ABSTRACTS

"Food Production and Nutrition for Consumer Well-being"

Undergraduate Research Abstracts - 2018

September 2018

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

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Message from the Editor
Food Production and Nutrition for Consumer Well-being

It is a great pleasure for me to present the Book of Abstracts of the Undergraduate Research - 2018 of Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka containing 88 abstracts.

Research in the fields of food production and nutrition promote intelligent and sustainable use of resources in the food supply chain. Also it maintains and further develops food security whilst bringing a value addition to the development of food innovations that support consumers' well-being.

The young researchers of the Faculty of Livestock, Fisheries & Nutrition have successfully completed their final year research projects under the guidance of faculty members in various research fronts while exposing to the high quality research environment in the faculty. The experience gained through this tremendous task will be a starting point of their research carrier which would lay the foundation of being a future eminent scientist in the field of 'food & nutrition' and food production. I congratulate them and wish all the success in their future endeavors.

On behalf of the editorial committee, I wish to convey my sincere thank to authors for their contribution. I wish to thank the Dean of the Faculty and Faculty members for the cooperation and support given.

Professor C.V.L. Jayasinghe
Editor-in-Chief

Message from the Dean
Faculty of Livestock, Fisheries and Nutrition

It gives me great pleasure to write this message for the publications of the abstracts of undergraduates in Faculty of Livestock, Fisheries & Nutrition (2018) in Wayamba University of Sri Lanka. I strongly believe that incorporating a research component along with a sound academic foundation enables students to develop independent critical thinking skills, problem solving skills along with oral and written communication skills. The research process impacts valuable learning objectives that have lasting influence on graduate profile as undergraduates prepare for professional service. As Sri Lanka's latest and modern learning and research institutions, in our faculty we try our level best to achieve these objectives through our undergraduate researches.

I am impressed with the research works accomplished by our students under the guidance of the academics over the past years. Doing research is only half of the picture while writing is the most important means for communicating scientific work. Therefore, publishing the evidences of research work is very imperative for the progress of science. Considering all these, highly appreciate the efforts taken by the publication committee to publish undergraduate research abstract.

Finally, I would like to extend my congratulations and best wishes to all undergraduate who published their abstracts. I also take this opportunity to give my sincere gratitude those who contributed to make this work a successful one.

Professor B.P.A. Jayaweera
Dean, Faculty of Livestock, Fisheries and Nutrition
Wayamba University of Sri Lanka

Message from the Vice Chancellor
Wayamba University of Sri Lanka

As the Vice Chancellor of the Wayamba University of Sri Lanka, I am pleased to provide a message for the Undergraduate Research Abstracts - 2018 of the Faculty of Livestock, Fisheries and Nutrition. Carrying out research and dissemination of the findings to stakeholders is a primary responsibility of the University. Our main aim is to support the fulfillment of social responsibilities of the Sri Lankan population through the advancement of science. I am delighted to see another group of young scientists about to be graduated from our university have done research successfully under experienced scientists and sharing research outcome with stakeholders in their disciplines through the Undergraduate Research Abstracts- 2018.

The theme of the compilation of abstracts, "Food Production and Nutrition for Consumer Well-being", is highly appropriate as the Faculty of Livestock, Fisheries & Nutrition is always the frontiers in this discipline in Sri Lanka. I understand that the research carried out by the undergraduates with the guidance of academic staff represents a common goal of the diverse fields of specialty in the Faculty. I am convinced that the researches carried out by the undergraduates in year 2018 made an effort towards solving the issues related to unsustainable and unhealthy food production systems and strengthening national food safety and self-sufficiency of the country through their research.

I wish to extend my congratulations to the Dean, Faculty members of Faculty of Livestock, Fisheries and Nutrition for the completion of this endeavor. I especially congratulate the undergraduates who authored the abstracts in Undergraduate Research Abstracts - 2018 which is the valuable evidence of the fruitful and memorable experience of their undergraduate education at the Wayamba University of Sri Lanka.

Professor E.M.P. Ekanayake
Vice Chancellor
Wayamba University of Sri Lanka

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Development of a Rice (Oryza sativa) incorporated yogurt

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Rice is a nutritious cereal and one of the cheapest and major sources of energy and protein for many people in Sri Lanka. Incorporation of rice in to yogurt will increase its nutritional and functional properties. Depending on customer preferences, rice based ready to eat yogurts have been developed using saccharification of rice, however, the procedure used was expensive and time consuming. Present study was conducted to develop a cooked rice incorporated yogurt using low amylose rice varieties; At 309 and At 405. For the development of yogurt the best sugar (10 %) and gelatin (0.8 %) percentages was selected by preliminary analysis. Raw rice was partially ground, cooked and incorporated in different percentages at the latter stage of the fermentation process of yogurt and the best formula was selected by sensory analysis. The best yogurt formula which consisted 10 % of At 309 rice variety was assessed for proximate composition, chemical and physical properties and microbial safety. Protein, fat, fiber, carbohydrate and ash contents of rice yogurt were 12.06 %, 2.22 %, 0.47 %, 72.25 % and 0.034 % respectively and values were significantly higher ($P < 0.05$) compared to plain yogurt. Water holding capacity, total solids, solid nonfat and Total soluble solids in rice yogurt were 71.60, 24.84, 22.61 and 19.97 respectively. Total bacterial count in rice yogurt was $4*10^8$ CFU g^{-1} and it was significantly higher ($P < 0.05$) compared to plain yogurt ($3*10^8$ CFU g^{-1}) confirmed the prebiotic effect of rice incorporated yogurt. Results revealed that consumer accepted rice yogurt with enhanced nutritional properties can be developed using local rice variety At 309.

Keywords: Low amylose rice, Physicochemical properties, Proximate composition, Rice yogurt.

Quality improvement to butter made from coconut milk by incorporation of cocoa butter

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Non-dairy butter products have higher demand among vegetarians worldwide. Coconut milk based butter is a healthy alternative to dairy butter. The present study was undertaken to evaluate the effect of different treatments on coconut cream for moisture reduction and evaluate the effect of cocoa butter incorporation on the quality of coconut milk based butter. Vacuum evaporation of coconut cream and steam treatment to coconut was used to evaluate the quality of coconut milk butter with different moisture level. Cocoa butter which was extracted using hand operating oil expeller from roasted cocoa nibs was incorporated in different levels with coconut cream to evaluate the effect of cocoa butter on the quality of coconut milk butter. Moisture (%), solid non-fat (%), fat (%), firmness (kg), water activity, slip melting point and fatty acid composition of each butter sample was measured. Stability of the emulsion was evaluated by measuring the creaming index (%). Organoleptic properties of different butter samples were evaluated by ranking test using 30 semi-trained panelists. The shelf life of coconut milk butter was evaluated by measuring the variation of pH, free fatty acid value and microbial load for 6 weeks of storage time at refrigerated conditions. Results revealed that mean values of moisture, solid non-fat and fat contents for all different coconut butter types were significantly different ($p < 0.05$) compared. Fatty acid profile analysis showed that the incorporation of cocoa butter had increased long chain saturated fatty acid and unsaturated fatty acid contents in coconut milk based butter. Creaming index and firmness of butter samples were ranged from 1.53 % to 6.8 % and from 13.08 kg to 51.44 kg respectively. Water activity values of different coconut milk butter samples were ranged from 0.76 to 0.66 and it was reduced with the moisture content. According to sensory analysis, the highest preference was for cocoa butter 5% incorporated sample and was obtained significantly higher ($p < 0.05$) mean ranks for texture, overall acceptability and taste. Proximate composition of 5 % cocoa butter incorporated sample was shown 49.54 % fat, 38.11 % moisture, 4.27 % protein, 6.09 % carbohydrate and 1.99 % ash. The free fatty acid value was increased from 0.1431 to 0.1539 and pH value was reduced from 4.84 to 4.28 in the 5 % cocoa butter added sample with 6 week storage time. Initial total plate count of 3.18×10^3 CFU g^{-1} was increased to 4.77×10^3 CFU g^{-1} with the 6-week storage confirmed the product safety.

Keywords: Coconut milk based butter; Cocoa butter; Fatty acid profile; Vacuum evaporation

Identification, quantification and characterization of local industrial fruit waste for scrutinizing its nutritional and antioxidant potential

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Commercial fruit processing industries in Sri Lanka generate more than 45 % of fruit wastes included fruit peels, seeds, rinds and bagasse. The present study was undertaken to identify the availability and reusable potential of industrial fruit wastes (IFW). A survey was carried out to recognize the types and amounts of IFWs. Randomly collected fruit waste samples were analyzed for proximate composition, mineral composition by ICP-MS, total phenolics, total flavonoids and antioxidant activity by DPPH radical scavenging capacity and total antioxidant capacity. Pineapple (*Ananas comosus*), Mango (*Mangiferai ndica L.*) and Papaya (*Carica papaya*) were recognized as prominently used fruit types in local industrial fruit processing and the average total waste percentages of these fruits are 66.8 ± 5.86 %, 51.25 ± 5.66 % and 49 ± 4.58 % respectively. Crude protein, crude fat and crude fiber contents of IFWs were respectively in the range of 3.1- 25.95 %, 1.60-25.40 % and 13.78 -43.10 %. Banana peel, papaya seed, ash gourd seed and watermelon seed respectively reported the highest ash, crude protein, crude fat and crude fiber contents. Results further revealed that IFWs were good source of micronutrient such as potassium, calcium, magnesium, zinc, copper and they were free from toxic heavy metals. The highest Total polyphenols content (mg GAE g^{-1}) was shown by mango seed (9.47 ± 0.21) followed by mango peel (8.64 ± 0.06) while the highest total flavonoids (mg RE g^{-1}) were shown by mango seed (21.82 ± 0.51) followed by ash gourd seeds (17.64 ± 0.47). High DPPH radical scavenging capacity (mg L^{-1}) were shown by mango seed (IC_{50} - 0.53) and mango peel (IC_{50}-1.66) while the highest total antioxidant capacity (mg AAE g^{-1}) was shown by mango peel (25.54 ± 0.66) followed by papaya peel (23.93 ± 0.49) and mango seed (20.27 ± 0.57). Results revealed that IFWs have potential to use as functional food ingredient or to recover nutraceuticals.

Acknowledge the financial assistance received by National Science Foundation (NFS) under the RG/2017/AG/02 project.

Keywords: Industrial fruit waste, proximate analysis, Functional ingredient, Recovering bio actives.

Antioxidant and anti-inflammatory properties of Aloe Vera (*Aloe barbadensis*) incorporated Ice cream

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Aloe Vera (*Aloe barbadensis*) is a perennial succulent plant and has been used for traditional medicinal purposes for thousands of years ago, because of its therapeutic properties. However, there is no much research done on antioxidant activity and anti-inflammatory activity of Aloe Vera. This research was done on the Aloe gel incorporated ice cream and antioxidant and anti-inflammatory activity of the methanolic extract of fresh Aloe Vera gel and Aloe gel incorporated ice cream. Physical and sensory properties of ice cream also evaluated. The ice cream was developed by following the ordinary manufacturing procedure. Four types of ice cream were developed by using Aloe gel juice, cubes and powder including control without Aloe Vera gel. Total phenolic content, total flavonoid content, total antioxidant capacity, DPPH free radical scavenging activity and singlet oxygen scavenging activity was evaluated the antioxidant activity (1) and protein denaturation, proteinase inhibitory activity and lipoxygenase inhibitory activity (2) under anti-inflammatory activity of the extracts were evaluated for both fresh Aloe Vera and Aloe gel incorporated ice cream. Results revealed that the highest antioxidant activity and anti-inflammatory activity was obtained by Aloe Vera gel powder incorporated ice cream (AGPIIC). The total phenolic content and total flavonoid content of AGPIIC was 0.070 ± 0.023 mmol GAE/g of DW and 0.0012 ± 0.0002 mmol RE/g of DW respectively. The antioxidant capacity of AGPIIC was 1.27 ± 0.08 mmol AAE /g of DW whereas the AGPIIC was obtained 0.00908 ± 0.00047 mmol GAE/g of DW for singlet oxygen scavenging activity. For the protein denaturation, Trypsin inhibition and Lipoxygenase inhibition of AGPIIC was obtained as 3.56 ± 0.39 % of DW, 2.47 ± 0.20% of DW, and 1.61 ± 0.08% of DW respectively. But Aloe Vera gel cubes incorporated ice cream was selected as the most consumer acceptable ice cream in sensory analysis. Physical properties of ice cream were moreover else similar to the control. In conclusion, Aloe Vera has shown significant antioxidant potential towards scavenging free radicals and some reactive oxygen species as well as anti-inflammatory activity towards protein denaturation, inhibition of lipoxygenase and trypsin. Therefore it can be used as a natural source of functional ingredient for functional food formulations to combat chronic diseases in the form of gel powder.

Keywords: Aloe Vera; Anti-inflammatory activity; Antioxidant activity; Lipoxygenase;

Singlet oxygen; Trypsin

Heavy metal contamination of rice cultivated in Ampara district, Sri Lanka

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Ampara district makes the highest contribution of rice production in Sri Lanka Therefore, in the case of contamination; it could become a significant dietary source of toxic elements. This study carried out for rice cultivated in Ampara district to examine 13 heavy metals including Arsenic (As), Cadmium (Cd), Selenium (Se), Lead (Pb), and Mercury (Hg). In addition, to identify whether the water sources to agricultural lands contaminated with above heavy metals. Rice sampling was done in multistage random sampling technique as whole Ampara district area covers according to the SLSI method (SLSI 528;1981) and Codex Alimentarius protocols. Heavy metals analysis was done by Mass-spectroscopic method using Inductively Coupled-Mass spectrometer (ICP-MS). Rice samples were analyzed based on rice varieties, rice type (Red rice or White rice), and the area of rice cultivated in Ampara district (coastal and in-land area)

Manganese (Mn) in BW-367 variety shows significantly ($p < 0.05$) higher concentrations compared to AT-362 variety. Thallium (Tl) in BG-357 shows significantly ($p < 0.05$) higher amount than all other varieties considered in this study. The next most available element found in rice is Copper (Cu). Cu concentration of all rice varieties ranged from 1.1014 ppm - 6.360 ppm. Next to Cu, nickel (Ni) found in considerably higher levels in all varieties, the highest level of Ni is 1.9164 ppm from a BG-94/1 rice sample. BG-357 shows highest Pb content and it is 0.7180 ppm notably very higher than the recommended levels. Cobalt (Co) content in white rice types (0.0390 ppm) has shown significantly ($p < 0.05$) higher levels than red rice (0.05031 ppm). Arsenic (As) (0.0194 ppm), beryllium (Be) (0.0002 ppm), vanadium (V) (0.0179 ppm), Co (0.0375 ppm), Nickel (Ni) (0.2674 ppm), Manganese (Mn) (21.8911 ppm) showed significantly ($p < 0.05$) higher concentrations in rice samples collected from in-land compared to the rice cultivated in coastal area. Mn shows the highest concentrations among all heavy metals in both in-land and coastal. Mn concentration in inland rice samples are ranged from 15.9788 ppm to 35.1046 ppm and in coastal area 16.7359 ppm range from 11.0960 ppm to 26.9360 ppm with a mean of 21.8911 ppm. Only Pb significantly ($p < 0.05$) exceeded maximum tolerable level (MLT) (0.2 ppm) for rice set by FAO/WHO among all metals. Only Mn shows a significant ($p < 0.05$) correlation ($R = 0.592$) between rice and water samples collected from Ampara district.

Keywords: Ampara district; Heavy metals; Lead (Pb); Maximum tolerable level; Rice, Sri Lanka

Assessing the quality of fruit based beverages incompliance with regulatory and standard requirements

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In Sri Lanka recent attention has been paid on regulating sugar content in fruit based beverages but other quality aspects have not been fully regulated. Through this research several quality parameters of Sri Lankan fruit based beverages are assessed incompliance with standards and regulations, in order to identify to which extend they have been regulated.

Four brands of fruit juices, fruit nectars, six brands of RTS fruit drinks and three brands of fruit cordials were used for the study. Each product was analyzed for the total soluble solid (TSS) (Brix°), titratable acidity (AOAC 1995), ascorbic acid content (AOAC1995), sulphur dioxide content (ISO1523), sorbic acid content (ISO 5519) and benzoic acid content (AOAC 994.11). Labeled composition of each product was compared with the results obtained through analytical testing and labeling regulatory requirements.

Results showed TSS and titrable acidity for fruit juice, fruit nectar, RTS fruit drink and fruit cordial ranged from 9.05-12.05 & 0.34-0.51 g/100ml; 10.98-11.03 & 0.31-0.69 g/100ml; 9.98-15.05 & 0.20-0.57 g/100ml; 51.05-70.03 & 0.58-1.16 g/100ml respectively. TSS content of 59% of products and titratable acidity of 88% of products were within the standards. Ascorbic acid content for fruit juice, fruit nectar, RTS fruit drink and fruit cordial ranged from 17.60-20.80mg/100ml;1.60-35.20mg/100ml; 3.20-21.6mg/100ml; 13.10-24.8mg/100ml respectively. All products had ascorbic acid content lower than the labeled value. 41%, 12% and 35% of products contained sulphites, sorbates and benzoates respectively. Sulphites were contained in fruit nectar, RTS fruit drink and fruit cordial, ranging from 0-70.83mg/L,0-269.03mg/L, 280.67-323.40mg/L respectively. Sorbates were contained in fruit juice, fruit nectar, RTS fruit drink and fruit cordial, ranging from 0-18.89mg/L,0-11.03mg/L, 0-8.07mg/L, 0-70.97mg/L respectively. Benzoates were contained in fruit nectar and fruit cordial ranging from 0-67.17mg/L, 0-42.38mg/L respectively.65% of the products had sulphite content within the standard levels. 100% of products had sorbate and benzoate content within the standard levels. 35% of the products fulfilled regulatory labeling requirements. Total soluble solids, titratable acidity, sulphites content and labeling of Sri Lankan fruit based beverages have not been fully regulated incompliance with regulatory and standard requirements.

Keywords: Ascorbic acid; Benzoic acid; Fruit based beverages; Preservatives; Sulphites

Development of Elephant Foot Yam (*Amorphophallus paeoniifolius*) flour incorporated jelly and evaluation of prebiotic activity

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Elephant Foot yam (EFY) (*Amorphophallus paeoniifolius)* is an underutilized crop in Sri Lanka. However it has higher functional properties. It is a rich source of glucomannan and has prebiotic properties. But limited studies have been performed related to prebiotic activity of elephant foot yam (EFY) flour, glucomannan and flour incorporated product. This study was designed to evaluate prebiotic activity of the EFY flour, glucomannan and developed jelly dessert. This study was done to extract elephant foot yam flour and glucomannan, to develop a jelly by incorporating extracted flour and to evaluate prebiotic activity of elephant foot yam flour, glucomannan and flour incorporated jelly.

Elephant foot yam flour was prepared by using oven dry method. Extraction of glucomannan from elephant foot yam was done by using ethanol extraction method. Elephant foot yam flour incorporated jelly was developed using different concentration of EFY flour at levels of 4% and 8 % (w/w). Sensory analysis, proximate composition, physico-chemical and microbial quality were analyzed for a storage period of 30 days at 4 °C. Prebiotic activity assay was conducted for elephant foot yam flour, glucomannan and 4 % of elephant foot yam flour incorporated jelly. 4 % of EFY flour incorporated jelly was well accepted in sensory test. Developed jelly contained 77.40 % of moisture, 0.18 % of ash, 7.30 % of crude protein, 0.11 % of crude fat, 15.00 % of carbohydrate and 1.40 % of crude fiber. EFY flour incorporated jelly contained high amount of carbohydrate and crude fiber than control jelly. Titrable acidity was decreased during storage period of 30 days. But pH of the jelly samples was increased. Water activity of the EFY flour incorporated jelly sample ranged from 0.783-0.733. Total soluble solid of the developed jelly sample was 21.83 ^{0}Brix. Microbial counts of yeasts and moulds and total plate count were not found in EFY jelly dessert during storage period of 30 days. Number of colony forming units of LAB (Lactic Acid Bacteria) in glucomannan ($>10^7$ CFU/g) was similar to inulin. The number of colony forming units of LAB in EFY flour and EFY flour incorporated jelly were more than 10^6 CFU/g. The results revealed that there is a potential in development of a nutritionally rich and microbiologically safe dessert jelly by incorporating elephant foot yam flour having potential as a prebiotic.

