BS3. Data on fermentation kinetics revealed that the batches prepared by the commercial culture, BS1, BS2, and BS3 took only 4 hours for coagulation which was extended to one more additional hour in the batches BS4, BS5, and BS6. Sensory analysis showed that the overall acceptability of CC and BS6 was significantly higher than others. The sensory attributes of taste, texture, mouthcoating, and mouthfeel exhibited a strong positive correlation with the overall acceptability. Total microbial counts, physicochemical, and sensory properties evidentially proved that curd could be prepared up to 6th back-slopping properly.

Keywords: Bubalus milk curd, back-slopping, cultured dairy, dairy, LAB

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Performance evaluation of puppies fed with locally formulated moist dog food

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Feeding puppies sets the foundation for future health, influencing body composition and overall well-being throughout life. During early stages, it is important to feed with good quality food which contains a higher levels of specific nutrients like protein, fat, and calcium to support rapid growth, bone, muscle, and brain development of puppies. To effectively compete with the dominance of imported dog food in the local market, it is essential to evaluate the nutritional quality and performance metrics of locally produced options. This study assessed the performance of puppies on a locally formulated new moist dog food compared to imported dog food. This study evaluated the performance of eight healthy mongrel puppies from one litter, aged 6-8 weeks, which were randomly and equally divided into control and treatment groups for a seven-week feed trial. Control group was fed with the imported moist dog food while treatment group was fed with newly formulated moist dog food. Weekly body weight and feed intake were measured by using weighing scale. A sensory evaluation and serum electrolyte concentrations were measured at the end of the feeding trial. The treatment group showed a mean growth rate of 0.46 kg/week±0.01 whereas control group showed a mean growth rate of 0.49 kg/week±0.22 with no significant difference among groups (P>0.05). The serum electrolyte concentration values did not differ significantly (P>0.05) between two groups. Both groups revealed a better impact on coat texture, fecal color and odor. The newly formulated moist dog food made locally serves as a viable substitute for imported brand, ensuring comparable growth and well-being for puppies.

Keywords: Moist-dog food, growth, coat condition, dog performance

Effects of pH and salt concentration on textural and functional properties of mozzarella cheese

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Mozzarella cheese is an extremely versatile food product known for its wide range of flavours, textures, and end uses with key functional properties. This study aimed to investigate the effects of pH and salt concentration on the texture and heat-induced functionality of Mozzarella cheese. The pH range (5.2 to 5.4) and salt concentration (2% to 10%) were optimized using the Box-Behenken design of response surface methodology (RSM) with Design Expert version 13 software. Mozzarella samples were prepared with starter cultures under controlled conditions according to the trial combinations. Samples were analyzed for proximate composition using AOAC methods, textural properties using TXT2 texture analyzer, and functional properties. Both proximate composition and textural properties were assessed using separate samples from the centre and the edge of each cheese. Expressible serum (mL/g) was used to measure the water-holding capacity. Proximate results (%W/W) revealed a significant decrease in fat content (P<0.05) at the edge than the centre. The lowest fat content was observed (12%±1.47) at the edge of the cheese with 2% salt and a pH of 5.4. Salt concentration showed a stronger negative effect (P<0.01) on meltability than pH. Stretchability and meltability tests revealed the highest values of 88.37 mm±10.29 and 8.31 cm^2±0.75, respectively, at 2% salt concentration and pH of 5.2. The 10% salt concentration resulted in lower expressible serum (P<0.05), while higher pH retained significantly more moisture. Hardness and chewiness (centre and edge) were not significantly affected (P>0.05) by pH or salt concentration. A strong negative effect on cohesiveness was observed with decreasing pH, while both gumminess and cohesiveness (centre and edge) were significantly influenced by both salt concentration and pH (P<0.05). Overall, this study highlights the significant impact of pH and salt concentration on mozzarella cheese's texture and functionality, influencing its quality and processing. Further research is recommended to explore complex interactions between these factors.

Keywords: Functional properties, mozzarella, pH, salt concentration, texture

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Formulation of low-cost ornamental fish feed using locally available sources

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Aquaculture is a rapidly growing sector that significantly contributes to national fish production. Cost of imported ornamental fish feed and the poor quality of locally produced feeds prompted this study to evaluate two cost-effective formulated feeds for guppy (*Poecilia reticulata*) and compare their effects on growth, colour development, and feed quality parameters. Number of six-week-old male guppy fries were randomly assigned to three dietary groups containing 20 fries each tank. The control group was provided with the commercial feed and treatment group 1 (T1) and the treatment group 2 (T2) were provided with experimental diets. Other parameters remained unchanged. The fish were fed ad libitum twice daily. Proximate analysis showed 40%, 42%, and 40% crude protein levels for diet 1, diet 2, and the control, respectively. There were no significant differences in feed intake and water stability among control and treatments groups ($P>0.05$). The T2 exhibited significantly higher mean weight gain (0.454 g/35 days) and specific growth rate (0.505 g/day), while the control group showed the lowest growth performances. There were no significant differences in colour development noted between treatments. The highest survival rate was observed in T1 (95%). Fish fed with the experimental diets showed better total lengths, final weight and body conditional scores compared to the control group ($P<0.05$). A cost analysis revealed that both formulated feeds were more affordable than the imported feed, with Diet 1 being the most economically viable option. These findings suggest that ornamental fish farmers in Sri Lanka can adopt these cost-effective formulated diets as viable alternatives to commercial feeds.

Keywords: Guppy, formulated feeds, low-cost feed, ornamental fish

Impact of milking practices on milk yield and farm income in Western province dairy farms

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Milk production is an important livelihood for dairy farmers and the overall dairy industry in Sri Lanka. However, milking practices could influence farm income and milk production to a large degree. The study aimed at the effect of various milking practices on milk production and income generation by dairy farms in the Western Province of Sri Lanka. Data were collected from 60 dairy farms in the districts of Kalutara, Gampaha, and Colombo through farm observations and structured questionnaires. The study considered several milking practices, containers type that used to collect and transport milk, milking frequency (daily or twice a day), and milking method whether hand milking or machine milking was employed. Statistical data were examined using SPSS software to determine the relationship between milking practice and milk yield and their impact on farm income. Results demonstrated that milking method and milking frequency ($P<0.05$) significantly increased milk production. About 16.7% of the farmers milk twice daily where 83.3% of the farmers do milking only once daily. Higher milk production was observed (102 L/ day) when milking twice a day compared to milking once a day (53 L/ day) ($P<0.05$). Farms that continued to both machine and hand milking experienced higher milk yield (on average 1850 L/month) compared to the hand milking farms (on average 970 L/month). Farms that do both machine and hand milking had an average farm income of Rs.1,055,000/month, compared to hand milking farms which averaged at Rs. 204,520/month. The majority (87%) is still practicing hand milking. The best fittest multiple linear regression model revealed that ($R^2=0.331$) milking frequency had a positive effect on farm income. The study implies the importance of milking methods that increase revenue on dairy farms.

Keywords: Dairy farms, farm income, milk yield, milking practices, Western province

Acknowledgement: The survey was conducted with the support of the Provincial Director of the Department of Animal Production and Health (DAPH) and veterinarians in the visited divisions of the Western Province.

Exploring the utilization of roadside forages, fruit, and vegetable waste as sustainable livestock feed: Nutritional composition and physical properties of pelleted feed

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With the rising cost of conventional livestock feed and the nation's reliance on imported supplies, farmers face financial and sustainability difficulties. To address this issue, this study explored the potential of using roadside forages along with the combinations of fruit and vegetable waste as an affordable and sustainable alternative feed source. Forages were collected from three different locations in the Pannala area to ensure a diverse nutrient profile. Harvested forages were chopped and sun-dried before subjecting to the pelletizing process. Three formulations were made with varying percentages of forages (100%, 85%, and 70%) with 0%, 15%, and 30% waste mixed with nutrient-rich ingredients respectively, until a balanced composition was achieved. Proximate analysis of 70% forage pelleted feed contained moisture (14.85%±0.17), crude protein (12.69%±0.15), crude fibre (51.95%±0.96), fat (5.13%±0.16), and ash content (6.89%±0.37). Physical properties such as bulk density (478.97 kgm^{-3}±0.56), hardness (44.08±1.6), water absorption (63.10%±1.2), and colour (*L**: 49.1±0.26, *a**: 4.47±0.05, *b**: 41.2±0.06) were evaluated to ensure feed quality and storage stability. The findings demonstrated the feasibility of utilizing locally available feed resources to formulate a nutritionally viable livestock feed while minimizing food and agricultural waste. Although the current formulation deviates from the nutrient requirements of specific livestock feed, it can be adapted for specific species through ingredient modification. This research provides a foundation for advancing cost-effective, sustainable livestock feeding strategies in Sri Lanka, contributing to long-term resource efficiency in animal nutrition.

