



PROCEEDINGS

of the
10th Undergraduate Research Symposium
UReS 2023

**“Food and Health Innovations
Towards Circular Economy”**

**Faculty of Livestock, Fisheries and Nutrition
Wayamba University of Sri Lanka**



6th March 2024

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**Proceedings of the
Tenth Undergraduate Research Symposium
UReS 2023**

“Food and Health Innovations Towards Circular Economy”

Organized by the
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

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Tenth Undergraduate
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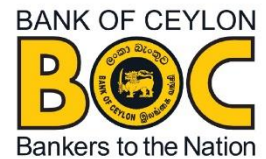
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UReS 2023

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FOREWORD

It is a great pleasure for me to write this Foreword to the e-Proceedings of the Tenth Undergraduate Research Symposium (UReS 2023) of the Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka. The UReS creates a better platform for the undergraduates to present their up-to-date, high-quality and original research findings in academic disciplines of food science, human nutrition, and food production and technology management, to a wider scientific community giving an ideal opportunity for networking with researchers, academics of universities and industry partners. This great event will also provide an opportunity for undergraduates to open the path for their future careers and further studies.

The tenth UReS is themed “Food and health innovations towards circular economy” and the e-proceedings consists of 156 abstracts of research conducted under the two-degree programmes; Food Science & Nutrition and Food Production & Technology Management, covering the fields of Food Science and Technology, Applied Nutrition, Livestock and Avian Sciences and Aquaculture and Fisheries. Academics and undergraduates have been creatively and effectively involved in research in casting their image in the research arena. Each abstract was reviewed by the student’s supervisor/s and the members of the editorial board who were appointed from each discipline. The faculty has well recognized its social responsibility of promoting scientific research and innovation. In this connection, the faculty has added novel feature of “Felicitation of Academic Research Excellence” and “Award for the Best Undergraduate Inventor” to the symposium programme in 2023. Such appreciation would encourage the new generation as well as academics towards excellence in research and innovations.

I take this opportunity to convey my sincere thanks to Senior 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 for the valuable support and guidance given in organizing UReS 2023. I extend utmost gratitude to Dr. H.P. Gunawardena, the Coordinator of UReS 2023 for the untiring effort made to make this event a great success. The success of the e-proceedings is primarily built on undergraduate researchers who did outstanding research work and published their abstracts, and their supervisors who have guided these youngsters to conduct scholarly work. At this moment, I congratulate all of them for their high caliber research work.

I express my gratitude to all the members of the organizing committee/ UReS 2023, all the members of the editorial committee and the postgraduate students of the faculty for their continuous support extended in compiling the e-proceedings. On behalf of the editorial board, I wish to thank all the academic and nonacademic staff of the faculty who assisted in numerous ways for successfully compiling the e-Proceedings of the Tenth UReS-2023. I congratulate and appreciate all undergraduate researchers who publish their abstracts in the symposium e-proceedings.

Mrs. A.M.N.T. Adikari
Editor-in-Chief/UReS 2023
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

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Message from the Vice-Chancellor

It is my great pleasure to write this message for the e-Proceedings of the Undergraduate Research Symposium (UReS 2023) organized for the tenth consecutive time by the Faculty of Livestock, Fisheries & Nutrition of the Wayamba University of Sri Lanka, under the timely theme “*Food and Health Innovations Towards Circular Economy*”.



It is a pleasure to see indeed that the abstracts of 156 final year undergraduate students of the B.Sc. Honors in Food Science and Nutrition and B.Sc. Honors in Food Production and Technology Management will be published which can be treated as a great achievement compared to the last year.

As a Faculty that is dealing with the research in the fields of Human Nutrition, Food Science and Technology, Aquaculture and Fisheries, and Livestock and Avian Science and many more, it is the Faculty's vested responsibility to dissemination of knowledge and being innovative through research findings in the above disciplines tackling the societal issues. I expect that the research undergone by the undergraduates will have an impact on the search for solutions in this context.

I would like to take this opportunity to appreciate the efforts of the Dean, Heads of the Departments and all the academic and academic support staff and all the non-academic staff and also the UReS organizing committee of the Faculty for their unwavering support and contribution to a fruitful symposium. Also, I take this opportunity to congratulate the undergraduates on their achievement of this final component of their academic career.

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

Message from the Dean

With immense pleasure, I would like to send my greetings along with this message to the Tenth Undergraduate Research Symposium (UReS) 2023 of the Faculty of Livestock, Fisheries and Nutrition. UReS, the most splendid annual event of the faculty, is a platform for final year undergraduates to showcase their innovations, inventions and high order academic skills and experiences. This would offer undergraduates the opportunity of networking with researchers and academics from universities and industries.



The tenth UReS is themed “Food and health innovations towards circular economy” and more than 156 research papers covering the fields of Applied Nutrition, Aquaculture and Fisheries, Food Science and Technology and Livestock and Avian Sciences will be presented in the technical sessions.

In recognizing the social responsibility of promoting the scientific research and innovation, this time faculty added a novel feature of “Award for Best Academic Researcher” in addition to the “Award for Best Student Inventor” to the symposium programme in 2023. It is expected that such appreciations would encourage the undergraduates and academicians towards research and inventions.

On behalf of the Faculty, I would like to congratulate all authors who are presenting at the symposium today and extend my gratitude to the supervisors and other collaborators of research work. I would like to acknowledge the organizing committee of UReS 2023, academic and non-academic staff members, our sponsors, and all those who worked hard to make this event a reality.

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 Tenth Undergraduate Research Symposium (UReS) 2023: “Food and Health Innovations towards Circular Economy” organized by the Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka. I expect UReS 2023 would create an ideal platform for the final year undergraduates of the faculty sharing their novel findings, innovations and inventions with a wider and distinguished scientific audience.



On behalf of the organizing committee, I wish to take this opportunity to acknowledge, Senior Professor Udith K Jayasinghe, Vice-Chancellor, Wayamba University of Sri Lanka and Professor Gamika A Prathapasinghe, Dean, Faculty of Livestock, Fisheries & Nutrition, for providing continuous encouragement and timely advice for organizing the event. I extend my gratitude to Dr. Harsha Subasinghe, Chief Executive Officer of CodeGen International, for accepting our invitation to deliver the keynote speech and inspiring the budding scientists. I also congratulate Professor G.A.P. Chandrasekara felicitated for her research excellence and Mr.J.K.A.S. Jayawardena for winning the Best Student Inventor Award 2023.

I wish to thank the academia of the faculty and the external supervisors for creating the interest in research of final year students and guidance throughout. I extend my gratitude to the judges for accepting our invitation to evaluate the research presentations. I would like to acknowledge the generous contributions of our sponsors. I express my profound gratitude to members of the UReS 2023 Organizing Committee, Dr H.A.C.K Jayathilake, Director, Information and Communication Centre, Makandura and his team, Assistant Registrar and all non-academic staff of the faculty for assisting the organizing committee in various ways to make this event a great success. Finally, I highly appreciate the hard work and dedication of final year students who are disseminating novel knowledge and technology generated by their research work at this symposium. While congratulating all the presenters, I wish the 10th UReS a great success.

Dr (Mrs) H.P. Gunawardena
Coordinator, UReS 2023
Faculty of Livestock, Fisheries and Nutrition
Wayamba University of Sri Lanka

Keynote Address

Food and Health Innovations towards Circular Economy

By

Dr. Harsha Subasinghe

Chief Executive Officer, CodeGen International

Humanity has a profound relationship with food. Food ensures our survival and it is a part of our identity. Food gives us pleasure and adds color to our cultures worldwide and therefore become the centerpiece of celebrations and festivities. Our current food production and consumption has various drawbacks. Twin scourges of malnutrition and obesity are at the front row. There are negative impacts created by the food production and disposal methods on the society and the economy.



Healthy food system can be accomplished by reforming our food production methods, designing food products and proper handling of its byproducts. Thus circular economy enables the healthy food system as it promotes the natural regenerative system. Industry can produce food to minimize the waste while consumers can be educated on healthy food choices. Food companies can design and market healthier food products.

Regenerative agriculture ensures high quality food production that improves the natural ecosystem. As significant proportion of food is wasted during processing, it is essential to initiate proper storage methods to minimize the spoilage, offer the soon-to-expire food at low prices and return the inedible byproducts to soil as organic fertilizers. By products can be turned to medicines, bioenergy or new products. Bio-economic hubs can reform the food byproducts to the reusable materials.

Designing the novel healthier food products and improving the exiting products can be an integral part of circular economy. It helps to develop wholesome and nutritionally balanced food products through effective processing methods. When the multiple food manufacturers in the community are linked for designing and marketing healthy food products, benefits will be shared among all. In making the novel food and health inventions, use of technology such as AI would be of great importance.

Health inventions and innovations of this digital era would help to create entrepreneurs and bring reforms to the existing healthcare systems for better performance. Digital solutions would aid the community to attain better health outcomes and ensures the access to standardized care.

In adjourning the unravelling march of non-communicable diseases, healthy and nutritious food supply is vital. Consumer education and awareness, dedication of food industry towards healthy and safe food production and community would enhance the circular economy. With a circular economy of food and health innovations may improve the access to nutritious food, combat the climatic changes, supports the community and create value.

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Department of Applied Nutrition

Assessment of adolescent's behavior on fruits and vegetables consumption in rural areas of Jaffna, Sri Lanka

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Regardless of importance of fruits and vegetables and nutrient composition, their consumption is still below the recommended level in Sri Lanka, including adolescents. The main objective of this study was to identify the Individual, Social and Physical environment factors affecting Fruits and vegetable acquisition, preparation and consumption behaviors among adolescents in rural areas of Jaffna Sri Lanka. A total of six Focus Group Discussions (FGDs) with 6 participants each were conducted recruiting school adolescents. The participants were both male and female aged 14- and 15-years and they were recruited from rural areas of Jaffna districts. The recorded discussions were transcribed into English and analyzed using the qualitative research data analysis software, NVivo after establishing the question-based themes. Study findings showed that adolescents' behaviors on fruits and vegetable consumption are affected by individual social macro and physical environmental factors. Adolescents' behaviors on fruit and vegetable consumption were affected by their taste preference for fruits and vegetables, color and aroma, knowledge about health benefits of fruits and vegetables, family influence, knowledge about new recipe and information about fruits and vegetables received from media. The overall study concluded that adolescents' fruit and vegetable consumption behaviors are influenced by individual, social, macro, and physical factors. Proper nutritional awareness programs need to be conducted considering the factors mentioned by the adolescents to improve the fruits and vegetable consumption of adolescents.

Keywords: Adolescents, barriers, consumption, focus group discussion, fruits and vegetables, qualitative study

Determining the breakfast eating patterns of preschool-aged children in an urban area of Sri Lanka

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The double burden of under and over nutrition, experienced by children in urban locations together with an increase in micronutrient deficiencies may be potentially linked to unhealthy dietary patterns, such as skipping breakfast. Childhood malnutrition is a public health threat in Sri Lanka. Breakfast eating patterns of young children in Sri Lanka have not been primely investigated in diet-related studies. Therefore, this study explored the breakfast eating patterns of urban living Sri Lankan preschool children. A cross-sectional study was conducted with a convenience sample of 215 primary caregivers of preschool children aged 3-5 years in Galle District, Southern Province, Sri Lanka. Demographic and socio-economic factors, breakfast eating patterns, food choices, meal times, Dietary Diversity Score (DDS) and the knowledge, and attitude, of primary caregivers on their child's breakfast eating patterns (using 24-hour dietary recall and an interviewer-administered questionnaire) were assessed. According to breakfast intake regularity, three dietary patterns were identified. Around 87.9% of children were regular breakfast consumers, followed by regular liquid only consumers (6%) and irregular breakfast consumers (5.6%). Four food combinations were found in preschool children's breakfast. Consuming rice plus fish plus a vegetable (80%) is identified as the most common food combination. Children had a mean DDS of 6.56 ± 0.49 out of 7, with most (55.8%) belonging to the score of 7 (56%). Breakfast eating pattern scores differs with parent/caregiver's level of education. While the knowledge scores of caregivers differ with their age, level of education and household income. The attitude scores of caregivers differ with their level of education. The knowledge scores showed a positive significant relationship with the breakfast eating pattern score. Findings highlighted the possibility of improving the primary caregiver's knowledge on breakfast would make positive breakfast eating patterns in urban living preschool children. Future studies in other locations are necessary to attain a comprehensive national perspective.

Keywords: Attitude, breakfast eating patterns, dietary diversity, knowledge, primary caregiver

Validating 24-hr recalls and weighed food records among female adolescents

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Adolescence is a critical period marked by significant physical, sexual, cognitive, and emotional changes. Malnutrition and micronutrient deficiencies pose significant risks during adolescence, potentially leading to adverse health outcomes that persist into adulthood. In this backdrop, identifying the dietary patterns and behaviors of adolescents and accurate measurements of their dietary intakes are vital. Hence, the objectives of this study were to assess the relative validity of weighted food records and multipass 24-hour recalls and to understand the challenges and opportunities for the aforementioned dietary assessment techniques among a group of female adolescents aged between 13-17 years old (n=22) from Muslim communities in Mathale and Kalpitiya. The locations were selected based on the convenience of data collection and adolescents were approached through schools. The dietary intake of the consented adolescent participants was assessed using two methods; Weighed Food Records (WFR) and phoned based 24 hour recalls (P24HR). The WFR was taken on a preselected day by one enumerator and the P24HR recall was taken the next day by another enumerator. Equivalence of nutrient intakes was tested using Food Base 2000 and SPSS software. The descriptive analysis was done to identify the mean values of nutrients consumed by the adolescents. Wilcoxon test and correlation test were carried out to identify the mean difference and strength. For macronutrients including Fat, Protein, and Carbohydrates reported, no significant differences between the two methods (p-values: 0.28, 0.76, and 0.87 respectively). The analysis shows slight differences in macro and micronutrient levels between the two assessment methods. Energy, carbohydrates, fat, and other micronutrients (Ca, Zinc, Iron, Vitamin B₆, Vitamin B₁₂, Vitamin C, and Vitamin A) showed a strong association between the two methods. While Protein shows moderate association which indicates some inconsistency in protein measurements. The comparable validity of WFRs and multi-pass 24-hour recalls provides adaptability in dietary assessments, but with addressing inherent challenges and opportunities.

Keywords: Adolescents, dietary assessment, 24-hour recall, relative validity, weighed food records

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Assessment of adolescents' behavior on fruits and vegetables consumption in rural areas of Anuradhapura, Sri Lanka

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Adolescence is a critical period of physical, cognitive, and social development that requires appropriate healthy diets. Despite the Sri Lankan Food Based Dietary Guidelines recommending the consumption of two vegetables, one green leafy vegetable, and two fruits per day, the daily intake of fruits and vegetables (F & V) among adolescent remains well below the recommended levels. Therefore, this study aimed to identify the individual, social, physical and macro system factors affecting F & V acquisition, preparation, and consumption behavior among adolescents in rural area of Anuradhapura, Sri Lanka. Focus Group Discussions (FGDs) (n= 06) were conducted in secondary schools (n=06); involving a total of 48 adolescents (n=24 males and n=24 females) aged between 14-16 years in Anuradhapura district. According to the deductive thematic analysis, several factors such as individual, social, physical and macro system influenced the F & V acquisition, consumption behavior and preparation of adolescents were investigated. Among them, personal preferences (individual factor), family influence (social factor), and marketing and media influence (macro system factor) are the most inflectional factors on the acquisition, consumption behavior, and preparation of F & V. Availability (physical factor) is the most influential factor for F&V acquisition and consumption behavior, while getting opportunity (physical factor) is the most influential factor for F&V preparation. Understanding above factors is crucial for planning targeted interventions aimed at promoting F & V consumption among adolescents in rural settings in Sri Lanka.

Keywords: Adolescence, consumption behaviors, factors, fruits and vegetables, rural

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Determining the patients' satisfaction with hospital diets

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The provision of diet to in ward hospital patients free of charge is a core component of the Sri Lankan health care system. However, patients' satisfaction, with hospital diets may affect food intake and recovery. Therefore, exploring the gaps that exist between patients' perceptions and expectations may improve the quality of dietary services not only to maximize patient satisfaction but also to aid in speedy recovery from illness. Hence, this study was conducted to determine patient satisfaction with hospital diets with the ultimate goal of improving menu planning and the food delivery process. A cross-sectional study was conducted among in ward patients in a selected government hospital located in the Kegalle district. Patients were selected after obtaining informed consent by excluding pediatric, psychiatric, and intensive care unit patients. The patients' information and satisfaction on hospital diets/food concerning amount of food served, taste, appearance, smell, variety of food, time of food served, temperature of serving meals, portion sizes of foods, having favorite food, cleanness of the equipment and hygienic condition of foods were collected by using a pre-tested interviewer-administered questionnaire. The data was analyzed by using simple descriptive statistics while the satisfactory level was demeaned by the responses of "yes" and "no" options. A total of 100 including both male and female in ward patients, age ranged from 21 to 74 years was in the study sample. Patient satisfaction on selected attributes of the provision of diet was shown the lowest satisfaction was observed regarding the taste (24%), timeliness of serving (46%), cleanliness of foods when served (56%), and presentation/appearance of food (57%). According to the study, patients were less satisfied with the taste, serving portion, timing, and temperature of food serving. Implementing interventions related to processes and providing diets according to patients' preferences can enhance their level of satisfaction.

Keywords: Hospital diets, malnutrition, patients, preferences

Ethical clearance was sort from the ethics review committee Faculty of Livestock, Fisheries and Nutrition of Wayamba University of Sri Lanka (Application No: 202312H22).

Acceptability, likability, and potential usability of smart devices to track and improve food choices among female adolescents

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Adolescence is a critical period of growth and development hence, nutritional needs during this time are heightened. Nevertheless, healthy food consumption is sub-optimal for many female adolescents in low- and middle-income countries, creating a need to better record and track the food choices of this group and also to influence their food choices to reflect healthier options. In this backdrop, Nudging for Good is an AI-driven diagnostics and behavior change initiative to improve diets and nutrition targeting a smartphone-based application named Food Recognition Assistance and Nudging Insights (FRANI) for diet assessment for the adolescent population in Sri Lanka. Since digital technologies for dietary assessment are becoming more popular at present, it's important to investigate their acceptability in contrast to conventional dietary assessments. This study evaluates the acceptability, likability, and usability of smart devices (FRANI Smartphone application) among 81 Sri Lankan adolescent girls aged 13 to 15 in Muslim communities around the Matale and Kalpitiya areas. Using a qualitative approach, 10 in-depth focus group discussions explored the accessibility, likability, and usability, highlighting participant attitudes toward technology for healthier eating. Results uncovered shared smartphone trends, rural disparities, and challenges in dietary tracking, such as family resistance and cultural considerations. Understanding user autonomy dynamics and support preferences, the study identified diverse motivations for app adoption, meal planning, and goal-setting attitudes. Usability insights emphasized essential app features, including transformative potential, gamification, and privacy safeguards. Positive inclinations toward meal photos and daily feedback underscored their motivational impact on dietary patterns. The study concluded that emphasizing challenges and preferences and advocating for tailored, user-centric interventions, may help popularize digital-based smart devices among this population. Further research is warranted to examine the feasibility of implementing this technology at scale and to explore its long-term impact on dietary behaviors.

Keywords: Female adolescents, food photos, food recognition, smart devices

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Association of adiposity with blood pressure in adolescents aged 17 – 18 years

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The surging prevalence of adolescent obesity has become a paramount concern due to potential health implications including elevated blood pressure and a higher risk of cardiovascular disease in later adulthood. This cross-sectional study aimed to investigate the association between adiposity with blood pressure in adolescents aged 17-18 years. A total of 300 adolescents (150 males and 150 females) aged 17-18 years (mean age \pm SD, 17.7 \pm 0.4 years) were recruited from selected schools in Gampaha, Kurunegala and Puttalam districts in Sri Lanka representing both urban and rural sectors. Body composition was assessed using a multi-frequency body composition analyzer (TANITA MC-780). Blood pressure measurements were obtained using a clinical blood pressure monitor. A 24-hour recall and a short version of the international physical activity questionnaire were used to assess adherence to Food Based Dietary Guidelines (FBDGs) and energy expenditure from physical activity, respectively. The association between adiposity and blood pressure was evaluated using the Spearman Rank Correlation test. The prevalence of obesity and overweight among the study population was 11.3% and 4.7%, respectively. Mean \pm SD systolic and diastolic blood pressure levels in the study sample were 118 \pm 13.5 mm Hg and 75 \pm 10.7 mm Hg, respectively. The prevalence of elevated blood pressure, stage 1 and stage 2 hypertension were 19.0%, 11.7% and 7.0%, respectively. The findings only showed a significant positive correlation with adolescents' visceral fat level and systolic blood pressure ($r=0.303$, $P=0.001$). The adherence to vegetables, fruits, eggs, nuts and oily seeds was lower than the recommended intake of Sri Lankan FBDGs. In conclusion, the visceral fat level was associated with systolic blood pressure in adolescents aged 17-18 years, which underscores the importance of further studies and early intervention with lifestyle modifications to address excess adiposity-related health concerns in adolescents.

Keywords: Adiposity, adolescents, blood pressure, birth weight, visceral fat

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Metabolic elevation through Soleus Push up: an exploration of prolonged energy expenditure during sedentary behavior

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The purpose of this study intended to investigate the ability of soleus push-ups, an ordinary isotonic exercise which performs while sitting, to enhance energy expenditure and improve metabolic health during sedentary behavior. This study aimed to determine the metabolic elevation achieved by soleus push-ups in improving insulin sensitivity among sedentary individuals and to examine the influence of soleus push-ups on blood glucose levels insulin sensitivity, metabolic rates and energy expenditure, building on previous studies that emphasized the soleus muscle's unique potential for prolonged oxidative metabolism. Ten individuals went through a two-hour and thirty minutes intervention with and without soleus push-ups, with the Oral Glucose Tolerance Test (OGTT) and taking consideration of the ethnic-specific Body Mass Index (BMI) criteria for Asian Indians (BMI ≥ 23 kg/m²). Blood glucose levels were monitored at 0, 15, 30, 45, 60, 90, 120 and 150 minutes of time periods, providing insights into glucose tolerance and insulin sensitivity. The findings revealed a significant 22.19% reduction in blood glucose levels in the treatment group compared to the control group. Notably, the results indicated that performing 80-100 repetitions per minute of Soleus Push-ups resulted in this remarkable improvement. The results demonstrate the potential of Soleus Push-ups as an effective intervention that reduces the implications of sedentary behavior, with a 22.19% decrease in post-prandial blood glucose levels. As well as indirectly we can determine that soleus pushups improve insulin sensitivity among sedentary individuals. This study provides beneficial insights into novel techniques to enhancing metabolic health, emphasizing the important role of tailored exercise strategies in sedentary populations.

Keywords: Blood glucose level, insulin sensitivity, OGTT, sedentary behavior

Determinants of muscle function and its association with dietary and lifestyle factors of older adults

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Muscle function is important for the quality of life and ensure the successful aging. However, the older adults undergo a gradual decline in the musculoskeletal system, leading to a deterioration of their muscle function. This cross-sectional study aimed to determine the association of dietary and lifestyle factors with muscle function and compare the muscle function between free-living and institutional older adults. Using convenience sampling method, a total of 200 older adults (free-living-100 and institutional settings-100) aged 65 or over (mean age \pm SD; 72 ± 6 years) were recruited from selected areas in Kurunegala and Gampaha districts. Anthropometric measurements, body composition (skeletal muscle mass), hand-grip strength, and 4-meter gait speed were used to assess the muscle function. Low muscle function was defined as low muscle strength (handgrip strength < 28 kg-men, < 18 kg-women) and low physical performance (gait speed < 0.8 m/s). A single 24-hour dietary recall was used to assess nutrient intake. Multiple linear regression analysis was used to derive determinants. Prevalence of sarcopenia was 1%, while majority had the possible sarcopenia (85%). Majority of older adults had the low muscle function (low muscle strength; 82.5%, low physical performance; 72.5%) and free-living older adults had a better muscle function than the institutionalized older adults. There were significant positive weak associations of protein ($r=0.255$, $P=0.000$), zinc ($r= 0.159$, $P=0.001$), vitamin D ($r=0.218$, $P=0.002$) and vitamin E ($r=0.299$, $P=0.001$) intakes with muscle function in terms of muscle strength and there was a significant positive weak association of vitamin D ($r=0.219$, $P=0.002$) intake with muscle function in terms of physical performance. In conclusion, physical activity was the only significant determinant of muscle function in terms of both muscle strength ($R^2= 0.258$, $P= 0.009$) and physical performance ($R^2=0.190$, $P=0.025$). Engaging in physical activity could be a healthy preventing strategy for proper muscle function of older adults.

Keywords: Gait speed, hand-grip muscle strength, physical performance, sarcopenia

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Assess the level of food wastage in food establishments

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“Food waste” is the discarded food during preparation, plating, consumption, and disposal of unopened packaged food. This cross-sectional study was conducted to estimate the amount of wasted cooked food in food establishments, identify the causes of food waste, and make suggestions to reduce food waste in food establishments. Twenty-three food establishments in urban and semi-urban areas were selected conveniently. Out of the total establishments, 12 were in Negombo, including hotels (3), restaurants (5), and cafeterias (4), and 11 were in Pannala, including reception halls (2), restaurants (5), and cafeterias (4). A pretested interviewer-administrated questionnaire, a face-to-face interview, and observation methods were used to collect information. The amount of wasted cooked food was calculated by dividing the total cooked food waste by the total prepared food. Microsoft Excel 2016 and SPSS 16.0 were used for the analysis of the data. The average daily cooked food waste (kg) in food establishments in urban and semi-urban areas was 26.7 ± 10.1 kg and 26.9 ± 7.4 kg, respectively. The results revealed that cooked food waste in urban areas was higher (30.7%) than in semi-urban (4.4%) areas. Causes for the food waste were overproduction and portioning, plate waste from customers due to over-purchasing, inadequate food storage facilities, and quality control issues when handling. The strategies to reduce food waste were reviewing stores frequently, using plating techniques to serve appropriate portions to customers, and keeping and maintaining daily food waste records. This study concluded the necessity of awareness programs for food establishments to achieve sustainable development targets of decreasing per capita food waste from retail to customer level by 2030.

Keywords: Cooked food, establishments, hotels, urban, semi-urban

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The effect of breakfast eating pattern on body mass index of preschool age children in Sri Lanka

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The nutritional habits established during early childhood play a pivotal role in shaping long-term health outcomes. Studies have linked regular breakfast consumption with improved cognitive function, increased school performance, and a reduced risk of overweight and obesity. This cross-sectional study investigates the influence of breakfast eating patterns on the Body Mass Index (BMI) of preschool-aged children in urban (Galle) and rural (Rathnapura) settings in Sri Lanka. A total of 426 participants, including 211 rural preschool children, 215 urban preschool children, and their primary caregivers, aged 3 to 5 years (mean age 48 months, were enrolled in this study. The investigation involved body height and weight measurements and assessments of breakfast eating patterns through interviewer administered questionnaire and a 24-hour recall. Statistical analyses were conducted to determine the associations between breakfast habits and BMI, as well as to compare urban and rural breakfast patterns. Major four types of breakfast eating patterns were identified: regular solid breakfast eaters, irregular solid breakfast eaters for 4-6 days, irregular solid breakfast eaters for 1-3 days, and regular liquid eaters. The majority (67%) of preschool-aged children (n=211) fell within the normal BMI range according to BMI-for-age z scores (ranging from -0.92 ± 1.19 to 2.62 ± 0.93). Around 67% is regular solid breakfast eaters in normal BMI range. Contrary to expectations, there was no significant effect of breakfast eating patterns on the BMI for age z scores as well as the BMI categories among preschool children. Significant difference in breakfast habits was observed between urban and rural areas. It is imperative to extend this study with multiple locations with a large representative sample to see possible effects of breakfast intake patterns on BMI of preschool-aged children in Sri Lanka.

Keywords: Breakfast, body mass index, preschool children, nutrition, urban-rural disparities

Accuracy of phone based 24-hr recall among females in Sri Lanka: A validation study

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Dietary nutrient intake data for female adults in low- and middle-income countries (LMIC) is limited due to a lack of validation studies for the 24-hour recall method. Phone-based 24-hr recall (P24HDR) method make them a promising approach for dietary assessment, offering cost-effective and convenient data collection methods that can be particularly beneficial in settings like LMIC. The main aim of this study was to determine the validity of P24HDR against the gold standard method of assessing dietary intake, Weighed Food Records (WFR). Thirty female adults in 2 age groups (15 in the 25-35 years and 15 in the 35-55 years) in Monaragala district in Sri Lanka were recruited for this study. Phone-based P24HDR was used to collect dietary data after the WFRs. Then recorded data were converted into nutrients. When comparing nutrient intakes derived from both methods, no statistically significant differences were observed for any assessed nutrients ($P > 0.05$). The study revealed a minimal mean difference of 0.04% for energy, accompanied by a p-value of 0.067 which was not statistically significant. A strong positive linear association was reported with Pearson Correlation coefficients ranging from 0.84 to 0.95 for nutrients such as protein, fat, carbohydrate, calcium and iron indicating strong positive linear associations, reflecting a considerable degree of similarity between the nutrient intake values obtained through both methods. In conclusion, the P24HDR method can be used as a valid tool in assessing dietary intake in female adults in Sri Lanka.

Keywords: Convenient, cost-effective, dietary assessment, low- and middle-income countries

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Feasibility study to design and introduce One-Dish Meals (ODMs) for canteens in Wayamba University of Sri Lanka (WUSL)

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Meals offered at canteens of Universities in Sri Lanka at concession prices are the major source of nourishment for the University community including students during the busy schedule of academic work. However, nutritional and sensory qualities of meals offered are a notable issue in the recent past. The aims of the present study were to develop novel One-Dish Meals (ODMs) with known nutrient content using underutilized vegetables, and to determine their sensory attributes and satiety responses. The current nutrient intake of undergraduates was assessed using one day 24-hour dietary recalls (n=50). Aligning with Sri Lankan Food Base Dietary Guidelines 30 nutritionally balanced ODMs were developed. The sensory attributes and satiety responses of developed ODMs were assessed. The current nutrient intake of students was not in accordance with Recommended Dietary Allowances (RDAs). Intake of energy, protein, and fat were 1991±723 Kcal, 51±20 g and 31±13 g, respectively and were below RDAs. Conversely, carbohydrate intake (402±158 g) surpassed RDA levels for both genders. The sensory evaluation indicated that Waya Chickpea Delight, Waya Peanut Crunch, and Waya Okra Medley meals scored high for sensory attributes and showed satiety responses of 112±67, 118±86, and 106±78, respectively. Further, mean energy, carbohydrate, protein, and fat contents per serving of meals were 689±77 Kcal, 107±11g, 21±5g, and 23±5g, respectively. Notably, developed ODMs fulfilled more than 50% of daily vegetable needs and contributed to a substantial uplift in vegetable consumption among undergraduates. Based on the current food prices cost of a meal was in the range of 120-150 LKR. In conclusion, the positive reception of developed, nutritious, ODMs options by the university community indicates the feasibility of introducing cost-effective meals in Wayamba University canteens. The establishing the developed meals in institutional food sector in Sri Lanka is warranted to achieve nutritional goals of the populations and to maintain sustainable diets.

Keywords: Estimated nutrient content, sensory attributes, satiety responses

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Effect of smartphone-based interventions on lifestyle modification and glycemic control of women with Hyperglycemia in Pregnancy (HIP)

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Hyperglycemia in pregnancy (HIP) is one of the most common pregnancy related health challenge. Effective HIP management involves consistent glucose monitoring and intensive lifestyle modification through creating self-awareness and improving self-care education. Therefore, a non-randomized controlled clinical trial was conducted with the objective of assessing the effect of smartphone-based self-management interventions on lifestyle modification and glycemic control of women with HIP. Forty-five ($n=45$) women with HIP in the age range of 18-45 years were recruited from De Soysa Maternal Hospital for Women and antenatal clinics of Pannala and Kuliapitiya. They were assigned either to receive smart phone based interventions (treatment) for standard care (control) for 15 weeks. The smartphone based interventions included an educational website, educational videos, interactive games and a smartphone application with reminders. The smartphone application particularly facilitated the monitoring of weight gain, plasma glucose level and provided the information on dietary management and adhering to physical activity. Body weight, blood pressure, Fasting Plasma Glucose (FPG), dietary intake, and physical activity levels were assessed at baseline ($t=0$), mid ($t=8$) and end ($t=15$) weeks of each study phase. Mean gestational age of the HIP women was 25 weeks. They had mean pre-pregnancy BMI of 27 kgm^{-2} . There was a significant ($P<0.05$) reduction of FPG observed among the HIP women followed the smartphone based interventions at the end ($t=15$) weeks compared to the baseline and control group. There was a significant ($P<0.05$) reduction of total energy intake of HIP women followed the smartphone based interventions at the end compared to the baseline. A significant ($P<0.05$) rise in physical activity level and dietary modifications might have improved the FPG of HIP women of the intervention group.

Keywords: Diet, hyperglycaemia, pregnancy, physical activity, smartphone-based interventions, self-management

Evaluating and updating existing Sri Lankan food exchange system

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This research aimed to update the Sri Lankan food exchange system, which was originally devised for diabetic individuals in the United States back in 1950 through collaboration between the American Diabetes Association, the American Nutrition Association, and the US Public Health Service. Its primary aim is to enhance dietary planning for diabetics by expanding their food choices. It's a versatile approach that can be adapted to various lifestyles and dietary preferences. The system categorizes foods into six groups, each with similar caloric and nutritional profiles. This is flexible and easy handling tool for planning diet. This system emphasizes portion control to manage caloric intake and maintain a balanced diet. This research involved selecting representative foods from eight distinct categories. The quantities of ingredients were meticulously quantified, and comprehensive data collection was conducted from local bakeries, restaurants, and other pertinent sources. This led to a detailed statistical analysis, revealing discrepancies between the expected and actual values of calories, proteins, fats, and carbohydrates. The study's findings underscore the variance in nutritional content, with notable discrepancies in energy (38.50% increase), protein (16.87% decrease), fat (404.76% increase), and carbohydrates (67.48% increase). These deviations highlight the need for an updated dietary planning approach, especially in the context of Sri Lanka. Discussion points within the study emphasize the pivotal role of technological advancements, particularly Artificial Intelligence (AI)-driven tools, in refining the efficiency and accuracy of dietary planning. This advancement not only benefits nutritionists and diabetic educators but also directly impacts the patients, leading to more precise dietary recommendations.

Keywords: Artificial intelligence, diet planning, food exchange system, nutritional content

Drivers of adolescents' dietary behaviors

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Identifying key drivers influencing adolescents' dietary behavior is crucial to promote healthy food choices and addressing the triple burden of malnutrition. Implementing interventions is most appropriate during adolescence which is a critical life stage. Limited studies have been done related to the perceptions of adolescents on food choices in Sri Lanka. A cross-sectional qualitative study was done to understand the key influences on adolescents' food choices. Ten Focus Group Discussions (FGDs) were conducted with 94 junior secondary students in Gampaha and Kurunegala districts. Perceptions regarding the school garden, school canteen, food outlets in the school neighborhood, and nutrition education were included in the FGD guide. Responses were organized according to the themes and codes created to analyze the data using the NVivo 14 software package. Four levels of influence on students' food choices were determined: individual factors, macro level, physical food environment, and social food environment. Students stated that only a few nutrition-related programs have been conducted in the school. Adolescents prioritize the aesthetics of food presentation over healthy food choices. It was found that adolescents' food choices are primarily driven by personal preferences, peer influence, and the affordability of easily available instant foods at school. School garden also impacts healthy food choices like fruits and vegetables. Media influence and exposure to food and beverage marketing greatly influence food behaviors. Including nutrition-related concepts in the co-curricular, offering nutritious food options in the school cafeteria, establishing policies for food regulation, and monitoring and evaluating the School Food Environment (SFE) should be done to promote healthy food choices. Reforming policies is necessary to improve the accessibility of healthy foods.