Keywords: Elephant foot yam; Glucomannan; Jelly; Lactic Acid Bacteria; Prebiotic

Development of Elephant Foot Yam (*Amorphophalus paeoniifolius*) incorporated short dough biscuits and evaluation of prebiotic activity

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Amorphophallus paeoniifolius/ elephant foot yam (EFY) is a food and traditional medicine. EFY is under exploited locally available tuber crop which contains glucomannan. Glucomannan is dietary fiber that act as prebiotic that promotes the growth of gut-friendly bacteria. This study was undertaken to prepare novelty formulated short dough biscuit from EFY flour with all-purpose flour and evaluate their proximate composition, quality characteristics, microbial quality and organoleptic properties. This study was designed to evaluate prebiotic activity of EFY flour, glucomannan, and EFY flour incorporated short dough biscuit. The flour was prepared using raw EFY. Glucomannan was extracted by using EFY flour. Biscuits were prepared with various percentage of EFY flour (20%, 25%, 30%, and 35%) and sensory evaluation was done to select the best acceptable formula. Under the physiochemical properties moisture, fat, protein, ash, crude fiber, color and texture of biscuits were determined. Microbial load and water activity were tested to determine self-life of product. Prebiotic activity was evaluated using *lactobacillus* culture. *Lactobacillus* was cultured in MRS agar with using inulin, glucose, EFY flour, biscuits, and glucomannan as substrates. According to the sensory evaluation test, 30% EFY flour incorporated biscuit showed higher mean rank for sensory attributes and was selected for further analysis. From the results of proximate composition, moisture, protein were low in EFY biscuit but carbohydrate, ash and crude fiber were slightly high in yam biscuit. The moisture content of the yam and control biscuits were 2.08% and 3.27% respectively while protein content of yam and control biscuits were 5.52% and 7.64% respectively. The higher ash content (2.26%) of the yam biscuit indicates that the biscuit contains higher mineral content than the control biscuit (1.08%). From the results, water activity of yam biscuits and control biscuit was between 0.2- 0.3. Total plate count and yeast and mold count were not detected for both biscuits during the 1 month storage period. EFY flour, glucomannan, and EFY incorporated biscuit shows considerable prebiotic activity. Overall analysis disclosed that the biscuit prepared from EFY flour proved acceptable not only in quality characteristics but also fulfill the demand of functional foods.

Keywords: *Amorphophallus paeoniifolius,* Biscuit, Glucomannan, Prebiotic activity

Rice bran: as an ingredient in functional beverage, and comparison of physicochemical and sensorial characteristics of selected extraction methods

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Rice bran is a by-product which has plentiful nutritional and bioactive compounds, to be considered as a significant by-product among all. However, a food application of rice bran for human consumption is still insignificant. As there is a surplus production of rice bran and, it is an underutilized resource in Sri Lanka, this research was conducted to select an extraction method for developing a functional beverage from the bran of a locally available rice variety.

Sample	Proximate Composition* %										
	Moisture		Lipid		Protein		Ash		Carbohydrate	Fiber	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	Mean	SD
SRB	5.28	0.02	26.87	0.80^{c}	18.77	0.80^{bc}	9.62	0.15^{c}	34.55	10.19	1.46^{b}
A 1:5	94.68	1.22	23.90	0.21^{b}	12.08	0.54^{a}	0.74	0.01^{b}	61.05	2.23	0.90^{a}
A 1:10	96.95	1.30	29.23	0.06^{d}	16.64	1.90^{b}	0.35	0.02^{a}	51.09	2.69	0.79^{a}
B 1:5	93.47	1.01	10.59	0.35^{a}	19.57	0.73^{e}	0.78	0.01^{b}	68.82	0.24	0.08^{a}
B 1:10	96.85	1.28	36.99	0.78^{e}	18.98	0.12^{bc}	0.40	0.07^{a}	43.36	0.27	0.01^{a}

Bg 406 rice variety was used to obtain the bran. Two extraction methods; blending (B) and autoclaving (A) were practiced with two different rice bran: water ratio combinations per each method (1:5 and 1:10). Then each extract (A 1:5, A 1:10, B 1:5, and B 1:10) and the stabilized rice bran (SRB) were analyzed for selected parameters. The extract with best chemical and sensorial properties was selected for the beverage development, using whole milk powder (7.5%) and sugar (5%) as ingredients. Crude protein, crude fat, ash, and moisture contents of each were determined (AOAC, 2000). Total phenolic content (TPC), and total flavonoid content (TFC) were analyzed. Physicochemical analysis along with microbial analysis (Total plate count and yeast & mold count) was performed for shelf life determination of the beverage. Statistical analysis was done using ANOVA and Turkey tests. Extract B 1:5 was selected for the beverage development. The shelf life of the product was only 12 days. Sensory analysis revealed there was no significant difference among tested samples. The beverage contained considerable content of functional components such as fiber and antioxidants. The extract B 1:5 has shown the potential for further developments.

Keywords: Extraction methods; Functional beverage; Rice bran

Influence of fermentation by *Rhizopusoryzae* on the bioactivity, bioaccessibility and bioavailability of rice bran phenolics and carotenoids

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Rice bran which is a rich source of bioactive compounds is an underutilized agro-industrial residue for human consumption. Solid-state fermentation (SSF) has been employed as a processing technique to increase the content of functional components from rice bran. This study executed to examine the effect of SSF by *Rhizopusoryzae* on the bioactive content, bioactivity, bioaccessibility and bioavailability of 4 different varieties (BG 352, BW 367, BG 406 and H 4) of rice bran. *In vitro* digestion with dialysis was done to assess the bioavailability and bioaccessibility of rice bran bioactives. Methanolic extracts and digested fractions of fermented and unfermented rice brans were analyzed for total phenolic (TPC), total flavonoid (TF), total carotenoid (TC), and total anthocyanin content (TAC). The antioxidant activity (TAA) was evaluated using total antioxidant capacity, ferric reducing power and DPPH radical scavenging assays. Anti-inflammatory property and the anti-diabetic property was assessed using protein denaturation assay and α – amylase inhibition assay respectively. Results indicated TPC, TF, TAC, TC, TAA and ferric reducing power of BG 352 and BW 367 has increased with SSF. The radical scavenging ability and anti-inflammatory properties of all samples have increased with SSF whereas anti-diabetic properties of all samples have decreased with SSF. Among the unfermented rice bran samples, highest bioaccessible phenolic (93.32%) and flavonoids (40.8%) were observed in BG 352 whereas highest bioaccessible anthocyanin (20.89%) and carotenoids (78.72%) were observed in BW 367 and H 4 respectively. With fermentation bioaccessible and bioavailable percentage of phenolic and flavonoid has increased in BG 406 and H 4 whereas the bioaccessible percentage of anthocyanin and carotenoid has increased in BG 406, BW 367 and BG 352. With SSF radical scavenging ability of digested fractions of all rice bran have decreased and the total antioxidant capacity of dialyzed fractions of all samples have increased. Among all samples, highest reducing power was expressed by fermented BG 352. Among unfermented samples, BW 367 expressed the highest anti-inflammatory and anti-diabetic property in all phases of digestion whereas with SSF, H 4 expressed highest anti-inflammatory property and BG 406 expressed highest anti-diabetic property in all phase of digestion. The results of this study indicate that SSF can be used as a processing technique to enhance the content of certain bioactive compounds and bioactivity of rice bran.

Keywords: Bioactives; *Rhizopusoryzae;* Solid state fermentation

Development of Pasta product from "Kirikawadi" Cassava cultivar

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Cassava is a highly available starchy crop in Sri Lanka with low price. But in Sri Lanka, utilization of cassava is low because of lower shelf life of tubers. Cassava flour is a low cost food and it has the potential to use in food industry as a replacement for wheat flour. Cassava based products are low in Sri Lankan market and Pasta is a cereal based food product consumed all over the world and it has high demand among consumers. Thus, this study has focused on the development of a pasta product with Sri Lankan Cassava cultivar "Kirikawadi". Cassava flour was prepared and subjected for analysis. For the pasta development, two different composite flour (wheat flour: cassava flour and semolina flour: cassava flour) were prepared separately according to the ratios of 90:10, 80:20, 70:30 and 100:0 respectively. Dough was prepared with constant levels of water and salt. Dough samples were kneaded, rested, sheeted and cut in to *Tagliatelle* shape pasta. Raw pasta was oven dried at 121°C for 30 min, cooled, packed and stored in room temperature until further analysis. Organoleptic characteristics of pasta were evaluated by a panel of 30 semi trained panelists using 9 point hedonic scale and the pasta sample which had 70:30 ratio of wheat flour and cassava flour was selected as the optimum formula for further analysis.

The moisture, ash, crude protein, crude fat, crude fiber and carbohydrate content for the optimum formula were 6.78 ± 0.16, 2.23 ± 0.01, 8.63 ± 0.11, 6.90 ± 0.10, 9.23 ± 0.08 and 66.24 ± 0.13 respectively. The results for the cooking characteristics of cassava wheat flour pasta revealed that the optimum cooking time, swelling index, water absorbance index and cooking loss were 7.54 ± 0.02, 2.51 ± 0.01, 205.27 ± 0.08 and 7.56 ± 0.03 respectively. Addition of cassava flour increased the firmness, stickiness, cyanide content of the formulated pasta while reducing the antioxidant value. Thereby it can be concluded that "kirikawadi" Sri Lankan Cassava cultivar can be utilized as a source for the pasta production as a non-conventional ingredient with a low production cost.

Keywords: Cassava; Durum Wheat; Kirikawadi; Pasta; Tagliatelle

Development of a ready to serve carbonated drink from coffee beans (*Coffea arabica and Coffea camphor)*

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Coffee is one of the major economically important plant. *Coffea arabica* and *Coffea camphor* are the most prominently used coffee varieties in Sri Lankan market. Due to the increment in ready to serve beverage consumption with the time, the present study aimed to develop a carbonated ready to serve coffee drink while protecting natural coffee composition and enhancing the shelf life of coffee drink up to several months. Due to availability and superior sensory qualities of roasted *Coffea arabica* and *Coffea camphor w*ere selected as major raw material for coffee drink formation. Sugar, citric acid and benzoic acid were added in to brewed coffee drink in selected ratios. *Cinnamomum zeylacium* (Cinnamon) and *Boesenbergia rotunda* (Chinese ginger*)* were used for value addition. Sensory evaluation was done to set the ingredient ratio in the beverage formulation using three different ratios 30%, 40%, 50% of coffee powder and sugar followed by three different citric acid values as 0.1%, 0.4%, 0.8% with selected formula. Final sensory evaluation was conducted to find out the consumer acceptance among value added and non-value added carbonated coffee drink. Seven-point hedonic scale was used for sensory evaluation. pH, brix, moisture, ash, sugar and protein were analyzed according to AOAC (2000). Caffeine was determined according to Smith et al (2005) and brix value was evaluated by refractometer method. Total plate count, Yeast & Mold counts were tested under microbial analysis according with SLSI (1998).

According to the consumer acceptability, the best ingredient composition ratio was 30: 50: 0.1 of coffee powder, sugar and citric acid. Majority of panelist were preferred for non-value added carbonated coffee drink according to P value for all the sensory attributes ($P < 0.05$). The pH of the drink was 5.85 and brix value was 10. Moisture, ash, protein, sugar and caffeine compositions of formulated coffee drink were 92.42g, 0.47g, 0.093g, 7.86g and 4.12mg per 100mL respectively while Total Plate Count and Yeast & Mould counts were 13.67 and 0.0 CFU/mL respectively. Results revealed that carbonated ready to serve coffee drink with the natural flavor and aroma were in hygienic level according SLSI (2013) standards and the product was appropriated for human consumption.

Key worlds – Aroma, Carbonated drink, Coffee drink, Ready to Serve (RTS), Roasting

Heavy metals and minerals analysis in common varieties of *Lasia spinosa* (Kohila) in Sri Lanka

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Green leafy vegetables are becoming more popular for the masses day by day due to the increased awareness of consumers about natural and organic foods. Although leafy vegetables are very nutritious, they contain both vital and toxic metals over a wide range of concentrations. *Lasia spinosa* (Kohila) is a well-known green leafy vegetable along with some important medicinal values, which is especially distributed in household waste water flowing locations in Sri Lanka. This waste water may contain different kinds of chemicals removed from personal care products and pharmaceuticals. Thus, *Lasia* has a high potential of accumulating of heavy metals. Pb, Cd, Hg and As are considered as non-essential, toxic metals in leafy vegetables. Leafy vegetables differ in their ability to take up and accumulate heavy metals, even among varieties within the same species. A total of 15 samples including common four varieties of *Lasia* (Maha kohila, Kalu kohila, Goda kohila and Wel kohila) collected from 15 waste water accumulating locations in Sri Lanka were analyzed and investigated for the plant accumulation of Cr, Cu, As, Cd and Pb and their distribution in the organs of the plant. Heavy metal concentrations and some important minerals in *Lasia* varieties were determined with Inductive Coupled Plasma with Mass Spectroscopy (ICP-MS).The results showed significant differences in elemental concentrations among *Lasia* varieties analyzed, on dry matter basis. Results showed that both rhizomes and leaves of Goda kohila contained the highest concentrations (μg/g) of Cr (23.46 and 52.72) and Cu (44.98 and 77.47) when compared to other varieties. Goda Kohila also contained the highest concentration of Cd in both rhizomes (8.22) and leaves (4.65). The rhizomes of Kalu kohila contained the highest levels of As (1.58) while the leaves of Goda kohila showed the highest As accumulation (0.69). The quantity of Pb were high in rhizomes of Maha kohila (5.81) and the leaves of Wel kohila (5.67) varieties. The mean concentrations of heavy metals in the rhizomes of all varieties of *Lasia* found in the order of their abundance as Cu > Cr > Cd > Pb > As while the leaves it varied as Cu > Cr > Pb > Cd > As. Furthermore, there was no significant difference ($p > 0.05$) in heavy metal accumulation between the rhizomes and leaves except Cu ($p < 0.05$). It was also found that the Cr, Cu, Cd and Pb levels exceeded the maximum permissible limits set by FAO/WHO for human consumption.

Keywords: Heavy metals; *Lasia spinosa; S*afe limits; Waste water

Gastrointestinal tolerance of probiotic (*Lactobacillus* species) in Arrowroot (*Maranta arundinacea*) incorporated synbiotic ice-cream

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Arrowroot (*Maranta arundinacea*) incorporated synbiotic ice-cream is a newly developed synbiotic dairy product which has beneficial effects of both probiotics and prebiotics. The recommended levels of probiotics in a product is between 10^6-10^7cfu/g in synbiotic or probiotic products at the time of consumption and they need to tolerate harsh conditions in gastrointestinal tract until they reach the colon where they exert their beneficial effects. As there are limited studies on the gastrointestinal tolerance of probiotic (*Lactobacillus* sp.) in Arrowroot incorporated synbiotic ice-cream, this research was conducted to investigate the survivability of *Lactobacillus* sp. in arrowroot synbiotic ice-cream. Moreover, the effect of arrowroot extract and the effect of ice-cream as a food matrix on viability of *Lactobacillus* sp. under the *in vitro* simulated gastrointestinal conditions were evaluated throughout 55 days of storage at -18 °C.

Arrowroot extract was prepared as the preliminary step to develop arrowroot synbiotic ice-cream using water extraction method. Arrowroot incorporated synbiotic ice-cream (with 7% of arrowroot extract), probiotic ice-cream without any prebiotics (control), ice cream with 7% inulin (reference) and fresh probiotic culture were prepared by adding ABY-3 freeze dried probiotic culture. Probiotic cell viability was determined by *in vitro* simulated gastrointestinal tolerance assay. All data were analyzed using factorial one-way ANOVA in SPSS 16. Results stated that cell viability of *Lactobacillus* sp. ranged from 7 to 6 log cfu/g during the 55 days of frozen storage of three types of ice-cream before digestion and no any significant difference ($p < 0.05$) was observed in probiotic cell viability of all three types of ice-cream. A significantly ($p < 0.05$) lowest cell viability was recorded in control ice-cream by the end of the *in-vitro* assay (6 h) for all storage periods evaluated compared to arrowroot and reference ice-cream. Furthermore, viability of *Lactobacillus* sp. in fresh probiotic culture was significantly lower ($p < 0.05$) than cell viability of three types of ice-cream by the end of the *in vitro* assay on 1st day of frozen storage. Finally, results can be concluded that presence of arrowroot extract in ice-cream positively improved the viability of *Lactobacillus* sp. compared to control ice-cream under simulated gastrointestinal conditions. Also, ice-cream food matrix can be considered as good vehicle for the probiotics tested and could play an important role in their protection against gastrointestinal juices.

Keywords- Arrowroot; *In vitro* Probiotic viability; Synbiotic

Development of elephant foot yam flour incorporated synbiotic Yogurt

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Elephant Foot Yam (EFY) is a tuber crop grown in mountain or hilly areas of subtropical countries. Glucomannan is a water soluble dietary fiber that can be extracted from the EFY matrix. The content of Glucomannan in EFY flour is 51.3–96.9% (DB). EFY is an underutilized crop with numerous functional properties. The dietary fiber in EFY shows potential as a prebiotic. Substitution of EFY flour in prebiotic yogurt can enhance the functional properties of the product. In this study, prebiotic activity of EFY flour extraction, development of yogurt with EFY flour, proximate composition, sensory properties, physico-chemical & microbial properties of yogurt were determined. Probiotic viability of yogurt was evaluated by using in-vitro digestion model. The data obtained were analyzed using SPSS16 software. Prebiotic activity of EFY flour and Glucomannan were similar to Inulin ($P > 0.05$). Sample with 2.5% of flour incorporation was the most preferred ($P < 0.05$). Proximate compositions of EFY flour added yogurt were significantly differ from control sample ($P < 0.05$). Physico-chemicals values of flour added yogurt were significantly differ from control sample ($P < 0.05$), except syneresis rate ($P > 0.05$). Probiotic count was only decreased by one log cycle (3.5×10^8 to 3.37×10^7) during in-vitro digestion. Since the recommended probiotic counts in a food ranges from 10^6 to 10^9, the yogurt can be introduced as 'probiotic' yogurt. The study reveals that, EFY flour has high activity as prebiotic and with substitution in yogurt gives synbiotic property.

Keywords: Elephant Foot Yam; Glucomannan; Prebiotic; Probiotic; Yogurt

Estimation of acceptable daily intake of chicken sausages in Sri Lanka based on residual nitrite content in six chicken sausages brands

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Amongst different types of processed meat products, chicken sausages are the prominent type of meat based value added food product in Sri Lankan market. Nitrite salts are one of substances that are added during sausage processing that are claimed to be harmful. The aim of this study was to determine the nitrite content of the chicken sausages brands in Sri Lanka and to estimate an acceptable daily intake for them considering the acceptable daily intake of nitrites.

Six brands of chicken sausage were selected for the evaluation of nitrites using the colorimetric detection of the diazo complex formed by the Griess reaction. All the reagents were prepared and the measurements were done referring to ISO 2978:1975 'Meat and meat products — Determination of nitrite content (Reference method)', with modifications. The calibration curves were developed by the standard addition method and the absorbance was measured at 538.0 nm.

The mean nitrite contents of the six chicken sausages brands ranged from 0.0 mg/kg to 33.2 mg/kg. The mean nitrite contents of individual chicken sausages brands were significantly different from each other. The mean values for different batches were not significantly different for Brand A, B, and D. At least one mean value was significantly different form other mean values within batches of the same brand for Brand C, E, and F. The results indicated the six chicken sausages brands evaluated did not solely depend on nitrite for the colour of the sausages. According to the sausages packaging labels, the evaluated brands have employed substitutional food colorants; Beet root red, canthaxanthin, and sunset yellow FCF. The six chicken sausages brands have used substitutional food additives to reduce the nitrite content in the sausages. The acceptable daily intake (ADI) for nitrites is 0.07 mg of nitrite ions per kg of body weight. Considering the highest nitrite content reported in this study, 33.5 mg/kg, a 50 kg healthy adult requires 104.5 g of chicken sausages to eat per day to reach the upper limit of the acceptable daily intake, only considering the risks from nitrite intake.