Keywords: Nutritional composition, pelleted feed, physical properties, roadside forages, sustainable livestock feed

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Development of a novel processed cheese hybrid combining semi-hard cheese and horse gram: Sensory, nutritional and physicochemical evaluation

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Horse gram is a nutrient-dense legume with a high protein and rich sources of micronutrients. This study aimed to develop a novel processed cheese hybrid partially incorporating horse gram pulp and to evaluate its sensory and physicochemical properties. The production process included pretreating the horse gram, preparing the pulp, and formulating the processed cheese hybrids using semi-hard cheese as the base. Based on preliminary trials, samples with 25% and 30% horse gram additions were selected for further analysis. Using a well-structured questionnaire with a 9-point hedonic scale, two samples with resemble sample were administered to 30 untrained panelists to assess consumer acceptability. Multivariate statistical analysis was conducted using XLSTAT software. Sensory analysis revealed that the 25% horse gram formulation received the highest overall acceptance (P<0.05). The proximate composition of the 25% horse gram addition contained moisture (60.95±0.34%), carbohydrates (5.88±0.44%), protein (14.36±0.07%), fat (14.44±0.11%), fibre (1.96±0.02%), and ash (2.40±0.01%). Textural properties of this formulation showed a hardness of 2.07±0.09, cohesiveness of 1.44±0.16, gumminess of 2.33±0.16, and chewiness of 2.30±0.16. The colour values were lightness (L^*) at 67.3±0.26, redness (a^*) at 2.46±0.06, and yellowness (b^*) at 12.53±0.40. The pH of the product was recorded as 6.86±0.03. The oil separation index (OSI), was 10.19±0.44%, reflecting a moderate OSI ideal for balanced meltability and stability. These findings suggest that incorporating horse gram pulp into processed cheese hybrids resulted in a product with favourable sensory and physicochemical properties. Future research should focus on assessing the shelf life and optimizing packaging to ensure the product's commercial viability.

Keywords: Horse gram, nutritional, physicochemical and sensory, processed cheese hybrids

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Partial incorporation of differently pretreated lentils (*Lens culinaris*) into processed cheese hybrids: Impact on the sensory, physicochemical and textural properties

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Lentils, rich in protein, fibre, and micronutrients, are a promising addition to processed cheese hybrids, enhancing both nutrition and functionality. To capitalize on the growing demand for plant-based proteins, this study aimed to investigate the effects of thermal treatments, boiling and roasting on the physicochemical, textural, and sensory properties of lentil-fortified processed cheese hybrids. Based on preliminary trials, samples with a 30% lentil addition, either roasted or boiled, were selected for further analysis. A well-structured questionnaire, incorporating a 9-point hedonic scale, the Just About Right (JAR) test was administered to 30 untrained panellists to assess consumer acceptability. Multivariate statistical analysis was conducted using XLSTAT software. Texture and physicochemical properties were analyzed using a Texture Analyzer (TX-700) following AOAC (2000 and 2005) guidelines. Proximate composition analysis showed no significant differences ($P>0.05$) in moisture content due to two different pretreatments, while roasted lentil processed cheese hybrids had significantly higher ($P<0.05$) fat (15.54±0.72%), protein (15.57±0.58%), and ash content (3.58±0.03%) compared to boiled lentil processed cheese hybrids. Textural analysis revealed that boiled lentil exhibited significantly greater cohesiveness (1.11±0.03%), gumminess (1.00±0.08%), and chewiness (0.99±0.08%) than their roasted counterparts. However, colour attributes (L^*, a^*, b^*) and pH remained similar between the two formulations. Sensory evaluation showed that roasted lentil-incorporated cheese hybrids received the highest overall liking scores and greater purchase intent, with higher mean values for appearance, colour, texture, aroma, flavour, and aftertaste, enhancing consumer acceptance. This study highlighted the potential of incorporating lentils into processed cheeses, though further research is needed to optimize their application and assess their long-term effects.

Keywords: Boiling, lentil, processed cheese hybrids, roasting and physiochemical

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Effect of nano hydroxy apatite as an alternative phosphorus supplement in layer diet

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Phosphorus plays a vital role in the development of bones, the strength of eggshells, and several metabolic functions in poultry. Dicalcium phosphate (DCP) is a commonly used phosphorus supplement in poultry feed. Due to its high cost and low bioavailability, it is necessary to explore more effective phosphorus sources. One promising option is nano hydroxy apatite (NHA), which is synthesized from Eppawala rock phosphate and is recognized as a beneficial source of P. This study aimed to investigate the impact of a newly developed NHA as a substitute for DCP. A total of sixty, 56-week-old 'Dikkanda white' layer chickens were randomly assigned to four treatment groups, each consisting of three replicates with five birds per group. The control group received a diet containing 2% DCP (T1), while the treatment groups were supplemented with 0.8% NHA (T2), 0.6% NHA (T3), and 0.4% NHA (T4). All other conditions remained constant throughout the experiment. At the end of the four-week feeding trial, no significant differences ($P>0.05$) were found between treatment egg production percentage, feed conversion ratio (FCR), shape index, eggshell thickness and eggshell weight. The only notable exception was average egg weight, which displayed significant variance among the treatments ($P<0.05$), with the highest egg weight recorded in T3. A previous study has shown that nano dicalcium phosphate can successfully replace DCP in layer diets at levels of up to 1%. This study suggests that including NHA at levels of up to 0.4% is also feasible, without negatively affecting production performance or egg quality. NHA is proposed as a viable alternative, potentially providing a more bioavailable source of phosphorus. It is beneficial to conduct further research to understand the long-term effects of NHA and determine its optimal inclusion levels to ensure a balanced calcium-phosphorus ratio in poultry diets.

Keywords: Egg production, egg quality, layer hen, nano hydroxy apatite,

Development of cool wrap technology for temperature control in milk canister: preserving microbial quality in raw milk transportation for smallholder dairy farmers in Sri Lanka

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Raw milk from smallholder dairy farmers in Sri Lanka has typically transported to milk chilling centers without prior cooling, leading to microbial deterioration under tropical conditions. Immediate cooling after milking and maintaining low temperatures during transport is crucial for preserving milk quality. To address this, a 'cool wrap' (CW) system consisting of an outer heat-resistant multi-layer fabric and an inner insulating layer with custom-formulated ice packs was developed. The CW was applied directly to milk canisters, allowing the raw milk to be cooled within the canister itself. This method effectively reduced the milk temperature to below 10 °C within 45 minutes and maintained it for over 3 hours under tropical conditions. Effectiveness of CW in controlling microbial growth was evaluated by storing equal volumes of raw milk (5 L) in stainless-steel canisters jacketed with (treatment, T) and without CW (control, C). Milk samples (n= 4) were taken from both C and T canisters immediately after storage and after two hours to simulate the average transportation duration. Temperature and colony-forming unit (CFU) counts were compared before and after transportation. Initially, there was no significant difference (P>0.05) in temperature (27.50±0.35 vs. 29.05±0.74 °C) or CFU counts ($2.3\pm0.07\times10^5$ vs. $2.5\pm0.11\times10^5$ CFU/mL) between T and C. However, after two hours, the milk in the T canisters had significantly lower (P<0.05) temperatures (9.75±0.18 vs. 27.25±0.18 °C) and CFU counts ($3.0\pm0.35\times10^6$ vs. $4.3\pm0.35\times10^6$ CFU/mL) compared to the milk in the C canisters. These results indicate that CW effectively cool milk below 10 °C during transport, preserving microbial quality and potentially reducing post-harvest losses. This innovation could enhance milk marketability and income stability for smallholder dairy farmers.

Keywords: Cool wrap technology, microbial quality, raw milk preservation, smallholder dairy farmers, tropical climates

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Development and quality assessment of a processed cheese hybrid prepared using semi-hard cheese and red rice powder *(Oryza sativa L.)*

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Red rice is rich in essential nutrients such as fibre, antioxidants, vitamins, and minerals and has been shown to possess potential medicinal properties, including anti-inflammatory, cholesterol-lowering, and antioxidant effects, contributing to improved heart health and overall well-being. This study aimed to develop a processed cheese hybrid by combining semi-hard cheese with red rice powder and to evaluate its physicochemical, textural, and sensory properties. After a preliminary study, two formulations were developed using 30% and 35% red rice powder. For texture and physicochemical analysis, a Texture Analyzer (TX-700) was employed, following the guidelines established by the AOAC (2000 and 2005) methods. A well-structured questionnaire was administered to 30 untrained panellists to assess consumer acceptability. Sensory analysis results revealed that the 35% red rice-fortified sample exhibited significantly higher consumer acceptability ($P<0.05$) compared to the 30% red rice-fortified sample, indicating a more favourable response to the higher red rice concentration. The proximate composition of the 35% red rice-fortified sample revealed moisture (59.87%±0.02), protein (11.31%±0.14), fibre (1.11%±0.05), fat (17.14%±0.06), ash (4.89%±0.08), and dry matter (40.13%±0.02). The pH (6.72±0.02), gumminess (2.49±0.33), hardness (4.46±0.45), cohesiveness (0.57±0.11), chewiness (2.47±0.41), and colour parameters L^* (72.93±0.95), a^* (4.33±0.12), b^* (17.6±0.26) were measured. These results suggest that the incorporation of red rice powder slurry into processed cheese hybrids can enhance the nutritional profile while maintaining desirable sensory and textural properties, making it a viable substitute for cost-effective and health-conscious cheese production.