Keywords: Perceptions, qualitative, food choices, policies

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Association of adiposity with arterial stiffness in adolescents aged 17-18 years

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Number of adolescents with overweight and obesity are increasing worldwide. Children and adolescents with excess adiposity are at risk of cardiovascular diseases in the future. Excess adiposity can trigger stiffness of the arteries, which is an early sign of cardiovascular diseases and vascular functions. The influence of dietary pattern, physical activity level, and birth weight on arterial stiffness is unclear in the current literature in Sri Lanka. The objective of this study was to determine the association of adiposity with arterial stiffness in adolescents aged 17–18 years. A cross-sectional school-based study was conducted among 300 adolescents (mean age 17.7 ± 0.4 years) including both males ($n=150$) and females ($n=150$) from Gampaha, Kurunegala, and Puttalam districts. Arterial Stiffness was measured in terms of Pulse Wave Velocity by a Pulse Wave Analyzer, Mobil-O-Graph and adiposity was measured by using a multi-frequency body composition analyzer. A 24-hour recall and short version of international physical activity questionnaire were used to assess the Dietary Diversity Score and energy expenditure, respectively. The association of adiposity with arterial stiffness were evaluated using Spearman Rank Correlation test. BMI-for-age z-score was -0.5 ± 0.4 and 11.3% of the study sample was overweight and 4.3% was obese. Mean arterial stiffness of the study sample was $4.7 \pm 0.4 \text{ ms}^{-1}$. Arterial stiffness showed a positive correlation with visceral fat level ($r=0.328$, $P=0.0001$). Dietary Diversity Score (DDS) was calculated using 12 food groups. According to the results, urban school adolescents (9/12) had a higher DDS than rural school adolescents (8/12). In conclusion, visceral adiposity was positively associated with arterial stiffness in adolescents aged 17-18 years. This results support the view that adiposity was a determinant of early vascular aging in adolescents. Overall, these findings could guide specific therapeutic interventions and further studies for young individuals aiming to mitigate the risk of future cardiovascular diseases.

Keywords: Anthropometric assessment, cardiovascular disease, Dietary Diversity Score, Pulse wave velocity

Ethical clearance was obtained from the ethics review committee Faculty of Livestock, Fisheries and Nutrition of Wayamba University of Sri Lanka (Application number: 202311H18).

Development of digital based education resources for women affected with hyperglycaemia in pregnancy (HIP)

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Hyperglycemia in pregnancy (HIP) affect nearly 17% of pregnancies globally. Sri Lankan figures also show definite upward trend. Promotion of self-management education empowers the women affected with HIP in achieving the proper glycaemic control and thereby the profound pregnancy outcomes. Therefore, current study was conducted with the objective of developing digital based education resources to motivate and educate women affected with HIP. This study consisted of three phases as content identification, development of materials and collecting user feedback and face validation. Individual interviews were conducted with fifty-six (n=56) women with HIP. Major themes identified were food consumption patterns, dietary management, physical activity guidelines and blood glucose monitoring. Majority (41%) of HIP mothers recognized their primary source of information as antenatal clinic. Nearly 64% preferred the digital education resources. Considering the perceptions and preferences of women affected with HIP and level of knowledge on key aspects of HIP management, a website, smartphone based app, video series and online games were developed as education resources. Video series focuses on achieving proper glycaemic control using dietary and physical activity management. Videos were incorporated to the website and You Tube channel named as Suwadaru. Mobile application aids the access to all educational tools appeared in the website, video series and games. In addition, app provides the platform for women affected HIP to monitor the progress of their weight gain and fasting plasma glucose. Further, it has the facility to offer sample menus developed based on HIP women's pre-pregnancy BMI and weight gain pattern. It is expected that the developed digital education resources will assist the women with HIP in improving the food and nutrition literacy and good glycaemic control to achieve the better pregnancy outcomes.

Keywords: Digital education resources, hyperglycaemia in pregnancy, mobile application, website

Mapping what adolescents eat: development and validation of a photographic food atlas for adolescents in Sri Lanka

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Assessment of portion sizes is an important aspect of the accuracy of food consumption surveys. A food atlas is a set of photograph series depicting different amounts of a particular food, usually bound together in a single volume that can be used to describe portion sizes. In this study, we aim to develop and validate a photographic ‘Food Atlas’ for adolescents in Sri Lanka. Foods that are commonly consumed by adolescents were identified based on previous local dietary surveys and using a quick checklist with a sample of adolescents. A total of 240 commonly consumed food items by Sri Lankan adolescents were selected for the development of the atlas. For food photographs, all the identified food items were prepared based on a standard recipe book while other items were purchased from recognized restaurants and the local market. All the selected food items were photographed using smartphones. The serial photographs were taken from two angles and portrayed on consecutive pages. For better representation and clarity, two food atlases were developed. A single food atlas (224 food items), and a mixed food atlas (151 food items) were crafted with four portion sizes (small, medium, large, and extra-large) for each food item. The face validity of the developed atlases was evaluated through a series of key informant interviews with an expert panel of dietary survey experts, nutrition scholars, and dietitians. In the expert validation, feedback was received that the food atlases are well organized and portion sizes depicted are adequate. Future research should look into content validation of the aforementioned developed food atlases by evaluating the validity of the portion size estimates using the intended target population of adolescents. These developed food atlases could be greatly useful in future dietary surveys among young populations in Sri Lanka after further testing and validation.

Keywords: Adolescents, food atlas, food photography, Sri Lanka

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The effect of a cereal based functional beverage on patients with chronic gastritis; a pilot study

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Chronic Gastritis (CG) is a common gastrointestinal disease that can significantly reduce the Quality Of Life (QoL) of those affected. The aim of this study was to investigate the effect of a cereal based functional beverage on the QoL of CG patients. A beverage was formulated as a dry powder using a traditional red rice variety and soy milk. Volunteer participants (n=22) who were verified as CG patients following a medical screening were recruited for 10 week study. They were instructed to consume 30 g of formulation as the first meal in the empty stomach at least for 5 days per week continuously for 8 weeks. The stress levels, dietary intake, anthropometry and body composition data were collected at the baseline, 4th week and 8th week of the study. The QoL of the participants was measured using QoL Instruments for Chronic Diseases-Chronic Gastritis (QLICD-CG) questionnaire. The QoL data were obtained throughout the 8 weeks of beverage consumption and 9th and 10th after the discontinuation of the consumption. The results showed that the overall QoL of the participants improved by 38 %. The baseline QoL value of 54% was gradually improved to 75% at the end of 8th week. However, discontinuation of the beverage consumption decreased the QoL value to 69%. The psychological stress and the QoL of the participants were inversely related. There were no significant differences in the anthropometric and body composition measurements due to beverage consumption. Soy milk and whole grain rice contain a number of bioactive compounds that may aid in reducing the inflammation of the gastric mucosa alleviating CG symptoms. It is warranted further in-depth studies to explore the effectiveness of novel formulation as a functional beverage for the dietary management of chronic gastritis.

Keywords: QoL, soy milk, whole grain rice

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Perceptions of teachers and principals on school garden and school food environment in relation to food literacy

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Schools represent a key environment in which children spend a lot of time at school and consume a substantial portion of their daily intake at schools. There is lack of research evidence on educators' perceptions on school food environment and its appropriateness for children's food literacy. Therefore, this qualitative study explored teachers' and principals' views on the current status of school gardens and school food environment in Sri Lanka in relation to food literacy. In-depth interviews were conducted with ten principals and twenty teachers in 10 secondary schools in Gampaha and Kurunegala districts to determine their perceived practices, resources, benefits, and barriers associated with components such as school gardens, nutrition education, school canteens, policies related to nutrition, and social factors. NVivo 14 software was performed to analyse the data. Most of teachers identified healthy food choices as an important nutrition topic. However, nutrition education lacks a specific subject, with concepts dispersed across various subjects, often as elective subjects. This results in a significant portion of students not being exposed to concepts related to food and nutrition. Teachers mentioned that school garden is effective way to deliver food and nutrition concepts with hands-on experiences. But currently most schools used school garden as an income source. School canteens were not functioning according to the existing school canteen policy due to the children's food preferences and profit oriented marketing of the canteen owners. Most media predominantly focus on promoting processed foods, allocating minimal time in importance of nutritionally balanced foods. Students' dietary attitudes are influenced by their family background and cultural factors, making it challenging to change them. In conclusion, teachers and principals have the perception that school food environment is playing a vital role in enhancing food literacy, but it is not effectively utilized for that purpose. Health educators can use the findings to advocate for and implement school garden programs and improve the current school food environment.

Keywords: Food literacy, principals, qualitative study, secondary schools, teachers

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Determination of sensory attributes, Glycemic Index (GI) values and satiety responses of whole grain functional beverages

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Whole grains are known for rich nutrient content and offer additional health benefits for the prevention and management of non-communicable diseases. This study aimed to determine the sensory attributes, Glycemic Index (GI) values, and satiety responses of novel whole grain instant functional beverages formulated for effective gastritis management and overall health promotion. A sensory evaluation involving 50 untrained panelists was conducted to determine sensory attributes of the beverages formulated with rice alone or rice added with either soy milk or coconut milk in addition to flavouring ingredients such as vanilla, chocolate and cinnamon. Randomized cross-over design was adopted (n=15) in each study for GI and satiety response assessments for four selected beverages, composed of rice alone, vanilla flavoured rice-soy, cinnamon flavoured rice-coconut and vanilla flavoured rice-soy with added sugar. For GI testing, participants ingested 25g of glucose as the reference and test beverage portion with 25g of available carbohydrates. Glucose levels were monitored over 2 hours of capillary blood. The mean GI values of the four tested products varied from 49±31 to 71±19. Satiety responses of four products were determined against a malted beverage providing 25g available carbohydrate. Satiety ratings of participants were recorded every 15 minutes over 2 hours using a 7-point scale. The mean satiety responses varied from 70±66% to 90±46%. In conclusion, all beverage formulations are accepted to varying degree of preference and there is potential to use the novel formulations as suitable dietary options for improving overall health.

Keywords: Coconut milk, gastritis, randomized cross-over clinical trial, soy milk

Acknowledgement: The study was funded by UBL grant No: AHEAD/RA3/WUSL/UBL/OVAA/39

Determination of phenolic content and antioxidant activities of underutilized yams in Sri Lanka

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Yams are widely consumed as a staple food in numerous countries; however, in Sri Lanka, these yams, especially *Dioscorea* species are underutilized. Yams play a key role in diet as they are included in major food groups. They not only provide nutrients but also add variety to the diet. They provide enormous health benefits such as antioxidative, hypoglycemic, hypocholesterolemic, antimicrobial and immunomodulatory activities attributed to bioactive constituents like phenolic compounds. Current studies in terms of their phenolic content and antioxidant activities remain highly unexplored. In this study, fifteen yams mainly of *Dioscorea alata*, *Dioscorea esculenta* and *Dioscorea bulbifera* were studied for their phenolic content and antioxidant activities. Soluble phenolics were extracted from the selected yams which are locally available in Sri Lanka. The extracts were analyzed for their Total Phenolic Content (TPC) and the antioxidant activities were measured by using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (DRSA), Trolox Equivalent Antioxidant Capacity (TEAC), Reducing Power (RP) and Ferrous ion chelating activity (FICA). Among the yams studied, *Ledhantha* (*Dioscorea alata*) showed the highest phenolic content and antioxidant activities compared to *Hingurala* (*Dioscorea alata*) and *Angiliala* (*Dioscorea alata*) yams. Recognizing the health-promoting effects of these yams, as evidenced by their phenolic content and antioxidant activities, is crucial for advocating the optimal utilization of these currently underutilized varieties.

Keywords: *Dioscorea* species, DPPH, RP, soluble phenolics, TEAC

Validating phone-based 24-hour dietary recall against weighed food records among Sinhala male in Sri Lanka

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Accurate dietary assessment method is crucial for understanding nutritional intake of different population groups. Limited studies have focused on validating phone based 24-hour dietary recall (P24HDR) which is easy and low-cost method in Sri Lanka. The aim of this study was to investigate the validity of P24HDR method in comparison to Weighed Food Record (WFR) method which is considered as gold standard method of assessing nutrient intake. A quantitative cross sectional study design was conducted recruiting sample of 30 Sinhala male adults aged 20-55 years from the Matara district using the convenience sampling method. Participants involved in both P24HDR and WFR methods. WFR was performed by one enumerator and P24HDR was conducted on the next day by a different enumerator for each household. Nutrient intake values were identified by FoodBase2000 Software for both methods separately. Statistical analysis was performed by SPSS software. Preliminary results indicated that significant differences ($P < 0.05$) between the mean intake of most nutrients except Fe, vitamin C, and Niacin, as recorded by WFR and the P24HDR methods. Regression analysis showed the statistically significant positive and weak correlations (R value, 0.5-0.9) between the two methods for most nutrients including protein, fat, iron, riboflavin, vitamin B₁₂, B₆, vitamin C, and vitamin E. In conclusion the findings of this study did not support the validation of the P24HDR as a valuable alternative to WFR in assessing dietary intake among Sinhala male adults. Further studies are recommended to conduct on large and diverse populations in Sri Lanka.

Keywords: Accuracy, dietary assessment, dietary intake, dietary recalls, male adults

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Factors influencing adolescents' fruits and vegetables consumption in urban schools

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Adequate intake of fruits and vegetables (F&V) is associated with reducing the risk of developing diet-related disease conditions. Urban populations are more vulnerable to accessing nutritionally rich diets. The stage of "adolescence" is recognized as a crucial period for nutritional requirements for their growth and development. The F&V intake was low among adolescents. This study aimed to identify individual, social, physical, and macro-system environmental factors affecting urban adolescents' F&V consumption. The data were collected using focus group discussions from 48 school children studying in Grades 9 and 10. A total of 6 focus groups were conducted in six educational divisions within the Gampaha district. The qualitative data were extracted by content analysis. It was found that the majority of participants lack awareness about the recommendations of F&V, and their choices prioritize sensory aspects over nutritional considerations. Nearly all respondents had a good understanding of the health benefits associated with the consumption of F&V. Respondents expressed a strong preference for fresh and naturally ripened F&V. Furthermore, adolescents' consumption behavior was significantly influenced by parental beliefs; categorizing certain F&V as "hot," "cold," "good," or "bad". The main suggestions came from adolescents to increase consumption are promoting culinary diversity, ensuring affordable access to fresh and quality products, minimizing chemical usage during production, and seasonal management of F&V. In conclusion, the primary reasons for the low consumption of F&V among adolescents are the low availability of the preferred and fresh form of F&V, high prices, concerns about chemical use in the production process, and unfavorable beliefs about certain F&V.

Keywords: Adolescents, factors, focus group discussions, fruits and vegetables, urban

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Validation of the Visual Analog Scale (VAS) appetite assessment tool for Sri Lankan hospitalized patients

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In hospitalized patients, lack of appetite, or disease-associated anorexia, is the main factor determining insufficient food intake, which increases the length of hospital stay, recovery period of the disease, and hospital food waste. In clinical settings, the Visual Analog Scale (VAS) tool is the most commonly used tool to measure appetite. Currently, there is no validated VAS that can measure the appetite levels of Sri Lankan hospitalized patients. Therefore, a cross-sectional study was conducted to validate the VAS appetite assessment tool against the Functional Assessment of Anorexia/Cachexia Therapy (FAACT) tool, which is considered the gold standard tool. Hospitalized patients who had low food intake, identified from the previously performed Malnutrition Screening Tool (MST) in a private hospital were considered. An interviewer-administered questionnaire was used to collect socio-demographic, health-related information, and reasons for low food intake after obtaining informed consent. An anorexia diagnosis was determined by a total score ≤ 30 in the FAACT, while the VAS score was ≤ 50 mm. Subsequently, both VAS and FAACT tools were administered to each patient separately by two researchers. All statistical analysis was done using SPSS software. Thirty-five patients were identified as having low food intake and selected as study participants (18M: 17F; 58.8 ± 15.2 years). The majority (77%) had a reason for low food intake due to loss of appetite, while other reasons were loss of taste, early satiety, nausea, and vomiting. The prevalence of anorexia among patients, according to the FAACT and the VAS tools was 74% and 69%, respectively. The VAS tool shows good sensitivity (92.3%) and specificity (81.8%), with a positive predictive value of 92.3% and a negative predictive value of 81.8%. The agreement was considered good, as represented by a kappa coefficient of 0.741. In conclusion, the VAS tool is a reliable and validated tool to assess appetite in Sri Lankan patients.

Keywords: Anorexia, appetite, hospitalization, Sri Lanka, validation

Ethical clearance was sort from the ethics review committee Faculty of Livestock, Fisheries and Nutrition of Wayamba University of Sri Lanka (Application No: 202312H23).

Physical activity levels of individuals with type 2 diabetes mellitus

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Physical inactivity has been recognized as major risk factor of global mortality. Physical activity is important for reducing insulin resistance, improving glycaemic control and plasma lipids and reducing the diabetes related complications of diabetes. Understanding the physical activity level of individuals with type 2 diabetes mellitus (IT2DM) is essential for optimizing individualized care and promoting overall well-being. Therefore, the current study was conducted with the objective of identifying the current physical activity levels of IT2DM. Hundred and sixty-eight (n=168) IT2DM in the age range of 30-65 years were recruited in this cross sectional study. Physical activity level of them were assessed using the long version of International Physical Activity Questionnaire (IPAQ). IPAQ scoring protocol was used to categorize IT2DM into low, moderate and high physical activity categories based on their weekly metabolic equivalent of task (MET) value. Socio-demographic information, general lifestyle details and disease history were taken using a general lifestyle questionnaire. Mean duration of diabetes was 6.5 year (SD 6). Majority (63%) of them were unemployed females in the age range of 50-65 years. Nearly 90% of them were on oral hypoglycaemic agents for their glycaemic control. The mean weekly total MET of the study population was 1898 MET minutes per week (SD 1188). Nearly 11% were sedentary where as 17% were highly active. The majority of IT2DM were moderately active with 1176 (SD 638) MET minutes per week. Among IT2DM participating in the current study, walking, moderate PA, and vigorous PA contributed, respectively, 11%, 87%, and 2% of total MET minutes per week. Moderately active IT2DM were engaged in house work including the cooking, cleaning and caring for the family. Nearly 14% of IT2DM spent more time in viewing screens while laying on bed (232 SD 269 minutes per week) and the mean sitting time were 1845 (SD 896) minutes per week. It can be concluded that majority of study population were moderately active and most of them were engaged in moderate physical activities.

Keywords: Glycaemic control, moderate, sedentary, vigorous, walking

Validating phone-based 24-hour dietary recall against weighed food records among Tamil female adults, in Sri Lanka

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Phone based 24-hour recalls (P24HDR) are widely use methods in Low- and middle-income countries (LMIC) to assess the dietary intake. However, their accuracy compared to Weighed Food Records (WFRs) remains unclear. This study aimed to validate P24HDR against WFR among female adults in Sri Lanka. A sample of 30 female adults between 20-55 years old were recruited for this study. WFR was performed by one enumerator and P24HDR was conducted on the next day by a different enumerator. The amount of energy and nutrient intake using both dietary assessment methods were identified using Food Base 2000 software. The statistical software SPSS 16.0 was used to analyze the data. There was a significant difference in the median intake of some macronutrients including energy and protein were observed and there is no significant difference in median micro nutrient intake between both assessment methods. In Bland-Altman plot, the differences in mean between WFR and P24HDR appeared above the average value for most of the nutrients and most points appeared cluster around the mean difference line of the plot for majority of nutrients. Strong positive correlations and interclass correlation which ranged from 0.7 to 0.8 were observed in macro nutrient intakes and micro nutrients intakes. In conclusion this study suggested that P24HDR constitute an acceptable method for most nutrient intake assessment, particularly among Tamil female adults in Sri Lanka. Future researches recommended recruiting large and diverse population groups to ensure the validity of P24HDRs against WFRs and to identify the possible errors of P24HDRs is recommended.

Keywords: Accuracy, dietary assessment, nutrition, weighted food records

Acknowledgement: This study was funded by International Food Policy and Research Institute (IFPRI)

Postprandial glycemic response and antioxidant activities of fruit-flavoured green and black tea infusions

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Naturally flavoured teas are becoming increasingly popular worldwide. Addition of natural fruits to black and green teas enhances sensory attributes and antioxidant properties. In this study, three underutilized commonly available seasonal fruits, Wood apple (*Limonia acidissima*), June plum (*Spondias dulcis*) and Carambola (*Averrhoa carambola*) were used. The aim was to determine the sensory acceptance, postprandial glycemic response, phenolic content, and antioxidant activities of fruits-flavoured black and green tea infusions. Sensory evaluation was performed to determine the most preferred mixing level of fruit and tea and fruits-flavoured tea type. The Total Phenolic Content (TPC) and Total Flavonoid Content (TFC) were determined using spectrophotometric methods. The antioxidant properties were evaluated through DPPH Radical Scavenging Activity (DRSA) and Ferrous Ion Chelating Activity (FICA). Postprandial glycemic responses of Wood apple-flavoured teas were investigated against a meal containing 25 g of available carbohydrates and 309 Kcal of energy. Blood glucose levels of capillary blood were measured at baseline and 15, 30, 45, 60, 90 and 120 minutes postprandial. Sensory acceptability of different mixing levels of fruit to tea varied among tea types. Carambola was the preferred choice of fruit for black tea blends, while June plum was the most preferred for green tea. Significant differences were reported for phenolic contents and antioxidant activities among tea types. Among fruits-flavoured teas, Carambola exhibited high amounts of TPC, TFC and DRSA while Wood apple showed highest FICA. There was no significant difference of postprandial blood glucose fluctuations between meal alone and meal with tea. The low volume of tea or the presence of concentrated simple sugar in dried fruits might contribute to the observed effect. In conclusion, natural fruits-flavoured teas are potential beverages that add variety and are healthy choices for improvement of wellness among health-conscious consumers.

Keywords: Natural fruits-flavoured teas, sensory evaluation, underutilized fruits

The effect of *Garcinia cambogia* on visceral fat and metabolic syndrome risk factors

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This research delves into the effects of *Garcinia cambogia* supplementation as a strategy for mitigating risk factors associated with metabolic syndrome, primarily through weight reduction. The study provides a thorough examination of how *Garcinia cambogia* supplementation influences key metabolic parameters and its efficacy in facilitating weight loss. Metabolic syndrome, increasingly prevalent and is closely linked with central obesity. This syndrome is characterized by a cluster of conditions including central obesity, insulin resistance, elevated blood pressure, and high abdominal lipid levels. This study adopted a convenient sample control intervention single blind trial methodology. Participants were categorized into a treatment group and a control group. To assess the impact of the supplementation, we measured anthropometric and biochemical parameters and collected 24-hour dietary recalls, both before and after the intervention. The treatment group received *Garcinia* tea bags, while the control group received standard tea bags. Over approximately eight weeks, participants were encouraged to continue with their assigned tea bags. The results revealed a significant reduction in weight, fat percentage, and fat mass in the treatment group, whereas the control group showed a non-significant reduction, likely due to the placebo effect. Both groups experienced a decrease in total cholesterol and Low-Density Lipoprotein (LDL) levels, but the differences between the groups were not statistically significant. Importantly, there was no significant increase in liver enzymes, suggesting a low risk of side effects from the supplement. In conclusion, our findings suggest that *Garcinia cambogia* supplementation can potentially reduce risk factors associated with metabolic syndrome by decreasing body fat and weight. The absence of significant liver enzyme elevation indicates a low likelihood of adverse effects.

Keywords: Fat percentage, high blood pressure, insulin resistance, low-density lipoprotein, total cholesterol.

Determining the breakfast eating pattern of preschool-aged children in rural areas of Sri Lanka

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Childhood malnutrition is a public health concern in Sri Lanka, which could be potentially linked with unhealthy dietary patterns, such as breakfast skipping. In children, demand for nutritious food remains high because of their rapid physical and mental development. Providing healthy foods is important to ensure optimum growth, development, cognition, and better academic performance in children. Previous studies investigated dietary intake and quality, had overlooked the intake of breakfast, which is an essential meal to start the day. Therefore, the current study explored the breakfast eating patterns of rural Sri Lankan preschool-aged children. A cross-sectional study was conducted with 225 children aged 3-5 years based on a convenience sampling method in Ratnapura district, Sri Lanka. Primary caregivers of preschool-aged children were recruited and their demographic and socio-economic factors, knowledge, and attitude on their child's breakfast eating patterns, children's food choices, meal times, Dietary Diversity Score (DDS), and breakfast eating practices (using 24-hour dietary recall and an interviewer-administered questionnaire) were assessed. Based on the regularity of intake, three patterns were identified. The majority (65.4%) adhered to a regular intake of breakfast, while 24.5% exhibited an irregular pattern in consuming breakfast meals for 4-6 days, followed by an irregular pattern with 1-3 days of breakfast intake (10%). Eleven food combinations of breakfast were observed. Notably, the most prevalent food combination was 'bread or wheat flour-based products', followed by 'rice plus green leaves plus a lentil or vegetable or protein source'. Children had a mean DDS of (4.41 ± 1.07) , and a majority (83%) had achieved the minimum DDS (4.0), indicating the variety in their diets. The knowledge scores of caregivers differ with their level of education. Knowledge and attitude scores of caregivers showed a significant positive relationship with the breakfast eating pattern scores of children. Improving caregiver knowledge on children's breakfast eating is necessary in future interventions to ensure their optimum health.

Keywords: Attitude, breakfast, dietary diversity, knowledge, primary caregiver

The impact of circadian disruption on cardiometabolic risk markers & eating patterns in shift workers

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Shift work-induced circadian disruption has strongly linked to cardiometabolic diseases including obesity, diabetes & cardiovascular disease. Limited studies have explored the impact of different variables such as night work durations, intensity and chorotype on cardiometabolic risk. The study aimed to determine the impact of circadian disruption on cardiometabolic risk markers in shift workers. This case-control study was conducted with 104 male workers (shift workers; n=52, mean age \pm SD; 43.3 \pm 10.2 and non-shift workers; n=52, mean age \pm SD; 41.2 \pm 9.8). Shift work status, durations and intensity of night shifts were determined using an interviewer administered questionnaire. Cardiometabolic risk were evaluated through anthropometric (height, weight, waist circumference and body composition), biochemical (fasting glucose and lipid profile), clinical (blood pressure) and dietary assessment (single 24-hr recall). Chronotype was determined using the Munich Chronotype Questionnaire (MCTQ). Shift-workers had significantly higher mean body fat percentage (31.7, 22.7% $P=0.031$), systolic blood pressure (138.6, 128.5mmHg $P=0.009$), pulse rate (78.7, 72.3bpm $P=0.015$), triglycerides (1.60, 1.30mmol/l $P=0.021$) and LDL-C (3.90, 3.40mmol/l $P=0.012$) than non-shift workers. Evening chronotype shift workers had significantly higher visceral fat level (12.8, 8.90 $P=0.001$), systolic blood pressure (137.0, 127.6mmHg $P=0.006$), pulse rate (82.7, 73.3bpm $P=0.005$) and LDL-C (4.00, 3.40mmol/l $P=0.039$) than shift workers with morning chronotype. Shift workers had higher mean daily intake of energy percentage derived from added sugar (6.76, 5.98% $P=0.001$). Variations in temporal patterns of energy consumption were observed across different time intervals, with the highest energy intake per day exhibited during the night (18:00pm–6:00am) by shift workers. Working number of hours & years duration of current shift work status were associated with cardiometabolic risk markers. In conclusion, evening chronotype showed significant associations with cardiometabolic risk markers than morning chronotype. Further research is warranted to elucidate underlying mechanisms and inform targeted interventions for individuals engaged in shift work, considering chronotypes.

Keywords: Cardiometabolic risk factors, chronobiology, chrono-nutrition, chronotype, circadian misalignment

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Effect of nutrition education programme on diabetes management of type 2 diabetes patients

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Nutrition education plays a pivotal role in empowering the individuals with type 2 diabetes towards sustainable lifestyle management and achieving better clinical outcomes. Nutrition Education Programme (NEP) aids the delivery of knowledge and skills related to the self-management of diabetes through proper lifestyle management, regular blood glucose monitoring and self-awareness. Therefore, current study was conducted with the objective of evaluating the effect of NEP on managing the diabetes condition and achieving the proper glycaemic control of individuals with type 2 diabetes mellitus (IT2DM). Forty-four (n=44) IT2DM were assigned either to receive NEP (n=22) or standard care (n=22). NEP consisted of 02 group nutrition education sessions of dietary management, foot care and motivational session on physical activity, 02 counseling sessions and 02 cooking sessions. Dietary educational materials were provided to the IT2DM of the NEP phase. Information on general lifestyle, disease, and medication history was obtained using a general lifestyle questionnaire at the baseline (t=0). Body weight, waist circumference, body composition, Fasting Plasma Glucose (FPG) level, dietary intake, physical activity level and knowledge and skills of IT2DM on self-management of diabetes were collected at the baseline (t=0) and the end (t=12) weeks of each study phase. IT2DM had the mean age of 59 (SD 6) years and diabetic duration of 8 (SD 6) years. IT2D followed the NEP showed significant ($P<0.05$) reductions in their total energy intake, energy from carbohydrates and energy from added sugar compared to their baseline. FPG of the IT2DM who followed the NEP, showed significant ($P<0.05$) reduction at the end (t=12) weeks compared to their baseline. Therefore, it can be concluded that the NEP was effective in reducing the FPG through improvements of their dietary intake.

Keywords: Diabetes self-management, diet, glycaemic control, nutrition education

The current status of school food environment in secondary schools in Kurunegala district, Sri Lanka

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Food environment in school plays a crucial role in manipulating food choices of school children. Therefore, interventions in the school environment to promote nutrition among school children have received considerable attention from researchers over the past years. However, there is lack of evidence on school food environment including school gardens in Sri Lanka. Therefore, this study aimed to identify the current status of secondary school food environment in Kurunegala district. This cross-sectional study surveyed the perspectives of students and teachers on school food environment of selected secondary schools (n=10) in Kurunegala district, Sri Lanka. Data was collected using self-administered questionnaires from a representative sample of junior secondary school students (n=160) and teachers (n=30). Descriptive analysis was performed using SPSS version 22. The students' survey included 70% female and 30% male students, the teachers' survey included 80% female and 20% male teachers. Of the students, 64% and 27% of teachers frequently participated in school gardening. Further, the study revealed that high student engagement and positive attitudes towards school gardening activities. Additionally, 63% of teachers utilized the school garden for their teaching purposes. A substantial 67% of students perceived engaging in school gardening activities as a learning opportunity. Of the teachers, 43% acknowledged that inadequate time allocated for school gardening-related teaching activities posed a challenge. Teachers stated that school canteens practised unhealthy food restrictions and high-sugar, fat, and salt contained snacks were preferred by 71% of students, while fruit consumption was found to be negligible at 1% during school time. In conclusion, school food environment was not conducive in promoting healthy food habits of the children. School garden was not properly utilized for improving healthy food habits. Therefore, implementing school-based interventions that align with the current food environment is crucial as it significantly impacts children's dietary behavior.

Keywords: Cross sectional study, food choices, healthy food habits, learning opportunity, school gardening

Acknowledgement: This study was funded by Nestle Foundation, Switzerland.

Digital dietetics: building an artificial-intelligence powered diet planning platform for evidence-based nutritional guidance

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The conventional paradigm for dietetic planning, despite its thoroughness, often falls short in addressing the efficiency and specificity required for individual health needs. This has spurred a demand for personalized nutrition strategies. Our study aims to fill this gap by employing Artificial Intelligence (AI) to enhance the efficiency and precision of dietetic planning. We introduce a novel AI-powered platform, EDIETETICS, which integrates artificial intelligence through an API-connected framework, using PHP technology and the capabilities of Chat-GPT. This web-based repository amalgamates extensive nutritional data to create personalized diet plans based on user inputs and a robust nutritional database, ensuring dynamic, evidence-informed dietary advice. The efficacy of the EDIETETICS platform was evaluated through a pilot study with ten professional dietitians, using a structured questionnaire. The feedback highlighted the platforms' user-friendly interface, high satisfaction levels, and significant improvements in diet planning efficiency. The research outcomes indicate that the developed AI-based diet planning platform successfully addresses the complexities of dietary guidance by providing tailored recommendations. The system's integration of evidence-based nutritional guidelines ensures that the diet plans align with established scientific principles. The positive feedback from the dietitians involved in the evaluation process underscores the platform's potential to support clinical nutritionists in their practice. This signifies a leap forward in integrating AI into clinical nutrition, offering a versatile tool for Clinical Nutritionists in managing data and aiding users with digital, evidence-based dietary guidance. The promising outcomes of this study indicate a trajectory toward the broader adoption of AI in healthcare technology, with potential transformative effects on nutritional science.

Keywords: Artificial intelligence, clinical nutrition, dietetic planning, healthcare technology

Determining the breakfast eating pattern of primary school-aged children in rural area of Northern Province, Sri Lanka

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Nutritional breakfast is crucial for starting the day, promoting healthy habits from childhood and providing essential nutrients for physical growth and psychological development. This study aimed to determine rural primary school-aged children's breakfast eating patterns, their caregivers' knowledge and attitudes on breakfast intake, and influence of socio-demographic and economic factors on breakfast eating patterns. A cross-sectional study was conducted among 225 children aged 6-9 years, in Jaffna district of Northern Province, Sri Lanka. Data were collected using an interviewer-administered questionnaire, which included socio-demographic information, 24-hour recall and questions related to knowledge and attitude of caregivers on their children's breakfast eating. Data were analyzed using both descriptive and statistical analysis. The study sample comprised of male children mostly (59%). Based on the regularity of intake, 81% of children were regular breakfast eaters and 19% were irregular breakfast eaters. None were identified as complete skippers. Twelve food combinations were identified in the breakfast. Nearly 30% of children consumed 'cereal with coconut sambol', followed by 'cereal with vegetables'(15%), 'bakery products'(13%), and 'cereal' (11%) only. Other combinations included fruits, animal proteins, legumes, and dairy, highlighting diverse dietary practices among the children. Children showed good Dietary Diversity Score (DDS) of 5.6 out of 7. Caregivers' level of education ($P < 0.01$), occupation ($P = 0.003$), and income ($P < 0.01$) showed a significant influence on caregivers' knowledge score. Caregivers' attitude scores significantly differ with their occupation ($P = 0.032$), household income ($P = 0.002$), and number of children in household ($P = 0.003$). However, no any significant relationship ($R = 0.017$) was found between knowledge ($P = 0.800$), and attitude scores ($P = 0.874$) with breakfast eating pattern score of children, which could be due to the higher prevalence of regular breakfast intake in the study population. Extended studies with representative large samples are recommended to obtain a comprehensive understanding of actual breakfast-eating patterns and its associations in Northern Province, Sri Lanka.

Keywords: Breakfast, Northern Province, regular eaters, rural population, Sri Lanka

Enhancing athletic performance through targeted dietary modifications: a study on athletes

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Aerobic endurance is a critical determinant of athletic performance, particularly in elite athletes. Dietary modifications, including supplementation with whey protein, have been proposed as a strategy to enhance performance by improving aerobic capacity. This study aimed to investigate the correlation between performance enhancements, specifically focusing on VO₂ max, and the implementation of whey protein supplementation in elite athletes. A sample cohort of 22 elite athletes was carefully selected for a mixed-methods study design, incorporating cross-sectional assessments and a longitudinal intervention to comprehensively explore the impact of whey protein supplementation on athletic performance. The sample was divided into an intervention group (n=11), receiving whey protein for 6 weeks, and a control group (n=11). VO₂ max, a critical determinant of aerobic endurance, was measured using the beep test. The mixed-methods approach provided a comprehensive understanding of the dynamic relationship between dietary modifications and performance outcomes. Post-intervention analysis revealed a statistically significant increase in VO₂ max within the intervention group (p value = 0.015), highlighting the efficacy of whey protein supplementation. Notably, there was also a significant reduction in triglyceride levels and liver enzymes in the intervention group, suggesting potential connections between whey protein, improved metabolic health, and insulin resistance reversal. The study findings underscore a notable positive impact on athletes' aerobic endurance resulting from the dietary modification of whey protein supplementation. Beyond the enhancement of VO₂ max, the observed reductions in triglycerides and liver enzymes suggest broader implications for metabolic health and insulin sensitivity. These results contribute valuable insights to the fields of sports nutrition and exercise physiology, emphasizing the potential benefits of whey protein supplementation in optimizing athletic performance and metabolic outcomes. Further research is warranted to elucidate the underlying mechanisms driving these improvements and to refine nutritional strategies for elite athletes seeking comprehensive performance optimization.