Keywords: Colorimetric detection, Griess reaction, Residual nitrite content, Chicken sausages

Physiochemical fingerprinting of instant tea produced by Broken Mixed Fannings from different elevations of Sri Lanka

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Instant tea is used as a natural colorant and a beverage ingredient due to the health beneficial compounds having in tea. Using refuse tea or Broken Mixed Fannings (BMF) as the raw material for instant tea production is the most popular way due to the cost effectiveness. The physiochemical characterization of instant black tea (IBT) extracted from BMF of up and low country elevations were carried out in order to explore further utilization avenues. Eight BMF samples of tea yield were collected in February 2018 from eight different estates which are Somerset, Ingestre, Nuwara Eliya, Robgill, Deniyaya, Kelani, Halgolla and Moragalla which belong to two elevations. The tea extracts were prepared using hot water extraction method and instant tea powder was obtained by spray drying method. Colour, haze, pH, total polyphenols, caffeine, and moisture contents of BMF and IBT were analyzed using standard methodologies.

Results showed that, for IBT, which obtained from low country showed the highest mean value for caffeine and total polyphenol content (mgL^{-1}) (6.03 ± 1.52 and 23.75 ± 2.28) respectively than the up country produced (4.71 ± 0.68 and 21.20 ± 2.59) respectively. The haze value of up country instant black tea (169.39 ± 34.72 NTU) was significantly higher than the values obtained for low country instant tea samples (95.32 ± 26.24 NTU). A positive correlation can be observed between the loose bulk density and the extractable solid content of the BMF obtained from both elevations. There was no significant difference observed for the colour values (L, a, b), pH and moisture contents when compared to the both elevations. L value is varying from 58.44 ± 0.87 to 67.63 ± 2.07 for both elevations. The pH values for eight IBT samples were around pH 4 and the moisture values for IBT were below 2% (W/W). Results revealed that high clarity (low haze value), caffeine content and polyphenol content was observed in low country instant tea infusions. Considering the health benefits and product quality, the study concludes that low country BMF produces a premium quality instant black tea than the BMF from up country estates.

Keywords: Broken mixed fannings (BMF), Instant black tea, Elevation, Haze, Polyphenol, Caffeine

Extraction and characterization of Arabinoxylans from rice bran and evaluation of its suitability for gluten-free bread

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Arabinoxylans (AXs) is a major component in the cereal grains which has many functional and physiochemical properties. It shows higher water holding capacity and industrially it is used as a good thickening agent, molecular binding agent and a stabilizing agent. Rice as the staple food in Sri Lanka with an annual production of 1.47 million metric tons which leads to 58.8 thousand metric tons of bran which is highly under-utilized. In this study, AXs were isolated from brans of three varieties of rice. AX1,AX2, and AX3, respectively extracted from BG 352, BW 367 and BG 406 rice varieties. The different AXs fractions were characterized and evaluated by incorporating into a gluten-free rice bread. The extractions consisted 27.43 $\pm$ 5.72% amount of AXs and the highest amount was resulted by AX1. The water holding capacities of the extracted AXs were at a range of 1-2g g^{-1} (DM basis) which showed a significant difference among the varieties ($p<0.05$). The highest oil holding capacity was observed in AX1which was 3.74 $\pm$ 0.09g g^{-1} (DM basis) and the range was 1-4g g^{-1} (DM basis). There was a positive linear relationship between the relative viscosities and concentrations of the AXs solutions. The relative viscosity decreased with the temperature of the AXs solutions. The addition of the extracted AXs to egg albumin solutions resulted in less initial foam volume compared to the control regardless of the variety yet lesser collapse during heating. Thus the extracted AXs appear to protect the gas cells in the protein foams against thermal disruption. The AXs incorporated gluten-free rice bread showed significant increment in moisture content. ($p<0.05$) Every treated bread with AXs showed high increment in the water activity yet the rate of decrement showed no significant difference with the control ($p>0.05$). Addition of AXs increased the moisture retention of the gluten-free rice bread but did not affect the rate of moisture loss during storage. The loaf volume showed significant increment at the 2% supplementation level of AXs in treated bread compared to 1% supplementation level and the control which indicates 2% supplementation is ideal to incorporate to gluten-free rice bread. In conclusion, the extracted AXs of the rice brans showed a potential to be used as a food ingredient.

Keywords: Rice bran; Arabinoxylans; Gluten-free; Extraction; Pentosans

Determination of probiotic viability in Elephant Foot Yam incorporated synbiotic ice cream

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Elephant foot yam (EFY) (*Amorphophallus paeonifolius*) is considered as a lesser known edible yam. Consumption of this yam is less preferred due to its bitterness. EFY is rich in glucomannan (49 %-60 %) which is a water soluble dietary fiber. The availability of EFY based products in Sri Lankan markets is low. Therefore there is a timely need to develop a consumer preferable product using this valuable yam. Novel products can be made with the incorporation of probiotic and prebiotic. Incorporating EFY flour can enhance the probiotic activity in culture (*Lactobacillus acidophilus*) added ice cream. Ice cream was developed using three different levels of flour (2.2 %, 2.7 %, and 3.2 %) (w/w %). The formulation of the ice cream was designed by adjusting the amount of the ingredients. After developing the ice cream sensory evaluation was carried out using nine-point hedonic scale. The proximate composition (moisture, protein, fat, fiber, and carbohydrate) and physiochemical properties (pH, Brix, Titratable acidity, and over run) were evaluated. Microbial tests for yeast & mold, coliform count and tolerance of the probiotic for gastro intestinal digestion were evaluated at weekly intervals using standard methods. Shelf life of the ice cream was evaluated during the six weeks of storage period. Sensory evaluation revealed that there was a significant difference ($P < 0.05$) among three levels of flour added ice creams. Ice cream with 2.7 % flour was selected as most acceptable one. Moisture, protein, fiber, fat, ash, and carbohydrate of the synbiotic ice cream were 66.65 % $\pm$ 1.14, 1.80 % $\pm$ 0.10, 3.7 $\pm$ 0.05, 0.89 $\pm$ 0.10, and 24.6 $\pm$ 0.05 respectively. Total soluble solid, pH, titratable acidity, and over run of synbiotic ice cream were 26 $\pm$ 0.57, 6.63 $\pm$ 0.1, 0.2 $\pm$ 0.1, and 26.74 $\pm$ 0.05 respectively. The results showed that there was no yeast, mold and coliforms in the ice cream. In conclusion a synbiotic ice cream was successfully developed with acceptable sensory qualities by the incorporation of 2.7 % of EFY flour. Synbiotic ice cream has shown increase survivability of probiotic by 2 % compare to control at six weeks of storage period.

Keywords: Elephant foot yam; Glucomannan; Ice cream; Synbiotic

Development of coconut milk based spicy ice cream as a non-dairy alternative with desired physicochemical and sensory a.ttributes

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Coconut milk based spicy ice cream was developed according to Sri Lankan standards to introduce a new flavor to the ice cream industry. Cinnamon (*Cinnamomum verum)*, ginger (*Zingiber officinale)* and white pepper (*Piper nigrum)* are the spices used in this study. Three different formulas were developed as 0.010%, 0.018% and 0.025% by changing the proportion of spices added. Among those, 0.018% spices added formula was selected as the most acceptable ice cream by sensory evaluation. Data were analyzed using Man-Witney test ($\alpha = 0.05$).Physicochemical and sensory attributes of coconut milk based spicy ice cream were compared with the ordinary coconut ice cream. Ordinary coconut ice cream was prepared without incorporating spices. The physicochemical properties were analyzed including pH, titratable acidity, moisture, ash, total solids, protein content, fat content (AOAC, 2000), melt down and overrun (AOAC,2005). Moreover, antioxidant activity of ice cream was tested using Total phenolic content, DPPH radical scavenging activity and Total antioxidant capacity. Results revealed that physicochemical properties of spicy coconut ice cream and ordinary coconut ice cream were similar to each other. Spicy coconut ice cream consisted of 61.86% moisture, 6.33 pH, 0.33% titratable acidity, 66.76% overrun, 11.66% fat, 4.18% protein, 38.02% total solids and 0.41% ash. Spicy coconut ice cream contains 0.093 (mmol Gallic acid equivalent/g of Dry weight), Total Phenolic Content, 60.39 (mg Ascorbic acid equivalent/mL of Dry weight), DPPH radical scavenging activity and 0.36 (mmol AAE/g of DW), Total antioxidant capacity as antioxidant properties. Total phenolic content and DPPH radical scavenging activity of spicy coconut ice cream were considerably higher than that of ordinary coconut ice cream. All the results are within the recommended limits of Sri Lankan standards for ice cream. With the spicy flavor, aroma and smooth texture, coconut milk based spicy ice cream can be introduced to the market as a potential marketable non-dairy product.

Keywords: Cinnamon; Coconut milk; Ginger; Ice cream; Spicy; White pepper

The effect of thermal treatment and processing conditions on Hydroxymethylfurfural (HMF) content in selected foods

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HMF is a common component of heat treated food products. It is an intermediate formed in Maillard reaction and caramelization due to thermal dehydration of reducing sugars at high temperature. Therefore, HMF is generally known as an indicator of quality deterioration as a result of excessive heating in a wide range of foods. Although HMF is a relatively safe food component, it is having potential health hazards including cytotoxicity and genotoxicity. The HMF content in food products and how processing conditions affect on HMF formation are not adequately studied. Therefore, the study was conducted to determine the effect of thermal treatment and processing conditions on HMF content in selected foods in the local market.

The study covered forty samples of different foods and beverages collected from the local market. The HMF content was measured according to the spectroscopic method described by White, 1979. pH and moisture content of the above food products were also measured using pH meter and AOAC, 2000 method respectively. Different thermal treatments given during milk pasteurization and processing parameters in jam were considered in determining the effect of processing conditions on HMF content. The results were analyzed using SPSS 16.0 software.

The results revealed that the mean HMF concentration in yogurt, milk powder, cornflakes, honey, jam, fruit concentrates, plant extracts, ice cream, soft drinks and concentrated milk were 4.8017 (SD 1.9330), 3.0906 (SD 1.1704), 6.3290 (SD 1.9760), 4.9115 (SD 1.3208), 11.2505 (SD 2.4777), 4.5255 (SD 1.9922), 15.1612 (SD 2.4829), 7.0045 (SD 1.9053), 16.5712 (SD 8.6221), and 5.8898 (SD 2.5514) ppm respectively. There was a significant correlation ($P = 0.046$) between pH and HMF content and no significant correlation ($P = 0.229$) was observed between moisture content and HMF content in selected food products. The lowest HMF content was recorded as 1.7469 ppm (SD 0.6916) in fresh milk. There was a significant different on mean HMF content of milk with different thermal treatment temperatures ($P = 0.002$) and duration of heating ($P = 0.000$). The jam prepared under the conditions of 105 °C temperatures, 68% TSS and 0.6% TA had the lowest HMF concentration of 0.3993 (SD 0.0865) ppm. In conclusion, low temperature for short time heating was most suitable heat treatment method to be used in milk pasteurization while 105 °C temperature, 68% TSS and 0.6% TA were most suitable processing conditions for jam in relation to HMF formation.

Keywords: Food & beverages; HMF; Jam; Milk; Processing conditions

Quality evaluation of coconut oil manufactured from coconut kernel residue

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Coconut oil is manufactured from either matured coconut kernel or from coconut kernel residue (CKR). There are two types of CKR which are produced at household and industrially level. The CKR contained a considerable amount of fat (42.6%) which discarded without utilization. Therefore, the aim of this investigation was to determine the effect of drying method, moisture content and type of oil expeller on quality of coconut oil extracted from the CKR and suitability of the coconut oil for human consumption by comparing the quality parameters of extracted oil with quality standards. CKR samples were dried using sun drying, oven drying and industrially (fluidized bed dryer) dried samples were obtained. Samples were dried up to two different moisture levels which are 2- 3% and 6-7%. Cold press and baby oil expeller were used to extract the oil. Quality of the extracted coconut oils (twelve oil samples) were determined by analyzing the moisture content, free fatty acid, peroxide value, color of the oil (SLSI, 2012), fatty acid composition (AOCS, 1998) and oil recovery (AOAC, 2003). The extracted oils were compared with the standard of white coconut oil and virgin coconut oil. The result was indicated that drying method, moisture level of CKR and oil expeller machine were effected on oil quality, however, drying method was not significantly ($P < 0.05$) effect on moisture content of oil. But oil which are extracted by cold press from 2-3% moisture contained residual samples gave significantly ($P < 0.05$) low moisture content in oil (0.07 ± 0.01%). When considering the free fatty acid content, significantly lower ($P < 0.05$) FFA content can be observed in industrially dried samples (0.06 ± 0.01) and highest FFA content can be observed in sun dried samples (4.97 ± 0.06) and similar trend was observed for peroxide value of oil which were extracted by cold press (0.21 ± 0.02 meq kg^{-1} and 0.22 ± 0.05 meq kg^{-1} respectively). All the industrially dried CKR were given lower colour value (0.17 ± 0.06) in oil. Finally, it can be concluded as CKR is a good source to extract high quality coconut oil for human consumption.

Keywords: Coconut kernel residue, Coconut oil, Drying method, Moisture level, Expeller machine

Prebiotic activity of Arrowroot (*Maranta arundinacea*) extract and survivability of *Lactobacillus* species in synbiotic ice-cream

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Synbiotic product development plays a major role in the food industry due to the synergistic effect of probiotics and prebiotics. Arrowroot (*Maranta arundinacea*) is a locally available underutilized starchy root reported to contain considerable amounts of Fructo oligosaccahrides with a potential to develop low cost, prebiotic source for the functional food industry. Therefore, this study was performed to evaluate the potential prebiotic activity of arrowroot extract and to evaluate the probiotic cell viability during frozen storage of arrowroot extract incorporated synbiotic ice-cream.

Two types of synbiotic ice creams were prepared using *Lactobacillus* cultures as the common probiotic source with arrow root extract (sample) and inulin (reference) separately added as the prebiotic. A control ice-cream was maintained with only probiotic cultures. Prebiotic activity assay was based on the change of probiotic cell biomass in 1% glucose, 1% arrowroot extract and 1% inulin during incubation of 0 to 72-hours. Probiotic viability assay was based on the cell survivability during frozen storage of ice-creams.

Arrowroot extract showed the highest prebiotic activity compared to inulin and glucose. The prebiotic activity of both arrowroot extract and inulin were significantly higher than the prebiotic activity of glucose ($p < 0.05$) while the effect between arrowroot and inulin were not significantly different from each other ($p > 0.05$). Probiotic cell viability was similar among sample and reference ice-creams while the control ice-cream showed lower levels with no significant difference among all three ice creams during frozen storage ($p > 0.05$). The lowest difference in probiotic viability was recorded between sample and reference ice-creams ($p = 0.757$) compared to control sample ($p = 0.092$) and control reference ($p = 0.161$) ice-creams. Levels of total soluble solids (TSS) and titratable acidity (TA) between control and reference ice creams revealed a significant difference ($p < 0.05$) while no significant difference was seen between the sample and reference ice-creams ($p > 0.05$). The results conclude that prebiotic activity of both arrowroot extract and inulin to be similar hence arrowroot extract has a potential to replace commercial prebiotics like inulin. Both arrowroot and inulin incorporated ice-creams have shown higher cell viabilities than control ice-cream indicating that prebiotic substances have facilitated the survival of probiotics during harsh frozen storage conditions.

Keywords: Arrowroot; Synbiotic; Prebiotic activity; Probiotic viability

Probiotic encapsulated cellulose fibers derived from pineapple (*Ananascomosus* L.) peel waste

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Sri Lanka is consecrated with various kinds of fruits and vegetables. During industrial processing of pineapple (*Ananascomosus* L.), 70-80% of waste generates including peel (40%), bagasse (23%), stem and crown (14%), which however, is rarely used for value addition. This study explore the feasibility of utilizing extracted cellulose fibers from pineapple peel waste in probiotic encapsulation in order to utilize the industrial fruit waste in productive manner and to evaluate the structural characteristics of extracted cellulose. Wet milled pineapple pulp was treated with an alkali (2% NaOH) solution at 80 ± 5 °C for 2 h and it was bleached with equal parts of sodium hypochloride (2%, 5%, 7.5%, 10%) or commercial bleaching powder (2%, 3%, 4%), acetic buffer (pH 4.5), and distilled water at 85 ± 5 °C for 2 h. Extracted fibers were dried by dehydration at 45 ± 5°C or freeze drying at -40°C until a constant weight was obtained. They were treated with acid for 3 h and washed with distilled water. Cellulose structure was studied using Scanning Electron Microscope imaging (SEMI), Powdered X-ray Diffraction (PXRD) and Fourier Transforms Infrared (FTIR) spectrum. Probiotics were encapsulated in extracted cellulose fibers (CF) and structure was studied using SEM and PXRD. Yield of cellulose extracted using NaOCl and commercial bleaching powder from pineapple peel waste (PPW) contributed within the range of 30.38-21.90% in dry basis. CF showed increased crystallinity, indicating the exposure of the crystalline phase after the removal of lignin and hemicellulose via bleaching of PPW and the removal of the more amorphous region of cellulose via acid hydrolysis. Crystallinity index of probiotic encapsulated cellulose was reduced due to attachment of cells inside the fibers. SEM images of extracted CF revealed that cellulose is present as a three-dimensional structure with elongated rigid micro fiber bundles and encapsulated fibers showed probiotic cells on the fiber surface. The CF surfaces became smoother and eventually showed reduction size after acid hydrolysis. FTIR spectrum for extracted cellulose using 2% commercial bleaching powder has shown a peak at band 3335 cm^{-1} which is assigned to vibration-stretching hydrogen bond of O-H groups, while band at 1030 cm^{-1} is for C-O stretching at C-6. In conclusion, study indicated that there is a great potential to extract cellulose successfully using the developed process and it is suitable for probiotic encapsulation for different applications due to the high yield and low cost of raw materials.

Keywords: Bleaching; Cellulose fibers; Crystallinity index; Probiotic encapsulation

Physicochemical and cooking characteristics of selected Sri Lankan traditional and improved rice varieties (*Oryza sativa* L.)

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Rice consumption has a higher impact on the nutritional status of people in Sri Lanka. Interest towards traditional rice is drastically increasing due to high nutritional and functional properties. But, majority of traditional rice varieties are not being exploited for scientific analysis. This research was done to evaluate some physiochemical and cooking characteristics of selected eight traditional and four improved rice varieties grown in Sri Lanka.

Rice paddy was purchased from different locations in the country and de-husked and used for the analysis. As cooking characteristics; minimum cooking time, gelatinization temperature (GT), percentage gruel solid loss, volume expansion ratio, and water uptake ratio were determined. As physical characteristics; colour, length, width, length to width ratio, size, shape, and gel consistency were determined and, as chemical characteristics; moisture, crude ash, crude protein, crude fat, crude fiber, carbohydrate, and amylose percentages were determined.

The minimum cooking time, percentage gruel solid loss, volume expansion ratio, and water uptake ratio of the varieties were ranged from 20.97 ± 0.66 to 51.04 ± 0.56, 3.27 ± 0.01 to 10.06 ± 0.00, 0.833 ± 0.00 to 1.51 ± 0.29, and 1.0478 ± 0.00 to 2.0230 ± 0.00 respectively. High, High-Intermediate, Intermediate and Low GT classes were obtained by the selected varieties. All the selected verities were short in size where majority of the varieties were medium in shape. Most varieties had soft gel consistencies. Proximate composition of examined rice were varied (protein 11.26 ± 0.61-17.11 ± 0.76; Fat 1.03 ± 0.14—3.60 ± 0.16; Fiber 0.62 ± 0.14-5.90 ± 0.06; ash 0.44 ± 0.00-3.51 ± 0.59; Amylose 18.43 ± 0.15-25.52 ± 0.44). The results showed significant differences ($P < 0.05$) between traditional and improved varieties for some selected parameters.

Keywords: Cooking characteristics; Proximate composition; Traditional rice

Air frying as a way of substantially lower the fat content of snack with desired quality attributes

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Deep frying is the most popular method of frying in frying food industry as well as the household cooking although it is having Cardio vesicular risk factors. Repeated usage of oil during processing cause oxidative dehydration by increasing peroxide value. Different frying methods have been developed to minimize the oil uptake of fried foods and to reduce the oxidation of repeated oils. Air frying is an alternative method for deep frying. Even at 180 °C air fried products different from characteristics from its counter part of the deep frying. This study was conducted to improve the product characteristics of Air fried products toward the deep frying products. Developed mushroom nuggets were dipped in coconut oil for different time intervals.