Keywords: Processed cheese hybrids, proximate composition, red rice, sensory evaluation, texture

Acknowledgement: This study was funded by the Wayamba University Research Grant (SRHDC/URG/2024/13).

Evaluation of a cost-effective mineral supplement for enhancing dairy cattle performance

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This study evaluated the effectiveness of a cost-effective custom mineral supplement in enhancing dairy cattle performance in Sri Lanka. The research aimed to address the high cost and ineffectiveness of commercial mineral mixtures, which often fail to meet the nutritional needs of dairy cattle, leading to reduced milk yield, weakened immunity, and poor fertility. A custom mineral mixture was formulated using locally sourced raw materials, and its impact on milk yield, milk quality (fat and solids non-fat content (SNF)), and body condition scores (BCS) were assessed over a 4-week feeding trial. The study involved three groups of cows, a control group receiving 50 g of standard mineral mixture, and two treatment groups receiving 50 g and 75 g of the custom mineral mixture, respectively. Results showed that both the 50g and 75 g custom mineral groups had significantly higher milk yields compared to the control group ($P \leq 0.05$), with no significant difference between the two treatment groups. Milk quality also improved, with significant increases in fat and SNF content in both treatment groups ($P \leq 0.05$). Additionally, cows in the treatment groups showed significant improvements in body condition scores, indicating better overall health. The custom mineral mixture was found to be highly cost-effective, costing only Rs. 433 per kg compared to over Rs. 500 per kg for commercial mixtures, offering substantial savings for farmers. These findings suggest that the custom mineral mixture is a viable, affordable alternative to commercial supplements, capable of enhancing dairy cattle performance while reducing costs. Future recommendations include commercializing the mixture, educating farmers on its benefits, and conducting long-term studies to evaluate its effects across different breeds and environmental conditions.

Keywords: Cost-effectiveness, dairy cattle, milk yield, milk quality, mineral supplementation

Acknowledgement: This study was conducted with the support of the National Livestock Development Board (NLDB), Sri Lanka.

A novel approach to developing a hybrid processed cheese fortified with black-eyed Peas (*Vigna unguiculata*): Impact on nutritional, sensory, and physicochemical properties

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In response to the growing need for sustainable and healthy food alternatives, this study developed hybrid processed cheese using black-eyed pea pulp. Black-eyed pea is an important legume due to its high nutritional value, including rich protein, fibre, essential micronutrients, and bioactive compounds. Hybrid Processed cheese was formulated by incorporating 25% and 30% black-eyed pea pulp into semi-hard cheese. The descriptive sensory analysis of the experimental cheeses, compared to the resembled cheese, was conducted by 30 untrained assessors using XLSTAT software. The 30% black-eyed pea pulp incorporation showed significantly higher acceptance compared to the 25% formulation. A comparative analysis of the selected 30% formulation and two locally produced commercial processed cheeses revealed that the hybrid processed cheese using black-eyed pea pulp had a significantly higher protein content (22.59±0.57%WB) (P<0.05), establishing it as a protein-enriched alternative. Furthermore, it contained crude fibre (2.25±1.03%WB), which was absent in the tested commercial products, offering additional nutritional benefits. The developed product also had a relatively high crude fat content (21.63±2.8%WB), providing a rich texture. Moreover, the total phenolic content (TPC) of the hybrid processed cheese fortified with black-eyed peas (0.46±0.08 mg GAE/g extract) highlighted its potential as a functional food. Texture analysis determined that the hardness of the hybrid processed cheese was (2.01±0.23N) (P<0.05), indicating a firm yet pliable texture, which was neither too soft like some commercially processed cheeses nor excessively hard. Colour analysis revealed a lightness (L*) value of (71.88±0.93), positioning the product within the acceptable visual range of conventionally processed cheeses. Hybrid processed cheese with black-eyed peas offers higher protein, fibre, energy, moderate fat, and phenolics, with favourable physicochemical and sensory properties, making it a nutritious and functional alternative to traditional cheeses.

Keywords: Black-eyed pea, fibre, phenols, processed cheese hybrids, semi-hard cheese

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Effect of dried seaweed supplementation on feed intake and growth performance of pre-weaning lambs

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The preweaning period is critical for the health and development of ruminants. Modern livestock farmers seek nutritional interventions to enhance the growth and performance of young animals. Seaweed has demonstrated promising prebiotic effects, suggesting its potential to improve livestock health and productivity. This study investigated the effect of dried seaweed supplement on the growth performance and feed intake of pre-weaning lambs. A total of 10 newborn Madras-Red lambs were randomly assigned to two dietary treatments over a three-week feeding trial: a control group (C) and treatment group (T). Both groups received the same basal diet, consisting of milk and commercial cattle feed. In addition, lambs in the T group were supplemented with dried seaweed (1.5 g/lamb/day) from 3 to 21 days of age. Feed intake was measured daily and growth parameters including body weight, heart girth, body length, withers height, and hip height were recorded weekly. Seaweed supplementation significantly increased (P<0.05) concentrate feed intake in the T group throughout the experimental period. No significant differences (P>0.05) were observed between the groups in birth weights and all measured growth parameters before the initiation of seaweed supplementation. However, seaweed supplementation influenced body weight (P<0.10), heart girth (P<0.05), and body length (P<0.1) throughout the experimental period. Lambs in the T group had higher body weight at day 14 (P<0.1), 21 (P<0.1), and 28 (P<0.05) compared to those in the group C. Additionally, the T group exhibited significantly higher (P<0.05) heart girth at day 28 and body length at day 21 and 28 compared to the C group. These, findings indicate that, dried seaweed supplementation during the pre-weaning period can positively influence feed intake and enhance the growth of newborn lambs. Further studies with larger sample sizes are recommended to validate these findings.

Keywords: Feed intake, growth performance, pre-weaning lambs, weight gain

Acknowledgement: This study was partly supported by Carbon Blueprint Pvt Ltd.

Assessment of commercially available dog food in the Sri Lankan pet food market and investigating the impact of different fat sources on locally manufactured dry extruded dog food

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This study aimed to examine the quality of commercially available dry extruded dog foods in the Sri Lankan pet food market, with particular reference to (i) evaluating the nutritional value and compliance with nutritional guidelines (AAFCO) with the label values for dogs, and (ii) the effects of different fat sources on locally manufactured dry extruded dog food. Seven adult dog diets were analyzed for proximate composition, colour, texture, and palatability through a two-bowl free-choice test. All samples tested were complied with AAFCO crude protein standards. The analyzed crude fat and fibre content ranged from 5.36±9.38% to 14.85±4.75% and from 0.47±0.63% to 3.55±0.88%, while the label values were 8 - 15% and 1.1 - 5%, respectively. Lightness (L^*) ranged from 35.0±2.72 to 47.9±1.12, yellowness (b*) from 6.0±1.78 to 15.2±1.60, and hardness from 9.67±0.95N to 29.98±4.89N. Locally manufactured dry extruded dog food was modified with poultry and fish oil at 6%, 8%, and 10% levels. The 10% fish oil-coated dog food samples showed significantly higher acceptance (73.1±32.1%, $P<0.05$) than 8% poultry oil-coated samples (26.9±32.1%). The fish oil-coated sample had a higher fat percentage (11.94±0.09%, $P<0.05$) than the poultry oil-coated sample (10.62±0.17%), with no impact on texture ($P>0.05$). The poultry oil-coated sample had significantly the highest lightness (L^*= 49.9±0.55, $P<0.05$) compared to the fish oil-coated (48.2±0.32) sample. In conclusion, the dry extruded dog foods displayed varied nutritional and physical qualities, with optimal fish oil incorporation improving the palatability of locally manufactured extruded dog food.

Keywords: Dry extruded dog food, fat sources, nutritional value, palatability, physical qualities

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Development of a low-cost diagnostic model for early mastitis detection in small-scale dairy farms using milk quality parameters

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Mastitis is one of the most economically significant diseases in dairy cattle, leading to reduced milk yield, altered composition, and increased veterinary costs. Early detection, particularly at the subclinical stage, is crucial for effective control. Somatic cell count (SCC) is a key indicator of subclinical mastitis, but its measurement is costly, limiting access for small-scale farmers. Alternative milk quality parameters have been explored as potential indicators, but a cost-effective, field-applicable diagnostic model remains unavailable. This study aimed to develop a low-cost mastitis detection model using simple milk quality tests [pH, lactometer test, electrical conductivity (EC), alcohol test and resazurin test] and milk composition parameters (fat, protein, and solids-not-fat) correlated with SCC. Milk samples from 146 lactating cows in Kurunegala District were tested, and farm management practices (milking methods, hygiene, udder care, feeding, and housing) were assessed for their impact on mastitis prevalence. Statistical analysis revealed a moderate correlation between SCC and EC (r=0.22, P=0.009) and a weak correlation with pH (r=0.15, P=0.079). A multiple linear regression model was developed to predict mastitis occurrence: Mastitis = −4.366 + (0.592 × pH) + (1.575 × EC (S/m)). Both pH (P=0.029) and EC (P=0.001) were significant predictors, though the model had low explanatory power (R^2 = 0.126), suggesting the need for additional predictive factors. A binary logistic regression analysis indicated proper udder care (P =0.002) and daily shelter cleaning (P=0.04) significantly reduced mastitis risk. Inadequate cleaning increased the risk by 99.3%, while housing cows in closed barns (P=0.026) reduced the risk by 96.1%. These findings suggest EC and pH as promising low-cost indicators for mastitis detection and highlight the importance of hygiene and shelter management. Further validation with a larger dataset is recommended to improve model accuracy and field applicability.