Keywords: Aerobic endurance, beep test, improved metabolic health, VO₂ max, whey protein supplementation

Mapping school food environment using geographic information system techniques

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Students' formative years are crucial for their development, with school playing a pivotal role where they obtain a significant portion of their daily nutritional requirements. Hence, the school food environment plays an unparalleled role in shaping students' dietary habits and influencing their overall health and well-being. This study aimed to utilize Geographic Information System (GIS) techniques to examine the availability, accessibility, and distribution of healthy and unhealthy food options around schools. The study is conducted in the Western Province, of Sri Lanka, specifically focusing on the Negombo Educational Zone, comprising purposively selected 30 schools across three educational divisions. The availability and accessibility of food options within a 500m buffer around each school were observed and analyzed using ArcGIS software. Out of the surveyed schools, 25 were equipped with canteens, while 14 featured aesthetically pleasing and well-maintained school gardens. The study identified a concentration of items such as starchy foods, pulses, short-eats, and confectioneries in school canteens. In addition, the implementation of nutrition meal programmes in schools was notable. An examination of 476 food outlets within a 500-meter buffer distance revealed a predominant presence of grocery shops and pastry shops. Noteworthy was the significant representation of mobile vendors. In the studied urban area, starchy foods, dairy products, nuts and seeds, animal protein foods, carbonated beverages, confectionaries, sugar-sweetened beverages, short eats, fried foods, and processed foods are the most common food categories around the schools. Also, it was identified that the ability to get unhealthy foods inside the school is less, and the availability and accessibility of unhealthy food options is more than healthy food options around the schools with numerous food outlets easily reachable. Understanding the spatial distribution of food options allows for targeted interventions and encourages healthy eating both inside and outside schools contributing to the overall well-being of students.

Keywords: Geographic Information System (GIS), food environment, schools, spatial maps

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Determinants of sarcopenic obesity and its association with dietary and lifestyle factors of older adults

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Sarcopenic obesity (SO) is defined as the coexistence of sarcopenia and obesity in the same individual, characterized by the co-presence of body fat accumulation and muscle loss. This condition is currently a major concern as it is associated with frailty and disabilities among older adults. This cross-sectional study aimed to determine the determinants and its association with SO among older adults. Using convenience sampling method, a total of 200 older adults (freeliving-100 and institutional settings-100) aged 65 or over (mean age \pm SD; 72 \pm 6 years) were recruited from selected areas in Kurunegala and Gampaha districts. As described by the European Society for Clinical Nutrition and Metabolism (ESPEN), anthropometric, body composition (body fat percentage %, and skeletal muscle mass), hand-grip strength (HGS), 4-meter gait speed and SARC-F (strength, assistance in walking, rise from a chair, climb stairs and falls) questionnaire were used to determine SO considering ethnic and gender-specific cut-off values. As proposed by ESPEN diagnostic criteria, low handgrip strength (<28kg-men, <18kg-women), reduced gait speed (<0.8 m/s), SARC-F(\geq 4) and altered skeletal muscle mass (<31.5% for men, <22.1% for women) were used to determine sarcopenia and high BMI (>25 kg/m²) and increased body fat percentage (>37.2% -women, >29.7%-men) were used to determine obesity. A single 24-hour dietary recall was used to assess nutrient intake. Multiple linear regression analysis was used to derive determinants. SO prevalence was 2.5%, while males showed slightly higher prevalence (4%) than females (2%) and institutionalized older adults exhibited higher prevalence (3%) compared to free-living older adults (2%). Physical activity showed significant positive weak associations with HGS ($r=0.292$, $P=0.0001$) and skeletal muscle mass ($r=0.192$, $P=0.001$) while a significant negative weak association was observed with gait speed ($r=-0.261$, $P=0.0001$). In conclusion, physical activity was the only significant determinant of SO among older adults and it could be mitigated or prevented by engaging in physical activity.

Keywords: Body fat percentage, gait speed, hand-grip muscle strength, skeletal muscle mass

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The past, present, and future role of dietitians in Sri Lanka

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The role of dietitians in Sri Lanka has evolved over time, adapting to changes in healthcare and dietary patterns. It is crucial to understand the historical context, current status, and future prospects of Sri Lankan dietitians in order to assess their impact on public health and identify areas for further development. This research aimed to identify the historical evolution of the dietetics profession, the establishment of nutrition and dietetic education, and evaluate the present state, future prospects, challenges/obstacles, and recommendations to overcome those obstacles. The study investigated the role of dietitians in Sri Lanka using a cross-sectional design. Information gathered from registered dietitians and experts in nutrition from Wayamba, Kelaniya, and Peradeniya universities. Further, information from important people in nutrition from the Ministry of Health and Sri Lanka Medical Council (SLMC) was collected. Data collection was accomplished by referencing reliable written materials, conducting face-to-face interviews, and using a Google questionnaire. The dietetic profession was first established in Sri Lankan government hospitals in the 1960s and in private hospitals in 1988. In 1974, Kelaniya University started offering nutrition and dietetic education. At present, Wayamba University is playing a key role in delivering dietetics education. There are currently 110 dietitians registered with SLMC in Sri Lanka. Among the respondent dietitians (87), the majority are working in the private sector (57), a few are working in the government sector (21), and 9 of them are not involved with any dietetic-related job. The main challenges faced by the dietitians were the lack of government support, the low salary scale for the profession, and the involvement of other healthcare professionals in the dietetic field. Sri Lanka's dietetic profession has more than 50 years of history and has undergone significant changes. To enhance its growth and contribution towards public health, it is crucial to receive more government support.

Keywords: Current status, dietitians, future opportunities, historical development, Sri Lanka

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Validating phone-based 24-hour dietary recall against weighed food records among Tamil male adults

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Phone-based 24-hour dietary recalls (P24HDRs) are frequently used in low and middle-income countries (LMICs) for dietary intake assessment due to their simplicity and cost-effectiveness. However, its accuracy compared to Weighed Food Records (WFRs) remains unclear. This study investigated the validity of P24HDRs against WFRs among Tamil male adults in the Nuwara-Eliya district in Sri Lanka. A total of 30 Tamil male adults aged 20-55 years from Nuwara-Eliya district was recruited using a convenience sampling method. One day, dietary intake was recorded by the WFRs performed by one investigator. The next day, a phone-based 24HDR was conducted by another investigator. Energy, macro, and micro-nutrient intake were analyzed using Foodbase 2000 software. Comparisons of the nutrient intake between the two methods were determined using SPSS. The results showed no significant differences ($P < 0.05$) between the mean intake of most nutrients, including protein, fat, iron, thiamine, riboflavin, vitamin B₁₂, B₆, vitamin C, and vitamin E, as recorded via the two methods. However, significant differences were found in the mean intake of energy, carbohydrate, calcium, folate, and niacin. Regression analysis revealed the statistically significant positive correlations (ranged from $r = 0.53$ - 0.83 , $P < 0.05$) between the methods for most nutrients including protein, fat, iron, thiamine, riboflavin, vitamin B₁₂, B₆, vitamin C, and vitamin E. In conclusion, this study suggested that phone-based P24HDRs is a reliable method in assessing most nutrient intakes, including protein, fat, iron, thiamine, riboflavin, vitamin B₁₂, B₆, vitamin C, and vitamin E, particularly among Tamil male adults. Further studies are recommended to conduct recruiting large and diverse population groups in Sri Lanka.

Keywords: Dietary assessment, dietary recalls, validation, weighted food records

Acknowledgement: This study was funded by the International Food Policy Research Institute (IFPRI).

Department of Food Science and Technology

Comparison of phytochemical contents and antioxidant properties in three commercially grown *Capsicum chinense* varieties and extraction of oleoresin for product development

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Unravelling the differences between hot chilli pepper varieties would help farmers understand which variety should be grown for different applications. In this study, the variabilities of the amounts of phytochemicals, antioxidant properties and sensory properties were examined of three commercially available *Capsicum chinense* (*Nai Miris*) varieties (*Piquante* F1 [Abv:PF1], Dark green Scotch Bonnet [Abv:DGSB] and local variety: *Kevum Kochchi* [Abv:KK]) in Sri Lanka and Response Surface Methodology (RSM) was used to optimize the Ultrasound-Assisted Extraction (UAE) conditions to produce oleoresin. To determine phytochemicals and antioxidant properties, ethanolic extracts from UAE were used. Considering the phytochemical quantification, total phenolic, total flavonoid and total anthocyanin contents were evaluated, while the *in vitro* antioxidant activities were determined by 2,2-diphenyl-1-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant Power (FRAP) assays. The sensory properties were evaluated by incorporating the extracted oleoresin to tomato sauce and spicy noodle. For the oleoresin extraction optimization, the temperature, time and solvent/solute ratio were examined as parameters and 60 °C, 180 min and 50:1 (ml/g) respectively were found as optimum conditions. There were variabilities in phytochemical amounts and antioxidant properties and the values were significantly higher ($P < 0.05$) in PF1 and DGSB than variety KK. Between PF1 and DGSB, PF1 have a greater ($P < 0.05$) antioxidant activity ($59.85 \pm 0.42\%$ inhibition-DPPH, 33.31 ± 0.67 mgAAE/g DW-FRAP) which is relatable to the higher phenolics content (16.05 ± 0.83 mg GAE/g DW). In the sensory evaluation, PF1 oleoresin incorporated tomato sauce received higher ratings by the panelists and in the spicy noodle, 0.08g of oleoresin per 100g of product was identified as the best proportion. The study highlights significant variations in phytochemical content, antioxidant activity, and sensory attributes among *Capsicum chinense* varieties, with *Piquante* F1 (PF1) demonstrating superior qualities. Also, it provides fundamental data for the identification of appropriate varieties in cultivation programs aimed at enhancing nutritional, pharmacological and commercial attributes.

Keywords: Antioxidants, *Nai Miris*, phytochemicals, response surface methodology, ultrasound-assisted extraction

Evaluation of the functional properties of banana pseudo-stem flour incorporated composite flour and its application in veggie balls

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The Embul banana (*Musa acuminata* L.) ranks as one of the most important agricultural food crops in Sri Lanka and pseudo-stem is its main by-product which remains underutilized after harvesting. This study aimed to assess the functional properties of the banana pseudo-stem flour (BPSF) incorporated composite flour and its suitability in veggie ball production while addressing bioresource wastage. The production of BPSF involved treating the pseudo-stem with 0.2% citric acid, drying at 60 °C for 24 hours, and then grinding. The veggie ball was prepared by mixing BPSF and wheat flour (WF) in different ratios (52:48, 55:45, 58:42, 60:40) with chickpea, texturized soya, and other ingredients, followed by balling and steaming. Among four treatments, the veggie ball with 60% (w/w) BPSF gained a higher acceptability in sensory evaluation (9-point hedonic scale) for appearance, texture, flavor, aroma, and overall acceptance by thirty semi-trained panelists and was selected for further analysis. The composite flour containing 60% BPSF showed distinct functional properties namely water-holding capacity (6.86±0.04g/g), oil-holding capacity (2.65±0.11g/g), swelling power (5.70±0.03g/g), and water solubility index (3.38±0.04%) making it ideal for food production. The study found that except for fat (1.84±0.12%), it had a significantly ($P<0.05$) higher levels of moisture (9.56±0.08%), carbohydrates (58.66±0.06%), and proteins (6.27±0.11%), while displaying lower fiber (16.38±0.07%) and ash contents (7.29±0.25%) than BPSF. The developed veggie ball expressed its proximate composition: moisture (56.87±2.33%), carbohydrates (19.79±2.25%), protein (10.31±0.10%), fat (6.68±0.06%), fiber (3.96±0.02%), and ash (2.39±0.10%) offering a tender, and less resistant eating experience. In frozen conditions, there were slight alterations in total plate count, yeast and mold count, water activity, and pH of the product until the third week. Therefore, the developed BPSF-incorporated composite flour serves as a viable substitute for WF in the production of veggie balls, contributing as both a binding and filling agent while offering nutritional richness.

Keywords: Banana pseudo-stem, bioresource wastage, wheat flour, wheat substitute

Development of a preliminary platform for automated identification and sorting of cracked eggs based on deep learning

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Eggs are one of the most valued food items due to their high nutritive value, which makes them a highly consumed food in the present context. In egg production, maintaining quality is a critical factor for consumer acceptance. For determination of egg quality, different quality parameters are used in industry. Among these, eggshell cracks must be detected before sending them to the market. Approximately 8-10% of eggs suffer shell damage due to mechanical impacts during various stages of production, handling and transportation and their presence poses a significant challenge to food safety and consumer satisfaction. Manual identification of egg cracks is a complex and time-consuming process. The aim of study is to develop a preliminary automated system for identification of egg cracks using deep learning. A transfer learning TensorFlow Lite model based on Mobilenet multi AVG model was trained using 148 images of cracked and normal eggs with 108 images for the training set and 40 images for the validation set. Images from a live video feed obtained from a USB webcam that is focused on normal and cracked eggs carried on a conveyor belt was fed to the above-created model housed in a Raspberry Pi 400 device. The classification output of the model was sent to an Arduino Uno board via serial communication which in turn gave signal to a photoelectric proximity sensor and a servo motor whose combined action resulted in sorting the eggs as cracked and normal. This study demonstrated the capability of the created deep learning model and the preliminary automated platform to identify and sort eggs as cracked eggs and normal/uncracked eggs. The development and further refinement of this automated system can reduce the human involvement in detecting and sorting out cracked eggs while maintaining egg quality.

Keywords: Arduino Uno board, conveyer belt, mobilenet multi AVG model, raspberry Pi 400 device

The effect of lactic acid fermentation on physicochemical and functional properties of cassava starch extracted from locally available varieties and suitability of fermented starch in processing of cassava pearls

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This study investigates the impact of lactic acid fermentation on the physicochemical and functional properties of cassava starch extracted from seven different local varieties (HORDI-MU51, Shani, Suranimala, Kirikawadi, CARI555, Mu-51, Swarna), using *Lactobacillus delbrueckii* and *Streptococcus thermophilus* as starter cultures. The chemical composition, Whiteness Index (WI), Swelling Power (SP), Solubility Index (SI), Water (WHC) and Oil Holding Capacities (OHC), Amylose Content (AC), were determined for Non-Fermented Cassava (NFC) and Lactic Acid Fermented Cassava (LAFC) starches in all varieties. The starches were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). The suitability of fermented starch for cassava pearl production in bubble tea was assessed using three treatments: 100% NFC starch, 100% LAFC starch, and a blend incorporating 50% LAFC starch. Comparison of freshly extracted cassava starches with LAFC starches showed significant alterations in the chemical composition and textural properties. Fermentation resulted in a notable decrease in pH, WI, SP, OHC, and an increase in WHC, SI in all LAFC starches compared to NFC starches. The AC of LAFC starches were not significantly different for all the evaluated varieties except for *Shani* and CARI555. The WI showed a significant difference among the LAFC starches with values ranging from HORDI-MU1(94.71±0.12) to *Suranimala* (89.89±0.39). The SI and OHC were not significantly different for LAFC starches. SP and WHC showed a significant difference among the varieties ranging from HORDI-MU1(8.34±0.6%) to CARI555(11.19±0.03%) and *Shani* (0.97±0.02%) to Kirikawadi (1.33±0.06%) respectively. The FTIR results indicated a consistent peak pattern in NFC and LAFC starches, with a notably increased peak intensity for LAFC starches at 1700cm⁻¹. SEM analysis showed fractured granules and roughened surfaces, highlighting the impact of fermentation. Sensory results of cassava (tapioca) pearl showed that 50% LAFC starch incorporated sample received the highest preference. The simplicity of the process, sensory acceptability, improved properties indicate the potential for incorporating LAFC starch in the production of tapioca pearls.

Keywords: Bubble tea, lactic acid fermentation, starch, tapioca pearls

Determination of phytochemical, antioxidant and antibacterial potential of selected leafy spices in Sri Lanka

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In Sri Lankan culture, leafy spices serve culinary and therapeutic purposes, offering flavor, color, and food preservation benefits. The bioactive compounds isolated from leafy spices have been investigated in many studies individually, but comparative study of their bioactive properties is still lacking. This research aims to investigate and compare the phytochemical composition, total phenol and flavonoid content, antioxidant, and antibacterial activities of four commonly used leafy spice varieties. Among the numerous botanical treasures, *Murraya koenigii*, (Curry leaves), *Pandanus amaryllifolius* (Pandanus), *Cymbopogon citratus* (Lemongrass), *Mentha Piperita* (Mint) leaves were selected for the study considering the high consumption rate in Sri Lanka. During the study, the total phenolic content (TPC) was quantified using the Folin-Ciocalteu method, total flavonoid content (TFC) was assessed through the Aluminum chloride colorimetric assay, in vitro antioxidant capacity was evaluated via the DPPH radical scavenging assay and the phytochemical composition was qualitatively analyzed. The evaluation of antibacterial activity was conducted against three bacterial strains, *Escherichia coli* ATCC 11229, *Staphylococcus aureus* ATCC 6538, and *Pseudomonas aeruginosa* ATCC 15442, utilizing minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) tests. *Murraya koenigii* exhibited the highest phenolic content (335.13 ± 0.13 mg GAE/g), highest flavonoid content (25.05 ± 0.10 mg RE/g), distinct from the other varieties, and recorded the highest DPPH radical scavenging activity ($87.26\% \pm 0.15$). Further, *Murraya koenigii* recorded the lowest MIC and MBC, showing its potent antimicrobial properties. Qualitative phytochemical analysis revealed that all four varieties are rich in phytochemicals, except for *Murraya koenigii*, which tested negative for saponins. Additionally, *Mentha piperita* and *Pandanus amaryllifolius* were negative for steroids. The study indicated that *Murraya koenigii* possessed a significantly high TPC, TFC, higher antibacterial and antioxidant activity than other three leafy spices investigated. Further analysis conducted using sophisticated equipment with other available varieties can give a clearer image of the bioactive potential of the selected leafy spices.

Keywords: Antimicrobial properties, *Murraya koenigii*, phytochemical composition, total phenolic content, total flavonoid content

Evaluation of bioactivity and stability of cocoa beverages formulated with encapsulated avocado seed extract

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Cocoa beans contain antioxidants and other bioactive compounds, but processing can affect bioactivity retention. Therefore, it is important to incorporate bioactive-rich natural substances to enhance the bioactivity of cocoa beverages. Avocado seed extract (ASE) is a natural extract rich in various functional and bioactive components. However, low stability disturbs their full bioactivity expression in ASE. Hence, to preserve their vitality, an encapsulation technique was used. In this study, the functionality of encapsulated ASE in improving the bioactivity and stability of cocoa beverages formulated with different ratios of ASE was investigated. ASE encapsulated in Maltodextrin as the coating material was incorporated in cocoa beverages in six different ratios. The percentage of encapsulated ASE in cocoa drinks was designated as C1 (0%), C2 (2%), C3 (4%), C4 (6%), C5 (8%) and C6 (10%). The results of the study showed that the formulation which contained the highest percentage of the encapsulated ASE (C6) showed the highest values for total polyphenols (TPC- 60.06 ± 2.55 mg GAE/g), total flavonoids (TFC- 90.17 ± 1.44 mg rutin equivalent/g), DPPH radical scavenging activity ($37.28 \pm 0.44\%$ of inhibition) and total antioxidant capacity (TAC- 57.05 ± 1.65 mg AAE/g). Improvement of the physical stability of the cocoa beverages encapsulated with ASE was observed. Results revealed that with the added encapsulated ASE in the cocoa powder, the hygroscopicity of the mixture increased whereas the moisture content of the mixture decreased significantly. The results of the color evaluation showed that the C6 formulation had the highest overall color difference. Additionally, pH, dissolution time, and sedimentation decreased, while viscosity, total soluble solids, and solubility increased when the percentage of encapsulated ASE increased. Particles of encapsulated ASE in maltodextrin showed a polyhedral shape in scanning electron microscopic imaging. In conclusion, formulated cocoa beverages incorporated with encapsulated ASE can be used as a bioactive enriched ready-to-serve beverage.

Keywords: Antioxidants, avocado seed extract, bioactive compounds, encapsulation, functional food

Study on market acceptability of locally available processed fruit and vegetable products in three districts of Sri Lanka

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Fruit and vegetable processing is important for food preservation, shelf-life extension, reduction of post-harvest losses and enhance food availability. This research aimed to develop a novel food product to fulfil the current consumer demand as identified through market and consumer surveys. Market acceptability of processed fruits and vegetable products was explored through in-person interviews with staff members of 52 marketplaces and through online questionnaires provided to 278 consumers in Colombo, Kandy, and Kurunegala districts, Sri Lanka. The results revealed that demand variations for processed fruits products are significantly influenced by both age and area, while demand variations for processed vegetable products are significantly influenced only by the area ($P < 0.05$). The study found that price, product quality, and nutritional value are the factors focused on by consumers before making the purchasing decision for processed fruits and vegetable products. Fruit juice, jam, and minimally processed fruits are the most preferred fruit products, according to the analysis of mean values of consumer preferences and product selling quantities, while minimally processed vegetables, sauce, and soup mix powder were the most preferred vegetable products. In response to these findings, a novel vegetable soup mix powder was developed using carrot, pumpkin, soya milk powder, tomato, celery, leeks and arrowroot flour, substituting corn starch. The water activity, moisture content and viscosity of the vegetable soup mix were 0.3656, 16.48 %, and 844.36 cP respectively. The arrowroot-based soup mix (6.40) gained the highest overall acceptability than the corn starch-based soup mix (5.46), according to the sensory analysis conducted using a nine-point hedonic test. The results of this research provide information about consumer preferences for processed fruits and vegetable products that will be beneficial for future marketing strategies and product development in the processed food industry in Sri Lanka.

Keywords: Consumer preferences, market demand, product development, soup mix powder, arrowroot flour

Development of a vegan sausage incorporated with white button mushroom stem and assessment of physicochemical and sensory properties

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Asian countries being major contributors to global mushroom production, the often-disregarded value of mushroom stems poses challenges as they are commonly treated as food waste. This study was conducted to evaluate the potential of utilizing white button mushroom (*Agaricus bisporus*) stems to develop a vegan sausage. Six formulations of sausages were prepared by varying the ratios of mushroom stems, textured soy protein (TSP) and breadcrumbs. Proximate composition was analyzed for stems, caps and formulations. The products were analyzed for the physicochemical, textural and sensory properties for 28 days of storage period at -18°C. According to the results of proximate composition, the fiber content (20.69±0.09%) in mushroom stems was significantly higher ($P<0.05$) compared to the caps, while the fat content (1.54±0.16%) was lower in the stems. Proximate composition analysis revealed that formulations with 50%, 55% and 60% of mushroom stems had significantly higher ($P<0.05$) fat (6.08±0.12%), protein (12.38±0.53%), and fiber (3.78±4.21%) contents respectively. The color parameter values (L^* , a^* , and b^*) were not significantly ($P<0.05$) different for all formulations with storage period. The water activity, emulsion stability, and water holding capacity of all developed sausage formulations showed a decreasing pattern with the storage period. The pH and total bacterial count of all formulations increased significantly ($P<0.05$) during storage period; however, remained within the safe level ($<10^6$ CFUg⁻¹). Formulation of 60% stems and 10% TSP showed the lowest cohesiveness (0.26±0.12) and gumminess (1.84±0.23N), whereas formulation of 50% stems and 16.66% TSP had the highest values in both parameters. Formulation which contained 55% stems, 13.33% TSP, and 6.66% breadcrumbs showed the highest scores for sensorial attributes and overall sensory acceptability, making it the preferred formulation. Overall, the study demonstrated that button mushroom stems can be used to develop a microbiologically safe and organoleptically acceptable vegan sausage upto 28 days.

Keywords: Mushroom stems, proximate composition, sensory evaluation, vegan sausage

Phytochemical screening and *in vitro* antibacterial, antioxidant, anti-inflammatory and antidiabetic attributes of herbal tea formulated from *Ixora coccinea* flowers

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Ixora coccinea, esteemed in Ayurveda and folk medicine, is renowned for its medicinal properties. The aim of this study was to evaluate phytochemical content and *in vitro* bioactivities of distilled water extract (DWE), methanolic extract (ME), and hot water infusion (HWI) from *Ixora coccinea* flowers. Total phenolic, flavonoid, tannin content, DPPH radical scavenging, FRAP, alpha-amylase, amyloglucosidase inhibition, and anti-inflammatory activity were meticulously assessed. ME exhibited the highest total phenolic, tannin and flavonoid contents of 0.69 ± 0.05 mg GAE g⁻¹, 509.58 ± 22.17 mg AAE g⁻¹ and 182.48 ± 4.84 mg RE g⁻¹ respectively. ME exhibited robust antibacterial effects, with 3.33 ± 0.57 mm and 6.33 ± 0.58 mm inhibition zones against *E. coli* and *S. aureus*. Antioxidant potential was demonstrated by IC₅₀ values of 54.37 mg/ml and 112.21 mg/ml for DPPH and FRAP assays in DWE. DWE emerged as the most potent anti-inflammatory agent (IC₅₀ = 94.5 mg/ml), compared to HWI and ME. Methanolic extract displayed superior alpha-amylase and amyloglucosidase inhibitory activities, showcasing potential anti-diabetic properties. In HWI the bioavailability of phenolic content is 13.04% and bio-accessibility of phenolic content is 28.99%. In conclusion, this study reveals that hot water infusion of *Ixora coccinea* flowers shows comparable bioactivity potency with its methanolic and distilled water extracts.

Keywords: Anti-inflammatory, bioactivity, herbal tea, *Ixora coccinea*, phytochemical content

Development of vegetarian patty incorporated with jackfruit (*Artocarpus heterophyllus* Lam) by-products, brown rice (*Oryza sativa* Lam) and paneer

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Plant-based alternatives replicating traditional meat products are gaining attraction in the protein-based food industry. This research introduces an innovative approach to crafting a nutritious, protein-rich vegetarian patty using underutilized jackfruit by-products: rags and rinds, with the addition of brown rice and paneer. Analysis covered proximate composition, physicochemical properties, textural characteristics, and sensory acceptability. The study includes a thorough shelf-life assessment with microbial tests such as APC, coliform, yeast and mold count assessments. The results of the proximate composition analysis revealed a significant increase ($P < 0.05$) in protein ($14.79 \pm 0.18\%$) and fat ($11.74 \pm 0.42\%$) in the vegetarian patty with a formulation comprising 45% paneer, 25% brown rice and 20% jackfruit by-products respectively, and in fiber ($10.14 \pm 0.84\%$) and carbohydrates ($12.27 \pm 0.32\%$) in the vegetarian patty with a formulation comprising 20% paneer, 30% brown rice and 40% jackfruit by-products. Considering the color change during the 15-day storage period, L^* values increased, reaching from 51.84 to 53.06, indicating a reduction in the product color. The pH and the water activity decreased noticeably, and the values changed from 5.75 and 4.86 in pH and 0.71 to 0.59 in water activity respectively. There is a gradual increase in bacterial count and yeast and mold count over the 15-day storage period. Incorporating jackfruit by-products, rags, along with paneer and brown rice, can be used to enhance sustainability and provide nutritious plant-based foods.

Keywords: Jackfruit by-product, innovative approach, L^* values, sustainability, water activity

Evaluating the effect on the stability and the shelf life of virgin coconut oil, blended with vitamin E, olive oil and Ascorbyl Palmitate

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Oil blending enhances nutrition, taste, aroma, stability, and shelf life better than single-sourced oils. This study investigates the effects of blending Virgin Coconut Oil (VCO) with Vitamin E, Olive Oil, and Ascorbyl Palmitate (AP) on its stability, shelf life, and sensory characteristics. The stability of oil blends was evaluated under different cooking conditions, such as frying, baking, and boiling, and the shelf life was determined using accelerated aging. Additionally, sensory profiling was assessed by a 7-point hedonic scale for air-fried chips and plain oil samples. VCO was blended with varying concentrations of Vitamin E (0.5%, 1.5% and 3%), Olive Oil (10%, 20%, 30%, 40% and 50%), and AP (200mg/kg and 400mg/kg). Oxidative stability was assessed through changes in Free Fatty Acid (FFA) content and Peroxide Value (PV) over time. According to sensory evaluation, the preferred oil blend was VCO blended with Vitamin E 0.5%, AP 200mg/kg, and Olive oil 40%. VCO blends demonstrated improved stability compared to pure VCO, with VCO blended AP 200mg/kg exhibiting the lowest PV of 3.43 ± 0.17 after 60 minutes of baking. When boiling for 30 minutes, VCO control exhibited lowest PV which was 7.335 ± 0.09 . Under frying conditions, VCO control exhibited lowest PV which was 5.315 ± 0.007 . Sensory evaluation revealed that VCO blended with Vitamin E 0.5% as the preferred blend for fried chips, while the unblended VCO control was preferred for plain oil. VCO blended with AP 200 mg/kg showed the highest shelf life among other blends which was 973 days while the other samples deteriorated within 100 to 600 days. Various cooking methods and blend compositions affect sensory profiles and consumer preferences. Pure VCO remains stable for frying and boiling, while VCO Blended with AP 200mg/kg shows more suitability for baking purposes. Future research should prioritize determining optimal blend ratios for diverse culinary applications and evaluating blending's overall quality impact.

Keywords: Accelerated aging, free fatty acids, oxidative stability, peroxide value

Development of a biodegradable alternative to single use sachets using agar extracted from *Gracilaria edulis*

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This study aims to address the urgent issue of plastic pollution by creating sustainable alternatives, focusing on biodegradable films made from agar extracted from the seaweed *Gracilaria edulis*, specifically targeting single-use sachets. The study involved extracting agar, creating normal agar film (NAF) and composite films using corn starch (CSC) and beeswax (BC). Mechanical and physical properties including thickness, density, opacity, water vapor permeability, moisture content, and XRD patterns were assessed. Chemical properties were analyzed through FTIR tests, while antimicrobial properties were assessed using the CFU method. A three-week shelf-life assessment was conducted, involving chemical parameters, microbial testing, and sensory evaluation using milk powder samples packed in each film. Highest thickness ($0.19 \pm 0.09 \text{ mm g}^{-1}$) and highest apparent density ($1.39 \pm 0.05 \text{ g mm}^{-3}$) were reported in CSC film. BC film demonstrated increased opacity ($4.86 \pm 0.07 \text{ Am}^{-1}$), decreased water vapor permeability ($7.34 \times 10^{-3} \pm 0.11 \text{ gm}^{-1}\text{s}^{-1}\text{Pa}^{-1}$) and decreased moisture content ($17.83 \pm 0.07 \%$). In XRD patterns, a significant ordered semi-crystalline structure, and in FTIR spectrum, a notable ester peak (1740 cm^{-1}) were observed in BC film. Results from mechanical, physical, chemical, and antimicrobial analyses suggest that incorporating beeswax into agar could enhance crystalline structures, potentially influencing rigidity and barrier properties, thereby extending the shelf life of food products. The study observed efficient antimicrobial properties in the corn starch (CSC) film, while beeswax (BC) was found to preserve milk powder better than other films during shelf-life studies. This offers a promising sustainable alternative for food preservation. Analyzing the storage stability of BC for various food samples will provide deeper insights for future studies.

Keywords: Beeswax, biodegradable packaging, corn starch, single- use packaging, seaweed

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Brewing excellence: optimizing amla (*Emblica officinalis*) tisane for a perfect sip: particle size, infusion time, and bag design impact on color, aroma, and taste

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This research aimed at making amla tisane, which is instantly consumable in a non-woven corn fiber pyramid bag to be prepared as a hot beverage by brewing with hot water, in collaboration with Aurasa Lanka (Private) Ltd. Three pyramid bag sizes (120 mm, 140 mm and 160 mm) and four-particle sizes (ranging from 0.2 mm to 0.6 mm) were investigated for optimization, along with particle size corresponding to the regular ground particle composition. Sample weights varied between 1.5 g and 3.0 g depending on the bag size. Samples underwent brewing for 5, 7, and 10 minutes, employing extraction as the primary method. Each experimental unit had two replicates, resulting in 300 samples brewed in 300 mL tea infusers. Mean extractions for the 120 mm, 140 mm, and 160 mm bag sizes were 1.30 ± 0.26 g, 1.46 ± 0.28 g, and 1.57 ± 0.40 g, respectively, at a 5% significance level. The smallest particle size yielded the lowest extraction (1.39 g), while the 0.45 mm particle size exhibited the highest (1.51 g). In relation to the sample weight, 1.5 g showed the lowest extraction (1.07 g), while 3.0 g demonstrated the highest (2.11 g). Notably, brewing periods of 5 and 7 minutes showed no significant difference in extraction weight (1.42 g and 1.45 g respectively), while a 10-minute brewing duration resulted in an extraction weight of 1.51 g. Sensory evaluations indicated that tisanes brewed for 10 minutes had higher overall acceptability over other brewing periods. Tisane pH ranged from 3.37 to 3.47 at 24°C, with a Total Soluble Solids (TSS) of 0.5 brix. Consequently, the optimal amla tisane configuration identified consists of 2.5 g initial weight with a particle size of 0.45 mm, packed in a 160 mm pyramid bag, brewed for 7 - 9 minutes, according to research findings.

Keywords: Brewing, extract, pyramid bag, sensory evaluation

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Optimizing characteristics of fermented curry leaves (*Murraya koenigii*) tisane: fermentation, particle size, brewing process and sensory profile

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The curry tree, an ancient medicinal/culinary plant in Sri Lanka, offers therapeutic benefits according to Ayurvedic medicine. Innovatively applying the fermentation process on curry leaves presents a novel approach to herbal beverage production showcasing unique features in herbal products beyond traditional tea. The study aimed optimizing infusion extraction and preventing string breakage in curry leaves tisane pyramid bags. In this study, three different sizes of pyramid shaped tisane bags (120, 140 and 160 mm), five different fermentation periods (1-5 hours), four different sample weights (1.5-3.0 g) and three different brewing times (3, 5 and 7 minutes) were tested. The mean extraction of infusion for 120 mm, 140 mm and 160 mm pyramid bags were 0.225 ± 0.059 g, 0.403 ± 0.080 g and 0.358 ± 0.096 g respectively. In relation to the sample weight, 1.5 g sample showed the lowest extraction (0.270 g) and 3.0 g sample showed the highest (0.474 g) extraction. In considering the brewing period, the 3 minutes brewed tisane showed the lowest extraction (0.332 g) while 7-minute brewed tisane showed the highest (0.391 g) extraction. The study revealed that the fermentation period does not significantly affect the extract of infusion weight. Considering the occurrence of breakage of string, the mean sample weight that can be added into the 120 mm, 140 mm and 160 mm pyramid bags were 1.58 ± 0.19 g, 1.81 ± 0.35 g and 1.96 ± 0.45 g respectively without breakage of the string. Five-hour fermented, 5 minutes brewed fermented curry leaves tisane showed the highest sensory quality compared to other fermentation periods and brewing times. Thus, curry leaves fermented for 5 hours, sample weight of 1.96 ± 0.45 g added into the 160 mm pyramid bag and brewed for 5 minutes is recommended for fermented curry leaves tisane.

Keywords: Extraction, pyramid bag, string breakage

Acknowledgment: Aurasa Lanka (Pvt) Ltd is acknowledged for providing financial assistance for the research.

Physicochemical and functional properties of dietary fiber-rich powders from yellow passion fruit peel: extraction and applications in a meat model

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The primary objective of this research was to utilize Yellow Passion Fruit (*Passiflora edulis flavicapa*) Peel (YPPF), a waste material from juice production, as a source of dietary fiber. Dietary fiber is an important component of a healthy diet, as it can lower the risk of chronic diseases such as diabetes, cardiovascular disease, and obesity. The research examined different extraction methods and assessed the physicochemical and functional characteristics of the obtained fiber-rich powders, focusing on their potential use in a model meat system. The study compared the insoluble dietary fiber (IDF), soluble dietary fiber (SDF), total dietary fiber (TDF) contents, physicochemical and functional properties in acidic (1% and 2% citric acid with heating-assisted and heating + ultrasonication-assisted) and enzymatic extraction methods. Compared to the whole peel powder, the obtained powders showed a significant increment in total dietary fiber (TDF). All fiber-rich powders showed excellent water and oil holding capacities, as well as cholesterol absorption capacities ranging from 32.07 ± 0.76 to 36.14 ± 0.58 mg/g. The acid-extracted powders had higher total phenolic content and antioxidant activity than the enzymatically extracted powders. Adding fiber-rich (heating-assisted 2% acid extracted) powder to the meat model, increased cooking yield and enhanced emulsion stability compared to the control sample which includes 7.5% wheat flour. Overall, the findings indicated that acidic extraction is the best method for extracting dietary fiber from YPPF and adding fiber-rich powder at 2% and 4% levels offers improved cooking yield and emulsion stability in meat products. Thus, this study provides a possibility for functional food production using YPPF dietary fiber, addressing the problem of waste management in the food industry.