This study compared: the process dynamics between deep frying and air frying products which pre oil treatments were done (oil dipped for 5-7 sec, 30 sec, 60 sec and 90 sec) and products were formed by two processes were analyzed for color, texture, Scanning Electron Microscopic Image (SEM), moisture, fat and sensory analysis. According to the results of sensory analysis, six minutes and nineteen minutes at 180°C was selected as suitable frying time for deep frying and air frying in respectively. Temperature profile showed, initially at the center of the product almost linearly with the dipping time of the air fried samples until it reaches approximately100°C. The pre oil dipped samples took approximately 8.5 minutes to reach the boiling point of water, whereas deep fried and control samples took 4 minutes and 16 minutes respectively. In the case of oil up take deep oil fried samples were recorded the maximum oil content 13.79g /100g of dry matter of sample (DMS) and oil uptake of air fried samples were increased with the dipping time (0.1739g/100g of DMS in control to 11.28g/100g of DMS). Sensory analysis revealed that the suitable frying time for mushroom nugget with air frying was 16 minutes. Comparison of fried products belong to two processes showed significantly different ($p < 0.05$) sensory characteristics. SEM images demonstrated the fat penetration towards the core. In conclusion, pre oil treated air frying process permits to manufacture of products with lower fat content and high consumer acceptance than deep oil fried control samples.

Keywords: Air frying; deep oil frying; oil content; sensory analysis

Development & quality evaluation of refreshing ready to serve (RTS) beverage of coconut haustorium without chemical preservatives

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Coconut haustorium can be considered as the sole type of waste in the coconut industry. This, study was carried out to develop a ready to serve (RTS) beverage using coconut haustorium and to comparatively assess its nutritional and physiochemical properties with a commercially available counterpart. The most acceptable beverage formula was; 18% extracted haustorium, 9% sugar, 0.1% citric acid and 0.2% pectin which comply with SLS 729:2010. The developed beverage was analyzed for its physicochemical parameters; pH (4.04), total soluble solids (^{o}Brix) (7.5) and titratable acidity (0.16 %). Microbial analysis (Yeast and Mould count) revealed no any presence of colonies in the formulated beverage while total plate count revealed 16 (CFU) per 1 ml of beverage. Proximate composition was analyzed in dry weight basis of 100mL of the beverage revealed that ash, proteins, fat, fibre and carbohydrate (by difference) contents of developed beverage were 0.19 ± 0.04, 0.95 ± 0.10, 2.94± 0.00, 5.39 ± 0.28 and 90.52 respectively whilst commercial coconut water contained for the same 0.42 ± 0.05, 0.54 ± 0.11, 0.20 ± 0.09, 0.43 ± 0.07 and 98.41 respectively. Proximate composition of the two beverages is significantly different ($p < 0.05$) from each other. Mineral constituents of coconut haustorium RTS beverage shows 1055.70 ± 0.43, 702 & 1.00 mg of P, K & Fe respectively per 1L beverage. Total phenolic content of developed beverage and commercial coconut water were 12.58 ± 0.05 mg and 4.27 ± 0.06mg (Gallic Acid Equivalent GAE) per 100 ml respectively. Total flavonoid content was 75.29± 4.04 mg (Rutin Equivalent) per 100 ml of the beverage. Developed product had 5 days of shelf life under refrigerated conditions. Coconut haustorium can be considered as a commercially viable raw material and has the potential of developing more nutritious beverages which can be introduced as a new product as well as an alternative to commercial coconut water.

Keywords: Coconut haustorium; Coconut water**;** RTS beverage

Comparison of physicochemical and antibacterial properties of Sri Lankan bee honey with New Zealand Manuka honey

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Manuka honey which originates from Manuka flower exhibits non-peroxide antibacterial activity and obtained higher market value in Sri Lanka compared to the Sri Lankan bee honey (SLBH). Present study was undertaken to compare physicochemical parameters and antibacterial activity of both honey samples in order to understand the possible foreign market potential for Sri Lankan bee honey. Wild SLBH samples were collected from Ella, Gampaha, Minipe, Elpitiya, Loggaloya, Nuwara Eliya, Anuradhapura, Haputhale, Kothmale, and Welimada areas while Manuka honey obtained from Mosgiel, New Zealand.

Bee honey samples were subjected to analyze for color, pH, free acidity, Hydroxy Methyl Furfural (HMF), total soluble solids (TSS), specific gravity, water activity, moisture contents and antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. Pollen analysis was conducted to identify the major floral sources of bee honey and pollen density. The results showed that specific gravity, pH and water activity for SLBH were 1.40, 4.38, 0.576 respectively and for Manuka honey the values were 1.43, 4.56, 0.555 respectively. Manuka honey had highest darkness value (8.63) and lowest yellowness value (8.07), lower moisture content (17.00%), higher specific gravity (1.43) and higher total soluble solid content (80.27) compared to SLBH. HMF content of Manuka honey (91.52 mg/kg) is higher than CODEX, however SLBH (62.92 mg/kg) values were upto the standard. Results revealed that regard to the physiochemical properties, SLBH are in good quality. Mean bacterial growth inhibition zone diameter of SLBH exhibited significantly higher activity (*E. coli* 26.35mm and *S. aureus* 28.94 mm) compared to Manuka honey (*E. coli* 25.39 mm, *S. aureus* 26.69 mm). Moreover, Welimada, Haputhale, Nuwara Eliya honey samples and Manuka honey were contain Myrtaceae family predominantly (frequency >45%) which were classified as unifloral honey. Among the collected bee honey samples there were 27% (Nuwara Eliya, Elpitiya, Kothmale) bee honey samples having pollen density >1,000,000/10g. Results revealed that bee honey obtained from Kothmale and Elpitiya showed the best quality in all physicochemical parameters and genuine bee honey obtained from these areas have a potential to be sold at high prices as Manuka honey.

Keywords: Antibacterial; Manuka honey; Physicochemical; Pollen; Sri Lankan bee honey

Extraction of pectin from industry waste lime peels and optimization of process parameters using Response Surface Methodology

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Pectin is a carbohydrate bio polymer which has generated a good market demand due to it's gelling, stabilizing, emulsifying abilities in food products. Extraction is the most important part in pectin manufacture and it get influenced by three major factors, namely; pH, temperature and time. The present study has been aimed to investigate the impact of pH - temperature - time combination on pectin yield extracted from lime peels using conventional acid extraction method with the optimization to attain maximum yield of pectin. Box- Benkhen design of Response Surface Methodology was employed to study the effect of extraction conditions; pH of 1.3, 2.5 and 3.7, temperature of 60, 75 and 90 °C and time of 45, 90 and 135 minutes. The complete design consisted of 15 experiments with the triplicate at the center point. All experiments were conducted randomly.

Among the 15 treatments, the highest yield (21.96 %) of pectin was obtained at the combination of pH 2.5 - 75 °C - 90 minutes while the lowest yield was gained (8.1 %) at the pH of 3.7 - 60 °C - 90 minutes. The yield of pectin from 15 treatments were significantly different from each other. Results revealed that the combination of pH 1.7 - 81.2 °C - 125.9 minutes as the optimized condition with the maximum yield of 23.23 %. A quadratic polynomial model for yield of pectin was regressed using the statistical analysis as shown below. The R^2 value (97.03 %) and the insignificant lack of fit ($p = 0.064$) implied the high accuracy of the model. The present study demonstrated that the extraction conditions of pH, temperature and time had a significant polynomial regressed impact on yield of pectin and the derived model could be used to predict the extraction conditions to gain pectin from lime peels with required yield.

Yield = -130.2 + 24.56 pH + 2.948 Temperature + 0.199 Time - 3.445 pH*pH
- 0.01966 Temperature*Temperature- 0.001239 Time*Time
- 0.0582 pH*Temperature- 0.0622 pH*Time + 0.00272 Temperature*Time

Keywords: Box – Benkhen; Industry fruit waste; Lime peel; Optimization; Pectin

Iron fortification to rice cultivars through parboiling process

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Iron deficiency is widespread micronutrient deficiency in human. Usage of iron supplementation tablets and iron-fortified food has not been common in developing countries. The study was to focus on the alternative and cost-effective way to fortify iron in four rice cultivars which are often consumed by people in the low-income category in Northern Province through parboiling to increase Fe concentration and bioavailability of Fe in rice-based diets. Four paddy cultivars were parboiled in deionized water containing FeEDTA (250mg Fe kg^{-1} paddy rice) made by mixing ferrous sulfate ($FeSO_4$) with ethylenediaminetetraacetic acid disodium salt (Na_2EDTA) in acidic pH of 5.50- 5.70. Addition of Fe during the parboiling process resulted in increased concentration of Fe (40- 80mg Fe kg^{-1}) in grain compared to unfortified rice cultivars (30-35mg Fe/kg) ($p < 0.05$) depending on rice cultivars. Fe concentration in Fe fortified grain was negatively correlated with the concentration of Fe in unfortified grain ($r = -0.812$, $p < 0.01$). Fe retention test was conducted by rinsing the grain thoroughly three times using de-ionized water followed by oven drying at 70 °C for 72h. The fortified Fe was retained up to 75.51-99.67% in Fe fortified parboiled rice after rinsing treatment. However, there was no correlation between total Fe content and magnitude of Fe losses in fortified parboiled rice grain of four rice cultivars caused by rinsing treatment ($p > 0.01$). The bioaccessibility and bioavailability of Fe in rice cultivars (unfortified and fortified) were evaluated by *in-vitro* digestion which resulted in that bioavailability of Fe in fortified rice was significantly increased compared to unfortified rice ($p < 0.05$) depending on rice cultivars. There was no correlation between bioavailability of Fe and concentration of Fe in (fortified and unfortified rice cultivars; $p > 0.01$). In conclusion, without changing sensory attributes Pachchaperumal rice cultivar is more suitable for Fe fortification. Parboiling process is an effective way to fortify Fe into rice grain and Fe fortified rice is a vehicle for improving Fe status in rice-based diets consumed by low-income people.

Keywords: Fortification; Iron; Parboiling; Rice

Formulation of coconut oil mayonnaise and evaluation of microbial and chemical parameters

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The main aim of this study is to investigate the stability and quality of mayonnaise products with special emphasis on the changes in microbial content and chemical parameters. The main focus is to analyze the mayonnaise samples with selected analysis to understand the effects on the changes during storage period. Mayonnaises are produced egg free and commercial 'All in one stabilizer' replaced. Three mayonnaise recipes were formulated using 35%, 50%, and 65% of virgin coconut oil (VCO). All three samples were selected for further analysis. Sensory analysis was conducted using simple preference test and five point hedonic scale. Microbial load of the samples was determined during 8 weeks of storage period. Aerobic plate count (APC) of the samples was used to identify microbial stability of the finished mayonnaise products. Chemical compositions of the three formulas were done by proximate analysis within 2 weeks of time after manufacturing. As chemical parameters acidity, pH and peroxide value of the samples were evaluated during 8 weeks of storage period (0 week, 2 weeks, 4 weeks and 8 weeks) after manufacturing. Mean preference values of sensory data for coconut oil mayonnaise formula 01 were for texture consistency 4.80, spreadability 4.20, mouth feel 4.00, elasticity 2.40 and overall acceptance 3.80. Formula 02 were for texture consistency 3.20, spreadability 3.15, mouth feel 3.40, elasticity 2.25 and overall acceptance 3.00. Formula 03 were for texture consistency 2.00, spreadability 0.95, mouth feel 0.80, elasticity 2.15 and overall acceptance 2.45. For Formula 01, Formula 02, Formula 03 in chemical analysis moisture % was changed 26.33 $\pm$ 1.52, 41.06 $\pm$ 1.00, 54.7 $\pm$ 0.01 respectively. Protein content was ranged 1.13 $\pm$ 0.06, 1.27 $\pm$ 0.00, 1.23 $\pm$ 0.01 respectively. Fat content was ranged 68.66 $\pm$ 0.57, 50.66 $\pm$ 0.55 and 35.00 $\pm$ 1.52 respectively. Acidity of the three mayonnaise samples were evaluated during 8 weeks period. Due to hydrolysis of fat acidity was slightly increased. On contrary, pH of the samples was slightly decreased. Microbial load of the samples was within the acceptable range ($1x\ 10^4 – 5x\ 10^4$) during the 8 weeks of storage period. It can be concluded that coconut oil mayonnaise can be successfully prepared using commercial 'All in one' stabilizer and virgin coconut oil.

Keywords- 'All in one' stabilizer; mayonnaise; virgin coconut oil

Formulation of low sugar biscuit with composite flour mixture

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New health concerns associated with high sugar intake include excessive calorie consumption and decreased diet quality. With increased consumer interest in reducing sugar intake, food products made with sweeteners rather than sugar have become more popular. Most types of biscuits are made by only with wheat flour. But substitution of wheat flour with composite flour can enhance the nutritional quality of the biscuit. This study was done to formulate a low sugar biscuit with composite flour mixture as a substitution of wheat flour. Composite flours with different proportions of cassava, wheat and rice were prepared, with 100% wheat flour serving as control. Coded samples of biscuits were presented to thirty semi trained panelists and were instructed to score the following attributes; texture, color, aroma, taste, mouthfeel, and overall acceptability of the product using a 7 point hedonic scale. Most preferred treatment (20% cassava, 20% wheat, 60% rice flour) and control was selected to carryout proximate, physicochemical and microbiological analysis. Protein, fat, ash, crude fiber and moisture was determined using AOAC 2000 method. Hydrogen cyanide value was determined. Colour, texture, Total phenolic content, DPPH free radical scavenging activity and total flavonoid content was measured for both samples. Total plate count and yeast and mold count was carried out as microbiological analysis. Protein, fat, fiber and ash are significantly higher in control biscuit sample than the test biscuit sample. Carbohydrate and energy are higher in the test biscuit sample. Color analysis data shows that there is no significant difference ($p \geq 0.05$) between two biscuit types. The texture results was indicated both hardness and fracturability is significantly higher in control biscuit sample than test biscuit sample. No countable microbial count was observed during three weeks of period. Antioxidant values showed a significant difference ($p \leq 0.05$) between two samples. The cyanide content result showed the data are in the acceptable range. Results conclude that consumer acceptable low sugar biscuit can be formulated by incorporating composite flour. Incorporation of isomalt increased the shelf life of the biscuit.

Keywords: Composite flour, Isomalt, Low sugar, Healthy biscuit

Development of a beer like an alcoholic beverage using finger millet as a fermentable substrate

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Finger millet is a cereal which is abundant in Sri Lanka which has the potential of formulating products with modifications in processing. It shows a high potential in producing opaque beer and traditional lager beers. Finger millet variety "Oshada" was used in formulating the beer like the low alcoholic beverage. The samples were soaked in clean water for 24 hours after treating with $CaCl_2$ with regular change of water every 6 hours. Then they were allowed to germinate in room temperature with a trace amount of surface moisture (high watering regime) up to 48 hours. Malting studies indicated that the steeping loss, metabolic loss and vegetative loss were 1.023 ± 0.16%, 2.87 ± 0.24% and 1.68 ± 0.415% respectively. Malted seeds were taken and kilned at 50°C for 2 hours to arrest the germination. Then the dried millets were ground and sieved in 420 μm mesh sized sieve. Resultant malt is tested for free sugar content within 6-hour duration of malting which showed increment from 0.9% to 3.9% and reduction of starch from 68.2% to 55.3%. Mashing is done in home scale Aluminum container in a cooker by adding rice flour as an adjunct for 1 hour. Fermentation was done using instant dry yeast and fermentation yielded 7 % of alcohol after 5 days which was diluted to 4.4% in the formulation of the final beverage. Physicochemical parameters were also tested in the study which showed some resemblance to commercial beers. Total plate count and a yeast and mold count was done to estimate the shelf life of the product. The results showed no significant growth in bacteria, yeast and mold in the final product within the tested time span of 3 weeks. Finally, it was evident that the resultant beverage was having acceptable sensory properties and good shelf life. This study also showed that finger millet has the potential to be used as an alternative malt or barley malt extender in brewing.

Keywords: Beer; Finger millet; Gluten-free; Malting; Alcoholic beverage.

Estimation of the contribution to the consumption of protein, fat, fiber from commercial meat products (chicken sausages) in Sri Lanka

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Today, meat and meat products have become a vital component in the diet as it's a high nutritional value, such as high-quality protein, fat, vitamins. The growth potential of the local meat industry is significantly high due to an improved market and consumer perception. Although there is a high consumption, no studies have been conducted to assess the overall contribution to the consumption of the selected essential nutrient from commercially available processed meat products in Sri Lanka. Therefore, an estimation of the contribution to the total consumption of protein, fat, fiber from the commercial available all chicken sausage varieties is detected during the research study. Sausage is a major kind of processed meat products that undergo preservation methods to extend the shelf life and the sensory characteristics with the adding of non meat ingredients. Meat is the main ingredient that used to prepare the product. Sausage contains basically meat and fat (solid phase) dispersed into ice/water (liquid phase) forming a stable mass with moderate heat treatment. All varieties of sausage products (10) available in the market were analyzed for the protein, according to the AOAC 2000 method Crude protein content was measured by the Kjeldahl method. The crude fat content was measured by the Soxhlet extraction system. Crude fiber was analyzed for the defatted materials. According to the results obtained, sausage consists of high protein content 24.27 $\pm$ 12.43, Fat content is 22.41 $\pm$ 2.46 and fiber is 1.06 $\pm$ 0.40. Estimation, the contribution to the total consumption of protein, fat, fiber commercially available chicken sausage varieties are 12.28 g/month, 11.339 g/month and 0.536 g/month. Sausage consists with high protein value compare to the standard. Fat content is also higher compared to the standard value of 20% and it depending on the manufacture. Sausage fiber content is very low. Protein Content was situated close to the lower limit of the standard and fat percentage was nearly the maximum limits of the standards for all samples analyzed.

Keywords; Consumption, Contribution, Nutritional value, Processed meat

Effect of cooking methods on proximate composition and fatty acid profile of *Penaeus monodon* and *Penaeus indicus*

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Shrimps are good source of many nutrients that are required by human. Those nutrients can be changed during the processing of shrimp. In Sri Lanka, the main processing method is cooking (wet heat processing). The oxidation of unsaturated fatty acids can be enhanced by high temperatures that are used in cooking; therefore, the quantity of fatty acids may be affected. Shrimp flesh can absorb fatty acids from cooking ingredients that are not normally found in shrimps. The objective of this study is to evaluate the effect of different cooking methods commonly used in Sri Lanka (kirata, tempering and frying cooking methods) on fatty acid profile and proximate composition of *Penaeus monodon* and *Penaeus indicus*. Shrimp samples were collected from Negombo fish market. Moisture, ash, protein, fat and carbohydrate were analyzed under proximate composition. Fat was extracted by Bligh & Dyer method . Extracted fatty acids were converted into fatty acid methyl esters and analyzed by gas chromatography using standards. In *P. monodon*, cooked samples showed significantly higher mean values of protein than the raw sample ($p < 0.05$). There was no significant difference among mean protein values of cooked samples ($p > 0.05$). The fat content was increased in cooked samples than the raw sample. There was a significant difference in mean fat contents of raw and cooked samples ($p < 0.05$) and also among three different cooked samples ($p < 0.05$). In *P. indicus*, the protein contents of cooked samples were significantly higher than the protein content of raw sample ($p < 0.05$). There was no significant difference in mean protein values among three different cooked samples ($p > 0.05$). The fat content of cooked samples were significantly different from the raw sample ($p < 0.05$). The mean fat values of three different cooked samples were also significantly different ($p < 0.05$). There was no significant difference in mean Palmitic acid and Oleic acid contents among cooked samples ($p > 0.05$). When comparing three cooked samples, the highest eicosapentaenoic acid contents in *P. monodon* and *P. indicus* were resulted in kirata method and tempered sample respectively. When comparing three cooked samples, the highest docosahexaenoic acid content was observed in tempered sample in both species. According to this study, there is an effect of cooking on the proximate composition and fatty acid profile of shrimp.