Keywords: Dairy farming, diagnostic model, electrical conductivity, milk quality, somatic cell count

Development and evaluation of sensory, nutritional, and physicochemical properties of chicken sausage enriched with green banana flour

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The processed meat industry is in the transition and utilizing functional and health-promoting ingredients in meat product formulations that have been paid attention. Unripen (green) banana (*Musa acuminata*) flour (GBF) is a gluten-free, fiber-rich ingredient abundant in resistant starch, which enhances digestive health and improves food texture. This study aimed to develop a chicken sausage incorporating GBF of *Ambun* variety and evaluate its effects on physicochemical, sensory, and proximate properties. Four sausage formulations were prepared with varying levels of GBF 6% (T1), 8% (T2), 10% (T3), and 12% (T4) and a sensory evaluation was conducted with 30 panelists using a well-structured questionnaire, incorporating a 7-point hedonic scale to assess consumer acceptance. Among the formulations, samples T2 and T3 were the most preferred. Proximate analysis revealed a significant difference (P<0.05) in fiber, moisture, and ash content between these two samples. The T3 exhibited higher fiber (0.82±0.02%), ash content (3.25±0.06%), and a higher moisture content (60.15±0.15%) compared to other treatments. Cooking loss was lower in T3 (3.12±0.14%). The pH, color, texture, and water-holding capacity (WHC) of the two selected formulations were analyzed on days 1, 7, 14 and 21 while stored at -18°C. Initially, T3 exhibited a significantly higher pH (6.25±0.02) than T2 (6.15±0.02) (P<0.05). Among the textural properties, only gumminess has differed significantly (P<0.05), except hardness, cohesiveness and chewiness (P>0.05). No significant differences were observed in color parameters (L^*, a^*, b^*) between the samples during storage. The highest WHC was recorded in T3. Overall, the incorporation of GBF influenced initial pH, gumminess and WHC but did not affect their rate of change over storage time. These findings provide valuable insights for developing GBF-based processed meat products with enhanced nutritional and functional properties.

Keywords: Green banana flour, chicken sausage, physicochemical properties, sensory evaluation

Effects of dried seaweed supplementation on growth performance and gastrointestinal development in broiler chicken in Sri Lanka

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A healthy and functional gastrointestinal system is crucial for optimal broiler performance and health. Enzymes, prebiotics, and probiotics are commercially used to enhance gut health, and seaweed is a promising candidate with prebiotic properties. This study evaluated the effects of dried seaweed supplementation on broiler performance and gut health. Sixty one-day-old Ross 308 broiler chicks were randomly assigned to two dietary treatments in a 35-day feeding trial. The control group (CON) received a commercial broiler diet while the treatment group (SWS) received the same diet supplemented with 1 % of dried seaweed. Each treatment had three replicates of 10 chicks. Seaweed supplementation significantly increased (P<0.05) the live weight from day 21 to day 35 compared to the control. Additionally, SWS birds tended to have heavier valuable meat cuts (whole leg, P=0.07) and organ weights (liver, P=0.08). Although cumulative feed intake did not differ significantly (P>0.05) between groups, the SWS group exhibited a numerically lower feed conversion ratio. Notably, seaweed supplementation promoted gastrointestinal development, as indicated by significantly longer (P<0.05) cecum and intestinal lengths at day 35, which may have improved digestion and nutrient absorption. This was supported by lower crude protein content in feces in SWS group (SWS: 28.16% vs. CON: 36.16%). Furthermore, seaweed exhibited prebiotic effects by significantly increasing (P<0.05) *Lactobacillus* spp. and reducing (P<0.05) *Escherichia coli* counts in feces. These findings suggest that dried seaweed can be a beneficial feed supplement to enhance broiler growth and gut health without compromising feed intake or feed conversion efficiency.

Keywords: Beneficial bacteria, broiler performance, gut health, prebiotic, seaweed

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Formulation and comprehensive evaluation of ice cream prepared with plant-based sugar substitutes

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Ice cream is a globally popular dessert enjoyed by people of all ages. This study investigated physicochemical properties and sensory acceptance of different ice cream formulations prepared using plant-based sugar alternatives in contrast to refined sugar. The formulations included ice cream with refined sugar (control, T1), *kithul* treacle (T2), palmyra treacle (T3), and coconut treacle (T4). The ice creams were made using cow milk, 10% sugar, 4% non-fat milk, 8% cream, 0.1% tartaric acid, 0.1% gelatin, 0.1% corn flour, and 2% whipping cream by weight. Prepared ice creams were stored in airtight plastic containers in frozen conditions (-20 °C), and the physicochemical parameters were measured at weekly intervals over 21 days. *Kithul* and palmyra treacle significantly impacted pH, acidity, colour, and texture profiles compared to refined sugar ($P<0.05$). *Kithul* treacle lowered the pH, while palmyra treacle darkened the colour, and both improved texture, whereas coconut treacle showed minimal changes compared to refined sugar ($P<0.05$). *Kithu*l treacle increased fat content (7.67±0.58) and overrun (14.06±1.50), palmyra treacle decreased both, and coconut treacle showed no significant changes similar to refined sugar ($P>0.05$). The overall acceptance of ice cream manufactured using plant-based sugar substitutes was comparable to that of refined sugar, according to a sensory analysis of 40 panelists The mean sensory scores for attractiveness, iciness, melting, mouth coating, overall flavour, and sweetness were similar between plant-based treacle-incorporated and refined sugar-incorporated samples ($P>0.05$). Palmyra-incorporated ice cream received significantly higher sensory scores for aroma (7.60±1.53) and firmness (7.25±1.58) than that of other treatments. In addition, palmyra ice-cream also showed the highest values for firmness, chewiness, and gumminess, contributing to a denser texture. Results conclude that palmyra treacle significantly improved ice cream's sensory and physicochemical qualities and thus can be utilized as a better plant-based sugar alternative to compared to refined sugar.

Keywords: Ice cream, *kithul*, palmyra, plant-based sugar alternatives, treacle

A descriptive study on the longevity of dairy cows reared in government farms in Kurunegala district, Sri Lanka

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This study investigated the longevity of dairy cows reared on government farms in the Kurunegala District, Sri Lanka, focusing on the main reasons contributing to their elimination and the influence of first-parity traits on longevity. Individual animal records were collected from 469 crossbred dairy cows that were eliminated (culled or died) between 2018 and 2024 across eight National Livestock Development Board farms. These data were used to determine longevity based on herd life (HL), productive life (PL), milking life (ML), and the number of lifetime calvings (NLC). The factors affecting longevity were determined by Generalized Linear Model in SPSS software with farm, season of the first caving (SFC), age at first calving (AFC), first lactation milk production (FMP), and days in milk during the first lactation (DMFP) included as fixed factors. The average HL, PL, ML and NLC were 2759±1013 days, 1382±926 days, 628±587 days and 3±2 respectively. Among the total eliminated cattle, 8.53% died, while 91.47% were culled due to reproductive disorders (57.33%), poor milk production (19.91%), physical weakness (7.22%) and infectious or non-infectious diseases (7.00%). Moreover, 29.1% of cows were eliminated after completing five or more lactations, while 28.5% were eliminated after their first lactation. The statistical analysis indicated that both farm and DMFP significantly impacted all longevity traits considered (P<0.05). FMP affected HL and PL (P<0.05), while AFC influenced PL (P<0.05). SFC did not have a significant effect on any of the longevity traits examined. According to the results of this preliminary study, farm and first parity characteristics were crucial for predicting the lifespan of dairy cows. Further investigations with a larger sample size are required to confirm the effect of reported predisposing factors influencing longevity.

Keywords: Dairy cow, herd life, Kurunegala district, longevity, productive life

Impact of feed resources and feeding practices on milk production in dairy farms of the North Western province, Sri Lanka

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Dairy farming plays a crucial role in the economy of the North Western Province, but milk production has declined in recent years due to various challenges. This study examined the impact of feed resources and feeding practices on milk yield in dairy farms across the region. A total of 72 farms were selected using stratified and simple random sampling techniques. Data on socio-economic factors, feed resources, feeding practices, and milk production were collected through structured questionnaires from 12 purposively selected Veterinary surgeon divisions, based on dairy farm density and regional representation. Data were analyzed using descriptive statistics, chi-square tests, and multiple linear regression. The results indicated that semi-intensive farming was the most common system, with farmers primarily relying on natural grazing, green feeds, tree legumes, commercial concentrates, and minerals. The use of silage was significantly higher in medium and large farms (P<0.05). Milk yield per cow per day varied significantly across feeding systems (P<0.05), with zero grazing yielded the highest production (7.46±2.11 L), followed by partial grazing (7.38±2.36 L) and full grazing (5.17±1.90 L). Fodder quality significantly affected milk yield (P<0.05), but only 54% of farmers cultivated improved fodder due to land scarcity, lack of inputs, and inadequate government support. Concentrate intake explained 56.7% of the variation in milk yield, showing a moderate positive correlation. The best-fitted multiple linear regression model explained 60.9% of the variation in milk yield per cow per day. The model showed that the amount of concentrate (kg/day), feeding frequency, feeding system, fodder type, and education level significantly affected milk yield (P<0.05). The findings highlight the need for enhanced farmer training, increased government support for improved fodder cultivation, and a stable feed supply to improve milk production in the North Western province.