Keywords: Dietary fiber, functional properties, meat model system, passion fruit peel, physicochemical properties

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Encapsulation of cinnamon (*Cinnamomum zeylanicum*) bark oil in gum arabic using freeze drying technique

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Cinnamon bark oil, rich in cinnamaldehyde, is acknowledged for its natural antibacterial, antioxidant, and antiseptic properties. Despite its beneficial qualities, essential oils face instability issues when exposed to light, heat, air and moisture. To counteract this, encapsulation techniques, such as microencapsulation, have emerged as promising solutions. Microencapsulation involves enclosing a core material, enhancing stability and preserving bioactive substances. In this study, gum arabic is chosen as the wall material due to its remarkable film-forming abilities, lipophilicity, emulsifying capacity and biodegradability. The study focuses on encapsulating cinnamon bark oil, determining the optimal oil concentration for encapsulation using gum arabic & assessing the physical properties of microencapsulated cinnamon bark oil powder. The study investigated oil concentrations ranging from 10% to 40% concentrations. Initially Emulsion Stability Index (ESI), Viscosity, and Efficiency (%) were examined across the oil concentration range. Viscosity values decreased progressively with increasing oil concentrations, reaching a favorable level of 297.90 ± 1.97 mPas at 30% concentration. Efficiency (%) and Emulsion Stability Index (%) were noteworthy at 64.47 ± 1.69 and 92.26 ± 0.92 , respectively, for the 30% oil-concentrated powder. The chosen 30% oil concentration were assessed and resulted in Encapsulation Yield ($92.34 \pm 0.71\%$), Solubility ($85.67 \pm 3.06\%$), Moisture Content ($11.67 \pm 1.53\%$), Bulk Density (0.59 ± 0.01), and Tapped Density (0.64 ± 0.01). These parameters collectively indicated high efficiency, effective solubility, controlled moisture levels, and provided insights into the packing characteristics of the microencapsulated emulsion. The encapsulated oil exhibited notable Antioxidant (DPPH scavenging) Activity of ($66.36 \pm 0.42\%$) and a Water Activity (0.395 ± 0.01). The comprehensive examination of these parameters highlights the significance of the 30% oil concentration in achieving stable emulsions with desirable physical properties. These findings offer valuable insights for industries seeking efficient methods to incorporate Ceylon cinnamon bark oil into various applications in many food industries.

Keywords: Cinnamaldehyde, emulsion stability index, encapsulation efficiency, viscosity

Evaluating the possibility of replacing the artificial red colorant (E122) used in strawberry ice creams with natural red color extracts from selected natural sources

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The instability of red artificial colorants and associated health risks prompt exploration of alternatives. This study evaluates the feasibility of substituting the widely used artificial red colorant (E 122) in strawberry-flavored ice cream with natural color extracts from sources such as red dragon fruit (*Hylocereus costaricensis*), beetroot (*Beta vulgaris L.*), bougainvillea (*Bougainvillea glabra*), and *Hibiscus rosa sinensis*. Employing spectrophotometry and colorimetry, the research examined natural pigment color change at -18°C. Eight colorants were prepared by equal dry weights of dried and fresh forms of each of the four sources, with moisture content considered. Ultrasonication was employed for color extraction. The pH of hibiscus colorants was maintained under 2 by adding citric acid. Results revealed that dried bougainvillea colorant emerged with the highest initial pigment concentration (133.64±1.06 mg/L), while other colorants obtained significantly ($P<0.05$) lower values: dried hibiscus (261.06±1.93 mg/L), dried dragon fruit (69.42±0.14 mg/L), fresh dragon fruit (68.17±0.09 mg/L), fresh hibiscus (61.17±0.19 mg/L), dried beetroot (54.68±0.18 mg/L), fresh beetroot (54.47±0.14 mg/L), and fresh bougainvillea (45.93±0.14 mg/L). Fresh dragon fruit colorant showed the minimum color degradation percentage (3.05±0.02%) compared to the other seven colorants over a 21-day storage period. After adding all 8 colorants into the ice cream base separately, the minimum color change was shown by dried bougainvillea ($\Delta E=0.66\pm 0.18$), while others showed significantly ($P<0.05$) higher color change: fresh dragon fruit ($\Delta E=1.15\pm 0.59$), dried dragon fruit ($\Delta E=1.18\pm 0.04$), dried beetroot ($\Delta E=1.35\pm 0.05$), fresh beetroot ($\Delta E=1.42\pm 0.14$), dried hibiscus ($\Delta E=1.54\pm 0.07$), fresh hibiscus ($\Delta E=1.96\pm 0.09$), and fresh bougainvillea ($\Delta E=2.98\pm 0.07$). Sensory analysis designated fresh dragon fruit and dried beetroot as optimal natural colorants, closely resembling artificial counterparts. Accordingly, spectrophotometry favored fresh dragon fruit, colorimetry revealed dried bougainvillea, and sensory tests endorsed fresh dragon fruit and dried beetroot as superior natural colorants for strawberry-flavored ice cream, benefiting consumers seeking safer and more natural food options.

Keywords: Color change, color degradation percentage, colorimetry, spectrophotometry

Development and evaluation of brined green peppercorn (*Piper nigrum*) as a functional, value-added product

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Sri Lanka, the twelfth-largest global exporter of pepper, faces stiff competition from major players like Vietnam, Brazil, and India, due to their superior labour, land, and resource advantages. To address this challenge, the study explores the production of value-added spice products, focusing on immature green peppercorns, which have received a growing demand recently. The peppercorns were pickled in brine solution containing sea salt and citric acid. The pH changes of the brined pepper were measured to determine the point at which it becomes shelf stable (pH below 4.5) and a portion of the sample was pasteurized to stop the fermentation. The pasteurized peppercorn was tested 1-week after production to ensure fermentation has properly halted and microbial count remains at shelf stable level ($<10^6$ CFU). The functional, chemical, sensory, and microbial properties between brined peppercorns and fresh berries was also conducted. The flavonoids and phenolic contents in brined green pepper was significantly ($P<0.05$) higher than in fresh berries indicating comparatively higher antioxidant content in the former. The 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging capacities were higher in brined and pasteurised samples, shown by low “half-maximal inhibitory concentration” (IC₅₀) values. A salt content of 8.23 ± 0.4 g for 100g of peppercorn was calculated using Mohr’s test. Sensory evaluation using a 7-point hedonic scale showed no significant difference in the overall acceptability of pasteurized brined peppercorns compared to non-pasteurized ones. Accelerated shelf-life determination estimated a shelf life of 91 ± 1.2 days for brined peppercorns at room temperature determined by the values of yeast and mold count. After conducting cost analysis, the study revealed that a 350 g pickled green peppercorn bottle could be competitively priced at Rs.830 \pm 10, positioning it favorably against cucumber and olive pickles. These findings highlight the substantial potential for brined green peppercorn to emerge as a valuable functional spice product in the market.

Keywords: Antioxidants, brining, export market, value added spices

Assessing the knowledge and perception on food flavouring substances and flavour enhancer regulations among consumers in Galle district and food manufactures in the Southern Province, Sri Lanka

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The purpose of this study was to assess the knowledge and perception of flavouring substances and flavour enhancer regulations among consumers in Galle district and food manufactures Southern province, and to examine consumers' purchase intention for food products by investigating effects of attitude, subjective norms and perceived behavioural control on flavouring substances and flavour enhancers and its regulation. The conceptual model for the consumer survey was built using theory of planned behaviour. Consumer survey was conducted in Galle district using convenience sampling and total of 202 usable responses were collected. Descriptive analysis, reliable test and regression analysis were performed using SPSS 25. To assess the knowledge and perception of manufactures, a qualitative study conducted through in-depth interviews. Purposively eight manufacturers were selected in southern province to the study. A semi-structured guide was used to collect data. Generated ideas were thematically analysed using NVIVO software. Even though 98% of consumers believed that food industry is actively using flavouring substances and flavour enhancers, only 42.1% could distinguish the difference of different flavouring substances and flavour enhancers. Only 60.4% of consumers aware about the regulation of flavouring substances and flavour enhancer (2013). Overall model testing results confirmed that significant ($P < 0.05$) effect of attitude, subjective norms, and perceived behavioural control on consumers' purchase intention for food products. Among these, perceived behavioural control showed the highest impact on purchase intention. Manufactures perceived the importance of understanding regulation and further suggested that better and clear communication with authorities may enhance the adherence and avoid complexities of the regulatory jargons. These findings offer valuable insight for local stakeholders to navigate consumer choice and marketing strategies towards more responsible and informed approaches.

Keywords: Consumers, flavouring substances, manufactures, purchase intention, regulation

Development of fruit flavored jelly from the seaweeds *Kappaphycus alvarezii* and *Gracilaria edulis* and evaluation of nutritional and functional properties

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Gracilaria edulis and *Kappaphycus alvarezii* are found to be rich sources of agar-agar and carrageenan but are currently underutilized in Sri Lanka. The applications of these extracts in food industry are immense and a considerable cost occurs for their importation. This study focuses on extracting agar and carrageenan from the above sea weeds harvested from Sri Lankan coastal areas and studying their gel characteristics. Further, the suitability of the extracted compounds in development of a ready-to-eat jelly was also investigated during the study. The yield of extraction, physio-chemical, microbiological, sensory, and functional properties of the jelly were studied. The yield of agar obtained from hot-water extractions of *G. edulis* and alkaline extractions of *K.alvarezii* showed values of 32.11 ± 0.15 and 37.52 ± 1.23 (% dry weight basis) respectively. The viscosity of agar jelly was 17.01 ± 0.02 mPas and in the carrageenan jelly the value was 8.03 ± 0.05 mPas. Moreover, from the textural analysis, the hardness values obtained were 0.15 ± 0.003 N and 0.067 ± 0.005 N for agar and carrageenan respectively. Considering the sensory acceptance, the developed jellies received overall satisfactory responses. However, agar jelly was preferred due to its better textural properties. Both jellies showed a decline of pH during a shelf life of 25 days in refrigerated temperature of 4°C where the final pH for agar and carrageenan jellies were 3.5 ± 0.01 and 5.4 ± 0.02 respectively. This study has shown the potential of extracting agar and carrageenan from locally available sea weeds and successful product development of plant-based jellies.

Keywords: Agar, carrageenan, plant-based jelly, sea weeds

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The effect of ultrasound-assisted natural deep eutectic solvents (NADESS) on total phenolic content, total flavonoid content, and antioxidant activity of banana peels from four varieties of banana in Sri Lanka

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The banana processing sector produces numerous by-products, primarily composed of peels, which represent a valuable reservoir of bioactive compounds. This study is aimed at improving the recovery of bioactive compounds from banana peel using ultrasound assisted NADESS and conventional solvent extraction methods and finding the effect of extraction solvent, banana variety on the total extracted phenolic and flavonoid contents and antioxidant activity of the ripened stage peels obtained from four varieties (*Ambun, Kolikuttu, Ambul, Suwandel*) of banana in Sri Lanka. Banana peels were dehydrated at 45 °C for 72 hours and mechanically converted to powder. The NADES systems used in this study were malic acid: glycerol, lactic acid: glucose, lactic acid: glycerol, and water. 70% acetone, 70% methanol, and 70% ethanol were used as the conventional extraction solvents. The assays for total phenolics content (TPC), total flavonoids content (TFC), 1,1-diphenyl-2-picryl hydrazyl (DPPH) radical scavenging, and ferric reducing antioxidant power (FRAP) inhibition activity were analyzed using UV-visible spectrophotometric methods. Results showed that banana variety and extraction solvent had significant effects on TPC, TFC, and antioxidant activity of different solvent extracts. The ranges of values for TPC, TFC, DPPH, and FRAP, inhibitory activity were respectively 5.56-20.32 mgGAE/g DW, 2.18-10.20 mgRE/g DW, 21.57%-91.05% and 11.24- 103.54 mgAAE/g DW respectively. Lactic acid: glycerol NADES showed significantly highest extraction efficiency, and the *Ambun* variety showed significantly highest TPC, TFC, and antioxidant activity. The study showed the promising potential of employing ultrasound assisted NADESS in extracting bioactive compounds from banana peels when compared to conventional solvents which illustrates the potential utility of NADESS in extracting bioactive compounds in the fields of food and medicinal chemistry.

Keywords: Bioactive compounds, conventional extraction solvents, 1,1-diphenyl-2-picryl hydrazyl

Isolation of rice bran proteins and assessment of their physicochemical and functional properties

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Plant-based proteins are cost-effective, and abundantly available and are increasingly gaining attention among consumers. Rice bran, a byproduct of rice milling is considered as a rich source of protein. Sri Lankan rice varieties have not gained significant attention on rice bran protein isolation. Therefore, this research was conducted to evaluate the physicochemical and functional properties of rice bran protein isolates prepared from *Sudu Kekulu*, BG 358 (PI-SK) and *Rathu Kekulu*, Ld 368 (PI-RK) varieties and the results were compared with Wheat Gluten (WG). Rice bran protein isolates were prepared by alkaline extraction and isoelectric point precipitation. The protein yield of PI-SK and PI-RK were $12.37\% \pm 0.27$ and $11.88\% \pm 0.19$ respectively. PI-SK and PI-RK protein contents were found to be $53.65\% \pm 0.43$ and $49.59\% \pm 0.22$ respectively whereas WG showed $79.98\% \pm 0.42$ protein content. Total phenolic content, total flavonoid content, total carotenoid content and DPPH radical scavenging activity of the methanolic extracts of PI-SK and PI-RK were determined. Compared to the PI-SK extract, PI-RK extract showed higher values for bioactive compounds and DPPH radical scavenging activity. Colour parameters (L^* , a^* , b^* and WI: Whiteness Index) were also characterized. The water and oil absorption capacities of PI-SK and PI-RK were, $2.40 \text{ g/g} \pm 0.06$, $2.14 \text{ g/g} \pm 0.09$ and $1.79 \text{ g/g} \pm 0.10$, $1.85 \text{ g/g} \pm 0.14$ respectively. PI-RK had highest bulk density ($0.36 \text{ g/mL} \pm 0.01$) than PI-SK ($0.31 \text{ g/mL} \pm 0.01$). Foaming and emulsifying properties of protein isolates were determined under different pH values, (3, 5, 7, and 9). The emulsifying stability of protein isolates showed significantly ($P > 0.05$) higher than WG. In-vitro gastro-intestinal digestibility was significantly higher ($P < 0.05$) in WG than PI-SK and PI-RK. According to the results, PI-SK and PI-RK have relevant physicochemical and functional properties which can be explored as a source of plant-based alternative protein for food applications.

Keywords: Alkaline extraction, emulsifying, plant-based proteins

Extraction, characterization and assessment of stress releasing ability of essential oil extracted from blue water lily (*Nymphaea erangae*) flowers

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Blue Water Lily (*Nymphaea erangae*) is commonly available aquatic plant in Sri Lanka. Its flower is rich in mild fragrance, however, volatiles compounds in Sri Lankan variety has not been analyzed for its therapeutic effect. This study aims for the extraction of essential oil from flower parts, identification of volatile components and assessing the stress releasing ability using Depression, Anxiety and Stress Scale (DASS-21) standard tool. After obtaining the ethical clearance, final year undergraduates were used as subjects in clinical trials. The essential oil was extracted from petals, pollens and the middle part of the flowers with n-hexane using Soxhlet apparatus. Petals showed $0.39\% \pm 0.01$ oil yield. The pollens and the middle parts had $0.56\% \pm 0.04$ and $0.17\% \pm 0.00$ oil yields respectively. The total phenol contents of methanolic extracts of petals, pollens and middle part were 96.51 ± 3.14 , 88.66 ± 9.54 and 93.06 ± 0.74 mg GAE/g respectively. The pollens showed the highest values for total flavonoid contents and DPPH radical scavenging activity, 59.90 ± 1.05 mg RE/g and $35.88\% \pm 1.09$ followed by petals and middle part. The DASS-21 results showed that all subjects were 100% severely stressed in the first week. Severity of stress reduced to moderate levels in third and fourth weeks in oil inhaled subjects while control group remained severely stressed in entire period. The results conclude that blue water lily pollens possess the highest oil yield which volatiles have significant impact against stress. The findings will be useful to the pharmaceutical industry in the development of new stress releasing medicines.

Keywords: Essential oil, pollen fragrance, stress releasing ability, volatiles

Impact of different food label formats on healthiness evaluation and consumer food choices: a study in Kesbewa, Sri Lanka

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Food labels are crucial for informed consumer choices and fair trade in the food industry. In Sri Lanka, numerous research has focused on Traffic Light Food Color Coding System, but understanding various label formats' impact on healthiness evaluation and consumer choices remains limited. This study aims to evaluate different food label formats comprising a survey and consumer study comparing four labels (Traffic Light System, Nutrition Fact Panel, Nutrition Fact Panel with Daily Values, Simple Statements) in Kesbewa, Sri Lanka. An interviewer-administered questionnaire in Sinhala language was given to 383 participants to evaluate the impact of consumer awareness, knowledge, attitudes, and label utilization on healthiness perception and food choices. During the consumer study, participants performed a choice task and ranking test with no label and then with one of the four food labels. Statistical analysis was conducted using R studio. Gender, education level, income group, and health conditions introduced variations in consumer awareness, knowledge, attitudes, and label utilization. Knowledge ($\tau = 0.52$), attitudes ($\tau = 0.57$), and use ($\tau = 0.53$) of food labels were moderately positively related to healthiness perception. Similarly, knowledge ($\tau = 0.52$), attitudes ($\tau = 0.59$), and use ($\tau = 0.58$) were moderately positively related to consumer food choices, indicating higher levels lead to healthier choices. A potential positive association was noted between the Traffic Light System (OR = 2.41, $P = 0.37$) and Nutrition Fact Panel with Daily Values (OR = 2.44, $P = 0.37$) labels and improved nutritional choices, lacking statistical significance. Traffic Light System (OR = 2.12, $P = 0.12$) and Simple Statements (OR = 1.01, $P = 0.42$) were more effective than Nutrition Fact Panel in enhancing correct ranking based on nutritional quality. In conclusion, policymakers should prioritize educating the public about food labels to increase awareness and empower healthier food choices.

Keywords: Consumer food choices, food label formats, food label utilization, nutrition fact panel, traffic light system

Assessment of oxidative stability of virgin coconut oil infused with *gotukola* (*Centella asiatica*) and curry leaves (*Murraya koenigii*) extracts

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Lipid oxidation significantly affects the quality of edible oils, causing changes in flavor, storage properties, and overall nutritional value. To combat this, researchers have explored the potential of natural antioxidants to improve the oxidative stability of edible oils. Phytochemical extracts were prepared from Curry Leaves (CL) and Gotukola (G) using ultrasound-assisted extraction (UAE) and ethanol as solvent. The phytochemical extracts were assessed for their total phenolic content (TPC) and total flavonoid content. The antioxidant activities were determined by 2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) assay. The phytochemical extracts were incorporated individually into virgin coconut oil (VCO) with the aim of extending the oil's shelf life and counteracting the negative effects of oxidation. The antioxidant fortified VCO were kept under accelerated condition and parameters such as peroxide value (PV), free fatty acid value (FFA), conjugated dienes (CD) and fatty acid profile were evaluated with comparison to control (VCO). The TPC and TFC of G and CL phytochemical extracts were found to be 2.47 ± 0.40 , 6.94 ± 0.08 mg GAE/g and 1.75 ± 0.20 and 5.45 ± 0.40 mg RE/g on dry weight basis respectively. Their antioxidant potential was ranked as CL > G ($P < 0.05$) based on their ability to inhibit DPPH radicals. After 72 hours, the PV and FFA of the control VCO were higher than that of VCO fortified with *gotukola* (VCOG) and VCO fortified with *curry leaves* (VCOCL). CD values increased with storage time, similar to PV. The antioxidant fortified VCO displayed lower oxidation compared to the control VCO. This was evident by the maintained lower PV, FFA, and CD values obtained over time for VCOG and VCOCL. These findings underscore the practical importance of natural additives in mitigating lipid oxidation and preserving the quality of edible oils, providing insights relevant to the food industry.

Keywords: *Centella asiatica*, lipid oxidation, *Murraya koenigii*, natural antioxidant, virgin coconut oil

Fatty acid composition, health lipid indices and *trans* fatty acid content in commercial processed meat products in Northwestern province, Sri Lanka

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Processed foods are rich in fat. During the processing of meat, fatty acid (FA) composition is changed. Application of high heat treatment during processing steps can generate *trans* fats (TFA) in the final product. Adverse health effects of TFA are well recognized. Therefore, the determination of FA composition in processed meat is of prime importance. This study focuses on analyzing the FA profile, TFA levels and nutritional quality indices, i.e. index of atherogenicity (IA), index of thrombogenicity (IT), hypocholesterolemic/hypercholesterolemic ratio (h/H) and polyunsaturated/saturated ratio (P/S) in selected uncooked processed meat products available in Northwestern province, Sri Lanka. Eleven processed meat items and fresh chicken, beef & pork as control samples were chosen randomly collected from leading supermarkets and local boutiques. Fat was extracted using the modified Folch method, then fat samples were methylated and analyzed using Gas Chromatography- Mass Spectrometry (GC-MS) for determination of FA composition. All processed meat samples contain a high percentage of monounsaturated fatty acids (MUFA) compared to polyunsaturated fatty acids (PUFA) and the values ranged from 28.88 ±7.12 % for raw pork to 49.12 ±0.29 % for chicken sandwich slices brand 2. Oleic acid was the predominant MUFA in all processed meat samples, ranged from 23.33 ±7.25% for raw pork to 39.75 ±0.13 % for chicken sandwich slices brand 2. Despite variations, all processed meat types contained TFAs below 1% of total fat, with chicken ham exhibiting the highest TFA content at 0.78 ±0.10%. Beef products showed the highest SFA percentage and the lowest P/S ratio. Chicken processed meat products generally had h/H ratios ≥ 2.00, indicating desirable fatty acid composition from a nutritional perspective. In terms of IA and IT, chicken fat is healthier than beef and pork fat. In conclusion TFA content varied among processed meat types.

Keywords: Atherogenicity index, processed meat, thrombogenicity index, *trans* fats

Development of meat analogue using oyster mushroom (*Pleurotus ostreatus*) enriched with rice bran protein: extraction and characterization

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Rice (*Oryza sativa* L) bran is an underutilized milling byproduct of rough rice, and currently huge amounts of rice bran has been discarded and used as animal feed, also it is an inexpensive source of protein. This study aimed to extract protein from rice bran and analyze the physicochemical and functional properties of rice bran protein concentrates (RBPCs), to incorporate into a meat analog made from *Pleurotus ostreatus* (oyster) mushrooms, and to evaluate the final product quality. Three commonly consumed Sri Lankan rice varieties (Bw 358, Bg 368, and At 313) were used. The protein content of RBPCs ranged between $49 \pm 0.70\%$ to $53.9 \pm 0.87\%$. Bw 358, Ld 368 and At 313 were given 49.0 ± 0.70 , 50.6 ± 0.60 and 53.9 ± 0.87 of protein content respectively. At 313 resulted in the highest protein content compared to the other two varieties. The water absorption capacity of RBPCs ranged between 1.33 ± 0.11 to 1.59 ± 0.32 (g/g) while oil absorption capacity ranged 1.04 ± 0.20 to 1.54 ± 0.00 (g/g). A considerable water absorption capacity was shown by Bw 358 while Ld 368 exhibited the highest oil absorption capacity (water absorption capacity of Bw 358; 1.59 ± 0.32 , oil absorption capacity of Ld 368; 1.54 ± 0.00). Furthermore, the secondary structure of the protein was determined using Fourier transform infrared spectroscopy (FTIR). Some of the functional groups were identified using FTIR spectra (C=O stretching vibration, N-H bending vibration). Then mushroom nuggets were developed using RBPCs and textured soy proteins. Four types of mushroom nuggets; Control mushroom nuggets (CMNs), RBPCs included mushroom nuggets; (RMNs) (RMN₁s with 5% RBPCs, RMN₂ with 10% RBPCs, and RMN₃ with 15% RBPCs) were developed and selected physicochemical parameters and sensory properties were evaluated. 5% RBPCs was the most preferable nugget. Rice bran is a rich source of protein and innovative food products can be developed using it as an ingredient.

Keywords: Meat analog, rice bran proteins, secondary structure, soy protein

Encapsulation of bioactive compounds from *Plectranthus amboinicus* leaves and evaluation of bioactivity retention in functional foods

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Plectranthus amboinicus leaves, a rich source of various phenolic compounds with potent antioxidant and anti-inflammatory properties, can combat oxidative stress and offer immense potential for functional food development. Nevertheless, these compounds are sensitive to gastrointestinal digestion conditions, which results in low bioavailability and hinders their utilization. The present study aims to optimize the extraction of these bioactive compounds and enhance their retention through encapsulation for functional food incorporation. Response surface methodology (RSM) has been used to optimize the extraction parameters for the recovery of total phenolic compounds. RSM identified optimal extraction parameters: 87.01% ethanol, 70.2°C, and 62.54 minutes, yielding 19.18 ± 0.97 mg GAE/g DW of total phenolics. The optimized ethanolic extract of freeze-dried *P. amboinicus* leaf was encapsulated in chitosan, a natural biopolymer using the technique of ionic gelation with tri poly phosphate (TPP) as the cross-linking agent, and the retention of bioactivity was evaluated under simulated gastrointestinal and dialysis conditions. The encapsulated particles were characterized by their chemical properties using Fourier-transform infrared (FTIR) spectroscopy, and the morphological properties using scanning electron microscopy (SEM). Encapsulation efficiency and loading capacity of encapsulated particles were $76.38 \pm 2.00\%$ and $34.09 \pm 1.70\%$ respectively. *In vitro* digestion studies revealed a significantly higher release of polyphenols ($P < 0.05$) in simulated intestinal fluid and dialyzed fractions of fortified encapsulated extract compared to that of non-encapsulated extract. FT-IR and SEM confirmed the presence of extract within the chitosan wall matrix with particles in micro scale range. This successful encapsulation suggests targeted delivery of bioactive compounds, maximizing their potential in functional food applications.

Keywords: Chitosan, ionic gelation, *in-vitro* digestion, microencapsulation, polyphenols, response surface method

Optimization of the characteristics of coriander (*Coriandrum sativum*) based carbonated drink: sedimentation and color fading

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Carbonated beverages are the leading soft drinks in the market, yet they are currently denounced as unhealthy among society. To address the above issue, preliminary studies were conducted to develop a fizzy drink from water extract of coriander having therapeutic effects. Sedimentation and colour fading defects were observed during the above experiments. Therefore, the main objective of the current study was to develop a coriander-based carbonated drink with low sedimentation and reduced color fading, while optimizing sensory characteristics. Two temperature levels (~30°C, 4 to 10°C), 3 sugar levels (5.5%, 6.5%, 7.5%), 4 phosphoric acid levels (200 ppm, 350 ppm, 500 ppm as phosphate), 4 storage durations (week 1, week 2, week 3, week 4) were utilized during study to evaluate their effect on sedimentation and colour fading. Sedimentation was measured using centrifugation technique and color fading effect was measured using spectrophotometric technique using wavelength of 232 nm. Sensory characteristics of the samples were tested using simple ranking test with the employment of 30 semi-trained panelists. Results showed significant effects ($P < 0.05$) from storage temperature, storage duration, added acid levels toward sedimentation, while a significant effect ($P < 0.05$) from storage duration, added acid levels toward colour fading of the drink. Increased sedimentations were observed with increasing temperature, acidity, storage duration while color fading was observed over the time. Sensory evaluation revealed 200 ppm acid and 5.5% sugar as the most preferred ($P < 0.05$) acid and sugar levels. Together with the results it can be concluded that the sedimentation of the drink can be controlled by manipulation of acidity, sugar level and storage temperature; sensory characteristics can be controlled by sugar and acid levels, while color can be controlled by acid level.

Keywords: Phosphoric acid, sensory evaluation, storage duration, storage temperature, sugar

Development of all-natural, clear carbonated beverage using oleoresins extracted from pomegranate (*Punica granatum*) arils

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Pomegranate (*Punica granatum*) is a fruit that is rich in various bioactive substances such as polyphenols, anthocyanin, antioxidants and vitamins. The study focused on formulating a beverage aligned with the health-conscious preferences of the younger generation by leveraging the rich bioactive substances found in pomegranate. Pomegranate fruit of *Kalpitiya Hybrid* variety was used during the research and the arils were dried by two different methods: freeze drying at -30°C and oven drying at 40°C. Oleoresins were extracted using Soxhlet extraction method with 95% ethanol. The carbonated beverage was prepared by mixing oleoresin, pomegranate juice and sugar syrup mixture with carbonated water in a 1:4 ratio. Two levels of oleoresins (0.3%, 0.5%) were used for the formulation of beverage and tested by 30 untrained-panelists using 9-point-hedonic scale. Pomegranate juice, oleoresin and final beverage formulation were analyzed for phenolic content and antioxidant activity. Changes in Total Soluble Solids (TSS), pH, acidity, color and microbiological condition of the developed beverage were evaluated during 4 weeks of storage at refrigerated temperature (4°C). The highest oleoresin yield was obtained from freeze-dried arils and it was high in antioxidants as well. Thus, beverage formulation with 0.5% freeze-dried aril oleoresin was the most favorable in terms of sensory properties and high antioxidant activity. The antioxidant activity assessed by DPPH radical scavenging assay of pomegranate juice, oleoresin and beverage were 78.80%±0.48, 87.74%±1.17 and 43.41%±0.75 respectively. The total phenolic content of juice, oleoresin and beverage were 1.57±0.01, 10.17±0.37, and 0.28±0.03 mg GAE/g respectively. Titratable acidity, pH and TSS of the final formulation were 0.85±0.04g CAE /100 ml, 3.54±0.02 and 8.03°±0.06 respectively. Results indicated that, no significant difference ($P>0.05$) in pH, TSS and acidity while aerobic plate count was zero. This study concludes that 0.5% freeze-dried aril oleoresin can be used to formulate an acceptable, antioxidant-rich, natural carbonated pomegranate beverage.

Keywords: Antioxidant, freeze dry, polyphenols, soxhlet extraction

Acknowledgment: The authors thank the Agriculture Research Station, Kalpitiya, Sri Lanka, for providing Pomegranate samples.

Developing an effective pesticide with a fertilizing feature from food waste based on γ -aminobutyric acid

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Making proper use of food waste remains a significant global challenge. This study is aimed at developing a sustainable alternative product by converting food waste, including leftovers, into a natural pesticide with concurrent fertilizing effects. The targeted key active ingredient is GABA (*Gamma - aminobutyric acid*), an inhibitory neurotransmitter with potent pesticidal properties. Food waste was homogenized, treated with a pinch of Mono Sodium Glutamate, and fermented using specific bacterial strain, *Lactococcus lactis subsp. lactis B* at approximately 35 °C and an optimal pH range of 5 - 6. Samples for the test were prepared by a ninhydrin -based GABA assay and the absorbance of the GABA - ninhydrin complex was measured at a wavelength of 570 nm. Efficacy of the pesticidal and fertilizing nature was determined by comparing the difference in pest densities of aphid population and the growth of crops, in between 11 days for both control and treated samples. From the analysis, average GABA content was determined to be nearly 520 mM with the standard deviation of 10.4 when three pesticide samples were considered. Compared to the control ones, pesticide - treated crops exhibited nourished and significantly improved growth. There was a significant difference in both pest densities and growth, between the control and treated crops ($P > 0.05$). These findings demonstrate the potential of utilizing food waste to produce an effective bio pesticide based on the functionality of GABA with the added benefit of enhanced crop growth. Future studies may aim to improve the fermentation process, enhance the precision of measurements, and assess effectiveness across a broader spectrum of pests and crops.

Keywords: Inhibitory neurotransmitter, ninhydrin - based GABA assay, pest density, spectroscopy

Development and assessment of physicochemical and functional properties of dietary fiber rich powders from mango peel

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Mango peel is the major by-product of the mango processing industry. In response to the increasing demand for sustainable utilization of food products, this study focuses on the development of dietary fiber-rich powder from mango peel using three different extraction methods and evaluating their physicochemical and functional properties. Dietary fiber has a great impact on human health and helps to reduce and relieve several health conditions. The methods of acid extraction (ACE), enzymatic extraction (EE), and alkali extraction (ALE) were applied to extract both soluble dietary fiber (SDF) and insoluble dietary fiber (IDF). The AOAC methods (AOAC 1997) were used to determine SDF, IDF, and TDF. The physicochemical and functional properties of each fiber powder were evaluated for water and oil holding capacity, swelling capacity, water solubility, *in-vitro* digestive stability, and *in-vivo* postprandial glycemic response. The alkali extraction method yielded the highest yield of total dietary fiber ($76.0 \pm 0.9\%$). ACE fiber powder displayed greater water holding capacity (5.04 ± 0.01 g/g), oil holding capacity (1.48 ± 0.09 g/g), water solubility ($9.67 \pm 0.12\%$), and swelling capacity (3.11 ± 0.13 ml/g) than ALE fiber powder and EE fiber powder. Furthermore, among the three dietary fiber powders, EE fiber powder has the highest *in-vitro* digestive stability ($68.43 \pm 0.02\%$) and glucose adsorption capacity (0.52 ± 0.01 mmol/g). This study demonstrates the potential utilization of mango peel derived dietary fiber-rich powders, potentially serving as functional food ingredients.

Keywords: Dietary fiber, acid extraction, enzymatic extraction, glycemic response, mango peel, physicochemical properties

Acknowledgement: This study was funded by UBL of Wayamba University under AHEAD Grant.

Determination of optimum harvesting maturity stage of pomegranate (*Punica granatum* L.) fruit cv. Kalpitiya Hybrid by evaluation of physicochemical properties

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Pomegranate (*Punica granatum* L.) has gained high popularity in recent years due to its nutritional and functional properties. This study aimed to determine the optimum harvesting stage of pomegranate fruit (*Punica granatum* L.) cv. Kalpitiya hybrid is a newly introduced variety by evaluating physicochemical properties, and availability bioactive compounds. The fruit contains an orange-pink thin covering and soft-seeds, red-colored arils and a sweet taste. For assessing the maturity stage, the fruits were harvested on five different occasions: 10th, 12th, 14th, 15th, and 16th weeks after fruit set. The total antioxidant capacity (TAC), total phenolic content (TPC), and total anthocyanin contents were determined by DPPH assay, Folin-ciocalteu assay, and pH differential method respectively while pH, total soluble solids (TSS) and total acidity (TA) were determined using AOAC standard methods. Results showed that significant ($P < 0.05$) increment of fruit weight: 55.25g – 109.42g, diameter: 4.72cm – 6.21cm, volume: 57.92cm³ – 98.57cm³, and total aril weight: 29.88g to 51.31g and pH: 2.93-4.03, TSS: 9.16% - 15.32% of the fruit juice compared to the 10th week up to the 16th week. However, the TA of the juice decreased from 0.54±0.02g/100mL to 0.37±0.01g/100mL due to the degradation of organic acids. The bioactive content in the fruit juice showed a declining pattern as TPC from 1.74±0.02g/GAE to 1.37±0.06g/GAE; and TAC from 85.16±1.07% to 71.82±0.77% except for total anthocyanin content. At the 16th week, anthocyanins of the fruit juice showed 24.59±0.01mg Cyanidin-3-glucosides equivalents/L(C₃-GE/L) compared to the 2.69±0.02 mg C₃-GE/L in the 10th week. The results conclude that the 15th week after the fruit set was the optimum harvesting maturity stage of the Kalpitiya hybrid. The results of the research benefit pomegranate growers by providing specific guidance to harvest quality fruit at the fully ripened stage.

Keywords: Anthocyanins, bioactive compounds, cyanidin-3-glucosides, titratable acidity, total soluble solids

Acknowledgment: The authors would like to acknowledge the Department of Agriculture, Sri Lanka for providing pomegranate samples required for the research.