Keywords: Fatty acid composition; *Penaeus indicus*; *Penaeus monodon;* Proximate composition

Extraction, characterization and application of ash gourd peel wax in an edible coating of Spicy cube

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Ash gourd (*Benincasa hispidacogn*) has been cultivated as a vegetable and its pulp is used as a filling material in the food industry for manufacturing of jam. Ash gourd peel (AGP) constitutes 15% of the fruit discard as waste from fruit industry. AGP contains high edible waxy materials. Plant waxes are important material, which can be used as component of an edible coating to prolonged shelf life of various products. Present study aims at extraction, characterization and utilization of ash gourd peel wax as an edible coating for spicy cube which is a novel product having potential of being commercialized as ready to use condiment cube. AGP wax extracted with Soxhlet apparatus using petroleum ether. The physiochemical testing and FTIR analysis were carried out for characterization of AGP wax. Water based wax emulsion was prepared by adding 0.5% w/w and 1.0% w/w of melted peel wax and Sodium benzoate 1% (72 ppm) and 2% (144 ppm)(v/v) for each treatments with Tween 80 emulsifier. Spicy cubes were brushed in respective emulsions and packed in aluminum foil. Shelf life of coated Spicy cubes was studied for 4 week at room temperature by physiochemical and sensory analysis. The yield of crude wax of AGP was 2.20%. Waste generated after processing of 1 kg of ash gourd was found to be enough to coat 320 of spicy cubes. The crude wax was brownish green in color. Melting point was 89 °C. The Acid value, Saponification value, and Iodine values were 21.387± 13.42 mg/g, 36.55± 23.86 mg/g, and 71.49 ± 4.55 mg/g respectively. FT-IR analysis of wax sample revealed the presence of many organic functional groups present in AGP crude wax indicating their respective compounds, which are related to waxes. FT-IR prominent peaks were obtained at 2920.10 and 2854.91 cm − 1 (– CH), 1450.79 (–CH2), 1357.19 cm − 1 (–CH3), 3396.50 (–OH), 1164.96 cm − 1 (–C– O) and 1716.58 (–C = O) representing alkanes, alcohols, aldehyde and carboxylic acid. In conclusion, highly edible waxy materials were successfully extracted from ash gourd peel and it can be used as a wax component of edible food coating. There is a significant effect of weight of wax and concentration of sodium benzoate in edible coating on improving the shelf life of spicy cubes.

Keywords: Fruit processing waste, Edible coating, Ash gourd peel, Spicy cube, Shelf life extension

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Antioxidant activity of ready to serve legume based breakfast cereals

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Non-Communicable Diseases (NCDs) are estimated to account for 75% of total deaths in Sri Lanka. Obesity and overweight are leading causes of a number of NCDs. This study was designed to develop a breakfast cereal using horse gram which can be helpful to obese and overweight people to reduce body weight. Horse gram (*Macrotyloma uniflorum*) is a legume, which can be grown under adverse climatic conditions. Further, it is known for bioactivities due to the presence of various phytochemicals. Red rice (Variety Niroga), horse gram and organic coconut flour were used to produce an extruded cereal based flakes. Total phenolic content (TPC) and antioxidant activities of raw ingredients and the product were measured. The sensory characteristics and satiety index were measured for cereal flakes. TPC was 129.4 and 27.6 μmols ferulic acid equi/ gram of dry sample for horse gram and flakes, respectively. DPPH (2,2-dipenyl 1-1-picrylhdrazil) radical scavenging activity (DRSA) of horse gram and flakes were 74.3 and 16.4 μmol rolox equi/g, respectively. The average overall sensory acceptability of cereal flake is 6.5 out of 10 points scale. Satiety response analysis indicated that flakes had higher satiety index (184%) compared to the reference food**.** There is a high potential to use new product as a functional food but further studies are needed to determine the health benefits.

Keywords: Horse gram, Niroga red rice, Organic coconut flour, Anti oxidative properties, Satiety index

Adherence to guidelines and quality of life in Sri Lankan breast cancer survivors

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Breast Cancer (BC) is the leading type of gynecological cancer globally and locally. BC diagnosis and its harsh treatment methods often negatively alter the Quality of Life (QoL) in BC survivors. Dietary, physical activity and lifestyle guidelines are recommended by international organizations for survivors to reduce the recurrence and prolong their survival with improved level of QoL. Limited number of studies has assessed the impact of healthy eating and lifestyle changes on improving BC survivors' QoL. The objectives of this study are to determine the level of adherence to recommended guidelines by Sri Lankan BC survivors and its association with survivors' QoL. A cross sectional study was conducted involving 126 BC survivors aged between 20 to 70 years, registered at Kandy Teaching Hospital oncology clinic. Adherence to the guidelines of American Cancer Society (ACS) and World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) by BC survivors was assessed using a scoring system. European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC – QLQ Core 30) was used to determine the QoL. Only 30% of the survivors indicated adequate level of adherence to both ACS and WCRF/AICR guidelines. Increasing overall adherence to ACS guidelines was associated with higher scores of cognitive functioning levels ($p < 0.05$). Nearly 82% survivors had carbohydrate intake greater than the recommended level while 94% of survivors had protein intake less than the recommendations. Individual guidelines for healthy weight, regular physical activities and fruit and vegetable intake associated with high QoL in role and physical functioning levels. It can be concluded that the recommended diet and lifestyle guidelines can positively modify the QoL in Sri Lankan BC survivors.

Authors wish to acknowledge the staff of oncology unit at Kandy Teaching Hospital for the assistance in patient recruitment.

Keywords: Breast cancer survivors; Cancer survivor guidelines; Diet quality; Quality of Life

Effects of dietary patterns on blood pressure among adults in Kahatowita and Thihariya

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Blood pressure refers to the force exerted on the arterial walls of the large arteries by the blood circulating in the cardiovascular system. Prolonged raised blood pressure (hypertension) can lead to serious harm to various parts of the body while low blood pressure may result in fainting due to reduced blood flow to the brain, hence maintaining a fairly constant blood pressure is important. According to the research based study there are several factors influence on blood pressure level. Those are gender, age, obesity, vigorous physical activity and inactivity, obesity, lifestyle factors like smoking and alcohol consumption, and dietary factors. The objective of this study is to identify the different dietary patterns among rural setting adults, and determine the association between dietary patterns and blood pressure. This was a community based cross sectional study, which included adults age from 20 to 60 years in Kahatowita and Thihaariya. Pregnant ladies, lactating mothers, and people who have already diagnosed non communicable disease like hypertension, cardiovascular diseases, diabetes, cancer etc. were excluded. In the first evaluation, the people were asked general questionnaire and food frequency questionnaire. And also anthropometric measurements and Blood pressure of adults were measured. From this study, weight, height, BMI, WHR, hip circumference, waist circumference and age were significantly correlate with systolic blood pressure and diastolic blood pressure. But age was not significantly correlate with diastolic blood pressure. Factor analysis were performed based on food intake frequency of 31 food groups to identify the major four food groups. According to that, identified four major four food groups in both sexes, those are food group 1. food group 2, food group 3 and food group 4. Participants in the third quartile of food group 2 had 1.8 times more likely to increase the diastolic blood pressure than lowest quartile score of food group 2. As a conclusion high consumption of food group 2 (dhal, non- starchy vegetables, bread, sugar, milk rice) associated with increasing diastolic blood pressure among Kahatowita and Thihariya adults.

Keywords: Diastolic blood pressure; Dietary patterns; Hypertension; Systolic blood pressure

Correlates of the determinants of blood pressure among adults in Sri Lanka

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Blood pressure is the pressure of circulating blood against the walls of the arteries. Any conditions that dilate or contract the arteries or affect their elasticity, or any disease of the heart that interferes with its pumping power, affect the blood pressure. It can be low blood pressure or high blood pressure. Adults have high chance of getting elevated blood pressure, because of their lifestyle and behavioral patterns, and they are more chance of exposed to risk factors. Nearly one-third of the Sri Lankan adult population has high blood pressure. Recognizing risk factors of blood pressure among adults is important for preventive measures. The main objective of the study was to determine the association between blood pressure and determinants.

A cross sectional study was conducted using 185 subjects with the age range 20-60 years. General and food frequency questionnaires were used to collect information. Information regarding general, socio economic, environmental, lifestyle, and behavioral patterns were collected using general questionnaire. Dietary information was collected using food frequency questionnaire. Anthropometric measurements, namely height, weight, waist, and hip circumferences and systolic and diastolic blood pressure were obtained in this study. Statistical analysis was performed to find out the association between determinants and blood pressure. Anthropometric measurements such as height, weight, waist and hip circumferences and waist: hip ratio and gender had positively significant correlation with systolic and diastolic blood pressure. Age and alcohol consumption had positively significant correlation with systolic blood pressure, while smoking status had significant positive association with diastolic blood pressure. In females menopausal stage had positively significant correlation with systolic and diastolic blood pressure. When consider about menopausal stage compared with pre-menopausal stage post-menopausal stage had higher risk of getting high blood pressure in both systolic (OR 7.817) and diastolic blood pressure (OR 1.719). For the systolic blood pressure waist: hip ratios, age, alcohol consumption were identified as independent determinants. For the diastolic blood pressure pubertal age, menopausal stage, height was identified as independent variables. From principle component analysis, four major dietary patterns were identified, and associations between dietary patterns and risk of blood pressure were examined. Western dietary pattern had highly associated with increasing the risk of high blood pressure.

Keywords: Adults; Blood pressure; Principle component analysis

Factors influencing the food choices of preschool children in Kurunegala

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The double burden of malnutrition (under and over nutrition) in under five years of age is a significant public health issue in Sri Lanka. The etiology of malnutrition is complex. Unhealthy eating behaviors of children is an immediate causative factor to address the double burden of malnutrition. There is lack of evidence regarding the influence of individual, family and community factors on the development of eating behavior of preschool children in Sri Lanka. Understanding the factors shaping the eating behavior of preschool children will help inform effective healthy behaviors. The objectives of the study were to identify (1) the family and community factors influencing the eating behaviors (2) to identify the barriers to healthy eating and (3) to find out strategies that could be used to support healthy eating behaviors by parents of Sri Lankan preschool children. A qualitative study was conducted in twelve preschools in Kurunagala district. Focus group discussions were conducted for the parents of selected preschool children consisting of minimum of five mothers or a maximum of nine mothers. Questionnaires were used to collect information regarding least and most influencing factors on the food choices of preschool children and strategies which were used by the parents to improve healthy food choices and healthy eating behaviors among preschoolers. Partial nominal group technique was used to identify most and least influencing factors. The conversation were transcribed verbatim including questions, answers, and probes and the transcripts were analyzed by manual coding method.

In the current analysis, the most influencing factors on the food choices of preschool children were child preferences, nutritional knowledge and educational level of parents, family income and availability of food in home. Least influencing factors were gender, seasonal food items and the food cost. The most significant challenges in promoting healthy food choices were advertisements, grandparents and relations, aversion to some foods, neighborhood food accessibly. Strategies that were used by parents to promote healthy eating behaviors in children were rewarding for good food habits, restricting some foods, changing the cooking methods, avoid watching TV during the meal time and limit the pocket money.

Keywords: Eating behaviours; Food choices; Preschool children

Determination of adherence to dietary approaches by people in different stages of lifecycle in Northern and Eastern provinces of Sri Lanka

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Human life cycle can be in different stages; infants, young children, school children, adolescents, adults and elders. In Sri Lanka, dietary guidelines are available for each life stages to promote healthy diets and lifestyle. It is essential to evaluate the effectiveness of the guidelines to improve the nutritional status of the population. Inappropriate complementary feeding practices increase the risk of under-nutrition, illness and mortality in infants and children. Non-communicable diseases were estimated for 75% of deaths among adults in Sri Lanka. This study aims to assess the adherence to infant and young child feeding guidelines by mothers of infants and young children aged between 6 – 24 months and assess the adherence to food based dietary guidelines by healthy adults aged between 20-55 years.

A cross sectional study was conducted in Jaffna, Vavuniya, Batticaloa and Ampara districts. A total of 140 mothers and 150 adults were recruited for this study. A pre-tested interviewer administrated questionnaire was used to collect information on infant and young child feeding practices. Dietary intake of infants and young children was obtained from 24-hour dietary recalls. A food frequency questionnaire, includes 106 food items under several food groups were used to collect food consumption patterns of adults. According to the responses given by the subjects for the respective questionnaire, scoring method was used as 1 (for adherence) and 0 (for non-adherence). Subjects who got more than 50% of score considered as followers of respective guidelines and rest of them considered as non-followers. Descriptive analysis and SPSS version 16.0 was used for data analysis.

In the study population, mean age of the mothers was 31 (SD 3) years and mean age of the adults was 32 (SD 6) years. Majority of the mothers (96%) adhered to infant young child feeding guidelines and among them 65% of mothers adhered to 10 guidelines out of 17. Lowest adherence (2.9%) was for giving extra meal during illnesses. Less number (18%) of adults (male = 9.5% and female = 24.1%) adhered to food based dietary guidelines. Lowest adherence was obtained for guidelines on fruits and vegetables consumption. The study concluded that the necessity of awareness programs on dietary-guidelines for healthy living.

Keywords: Adults; Adherence; Dietary; Infants; Young children

Development of a healthy meal rating system for restaurants and eateries in Sri Lanka

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Non Communicable Diseases (NCDs) and foodborne illnesses may common among consumers who have meals more frequently from restaurants and eateries due to consumption of large portions of high calorie containing meals and follow improper hygienic, storage, food handling and preparation practices at the restaurants. Although other countries have established rating systems for restaurants and eateries that type of rating system is not available in Sri Lanka. Hence, this research was designed to develop a rating system to improve the quality and healthiness of meals at the restaurants and eateries.

The study was conducted under 3 phases. Available rating systems and considering rating criteria were gathered by searching literature and conducting a preliminary survey among the conveniently selected restaurants and eateries under the 1st phase. In the 2nd phase, a rating system was developed as a checklist with scores by considering the food handling and storage practices, food hygienic practices, food preparation methods and health and nutrition aspects of the meals provided by the restaurants and eateries. According to the total scores that achieved by restaurants for each aspects of the developed rating system, they were categorized as 1 star (160-175), 2 star (215-275) or 3 star (335-425). The developed rating system was name as "Healthy Meal Rating Guide" and presented as a booklet by including all the information. The draft version of the "Guide" was pretested by evaluating 10 restaurants to identify the drawbacks of the developed rating system and the final version was developed by addressing the feedbacks received from the pre-testing. Under the 3rd phase, 25 restaurants were evaluated/rated by using the developed "Healthy Meal Rating Guide".

Results showed that other countries have established rating systems for restaurant and eateries and they are based on hygienic, health aspects of meals and consumer satisfaction. Two rating systems available in Sri Lanka and they consider only hygienic and quality of the facilities in restaurants. The developed "Healthy Meal Rating System" has considered hygienic aspects, quality of the facilities as well as nutrition and health aspects of the meals. According to the developed Rating System 8% of restaurants were in 3-stars, 40% in 2-stars, 28% in 1-star and 24% were not eligible to rate under any star category. It can be concluded that the developed rating system for restaurant and eateries in Sri Lanka may be a useful guide to ensure the quality and healthiness of meals provided by restaurant and eateries for out-eaters in Sri Lanka.

Keywords: Eateries; Healthy meals; Outlets; Rating systems; Restaurants

Perceptions of a rural community on health and nutrition aspects of traditional and indigenous foods

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Indigenous and traditional plants have been the main source of food for many rural communities. Different communities have different perceptions and beliefs about the indigenous and traditional foods. A qualitative study was conducted to evaluate the perception of rural community on health and nutrition aspects of indigenous and traditional foods and to identify the most significant limitations and barriers of consumption of such foods. Focus group discussions and semi structured interviews were conducted in Monaragala and Siyambalanduwa divisional secretariat in Monaragala district. A total of 31key informants were invited to participate in the study. A focus group included a maximum of six members and the discussion were conducted for nearly thirty minutes in Sinhala language. All the data were transcribed to English and the transcriptions were analysed manually. Data were tabulated question-wise and focus group-wise. The villagers of the community understand the importance of consuming traditional and indigenous foods. They identified several barriers and limitations which prevent them consuming such foods and suggested various solutions for incorporating them as part of healthy diets. The present study demonstrated that making these foods available and accessible, making aware people about the health benefits and introduce new products using traditional and indigenous ingredients into the market will increase the consumption of such foods. Due to difficulties of finding the raw forms of these food and busy lifestyle coupled with longer preparatory time had caused a reduction in consumption of such foods. The study found that present consumption of traditional and indigenous foods was not practiced very much even in these rural areas due to inadequate resources, poor knowledge, and negative attitudes of the people. Based on the results obtained from this research the following recommendation can be proposed for the improvement of the traditional and indigenous food consumption. They are: promoting traditional and indigenous food in all around the country, proper nutrition awareness programs to aware new generation regarding the beneficial effects of such foods and promoting cultivation of traditional foods and indigenous foods in farmlands and home gardens.

Keywords: Perceptions; Traditional foods; Indigenous foods

Effects of dietary pattern on blood pressure of adults in Sri Lanka

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High blood pressure is an epidemic medical condition affecting one- third of Sri Lanka adults. The high disease-related mortality and economic burden associated with hypertension have prompted extensive scientific interest. Hypertension is a major public health burden since increased blood pressure contributes to cardiovascular and cerebrovascular endpoints, such as myocardial infarction, heart failure, cardiovascular death and stroke. The prevalence rate of hypertension increases with the age. There is a gap in statistical data related to the hypertension with dietary patterns of Sri Lankan population. Dietary pattern analysis has emerged as an alternative and complementary approach to examine the relationship between diet and the risk of chronic diseases. This study was aimed to address the association between blood pressure and dietary pattern and to identify the blood pressure prevalence among aged 20 to 60 years adults. A cross sectional study was conducted among 150 adults in Meemure, Pannala and Negambo areas during January 2018 to June 2018. A stratified, multi-staged probability sampling design was used. Blood pressure, anthropometric data were collected using the general questionnaire and statistical analysis was performed to find out the associations between selected determinants and blood pressure. The dietary patterns were collected from food frequency questionnaire. Four major dietary patterns were identified by using principal component analysis. Factor loading matrix was used to identify the dietary patterns of the population as food group 1, food group 2 and food group 3 and food group 4. Participants in quartile 3 and quartile 4 of food group 3, more like to increase DBPby 5.39 and 1.62 (95% C.I 0.156-24.231). The age has shown a significant association with high blood pressure. There were no significant association in systolic and diastolic blood pressure with income level, educational level, skipping meals and family history of hypertension, weight, height, body mass index, waist circumference. There was a significant association between the ages with systolic blood pressure and significant association between the hip circumference and the diastolic blood pressure and significant association in systolic and diastolic blood pressure with meal skipping. Weight and the BMI of the population have shown significant association with the blood pressure. High consumption of food group 3 (dried fish, fats & oil, fast foods, snacks and deserts) associated with increasing diastolic blood pressure among Sri Lankan adults.

Keywords: Blood pressure; Dietary pattern; Fast food; Hypertension; Principal component analysis

Effect of multicomponent intervention on diet quality and food behaviour among preschoolers

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Inadequate and unbalanced nutrition in childhood hinders growth and development of children to their optimum potential. Parents and their children are important target group to promote healthy eating behaviour among preschoolers through interventions. Majority of nutritional intervention studies have been developed to change dietary habits and healthy food knowledge of preschoolers. There were limited published studies to examine the impact of multicomponent intervention on dietary behaviour and food knowledge of preschoolers in Sri Lanka. Hence, the objective of the present study was to determine the impact of multicomponent intervention on diet quality, healthy food knowledge and preferences among preschoolers. An intervention study was carried out with conveniently selected 100 pairs of 3-5 y preschool children and their parents at Mawathagama in Kurunegala District. Data were collected before and after the intervention. Eating behaviour of children, food knowledge and preferences of children were collected. Food knowledge and preferences were collected through a digital photo pair activity. Their eating behaviour was studied using a self-administrated questionnaire completed by parents. Diet diversity score was obtained to evaluate the diet quality. Diet diversity score was constructed through the summation of the number of days that each of the nine food groups (rice, lentils, green leafy vegetables, yellow/orange fruits, eggs, fish, chicken, meat other than chicken and milk) was consumed in the previous week[2]. Results showed that a significant increase in healthy food knowledge and preferences after the intervention ($p = 0.000$). A significant difference was observed only for the fruit consumption ($p = 0.002$) among the healthy foods (rice, vegetables/pulses, milk, red meat, white meat, fish and egg). Salty snack consumption was significantly decreased ($p = 0.005$) among the unhealthy food choices (chips, short eats, sweets, soft drinks). After the intervention, percentages of children with low, average and high diet diversity score were increased and decreased, respectively. Overall diet quality of children was not significantly changed.The developed educational intervention is appropriate for changing food knowledge and preferences among preschoolers.