Keywords: Dairy farming, feeding practices, milk yield, North Western province

Acknowledgement: The survey was conducted with the support of the Provincial Director of the Department of Animal Production and Health (DAPH), veterinary surgeons, and field officers in the Veterinary Surgeon Divisions visited in the North Western Province.

Physicochemical, microbial and organoleptic evaluation of yoghurt made of cow and goat milk blend supplemented with probiotics and blue pea flower-extract

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Functional dairy foods including those from goat milk (GM) are becoming popular due to their health benefits, in addition to their conventional role in nutrition. Probiotic fermentation, and blending with cow milk (CM) and/or plant-based materials are being explored to enhance the sensory acceptance of GM products. The current research aimed to develop a functional set-type yoghurt using a CM-GM blend by incorporating blue pea flower (*Clitoria ternatea*) extract (BPFE) and probiotic *Lacticaseibacillus rhamnosus GG* (LGG). Three formulations were prepared using the CM-GM milk blend with varying levels of BPFE (0%, 5%, and 10% v/v). The products were fermented with a mixed starter culture containing the conventional yoghurt starter and LGG. The physicochemical properties of the products were determined at weekly intervals during 21 days of refrigerated storage. Sensory analysis was conducted at 7 days of storage. Post-acidification in all products was not significant ($P>0.05$) throughout the storage. The addition of BPFE significantly decreased the whiteness (L^*) while significantly increasing the greenness ($-a^*$) and blueness ($-b^*$) in a dose-dependent manner ($P<0.05$). The presence of BPFE significantly increased the survivability of probiotics in yoghurt, with significantly higher ($P<0.05$) viable counts after 14 days. The probiotic counts in all yoghurt formulations over the storage exceeded the minimum therapeutic dose (≥ 6 log CFU/mL). Sensory evaluation showed similar acceptability for yoghurts with 0% and 5% BPFE (7.7±1.5 and 7.5±1.4, respectively), while 10% BPFE had significantly lower acceptability (6.9±1.6). Higher BPFE levels negatively affected product acceptability in a dose-dependent manner. The study concludes that BPFE can enhance yoghurt functionality and probiotic survival, but incorporating levels above 5% may compromise consumer acceptability. Five percent (5%) BPFE was the most favorable incorporation level, balancing functional benefits with desirable sensory properties.

Keywords: *Clitoria*, dairy, *Lactobacillus rhamnosus*, probiotic, set yoghurt.
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Prevalence of lumpy skin disease in cattle in Kurunegala district and farm-level risk factors associated with outbreaks in selected veterinary divisions

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Lumpy skin disease (LSD) represents a significant economic threat, yet research has been scarce on this issue within the Kurunegala district. This study aimed to estimate the prevalence of LSD in the Kurunegala district and identify associated farm-level risk factors in selected veterinary divisions. Data on the LSD prevalence across all veterinary divisions (30) of the district was obtained from the Department of Animal Production and Health of North Western Province. Based on this data, six veterinary divisions with the highest prevalence (Horombawa, Mawathagama, Narammala, Mallawapitiya, Katupotha, and Kurunegala) were selected for the risk factor analysis. A survey was conducted on 10% of farms in each division, totalling 306 farms (both case and control), using a pre-tested questionnaire and data sheet. Risk factors associated with farm level LSD outbreaks were analysed using binomial logistic regression of SPSS software. The farm-level prevalence of LSD in Kurunegala District was 3.55% with an overall mortality rate of 1.20%. The highest division-wise prevalence was observed in Horombawa (24.26%), while the lowest was in Ehatuwewa division (0.11%). According to the results of logistic regression analysis the herd size, method of breeding, preventive measures at the farm entrance, usage of disinfectants for farm premises and awareness of farm owners on common LSD symptoms significantly contributed to the risk of farm level LSD outbreaks. Farms that did not use disinfectants and farmers who were unaware of common LSD symptoms had a 2.5 and 6.1 times higher risk, respectively, of experiencing LSD outbreaks. The risk of LSD increased with herd size (ODD ratio = 0.195). Natural breeding was associated with higher risk compared to artificial insemination. This study highlights the need for interventions focused on farmer awareness, breeding practices, and biosecurity measures to control LSD more effectively.

Keywords: Kurunegala, cattle, lumpy skin disease, LSD, livestock

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Development and evaluation of a dairy-based ready-to-serve beverage supplemented with-probiotics and blue pea flower (*Clitoria ternatea*) extract

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There is an increasing demand for functional dairy products as there is an increasing awareness among consumers about multiple health-promoting effects offered by these products. This study aimed to evaluate the impact of incorporating blue pea flower extract (BPFE) on probiotic viability, and physicochemical and sensory properties of a ready-to-drink beverage made from cow milk over 21 days of refrigerated storage (4 - 7 °C). Three different products were formulated by incorporating varying levels of BPFE (0, 10, and 20%, w/v) into cow milk base followed by fermentation using a mixed starter containing probiotic *Lacticaseibacillus rhamnosus* GG (LGG) and conventional yoghurt starter. Physicochemical analyses and microbiology analyses were performed at weekly intervals. A sensory analysis was performed after one day of storage using a semi-trained panel (n=37). During shelf life, redness (*a**), yellowness (*b**), chroma (*C**), and pH were decreased, while lightness (*L**), probiotic viability, sedimentation, and whiteness index (WI) were increased. Viscosity gradually increased during storage but decreased in all three treatments after 21 days. After 21 days of storage, all fermented milk samples containing blue pea flower (BPF) showed significantly higher ($P<0.05$) LGG counts compared to those without BPFE. The product containing 20% BPFE exhibited the highest viable probiotic counts (>8 log CFU/mL) at the end of storage. Throughout the storage period, all three products maintained viable probiotic counts of greater than 7 log CFU/mL. The incorporation of BPFE showed a dose-dependent decrease in the mean scores of all sensory attributes tested. However, the sensory scores between 0% and 10% BPFE-incorporated beverages were similar ($P>0.05$). Results conclude that a 10% incorporation level of BPFE is ideal for formulating a novel ready-to-drink beverage from cow milk with added health benefits.

Keywords: Cultured dairy, milk beverage, phytochemicals, probiotics, sensory

Explore market opportunities for local pet food and supplement production: Survey from Western province, Sri Lanka

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Globally recognized pet food and supplement brands have captured the majority of market shares in the pet food industry in Sri Lanka. So, domestic pet food and supplement producers face intense market competition with imported pet products. This research study aimed to provide basic market insights and market information for local pet care producers to identify key market opportunities to strengthen their business. A standard questionnaire was used to collect data from the pet owners (n=360) who raise dogs and cats in the Western province, of Sri Lanka. Data were collected from the pet owners who were distributed across the Colombo, Gampaha and Kaluthara districts through in-person surveys using the convenience sampling method. Among 360 respondents, 186 pet owners purchased pet food, and 254 individuals purchased pet supplements. Purchasing pet food showed significant relationships with monthly household income (P<0.05) and type of pet (P<0.05). Purchasing of a pet supplement showed significant relationships with residential area (P), monthly household income (P<0.05) and type of pet (P<0.05). Pet owners have the highest level of awareness score (3.68±0.61) for imported pet food brands, whereas the lowest level of awareness score (1.45±0.49) is observed for local pet supplement brands. About 75.86% of pet food buyers choose imported pet food brands, while 54.72% of pet supplement buyers purchase imported pet supplement brands. Pet preference is the primary factor in selecting a pet food brand, while veterinarian recommendations are crucial for choosing a pet supplement brand. Local pet producers must tailor their marketing strategies based on these factors to compete with imported brands. Expanding the study to include multiple locations and a larger sample is essential for identifying broader market opportunities.