Development and quality assessment of jackfruit (*Artocarpus heterophyllus*) seed based canned veggie ball

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This study was carried out to develop a canned veggie ball from jackfruit seeds, which are often discarded despite their high nutritional value. The study compared two varieties of jackfruit seeds, "Waraka" and "Vela", and their flour (JFSF) characteristics. The JFSF was prepared by oven-drying the seeds at 80°C for 10 hours followed by grinding and sieving them. The veggie balls were made with different proportions of jackfruit seeds, mushroom, potato, textured soy protein (TSP), corn flour, and spices. The study analyzed the proximate composition, physiochemical properties, textural properties, and consumer acceptability of both JFSF and veggie balls. JFSF proximate composition results showed that crude protein, crude fat, ash, moisture, carbohydrate and crude fiber contents ranged between 11.36-11.57%, 0.93-1.07%, 4.80-5.13%, 7.11-8.62%, 71.84-73.58% and 1.97-2.00%. Among the four formulations of veggie balls, formulation with 20% JFSF had the highest crude protein (10.25±0.10), crude fat (6.44±0.05%), crude fiber (3.64±0.05%) contents. The functional properties of JFSF, the textural properties of veggie balls, and the color values were significantly affected by heat treatments like steaming, open pan roasting, microwave roasting and storage conditions. Formulation with 35% JFSF had the lowest cooking loss, while formulation with 20% JFSF had the highest water holding capacity. The pH, water activity, and total microbial count of the veggie balls were within the safe range for consumer consumption during the tested one-month period. Formulation with 35% JFSF was the most preferred by consumers considering its overall sensory acceptability. In conclusion, this study demonstrates the potential to develop a JFSF based novel food product with nutritional benefits.

Keywords: Jackfruit seed flour, veggie balls, physiochemical, proximate, textural properties

Acknowledgement: This study was funded by UBL of Wayamba University under AHEAD Grant.

Optimizing ginger oleoresin extraction and comparative study of varieties for shelf-life extension in ginger-infused king coconut beverage

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Ginger (*Zingiber officinale Roscoe*)-flavored king coconut beverage offers a refreshing blend of tropical sweetness and the invigorating warmth of ginger, creating a unique and revitalizing beverage experience. This investigation aims to optimize the extraction of ginger oleoresin, a key ingredient in the production of a ginger-infused king coconut (*Cocos nucifera var aurantiaca*) beverage and the influence of temperature, extraction time, and ethanol ratio on oleoresin yield using ultrasonic extraction. Optimal conditions for the extraction were identified as: extraction at 60 °C, with 1:40 ethanol for 120 minutes. A comparative analysis was conducted using three ginger varieties prevalent in Sri Lanka. A statistically significant difference ($P < 0.05$) was observed in antioxidant capacity among ‘Sri Lankan’ (SLG) ($88.08 \pm 1.28\%$), ‘Rangoon’ (RG) ($85.21 \pm 0.37\%$), and ‘Chinese’ ginger (CG) ($89.45 \pm 0.42\%$). The phenol contents of SLG, RG and CG were found to be (2.11 ± 0.33 g/GAE), (1.71 ± 0.05 g/GAE), and (2.10 ± 0.11 g/GAE), respectively. In terms of oleoresin yield, SLG exhibited ($8.98 \pm 2.39\%$), RG showed ($12.69 \pm 3.93\%$), and CG displayed ($16.37 \pm 3.28\%$). However, these differences in oleoresin yield and phenol content were not statistically significant. To apply these findings practically, King Coconut beverage was formulated using the SL ginger oleoresin, and sensory evaluation was performed using 30 untrained panelists. The results indicated that a product containing 4g of sugar and 12 mg of oleoresin per 100 ml volume received the highest preference among the tested formulations. Over a four-week storage period, experimentation varied potassium sorbate and ascorbic acid proportions in 100 mL to assess fluctuations in TSS, pH, and color. The control group exhibited more variations. In conclusion, this research enhances the extraction process of ginger oleoresin and the extracts can be successfully used in king coconut- ginger beverage.

Keywords: Antioxidant capacity, phenol content, sensory evaluation, ultrasonic extraction

Efficacy of solvents on oleoresin extraction, piperine isolation and purification from Sri Lankan black pepper (*Piper nigrum*)

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Black pepper (*Piper nigrum*) is a commonly consumed spice grown in Sri Lanka and belonging to the Piperaceae family. Historically, it has found applications in both pharmaceutical and culinary sectors. Piperine, an abundant alkaloid in black pepper provides pungency and numerous medicinal benefits: anti-inflammatory, anti-malarial, fever prevention, stomachache cure, and aid in vitamin absorption. Sri Lankan black pepper varieties are rich in commercially valuable piperine, however, improving extraction efficiency and purity is necessary to get a high economical attraction. The purpose of this study is to determine the efficacy of isopropyl alcohol and acetone, in increasing piperine and oleoresins extraction, yield and purification. Further, comparative study on piperine content in black pepper collected from five regions was conducted. The black pepper oleoresin was extracted separately with isopropyl alcohol and acetone, (1:1v/v) using Soxhlet extraction. Purification was done by multiple KOH washing sessions, followed by piperine recrystallization. Acetone and isopropyl alcohol (1:1v/v) yielded the highest oleoresin (6.08±2.46%) in black pepper among the solvents (isopropyl alcohol and acetone) used. Piperine purity was determined using high-performance liquid chromatography. The highest oleoresin yield and piperine content were reported by Black pepper collected from Rathnapura region and the values were- 7.06±2.91% and 18.20±2.47% respectively. Results conclude that acetone was the best solvent to extract highest yield of piperine (16.50±3.50%), and three KOH washings, three hot water washings followed by recrystallization using isopropyl alcohol proved to be the optimal purification method for piperine.

Keywords: Recrystallization, soxhlet, washings, piperine yield

Consumer awareness on credence attributes: impact on consumer rice purchasing intentions in Galle District, Sri Lanka

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Credence attributes, such as organic and fair-trade labels, significantly impact consumer choices by providing transparent information. This research delves into consumers' awareness of credence attributes in the Galle district and focuses on influence of credence attributes on rice purchasing intentions. This study addresses a critical knowledge gap in Sri Lanka, offering insights with global relevance and guiding local producers and policymakers in a dynamically changing market. Examining consumer awareness regarding credence attributes and its influence on rice purchasing intentions, this study focuses on key credence attributes—organic certification, country of origin, and food safety certification. Consumer awareness on credence attributes was determined using a cross sectional survey using 386 participants. Credence attributes influence on rice purchasing was assessed through a consumer survey using 270 samples with 3 rice package conditions (without logo or claim, with logo and with logo and claim). Consumer awareness in Galle stands at 55.7%, with 53.9% understanding the impact of credence attributes on food safety and quality. Significant associations exist between the demographic variables age, education levels and occupation, while gender remains without any correlation with consumer awareness on credence attributes. Among respondents, 56% had an awareness on credence attribute logos used during the survey and reported regular reading of food labels. Specifically, 43% correctly identified the sustainability logo, 14% correctly identified the HACCP logo, and 49% correctly identified the organic logo. Only 44% believed that credence attributes impact their purchasing decisions. Organic certification was identified as the primary influencer for rice purchases, while the impact of food safety and local origin is limited. In conclusion, the findings emphasize the pivotal role of organic certification in influencing rice purchasing intentions, highlighting the importance for food marketers to prioritize obtaining and safeguarding organic certifications, while urging policymakers to implement measures to prevent the misuse of such certifications to ensure responsible consumer choices.

Keywords: Consumer awareness, consumer survey, credence attributes, rice purchasing intentions

Microencapsulation of amaranthus (*Amaranthus gangeticus* L.) leaf extract and vitamin C for enhanced non-heme iron bioaccessibility

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The study explores the synergistic effect of encapsulating vitamin C with *Amaranthus gangeticus* L, an iron rich plant extract, to enhance iron absorption in the gastrointestinal tract. This encapsulation could potentially address iron deficiency anemia. Different encapsulation conditions were tested, including varying drying techniques (freeze drying and spray drying), maltodextrin wall material proportions, and Vitamin C ratios. Encapsulation efficiency, moisture content, solubility, hygroscopicity, storage stability, and morphology were investigated. The encapsulate using 20g of maltodextrin with freeze drying (20FH) demonstrated the highest encapsulation efficiency. Spray-dried samples had greater solubility and moisture content, with the 25g spray-dried sample (25SL) reaching solubility of $76.23 \pm 0.20\%$ and moisture content of $5.14 \pm 0.08\%$. XRD analysis indicated an amorphous structure in spray-dried microcapsules, while freeze-dried samples were more crystalline. The Fourier Transform Infra-Red spectra of the microcapsules showed the sharp peak at 1000 cm^{-1} suggesting the presence of C-O stretching and the shift in peak position and changes in transmittance percentages may imply interactions between maltodextrin and other components during the encapsulation process. Storage stability favored freeze-dried samples, showing less degradation of Vitamin C content over five days. The 20FH sample outperformed others, suggesting it is a promising fortificant for food products.

Keywords: Antioxidant synergy, maltodextrin, nutrient delivery

Analysis of the effect on the nutritional profile of some selected meals with the inclusion of fresh and dried radish, mustard and, mung microgreens

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Microgreens, the young vegetables harvested when their initial true leaves appear, offer significant nutritional benefits. Global consumption data from FAO, 2017 indicates a shortfall in meeting the WHO's recommendation of 400g of daily fruit and vegetable intake for normal adults. This study investigates the incorporation of radish, mustard, and mung microgreens into the diet, focusing on changes in nutrients and sensory attributes, and evaluating microgreen proportions to find the most appealing and nutritious combination. The study also analyzes nutrient profiles from seed, microgreens to mature greens to comprehend potential variations associated with maturity. To conduct the research, proximate analysis was utilized to determine crude fat, crude protein, and carbohydrate contents. The study employed assessing total phenolic content (TPC), total flavonoid content (TFC) and DPPH radical scavenging antioxidant activity, while microbial counts were estimated for microgreens. Moreover, a sensory evaluation examined consumer preferences for varying proportions of inclusion of microgreens into coleslaw salad. Findings, based on fresh weights, seeds show the highest crude protein content while mature greens show the lowest, among them radish seeds have the highest ($24.10 \pm 0.58\%$) and mung mature has the lowest ($0.35 \pm 0.05\%$). Mustard seeds account for the highest crude fat ($27.15 \pm 0.12\%$) from three growth stages while radish microgreens show the lowest ($1.09 \pm 0.05\%$). Seeds show the highest TPC and TFC while microgreens set to least. Antioxidant activity is highest in mature greens while both seeds and microgreens have similar levels. Greater consumer acceptability with 15% microgreen inclusion compared to 30%, showing a 35.77% increase in crude protein, a 17.51% increase in TPC, a 37.07% increase in TFC, and a 55.50% increase in DPPH radical scavenging antioxidant activity relative to pure coleslaw salad as the control sample. In summary, incorporating microgreens into the diet can elevate nutritional value by boosting levels of TPC, TFC, antioxidants, and crude protein.

Keywords: DPPH, microgreens, proximate analysis, total flavonoid content, total phenolic content

Development and quality evaluation of plant-based high energy protein bar in different packaging materials

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Protein rich plant-based high energy bars have gained widespread popularity among active individuals as convenient meal supplements, with high nutritional value. Thus, this study aimed to formulate and evaluate the quality of a high energy protein bar using plant-based ingredients and the formulations contained Sugar, Dates, Oats, Peanuts, Suwadel rice (*Oryza sativa*), Dehydrated banana and Chickpea flour. Moreover, the research aimed to explore the impact of three distinct packaging materials, namely, T1-Aluminium foil, T2-Metalized Polyethylene Terephthalate and T3-Low Density Polyethylene, on the shelf life of energy bar. Proximate analysis, caloric value determination, sugar and salt analysis were conducted to assess the nutritional quality of the energy bar. Concurrently, sensory evaluation, using a 9-point hedonic scale over an eight-week period, microbial testing, analysis of moisture content and peroxide value were performed over a 12-week period under ambient temperature conditions utilizing T1, T2, and T3. Accordingly, the energy bar contained crude protein and energy at $22.07\% \pm 1.56$ and 476.85 ± 15.49 kcal/100g, respectively. Further it showed, a fat content of $20.44\% \pm 1.39$, sugar content of 10.34 g/100g, and salt content of 0.54 ± 0.02 g/100g, indicating a medium fat level and low sugar and salt levels aligning with the nutritional food labeling claims. T1-packaged bar consistently scored the highest overall acceptability (i.e. 8.05, 8.05, 8.05, 6.85) throughout the 8 weeks storage period. There was a significance deference ($P < 0.05$) in moisture content, peroxide value and microbial content between the energy bars with three different packaging materials and shelf life of 12 weeks was achieved with T1. Results concluded that, the energy bar could be recommended to meet the nutritional requirements of active individuals, while Aluminum foil has proved to be the most effective packaging material, providing the longest shelf life.

Keywords: Energy bar, plant based, shelf life

Development of cassava-soybean based extruded pasta product fortified with vitamin B₁₂ to combat micronutrient deficiency

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In response to the pressing global challenge of micronutrient deficiency, this research was undertaken to develop a cassava-soybean based extruded pasta product fortified with vitamin B₁₂ and the developed product can serve as a gluten-free alternative for individuals experiencing gluten sensitivity. Selecting an optimal flour blend, assessing the functional, physicochemical, cooking properties of pasta, and investigating the retention of Vitamin B₁₂ after cooking were focused during the study. Commercially available pasta was used as the control. Sensory evaluation was conducted with 20 semi-trained panelists using 9-point hedonic scale and it revealed the best product to have 60% cassava flour and 40% soybean flour with a pH of 6.01 and initial water activity of 0.302 ± 0.002 . Final product consisted of $8.45 \pm 0.02\%$ of moisture, $21.11 \pm 0.43\%$ of crude protein, $2.68 \pm 0.25\%$ of crude fat, $8.4 \pm 0.35\%$ of crude fiber, $1.8 \pm 0.14\%$ of ash and $65.96 \pm 0.60\%$ of carbohydrate contents. Accordingly, the developed pasta was packed with nutrients particularly with higher level of crude protein and fiber with low carbohydrate, compared to commercially available pasta. Furthermore, under the physicochemical properties, color of dried pasta showed 62.06 ± 1.66 for L, 1.12 ± 0.20 for a and 19.56 ± 0.36 for b while cooked pasta showed 73.62 ± 0.59 , 0.01 ± 0 , and 21.66 ± 0.07 for L, a and b respectively. Considering the texture, final product exposed 32.15 ± 0.13 N of hardness. Optimum cooking time was 6 minutes. Water activity of the product was in the range of $0.30 \pm 0.002 - 0.36 \pm 0.006$ during 9 weeks of storage period. The retention (%) of vitamin B₁₂ after cooking was recorded as 63.5%. So, the findings of the study contribute to developing a vegan-friendly, gluten-free and vitamin B₁₂ fortified pasta product using plant-based ingredients.

Keywords: Cooking properties, flour blend, gluten-free alternative, vegan nutrition, vitamin B₁₂ fortification

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Development of *Kappaphycus alvarezii* and *Gracilaria verrucosa* based herbal soaps

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Seaweed gives advantages in relation to their renewable character, wide distribution, and the richness and versatility of their valuable bioactive compounds, which can be used as ingredients, as additives, and active agents in the formulation of skin care products. *Kappaphycus alvarezii* and *Gracilaria verrucosa* are species of red algae which are commonly used for producing cosmetics. As these seaweeds rich in antioxidants, vitamins, minerals, antimicrobial and antifungal compounds, this study was conducted to develop herbal soap with *K. alvarezii* and *G. verrucosa*. Sea weed were obtained from seaweeds farms located in Jaffna. Collected seaweeds washed, oven dried at low temperature (below 50°C). Dried seaweeds were grounded into fine powder and incorporated in different percentages during soap preparation as 5%, 10% and 15% of seaweed powder from total weight of the soap. Soap preparation was done according to the standard protocol. Customer preference for the developed soap was screened by using sensory test. Soap pH was also detected under laboratory condition. According to the sensory analysis, most preferred seaweed percentage was selected as 10% from both *Kappaphycus* and *Gracilaria*. Most preferred scent and color of the soaps were lavender and green respectively. The pH value of the both soaps (10% seaweed soaps) were tested as 9.5 and confirm that soap pH is up to the standard level. Free alkali percentage of 10% *K. alvarezii* and 10% *G. verrucosa* incorporated soaps are 0.54% and 0.58% respectively. Total alkali percentage of 10% *K. alvarezii* based soap was 2.5% and 10% *G. verrucosa* based soap was 2.3%. Developed seaweed herbal soap bars have potential to be introduced as new soap products in to the Sri Lankan as well as to the foreign markets in the future.

Keywords: *Gracilaria*, *Kappaphycus*, saponification, seaweed, soap

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Enriching vinegar eel for feeding fish larvae

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Live feeds are essential in larval nutrition in ornamental fish farming. High cost, extra effort, resources and contaminations in culture media limit the use of live feed for fish larvae in Sri Lanka. There is a good potential to enrich the nutrient content of vinegar eels with simple techniques and with minimum cost, space and minimum contaminations; however, limited studies are available on its enrichment. This study intended to identify the vinegar eel species used in Sri Lankan ornamental fish industry, to study lifecycle and population dynamics in coconut water culture media and to study the possibility of enrichment for feeding fish fry using Molly fish (*Poecilia sphenops*). The vinegar eel species was identified as *Turbatrix aceti*. Their sex differentiation occurs at the sixth day of birth. Total length of the male and the female were 1.79 ± 0.07 mm and 1.39 ± 0.11 mm respectively. pH of the culture media ranged from 3.25 to 8.32 within 30-days culture period. Mass-produced vinegar eels in coconut water were enriched with *Chlorella*, *Saccharomyces cerevisiae* and fish oil for 12 hours. Three days old Molly fish were fed separately with both enriched and unenriched vinegar eels and *Artemia* fed fish were taken as the control. Fish stocking density was 30 larvae/ft² and feeding trial was continued for 21 days. Fish length and survival rates were compared among treatments and control. The total length of fish larvae of control had no significant differences ($P > 0.05$) with fish oil-enriched and unenriched nematode treatments but significantly lengthier ($P < 0.05$) than fish fed with yeast and chlorella-enriched nematodes. There were no significant differences ($P > 0.05$) in mortality and specific growth (based on the length) among treatments. The results suggest that both unenriched and fish oil-enriched vinegar eel may have good potential to be used as an alternative live feed to *Artemia nauplii*.

Keywords: Alternative live feeds, larval nutrition, nutrient enrichment, vinegar eels

Investigating the susceptibility of *Macrobrachium rosenbergii* to different traps in a controlled environment for developing an effective fishing gear

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In this research, the primary aim is to investigate the susceptibility of *Macrobrachium rosenbergii*, commonly known as the giant freshwater prawn, to a newly developed trap in a controlled environment. The study seeks insights into prawn behavior changes, focusing on moving patterns, feeding behaviors, resting or inactivity, social interactions, agonistic behaviors, and escape responses to a trap. The comprehensive methodology employs 2-D machine vision technology for data collection and relevant software for behavioral analysis. Data collection occurs in a controlled tank environment with specific dimensions (215 cm tank diameter, 85 cm tank height and 60 ± 10 cm height water level). Sampling methods and criteria for behavior identification align with previous research and observations. According to the results, *M. rosenbergii* shows more behavior patterns comparatively in the nighttime than daytime. Also, they show more behavior frequencies around full moon days than the new moon and quarter moons. Also, they show more behavior frequencies in the nighttime, to the green color light sources than the red color light sources. Finally, from 03 gear types, one gear type shows a significant amount of catch rate in the laboratory tank as well as in the natural environment (In reservoirs). The study's practical implications benefit the aquaculture and fisheries industry, offering valuable insights into prawn behavior, trap interactions, and potential enhancements in harvesting techniques. Positioned to guide sustainable management and maximize yields, this research serves aquaculturists, fisheries managers, and researchers, shaping future practices for industry advancement.

Keywords: Aquaculture, behavior, *Macrobrachium rosenbergii*, machine vision, trap susceptibility

Analyses of morphometric variability of family Unionidae in different river basins in Sri Lanka

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Trophic status of a waterbody is an indicator of nutrient loading and it has a direct impact on plankton diversity. This research aims to study the diversity of phytoplankton and zooplankton in four selected reservoirs with different trophic status. Samples were collected from Beira Lake (BL), Daduru Oya reservoir (DOR), Kandy Lake (KL) and Suruwila reservoir (SUR). Vertical sampling was performed at six sites in each reservoir using a 50µm mesh sized plankton net. Formalin and Lugol's iodine was used to preserve zooplankton and phytoplankton respectively. Trophic status indices (TSI) of the reservoirs were estimated based on Secchi disc depth. Plankton density was only estimated for BL, DOR and KL with Sedgwick rafter counting chamber. Two reservoirs (BL and DOR) were hypereutrophic and TSI were 80.01 ± 2.08 and 70.2 ± 3.18 respectively. KL and SUR were eutrophic and mesotrophic with TSI of 64.45 ± 1.41 and 56.56 ± 0.32 respectively. Simpson's diversity indices for BL, DOR, and KL were respectively 0.44 ± 0.22 , 0.66 ± 0.22 and 0.24 ± 0.09 . Twenty nine phytoplankton species were reported from reservoirs and were belong to eight Families. *Microcystis spp.* dominated in BL (56%), while *Aulacoseira sp.* dominated in DOR (73%) and KL (87%). Diversity of Family Euglenophyceae was high in SUR. Thirteen Euglenophyceae species from six genera; *Euglena*, *Trachelomonas*, *Phacus*, *Strombomonas*, *Monomorphina* and *Lepocinclis* were reported from SUR. Genus *Strombomonas*, and *Monomorphina* would be the first time recorded from Sri Lanka. Species *Trachelomonas hexangulata*, *T. crispa*, *Phacus pluronectus*, *P. undulates*, *P. longicauda*, *Strombomonas gibberosa* and *Monomorphina pseudonordstedtii* reported from SUR and would be the first time records from Sri Lanka. Twenty-one zooplankton species reported from all reservoirs and belonged to five Families. Family Cyclopidae dominated in BL (37%), while Family Brachionidae and Family Diaptomidae in DOR (56%) and KL (27%) respectively. Further studies on Family Euglenophyceae is required to confirm the diversity and species in Sri Lanka.

Keywords: Hypereutrophic, eutrophic, mesotrophic, euglenophyceae, TSI

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Impact of water qualities and farm management practices on *Enterocytozoon hepatopenaei* (EHP) infection status in shrimp farms located in Northwestern province of Sri Lanka

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Enterocytozoon hepatopenaei (EHP) disease affecting Sri Lankan shrimp aquaculture with notable impacts on shrimp health and growth rates and causing economic losses to the farmers. Several factors including water qualities and farm management practices can act as modulators of EHP in shrimp farms. Therefore, this research focused on understanding the relation between EHP, water qualities and farm management practises in shrimp farms located in the North Western province of Sri Lanka. Twenty active shrimp farms were selected from the North western province for this study. Water qualities such as temperature, alkalinity, salinity, Ca level, Mg level, PH measured and presence and absence of white feces which is used as indicator of EHP was also recorded in each farm. Water source, type of ponds were also recorded and their relation with white feces occurrence also examined. Chi square test is used for statistical analysis. According to the results, there is a significant ($P<0.05$) relationship between white feces disease and temperature, salinity and alkalinity. There was no significant relation between water source and pond type. Farmers use garlic powder and probiotics treatments occasionally to reduce EHP infection but proper records were not found. This study revealed temperature, alkalinity, salinity can be modulators on white feces occurrence in shrimp farms hence EHP disease outbreaks. Further research is necessary to find out the individual and cumulative effect of temperature salinity and alkalinity on EHP disease in shrimp farms.

Keywords: Alkalinity, EHP, salinity, shrimps, temperature

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Optimization of microalgal lipid extraction using green solvents

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Microalgae are renowned for their ability to produce diverse bioactive compounds, including lipids and further, serve as primary sources of omega-3 fatty acids. However, many lipid extraction methods rely on toxic, non-eco-friendly solvents, unsuitable for food and nutraceutical applications. Thus, this study aimed to modify microalgal lipid extraction protocols to meet food and nutraceutical industry standards by employing eco-friendly green solvents. Pure cultures of four marine microalgae species (*Chlorella vulgaris*, *Nannochloropsis oculata*, *Thalassiosira pseudonana*, *Chaetoceros calcitrans*) were used to assess lipid yield. The biomass of pure cultures was increased under laboratory conditions, and these biomasses were collected by centrifugation. Harvested microalgae were dried and they were subjected to cell lysis using three different methods; microwave, autoclave, and osmotic shock to determine the most effective cell disruption method for further analysis. For lipid extraction, the standard Bligh and Dyer method and the ethanol extraction method were compared. Fatty acid methyl esters were prepared using extracted lipids of *N. oculata* and fatty acid profile was analyzed by GC-MS. Considering the significantly higher lipid yield obtained from the microwave method, compared to the other two methods, the microwave method was selected as the best cell lysis method for further lipid extractions. Lipid yield extracted from the Bligh and Dyer method was significantly higher in all four species of microalgae compared to ethanol extraction. Notably, *N. oculata* exhibited the highest lipid content of $24.23\% \pm 0.42$ followed by *C. vulgaris*. Fatty acid profile analysis revealed that Bligh and Dyer extracts contain a higher amount of PUFAs (45% PUFA, 35% MUFA, 20% SFA) while ethanol extracts contain a higher amount of SFA (60% SFA, 40% MUFA). As this is the preliminary phase of the study, further analysis of the fatty acid profile needs to be done for other microalgae species to determine the potential of ethanol as a safe alternative lipid extraction method.

Keywords: Cell disruption, green solvents, lipids, microalgae, omega – 3

Analysis of total ecosystem carbon stock at Anawilundawa accelerated natural regeneration of mangrove site

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Mangroves, as a part of the blue carbon ecosystem, play an important role in global carbon cycling, serving as a significant carbon reservoir. Accelerated Natural Regeneration of Mangroves has been carried out in Anawilundawa Ramsar Sanctuary since 2019 to restore mangroves in the abandoned shrimp ponds. This study was conducted to compare the total Ecosystem Carbon stocks (TECS) in peripheral natural mangroves, areas restored with mangrove saplings as well as abandoned shrimp pond areas without any restoration as controls. Sampling included 5 circular plots of 7 m radius each in the three categories. A 1-meter soil auger was used for soil sampling, and vegetation characteristics were also recorded. Allometric equations were used to estimate above-ground and below-ground biomass of vegetation and loss on ignition method was used to calculate soil carbon content. Results revealed that TECS are 431.11MgC/ha, 450.91MgC/ha, and 709.57MgC/ha for peripheral natural mangroves, restored areas, and abandoned control shrimp ponds respectively. Highest soil organic carbon (SOC) was found in abandoned control shrimp ponds (177.25±15.48) while lowest SOC was present in the peripheral natural mangroves (96.05±10.77). The restored area had a mean SOC of 112.53±10.62. The peripheral natural area had the highest mean total vegetation Carbon of 28.98±5.49Mg/ha, of which 73.03% was present in above-ground carbon while 26.97% was present in below-ground carbon. Abandoned control shrimp ponds and restored area had vegetation Carbon stock (Above-ground + Below-ground) of 0.51±0.30Mg/ha and 0.78±0.13Mg/ha respectively. The percentage of above-ground Carbon at the abandoned control shrimp farm area was 77.39% while its below-ground C was 22.61%. The restored area had an above-ground and below-ground Carbon percentage of 68.29% and 31.71% respectively. This study highlighted higher levels of TECS in abandoned shrimp farms, where currently *Suaeda maritima*, *Suaeda monoica* and *Tamarix indica* are found. This is the first study applying the above methodology in Sri Lanka and it is recommended for all mangrove areas.

Keywords: Above-ground biomass, below-ground biomass, carbon, DBH

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Development and optimization of ready –to- eat seafood sauce utilizing Blue Swimming crab (*Portunus pelagicus*) and Indian white shrimp (*Penaeus indicus*)

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The global surge in seafood demand, coupled with Sri Lanka's active shellfish contribution to international markets, highlights the need to further explore opportunities in value-added products. Despite the nutritional richness of crab and shrimp meat, there is limited consolidated information on value-added processed products in scientific literature. This research addresses the growing global demand for seafood and the untapped potential in value-added products, focusing on the development of a novel seafood sauce using meat of Blue Swimming Crab (*Portunus pelagicus*) and Indian white shrimp (*Penaeus indicus*). For the sauce preparation, fresh seafood was sourced from the Negombo coastal area and stored at -20°C until use. Processing involves evisceration, boiling, tempering in oil, grinding, combining with a modified tomato sauce formula in three ratios, and cooking for 12 minutes at 85–100°C. Hot filling and storage at room temperature were consistently applied. Three ratios (20%, 40%, 60%) of crab and shrimp incorporated sauces were assessed for consumer acceptance and market viability against a control (0% crab meat and shrimp). Proximate composition and shelf- life were determined only for the best product selected through sensory evaluation conducted with an untrained sensory panel (n=40) to determine organoleptic qualities. Sauce with 60% crab and shrimp combination was selected as the best product. It exhibited an expected thirty- day shelf-life, slightly less than the control, with no significant quality defects observed until the fourth week, except for a slight increment in pH level teaching up to 4.54. Moisture, ash, crude-fat, crude protein, crude fiber and carbohydrate percentages were 73.08%, 2.64%, 6.25%, 7.97%, 2.41%, and 7.35% respectively, compared control sample's 79.30%, 2.55%, 3.67%, 1.28%, 6.02% and 7.18% values respectively. Commercial value addition of left-over meat and unmarketable catches is possible with this product. Additionally, this sauce is also a source of protein.

Keywords: Crab, proximate composition, seafood sauce, shelf-life, value added

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Comparative assessment of DNA extraction techniques for mangrove species: Evaluating DNA yield, purity and water salinity

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DNA extraction from mangrove species is crucial for diverse research applications, faces challenges due to interfering compounds and saline soil conditions. This study evaluated the efficiency, yield, purity and water salinity sensitivity of four DNA extraction methods for *Rhizophora mucronata*, *Avicennia marina*, and *Bruguiera cylindrica*. Samples were collected from two locations with varying water salinity levels: Anawilundawa Ramsar wetland and the Negombo lagoon. The study compared the efficiency of four DNA extraction methods: Basic CTAB (cetyltrimethylammonium bromide), CTAB with β -mercaptoethanol, CTAB with liquid nitrogen and β -mercaptoethanol, and SDS (sodium dodecyl sulfate) methods. DNA quantity and quality were assessed through gel electrophoresis and spectrophotometric methods. Statistical analyses revealed significant differences in DNA yield and quality among methods, salinity, and species. CTAB with β -mercaptoethanol delivered high quality DNA for *R. mucronata* and *B. cylindrica*, but not for *A. marina*, which performed well across all other methods. SDS extraction method showed limitations for *R. mucronata* and *B. cylindrica*. DNA yield and purity varied significantly between locations due to environmental factors, although no interaction between water salinity and DNA concentration was observed due to species specific salt tolerance. Notably, CTAB with β -mercaptoethanol and liquid nitrogen, while yielding high molecular weight DNA, resulted in RNA, phenolic compounds, salt and pigment contamination. Further optimization is needed to achieve both high quality and purity across all species. These findings offer insights into optimizing DNA extraction protocols for diverse mangrove species and underscore the importance of method selection based on desired outcomes and cost considerations.

Keywords: DNA, extraction, mangrove, purity, yield

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Where do all abandoned boats go: investigating Negombo and Chilaw lagoons as boat graveyards

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The widespread abandoning of fiberglass boats releases toxic substances and introduces microplastics, causing enduring harm to aquatic ecosystems and their biota. As of 2018 Fisheries Department data, Negombo and Chilaw have 4643 and 4281 registered boats, respectively. As there's no proper fiberglass boat disposal method practiced in Sri Lanka, the present study focused on investigating the prevalence of abandoned fiberglass boats, at Negombo and Chilaw fishing harbors. Data collection involved visual observations by multiple boat visits over the period of October to December 2023, covering 4.25 km² in Negombo and 2.78 km² in Chilaw lagoons, recording abundant boat type, location, sinking and degradation levels. Data were visualized using ArcGIS software. Fouling organisms were collected from sunken boats and were identified. The present study recorded 67 abandoned boats, with 56 in Negombo lagoon (38 Off-shore multi-day boats (IMUL), 11 One day Fiber Reinforced Plastic boat (OFRP), 5 Traditional boat (non-motorized) (NTRB), 2 other) and 11 in Chilaw lagoon (9 OFRP, 2 IMUL). IMUL was the most abundant boat type in Negombo lagoon, while OFRP were the highest abundant boat type in Chilaw. Additionally, 21 fouling organism samples were collected (10 from Negombo and 11 from Chilaw), and 14 organisms were identified up to species level. Among identified organisms, *Littoraria intermedia* was recorded in both lagoons. *Arcuatula capensis*, *Isognomon ehippium*, and *Saccostrea scyphophilla* were only recorded in the Negombo lagoon while *Septaria lineata*, *Nanostrea fluctigera*, *Dendostrea cristata*, *Magallana belcheri*, and *Saccostrea echinata* were only found in the Chilaw lagoon. Though these abundant boats served as a habitat for diverse fouling organisms, these organisms may be responsible for the changes of microplastics and other toxicant movements in such environments. Hence, findings of the present study will serve as baseline data for future environmental management efforts, highlighting the pressing need for the effective management of abundant fiberglass boats in Sri Lanka.

Keywords: database, degradation, fiberglass boats, harbor, fouling organisms

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Development of a fish spread using Rohu (*Labeo rohita*) fish species

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Except dry fish and smoked fish, a few value-added products developed from freshwater fish are available in the Sri Lankan market. Moreover, in a previous attempt to develop canned fish product from Rohu and Silver carp, an expert panel recommended to develop a fish spread from these species to overcome the poor texture in flesh. Thus, the present study aimed to develop a fish spread from these fishes and evaluate their quality standards and consumer preference. Initially quality of raw flesh was tested. Pressure cooked flesh was minced with different combinations of spices to develop seven products. Best products for further development were selected by a sensory evaluation. “Rohu garlic” (RG) “Rohu garlic-sesame” (RGS) products were further developed as the final products. Then these two products were steamed (65°C, 20 minutes) and retorted (121 ° C, 1.3 atm, 55 minutes). Finally, the quality of the developed fish spread was tested for microbiological, biochemical and sensory attributes. The total plate count (CFU/ml) for both raw flesh (4.30×10^6) and developed products (RG- 1.35×10^4 and RGS- 6.50×10^4) and commercial sterility test results were within the acceptable range. *Escherichia coli* and *Vibrio* spp. were absent in the final products. The proximate analysis revealed that both products contain 14-16% protein and 20-26% fat. A semi-trained sensory panel has granted higher mean ranks for odour, texture, flavour and after taste, for RGS compared to the RG and a commercial tuna spread. Sensory evaluation of the expert panel has commented RGS spread as a potentially marketable product based on SLSI guidelines. They have further indicated the potential of developing this product as a creamed paste. In conclusion, Rohu garlic-sesame spread can be considered as a suitable product for market and it has a potential to develop as a creamed paste.

Keywords: Fish spread, fish cream, freshwater fish, microbial test, sensory evaluation

Bioactive compounds and antioxidant capacity in different parts of selected mangrove species in Anawilundawa

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This study was undertaken to evaluate the total phenolic content (TPC), total flavonoid content (TFC), and total antioxidant capacity (TAC) of different parts (leaves, barks, and roots) of four mangrove species (*Rhizophora apiculata*, *Avicinia marina*, *Excoecaria agallocha*, and *Hibiscus tiliaceus*) grown in Sri Lanka. All the samples were collected from Anawilundawa, which belongs to the intermediate zone in Sri Lanka. Mangroves are used in traditional medicine for the treatment of many diseases. Even though many mangrove varieties are grown in different agro-climatic regions of Sri Lanka, studies and information on phytochemical content and bioactive compounds are lacking. The total phenolic content (TPC), total flavonoid content (TFC), and total antioxidant capacity (TAC) were determined using the Folin-Ciocalteu method, the colorimetric method, and the ferric reducing antioxidant power (FRAP) assay, respectively. Among all species tested, leaves (107.30 ± 1.19 mg GAE/g DW) of *Excoecaria agallocha* and roots (99.68 ± 9.24 mg GAE/g DW) of *Rhizophora apiculata* possessed higher TPC. The highest TFC was recorded in the roots (102.52 ± 4.93 mg RE/g DW) of *Hibiscus tiliaceus*. A significantly highest TAC was recorded in the roots (2.83 ± 0.07 mg TE/g DW) of *Avicinia marina* and the leaves (2.81 ± 0.06 mg TE/g DW) of *Hibiscus tiliaceus*. This study sheds light on the previously understudied antioxidant and bioactive compounds present in Sri Lankan mangroves, with far-reaching implications for both scientific advancements and conservation effort.