Keywords; Diet diversity score, Food knowledge, Food preferences, Food groups, Sri Lanka

Determination of the Factors Influencing Milk Consumption and Purchasing Behaviour of Urban Adults

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Milk and dairy foods are considered to be one of the main food groups important in a healthy balanced diet. Studies have shown that milk and dairy foods contribute to bone health and help to prevent cardiovascular diseases, high blood pressure, and Type 2 diabetes. Since the milk consumption of Sri Lankan community is in lower level, this study was conducted to determine the factors that influencing milk consumption and purchasing behaviour of urban adults in Sri Lanka. The study was carried out among customers who were purchasing their food from super-markets and retail shops located in urban areas; Maharagama, Homagama, Piliyandala, Horana, Panadura and Bandaragama. The data was collected by using an interviewer administrated questionnaire that has three sections namely personal information, milk consumption information, and milk purchasing information. Microsoft excel 2013 was used to data analysis and SPSS 20 was used to statistical analysis. The study sample consisted of 196 adult customers who purchased food from supermarkets and retail shops during the data collection period. The majority of the study sample was female (60.2%) and 58.2% of them monthly average income ranged from 20,000 LKR to 59,999 LKR. Per capita annual average milk consumption of the sample was 164 (SD 68.3) liters. The results showed that 38.2% of the sample consumed fresh milk while 61.8% consumed powdered milk. Out of the total 71.6% customers purchased milk from supermarket and 28.4% customers purchased milk from retail shops. Further, it showed that their milk purchasing depend on the brand of the milk products; 1.5% purchasing Anchor milk brand, 11.2% Pelwatte brand, 14.2% Maliban brand, 20.8% Ratti brand, 14.3% Highland brand, 8% other brands. The number of family members and the age of them also determined the milk consumption and purchasing behaviours of the sample. This study concluded, factors that influencing milk consumption of urban adults were monthly family income level ($p = 0.034$) and the place of milk purchasing ($p = 0.019$) and factors that influencing the milk purchasing behaviour of urban adults were number of family members ($p = 0.032$) and brand of the milk ($p = 0.036$). The findings of this study are important to identify the reasons of low consumption of milk among adults who are more vulnerable to bone disease and planning to interventions for improving the bone health among adult population as milk is good source of nutrients for healthy bones.

Keywords: Consumption; Milk; Purchasing behavior; Urban

Agreement between nutritional status and handgrip strength of lung and upper gastrointestinal cancer patients in Sri Lanka

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Malnutrition is a common burden in cancer. One from every five patients dies due to malnutrition rather than the malignancy. It increases patients' risk of complications, decreases tolerance to treatment and lowers quality of life with reduced survival. Therefore, early identification of malnutrition risk is important for better health outcomes. Hand Grip Strength (HGS) has been identified as an independent marker of early changes in muscle impairment characteristics to disease related malnutrition. It is a simple, cost effective and non-invasive screening method, well suited for Sri Lankan clinical setup. This study aims to evaluate the agreement between HGS and nutritional status of patients with lung and upper GI cancers. A cross sectional study was conducted with 102 cancer patients registered at oncology clinic in Kandy Teaching Hospital. The nutritional status was determined by Patient Generated Subjective Global Assessment (PGSGA) and HGS by handheld dynamometry. Correlation analysis between HGS and PGSGA scores, construction of receiver operating characteristic curve, and kappa evaluation were performed to evaluate the suitability of HGS in detecting undernutrition with reference to PG-SGA global classification. The study sample was composed with 86 upper gastrointestinal tract cancer patients and 16 lung cancer patients, between the age of 27 and 87 years. From total 81.3% were undernourished, including 67.6% moderately malnourished and 13.7% severely malnourished based on PG-SGA global classification. The actual HGS was in the range of 4 to 39kg while there was a significant difference ($P = 0.00$) between actual and predicted HGS of the participants. There was no significant difference between distributions of HGS in two selected cancer types. A statically significant moderate correlation was observed between HGS and mid upper arm circumference of the patients ($r = 0.5$) HGS and PGSGA scores were correlated ($r = 0.215$, $P < 0.05$) and statistically significant notable agreements were seen between HGS and classification for nutrition status by PGSGA assessment (AUC ROC = 0.845, kappa = 0.343). The results indicate that the HGS is a suitable malnutrition risk predictor in patients with lung and upper GI cancers.

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Keywords: Handgrip strength; Lung cancer; Muscle impairment; Nutritional status; Upper Gastrointestinal tract cancers

Dietary perceptions of type 2 diabetes mellitus individuals

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Diabetes mellitus (DM) is a rapidly growing health concern in Sri Lanka. Diet and physical activity are important modifiable risk factors for the incidence, severity and management of DM. Diet plays a major role in managing the DM through proper glycemic control. Dietary perceptions of DM impart significant effect on adhering to a proper dietary behavior. However, there are only limited number of studies have been conducted on their dietary perceptions. Therefore present study was conducted with the objective of assessing the dietary perceptions of type 2 individuals using qualitative research methods. Data were collected using 30 individual interviews of DM individuals attending Thambuththegama Base Hospital with a semi-structured questionnaire. All interviews were audio recorded and transcribed. Content analysis was performed using NVIVO (QSR International, VIC, Australia) software and themes and subthemes were derived.

Mean age of the DM individuals was 46.5 years (range 20 – 60 years). Average clinical duration of the DM was 4. 8 years (range 2-9 years). Majority (70%) of the study subjects perceived that they should follow a healthy dietary pattern to achieve the glycaemic control. Nearly 30% believed that changing dietary pattern is not important for the glycaemic control. A significant proportion (25%) of DM perceived the use of oral hypoglycaemic agents as main way of controlling the blood glucose level over the planned diet. Nearly 67% of DM perceived the importance of a controlled and planned diet whereas 13% only believed in decreasing the sugar intake to achieve glycaemic control. According to the DM, major barriers for adhering to a planned diet were lack of family support, low socio-economic status, lack of information on proper dietary practices, myths and food taboos and lack of motivation. Therefore, findings of the present study emphasize the importance of conducting awareness programs and education sessions for DM in their local setting in order to clarify their beliefs, taboos and myths and motivate them. Further, it highlights the urge for providing personalized nutrition care plan for DM to achieve the glycaemic control.

Keywords: Barriers; Diabetes mellitus; Dietary perceptions; Glycaemic control; Planned diet

Development of a new healthy eating index for measuring diet quality of Sri Lankan adults

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A high quality diet is associated with improved health and nutritional status whereas poor quality diet leads to malnutrition and related non-communicable diseases. Healthy Eating Index (HEI) is a simple summary measure developed to assess diet quality and the adherence to national dietary guidelines. Although the national dietary guidelines are available for Sri Lankan adults no studies have been conducted to assess the adherence to them. Therefore, current study was conducted to assess the adherence to national dietary guidelines by a group of adults and to develop a HEI for Sri Lankans.

Hundred and eight adults (age range, 18-75 years) living in Ragama area were recruited as subjects. Dietary data were collected using an interviewer administered food frequency questionnaire. Dietary data were analyzed using Foodbase 2000 software to obtain energy and nutrient intakes. Number of servings for each food group was also calculated. Food groups and nutrients intake data were used to measure adherence to national dietary guidelines and to derive the HEI scores. The new HEI was designed as a continuous scoring system comprising of 10 equally weighed components namely, cereals and equivalents, vegetables, fruits, animal protein(fish, meat) and pulses, milk, nuts, energy from saturated fats, energy from added sugar, sodium and dietary fiber resulting in maximum total score of 100.

Majority of subjects were over-consumers of cereals (63%) whereas as fruits (74%) and nuts (94%) being under-consumed. The mean healthy eating index score was 56.5. Mean component scores were less than 5.0 for grains, calories from saturated fats, sodium, dietary fiber and nuts. Further, 73.1% of subjects were in need for improvement (51-80) diet quality category while 26.9% of subjects were in poor (less than 51) category. Low diet quality and low dietary adherence to certain components in diet may be due to low levels of awareness, lack of proper eating habits and low purchasing ability. New HEI can capture diet quality though further modifications are needed. In conclusion, adherence to dietary guidelines for cereals, nuts, fruits, saturated fats should be improved and new HEI can be used to assess diet quality after further modifications.

Keywords: Dietary adherence; Dietary guidelines; Diet quality; Healthy eating index, Sri Lanka

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Relationship between nutritional status and quality of life in patients with cancer

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Cancer is the second leading cause of death globally and locally. High energy demand and reduction of food intake are the main reasons for cancer related malnutrition. Depleted nutritional status negatively affects patient's biochemical, physical and psychological functions and performance resulting in reduced Quality of Life (QoL). Cancer related malnutrition has the potential to involve into cancer cachexia which is the immediate cause of one in five of all cancer deaths. The present study aims to assess the nutritional status and quality of life of cancer patients to point out a relationship if any. A cross sectional study was conducted with 150 cancer patients at Kandy Teaching Hospital. Nutritional status of the patients was assessed by Patient Generated Subjective Global Assessment (PG-SGA) and the QoL was determined by European Organization for Research and Treatment for Cancer Quality of Life Questionnaire (EORTC-QLQ C30). The prevalence of malnutrition in the sample was 75% and the mean global QoL score was 42.5. A statistically significant inverse correlation was observed between the scores of PG-SGA and Global QoL ($r = -0.54$ and $p < 0.05$). Significant positive associations were seen between nutritional status and all domains of functional aspects in QoL namely physical, functional, emotional and cognitive ($p < 0.05$). Presence of symptoms such as nausea and vomiting, pain, dyspnea, insomnia, loss of appetite and constipation were negatively correlated with nutritional status of the patients ($p < 0.05$). Weight loss percentage, MUAC, hand grip strength and quality of life parameters (except social functions, diarrhea and financial difficulties) significantly associated with the nutritional categories of PG-SGA (Well nourished (A), moderately malnourished (B) and severely malnourished (C)). The identified relationships suggest the importance of strengthening nutritional care in oncology as a way to improve patients' QoL.

Authors wish to acknowledge the staff of oncology unit at Kandy Teaching Hospital for the assistance in patient recruitment.

Keywords: Nutritional status, Quality of life, Cancer malnutrition, Nutrition assessment, PG - SGA

Anthropometric, dietary and physical activity determinants of childhood blood pressure: A cross sectional study in urban Northern and Eastern provinces of Sri Lanka

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Children blood pressure has become a widely investigated topic. Elevated blood pressure is a well-known risk factor for cardiovascular disease. Children high blood pressure leads to the later life high blood pressure risk. Early identification of children at risk for high blood pressure is important to prevent serious complications. The aim of this study was to determine the contribution of genetic prenatal, behavioral, environmental and social determinants to blood pressure in children in urban settings. This is a community based cross sectional study, which included all children aged 8 to 10 years enrolled in 4 different schools in 3 districts and had the authorization of their parents/guardians, totaling 187 children. Inclusion criteria of the study were children must be in 8-10 years old and voluntary participants. Exclusion criteria was children who already diagnosed with high blood pressure. In the first evaluation, the child's family answered a questionnaire and food frequency questionnaire, and the child was submitted to anthropometric measurements and Blood pressure. Blood pressure, waist circumference, hip circumference, weight and height were measured through standardized techniques. They used to determine BMI, waist /hip ratio. General information gathered from the questionnaire and dietary assessments done by 24 hour recall and food frequency questionnaire. From this study Under the statistical analysis Physical activity, Birth weight, and Diet diversity score were significantly related to the systolic blood pressure and income was significantly related to the diastolic blood pressure. As expected the factors age, weight, height, BMI, and waist, hip circumference also played a significant role in systolic and diastolic blood pressure. Finally the BMI, weight, height, waist, and hip circumference, were directly associated with the increase in blood pressure values. DDS has positive and Physical activity has a negative significant association with systolic blood pressure values.Blood pressure distribution in children from our study population normal blood pressure children was high (80%).

Keywords: Determinants; Diastolic blood pressure; Diet diversity score; Prenatal; Systolic blood pressure

Perceptions and barriers related to diet and physical activity among women with Gestational Diabetes Mellitus: A qualitative study

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Gestational Diabetes mellitus (GDM) has now become a global priority. However, a careful combination of diet, physical activity, medications and self-monitoring of blood glucose is essential in management of GDM. Though perceptions on diet and physical activity among women with GDM and barriers greatly affect their glycaemic control, no studies have been conducted on their dietary and physical activity perceptions in Sri Lanka. Therefore, this study was aimed to explore dietary and physical activity perceptions of GDM individuals and to identify barriers and enablers for adhering to dietary and physical activity recommendations using a qualitative study.

Individual semi-structured interviews were conducted with 36 pregnant women diagnosed with GDM in their current pregnancy with their verbal consent. Data were thematically analyzed using Nvivo 12software (QSR International, VIC, Australia). Seven major themes were identified as perceived causes of GDM; possible management strategies, dietary management, management through physical activity, barriers, enablers and suggestions to manage GDM.

Majority of GDM women (53%) viewed diet as the most possible management strategy for GDM. They perceived that avoiding certain foods such as bakery products and encouraging certain foods such as red rice and green leaves may help them in achieving the glycaemic control. GDM women (39%) perceived that they get enough exercise from household chores and therefore additional exercises are not needed. Main barriers to adherence to diet were dislike over some foods (19%) and inability to prepare foods (11%) whereas key enablers were proper advice (53%), personal motivation (19%) and maternal health and baby's health (14%). Major barriers for physical activity were lack of time (17%), personal health problems (17%) and lack of motivation (11%) whereas proper advice (8%) and personal motivation (8%) were the main enablers.

Immediate adaption to dietary advice and lack of clear understanding on type, duration and frequency of physical activity has created challenges for women with GDM. This study provides an insight into the priorities for health care provision thus highlighted the need of individualized nutrition care plan for women with GDM.

Keywords: Barriers; Dietary management; Gestational diabetes mellitus; Glycaemic control; Physical activity

The association between eating behaviour and nutritional status of preschool children

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Malnutrition among preschoolers has become a significant public health issue in Sri Lanka. Nearly 20% of children under 5 years old were undernourished, whereas 1% was obese in Sri Lanka in year 2016. The energy and nutritional requirements are high since they are physically very active and have a higher rate of mental growth. If they are unable to fulfill their nutritional requirements they will be fallen into undernourished conditions. Dietary habits, educational level, socioeconomic factors, eating behaviors, infections and diseases are few factors those affect nutritional status of preschoolers. Eating behavior directly affect the nutritional status of preschoolers and there are many undesirable outcomes related to bad eating behaviors such as breakfast skipping, high sugar and sweetened beverages consumption etc. National prevalence of stunting, wasting, and underweight are 17%, 15%, and 21% respectively while in North Western province it is 11, 18.6 and 29% respectively. The present cross sectional study assessed the eating behaviors and nutritional status of preschoolers in urban and sub-urban areas in Kurunegala. Subjects were 146 preschoolers from Kurunegala and Mawathagama . CEBQ (child eating behaviors questionnaire) which consists 35 questions about the eating behaviors were given to parents and data were collected. In addition height, weight, and MUCA measurements were taken using Stediometer, Weighing scale, and MUCA Tape. WHO Anthro, 3.0.1 was used to analyze nutritional status. Total of 35 questions were divided into 8 eating behavior subscales as EF (Enjoyment of food), EOE (Emotional over eating), FR (Food responsiveness), DD (Desire to drink), SR (Satiety responsiveness) ,SE (Slowness in Eating) ,EUE (Emotional under eating), FF (Food fussiness) and these subscales were further divided as food avoidant, food approach and drinking approach . The highest mean score value was reported for SR subscale (18.17 ± 3.20). The second highest mean score value was reported for FF subscale (13.54 ± 2.32).which involved in food "avoidance category." Overall mean values of eating behaviors which involved in "food avoidance category" were greater than "food approach" and "drinking approach" eating behaviors. Overall stunting, wasting, and underweight prevalence in Kurunegala district were recorded as 16.43%, 75.3%, and 19.86% respectively. Male preschoolers showed a higher prevalence of above under nutrition problems than those of females. In conclusion there was a relationship between eating behaviour and nutritional status of preschoolers.

Keywords: Drinking approach; Food approach; Food avoidant; Preschoolers

Determinants associated with blood pressure distribution in urban adolescents – A cross-sectional school based study

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Elevated blood pressure is a serious health issue affecting more than 1 billion worldwide. Its etiologic process and risk behaviours start early during childhood and adolescence. It can be the foundation for later adulthood diseases such as stroke, cardiovascular and renal diseases. The determinants of high blood pressure have their association in different degree and contribute towards the large disparity of elevated blood pressure prevalence in adolescence. But the impact and health consequences of elevated blood pressure levels are far less concerned in adolescents. This study aimed to address the association between blood pressure and its determinants and to identify the blood pressure distribution among urban school adolescents.

A Cross-sectional school based study was conducted among 185 urban school adolescents. Information regarding general, prenatal, behavioural, environmental, social-economic, lifestyle and dietary patterns were obtained through pre-tested and self-administered general and food frequency questionnaires. Anthropometric measurements including height, weight, waist and hip circumferences and blood pressure measurement were taken during the study. Multivariate, stepwise multiple linear regression, principle component analysis and multi logistic regression analysis were done using SPSS 16.0 for statistical analysis. Majority were found to be with normal blood pressure. Increased anthropometric indicators, BMI, parental education, and income had positive significant association with both systolic and diastolic blood pressure. In addition Age, increased Birth weight and early puberty with systolic blood pressure and snacking with diastolic blood pressure had significant association. Overweight/ obesity increased the odds of elevated systolic and diastolic blood pressure by 9.8 and 15.6 times while waist circumference increased the odds by 1.09 and 1.08 times respectively. There was 1.9 times increased risk of elevated diastolic blood pressure in females. Hip circumference and gender were independently associated with diastolic blood pressure while it was hip circumference for systolic blood pressure. Higher consumption of processed meat products, fast foods and salty snacks was positively associated with higher risk of elevated blood pressure and had 5.487 and 4.549 times increased risk of developing elevated systolic and diastolic blood pressure respectively in urban school adolescents.

Keywords: Adolescence; Blood pressure; Diastolic; Obesity; Systolic

Pre-School Educational Intervention; the Impact on Healthy Food Knowledge and Preferences among Preschool Children

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The aim of this study was to develop an educational intervention to examine the healthy food knowledge and preferences of preschool children in urban area of Kurunegala. The subjects were 288 preschool children in the age between 4-5 y. Four educational strategies were used to develop the intervention program namely, introduction about food groups, a game, a colouring activity, and cutting and paste activity". Selected preschools were randomly divided into control group and intervention group. Individual groups were met for six weeks in one hour per day. None of programs were conducted to the control group. All subjects were faced initial and post data collection. The data of preschoolers were collected using specially developed digitized photo pair activity suitable for Sri Lankan context. Photo pair activity consisted two major topics “food knowledge and good food preference”. Eleven good and bad food pairs were used to collect data form preschoolers. The collected data was statistically analyzed by using Minitab 17 software. The difference on the food knowledge and food preference between intervention and control group was significant ($p < 0.05$). Both the knowledge and the food preference of the tested individuals showed a significant increment due to the intervention. That evidence showed a positive effect of the intervention program. However, this study was conducted in urban setting in Kurunegala. Therefore, further research is needed, with a demographically diversified sample, to validate the positive effect of the intervention program to use as a beneficial teaching strategy on pre- school nutrition.

Keywords: Digitize photo pair activity, Food preferences, Intervention progamme, Sri Lanka

Barriers and challenges of practicing school gardens as means of food and nutrition behavioural changes of children

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Effective use of school gardens in teaching food and nutrition curriculum and engagement of students in school garden related activities showed improvements in children's dietary behaviours. It helps children to learn beyond the classroom and to form a relationship with nature. The school garden is a place to entice students to participate, inspire parents, teachers and the community to connect. The present study was conducted to gain insight in implementation practices of school gardens and in perceptions of key members and children towards a school garden.

We conducted 18 focus groups discussion with 35 teachers and 65 children from grade eight to ten (13–15 y) in nine schools in educational zones of Giriulla in North Western Province and Tissamaharama in Southern Province. The interviews and focus group discussions were analyzed using NVivo 12 using thematic analysis. Ten themes were developed according to the teachers' responses and then a SWOT analysis was performed to interpret the results.