Keywords: Market competition and opportunities, pet food industry, pet supplements

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Roadside forage silage with pineapple peel: A cost-effective strategy to address forage shortages in Sri Lanka

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Forage shortages, particularly during droughts, pose a significant challenge for smallholder dairy farmers in Sri Lanka. Roadside forage, an underutilized but readily available resource, could serve as a viable solution for forage shortage if effectively converted into silage. However, their low soluble sugar content limits fermentation efficiency. This study evaluated the potential of incorporating ripe pineapple peels, rich in soluble sugars, to enhance fermentation process and improve silage quality. Silage samples were prepared by using chopped roadside forage mixed with different proportions of pineapple peel: 0% (Control), 2% (T1), 4% (T2), and 6% (T3). Samples were analyzed for acidity, proximate composition, and cattle acceptability at 3, 5 and 7 weeks post-ensiling. A two-way analysis of variance showed that both pineapple peel addition and storage duration significantly (P<0.05) influenced silage acidity, energy, and all the measured proximate composition parameters (dry matter, crude protein, and ether extract) except for crude fiber content. Increasing pineapple peel levels reduced silage pH while enhancing titratable acidity, indicating improved fermentation. Additionally, gross energy and dry matter content significantly (P<0.05) increased with pineapple peel incorporation. Notably, cattle exhibited a clear preference for T2 and T3 silages over the Control and T1, suggesting improved palatability. These findings demonstrate that roadside forage can be effectively converted into high-quality silage with the addition of ripe pineapple peels, offering a viable and cost-effective solution for forage shortage. However, further validation through long-term storage studies is needed to confirm the stability and quality of pineapple peel incorporated roadside forage silage.

Keywords: Dairy cattle farming, forage shortage, pineapple peel, roadside forages, silage

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Effect of dried seaweed supplementation on diarrhea incidence and fecal microbiota of pre-weaning lambs

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Pre-weaning ruminants are highly susceptible for infectious diseases, particularly diarrhea, which can negatively impact growth and overall health. Seaweed possesses prebiotic properties that may influence hindgut environment in young ruminants. This study evaluated the effects of dried seaweed supplementation on diarrhea incidence and fecal microbial populations of pre-weaning lambs to assess its potential as a natural feed supplement for small ruminant farming. A total of 10 newborn Madras-Red lambs were randomly assigned to two dietary treatments, control (C) and treatment (T), over a four-week feeding trial. Both groups received the same basal diet, consisting of milk and commercial cattle feed. In addition, lambs in the T group were supplemented with dried seaweed (1.5 g/lamb/day) from 3 to 21 days of age. Fecal consistency was evaluated using a standardized scoring system, while fecal samples were collected at baseline (1-3 days), 7, 21, and 28 days of age for pH analysis and microbial enumeration. There was no significant difference (P>0.05) in diarrhea incidence or severity between two groups. However, fecal samples from the T group exhibited higher *Lactobacillus* spp. counts at all time points, with significant differences at 7 days (P=0.01) and 21 days (P<0.1). By 28 days, populations of coliform bacteria including *Escherichia coli* were significantly reduced in the T group compared to the control. However, lactose-negative *Enterobacteriaceae* showed no significant (P>0.05) difference throughout the trial. The T group also had significantly lower fecal pH at 7 days, though no differences were observed at later time points. These findings suggest that dried seaweed supplementation can positively influence the hindgut environment without increasing diarrhea risk, supporting its potential as a natural feed additive for improved gut health and productivity in small ruminants. Further studies with larger sample sizes are recommended to validate these findings.

Keywords: Diarrhea, fecal pH, gut health, pre-weaning lambs, seaweed

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Utilization of keratin extracted from chicken feather for bio-based film innovation

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The poultry industry generates a significant amount of feather waste, which is primarily composed of keratin, a structural protein with potential applications in biomaterials. This study aimed to extract keratin from broiler and layer chicken feathers using different extraction methods and to develop a biofilm. Chicken feathers were cleaned, oven-dried at 60°C for 24 hours, and ground into powder. Keratin was extracted from feathers using both alkaline (Sodium hydroxide) and acid (Hydrochloric acid) hydrolysis methods, and the yield percentage was determined. A biofilm was then developed using cassava (variety *Rankawadi*) starch, glycerol, vinegar, and extracted keratin (200:40:40:1). A control biofilm was also developed without keratin, and mechanical properties of both were analyzed using a texture analyzer. Results indicated that broiler feathers yielded a significantly *($P<0.05$)* higher keratin (1.8%) than layer feathers (0.76%). Furthermore, the alkaline extraction method produced a significantly ($P<0.05$) higher keratin yield (3.95%) compared to the acid extraction method (1.8%), demonstrating its efficiency in keratin recovery. Though the control biofilm exhibited higher hardness (180 g>125 g), cohesiveness (0.92>0.26), and durability over keratin incorporated biofilm, it was less flexible. These results demonstrate that keratin improves the material's stretchability and recovery while slightly reducing hardness. Its combination of resilience, flexibility, and slight adherence suggests suitability for applications requiring stretchability, impact resistance, coatings, and biodegradable packaging. The findings of this study emphasize the feasibility of utilizing poultry feather waste as a valuable keratin source for biodegradable film development, contributing to the advancement of eco-friendly materials. Further studies are recommended to optimize the extraction process for enhancing the keratin yield and quality, leading to improved bioplastic.

Keywords: Acid hydrolysis, alkaline hydrolysis, biofilm, broiler, keratin, layer

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Evaluation of nutritional and physical qualities of commercially available cat food in the Sri Lankan pet food market and assessment of different fat sources in locally manufactured dry extruded cat food

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This study aimed to evaluate the quality of commercially available dry extruded cat foods in the Sri Lankan pet food market, with special emphasis on evaluating the nutritional value and compliance with the label values for cats, and the effects of different fat sources on locally manufactured dry extruded cat food. Eight adult cat diets were analyzed using AOAC methods for proximate composition, color, texture, and palatability through a two-bowl free-choice test. The analyzed fiber content ranged from 0.24±0.90% to 3.11±0.50%, while the label values were 2.5 – 5%. The crude protein and fat content of all samples complies with label values of cat diets. Lightness (L^*) ranged from 38.30±0.76 to 45.77±1.89, redness (a^*) ranged from 4.50±0.29 to 7.97±1.19 yellowness (b^*) from 10.00±0.93 to 13.57±0.06. There was no significant difference between the hardness, cohesiveness, gumminess and chewiness ($P>0.05$). Locally manufactured dry extruded cat food was coated with poultry and fish oil at 6%, 8%, and 10% levels. The 10% poultry oil-coated sample showed significantly higher acceptance than 10% fish oil-coated sample ($P<0.05$). The fat percentages of fish oil-coated sample (12.16±0.05) and poultry oil-coated sample (12.07±0.05%) were approximately equal ($P>0.05$), with no impact on texture and color ($P>0.05$). In conclusion, incorporating poultry oil at 10% enhanced the palatability of locally manufactured extruded cat food compared to fish oil without affecting its nutritional integrity, texture, or color. These findings highlight the importance of selecting appropriate fat sources.

Keywords: Dry extruded cat food, fat sources, nutritional value, palatability, physical qualities

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Sensory, physicochemical and textural properties of fresh cheese dips incorporated with lentil powder (*Lens culinaris*)

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This study focused on developing a fresh cheese dip incorporated with lentil powder (*Lens culinaris*) to create a nutritious alternative to traditional cheese dips. Three different formulations were created by adjusting the ratios of cheese and lentil powder. The first formulation contained 30 g of cheese and 15 g of lentil powder. In each subsequent formulation, the cheese content was decreased by 5 g, while the lentil powder was increased by 5 g. These three formulations were evaluated for physicochemical, textural and sensory attributes. A well-structured questionnaire, incorporating a 9-point hedonic scale, the Just About Right (JAR) test, and the Check-All-That-Apply (CATA) test, was administered to 30 untrained panelists to assess consumer acceptability. Multivariate statistical analysis was conducted using XLSTAT software. For texture and physicochemical analysis, a Texture Analyzer (TX-700) was employed, following the guidelines established by the AOAC (2000 and 2005) methods. Sensory results indicated that the cheese dip formulation with 30g cheese and 15 g lentil powder showed the highest overall liking ($P<0.05$). The sample containing 15 g of lentil powder exhibited the highest values for moisture content (65.39±0.36%), crude protein (16.42±0.41%), crude fat (11.63±0.42%), ash (3.75±0.40%), and total soluble solids (46.57±0.01%) ($P<0.05$). Conversely, the sample containing 25g lentil powder showed the highest crude fiber (2.71±0.11%) and pH (6.86±0.01) levels ($P<0.05$). Textural analysis showed that higher cheese content resulted in a softer, more cohesive texture, whereas increased lentil content led to a firmer texture ($P<0.05$). During 14 days of storage, all samples showed a significant decline in pH, moisture, lightness (L^*), yellowness (b^*) and redness (a^*) alongside significant increases in acidity and hardness ($P<0.05$). Overall, varying cheese-to-lentil ratios significantly influenced the sensory, physicochemical and textural properties of the fresh cheese dip added with lentil powder, demonstrating its potential as a nutritious and innovative alternative to conventional cheese dips.