Keywords: Antioxidant, *Avicinia marina*, *Excoecaria agallocha*, flavonoids, *Hibiscus tiliaceus*

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Designing an automated siphon system for ornamental fish tanks to improve water quality and maintenance through intelligent bottom siphoning triggered by time intervals or pH level thresholds

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Aquaculture is a fast-growing industry as it provides relatively cheap protein sources, attractive fish and plant species for the ornamental industry. Intensive indoor aquaculture systems are practiced to fulfil high demand and maximize the use of water and land spaces as well. Considerable amount of expenditure in the industry is used on labourers for feeding, tank cleaning, water replenishment, water quality checking etc. Further, aquaculture production is considerably decreased due to poor water quality. Therefore, a smart aquaculture system to clean fish tanks (siphon) and replenish water according to pH level has been proposed in this study. The system employs an Arduino Mega 2560 board as the core unit and integrates digital sensors for monitoring water quality parameters, including pH, temperature, and dissolved oxygen (DO). The experimental setup consisted of two tanks: the experimental tank and the rest tank, serving as a control. Both tanks have the same dimensions (75cm x 30cm x 30cm). Five pairs of Platy (*Xiphophorus maculatus*) fish are used for each tank. Their preferred pH range 6.8 to 8.5 was set as optimum pH range. System was tested for two- and three-days siphon intervals. pH, temperature and DO was recorded at every 6 hrs of the day for ten days. The sonar sensor monitors water levels, while a digital pH sensor provides real-time pH data from the tank. The system incorporates a siphon arm along the tank's length, removing sediments below the water surface up to 30%. Following sediment removal, the replenishment process commences. Results indicated that the experimental tank maintains water quality at optimal levels compared to the rest tank on various occasions. Therefore, the system can be considered as a good replacement for manual siphoning. Overall, the developed smart aquaculture system demonstrates its effectiveness in achieving efficient and sustainable aquaculture practices.

Keywords: Aquaculture, arduino, ornamental, pH, smart

Extraction of chitosan from the cockle shells (*Lunulicardia retusa*) and screening water purification capacity

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Chitosan is derived from chitin found in shellfish shells. Cockle shells have a high calcium carbonate (CaCO_3) and chitin content. The extraction of chitosan from cockle shells and its optimization for use as a natural coagulant in water treatment procedures are the main objectives of this study. Chitosan extraction procedure consists of demineralization, deproteinization, deacetylation, and purification. During demineralization, three different concentrations of HCl (6%, 10%, and 14%) were used to optimize the yield and purity of chitosan. The Fourier-transform infrared spectroscopy (FTIR) and X-ray refractometry (XRD), were used for the characterization of the extracted chitosan. The potential of the extracted chitosan as a natural coagulant in water treatment was also investigated. This was screened by the evaluating ability of chitosan to purify turbid water. Water clearness was tested by using a spectrophotometric method at 650 nm. Based on the FTIR and XRD analysis, extracted powder was confirmed as chitosan. Highest purity of extracted chitosan was achieved by using 14% HCl based demineralization process. Water purification experiments showed significantly higher water purification ability of extracted chitosan ($P < 0.05$), ($73.52\% \pm 0.45$) compared to the negative control ($7.96\% \pm 2.00$). This research revealed chitosan can be extracted from cockle shells and extracted chitosan can be used as a purification agent for water treatment plants in future.

Keywords: Chitosan, coagulant, cockle, demineralization, FTIR

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Investigation, perception and level of awareness on marine litter and microplastic contamination in Trincomalee District

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Marine litter and microplastic pollution is now globally flagged problem to livelihoods, biodiversity, and public health due the pervasive nature of plastic wastes, poor knowledge of its ecological impact and poor sustainable waste management practices. Hence, present study explores public awareness, knowledge, attitude and perception on marine litter and microplastic contamination. Data were collected from 250 responses in coastal communities around Trincomalee town, Nilaveli, Mutur and Kinniya using a questionnaire and analyzed using descriptive statistics and multiple responses statistics on the IBM SPSS 25 version. The results reveal a nuanced landscape of public awareness. While a majority of respondents expressed concern about litter and its impact on the environment, there exists a notable gap in understanding the intricate issue of microplastic contamination. The survey found that approximately two third of participants were aware of marine litter and 92% of respondents know about that plastics have long term effects on environment. However, when it came to microplastics, nearly 40% correctly demonstrated “what is microplastic”. Interestingly, the study identified a correlation between higher education levels and increased awareness of microplastic contamination, highlighting the role of education in shaping environmental consciousness. Furthermore, the research shed light on specific areas where awareness is lacking, such as the sources and long-term consequences of microplastic pollution. Respondents displayed varying levels of knowledge, with marine ecosystems being more commonly associated with microplastic contamination than terrestrial environments. In conclusion, the findings underscore the need for targeted educational campaigns to address gaps in public understanding, particularly regarding microplastic contamination. Such initiatives could enhance awareness, promote responsible consumption, and contribute to more informed decision-making for sustainable environmental practices.

Keywords: Environmental education, pollution, public health, wastes

A comparative analysis of awareness and livelihood dynamics: fishermen versus dolphin and whale watching safari boat operators in bar reef marine sanctuary in Kalpitiya, Sri Lanka

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In order to ensure the sustainability of a marine sanctuary, it is important to understand the connectedness and awareness of key stakeholders. This research paper presents a comparative analysis of awareness levels and livelihood dynamics between two distinct user groups, namely fishers and operators of dolphin and whale watching (DWW) safari boats within the Bar Reef Marine Sanctuary in Kalpitiya. Data were collected during 2020 and 2021 through semi-structured interviews covering demographics, livelihood, environment awareness and perceptions. The sample comprised of 121 in the fisheries and 42 respondents in safari boat sector who volunteered to provide data. Results revealed a higher education level in DWW, with 62% having secondary education compared to 38% in the fisheries sector. Employment rates were higher in DWW, with 98% employed throughout the year compared to 72% in the fisheries sector, where artisanal fishes lose employment during off-season. A higher percentage of DWW individuals owned their vessels (78.6%) compared to the fisheries sector (65.3%). Moreover, DWW exhibited a higher awareness regarding the Marine Sanctuary with over 60% of the respondents being aware that it is a protected area and governed by the Department of Wildlife Conservation. Also over 50% respondents were aware that there is a management plan for the protected area and have involved in making it. Comparatively only 25% fishers have involved in management planning. Similarly, compared to fishers, DWW had a better awareness on contemporary environmental issues such as sea level rise, coral bleaching and impacts of coral fish removal. Both groups had a lesser awareness on microplastics contamination in seafood. Study also indicated better preparedness to sea among DWW with life jackets on board. These findings suggest to support both the sectors through initiatives focusing on greater communication and opportunities for involvement in management.

Keywords: Awareness, dolphin, fishery, marine, protected area, whale, safari

Acknowledgement: COLIBRI Project of EU for data.

Formulating herbal tea blends from *Rhizophora mucronata* hypocotyl, *Sonneratia caseolaris* fruit, and *Tragia plukenetti* leaves

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The rising popularity of herbal tea blends and the need to incorporate under-utilized food in value addition of tea products has sparked interest among producers and consumers. This study aimed to formulate three herbal tea blends using two true mangroves *Rhizophora mucronata* hypocotyl and, *Sonneratia caseolaris* fruit, and medicinal plant *Tragia plukenetti* leaves. Sensory evaluations were conducted by professional tea tasters using a nine-scale Hedonic test. The most preferred blends were identified as follows: 60% Ceylon green tea with 39% *R. mucronata*, 0.5% cardamom, and 0.5% peppermint; 70% Ceylon green tea with 15% *S. caseolaris* fruit, 10% lemongrass, and 5% peppermint; and 50% Ceylon green tea with 40% *T. plukenetti* leaves and 10% peppermint. pH, Color, Turbidity, and Total soluble solids were determined in all tea blends. Total plate count, Yeast and Mold count, Total Coliform count, *Salmonella* spp. as well as Cadmium and Lead levels were measured. The *S. caseolaris* blend demonstrated the highest total antioxidant capacity (1.47 ± 0.06 mg TE/g DW) and total flavonoid content (232.95 ± 2.81 mg RE/g DW) in hot water extracts. All blends showed similar total polyphenol content. Proximate analysis provided insights into the nutritional composition of each blend. Total plate count, Yeast and Mold, Total Coliform count, and *Salmonella* spp. were within the ranges of the International Organization for Standardization (ISO). Cadmium was not detected in any blend, while lead was found in trace amounts in the *T. plukenetti* blend (2.80 mg/Kg) and *S. caseolaris* blend (0.21 mg/Kg). These results suggest that Ceylon green tea blended with the aforementioned herbs can serve as recommended value-added herbal tea beverages. The introduction of sustainable harvesting will also promote communities engaging in conservation and earning an alternative income.

Keywords: Herbal tea, *Rhizophora mucronata*, *Sonneratia caseolaris*, *Tragia plukenetti*

Acknowledgement: This study was funded by the United States Forest Service, facilitated through the Wildlife and Nature Protection Society (WNPS). Sensory evaluation was conducted at Dilmah Ceylon Tea Company PLC.

Exploring flower development and pollen morphology in some selected mangrove species at Kadolkele, Negombo, Sri Lanka

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Restoring degraded mangroves is a global need at present and these efforts require in depth knowledge on plant phenology. This research focuses on the understudied reproductive biology of four mangrove species *Bruguiera gymnorhiza*, *Lumnitzera littoria*, *Scyphiphora hydrophyllacea* and *Ceriops decandra*. Field work was done in the Research Station of National Aquatic Resources Research and Development Agency as all four species are found there growing under similar climatic conditions in Kadolkele at Negombo. The investigation tracked the development of male and female floral organs, noting distinct stages from bud initiation to withering. Already tagged samples (n= 58) were monitored daily with hourly closed observations especially as they reached blooming. Separate samples from each maturity stage were collected followed by immediate dissection to determine the position of male and female reproductive parts which were photographed. Pollen samples were examined under a light microscope to assess shape and size. The study unveiled varying blooming durations among the species. *B. gymnorhiza* had 20 distinctive stages of flower maturity and displayed a blooming period lasting approximately 77 days, while *C. decandra* had 13 stages and blooming lasted 113 days, and *L. littoria* had 16 stages and took 65 days, *S. hydrophyllacea* had 9 stages and blooming period lasting at least for 42 days. The shape of pollen grains of *B. gymnorhiza* ($24.08 \pm 1.53 \times 22.4 \mu\text{m}$) and *C. decandra* ($28 \mu\text{m}$) oblate to spheroidal; tricolporate, *L. littoria* ($33.04 \pm 1.25 \times 29.12 \pm 1.53 \mu\text{m}$) is subprolate to spheroidal; pseudocolpate and *S. hydrophyllacea* ($26.88 \pm 1.53 \times 25.2 \mu\text{m}$) spheroidal; tricolporate in shape. *S. hydrophyllaceae* demonstrated early morning blooming and self-pollination characteristics with both male and female parts maturing concurrently. *L. littoria* exhibited stamens of varying lengths and asynchronous anther dehiscence. The study highlights the need to study the maturity cycle of fruits of these four species.

Keywords: *B.gymnorhiza*, *C.decandra*, flowering phenology, *L.littoria*, *S.hydrophyllacea*

Acknowledgement: This study was funded by United States Forest Service, facilitated through Wildlife and Nature Protection Society (WNPS).

Diversity and abundance of marine plankton in North-western province, Sri Lanka

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The significance of oceanic plankton lies in its foundational role within the marine food web, driving primary production. Understanding variations in plankton abundance and species diversity are essential for managing and conserving marine resources and to recognize the further commercial exploitation potential. However, information on plankton in the coastal waters of Sri Lanka is limited. Thus, this study attempted to uncover the diversity and abundance of plankton in North-western province (NWP), Sri Lanka. Samples of phytoplankton, zooplankton and water quality parameters were collected during December 2023 and January 2024 from three locations in NWP, namely Wennappuwa, Thoduwawa and Chilaw. Then these sampled plankton were identified, diversity indices were calculated and the association of the two plankton groups was determined. A total of 19 species of phytoplankton and 14 species of zooplankton were identified. Bacillariophyceae were the most abundant among the phytoplankton groups, while Copepoda were the most abundant zooplankton in all three locations. Shannon-Wiener diversity index (H') for phytoplankton varied between 1.2-1.9, 1.0-1.8 and 1.9-2.3 while it varied between 1.3-1.4, 1.0-1.5 and 1.4-1.8 for Wennappuwa, Thoduwawa and Chilaw respectively, indicating the highest diversity in Chilaw for both phytoplankton and zooplankton. According to the Sorensen index, community overlap is higher between the three locations. Further, a positive linear correlation could be observed between phytoplankton and zooplankton abundance. However, water quality parameters did not show any significant variation between the two months and the three locations. This study will provide valuable insights into the diversity and abundance of plankton species in North-western province during the study period. Yet, long term studies are required to understand the spatio-temporal dynamics of these planktons to establish baseline information that contribute to further commercial exploitation and management of fish-related industries.

Keywords: Abundance, diversity, phytoplankton, zooplankton

Social dynamics, willingness and value of adopting non-mangrove plants to brush park fishery

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Brush park fishery is a unique feature distributed among Negombo Lagoon, Sri Lanka, mainly using mangroves for brushpark construction. This research aims to develop a comprehensive socio-economic evaluation model for the sustainable use of alternative non-mangrove species in brush park construction within the Negombo lagoon, Sri Lanka while promoting the economic well-being of communities dependent on these resources. Three types of brush parks were constructed: one using traditional mangrove species and the others using identified suitable non-mangrove species. *Annona glabra*, *Akacia sp.*, *Terminalia catappa* were assessed in terms of environmental impact, economic viability, and community welfare. A socio-economic survey was performed to assess the impact on income and well-being of fisher communities. Fish catch was monitored to evaluate the income from each brush park. Data were collected to identify common mangrove and non-mangrove species in the area, suitable locations for brush park construction, brush park construction techniques, fish catch, species diversity and also to determine income and well-being. Cost analysis for construction of one brush park was calculated as; *A. glabra*: Rs.9000, *Akacia sp.*: Rs.7000, and *T. catappa*: Rs.9000 with the transport and labour cost. Income from each brush park was determined and *A. glabra* and *T. catappa* were recorded with highest income. Survey out comes show that many people have a significant income from the existing brush park fishery and also many of them like to use alternative species for brush park construction, in terms of conservation. Collectively, this study suggests that implementing alternative non-mangrove species in brush park construction has the potential to protect mangrove ecosystems by reducing deforestation, providing sustainable livelihood options for fishing communities through similar catch yields and thereby improve social and economic welfare of surrounding communities through increased income.

Keywords: Brush park mangroves, Negombo lagoon, socio-economic, willingness

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Development of an edible food wrapper using marine collagen and chitosan

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Many food packaging materials are currently sourced from petrochemical-based substances like polythene and plastic, which possess drawbacks such as low recyclability, limited biodegradability, high costs, and the potential to emit harmful substances. Hence, the demand for healthier and safer food wrapping options is increasing. Conversely, one-third of fish harvests are discarded as “wastes” during processing. Therefore, this study developed and characterised an edible food wrapper using chitosan and collagen which are extracted by processing “wastes”. The existing film preparation protocol was modified to develop a food wrapper, by dissolving in acetic acid under three different ratios of chitosan: collagen at two different pH levels. The prepared films were characterised as food wrappers by measuring their physical properties: film thickness; grammage; density; colour; UV absorbance; moisture content; swelling properties; water vapour permeability; tensile strength; and chemical properties: antioxidant activity. Further, thermal properties of these films like degradability in hot water; degradability in microwave; and thermo-gravimetric analysis were measured. Moreover, biodegradability of this wrapper was tested in soil. The morphology of the wrapper was analysed by scanning electron microscopic images and the chemical bonds were analysed by X-ray diffraction and Fourier Transform Infra-Red spectroscopy. In comparison with existing film development protocols, this study introduced a modified protocol which saves additional costs associated with energy by shortening the processing duration by 40 h and avoiding the use of some chemicals such as glycerol. There was a significant effect of pH and chitosan: collagen ratios on film thickness and density, however, other properties were not significantly different ($P < 0.05$). All films showed heat resistance up to 200°C and can be used as a thermally stable food wrapper. These films biodegrade in less than twelve days. In conclusion, these findings emphasise potential applications in the food packaging industry, offering an edible, thermally stable and biodegradable (eco-friendly) alternative to conventional petrochemical-based food packages.

Keywords: Antioxidant, biodegradability, food wrapper, swelling power, thermal stability

Development of a seaweed-based gel for a sheet face mask

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A diverse range of cosmeceuticals, including facemasks that utilize natural active components, presents a chance for incorporating seaweed as a key ingredient in cosmetics. *Kappaphycus alvarezii* which is an aquacultured red seaweed species in Sri Lanka contains carrageenan as their one of major compounds. The carrageenan extracted from the *Kappaphycus alvarezii* purveys cosmeceutical effects such as moisturizing, antioxidants, antimicrobial, antiaging and skin whitening effects. The main purpose of this study is to modify a method to extract carrageenan from *Kappaphycus alvarezii* and to incorporate the extracted gel into a face mask that composed of best characteristics to suit the skin. Carrageenan was extracted using Ca (OH)₂ and three different KCl concentrations (1.5%, 2.5% and 3.5%). Carrageenan yield was calculated. Extracted gel with different carrageenan concentrations (1%, 0.75% and 0.50%) were tested for color, pH, spreadability, skin moisture%, skin oil %, shelf-life and consumer preference to use this gel for a face mask. Highest yield of extracted carrageenan powder was 35.28% that was extracted using 3.5% KCl. Gel that has the most similar spreadability to the commercial face mask gel is 3.5% KCl 1% carrageenan gel. Gel with highest skin moisture increase is 2.5%KCl, 0.5% carrageenan gel. Gel with highest skin oil decrease is 2.5%KCl, 0.75% carrageenan gel. pH of the all gels lies on the skin pH range. As these gels ranges in the skin pH levels, it can be used for cosmetics. As this gel is a good moisturizing agent it can be used as a good ingredient for moisturizing the skin. It can be concluded that carrageenan gels can incorporate into a sheet face mask successfully.

Keywords: Carrageenan, face masks, moisturizing

Isolating potential probiotic bacteria from Chilaw lagoon and screening their probiotic properties *in vitro* and *in vivo* with *Litopenaeus vannamei* reared in zero-water exchange system

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The use of probiotics in the shrimp industry of Sri Lanka is now becoming a trend. This research aimed to isolate and identify potential probiotic bacteria from the Chilaw Lagoon environment for improving the water quality, growth performance and health of *Litopenaeus vannamei*. Necessary water samples were collected from Chilaw lagoon, enriched with molasses and bacterial colonies were isolated. Identification of the isolates done with colony characteristics, cell morphology, biochemical test, and 16S rRNA sequencing. Sensitivity to different pH levels, salinity, and bile salt tolerance were tested *in vitro*. The antimicrobial properties were also examined *in vitro* against *Vibrio spp.* In the *in vivo* experiments, four bacterial isolates, a commercial probiotic, and a control group were set and *P. vannamei* post larvae (PL15) were stocked at density 30PLs/0.028m³ and tanks were treated with respective probiotics once per week for a five weeks' period. The four isolates were identified as *Pseudomonas aeruginosa* strain 01 (Colony 01), *Bacillus cereus* (Colony 02), *Bacillus thuringiensis* (Colony 03), *Pseudomonas aeruginosa* strain 02 (Colony 04). Highest antimicrobial properties were shown by *P. aeruginosa* strain 02 against *Vibrio spp* 01 (32.13±0.891mm). *P. aeruginosa* strain 02 was showing significantly low total ammonia (5.65±0.01414 mg/L) in the 5th week compared to the control and other probiotics treatments. The final weight of the PL's were also significantly higher (5.02±1.11g) in *P. aeruginosa* strain 02 fed PL's compared to the control and other treatment groups. In conclusion, the isolated potential probiotic species showed anti-microbial properties, water quality improving abilities and having a positive impact on weight gain of shrimp PL's, hence can be used in the Sri Lankan shrimp industry as an alternative to the high cost imported probiotics.

Keywords: Antimicrobial, lagoon, *Litopenaeus*, probiotics, *vibrio*

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Development of a low-cost filter unit for removal of microplastic in drinking water

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Microplastic (MPs), synthetic solid particles less than 5 mm in size, is abundantly available in surface waters. Therefore, present study was focused on development of a low-cost filter unit to remove microplastics in drinking. After preliminary screenings, stoneware clay was selected as the filter material with basic soil properties; pH (7.74±0.63), conductivity (0.063±0.029 μscm^{-1}), Oxidative Reduction Potential (221.67±27.15), moisture content (2.163±0.317 %) and Loss of Ignition (0.084±0.018 %). Filter-bed was developed incorporating stoneware clay, rice bran, wood dust, and dry leaves in 20:1:1:2 ratios to obtain 10 mLmin⁻¹ of filtering efficiency and conditioned for 3 days using distilled water. The efficiency of the filter was evaluated for artificially prepared MPs (200 μm - 02 mm diameter) and drinking water samples collected from Ma-oaya, municipal drinking water (from Pannala, Giriulla, Negambo) and well-water (from Makandura). Microplastics were analyzed filtering 20 L of water through the filter unit, followed by organic matter digestion and stereo-microscope identifications. Further, water pH, conductivity, dissolved oxygen, phosphate concentration were analyzed before and after the treatments. Triplicates were maintained where necessary. The total number of MPs recorded in the drinking water samples were; 5.85, 2.3, 1.2, 0.65, 0.6 pieces L⁻¹ in Ma-Oya, Municipal water from Pannala, Giriulla, Negambo and well-water from Makandura respectively. All the water samples showed significant MPs filtering efficiency recording 100%, 98.64%, 97.87%, 96.34%, 91.5%, and 100% for artificial microplastics, Ma-Oya, Municipal water from Pannala, Giriulla, Negambo area and well-water from Makandura water samples, respectively. Water quality in all the drinking water were within the range accepted in Sri Lankan water quality standards. Therefore, the filter unit developed in the present study can be further modified to develop a low-cost and efficient drinking water filtering unit which address both MPs and other relevant water quality parameters.

Keywords- Drinking water, efficiency, filtration, stoneware clay

Recovering fat from wastewater generated at fish canning

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This research focuses on the sustainable recovery of fat from fish canning factory wastewater, specifically targeting the pre-cooking removal water as a rich source of substantial fat content. Initial trials involved the exploration of various extraction methodologies, with a methanol- chloroform mixture (2:1) showing promising results, achieving an impressive 84% fat recovery. However, due to high solvent costs and potential chemical hazards, this method proved industrially impractical. Subsequent experiments investigated a high-temperature heating method exceeding 105°C, resulting in a lower recovery yield of approximately 7.53%, primarily due to elevated energy consumption. Centrifugation trials, optimized at 13,000 Relative Centrifugal Forces (RCF) in pre-trial conditions, proved ineffective when applied to actual pre-cooking water samples. A strategic shift towards emulsion development emerged as a viable alternative. Natural seaweed-based compound was employed as the emulsifier agent, leading to successful trials. The finalized protocol was developing the emulsion. Stability assessments via bottle tests demonstrated success, though instantaneous stability testing presented challenges. Analyzing particle distribution confirmed the favorable characteristics of the emulsion, with an average particle size of 90.46 (± 11.81) μm . This micro-scale emulsion showcased superior properties compared to the standard average particle size of 114.41 (± 1.47) μm , opening avenues for potential advancements in food product development. The emulsion was further analyzed for its fatty acid profile (GCMS), revealing higher amounts of EPA, DHA fatty acids. This innovative approach to fat recovery from fish canning wastewater not only overcomes the limitations of previous methods but also offers a sustainable solution with potential applications in the development of omega-3 enriched food products. The findings contribute to the overarching goal of converting waste into valuable resources and present a novel avenue for further exploration in the field of food science and technology.

Keywords: Emulsion development, fat recovery, fish canning, omega-3

Estimating plastic debris contamination and associated water quality in different sources of water feeding into accelerated natural regeneration of mangroves site in Anawilundawa Ramsar Sanctuary, Sri Lanka

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Since 2022 an annual assessment of plastic debris is being conducted in the Accelerated Natural Regeneration of Mangroves (ANRM) as a part of a long term study where restoration of abandoned shrimp farms are in progress. As both macro and micro plastics can impact fauna and flora, it is important to quantify and identify in various water feedings into restoration sites. Present study reassessed the same locations of 2022 in the Southern boundary (Muthupanthiya) and expanded to the Northern boundary (Udappuwa). Four locations each of restored mangrove, Dutch Canal, Shrimp farm outlet and Paddy field outlet were selected. Between the period of October to December 2023, Macro-plastic debris was assessed using (OSPAR) waste assessment protocol. For microplastics in water, 20L of water was sieved through a 200µm filter, organic matter was digested and filtered (0.45µm). Sediments (500 mL) were subjected to density separation and the same procedure was followed. Extracted microplastics were categorized into shape and color under stereo-microscope and polymer types were confirmed by FTIR-ATR mode. During the study period, the Dutch canal exhibited the highest total macroplastic count (283 pieces) and weight (2242g). The restoration site showed the lowest with 16 plastic pieces and 63g of weight. Highest microplastics in water were recorded in the Dutch canal (2.48 ± 0.43 pieces/L) while lowest in the mangrove restoration site (0.17 ± 0.06 pieces/L). Highest microplastics in sediments were recorded in mangrove restoration sites (61.33 ± 4.16 pieces/L) and the lowest in paddy fields (11.33 ± 2.03 pieces/L). Filaments and fragments were the dominant microplastic shapes in water and sediments and blue and white emerged as the dominant color. FTIR analysis revealed the analyzed micro plastics belonged to Polyethylene: propylene groups. The findings may serve as the baseline data for strategy development on mitigation of microplastics contaminations in sensitive environments.

Keywords: Density separation, macroplastic, mangrove, OSPAR

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Present and past status of Kadolkele mangrove reserve in Negombo

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Mangroves are a diverse group of highly salt-tolerant woody plants, which grow in the intertidal zones in tropical and subtropical latitudes. Despite its unique services to the people, and marine and brackish ecosystems, mangroves becoming one of the most rapidly disappearing ecosystems in the world. Thus, this study aimed to determine the diversity and to evaluate the distribution patterns of different mangroves in the Kadolkele mangrove reserve in Negombo (7°11' 49.82"N, 79°50' 32.29"E), from 2012 to 2022 using Google Earth Pro application. Kadolkele mangrove reserve is in the northern extremity of the Negombo estuary. This reserve is home to 30 mangrove species and of them, 19 are considered as true mangroves and others are mangrove associates. To determine the diversity of mangroves, data were collected through random sampling using 100m line transect and 5x5 m quadrat sampling methods. Further, diversity indices were calculated. Spatial distribution pattern maps were developed using unsupervised classification satellite images from 2012 to 2022 using the Google Earth Pro application in the Kadolkele mangrove reserve. Among all the mangrove species, *Rhizophora apiculata* is the most abundant species for both seedling and mature stages. Based on the analysis of diversity indices, Shannon-Weiner and Simpson's Dominance index were 1.66 and 0.24 respectively, indicating medium vegetation diversity and scattered growth pattern in the study area. From the spatial distribution maps, it is evident that the mangrove diversity in the Kadolkele mangrove reserve increased from 2012 to 2023, probably after its declaration as a reserve site.

Keyword: Diversity, dominance, ecosystem, mangrove, quadrat

Evaluation of post-harvest losses of coastal fish catches along the market chains in Mullaitivu fish landing sites

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Post-harvest fish losses (PHLs) pose a significant challenge to the sustainability and profitability of fisheries sectors worldwide, including Sri Lanka. This study aims to evaluate PHLs along the market chains of coastal fisheries in Mullaitivu, Sri Lanka, by quantifying losses at each stage, identifying key reasons for losses, and providing recommendations to mitigate them. Data was collected from October 2023 to January 2024 through literature surveys, pilot surveys, questionnaire development, field surveys, and data analysis. The study identified five market actors: fishing, landing, collector/distributor, retailer, and consumer. The fishing level has an average of 6.6% of discards significantly with $\pm 6.8\%$ standard deviation ($P < 0.05$). Significantly higher discards average of 43.5% were reported with a standard deviation of $\pm 26.7\%$ from Landing compared to other market actors ($P < 0.05$). The collector level has an average of 1.9% of discards significantly with $\pm 0.2\%$ standard deviation ($P < 0.05$). The retailer level has an average of 2.7% of discards significantly with $\pm 4.4\%$ standard deviation ($P < 0.05$). The consumer level has an average of 13.6% of discards significantly with $\pm 20.0\%$ standard deviation ($P < 0.05$). At the fishing level, the hand line and pole have the highest average discards which is 11.3% while the drift gill net has 10.6% average discards. At the landing level, the beach seine has the highest average discards which are 65.1% while the drift gill net has 22.0% average discards. At the collector/distributor level, truck collectors have a more average discards percentage which is 2.7%. At the retailer level, wholesale markets have the highest average of 4.4% discards. Key reasons for losses included inadequate infrastructure and technology, poor handling practices, and seasonality. Current practices to reduce PHLs include minimum handling, quick distribution, and the use of cooling bins and plastic boxes. Suggestions to overcome PHLs include improving infrastructure and technology, promoting better handling practices, developing market access, and promoting value addition.

Keywords: Beach seine, discards, drift net, hand line, post-harvest

A soft-shelled giant freshwater prawn incorporated cheese

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This study addresses the challenges in the soft-shelled giant freshwater prawn (GFP) – (*Macrobrachium rosenbergii*) industry, where a significant number of caught prawns are discarded due to market dynamics. Amarasinghe *et al.* (2023) introduced an innovative protocol for producing soft-shelled GFP-incorporated cottage cheese. However, that method utilized a relatively expensive commercial coagulant, prompting the need for cost-effective alternatives. Our research presents a new rational approach in production of GFP-incorporated cottage cheese. For the preparation, acid-heat coagulation method was used employing lime juice as a coagulant. Through systematic experimentation, it was determined that, by adding 30ml of lime juice which has a pH of 2.5 to 250ml of fresh cow milk, effectively coagulates the milk, forming a desirable cottage cheese texture at the isoelectric pH of the coagulation (4.7). To assess the sensory attributes of the developed cottage cheese, a lexicon method and a 9 – point hedonic scale sensory evaluations were conducted with the participation of 30 panelists. The evaluations revealed key sensory characteristics, providing insights into the overall quality, texture, and flavor profile of the GFP-incorporated cottage cheese. The results indicated that the most preferable cheese type is ground prawn incorporated cheese using lime juice as coagulant. This research presents a sustainable approach in household level cottage cheese production and also highlights the potential for incorporating aquatic resources into dairy-based products, thereby enriching and promoting resource-efficient food systems. Using lime juice as a coagulant stands as an advancement in dairy processing, opening avenues for further exploration and application in the food industry.

Keywords: Coagulant, cottage cheese, GFP, lime juice, pH

Feeding preference and feeding behavior of *Terebralia Palustris* (Linnaeus, 1767)

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This research investigates the feeding preference and behavior of *Terebralia palustris*, a mud whelk gastropod in mangrove ecosystems and a pioneer fauna in mangrove restoration sites. *Terebralia palustris* influences sediment stability and nutrient cycling as an epifauna. The study investigated their preference for mangrove species, leaf maturity, odour, and colour, providing insights into their ecological role. *Terebralia palustris* specimens were sampled from Puttalam Lagoon and acclimatised for two weeks. Experiments involved first presenting just fallen *Rhizophora mucronata*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, and *Lumnitzera racemosa* leaves to 25 snails kept in specially constructed cages individually. Weight and area loss were calculated in each presented leaf. Preference for leaf maturity was assessed using four combinations of leaves (green, mature but attached to tree, just fallen and dried) of *Rhizophora mucronata*, the preferred species as detected from the first experiment. Sensory cues were examined for odour and colour preferences. Fecal matter carbon was conducted through the Loss of Ignition method. Results indicated a significant preference for *Rhizophora mucronata* (weight loss-0.50g, area loss - 3.25cm² per day) followed by *L. racemosa* (weight loss-0.34g, area loss - 2.83cm² per day), Study revealed preference for green leaves (weight loss-0.54g, area loss – 4.4 cm² per day) followed by just fallen leaves (weight loss-0.18 g, area loss – 1.6 cm² per day) of *R. mucronata*. Sensory cue experiments demonstrated an attraction to green colour leaves and green leaf odour. Fecal matter carbon content was 35.36% ± 3.48%. In terms of restoration, the results suggest that planting of *R. mucronata* and *L. racemosa* can facilitate their arrival, initiating nutrient cycling and sediment dynamics of mangrove ecosystems. Therefore, understanding *Terebralia palustris* feeding preferences informs mangrove conservation.

Keywords - *Terebralia palustris*, feeding preferences, mud whelk, nutrient cycling

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A moisture and blood-absorbent paper from seaweed and pineapple leaves to use in seafood packaging

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Food packaging is crucial for perishable products like seafood, which can spoil easily. This paper investigates the potential of utilizing pineapple leaf fibers combination with seaweed powder (*Kappaphycus alvarezii*) to produce moisture and blood-absorbing wrapping paper instead of wood fiber, which has severe impacts on deforestation. Papers were produced by combining the same amount of pineapple leaf pulp with varying amount of seaweed powder (1-4 grams), and they were compared with commercially available absorbent paper. Two varieties of pineapple were used and the pulping process was conducted via soda pulping method at a concentration of 15% w/v for 90 minutes at 90°C. The cellulose analysis test was conducted for pineapple leaf pulp, and it gave approximately 65% cellulose yield for both pineapple varieties, emphasizing the feasibility of using pineapple leaf fibers to produce absorbent wrapping papers. While the developed papers exhibited lower moisture and blood absorbency times compared to the commercial paper, they displayed both positive and negative effects. The total plate count method showed fewer colonies when increasing the seaweed amount, confirming the antimicrobial properties of the paper containing seaweed powder. These findings highlight the potential of utilizing pineapple leaf fibers and seaweed powder in moisture and blood absorbent paper production, offering a sustainable alternative with added antibacterial benefits.

Keywords: Absorbent paper, antibacterial, cellulose yield, pineapple, seaweed

Mangrove extract evaluation; unveiling antimicrobial and antioxidant potentials for mouthwash formulation

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Mangrove extracts, rich in phenolic compounds, hold promise as antimicrobial and antioxidant agents for periodontal disease treatment. This study aimed to evaluate various mangrove extracts against oral microbes to identify species with optimal antimicrobial and antioxidant properties for mouthwash formulation. Leaves and barks of four mangrove species; *Avicennia marina*, *Excoecaria agallocha*, *Xylocarpus granatum* and *Heritiera littoralis* were extracted using 75% ethanol in soxhlet apparatus and using hot water extraction methods. Antimicrobial activity against *Streptococcus mutans* and *Candida albicans* was assessed via agar well diffusion assays. The extract with the highest inhibition zone underwent minimum inhibitory concentration (MIC), total phenolic content, and antioxidant activity evaluations. Hot water-extracted *E. agallocha* leaves exhibited the highest inhibition zone against *C. albicans*, while hot water-extracted *X. granatum* bark showed highest inhibition zone against *S. mutans* (21.67±0.29 mm and 23.00± 0.00 mm respectively). Meanwhile hot water-extracted *E. agallocha* leaves has exhibited 16.67±0.29 mm of inhibition zone against *S. mutans*. Most mangrove extracts displayed promising antimicrobial activity against both pathogens, with a stronger effect on *S. mutans*. Considering the impact on both oral pathogens, hot water-extracted *E. agallocha* leaves demonstrated the best antimicrobial activity. MIC values of the extract were 90mg/ml for *C. albicans* and 85mg/ml for *S. mutans*. Additionally, the extract showed a total antioxidant capacity of 1.70±0.02 mg TE/100g DW and a total phenolic content of 334.76±20.89 mg Gallic/ 100g DW. This study confirms the significant antimicrobial effects of mangrove extracts, particularly *E. agallocha* leaves, against oral pathogens, suggesting potential for mouthwash formulation.