Teachers were in the view that school gardens were mainly initiated to involve children in nature, not to change food related behavioural changes. According to the results obtained from the study, participants were positive about having a school garden, experienced facilitating factors (e.g., adaptability of the garden, having a person responsible for the garden), but also face various barriers (e.g., difficulties with startup, not having adequate time for gardening, lack of funds, water shortages, no enough knowledge regarding the use and maintenance of garden, problem with wild animals, difficulties in maintenance during holidays and limited integration in the school curriculum). Participants suggested some solutions (e.g., incorporate the home garden related activities in the curriculum, assigning a permanent time period for school gardening, need to give guidance for the teachers about school gardening, need of monitoring school gardens by the authority, supplying water to the schools) and motivating factors for children (e.g., growing colorful plants). In conclusion, to have a positive impact on children's food behaviour, school gardening projects should address the current barriers and steps must be taken to overcome them. The present school gardens are not effective as perceived by the key stakeholders as a means of food and nutrition related behavioural changes.

Keywords: Focus groups discussion; Nutritional behavior; School garden

Developing healthy dietary menus for pre-dialysis patients with chronic kidney disease

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Chronic Kidney Disease (CKD) is defined as either renal damage or decreased renal function for three or more months. According to the World Health Organization (WHO) report of 2012, more than 15% of the population aged 15-70 years in the North-Central and Uva provinces are affected by CKD. Since nutrition plays a major role in management of CKD this study was conducted to develop healthy dietary menus for pre-dialysis CKD patients.

Initially, a preliminary survey was conducted at Teaching Hospital, Batticaloa to identify the food preferences, dietary patterns and nutrient intake of patients with CKD who were in pre-dialysis condition by using a pre-tested interviewer administered questionnaire and 24 hour dietary recall. In the next step dietary menus were planned for pre-dialysis patients. When developing the dietary menus, calorie and nutrient requirements were determined by referring the dietary guidelines of National Kidney Foundation, ESPEN guidelines and Renal Association guidelines for pre-dialysis patients. Dietary menus were developed incorporating appropriate foods with portions to full fill the dietary guidelines for pre-dialysis CKD patients.The major concerning nutrients for developing menus were calorie (30–35 kcal/kg/IBW/day), protein (0.75g/kg/IBW/day), fat (30% of calorie), sodium (1.8–2.5 g/day), potassium (1.5–2 g/day) and phosphorus (600–1000 mg/day). Developed dietary menus' nutrition composition was analysed by FoodBased 2000 software. After developing the menus they were compiled as a booklet and each menu was presented with total energy, carbohydrate, protein, fat, sodium and potassium levels of whole menu per day and portion sizes of each menu items.

Findings showed that all (30) patients were non-vegetarian, 56.7% of them preferred to eat animal based protein sources and their fruit and vegetable consumption varies. Although the mean intake of energy was lower than recommendations, sodium intake was within the recommendations for pre-dialysis CKD patients. The menus were developed by incorporating available and preference foods of the study sample. The menu booklet consisted of menus for 8 days and their energy ranged from 1700 to 2300 kcal/day. The amount of macro and micro nutrients in developed menus were tally with recommendations. The developed menus may be useful to slow the progress of kidney damage and maintain the nutritional status of patients.

Keywords: CKD; Pre-dialysis; Diet therapy; Dietary menus; FoodBase software

Anthropometric measurements and dietary patterns influence on blood pressure variability among rural school children

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The blood pressure is the force in the circulation that pushes blood around the body. All the cells in our body need a continuous supply of arterial blood, which carries oxygen and nutrients. High blood pressure is a major health problem in both developed and developing countries. Generally, high blood pressure is called a "silent killer". The rapid economic development, industrialization and lifestyle changes are major factors contribute to have increased the prevalence in both regions. Early identification of children at risk for elevated blood pressure is important to prevent serious complications in their later life. There are some of the risk factors contribute to develop the hypertension such as obesity, specially central obesity, diabetes, low levels of physical activity, psychosocial stress, excessive salt consumption, smoking, family history of hypertension and an unhealthy diet. The present study aimed to determine the distribution of blood pressure among the rural school children and determine the association between blood pressure and determinants including genetic, prenatal, behavioral, environmental and social in children in rural setting.

A cross-sectional study was carried out among 180 school children in the age group of 8 to 10 years in selected districts in Northern and eastern provinces. General information was collected from school children through a pre-tested questionnaire. Blood pressure, weight and height were measured during the study. The distributions of blood pressure by anthropometric characteristics were examined. Mean, standard deviation, chi square and correlation coefficient were used for statistical analysis using SPSS 16.0 software. High blood pressure was defined as systolic and/or diastolic blood pressure over the 95th percentile.Weight, Height, BMI, Hip Circumference, gender and skipping breakfast factors had a significant association with blood pressure. Higher intake of fast foods ($P < 0.05$) was found to have higher risk of increasing systolic blood pressure. The mean systolic and diastolic blood pressure were significant in the range of weight and BMI. Therefore, it is recommended that the children must be screened regularly for blood pressure to detect the prevalence so that remedial measure may be initiated as early as possible.

Keywords: Blood pressure; Children; Hypertension

Developing and introducing low-cost nutritionally balanced dietary menus for undergraduates

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A healthy body and fresh mind greatly help to create an educated and successful graduate. An unbalanced diet due to excessive or inadequate intake of calories and other nutrients is closely related to higher prevalence of nutritional issues. However, nutritionally balanced diets provide adequate energy, macro and micronutrients for healthy life. The objective of this study was to develop low-cost nutritionally balanced dietary menus for undergraduates.

A preliminary survey was conducted to identify food consumption patterns, current nutrient intake of undergraduates and identify commonly available low-cost foods. Data were collected by using a self-administered questionnaire, 24-hour dietary recall, direct observation, and market survey. Energy and nutrient requirement of the young adults were calculated. Whole-day meal planning for 10 days was done and menus for breakfast, lunch, dinner and snacks were developed by incorporating low-cost foods. Required amount of each cooked food portions were determined and prices of each menus were calculated. Nutrient compositions of menus were determined by using FoodBase 2000 software. Developed dietary menus were compiled in booklet and it was evaluated by undergraduates.

Although the majority of the students obtained their meals from the University canteen 64% of them do not satisfy with the foods in the canteen. However, 88% of the students satisfied with the prices of foods in the canteen. While the mean intake of energy; 1679.93 (SD 506.27) Kcal and protein; 45.29 (SD 17.17) gwere less than RDA, mean intake of carbohydrate280.77 (SD 68.66) g was higher than the RDA. The nutrient composition of developed menus for 10 whole days confirmed that all the menus were nutritionally balanced. The average prices of developed breakfast, lunch, dinner and snacks menus were 45, 60, 57 and 24 LKR respectively. The menu booklet consisted of developedmenus, photographs, prices and nutrient composition. The students who evaluated the developed menus (booklet), accepted developed menus in the terms of prices and foods in the menus. If the University canteen could provide meals according to the developed menus, itmay be helpful to uplift the nutritional status of the undergraduates.

Keywords: Dietary menus; Low-cost; Meal planning; Nutritionally-balanced; Undergraduates

The association between physical activity and quality of life among breast cancer survivors of Sri Lanka

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Breast cancer (BC) is the most prevalent type of cancer among women throughout the world and in Sri Lanka. The number of women living with the disease increases every year, creating a growing interest in the quality of life (QoL) of BC survivors. Physical activity helps to prevent heart disease, type 2 diabetes and bone weakening (osteoporosis) and enhances the QoL of the BC cancer survivors. Bone weakening results in reduced physical activity as well as low QoL. The aim of this study is to assess the association between physical activity and quality of life (QoL) in BC survivors.

A cross-sectional study was conducted with 116 BC survivors aged 21-60 years registered at Kandy Teaching Hospital. The QoL was assessed by European Organization for Research and Treatment of Cancer quality of Life Questionnaire (EORTC – QLQ Core 30) and engagement in physical activity was tested using and International Physical Activity Questionnaire - Short version. The association between QoL and physical activity was examined by using non parametric – Kruskal-Wallis test. BC survivors in high physical activity group were more likely to have significantly higher scores for role functioning and social functioning and lower scores for symptoms such as nausea/vomiting, appetite loss, constipation and diarrhea compared to the survivors in low physical activity group ($p < 0.05$). Level of physical activity of BC survivors are not influenced by other factors such as demographic, lifestyle and nutritional status. Most of the BC survivors who use Tamoxifen has reported increased risk of bone fractures. It can be concluded that BC survivors with high physical active level experience high level of QoL than the sedentary survivors.

Acknowledgment: Authors wish to acknowledge the staff of oncology unit at Kandy teaching Hospital for the assistance in patient recruitment.

Keywords: Breast Cancer; Breast cancer survivors; Physical Activity; Quality of Life Questionnaire; Quality of Life.

Dietary practices and nutritional status of undergraduates in Wayamba University of Sri Lanka

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The University students face a lot of challenges for academic works and maintaining healthy eating behaviours in this new environment. The inappropriate eating behaviours among University students may deteriorate their nutritional status. Therefore, this cross sectional study was conducted to determine the dietary practices and nutritional status of undergraduates and find out the association between them.

A multi stratified random sampling technique was applied to select the study sample. The data collection was done by using a self-administered questionnaire, a food frequency questionnaire and anthropometric measurements; (height & weight). The Body Mass Index (BMI) was calculated to assess nutritional status. According to the food consumption frequency the study sample was categorised as high consumers; daily / six days per week, medium consumers; one to five days per week and low consumers; one to three days per month/ really. Statistical analyses were performed by using SPSS version 16.0.

The study sample consisted of 250 undergraduates; Female (171), Male (79). Out of the total 95.2% of students were following non vegetarian dietary pattern. Nearly one fifth (19.6%) of the sample skipped their breakfast. However, nobody skipped their lunch or dinner. Almost all consumed rice daily. Out of the total 91.6% had vegetables daily while 61.2% of students consumed green leafy vegetables daily. Out of the total 86.4% of undergraduates consumed fruits 1 or 2 days per week. The half of the study sample consumed meat/ fish/ or eggs 3 to 5 days per week. The results showed that 44.8%, 24.4%, 16.4%, and 14.4% of undergraduates were in normal, overweight, obese and underweight nutritional status respectively. Further, it showed a trend of increasing obesity from 1st year to 4th year students. There was a positive association between high frequent consumption of wheat flour based foods, sweets, desserts, fast foods, fruit drinks, soft drinks, carbonated beverages, fish, meat and obesity. Since undesirable nutritional status of the sample associated with inappropriate dietary practices nutritional awareness programmes should be conducted for the undergraduates.

Keywords: Dietary practices; Food; Nutritional status; Undergraduates

Usage of herbal teas among the patients suffering from non-communicable diseases in Sri Lanka

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The epidemic of non-communicable diseases (NCDs) has become a serious economic as well as public health issue. There has been a concurrent rise in the usage of herbal teas to manage NCDs due to their natural origin, common availability and lesser side effects. NCDs including heart disease, stroke, cancer, diabetes and chronic lung disease, are collectively responsible for almost 70% of all deaths worldwide. Herbal teas are popular due to the lack or less quantity of caffeine and there are a number of natural herbal teas in Sri Lanka[2]. The aim of the present study was to determine the usage of herbal teas among the patients suffering from NCDs. A community based cross sectional study was designed to determine the usage of herbal teas in the management of NCDs among the patients. Subjects (350) were recruited from eight districts in Northern and Eastern provinces. The data were collected using an interviewer administered questionnaire. Pregnant mothers and bed headed patients were excluded from the study. There were seven types of NCDs including type 2 diabetes mellitus, hypertension, hyper-cholesterolemia, heart diseases and cardiovascular diseases, cancer, chronic kidney diseases and chronic respiratory diseases wee reported. The results showed that 14 types of herbal teas were commonly used by the study group. Usage of herbal teas was high in Vavuniya and it was low in Ampara within the selected eight districts. The percentage of population known about herbal teas among the patients suffering from NCDs was 38.2% and actual usage of herbal teas was 15.2%. The ethnicity and religion showed strong and positive association with usage of herbal teas whereas the family income and educational level showed a negative association. Frequent use of herbal teas was seen in high income families. In conclusion, further studies are warranted to find out different types of herbal teas used by populations in Sri Lanka.

Keywords: Family income; Herbal teas; Non-communicable diseases; Interviewer administered

Assessment of dietary Intake and breakfast of preschool children in Kurunegala area

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Early childhood malnutrition is becoming a crucial problem of the world that adversely affecting the growth of nations and children. Preschool age is one of the important stages of the human life cycle. During preschool age, they show a slow growth rate and less appetite. During this age they will undergo a rapid cognitive development, therefore malnutrition causes serious impact on growth and development. They are the one of the vulnerable groups who have the high demand for the nutrients. In Sri Lanka, several studies conducted to assess the preschool children's nutritional status and factors affecting their nutritional problems. But there are few studies conducted to assess the preschooler's diet. Hence, the main objective of this study was to assess dietary intake and breakfast habits of preschoolers and to determine the association between frequencies of intakes of food groups and socio-demographic factors.

A cross sectional study was conducted to assess dietary intake of preschool children. A convenient sample of 130 preschool children from Kurunegala area and 85 preschool children from Mawathagama area were selected from 16 preschools. A self-administrated questionnaire, dietary intake using five-day breakfast recall, usual consumption of snack recall, simple food frequency questionnaire were used to collect data from parents or caretakers of preschool children.

In the study sample, 55% of preschool children were males and according to the race of preschool children 58% were Sinhalese, 36% were Muslims and 5% were Tamils. In this study, the respondents were mothers (83%), fathers (15%) and the other care takers (2%). The results showed that 89.8% of preschool children consumed starchy foods for their breakfast and 46.8% consumed legumes. The mean intake of rice and vegetables were 2.5 and 1.1 servings, respectively. The mean intake for the lean meat and milk were 1.8 servings and 1.5 servings, respectively. The study found that there was no significant association between vegetable consumption frequencies and gender, but there was an association between meat consumption and ethnicity. Muslim children ate more meat than other ethnic groups. The mean Food Variety Score for the breakfast was 2.8; the most common snack was biscuits (89% of total preschool children). The study concluded that preschool children consume enough serving of major food groups for their breakfast and other meal times. There was a difference in food habits among different ethnic groups.

Keywords: Breakfast; Dietary intake; Malnutrition; Preschool children; Snacks

Obesity perceptions of youngobese individuals in Wayamba University of Sri Lanka

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Obesity has now become a global epidemic. Increasing trend of overweight and obesity is one of the most serious public health concerns among young adults. Lifestyle modification through planned diet and increased physical activities are used in obesity management. Assessment of perceptions on obesity and its management has not been adequately studied. Therefore, present study was conducted with the objective of assessing the perceptions on obesity and lifestyle management of obesity in a sample of obese young adults of Wayamba University of Sri Lanka.

A descriptive qualitative study was conducted with a sample of 30 obese young adults in the age range of 22-25 years. Six focus group discussions were steered with semi-structured questionnaire until the data saturation achieved. All the discussions were conducted in their native language and transcribed verbatim. Themes and subthemes were derived using the Nvivo Software (QSR International, VIC, Australia).

Nearly 33% of the young adults did not know that they were obese by their current body weight whereas 54% of them were unaware about the BMI concept. However, majority (83%) of them were unhappy about their current body weight and shape. As well as 60% of them had physical and psychological concerns due to protruded belly and abdominal obesity. Dietary modifications (53%) and engaging in physical activities (80%) were perceived as effective obesity management strategies. According to their view, increased consumption of fruits and vegetables, reduced consumption of fast and junk foods, drinking plenty of water and receiving nutrition advices are better dietary management options. Also they needed to engage with exercises by using proper diet plan for keeping their better mood and activeness. However, time and limited availability of nutritious food items were major barriers and they needed to engage more time with sports and exercises to burn fats. Ensuring the continuous access to nutritious food, motivation to go for healthy dietary options and engaging in physical activities are the major suggestions to overcome the obesity. Further this study highlights the urge of creating the awareness among the young adults on obesity and its management.

Keywords: Diet; Obesity; Perceptions; Physical activity; Young adults

Obesity perceptions of obese housewives

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Prevalence of obesity has reached epidemic proportions worldwide. Obesity is one of the major public health concerns in Sri Lanka. Current obesity prevalence data suggests a definite upward trend. Lifestyle modifications through planned diet and engaging in physical activities are the key for the obesity management. However, studies on perceptions on obesity and obesity management via diet and physical activities of the women are scare. Therefore, the current study was conducted with the objective of assessing the obesity perceptions and dietary and physical activity perceptions of obese housewives.

A descriptive qualitative study conducted using individual interviews with the use of semi-structured questionnaire. BMI (body mass index), waist and hip circumferences were used as obesity parameters of participants. Interviews were steered with purposely selected obese housewives aged 25–50 years living in Pannala area. All the interviews were conducted in participants' native language and transcribed verbatim. Data were analyzed using Nvivo software and themes and subthemes were derived.

As stated by the participants, only 23% of them were aware about their obesity condition according to the BMI. Nearly 30% of women were aware about the central obesity condition. Genetics, surgeries, birth control methods, multiple pregnancies and unhealthy diet are perceived causes of obesity among housewives. Majority believed that diet (83%) and physical activity (86%) has an impact on obesity. Majority (71%) of them has faced difficulties with their day to day activities due to the obesity condition. As perceived by them adopting a healthy diet, engaging in more physical activities and dieting in the night were the strategies of obesity management. However, the stated barriers for obesity management were lack of time, lack of motivation and less interest. Inconvenience in continuing a diet plan, impact of family members, limited time to do exercises, less interest in losing body weight and physical inconveniences following the exercises were the barriers related to dietary management and engaged in physical activities. However obese women suggested dieting in the night, jogging, and gardening for the obesity management strategies. Findings of the current studies highlighted the lack of awareness about their current obesity condition, role of diet and physical activities on obesity management thus urge of initiating awareness and education programmes is emphasized.

Keywords: Diet; Housewives; Obesity; Perceptions; Physical activities

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The relationship between microbial rennet concentration and curd development in cheddar cheese

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Cheese has been made in most cultures since ancient times which is the generic name for the diverse group of fermented dairy products in the world. Due to the action of rennet liquid milk is converted into a gel form. There are two distinct phases in rennet coagulation of which the first one is enzymatic and the second is non-enzymatic. During the first phase casein is converted into para casein and glycomacropeptide. In the secondary phase non-enzymatic precipitation occurs on para casein by calcium ions. These calcium ions are responsible to make lattice structure in curd. The purpose of this study was to develop a relationship between microbial rennet concentration and curd development time in cheddar cheese. Cheddar cheese samples were made by using cow milk bought from Makandura milk collecting center. Milk was pasteurized (72°C for 15 seconds) immediately after taking in to the laboratory and temperature was reduced to 31°C followed by add $CaCl_2$, starter culture and color respectively and kept for 40 minutes. Microbial rennet in different concentrations were added and curd development time was recorded accordingly. After the curd was cut into small pieces and cooked by increasing temperature upto 40°C within 40 minutes. After cooking, cheddaring was done and cheese was cut into small pieces and added salt and pressed for 6 hours and kept for ripening. pH variation during the process and weight of cheese after final pressing were recorded for each sample. After 2 months of maturation titratable acidity and pH of the cheddar samples were evaluated and proximate analysis was conducted to determine the moisture, protein, fat and ash content in every cheese samples. There was a linear relationship between microbial rennet concentration and curd development time that when the rennet concentration was increasing, the curd development time was reducing accordingly. $Y = -279.95X + 74.096$ was the formula for the both parameters and there was 0.8499 regression which gave more linearity. During the production process of cheese, the pH was decreased with the time. The highest cheese weight was 344g which made using 0.075 g/L of milk rennet concentration. It fulfilled the requirement that giving the highest cheese yield with minimum casein loss and curd was set before an hour. In the proximate analysis for moisture, protein, fat and ash were ranging 30.06 – 40.84%, 21.42 – 25.88%, 26.48 – 32.41% and 3.54 – 4.99%. Therefore, according to the study it can be concluded that there is a linear relationship between microbial rennet concentration and curd development in cheddar cheese and the optimum combination of both parameters were 0.075 g/L of milk rennet concentration with 50 minute curd setting time in local conditions.