Keywords: Fresh cheese dip, lentil powder, physicochemical, sensory, textural

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Evaluation and comparison of physicochemical and sensory properties of curd stored in different container types during refrigerated storage

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The buffalo curd known as *Meekiri*, is a fermented dairy product that is integral to the culture and traditions. While clay pots remain the traditional packaging, some producers are transitioning to plastic containers upon easiness, durability and convenience. This research aimed to investigate the impact of container type of curd (clay pot vs. plastic cup) on physicochemical and sensory properties during refrigerated storage. Curd was prepared by inoculating 5% of curd starter culture into pasteurized buffalo milk, incubated and set in clay pots and plastic cups. The physicochemical properties of curd were measured at weekly intervals during 21 days of storage. A sensory evaluation was conducted to assess the sensory attributes of the curd samples. The results revealed that in refrigerated storage, curd in clay pots exhibited a notable pH decrease between day 14 and 21. In contrast, pH in curd stored in plastic cups showed a rapid drop between day 01 and day 07, followed by stabilization between day 14 and 21. The variations in syneresis became more noticeable over time, with clay pot, yielding lower syneresis values at day 21 (P<0.05). Titratable acidity remained stable throughout the study. There were no significant differences observed both in whiteness *(L*)* and yellowness *(b*)* between either of the containers. Texture analysis revealed that curd stored in clay pots consistently exhibited higher hardness and lower adhesiveness compared to plastic cups (P<0.05). The cohesiveness of curd stored in both clay pots and plastic cups did not show any significant differences *(*P<0.05) over time. Sensory analysis revealed that curd stored in clay pots had improved texture (7.45±1.09) and aftertaste (7.25±1.35) compared to curd stored in plastic cups. The same observation was reported in all sensory attributes tested. Results conclude that curd stored in clay pots have better physicochemical and sensory properties than those stored in plastic cups in refrigerated conditions.

Keywords: Buffalo**,** clay pots, curd, plastic cups, sensory

Evaluation of reproductive performance and preweaning mortality rate of sheep reared in a large-scale government farm in Puttalam district, Sri Lanka

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This study aimed to evaluate the selected reproductive performance and survival rate of sheep reared in a large-scale government farm located in the Puttalam district of Sri Lanka, where natural mating was practiced in a semi-intensive management system. Data on 2903 red madras sheep were collected from birth and herd register records between 2017 to 2024. Descriptive statistics was used to analyze the reproductive performance and pre-weaning mortality rate, while the General Linear Model Univariate procedure using SPSS (Version 26) was used to determine the factors affecting the birth weight of lambs. The fixed factors considered were birth year, birth month, sex, and birth type. The overall mean for lambing interval, birth weight of lamb, litter size, sex ratio, and twining percentage for sheep were 370.28±12.72 days, 2.08±0.01 kg, 1.01, 1.14, and 1.46%, respectively. The overall preweaning mortality rate was 22.08%. The birth year, birth month, and sex had a significant (P<0.05) effect on birth weight, while there is no statistically significant (P>0.05) effect between birth weight of lamb and birth type. The highest birth weight was found in 2021 (2.31±0.01 kg), while the lowest birth weight was found in 2023 (1.93±0.01 kg). Male lambs had a significantly lower (2.08±0.01 kg) birth weight than female lambs (2.09±0.01 kg). The preweaning mortality rate had a significant (P<0.05) association to birth year, sex, and birth type. The reproductive parameters indicate stable productivity, while the preweaning mortality rate suggest potential areas for management improvement. Also, the significant variations in birth weight highlight the influence of environmental and genetic factors.

Keywords: Puttalam district, reproductive performance, sheep, survival rate

Economic insights into cost structures, revenue streams, and net profit of small-scale cattle farms in Northern Sri Lanka

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Small-scale cattle farming plays a vital role in Sri Lanka's rural economy, particularly in the Northern Province. However, research on its economic viability, specifically in terms of net profit analysis, remains limited. This study provides an initial economic assessment by analyzing the cost structure, revenue sources, and net profit of small-scale cattle farms in Northern Sri Lanka on an annual basis. A multistage sampling technique was employed to select sixty small-scale cattle farms. Primary data were collected through structured interviews using a pre-tested questionnaire. Statistical analyses, including descriptive statistics, multiple linear regression, and non-parametric tests, were conducted using IBM SPSS 26 software. Results of descriptive statistics showed that 63.3% of farmers were male and 36.3% were female. Further, findings indicated that the feed cost accounted for the largest proportion of total expenses (83.6%), while milk sales were the primary revenue source (94.4%). Despite variability in net profit among farms, 90% of the farms reported positive annual net profit, suggesting the small-scale cattle farming in this region is economically beneficial. The best fitted multiple linear regression model ($R^2 = 0.992$) revealed that total revenue had a strong positive effect on net profit, whereas feed cost had a strong negative impact. Additionally, gender showed a significant ($P<0.05$) influence on net profit, while education and experience showed no significant ($P>0.05$) influences on net profit. Mean rank of net profit indicated that the male farmers generally exhibited higher annual net profit than female farmers. Since this study offers a preliminary overview rather than an in-depth economic analysis, its findings provide a valuable starting point for understanding the economic aspects of small-scale cattle farming in the Northern Province by serving as a foundation for future research.

Keywords: Cost structure, net profit, Northern province, revenue streams, small-scale cattle farming

Acknowledgement: Authors acknowledge the valuable contributions of provincial director, provincial veterinarians, and officials from the Provincial Department of Animal Production and Health (DAPH) for their assistance in this research.

Development of frozen yoghurt bites incorporated with roasted chickpea (*Cicer arietinum*) powder

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This study aimed to develop novel frozen yoghurt bites by incorporating roasted chickpea powder and to evaluate the effects of varying chickpea powder concentrations on the texture, proximate composition, and sensory properties of the product. Three formulations were prepared by varying chickpea powder levels: 1.5%, 3%, and 4.5% (w/w) respectively. The samples were stored at a temperature below -18°C after preparation. Proximate composition was analysed according to the AOAC methods. The total solid, ash, and fibre significantly increased with increasing roasted chickpea powder concentration, while moisture content and titratable acidity decreased ($P<0.05$). With increasing roasted chickpea powder concentration, the protein content and pH increased, and the fat content decreased, but the changes were not significant ($P>0.05$). Textural analysis demonstrated a significant increase ($P<0.05$) in hardness, chewiness, and gumminess with higher chickpea concentrations. The meltability was significantly affected by the addition of roasted chickpea powder. Increasing the concentration of roasted chickpea powder reduced the first dripping time and melting rate, improving the stability of the product. Colour analysis revealed a decrease in lightness (L^*) and an increase in redness (a^*) and yellowness (b^*) with increased chickpea content. Sensory evaluation using a 9-point hedonic scale showed no significant differences between samples ($P>0.05$). However, the 1.5% chickpea-fortified sample received the highest mean scores across all attributes, particularly in flavour (7.63±0.85) and overall acceptability (7.60±0.97). This study concludes that the 1.5% inclusion of roasted chickpea powder in frozen yoghurt bites results in a consumer-preferred frozen dairy snack, with the potential for further improvements in future studies.

Keywords: Chickpea, frozen yoghurt, proximate composition, physicochemical properties, texture

Impact of housing conditions and cow welfare on milk production in Sabaragamuwa province, Sri Lanka

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Milk production in Sri Lanka is affected by a variety of factors, with housing conditions and cow welfare arguably being predominant among these. Despite the importance of these variables, limited research has studied the effect of housing conditions and also cow welfare on milk production in Sabaragamuwa Province, Sri Lanka. This research therefore evaluated the link between housing conditions, welfare indicators and milk production to fill the gap towards improving dairy farming practices. The primary welfare indicators- lameness, pasture access, and lying space adequacy were incorporated with housing attributes such as flooring design, type of bedding, lighting, ventilation, and cleaning frequency on data gathered from 60 dairy farms. Then, the effects were further analysed statistically to milk yield. Results demonstrated that of all these indicators, pasture access ($P<0.05$), lighting ($P<0.01$), and adequate lying space ($P<0.05$) significantly increased milk production, while lameness ($P>0.05$) did not appear to have any appreciable effect on milk production. Housing conditions like flooring types were also very important, as there was a higher yield observed with dirt flooring ($P<0.05$). The type of bedding ($P>0.05$) also had no appreciable effect on productivity. Poor ventilation and hygiene conditions ($P<0.05$) were also correlated with decreased milk yield. This study emphasizes improvements in housing design and welfare conditions to enhance dairy productivity. Notably, the research introduces a multi-factor approach to analysing both housing and welfare indicators simultaneously, which is uncommon in previous studies. The integration of welfare scoring with milk production data offers a novel perspective in evaluating farm efficiency. Farmers from Sri Lanka's Sabaragamuwa Province can apply these findings to optimize cow welfare and dairy housing so that the productivity of milk becomes more efficient.

Keywords: Cow welfare, dairy housing, lameness, milk production, pasture access

Acknowledgement: The survey was conducted with the support of the Provincial Director of the Department of Animal Production and Health (DAPH), veterinary surgeons, and field officers in the visited Veterinary Surgeon Divisions of the Sabaragamuwa Province, Sri Lanka.