Keywords: Antimicrobial, antioxidant, mangrove extract, mouthwash, oral microbes

Acknowledgement: The financial support provided by United States Forest Service, facilitated through Wildlife and Nature Protection Society (WNPS) is deeply appreciated.

A novel method to formulate chitosan beads to incorporate into a face wash

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The face wash is a popular skincare product that contains some coarse particles to help exfoliate the skin. Today microplastic beads contained in personal care and cosmetic products are widely used for the scrubbing purposes. But they cause severe environmental threats due to non- biodegradability. Therefore, this study proposes to develop a novel protocol to formulate chitosan beads as a biodegradable exfoliant to incorporate into a face wash and characterize the chitosan beads as a face wash. Chitosan beads were made into uniform spherical shapes with a diameter of 800-1000µm through modifying some methods with optimizing method parameters. Study of the chitosan beads were carried out by optical microscope and scanning electron microscopy (SEM) further. Structural properties of the chitosan beads were investigated by FT-IR analysis. The swelling ratio and water stability of the beads were tested as a function of the weight of the beads at different times and temperatures. Spherical beads were produced with diameter in the range 0.82 - 1.25mm. It can be concluded that chitosan beads are in the synthesis microplastic beads range also (< 5mm). Bead size changed with the needle length, diameter and the size of syringes. The experimental data could be analyzed by SPSS software. Independent T-test studies in SPSS showed that there was a significant difference in the swelling ratio between the prepared chitosan and the reference one, but no significant difference in the water stability. According to the sensory evaluation test, the cleaning efficiency of chitosan beads was confirmed to be higher than that of synthetic exfoliants. This is because the unique pores and uneven shape of chitosan beads increase their cleaning effectiveness. These preliminary results suggest that chitosan beads can be used as a biodegradable exfoliant for incorporation into a face wash.

Keywords: Biodegradability, chitosan beads; exfoliant, microplastic, swelling ratio

Phytoplankton and Zooplankton diversity in reservoirs of different trophic status in Sri Lanka

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Trophic status of a waterbody is an indicator of nutrient loading and it has a direct impact on plankton diversity. This research aims to study the diversity of phytoplankton and zooplankton in four selected reservoirs with different trophic status. Samples were collected from Beira Lake (BL), Daduru Oya reservoir (DOR), Kandy Lake (KL) and Suruwila reservoir (SUR). Vertical sampling was performed at six sites in each reservoir using a 50µm mesh sized plankton net. Formalin and Lugol's iodine was used to preserve zooplankton and phytoplankton respectively. Trophic status indices (TSI) of the reservoirs were estimated based on Secchi disc depth. Plankton density was only estimated for BL, DOR and KL with Sedgwick rafter counting chamber. Two reservoirs (BL and DOR) were hypereutrophic and TSI were 80.01 ± 2.08 and 70.2 ± 3.18 respectively. KL and SUR were eutrophic and mesotrophic with TSI of 64.45 ± 1.41 and 56.56 ± 0.32 respectively. Twenty eight phytoplankton species were reported from reservoirs and were belong to sixteen Families. *Microcystis* spp. dominated in BL (56%), while *Aulacoseira* sp. dominated in DOR (73%), KL (87%) and SUR (79%). Diversity of Family Euglenophyceae was high in SUR. Thirteen Euglenophyceae species from six genera; *Euglena*, *Trachelomonas*, *Phacus*, *Strombomonas*, *Monomorphina* and *Lepocinclis* were reported from SUR. Genus *Strombomonas*, and *Monomorphina* would be the first time recorded from Sri Lanka. Species *Trachelomonas hexangulata*, *T. crispa*, *Phacus pluronectus*, *P. undulates*, *P. longicauda*, *Strombomonas gibberosa* and *Monomorphina pseudonordstedtii* reported from SUR and would be the first time recorded from Sri Lanka. Twenty-one zooplankton species reported from all reservoirs and belonged to five Families. Family Cyclopidae dominated in BL (37%), while Family Brachionidae and Family Diaptomidae in DOR (56%) and KL (27%) respectively. Nauplius larvae (38%) were dominated in SUR. Further studies on Family Euglenophyceae is required to confirm the diversity and species in Sri Lanka.

Keywords: Hypereutrophic, eutrophic, mesotrophic, euglenophyceae, TSI

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A comparative study of genomic DNA extraction methods: Assessing high-yield and high-purity approaches for selected aquatic plant species

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The success of molecular biology techniques relies on the high quantity and quality of the extracted DNA. DNA extraction from plants is more challenging due to tough cell walls and secondary metabolites that can interfere with the extraction process. Extracting DNA from aquatic plants is less common than terrestrial plants. However, it is important for conservation efforts, ecological research, and biotechnological applications. Here, we optimize DNA extraction protocols for four invasive aquatic species in Sri Lanka: Water hyacinth (*Eichhornia crassipes*), Salvinia (*Salvinia molesta*), Water lettuce (*Pistia stratiotes*), and Hydrilla (*Hydrilla verticillata*). We compared four protocols: cetyltrimethylammonium bromide (CTAB), CTAB with beta-mercaptoethanol (CTAB- β -ME), CTAB with liquid nitrogen (CTAB-N₂), and sodium dodecyl sulfate (SDS). The concentration and purity of extracted DNA were assessed using the spectrophotometric method, with A₂₆₀/A₂₈₀ ratios ranging from 1.8 to 2. This indicates minimum contamination from proteins, RNA, and polyphenolic/polysaccharide compounds. CTAB-N₂ yielded the highest quantity of DNA from *E. crassipes* (1598.17 ng/ μ l) with relatively acceptable purity. For *S. molesta* and *P. stratiotes*, both CTAB- β -ME and CTAB-N₂ extraction methods were effective. *S. molesta* yielded 965 ng/ μ l DNA, while *P. stratiotes* yielded 1666.7 ng/ μ l from CTAB- β -ME protocol. *H. verticillata* yielded the highest DNA concentration (723.7 ng/ μ l) with comparatively pure DNA from the CTAB-N₂ extraction method. The results showed that the most effective methods for DNA extraction from examined aquatic plants were CTAB- β -ME and CTAB-N₂, considering both quality and quantity. However, purifications are essential before using for further applications. The research also explored necessary modifications to extraction methods for dried samples. Overall, this underscored the potential of this research in comprehending and utilizing invasive aquatic plants for both scientific and environmental advantages.

Keywords: Aquatic plants, DNA Extraction, high-purity, high-yield, invasive species

Performance of non-mangrove species in brushpark fishery in Negombo Estuary, Sri Lanka

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Brushpark is constructed with branches and twigs from mangroves or terrestrial plants and serves as a fish aggregating device. It is a traditional fishing method in some regions and in Sri Lanka. It is considered as destructive to mangrove ecosystems. Therefore, there is a need to seek alternative species, thus ensuring the continuation of fisheries and lesser impact on carbon rich mangrove ecosystem. This study investigated the efficiency of three alternative plant species; *Anona glabra*, *Terminalia cattappa*, *Acacia auriculiformis* with *Rhizophora mucronata* as the control in Negombo lagoon. From alternative species, 3 replicates each were constructed. Water quality parameters (Seston weight, Chlorophyll, Temperature, pH, DO, Salinity, TDS, Ox/Red. Potential, and Electric conductivity) were measured during study period. After one month, brushparks were harvested between 2-6 am, and species composition and marketable yield from each brush park were recorded. The measured water quality parameters did not differ among brush parks with parameters fluctuating as follows (Seston weight: 0.001-0.004, Chlorophyll: 0.002-0.436, pH: 5.03-8.33, DO: 6.29-8.99, Salinity: 0.56-2.61, TDS: 0.72-2.78, Ox/Red. Potential: 174-256, Electric conductivity: 1.19-4.64). The mean catch of four treatments were 2.2kg for *R. mucronata* 2.2kg, 143.67±7.5kg for *A. glabra*, 2.2±1.5kg for *T. cattappa* and 1.6±0.265kg for *A. auriculiformis*. No significant differences in mean yield among the four brushparks were observed. The mean Shannon index in *A. glabra*, *T. cattappa*, *A. auriculiformis*, and *R. mucronata* were 1.49±0.19, 1.06±0.55, 1.45±0.24, and 1.41±0.00 respectively with no significant differences. Results revealed poor catches from brush parks, lesser diversity, and no significant differences between catches. However, seasonal changes and potential role played by brushparks as a refuge for juvenile fish need to be further investigated.

Keywords: Brushpark, mangrove, Negombo estuary, non timber forest produce

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Department of Livestock and Avian Sciences

Usage of long pepper (*Piper longum*) and garlic (*Allium sativum*) as flavouring agents in sunflower oil mayonnaise

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Long pepper (*Piper longum*) and garlic (*Allium sativum*) have been used in the pre-colonial era of Sri Lanka and are well known for their antioxidant properties. The high fat content in mayonnaise can hamper oxidative stability and affect the storage duration and quality. Therefore, this study aimed to develop a mayonnaise incorporated with long pepper and garlic as flavouring ingredients and natural antioxidants. Mayonnaise was prepared by using a mixture of different concentrations of long pepper and garlic. The effect of different concentrations of the long pepper and garlic mixture on sensory attributes at 1%, 1.5%, and 2% was assessed. A seven-point hedonic scale was used for the sensory analysis and data was analyzed using the Friedman test. The most preferred mayonnaise was then evaluated for its proximate composition, emulsion stability and total phenolic content. Colour, texture, water activity, antioxidant activity and microbial quality were measured during the storage period of 30 days. Antioxidant activity was evaluated using the pH, peroxide values, and free fatty acid values. According to consumer preference, the 1% long pepper and garlic mixture was the most preferred and used for further analysis. The peroxide and free fatty acid values increased rate of 1% long pepper and garlic mixture mayonnaise were significantly ($P<0.05$) lower than in the control group. L value of colour and pH were significantly decreased ($P<0.05$) during the storage period. Peroxide value, free fatty acid, water activity, and a value of colour were significantly increased ($P<0.05$) during the storage period. The results of the microbial study showed that the 1% long pepper and garlic mixture mayonnaise total plate count and yeast and mould count were significantly ($P<0.05$) lower than the control. These results show the long pepper and garlic mixture incorporated in mayonnaise was effective in controlling the lipid oxidation of mayonnaise.

Keywords: Antioxidants, garlic, long pepper, lipid oxidation

Cultured buttermilk added with cardamom (*Elettaria cardamomum*), ginger (*Zingiber officinale*), and pepper (*Piper nigrum*): A comprehensive analysis of compositional and physicochemical properties

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The fermentation process of milk, an ancient technique for preservation, gives rise to cultured buttermilk, a prized dairy beverage renowned for its rich nutritive and therapeutic properties. This study aimed to analyse the composition and physicochemical properties of cultured buttermilk fortified with cardamom, ginger, and pepper, selected based on prior sensory evaluation. Upon analysis, the proximate composition unveiled mean values for various parameters: total solids (17.11%), total ash (0.69%), total fat (0.23%), and total soluble solids (48.00%). The physicochemical evaluation of the beverage exhibited significant differences ($P < 0.05$) in pH (ranging from 4.39 to 4.22), titratable acidity (ranging from 0.68% to 0.86%), and phase separation (ranging from 0.37% to 1.00%) throughout the storage period under refrigerated conditions. Additionally, viscosity underwent significant alterations ($P < 0.05$) over the 21-day storage duration. Further investigations through colour analysis revealed significant shifts in L^* and b^* values during storage ($P < 0.05$), while a^* values exhibited no substantial differences. This comprehensive investigation concluded that the physicochemical attributes of the developed buttermilk underwent modifications during the storage period.

Keywords: Cardamom, cultured buttermilk, fortification, ginger, pepper

A Comparison of the meat quality characteristics and nutritional composition of commercial broiler, indigenous village chicken, and spent hen meat in Sri Lanka

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This preliminary study aimed to compare the nutritional composition (moisture, crude ash, crude fat, and crude fibre) and meat quality characteristics (texture, water holding capacity, cooking loss, drip loss, pH, and colour) of raw leg meat among spent hen (SH), indigenous village chicken (IVC), and commercial broiler chicken (CBC) in Sri Lanka. For analysis, leg meat samples were obtained from three carcasses per chicken type, and prior to analysis, visible skin, fat, and connective tissues were trimmed off. Data analysis was conducted using ANOVA through version 26.0 of the SPSS program. According to the results of this preliminary study, leg meat of CBC showed significantly higher crude fat ($4.82 \pm 0.28\%$) and moisture content ($76.30 \pm 1.10\%$) compared to SH ($3.04 \pm 0.37\%$, $72.00 \pm 0.66\%$) and IVC ($2.17 \pm 0.68\%$, $70.39 \pm 1.08\%$) ($P < 0.05$). Meanwhile, IVC exhibited significantly higher crude protein ($23.86 \pm 0.87\%$) and ash ($3.27 \pm 0.27\%$) contents than SH and CBC ($P < 0.05$). Crude fibre contents of CBC, SH, and IVC meat were $0.17 \pm 0.05\%$, $0.19 \pm 0.05\%$, and $0.22 \pm 0.06\%$, respectively, with no statistically significant differences. Commercial broiler meat displayed significantly higher cohesiveness ($0.48 \pm 0.03\text{N}$) and lower hardness ($6.38 \pm 0.11\text{N}$), gumminess ($1.75 \pm 0.07\text{N}$), and chewiness ($1.05 \pm 0.04\text{N}$) values compared to SH and IVC meat ($P < 0.05$). CBC meat showed significantly higher water holding capacity ($77.18 \pm 0.54\%$) than IVC and SH meat ($P < 0.05$). Cooking loss and drip loss were significantly higher in IVC meat compared to others ($P < 0.05$). CBC meat had significantly lower L^* and b^* values but a higher a^* value compared to SH and IVC meat ($P < 0.05$). This information helps consumers better understand the nutritive value and essential quality traits of different types of chicken meat.

Keywords: Commercial broiler, indigenous village chicken, nutritional composition, spent hen, quality characteristics

Potential application of Pre-Colonial processing techniques in developing pork meatballs

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The present study was undertaken to evaluate the potential application of pre-colonial processing techniques in developing pork meatballs. Meatballs were produced using a pre-colonial meatball recipe, including pork, roasted rice flour, green chilli, salt, cumin, coriander and asamodagam leaves (*Trachyspermum roxburghianum*). The research method was a completely randomized design, with four treatment groups, with triplicates. Four treatment groups were formulated with different levels of roasted rice flour: 0%, 5%, 10% and 15%, respectively. The sensory characteristics (colour, flavour, texture, juiciness, tenderness, overall acceptability) and physiochemical characteristics (cooking loss, colour and texture) were evaluated. The inclusion of roasted rice flour in pork meatballs increased cooking yield by reducing weight loss from 31.28% to 3.31%, which was significant ($P < 0.05$). Meatballs made with the addition of 15% roasted rice flour had the significantly highest hardness and shearing energy, while 5% roasted rice flour incorporated meatballs had the lowest hardness and shearing energy. Among the four treatments, the preferable colour, aroma, juiciness and taste were significantly increased ($P < 0.05$) in the 10% roasted rice flour group, while the preferable mouth coating was observed in the 5% roasted rice flour group. The preferable tenderness was observed in both the 5% and 10% rice flour groups. According to the sensory evaluation, meatballs with roasted rice flour inclusion at 10% were the most acceptable.

Keywords: Meatballs, pork, pre-colonial, roasted rice flour

Comparison of meat characteristics of wild, village and exotic Pork types

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Pork meat is recognised as one of the main meat varieties in Sri Lankan food culture, where mainly Sri Lankan wild boar, village pig and exotic types are available. This study aimed to compare meat quality characteristics, including colour, pH, texture, drip loss, cooking loss and water holding capacity and nutritional composition, of these three pork varieties. The wild boar meat exhibited significantly ($P < 0.05$) higher protein, ash, moisture, fibre and carbohydrate content than village pig and exotic pork. The results revealed that exotic pork had the highest fat content ($12.132 \pm 0.005\%$) than the other two pork types. Colour profile analysis showed that the highest L* values (lightness) and b* values (yellowness) were associated with exotic pork, while wild boar meat had the highest a* values (redness). The drip loss and cooking loss values were significantly ($P < 0.05$) lower in wild boar meat than in village pigs and exotic pork. The water-holding capacity, muscle fibre diameter and pH values were higher in wild boar meat than in the other two pork types. The texture analysis indicated hardness, cohesiveness, gumminess and chewiness exhibiting the highest values in wild boar meat, whereas exotic pork had the lowest values in those parameters ($P < 0.05$). In conclusion, this research output provides scientific data on nutritional and physicochemical attributes of wild boar, village pig, and exotic pork meat varieties, which will be useful from nutritional and processing points of view.

Keywords: Sri Lankan wild boar, exotic pork, village pig, composition, physicochemical analysis

Effects of the wood type used for smoking step on quality parameters of beef sausage

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Smoking, a cooking and preservation technique, exposes food to smoke from burning wood, a method commonly employed by ancient Sri Lankans to preserve fish and meat. Organic compounds such as phenols, aldehydes, and ketones in smoke impart the flavour, colour, and aroma of smoked food products such as sausages, in which smoking is one of the important steps in its production process. Because the composition of smoke is highly dependent on the wood type, the present study determined the effects of smoke generated from different types of wood on the sensory, chemical, and microbial quality of beef sausages. Four groups of beef sausage were processed, only changing the wood type used to generate smoke for the smoking step, such as control (without smoking step), coconut shells, citrus wood, cinnamon wood, and sawdust. Principle coordinate analysis of the sensory parameters of sausages evaluated by thirty untrained panellists revealed that five sausage groups significantly differed in their sensory profiles. Compared to the control group, all the other groups of sausages smoked using different wood types were given the highest ($P < 0.05$) marks for the sensory attributes such as smokey flavour and smokey aroma, which were the two major sensory attributes contributed largely to the principal component responsible for 56.3% variability among the groups. Compared to the control group, all other sausage groups had significantly higher ($P < 0.05$) total phenolic contents, which might be transferred from the smoke generated from different wood types. Furthermore, the sausage pH was negatively correlated with the phenolic acid content of the sausages. Additionally, no difference ($P > 0.05$) in the total plate counts was observed among all the sausage groups measured at 7 and 28 days of frozen storage. Therefore, these results conclude that the wood type used to generate smoke has a significant effect on beef sausage's sensory properties and chemical parameters.

Keywords: Smoked beef sausages, smoking, total phenolic content, wood type

Evaluate the effect of garcinia (*Garcinia cambogia*) and tamarind (*Tamarindus indica*) juice marinades on selected physicochemical properties of porcupine meat

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This study aimed to investigate the impact of garcinia and tamarind juice, along with salt marinades, on the texture, colour, and marinate uptake, cooking loss, and water-holding capacity of porcupine meat. The evaluation process involved marinating porcupine meat with each marinade mixture and assessing various parameters, including texture, pH, colour, water-holding capacity, and marinate uptake before and after cooking. The marinated meat samples were compared with non-marinated ones, while the cooked samples were compared with meat cooked without marinade mixtures. The results unveiled significant effects of the marinades on the physicochemical properties of porcupine meat. Specifically, the tenderness of the meat significantly increased after using garcinia, whereas it decreased notably with tamarind ($P < 0.05$). The pH of the meat marinated with garcinia and tamarind indicated a significant decrease ($P < 0.05$) compared to both salt-marinated and non-marinated meat. Differences in the L^* values were observed between each treatment. Marinate uptake of meat significantly decreased ($P < 0.05$) after marination using garcinia and tamarind juice compared to meat marinated solely with salt. Moreover, cooking loss of meat post-marination was higher with salt but lower with garcinia and tamarind juice. Overall, the findings underscore the significant impact of both garcinia and tamarind juice marinades on the physicochemical properties of porcupine meat. Particularly, Tamarind demonstrates substantial potential as a natural tenderizer in meat preparation.

Keywords: Garcinia, marination, porcupine meat, tamarind, tenderization

Relationship between the occurrence of Kidney disease among cat fed on commercial dry food

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Chronic Kidney Disease (CKD) is a common systemic disease affecting cats. Clinical studies have demonstrated the importance of dietary management in slowing the progression of CKD in the cat. Common clinical signs associated with CKD are decreased appetite, halitosis, dull hair coat, polyuria and weight loss. There is a large variety of medications and dietary supplements recommended for treatment of CKD available commercially but there is very little information as to the frequency of dietary supplement administration by owners of cats with CKD and whether the commercially available cat food predisposes cats to CKD. This research aimed at finding out the effect of commercially available dry foods on CKD in cats. Randomly selected, total of 100 local and pure-bred cats in Sri Lanka were taken into this survey. To collect information on cat's clinical history, owner awareness of CKD of cats, and signs of diseases were presented to cat owners through a pretested standardized questionnaire. It was revealed that a greater number of cat owners gave mix (homemade and commercial) foods. Cats were completely on commercial food category showed more tendency to acquire CKD and of which cats that were above 7 years old showed more clinical signs. In conclusion, there was a notable predisposition that cats acquire CKD when fed with commercially available dry food than those were fed either a homemade or mixed diet. It was further revealed that many of the pet owners stopped giving commercial dry food after their cats were first diagnosed with CKD.

Keywords: Commercial dry food, kidney diseases, kidney failure, renal health

Effects of spices on growth and survival of *Salmonella enterica* serovar Enteritidis and mayonnaise prepared with Nasnaran mandarin (*Citrus madurensis*)

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Various species were closely connected to the culture and traditions of Sri Lankan cuisines. The usage of spices was documented even before the pre-colonial era. *Salmonella enterica* serovar Enteritidis is a food-borne pathogen which can be associated with mayonnaise. The purpose of this study was to assess the survival of *Salmonella enterica* serovar Enteritidis in the presence of Cinnamon (*Cinnamomum zeylanicum*), Nasnaran mandarin (*Citrus madurensis*) and long pepper (*Piper longum*). Each spice was extracted, and its antibacterial activity was assessed using the well diffusion method at four different concentrations. The long paper had no bactericidal effect according to the used concentration. Nasnaran and Cinnamon showed antibacterial activity. Then Nasnaran was selected in the formulation of mayonnaise due to its ability to improve bacteriological quality by inhibiting the growth and survival of *Salmonella enterica* serovar Enteritidis, as well as its sensory appeal. Antibacterial activity of Nasnaran was significantly higher compared to cinnamon ($P < 0.05$). The efficacy of Nasnaran artificially contaminated mayonnaise with *Salmonella enterica* serovar Enteritidis at 10^5 CFU/g was tested. The total bacteria count in 2% Nasnaran was significantly ($P < 0.05$) lower than in 1% Nasnaran and control sample. The results from the present investigation showed a possible application of the antimicrobial activity of spices in food systems to prevent growth or even decrease viable cell numbers of pathogenic bacteria *Salmonella* Enteritidis. Further investigations with *Salmonella enterica* serovar Enteritidis and Nasnaran or cinnamon extracts in food systems would help to assess the potential of ‘natural antimicrobials’ for food preservation.

Keywords: Cinnamon, mayonnaise, Nasnaran mandarin, *Salmonella enterica* serovar Enteritidis

Determination of microbial quality and sensory characteristics of a novel milk delicacy formulated based on a Sri Lankan authentic *kiri-dodol*

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Kiri-Dodol is a traditional milk-based delicacy prepared for special ritual events from ancient history. Despite its appealing organoleptic properties, its major limitations are the significantly shorter shelf life and unavailability in the market. The objective of this study was to evaluate the microbial quality, sensory acceptance, and sensory profiles of alternatives to *kiri-dodol* prepared using different milk bases: coconut milk, cow milk, and buffalo milk. Three different formulations of delicacies were prepared according to a traditional recipe, vacuum-packed, and stored under refrigerated conditions (4 °C) for over 21 days. The sensory acceptance of the products was assessed by an untrained panel (n=43, aged 21-30 years) using a three-point Just-About-Right (JAR) scale. Panellists evaluated 17 attributes of appearance, aroma, flavour, texture, mouthfeel, and aftertaste. A hedonic test was also conducted to evaluate the consumer liking for the products using a 9-point hedonic scale (1=dislike extremely, 9=like extremely) on days 1 and 14 of the refrigerated storage. Microbial quality was determined by total aerobic plate count and selective enumeration of yeast, mold, and coliform in 10-day intervals. Sensory analysis revealed that the panellists mostly preferred cow milk-based product. It obtained the highest mean scores for all attributes: colour (7.24 ± 0.79), aroma (7.85 ± 0.62), overall flavour (7.88 ± 0.60), texture (6.82 ± 0.98), mouthfeel (6.82 ± 0.98), after taste (7.82 ± 0.68), overall liking (7.73 ± 0.76). JAR analysis showed that coconut milk-based products possessed the highest number of attributes with optimum JAR levels. Dryness, first-bite hardness, and creaminess had the highest discrimination power among treatments. Microbial counts were within the acceptable limits for a milk-based food. In conclusion, results suggest that milk delicacies made from cow milk have the best sensory acceptance compared to those produced from coconut or buffalo milk.

Keywords: Buffalo milk, coconut milk, ethnic foods, Just-About-Right, milk delicacy

Effect of Pre-Colonial meat preservation techniques on physicochemical and microbial quality of turkey meat

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Various traditional meat preservation techniques were used in Sri Lanka in the pre-colonial era. This research investigates the effectiveness of common meat preservation methods used in Sri Lanka during pre-colonial periods, on the physicochemical and microbial quality of turkey meat. Turkey breast meat samples were subjected to smoking, drying, and immersing dried meat in honey, then vacuum packed and stored under refrigerated conditions and room temperature. Samples were smoked and dried up to 25% moisture level, and samples dried up to 50% moisture level were immersed in bee honey. Physicochemical properties such as water holding capacity (WHC), pH level, water activity, colour, texture, and microbial quality were assessed weekly. Across the treatments, significant decreases ($P<0.05$) in the pH and WHC were observed. Significant increases ($P<0.05$) in the hardness were observed in the dried and smoked samples while honey-treated samples showed a decrease in hardness. There was no significant increase of microbial growth or deterioration of physicochemical parameters of the samples which were stored under room temperature or refrigerated conditions. Preserved samples under smoking and drying had developed darker colours externally and light colours internally. All three treatments resulted in a pleasant aroma in meat. Under the pre-said preservation methods, meat could be stored without harmful effects on the physicochemical properties of meat for up to 28 days. Further exploration and refinement of these techniques could offer valuable insights for preserving and enhancing the quality of perishable meats in contemporary settings.

Keywords: Drying, honey immersion, preservation, smoking, turkey meat

Product characterization and storage stability of wood-apple-milk beverage (*divul-kiri*) prepared from different milk bases

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Woodapple milk beverage (*divul-kiri*) is an astringent beverage popular in Sri Lanka from the time immemorial. The current study aimed to evaluate the physicochemical properties and storage stability of three different formulations of *divul-kiri* over refrigerated storage. Beverages were prepared with three different milk bases: coconut milk, cow milk, and probiotic fermented cow milk (*Lactocaseibacillus rhamnosus* LGG with conventional yoghurt starter). Each beverage was composed of 50% milk base, 25% water, and 25% wood-apple pulp by volume. The pH, titratable acidity (TA), viscosity, instrumental colour, serum separation, sedimentation, and free fatty acid (FFA) content were determined at weekly intervals for over 21 days of refrigerated storage (~4 °C). The proximate composition of the beverages was also determined. The total solid content of the product ranged from 19-21%. Cow milk-based beverages contained considerably higher amounts of protein (11-13%) than coconut milk-based beverages (~7%). On day 1, the probiotic product showed the highest titratable acidity, whiteness (L^*), yellowness (b^*), free FFA content, and the lowest pH. The highest viscosity and serum separation were observed in coconut milk-based and cow milk-based beverages, respectively ($P < 0.05$). When the variations throughout the storage were concerned, the whiteness in the probiotic beverage and the viscosity in the coconut milk-based product was continuously decreased. In contrast, yellowness (b^*), the sedimentation in the coconut milk-based beverage, and the FFA content in probiotic beverage showed an increasing trend over the storage. Acidity in coconut and cow milk-based products did not vary significantly ($P < 0.05$) compared to the probiotic beverage which showed an increasing acidity. Variation in other parameters was not significant. Results conclude that variations in physicochemical properties during refrigerated storage largely depend on the milk base used and the probiotic beverage may be highly susceptible to developing off flavours due to accumulation of FFAs.

Keywords: Beverage, coconut, cow milk, *Limonia acidissima*, probiotic

Determining the optimum initial moisture content of pork for preservation using bee honey

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Honey has long been recognized as a preservative in ancient cultures due to its antibacterial properties. This study aimed to analyse the impact of different moisture levels (73%, 55%, 40%, and 25%) on the microbiological and physicochemical properties of pork preserved in honey. Oven-dried pork samples were used as a control. Total plate count, pH, Colour, and texture assessments were done weekly. Results showed significant ($P < 0.05$) microbial growth in samples with 40% and 55% moisture, and 73% moisture led to spoilage. However, the 25% moisture sample, preserved in honey, effectively controlled microbial growth for a month, keeping colony-forming units within safe limits (ranging from 5.72 ± 0.05 log cfu/g to 7.01 ± 0.04 log cfu/g). The study found significant differences ($P < 0.05$) in microbial growth during storage and moisture changes. The control sample's pH increased gradually (from 5.69 ± 0.02 to 7.64 ± 0.05), while the honey-preserved sample's pH decreased (from 5.69 ± 0.02 to 4.07 ± 0.04). Colour analysis revealed a mold-induced L value increase in the control sample, while honey-preserved samples showed an initial L value decrease followed by a gradual increase. Texture analysis showed decreased hardness in both control and honey-preserved samples during preservation (from 15.96 ± 1.14 N to 0.66 ± 0.62 N). According to the study results, the changes in pH, Colour and texture were significantly different ($P < 0.05$) in the control and honey-treated samples during the storage time and their combination effects. In conclusion, this research recommends reducing initial moisture to at least 25% for effective pork preservation with bee honey.

Keywords: Bee honey, moisture content, physicochemical properties, pork preservation, total plate count

Improving quality and extending the shelf life of traditional Sri Lankan butter through enrichment of moringa (*Moringa oleifera*) leaf extract

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With its abundance of bioactive compounds and essential nutrients, the moringa plant has recently gained recognition as a valuable ingredient in food product fortification. This study explores the potential of incorporating moringa leaf extract into Sri Lankan traditional butter to enhance its quality and shelf-life attributes over a 21-day storage period. Before the study, the optimal proportion of moringa leaf extract in butter was determined through sensory analysis. The proximate composition of the developed moringa extract-added butter revealed moisture (17.90%), fat (59.19%), and ash (2.36%). Statistical analysis showed no significant difference in the proximate composition compared to the control, except for ash content ($P < 0.05$). Throughout the storage period, the butter enriched with moringa leaf extract demonstrated significantly lower changes ($P < 0.05$) in peroxide value (ranging from 0.16 to 0.20 mEq O₂/kg) and free fatty acid value (ranging from 0.57 to 0.75%) compared to the control. Regarding colour, a* values increased significantly ($P < 0.05$) over time. Texture profiling results showed a significant increase ($P < 0.05$) in hardness with time, with no effect observed on cohesiveness, gumminess, and chewiness in moringa extract-added butter. Microbial analysis indicated no significant difference ($P > 0.05$) in standard plate count and yeast and mold count between the control and moringa-enriched butter. Overall, this study highlights the potential of moringa leaf extract as a natural additive for improving traditional butter's quality and shelf-life attributes, offering a healthier perspective for innovative product development.

Keywords: Moringa, peroxide value, shelf life, traditional butter

A comprehensive analysis of the tenderizing potential in venison using raw papaya (*Carica papaya*) fruit, leaves, and peel with a traditional cooking method

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This study delves into the historical culinary practices of ancient Sri Lanka, focusing on tenderizing Venison through the use of raw papaya. Emphasizing the scientific exploration of papain enzymes from different parts of papaya, the research aimed to elucidate the underlying mechanisms behind these traditional practices. By systematically examining traditional and modern culinary techniques, the study evaluates the efficacy of papaya-based powders in enhancing the sensory attributes of Venison. A comprehensive assessment of various parameters, including texture, colour, pH levels, water holding capacity, marinade uptake, and cooking loss, was conducted through several marination and cooking protocols. The findings revealed significant impacts of papaya-based powders on venison texture, pH levels, and water retention properties, with distinct responses observed during the marination and cooking stages. Notably, papaya fruit powder exhibited a noticeable tenderizing effect, while papaya leaf and peel powders led to varied textural responses, including increased firmness, cohesiveness, gumminess, and chewiness during cooking. Furthermore, the marination process induced significant pH variations, with papaya leaf powder exhibiting the highest initial pH level. Subsequent cooking resulted in pH elevation, suggesting a potential alkalizing effect. Additionally, water-holding capacity studies emphasized papaya leaf powder's exceptional water retention properties. Diverse responses were observed regarding marinade uptake and cooking losses, highlighting practical implications for culinary practices and cultural preferences in venison preparation with papaya-based tenderizing agents. Overall, this research contributes to a deeper understanding of meat tenderization techniques and offers valuable insights for optimizing the sustainable usage of papain while bridging the traditional and modern culinary approaches.

Keywords: Culinary practices, papain enzyme, raw papaya, tenderizing, Venison

Potential packaging applications for newly developed pasteurized milk beverage infused with bee honey (*Apis mellifera*) and pepper (*Piper nigrum*)

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Packaging plays a vital role in safeguarding dairy products by forming a protective barrier against physical damage and microbial contamination. Common choices for storing pasteurized milk include PET (polyethylene terephthalate), High-density polyethylene (HDPE), and glass bottles. This study aimed to identify the most suitable packaging option among these materials for a newly developed pasteurized milk beverage infused with bee honey and pepper. Over a 21-day refrigerated storage period ($8\pm 1^\circ\text{C}$), physicochemical and microbiological characteristics were assessed to estimate the beverage's shelf life. Thermal shock and leakage tests were assessed to determine the physical quality of the packages. Results indicated a significant increase ($P < 0.05$) in titrable acidity for all packaging types, with glass bottles demonstrating the least increase (0.17% to 0.19%) while pH levels decreased significantly across all packaging materials during the 21 days of storage. Free fatty acid values increased in all packaging types, with glass bottles exhibiting the least increment (1.14% to 1.34%). Based on the colour analysis, the L^* and b^* values of milk beverages increased and the a^* value decreased significantly ($P < 0.05$) during storage. Thermal shock test indicated that glass bottle is more thermal resistant than other materials. Based on leakage test all three packaging materials were free from leakages. Microbiological quality assessment indicated a significant increase in total bacteria count during storage, yet milk in glass bottles exhibited lower total plate counts (3.74 log CFU/ml to 4.43 log CFU/ml) compared to other materials. Despite a significant increase in total bacteria count during the 21-day refrigerated storage, the bee honey and pepper-added pasteurized milk beverage maintained a microbiological shelf life beyond 21 days in glass and HDPE bottles. Overall, milk beverages stored in glass bottles showed superior preservation qualities, suggesting glass as the preferred packaging material for pasteurized milk beverage infused with bee honey and pepper.

Keywords: Microbiology, packaging, pasteurized milk, physicochemical, shelf life

Development of traditional rice flour (*Kalu Heenati*) cookies incorporated with ginger (*Z. officinale*) and long pepper (*P. longum*)

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In the pre-colonial era in Sri Lanka, spices were integral components of the indigenous culinary and medicinal practices. In the present study, the antioxidant content of the cookies was improved by incorporating ginger and long pepper. Thus, three types of cookies were formulated with *kalu heenati* rice flour with 0.25% (T₁), 0.50% (T₂), and 0.75% (T₃) long pepper and ginger mixtures with commercial butter cookies (Co), and the most preferred percentage was determined using a sensory evaluation on a nine-point hedonic scale with XLSTAT. According to the results, 0.25% (T₁) has the highest LS means-product value (0.967±0.24), and further analysis was done with T₁, 0% (T₀) spiced cookie, and Co. The comparatively lowest spread ratio was in T₁ (9.881±0.12). Proximate analysis of T₁ had fat, moisture, raw fiber%, and ash, respectively, as 13.31±0.07%, 2.10±0.28%, 58.29±2.83, and 1.67±0.04%. The anti-oxidative effect of the cookies were evaluated by calculating factors such as peroxide values, free fatty acid values, and pH. Comparatively, a higher phenolic content was observed in T₁ cookie (2.55 mg GAE/g). According to the free fatty acid and peroxide values, T₁ showed significantly ($P<0.05$) lower mean values throughout the 4-week storage period. (0.23±0.02 to 0.29±0.02, 1.23±0.561 to 2.24±0.1131). Shelf-life studies found that the mean PH (6.11±0.03 to 5.64±0.08), water activity (0.2±0.00 to 0.19±0.00), and hardness of the cookies decreased significantly ($P<0.05$). T₁ showed the lowest yeast and mold count, the highest total plate count, and the highest moisture content throughout the storage period. Therefore, long pepper and ginger can be used as natural antioxidants to retard lipid oxidation in snack products and improve their shelf life.

Keywords: Antioxidants, lipid oxidation, proximate analysis, sensory analysis, shelf-life

Effectiveness of traditional food tenderizing techniques for turkey meat by using Koora thampala roots (*Amaranthus viridis* L.), wood apple pulp (*Limonia acidissima*) and gingelly seeds (*Sesamum indicum*)

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This study aimed to investigate the efficacy of traditional meat tenderizing techniques, utilizing *Amaranthus viridis* L. (koora thampala) roots, wood apple pulp, and gingelly seeds to enhance the tenderness and quality of turkey meat. The physicochemical properties of turkey meat were assessed, including tenderness, pH, colour, water holding capacity (WHC), cooking loss, and marinade uptake. Different proportions of these ingredients were applied to marinate turkey meat, with detailed measurements conducted pre- and post-cooking. Significant pH variations ($P < 0.05$) were observed, particularly with sesame seeds displaying the highest initial pH. Marinating induced a pH decrease, especially in sesame seed-added samples, but cooking raised pH levels, suggesting alkalization. The texture analysis of turkey meat highlighted a significant reduction ($P < 0.05$) in hardness post-marination, with wood apple at 80% concentration exhibiting the lowest hardness, indicating its potential as a robust tenderizing agent. The brightness, redness, and yellowness have changed significantly ($P < 0.05$) throughout the marination and cooking processes. Marination had a significant effect ($P < 0.05$) on WHC and moisture retention, with varying effects observed among marinating agents. By exploring the benefits of koora thampala roots, wood apple pulp, and gingelly seeds as tenderizing agents, this study contributes to understanding the effects of natural tenderizing agents on meat quality attributes.

Keywords: Gingelly seeds, koora thampala roots, turkey meat, tenderization, wood apple pulp

Preservation of chicken meat utilizing a traditional Sri Lankan technique incorporated with *Garcinia cambogia* and *Pepper nigrum*

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Natural antioxidants and antimicrobial compounds in plant materials help preserve meat by reducing its susceptibility to lipid oxidation and microbial spoilage. The study aimed to evaluate the preservation properties and sensory quality under various inclusion levels of *Garcinia* (*Garcinia cambogia*) and *Pepper* (*Piper nigrum*) in chicken meat prepared according to traditional Sri Lankan techniques. Commercially available broiler chicken meat was marinated with different combinations of *Garcinia* (G) and *Pepper* (P): C (G = 0.0g, P = 0.0g), T1 (G = 12.5g, P = 0.0g), T2 (G = 0.0g, P = 3.0g), T3 (G = 12.5g, P = 3.0g), T4 (G = 3.0g, P = 12.5g), and T5 (G = 12.5g, P = 12.5g), and cooked under similar conditions. The final products were vacuum-packed and stored under refrigerated conditions (-4°C). Microbial quality and physicochemical quality parameters were measured weekly over 4 weeks. Sensory quality was evaluated by 35 panellists using nine point hedonic scale. The results showed significantly lower microbial counts in all the marinated samples compared to the control ($P < 0.05$). Meanwhile, the lowest total plate count value (6×10^5 cfu) was recorded in T3 and T5 samples after 28 days of storage. Furthermore, peroxide values of marinated and control samples significantly differed between time points. All recorded peroxide values of treatments at day 14 were lower than the control ($P < 0.05$) and lay within the acceptable limit. According to the sensory analysis, T2 received higher mean sensory scores for aroma, taste, texture, and overall liking. Meanwhile, T3 received the highest mean scores for aroma and aftertaste. Linking analysis showed that the same two products were the most popular among panellists. The results concluded that T3 exhibits the desired meat quality parameters, is microbiologically safe, and maintains the best sensory attributes for up to 14 days of refrigerated storage.

Keywords: Antioxidant, Chicken, *Garcinia cambogia*, *Pepper nigrum*, lipid oxidation

Evaluation of physicochemical properties of rabbit meat marinated with ginger (*Zingiber officinale*), garlic (*Allium sativum*), and a combination of both marinades

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This study aimed to evaluate the physicochemical properties of rabbit meat, focusing on pH, colour, tenderness, water holding capacity, marinade uptake, and cooking loss. The focus is on the effects of marination using extracts of ginger, garlic, and a combination of both. Meat cubes (3 × 3 cm) were marinated for 16 hours separately with marinades of ginger, garlic, and their combination, while control samples were marinated with distilled water. Measurements were taken before marinating (raw meat), after marinating, and after cooking. A comparative analysis was conducted, comparing the results of marinated samples with their respective controls and cooked samples with their corresponding controls. Overall, L*, a*, and b* values showed no significant differences ($P > 0.05$) across all four samples after marinating and cooking. Ginger-marinated and ginger-garlic combined samples showed no significant difference ($P > 0.05$) in pH compared to control. The hardness and the shearing force increased in all samples after cooking, but there was no significant difference in garlic in marinated samples. Notably, ginger-marinated meat showed a significant increase ($P < 0.05$) in water holding capacity, both after marinating and cooking. Marinade uptake and cooking loss varied significantly in garlic and ginger-garlic combined samples ($P < 0.05$). In conclusion, marinating rabbit meat with ginger, garlic, and their combination induced notable changes in pH, tenderness, water holding capacity, and marinade uptake but not in colour.

Keywords: Garlic, ginger, Rabbit meat, marination, physicochemical properties

Analysis of bee honey pickle solution on quality and shelf life of pickled quail eggs

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Pickling is an important preservative technique which is used to extend the shelf life of eggs. Bee honey pickling solution was used as a food preservative in ancient Sri Lanka which was valued for its potential health benefits. The objective of this study was to evaluate the effect of different bee honey pickling solutions on the pickled quail eggs. Bee honey pickling solution with 2% acidity was prepared by fermenting bee honey and yeast. The quail eggs were pickled in three bee honey pickling solutions (without spices, with cinnamon (*Cinnamomum verum*) and with ginger (*Zingiber officinale*)). The pickled quail eggs were stored at ambient temperature (27-30°C) for 30 days of storage time, and pH, colour, proximate, sensory and microbial analyses were performed in 0, 15 and 30 days, respectively, in order to analyze the quality and shelf life of pickled eggs. A significant decrease ($P < 0.05$) was observed for moisture, fat and pH of pickled quail eggs throughout the storage period from 0 to 30 days. As per the observations, the colour of the pickled eggs was significantly ($P < 0.05$) different during storage from 0 to 30 days. According to the sensory evaluation, pickling solutions prepared incorporating bee honey pickling solution without spices and cinnamon had the best consumer preferability. The total plate count of the three treatments was numerically lower than the commercial product (control) in three respective time intervals. Therefore, bee honey pickling solution can be introduced as a natural preservative, which consists of high preservative action, and spices like cinnamon and ginger also possess some natural preservative properties. The results of this study will guide producers in optimising manufacturing procedures and storage of pickled quail eggs.

Keywords: Bee honey, pickling, quail eggs

Enhancing tenderness in spent hen meat through the application of plant-based materials from ancient Sri Lankan culinary practices

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Spent hen meat, derived from hens at the end of their egg-laying cycle, is characterised by a distinct flavour profile. But its poor tenderness limits its consumer acceptability and processing potential. This study aimed to evaluate the effectiveness of three selected plant-based materials: papaya (*Carica papaya*) and wood apple (*Limonia acidissima*) fruit pulps, and lotus (*Nelumbo nucifera*) leaf extract, used in pre-colonial culinary practices of Sri Lanka as possible tenderizing agents for spent hen meat. Approximately similar-sized breast meat chunks from spent hens were marinated with the above ingredients and kept for 1 ½ hours at room temperature and 24 hours under refrigerated conditions. The textural properties and other selected meat quality parameters (pH, marinade uptake, water holding capacity, cooking loss, and drip loss and color) were systematically assessed in both uncooked and cooked states. The results were analysed using One-way ANOVA of SPSS version 26.0. Notably, all marinated samples (both raw and cooked) showed significantly lower ($P < 0.05$) hardness, chewiness and gumminess values compared to the control samples under both marination conditions. Among the plant-based ingredients tested, wood apple-treated samples exhibited significantly lower hardness values for raw and cooked forms, irrespective of marination under room temperature or refrigeration. However, there was a noticeable decrease ($P < 0.05$) in water-holding capacity and cooking yield across all treatments compared to the control, accompanied by an increase ($P < 0.05$) in drip loss in wood apple and lotus treated samples. Wood apple-treated samples demonstrated the lowest water holding capacity and cooking yields and the highest drip loss values under both marination conditions. These findings suggest wood apple pulp emerged as the most effective natural tenderizer compared to other ingredients. However, it should be noted that it adversely affects other meat quality parameters emphasizing the need for further research before consider it in future industry applications.

Keywords: Lotus leaf extract, papaya, spent hen meat, tenderness, wood apple fruit pulps

Development of a milk beverage infused with bee honey and pepper (*Piper nigrum*): Evaluation of sensory characteristics and physicochemical properties

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This study aimed to develop a pasteurised milk beverage utilising cow milk as the primary component, enhanced with bee honey and pepper. The process involved cream separation from raw milk followed by preheating at 40°C. Subsequently, honey and pepper were incorporated into the mixture, which was then pasteurised at 63°C for 30 minutes. Bottled samples were stored under refrigerated conditions. To determine the most favourable combination, sensory evaluation was conducted among three predefined ratios: bee honey concentrations of 14%, 16%, and 18% (w/v), paired with pepper concentrations of 0.4%, 0.6%, and 0.8% (w/v), respectively. A 9-point hedonic scale was utilised, with 30 untrained panellists participating. Results indicated that the pasteurised milk beverage infused with 16% bee honey (w/v) and 0.6% pepper (w/v) received the highest consumer acceptance. Significant changes in various physicochemical properties were observed throughout the 21-day storage period. Total solids, ash content, total sugar and viscosity significantly increased across all three ratios, while moisture content decreased significantly ($P < 0.05$). Moreover, ascending concentrations of honey and pepper correlated with increased ash content, total solids, and total sugar, alongside decreased viscosity and moisture content in the milk beverages. In summary, varying ratios of honey and pepper influenced the sensory attributes and physicochemical properties of the pasteurised milk beverage.

Keywords: Bee honey, pasteurized milk, pepper, physicochemical, sensory

Determination of product characteristics and variation in physicochemical properties of vacuum-packed *kiri-dodol*-type milk delicacies during refrigerated storage

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Kiri-Dodol, a traditional Sri Lankan sweet delicacy, holds cultural and religious significance. It is traditionally made from rice flour, sugar, and coconut or cow or buffalo milk. However, the concise shelf life of the product (~1 day) is a significant constraint. The current research aimed to evaluate the product characteristics and the variation in physicochemical properties of different formulations of vacuum-packed *kiri-dodol*-type milk delicacies under refrigerated storage. Three different formulations were prepared using a traditional recipe using three milk bases (coconut, cow, and buffalo). The proximate compositions of the products were determined on the same day of preparation. Then, the products were vacuum-packed and stored under refrigerated conditions (~4 °C) for over 21 days. The pH, titratable acidity, instrumental colour, water holding capacity (WHC), and texture profile (hardness, chewiness, gumminess, and cohesiveness) were evaluated on days 1, 3, 7, 10, 14, and 21. The total solid, crude protein, and crude fibre contents in the products varied from 62 – 70%, 6 - 8%, and 5 - 8%, respectively. The crude fat content was approximately 4% in cow milk-based, 10% in buffalo milk-based, and 12% in coconut milk-based products. The pH, titratable acidity, whiteness (L* value), free fatty acid content, gumminess, and cohesiveness were stable in all products throughout the storage period. Redness (a* value) and yellowness (b* value) did not vary significantly ($P < 0.05$) in the products made of coconut and buffalo milk. In contrast, hardness, chewiness, and WHC did not vary significantly ($P < 0.05$) in coconut and cow milk products. When all physicochemical parameters were concerned, all of them were maintained constant until 14 days of storage. Results concluded that the product's nutrient composition depends on the milk base used, and vacuum-packaging is a practical approach to prolong its shelf life by at least up to 14 days.

Keywords: Authentic, buffalo, coconut, cow, milk

Pre-colonial processing of buffalo ghee with added spice mix: Technology and its properties

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Buffalo ghee was a favored dairy product in pre-colonial Sri Lankan cuisine. This study aimed to assess the impact of adding four spices; ginger (*Zingiber officinale*), garlic (*Allium sativum*), cinnamon (*Cinnamomum verum*), and cardamom (*Elettaria cardamomum*) to traditional buffalo ghee, enhancing its physicochemical, textural, microbial, and sensory properties. After conducting a sensory evaluation, the optimal proportion of four spices was determined. Sensory analysis identified two distinct groups: one with positive comments and one with negative comments. The highest spice percentage yielded the highest mean liking score (0.200), while the lowest spice ratio resulted in a negative mean liking score (-0.367). Overall, adding spices enhanced colour, appearance, aroma, flavour, texture, and overall liking scores. Subsequently, the chosen optimal proportion underwent physicochemical, textural, and microbial analysis. The results showed a significant increase in ash content (0.03% to 0.04%) and changes in colour parameters, with increases in a* (-0.1 to 5.1) and b* (5.7 to 11.4), while moisture (0.32% to 0.21%), peroxide values (1.88 mEq O₂/kg to 1.43 mEq O₂/kg), and L* (49.6 to 35.9) decreased significantly (P<0.05). However, no significant differences were observed in fat content, pH, or free fatty acids. Hardness increased (0.19 N to 0.30 N), while cohesiveness, gumminess, and chewiness remained unchanged. Microbial count decreased considerably after 48 hours (4.39 log CFU/ml to 4.23 log CFU/ml). In conclusion, incorporating spices beneficially improved the proximate composition, physicochemical characteristics, microbial profile, and sensory attributes of buffalo ghee. These findings can be utilized to enhance consumer preference for buffalo ghee.

Keywords: Buffalo ghee, cardamom, cinnamon, garlic, ginger

Assessment of the sensory characteristics of traditional Sri Lankan butter enriched with moringa (*Moringa oleifera*) leaf extract

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This research aimed to understand consumer preferences for moringa leaf extract-enriched traditional Sri Lankan butter, focusing on its sensory properties. Fortifying traditional butter with antioxidant-rich moringa extract presents a promising solution to the storage quality challenges typically associated with its high moisture and high-fat content. The study involved sensory evaluations by untrained panellists using three different proportions of moringa extract: 1%, 1.5%, and 2%. Data analysis was conducted using XLSTAT statistical software. Results revealed significant differences in overall flavour among the three types of butter, with this factor strongly influencing overall liking. The 1.5% moringa-enriched butter emerged as the consumer-preferred variant during the initial evaluations, leading to a second sensory assessment. In the subsequent analysis, the 1.5% moringa-enriched traditional butter was compared with traditional butter and commercial butter. The moringa extract-enriched butter showed significant differences in overall flavour, texture, and aroma compared to the other variants. While appearance did not significantly differ, overall aroma strongly impacted overall liking. Further, the study found that among the sensory attributes of the 1.5% moringa-enriched traditional butter, astringent flavour, dullness, stickiness, lightness, visual graininess, white specks, astringent aroma, and buttery aroma were prominent. Conversely, Sri Lankan traditional butter was characterized by attributes such as sweetness, cohesiveness, and aftertaste. Overall, this comprehensive study provides valuable insights into the development of moringa leaf extract-enriched traditional butter, offering a balance between sensory satisfaction and health-conscious consumer preferences.

Keywords: Moringa, sensory evaluation, traditional butter, panellists

Evaluation of the Pre-Colonial preservation methods in Sri Lanka: smoking, drying and preservation with honey

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Regeneration of knowledge on pre-colonial processing techniques is important to suggest alternative methods for modern processing practices. This study also focused on the effects of smoking, drying, and preservation with honey on the physicochemical and microbial attributes of pork meat. Fresh pork meat samples were subjected to preservation treatments: smoking, drying, and honey preservation. The preserved samples were stored under two storage temperatures: refrigerated (4°C) and at room temperature (25°C). The water holding capacity, pH, water activity, colour, texture (hardness) and microbial quality were assessed weekly. Results revealed a significant decrease ($P < 0.05$) in pH and colour (L value) in all treatments during storage of 28 days in refrigerated and room temperature conditions. Hardness significantly increased ($P < 0.05$) in smoking and drying treatments, while honey treatment significantly decreased in both storage conditions throughout the storage period. Water activity initially decreased in the first two weeks of all treatments, followed by an increase in the rest of the storage period, significantly in both storage conditions ($P < 0.05$). Smoking exhibited reduced water-holding capacity in both conditions throughout storage, while honey treatment showed a decrease in refrigerated conditions and an increase at room temperature throughout the storage. The water-holding capacity of smoking and honey treatments was significant ($P < 0.05$) in both storage conditions, while drying showed no significance ($P > 0.05$) in either condition. Microbial analysis, including total plate count, demonstrated a weekly increase throughout the storage, with significant differences between storage conditions for each treatment. These findings contribute valuable insights into the effectiveness of pre-colonial preservation methods and their impact on pork quality over time.

Keywords: Drying, honey, pork preservation, physicochemical properties, smoking

Tenderizing effect of wood apple (*Limonia acidissima*) in goat meat

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Health-conscious people are increasingly drawn to goats' lower fat content and impressive protein profile, making them a compelling alternative to traditional red meats. Generally, meat tenderness is indicated by age and species of the animal that indicate minimum cross-linking of collagen and actomyosin effect in the muscle. Toughness in goat meat poses a significant barrier to consumer acceptance. This study investigated the potential of wood apple (*Limonia acidissima*) as a natural tenderizing agent in goat meat processing. Experiments assessed the impact of the type of wood apple used (ripen and unripened) (Experiment 1), concentration of wood apple extract (0%, 50%, 33%, and 25%) (Experiment 2), and marination durations (1hr, 2hr, and 24 hr) (Experiment 3) on goat meat tenderness, cooking loss, colour, pH and sensory attributes. Results of experiment 1 revealed that wood apple extract obtained from the ripened fruits resulted in lower ($P<0.05$) hardness in the goat meat marinated for 2 hr compared to the extract obtained from unripe fruits. According to experiment 2, increasing the concentration of ripened wood apple fruit extract leads to decreased ($P<0.05$) hardness in the goat meat marinated for 2 hr. Experiment 3 investigated that marinating goat meat with ripened wood apple extract at 50% concentration for 2 hr grants the highest ($P<0.05$) tenderness compared to marinating for 1 hr and 24 hr. Furthermore, the cooked goat meat samples marinated with ripened wood apple at 50% concentration for 2 hours were given the highest ($P<0.05$) values for all the sensory attributes compared to the unmarinated and cooked goat meat by the thirty untrained panellists. These findings suggest that wood apple extract can be used as an effective natural tenderizer for goat meat tenderization. Furthermore, this study opens exciting doors for further research on using wood apple powder as a natural meat tenderizer.

Keywords: Goat meat, marination, natural tenderizer, tenderness, toughness

Evaluation of sensory and microbial characteristics of cultured buttermilk infused with cardamom (*Elettaria cardamomum*), ginger (*Zingiber officinale*) and pepper (*Piper nigrum*)

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Buttermilk is an important liquid by-product of the dairy industry. The present study aimed to formulate a buttermilk-based beverage by infusion of cardamom, ginger, and pepper and investigate the effect of adding spices on its microbial quality and sensory attributes. A panel of 30 untrained panellists did a sensory evaluation, and products were evaluated for colour, appearance, mouthfeel, texture, taste, aftertaste, and overall acceptability. The buttermilk sample with 12% sugar obtained the highest liking score out of the three buttermilk samples. The overall colour and texture had a stronger impact on the product's overall liking than the other JAR sensory attributes. The overall colour, aroma, texture, and aftertaste are not significantly different from the other JAR sensory attributes of the 12% sugar-added product. The study determined the shelf life of the pasteurised buttermilk beverage by assessing the microbiological quality of the beverage. Buttermilk samples were monitored for 21 days at seven days intervals. The results indicated no significant difference in total plate count ($P > 0.05$) of the control buttermilk sample and 12% sugar-added buttermilk sample. There was a significant difference ($P < 0.05$) in yeast and mold counts of the control and 12% sugar-added buttermilk samples. The total plate count and yeast and mold count exceeded the maximum permissible limit at seven days of storage. Therefore, the microbiological shelf life of buttermilk fortified with ginger, cardamom and pepper was detected at seven days at $10 \pm 1^\circ$ C of storage.

Keywords: Buttermilk, sensory, microbiological quality, permissible limit, shelf life

Evaluation of quality characteristics of chicken, turkey, quail meat-based traditional meatballs

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Chicken meatballs are the most famous meatball variety in Sri Lankan food culture. Other meat sources, such as quail and turkey, are potential raw materials for meatball production. This study aimed to develop rice-flour-incorporated meatballs from turkey and quail meat using pre-colonial recipes (Mas guli/ Kurakkal) and investigate the effect on proximate composition, physico-chemical properties and sensory qualities of meatballs. According to the sensory and texture analysis results, 10% inclusion was the optimum inclusion rate of rice flour for this formulation. Chicken meatballs were used as the control. The quail and turkey meatballs had significantly ($P<0.05$) higher protein percentage and lower hardness than chicken meatballs. The highest ash content and lowest fat percentage were observed in quail meatballs ($P<0.05$). Significant differences ($P<0.05$) in the colour parameters were observed among the samples. The highest a^* value (redness) was observed in quail meatballs, followed by turkey meatballs, while the lowest value was observed in chicken meatballs. Sensory evaluation results showed that quail meatballs had received the highest scores for colour, flavour, juiciness, and overall acceptability. In conclusion, developed quail meatballs exhibited better quality and sensory attributes than turkey and chicken meatballs.

Keywords: Meatballs, chicken, quail, turkey, quality characteristics

Pre-colonial techniques for post-mortem tenderization in pork processing

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This study was conducted to investigate the tenderizing potential of plant-based natural tenderizers that were used for meat tenderization in the pre-colonial era in Sri Lanka, specifically focusing on papaya fruit (*Carica papaya*), lotus leaves (*Nelumbo nucifera*) and wood apple (*Limonia acidissima*). Their tenderizing efficacy was compared based on the marinating time at different time intervals (1.30hrs and 24hrs). Then, uniform-sized chunks (2 × 2 × 2 cm) from exotic pork meat of cross breed of Landrace, Large white and Duroc (6 months aged) were marinated with sap of the lotus leaves, pulp of papaya fruit and pulp of wood apple separately for 1.30hrs at room temperature and 24hrs at 4°C. The textural and physio-chemical characteristics of the marinated raw and cooked meat chunks were studied. pH of meat was reduced significantly ($P < 0.05$) in all treated samples than control after 1.30h marination period. After both marination periods, water holding capacity was decreased, and drip loss of meat was increased ($P < 0.05$) in all tested samples than control. Also, after both marination periods, reduction ($P < 0.05$) in hardness values of raw and cooked meat and muscle fibre diameter values were observed in all treated samples compared to the control. From these results, it is shown that all tested ingredients can tenderise the meat, while wood apples could be used as a more effective tenderizer than other tenderizing ingredients.

Keywords: Lotus leaves, papaya, pork meat, tenderization, wood apple

The impact of the use of fresh coconut shells, coconut water, and date palm fruit, on the tenderness and flavour of venison

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The research study aimed to investigate and compare the tenderizing effects of three traditional cooking techniques, especially the use of fresh coconut (*Cocos nucifera*) shells, coconut water, and date palm fruit (*Phoenix dactylifera* L.). Venison was selected as the meat type, for the research study. It was chosen due to its toughness, nutritional profile, and distinctive sensory qualities, serving as the ideal meat for evaluating these traditional cooking techniques. Coconut water and date palm marination lasted 24 hours, while coconut shells were added directly during the cooking process. The analysis provided a detailed review of key meat characteristics such as meat pH, colour, water holding capacity, marinade uptake, cooking loss, and textural properties like cohesiveness, gumminess, and chewiness. Marination with coconut water and date palms significantly lowered meat pH ($P < 0.05$), whereas coconut shells increased it. Cooking loss significantly increased ($P < 0.05$) with coconut water and date palm and decreased with the coconut shell method. There was no significant difference in marinade uptake between coconut water-marinated and date palm-marinated meat. The analysis revealed no statistically significant difference ($P > 0.05$) in colour across all tested methods. Treatment textural properties exhibited significant differences ($P < 0.05$) compared to untreated cooked meat. Notably, all treated samples showed a significant reduction ($P < 0.05$) in hardness values, demonstrating the importance of traditional cooking techniques. These findings conclude that all three traditional cooking methods contribute to enhancing venison tenderness and overall quality, thereby helping to preserve Sri Lankan culinary traditions.

Keywords: Coconut shell, coconut water, date palm, marination, venison

Determination of microbial quality, shelf life and sensory properties of wood apple-milk beverages

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Wood-apple (*Limonia acidissima*) milk beverage (*divul-kiri*) has been a popular beverage in Sri Lanka since ancient times. This study aimed to investigate the microbial quality and sensory acceptance of various formulations of *divul-kiri* prepared using three different milk bases: coconut milk (CON), cow milk (T₁), and probiotic fermented (*Lacticaseibacillus rhamnosus* GG in combination with conventional yoghurt starter culture) cow milk (T₂). The beverages were formulated by combining milk base, wood-apple pulp, and water in 50%, 25%, and 25% ratio by volume. The beverages were then stored in transparent and airtight plastic containers under refrigerated conditions (4 °C) for over 21 days. A consumer test was conducted to assess the consumer acceptability of the beverages using an untrained panel (n=83, aged 21-30 years) recruited from the Wayamba University of Sri Lanka adapting the Rate-All-That-Apply (RATA) scale. A hedonic test was conducted on the 1st and 14th day of storage to assess the sensory liking for the beverages using a 9-point hedonic scale (1=dislike extremely, 9=like extremely). Microbial quality was determined by selective enumeration of yeast and mold, and coliform at 10-day intervals. Probiotic viability was determined by selective enumeration of LGG in vancomycin-MRS agar. In the consumer preference test, probiotic beverage received the highest mean scores for all sensory properties tested: colour (6.56 ± 2.27), aroma (6.19 ± 2.52), flavour (6.90 ± 2.29) texture (6.60 ± 2.07), after taste (6.73 ± 2.18), mouthfeel (6.61 ± 2.16), overall liking (6.61 ± 2.13) after 14 days. Colour and the milk aroma was the attributes having the highest discriminating power among the products. Probiotic beverage (T₂) maintained LGG counts of >10⁶ CFU/mL. In conclusion, the Probiotic wood apple-milk beverage demonstrated promising microbial quality, extended shelf life, and favourable sensory attributes.

Keywords: Cow milk, coconut milk, *Lacticaseibacillus rhamnosus* GG, probiotic, RATA

Comparison of proximate composition, physicochemical and sensory characteristics of traditional cow ghee, novel spiced cow ghee, and commercially manufactured cow ghee

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Ghee, also known as clarified butter, holds significant historical and cultural importance, particularly in culinary practices, due to its flavourful aroma, golden colour, and several health advantages. This study aimed to assess the proximate composition, physicochemical characteristics, and sensory attributes of traditional cow ghee and a newly developed spiced cow ghee, comparing them to commercially available cow ghee. During the ghee-making process, a spice powder mixture comprising ginger (*Zingiber officinale*), garlic (*Allium sativum*), cinnamon (*Cinnamomum verum*), and cardamom (*Elettaria cardamomum*) was incorporated in specific proportions. The proximate analysis unveiled subtle disparities among the ghee types, with traditional ghee exhibiting the lowest moisture content (0.13%) and spiced ghee showing the highest (0.18%). Notably, spiced ghee demonstrated the highest ash content (0.02%) among the variants, while all types maintained consistently high crude fat content. Traditional ghee had the highest viscosity (42.25 mPa.s), indicating its thicker consistency compared to the other variants. Chemical analysis revealed variations in pH levels, with spiced ghee displaying the highest pH (5.48). Additionally, commercial ghee exhibited higher peroxide values (2.30 mEq O₂/kg) and free fatty acid levels (FFA) (0.23% oleic acid) in comparison to traditional and spiced ghee. In sensory evaluation, spiced ghee received the lowest mean score for overall acceptability. Notably, the study found no significant differences in pH and FFA content within traditional and spiced ghee samples during a 30-day storage period ($P > 0.05$). Overall, this research highlighted the notable differences between traditional and spiced ghee varieties, offering insights into their composition, quality, and sensory appeal.

Keywords: Clarified butter, cow ghee, physicochemical, sensory, spiced

Determining the maximum initial moisture content of beef for preservation using bee honey

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The use of bee honey as a method for preserving meat dates back to ancient times. However, there is a lack of knowledge regarding the optimum initial moisture content of meat for preservation when dipped in bee's honey. Therefore, this study aimed to investigate the optimum initial moisture content of beef for preservation using bee honey. Groups of beef samples (2cm × 2cm × 2cm) with varied initial moisture contents [Fresh (76%), 55%, 40%, 25%] were prepared. As controls for each moisture category, a portion of beef in each group was stored in a sterilized container. The remaining portion of beef in each moisture category was stored in a sterilized container containing bee honey at room temperature. All the groups were analyzed for total plate counts (TPC), texture, pH, and color at 7-day intervals for a period of 28 days. The TPCs of beef samples in all control groups exceeded their maximum allowable limit for safe consumption (7.00 log CFU/g) within 7 days of storage, regardless of the initial moisture content of the sample. Although similar results were observed for the beef samples stored in bee honey for the 76%, 55%, and 40% moisture categories, beef samples in the 25% moisture category took more than 21 days (TPC at 21 days is 6.88 ± 0.06 log CFU/g) to exceed the safe consumption limit of TPC. Furthermore, the beef samples stored in bee honey in the 25% initial moisture category did not exhibit spoilage related changes in meat pH, texture, and colour throughout the 28 days of storage period compared to the control group for the same moisture category. Therefore, these findings conclude that beef with an initial moisture content of 25% can be preserved by dipping it in bee honey over a 21-day period.

Keywords: Beef, bee honey, meat preservation, moisture content, total plate count

Optimizing quality characteristics of sausages incorporating chicken and quail meat

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Quail products have gained popularity in the last few years by consumers due to the recommendation of the low-fat diet because they contain low amounts of fat and cholesterol. This study aimed to determine the effects of different chicken and quail meat formulations on the proximate composition, organoleptic properties, and physicochemical characteristics of sausages. The five (05) different formulations were chicken: quail meat; 0:100, 25:75, 50:50, 75:25, and 100:0. The proximate contents were significantly different ($P < 0.05$) among all samples. The moisture and fat contents exhibited significantly decreasing ($P < 0.05$) trends with increased chicken meat proportion, while protein, ash, and carbohydrate contents showed increasing trends. The range of moisture, protein, fat, ash, and carbohydrate content of sausages was 50.24 – 42.06 %, 28.88 – 34.34 %, 17.34 – 4.77 %, 2.35 – 3.26 %, 1.21 – 15.58 %, respectively. Cooking yield and cooking loss showed significantly increased ($P < 0.05$) values by increasing the sausage's quail meat ratio. Meanwhile, pH and water holding capacity (WHC) showed decreasing values. The range for cooking yield, cooking loss, pH, and WHC values was 93.85 – 88.53 %, 6.15 – 11.06 %, 5.89 – 5.14 %, and 91.33% - 55.00%, respectively. Instrumental texture and colour analysis showed significant differences ($P < 0.05$) among samples whereby L^* and b^* values decreased, but the a^* value increased with the increases in quail meat ratio. The highest L^* value (59.93) was observed in formulations with 100% quail meat, while the lowest L^* value (51.33) was observed in formulations with 100% chicken meat. The texture of sausages was harder with increasing levels of quail meat. Colour, aroma, texture, juiciness, overall appearance, meaty aroma, meaty taste, and mouth coating abilities were significantly different ($P < 0.05$) among samples. Therefore, these findings conclude the possibility of developing quail meat-based sausages with more health benefits.

Keywords: Chicken, proximate composition, sausages, quail, sensory evaluation

Development of packaging for wet aging beef using beeswax, pine rosin and ginger essential oil

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Meat preservation is crucial because it alters the sensory attributes of meat. The conventional approach to beef preservation frequently involves vacuum packaging, which is considered wet ageing. However, vacuum packaging is artificial and non-biodegradable. Furthermore, it lacks inherent antimicrobial and antioxidant properties, which are critical for extending the shelf life and ensuring the safety of packaged beef. Therefore, this study was focused on developing a novel beef packaging film using bee wax, pine rosin, and ginger essential oil, which are natural, biodegradable, and reported antimicrobial and antioxidant properties. Three different packaging films were prepared using different inclusion levels of bee wax, pine rosin, and ginger essential oil such as 44%: 33%: 22% (film 1), 50%: 37.5%: 12.5% (film 2), and 43%: 43%: 14% (film 3). Wet-aged beef processed using three different novel films followed by 21 days of cold storage was compared with the same made using vacuum packaging for the sensory attributes to find the optimum combination of bee wax, pine rosin, and ginger essential oil. Compared to the wet-aged beef processed using vacuum packaging, only film 2 was given the highest ($P < 0.05$) values for the sensory attributes such as tenderness, juiciness, and colour, which thirty untrained panellists evaluated. The increase in the inclusion rate of ginger essential oil and decreasing the inclusion level of bee wax led to the decreasing acceptance rate of wet-aged beef by the panellists under all the sensory parameters. Therefore, these results can be concluded that packaging film made by incorporating bee wax, pine rosin, and ginger essential oil at 50%, 37.5%, and 12.5% inclusion rates, respectively, grants better sensory attributes in wet-aged beef compared to the wet-aged beef produced using vacuum packaging.

Keywords: Beeswax, ginger essential oil, pine rosin, vacuum packaging, wet ageing

Evaluation of the effect of flour type on bee honey and incorporated chicken meat snacks

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Snack foods are widely popular but often lack protein, leading to efforts to enhance formulations by adding valuable animal proteins to address this nutritional gap. This study aimed to evaluate the effect of flour type (Wheat (W), Rice (R) and Kithul (K) flour) on bee honey-incorporated chicken meat snacks. After optimizing the initial formulation, two cracker-type snacks [(C₁ = W: R in 1:1 ratio) and (C₂ = W: K in 1:1 ratio)] and three wafer-type snack types [(W₁ = only W), (W₂ = R:W in 1:1 ratio), (W₃ = R:K in 1:1 ratio)] were prepared. Sensory evaluations were conducted with a 30 untrained panel using a nine-point hedonic scale. Proximate composition and microbiological quality [Total plate count (TPC), yeast and mold count (YMC), and total coliform count (TCC)] at day 0, 7 and 28 were checked for the selected formulations. According to the sensory evaluation results, wafer type, W₂ types and cracker type C₂ were selected based on overall aroma, crispiness, flavour, appearance and preference. Fat, fibre and protein contents in W₂ were 16.82±0.09%, 2.13±0.27% and 35.33±0.79, respectively. Meanwhile, Fat, fibre and protein contents in C₂ were 11.79±0.79%, 3.10±0.23% and 29.47±0.98%, respectively. The protein and Fat content was significantly higher (P<0.05) in the wafer than in the cracker. TPC and YMC were slightly increased during storage in both W₂ (TPC -3.00 cfu/g at first week, 6.87 cfu/g at fourth week, YMC - 3.30 cfu/g at first week, 6.58 cfu/g at fourth week.) and C₂ (TPC -3.23 cfu/g at first week, 6.78 cfu/g at fourth week. YMC - 6.24 cfu/g at first week, 6.72 cfu/g at fourth week). Incorporating varied flour types in bee honey-infused chicken snacks produced two favoured options: the W₂ wafer and C₂ cracker types, praised for sensory appeal and nutrition.

Keywords: Bee honey, chicken meat, scotch bonnet pepper, snack food

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