Effect of probiotics and coconut treacle on microbial and organoleptic properties of yoghurt made from cow and goat milk blend

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This study aimed to assess the impact of probiotic *Lacticaseibacillus rhamnosus* GG (LGG) and coconut treacle on microbial and sensory properties of yoghurt made from cow and goat milk blend over 21 days of refrigerated (4-7 °C) storage. Four experimental yoghurt formulations were prepared: (i) fermented with conventional yoghurt starter culture (CYSC) only (Treatment 1), (ii) fermented with CYSC and supplemented with coconut treacle (Treatment 2), (iii) fermented with a combination of CYSC and LGG (Treatment 3), and (iv) fermented with a combination of CYSC and LGG, and supplemented with coconut treacle (Treatment 4). The viability of *Lactobacillus bulgaricus* and LGG was evaluated at weekly intervals. Sensory analysis was conducted after 7 days of refrigerated storage using a semi-trained panel (n= 40). All treatments showed declining lactobacilli counts throughout the storage. The addition of LGG significantly increased the total viable lactobacilli counts. Both probiotic yoghurts (treatments 3 and 4) maintained viable LGG counts of $>10^8$ CFU/g which ensures the delivery of the minimal therapeutic dose of probiotics for any health effect in the host. The addition of coconut treacle had a significant positive correlation with the probiotic viability. The addition of coconut treacle significantly improved the mean scores for aroma, taste, texture, mouthfeel, and overall acceptability of the plain- and probiotic plain yoghurts. Probiotic yoghurt supplemented with coconut treacle showed the highest overall acceptability (8.3±1.3). Correlation analysis of the sensory attributes showed that taste and mouthfeel have a significant impact on overall acceptability. Just-about-right (JAR) analysis showed that the addition of CT improved the responses for just-right categories in both conventional and probiotic yoghurts. In conclusion, results showed that the addition of coconut treacle into cow and goat milk blended yoghurt has a positive effect on probiotic viability and overall sensory properties of the yoghurt.

Keywords: Coconut, dairy, goat milk, *Lactobacillus rhamnosus*, sensory analysis

Nutritional and botanical composition of roadside forage in Sri Lanka as a potential cattle feed source

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Feed scarcity during the dry season presents a significant challenge for smallholder dairy farmers in Sri Lanka, limiting cattle productivity. Roadside forage represents an underutilized resource with potential for cattle feeding. This study aimed to evaluate the yield, nutritional composition, and botanical characteristics of roadside forage across different climatic zones in Sri Lanka. Forage samples were collected from roadside areas in three locations per zone (dry, intermediate, and wet) using quadrat method from December, 2024 to January 2025. Forage yield, species composition, and proximate composition were assessed. Results revealed significant variations in the yield and nutritional quality among climatic zones. Dry matter content ranged from 19.05 to 27.17%, with the highest values recorded in the dry zone. However, dry matter yield was highest in the wet zone (4173.8 kg/ha), followed by intermediate (3239.13 kg/ha) and dry zones (2826.2 kg/ha). Crude protein content varied from 10.74 to 15.40%, with the highest levels observed in the Wet Zone, suggesting better nitrogen availability. Crude fiber content remained relatively stable (30.47 to 35.28%), while crude fat showed minor variations across zones (2.85 to 3.68%). Ash content was highest in the dry zone (12.17%), followed by the intermediate (10.68%) and wet zones (9.27%), indicating grater mineral accumulation in drier conditions. Gross energy content was comparable across zones (14.75 to 14.88 MJ/kg), confirming the suitability of roadside forage as cattle feed source. Botanical analysis identified *Panicum maximum* (Guinea grass) as the dominant species in all zones, comprising 70 to 80% of the total fresh biomass. The findings suggest that roadside forage could serve as an alternative feed source for smallholder dairy farmers across Sri Lanka. Preservation methods such as silage, drying, and pelletizing could improve feed availability during shortages. Further research on seasonal variations in yield, nutritional composition, and digestibility is recommended to optimize utilization strategies.

Keywords: Climatic zones, nutritional composition, *Panicum maximum*, roadside grass, smallholder farmers

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Effect of first parity characteristics on longevity of dairy buffaloes reared in three selected farms in Kurunegala district, Sri Lanka

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The longevity of dairy buffaloes is crucial for the profitability and sustainability of the dairy industry. Understanding causes influencing cow elimination aids in developing effective preventive measures and improving efficiency. This study evaluated the longevity, reasons for elimination, and the impact of first-parity characteristics on dairy buffalo longevity in Kurunegala District, Sri Lanka. Records of 223 crossbred dairy buffaloes, eliminated from three government farms, between 2016 and 2024, were analysed. Longevity was assessed based on herd life (HL), productive life (PL), milking life (ML), and the number of lifetimes calving (NLC). Effects of first-parity traits on longevity were analysed using a Generalized Linear Model in SPSS software. Fixed factors considered included the season of first calving (SFC), farm, age at first calving (AFC), and first lactation milk yield (FMY) and total days in milk during first lactation (FMD). The average HL, PL, ML, and NLC were 4,145±1,184 days, 2,342±1,286 days, 986±711 days, and 5±3 calvings, respectively. Among the eliminated buffaloes, 11.26% died, while 88.74% were culled, primarily due to physical weaknesses (43.24%). Reproductive disorders and unproductivity accounted for 26.13% and 19.37% of culling cases, respectively. A total of 43.95% of cows were eliminated after five or more lactations, while 17.04% were culled after the first lactation. Statistical analysis revealed that HL was significantly influenced by AFC (P=0.03) and SFC (P=0.04), while PL was significantly affected by AFC (P<0.01). ML was significantly influenced by AFC (P<0.001) and FMY (P=0.016). Additionally, NLC (P<0.01) was significantly associated with AFC (P<0.001) and farm management practices (P<0.01). These findings highlight the importance of optimizing first-parity traits and farm management to enhance dairy buffalo longevity and productivity, contributing to industry sustainability.

Keywords: Buffaloes, herd life, Kurunegala, longevity, milking life, productive life

Formulation of low-cost fish feed for table fish using locally available feed resources

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Aquaculture is a rapidly growing sector that significantly contributes to national fish production. It expects to continue its rapid growth in quantity and variety of species and thereby become the primary source of protein in Sri Lanka. The high feed cost is the major constraint to the profitability and expansion of this industry. As a solution, this study was carried out with the objectives of developing two cost-effective fish feeds with two different protein levels to determine their effects on the growth performances of fish. A six weeks of feeding trial was conducted to compare the growth performances of Nile tilapia (*Oreochromis niloticus*) reared on the two newly developed cost-effective feeds (treatment one and treatment two) and a commercial feed (control). A total of sixty Nile tilapia of average body weight of 6.06 g±0.28 were allocated to control and two treatment groups. Apart from the diet all other factors were remained unchanged. The proximate analyses indicated that the crude protein level of the feeds were 30%, 32% and 37% for control, treatment one and two respectively. There was no significant difference (P>0.05) between treatments and control in feed intake. Treatment two group demonstrated the highest final mean body weight, mean weight gain and final mean body condition score (P<0.05). The cost analysis revealed that both developed feeds were more affordable than the commercial feeds. And treatment two was more commercially viable amongst others. These findings reveal that formulating cost-effective fish feeds using locally available resources is feasible and aquaculture farmers can adopt these formulated feeds as viable alternatives to commercial feeds, providing a more affordable and commercially sustainable option for the industry.

Keywords: High protein, fish feed, growth performance, Nile tilapia

Comprehensive quality analysis of pork bacon processed with different smoking techniques

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Smoking is a widely used meat-processing technique that enhances the color, aroma, texture, and overall quality of bacon. This study assessed the effects of different smoking methods (unsmoked control, commercial liquid smoke, and traditional wood smoke) on the proximate composition, sensory, and microstructural properties of pork bacon, with the physicochemical properties evaluated over a 21-day storage period. The analysis of proximate composition revealed that traditionally smoked bacon had the significantly lowest moisture content (47.61±0.33%) (P<0.05), while crude fat, protein, and ash contents remained unaffected across treatments (P>0.05). Sensory evaluation using a nine-point hedonic scale with 30 untrained panelists found liquid-smoked bacon to be the most preferred, scoring the highest in color (7.83±1.02), aroma (7.83±1.02), texture (7.97±1.13), taste (8.17±0.75), and overall acceptability (8.20±0.76). Over storage, water holding capacity (WHC) declined in all samples, with traditionally smoked bacon retaining the highest WHC (13.50±0.21%) compared to other treatments, indicating structural changes that enhance moisture retention. Traditionally smoked bacon had the lowest mean pH (5.89±0.02) throughout storage and maintained a more stable pH over time. Color analysis showed that redness (a*) was more intense in liquid-smoked bacon, with significant differences observed in the second week (P<0.05). Textural analysis during storage showed that both smoking methods significantly reduced hardness and chewiness compared to the control (P<0.05), indicating that smoking improves bacon's textural properties. Scanning electron microscopy (SEM) analysis revealed a denser structure in control bacon, greater fiber disruption in liquid-smoked bacon, and smoother surfaces with globular structures in traditionally smoked bacon. In conclusion, liquid smoking enhanced color and sensory appeal, while traditional smoking improved WHC, with both techniques enhancing textural properties, making them effective for optimizing bacon quality.

Keywords: Bacon, liquid smoke, quality analysis, smoking methods, traditional smoke

Author Index