Keywords: Cheddar cheese; Curd development; Microbial rennet

Prevalence and antibiotic resistance of Escherichia coli in chicken meat in selected areas of Kurunegala district

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Development and spread of antibiotic resistant*E. coli* have become a significant health concern requiring unprecedented global coordination in antibiotic usage to avoid dreadful setbacks in medical and societal developments. This study was conducted to determine the prevalence and antibiotic resistance of*E. coli* in chicken meat and edible internal organs at retail and supermarkets in selected areas of Kurunegala district. A total of 50 samples consisting of chicken meat (n = 26) and internal organs (n = 24) were collected from supermarkets (n = 25) and retail shops (n = 25) located in Alawwa, Boyagane, Dambadeniya, Giriulla, Hettipola, Kappatiwalana, Kuliyapitiya, Kurunegala, Makadura, Mawathagama, Pannala, Polgahawela and Sadalankawa areas. Quantification of *E. coli* was conducted using the MostProbableNumber (MPN) method and antimicrobial susceptibilities of the *E. coli*isolates to ten common antimicrobial agents were determined by the Kirby-Bauer disc diffusion method. The overall prevalence of *E. coli* in collected samples was 72%. The contamination of *E. coli* at the retail level (76%) was higher than the supermarket level (68%). The prevalence of *E. coli* in chicken meat and edible organs was 69.23% and 75%, respectively. However, there was no significant difference between the mean *E. coli* levels in retail shops and supermarkets as well as chicken meat and edible organs according to the statistical analysis of t test ($p \leq 0.05$). The highest amount of *E. coli* contamination was obsereved in retail meat (20%) and the lowest *E. coli* contamination was shown by super market meat (16%).The MPN values of *E. coli* in the samples ranged from < 3/MPN g to > 1100/MPN g. A high percentage of collected *E. coli* isolates were resistant to erythromycin (82.35%),amoxicillin (70.58%), ampicillin (66.67%) and tetracycline (64.71%). Lower resistivities were exhibited by gentamicin (3.92%), cefalexin (9.81%) and ceftazidime (11.76%). All*E. coli* isolates exhibited 8 different antibiotic resistant patterns with Multiple Antimicrobial Resistance (MAR) index ranging from 0.1 to 0.8. Most of the isolates (27%) showed resistance to 5 antibiotics with 0.5 MAR index while the lowest number of isolates (6%) showed 0.8 MAR index. Seventy six percent of the isolates were resistant to the three or more antimicrobials and demonstrated the Multi-Drug Resistance. The present study indicates the potential public health risk associated with the chicken meat and organs in Kurunegala district. Hence stringent surveillance, regulatory measures, and appropriate interventions are required to minimise*E. coli* contamination and prudent antibiotic usage that can ensure consumer safety.

Keywords: Antibiotic resistance; Chicken meat; *Escherichia coli*; marketing

A cow- friendly method to orally administer a milk booster and the evaluation of efficacy of the Milk booster on milk yield, fat and solid-non-fat

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Maximizing milk yield by meeting the cow's nutrient requirement is the aim of feeding regimen for dairy cows(1). Minerals make up a small portion of the diet but have a major functional role. Although, the basal diet contains minerals, it is inadequate for high producing dairy cows. Mineral requirement of an animal is highly dependent on its physiological state.

The oral administration of mineral supplements is an important aspect because the proper dose may not be made available to the cow if the preparation is not palatable to the animal. Therefore, this study was conducted to evaluate the level of "voluntary acceptance" of milk booster (mineral supplement) offered in different forms to dairy cows and to determine the effect of it on milk yield, fat and SNF content.

The voluntary acceptance was examined by offering the milk booster in the forms of a block, paste, gel and powder and it was found that cows preferred the solid block form of the milk booster. The effect of the milk booster on milk yield and quality parameters was determined by feeding the milk booster to milking cows (n = 12) for two weeks. Lactating stage, milk yield, body condition scores were taken into consideration when cows were assigned to treatment and control groups. Milk yield was pre measured before offering milk booster. Milk yield, Fat%, SNF% were measured and tested. There was a significant increase in the milk yield in the treatment group however, Fat%, SNF% were not significantly different ($P > 0.05$). Therefore, it was concluded that the milk booster prepared in solid block form was accepted by dairy cows and it had a significant impact on the milk yield of the cow.

Keywords: Palatability; Milk booster; Milk yield; Fat; Solid- nonfat

Changes of sensory attributes during Cheddar cheese maturation

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Cheddar cheese is an important food commodity and it is produced by acidification and concentration of milk following gel formation with rennet, starter cultures. Textural and sensory characteristics of Cheddar cheese are affected, among other variable,by the rate and extent of proteolysis during ripening. Cheddar cheese flavour and texture are composite and complex phenomena that vary wide ly with origin, age,and composition. The purpose of this study was to evaluate sensory attributes, color and texture changes with cheddar cheese maturation. Cheddar cheese samples were made by using cow milk bought from Makandura milk collecting center. Milk was pasteurized (72°C for 15 seconds) immediately after taking into the laboratory and temperature was reduced to 31°CfollowedbyaddingCaCl$_2$, starter culture and color respectively and kept for 40 minutes. Microbial rennet was added and after one hourcurd was cutin to small pieces and cooked by increasing temperature upto 40°C within 40 minutes. After cooking, cheddaring was done and cheese was cut into small pieces and added with salt and pressed for 6 hours and kept for ripening. Four cheddar cheese samples were made with four different maturation periods (2 weeks, 4 weeks, 6 weeks, and 8 weeks). Sensory evaluation was conducted using 30 untrained panelists and pH and titratable acidity were evaluated in each sample. The fat, protein, moisture and ash contents were estimated. Results obtained were statistically analyzed to assess sensory changes during Cheddar cheese maturation.

The sensory evaluation scores for color, aroma, and consistency were the highest in cheese sample with six week of maturation time and taste and overall acceptabilitywerehighestinthe cheese sample of eight week maturation time. Bitterness was highest in cheese sample of two week maturation and lowest in sample of eight week maturation. pH was highest and titratable acidity were lowest in the sample of two week maturation and pH was lowest and acidity was highest in the sample of eight weeks maturation. On the basis of statistical evaluation, it was found that there is gradual decrease in pH and gradual increase in titratable acidity during ripening. According to the mean values of protein, fat, moisture and ash were 23.06% ± 0.28, 32.19% ±0.71,35.68% ±0.23 and 4.37%±0.18 respectively. Therefore,basedonthisstudyit can be concluded that with aging, consumer preference and acceptability were increased and bitterness was reduced in Cheddarcheese.

Keywords: Cheddar cheese; Maturation; Titratable acidity

Prevalence of livestock and poultry disease outbreak pattern in Batticaloa district

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The livestock and poultry sectorscontribute to food production in Sri Lanka next to agriculture. Livestock sub-sector contributes 0.6% to the National Gross Domestic Production (GDP)[1].While several factorsare affecting on animal production, animal diseasesare one of thehuge threatsto animal productionindustry in Sri Lanka. To obtain the disease outbreak patterns, the study was conducted in 15 veterinary range offices in Batticaloa district. Secondary data were collected using questionnaires for cattle, buffalo, goat and poultry. Number of cases and deaths were recorded for 2016 and 2017. Data were analyzed by Microsoft excel 2013. Disease outbreak pattern was identified in Batticaloa district for major livestock and poultry diseases. Helimthiasisshowed the major incidence in cattle and buffaloes. Cattle disease outbreaks were recorded than buffalo disease outbreaks. Cattle diseases were recorded in Kokkaddichloai, and Karadiyanaru veterinary regions. Buffalo disease were recorded Kokkaddicholai and vaharai veterinary region.Goat disease outbreaks observed atKokkaddicholai, Karadiyanaru, and Thumbankerny in higher numbers. Poultry diseases were observed in Kokkaddicholai, Kattankudy and Vavunathivu. Kokkaddicholai was observed as a disease prevalentarea, which had cattle, buffalo, goat, and poultry diseases in highest level.The outbreak pattern showed higher cases and deaths in November and December period because of heavy rainy period in Sri Lanka.The frequency of animal diseases varied with seasonal changes and pathogen availability.In order to reduce the disease related loss in animal sector; vaccination programmes, establishment of veterinary hospitals, awareness and supervision of farms have to be done.

Keywords: Baticalao; Disease outbreaks; Mastitis; Paramphistomiasis; Newcastle Disease; Colibacillosis; Coccidiosis; Ephemeral Fever; Helminthiasis.

Performance evaluation of artificial insemination over natural service of pigsin selected farms of Sri Lanka

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Production rates and consumption demands for pig meat are continuously increasing worldwide and for that reason production must be sustainable and highly efficient in a livestock-compatible environment[1]. The pig is the most rapidly reproducing animal among domestic mammals. Pigs are extremely prolific and maturity comes early. Hence, it is very suitable for rapid improvement through the use of artificial insemination (AI)[2]. AI is a technique in which semen with live sperms is collected from the male and introduced into the female reproductive tract at the proper time with the help of instruments under hygienic conditions that results in the formation of a normal offspring. All over the world, AI has helped to improve the reproduction and genetic use of farm animals. With intensive swine production, there is now a need to increase the genetic potential of swine through AI. In Sri Lanka, pig holdings are small scale with approximately five to ten sows per farm. Typically, this type of farm lack boars for serving and when the sows are in estrous, a boar is leased from a neighboring farm. AI is now widely accepted as the primary breeding technique for medium and large farms.The objective of the study was to evaluate the conception rate, litter size, birth weight and weaning percentage of piglets following AI with chilled semen and compare with natural service (NS).The study was carried out at DON BOSCO farm in Kotadeniyawa and Horrakelle NLDB farm. Data were collected under 4 parameters; conception rate (success rate), birth weight, litter size, and weaning percentage. Sows bred by AI (n = 60) were inseminated twice per estrus by trained inseminator. Further, 60 sows were mated by NS using boars. In this study, litter size (P = 0.01) and birth weight (P = 0.001) of piglets were higher for AI than NS. The insemination method did not show any significant effect on conception rate (P = 0.20) and weaning percentage of piglets (P = 0.43).In Sri Lankan conditions both artificial insemination and natural service can be used in the swine industry. Both of the methods did not show a difference in conception rate and weaning percentage of piglets, but AI gave higher litter size and a high birth weight of piglets.

Keywords; Artificial Insemination; Natural service; Genetic; Swine industry

The relationship between body condition score and milk production in dairy cows

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In Sri Lanka, livestock sector recorded 8.0 percent growth during 2015 with 0.6 percent contribution to national GDP. Eventhough, Sri Lanka is not self sufficient to meet the local demand, import of milk and milk products were increased by 22% during 2015, when compared to 2014. Milk is a complete food and it is a good source of essential nutrients including the most needed minerals and vitamins. Milk being one of the major constituents of the diet of infants, children as well as adults, its demand increases with population. Per capita consumption of milk was 48.56L per annum in 2015(1).

Body condition scoring(BCS) system is a subjective method of analyzing energy that stored in adipose tissues and muscles of live animals, which can be used as a tool to measure the implementation of proper management practices. Proper management of BCS during lactation of the animal helps to optimize milk production as well as to minimize health and reproductive disorders (2). This study aimed at finding the relationship between BCS and milk production in dairy cows, through which better management practices are expected to be recommended. This study was carried out onselected farms which run under "Forsight" project in Nuwara-Eliya, Vavuniya, Matale and Kurunegala districts. The selection of farms under this program helped to avoid the effects of variabilities such as breed, age, and management practices in this study. A detailed questionnaire was used to collect data regarding milk production, mean BCS, reproductive problems, disease outbreaks and feed management and those data were analyzed with SPSS 16.0 software. All the animals in selected farms were in the optimum range of BCS. The P value of regression test was 0.913, which was higher than significant P value (0.05). The tested R square value was -0.03 which was negligible. Therefore, there was no significant relationship in between mean BCS and mean milk production in dairy cows. But, better management of BCS during lactation helps to monitor management practices as well as optimize animals' productivity in subsequent ways.

Keywords: Body Condition Score (BCS); Relationship; Milk production

Availability of phosphate in heat treated Eppawala Rock Phosphate

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Phosphorus is used as a major macro mineral in animal feed formulation as it has long been considered much important to provide an adequate safety level of this mineral, because of the high demand for required skeletal development, metabolic reactions and, requirement for feed utilization, necessity for building muscle tissue and egg shell formation, importance in energy metabolism and, component and activator of many enzymes[1]. Deficiency of phosphorus can result in inadequate bone mineralization, retarded growthand cage layer fatigue in laying hens. Inorganic phosphorus addition has become important in animal diets as many cereal grains contain phytate phosphorus which are not available for monogastricanimals. Chemically processed phosphates are used majorly in animal feed formulation. Dicalcium phosphates, mono calcium phosphates, mono sodium phosphates and defluorinated phosphates are such chemically processed feed phosphates. Dicalcium phosphate is the major feed phosphate used in the country which is imported to Sri Lanka at high prices.Defluorinated phosphates are produced using rock phosphate. Eppawala Rock Phosphate ($3Ca_3(PO_4)_3.Ca(F,Cl)_2$) is the cheapest phosphorus source in Sri Lanaka with nearly 36% P_2O_5 content[2]. Its less solubility and high fluorine content makes Eppawala Rock Phosphate unsuitable in animal feed. This study was aimed to produce a feed grade phosphorus source using Eppawala Rock Phosphate and to evaluate its suitability in animal feed.Commercial Eppawala Rock Phosphate samples were applied with two treatments and one sample was used as control. 30% and 25% sodium carbonate levels were used in 6g Eppawala Rock phosphate samples along with 2.2ml 54% phosphoric acid. Sample mixtures were calcinized at 1150^0C for 3 hours after 24 hours from mixing. The heat treated samples were tested for water solubility, 2% citric acid solubility and 0.1M HCL solubility using UV Visible spectrophotometry under 460nm for phosphate concentration followed by a calculation. The solubility values were compared with values of the control and Dicalcium phosphate. Water solubility was not significantly affected by the two treatments($p > 0.05$). Citric acid and HCL solubility increased with both treatments in heat treated Eppawala Rock Phosphate ($p < 0.05$)and samples applied with 30% sodium carbonate showedthe highest solubility. Both P solubilities in 0.1M HCl and 2% citric acid of 30% Na_2CO_3 treatment has nearly reached the P solubility values of Dicalcium phosphate. It can be suggested that application of Eppawala Rock Phosphate treated with 30% Na_2CO_3 can be added in animal feed as an inorganic source of phosphorus.

Keywords : Defluorination; Eppawala Rock Phosphate; Solubility

Development of a chicken jerky as a regular snack

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Chicken Jerky is a protein-rich dehydrated meat product which could be kept without refrigeration. A survey was conducted in three different districts in Sri Lanka namely, Colombo, Kalutara and Kurunegala to study the consumer preferences, choices, and consumption patterns of meat type snack foods ($n = 100$). From the study, it was found that 54% of the consumers were concerned about the amount of protein in snack foods. The most preferred meat type among the consumers was chicken (96%). Quality changes of chicken jerky with different physical forms, filling agents and meat parts; minced breast, whole muscle breast, thigh 20% and Breast 80 %, Coconut flour 20% + minced breast and boneless meat were evaluated using the same spicy recipe. All samples prepared from minced chicken breast had the highest consumer acceptability in all sensory attributes (taste, color, mouth feel, aroma, springiness, texture and overall acceptance) and the compositional analysis also suggested that the minced breast sample had the highest protein content; 46.30% S.D.; 0.54 and the lowest fat content; 2.01%, S.D.; 0.49 ($p < 0.05$). Even though the whole muscle jerky samples had contained higher amount of protein and lower fat values, the sensory attributes had lower scores. The major limitation in whole muscle jerky was the aggravated off dark colors, which were developed during the thermal processing. The whole muscle jerky had the lowest water activity; 0.614 and the lowest moisture content 16.00%. The thigh and breast mixed jerky sample had average sensory attributes, but the major drawback was the textural difference of the two muscles which caused less binding ability, resulting in a lower springy product. The minced meat jerky samples had the lowest sensory attributes and showed the lowest protein content; 16.07%, S.D.; 0.38 and highest fat content 38.41%, S.D. 0.36. The coconut flour incorporated jerky sample had acceptable sensory attributes compared with the rest while the protein content; 29.49%, S.D.; 0.73 and fat content of 3.93%, S.D.; 0.041 were obtained from the proximate analysis. The coconut flour incorporated samples were the most cost-effective and could be developed further as a meat type snack. A lethal treatment of 100°C for 15 minutes was applied to prevent bacterial contamination. The Horizontal method for the detection and enumeration of coliforms (ISO 4831:2006 - Most probable number technique) was used to assess the quality of the product following lethal treatment. The MPN value after the lethal heat treatment was < 10 MPN/g.

Keywords: Protein content, Fat content, Sensory evaluation, Quality changes, Lethal treatment

Optimization of an ELISA for determination of progesterone in bovine whole milk

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Effective reproductive management is a crucial factor for a profitable dairy industry and determination of Progesterone levels in whole milk is a valid tool to assess the reproductive status such as ovarian activity and pregnancyin dairy cows. The objective of the present study was tooptimize the conditions of an Enzyme Linked Immunosorbent Assay (ELISA) to determine progesterone concentration in bovine whole milk under Sri Lankan conditions. Microtiter plates were coated with 150 μl of Progesterone antibody of two dilutions (X10 000 dilution and X5 000 dilution) and incubated for 4 hours at 20^{o}C. Then, 200 μl of assay buffer was added and plates were incubated for 30 min at 20^{o}C.During the assay,10 μl of standard solutions with known progesterone concentrations, control samples (with high and low progesterone concentrations) and the samples were added to each well.Then plates were incubated for another 3 hours at 20^{o}C after adding 150 μl of horseradish peroxidase(HRP) labelled-progesterone of two dilutions (X25 000 and X50 000). Absorbance readings were obtained at 492nm after adding 150μl of tetramethyl benzidine (TMB) for 30 min at 20^{o}C.A better standard curve with R^2 = 0.8704 was obtained with X10 000 dilution of progesterone antibody and X50 000 dilution of HRP labelled-progesterone.Theinter-assay coefficients of variationwere10.77% (n=6) and 14.29% (n=6) forhigh and low control samples,respectively. The intra-assay coefficients of variationwere9.00% (n=6) and 15.21% (n=6) for high and low control samples, respectively.The optimized in-house ELISA protocol for determination of progesterone in bovine whole milk is currently being used to monitor the resumption of ovarian activity postpartum of adairy herd.

Keywords: Cow milk; ELISA; Progesterone; Sri Lanka

Prevalence of livestock and poultry diseases in Trincomalee district

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Food safety is a critical factor which affects the production and processing of animal food sources. In Sri Lanka, livestock sub-sector contributes 0.6 percent to the National Gross Domestic Production (GDP)(1).There is a great potential for further development of this sector. However, animal disease is one of the important factors to be concernedin developing the industry and improving the food safety.Animal disease outbreaks are somewhat high in Sri Lanka due to many reasons. The major objectives of this study were toidentify the major livestock and poultry disease outbreaks in Trincomalee District and to find out the frequency and pattern of the livestock and poultry diseases in Trincomalee District. This study was conducted including all the veterinary rangesin Trincomalee District based on a questionnaire and finally primary data were analyzed using Microsoft office excel 2007.As the main animal disease outbreaks in Trincomalee District;cattle/ buffalo diseases likeMastitis, Ephemeral Fever, Helminthiasis, Bovine Babesiosis; poultry diseases likeNewcastle Disease, Fowl Pox, Infectious Bursal Disease, Colibacillosis, Coccidiosis andgoat diseases likeMastitis, Helminthiasis, Paramphistomiasis, Goat Pox were identified. The study concluded that there were differences in disease outbreak pattern of different livestock diseases. Echchilampattu had the highest incidences of livestock diseases in line with this area being the highest livestock production in Trincomalee district. Kinniya had the highest poultry disease outbreaks.Helminthiasis was the major disease of cattle and buffaloeswhilethe cattle were affected the most when compared with buffaloes. There was a reduction in the goat disease outbreak incidences in 2017 than 2016.

Keywords: Disease outbreaks; Goat Pox; Newcastle Disease; Fowl Pox

Microbiological quality assessment of milk collecting chain in Puttalam district

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Milk is described as nature's most nearly perfect food, especially for infant mammals. Generally milk contains water, protein, fat, lactose, minerals, vitamins and ash. A neutral pH, high water activity and high nutrient content; milk provides rich media for the growth of variety of microorganisms specially bacteria, yeasts and moulds. Milk collecting chain consists of activities from farm level to factory level including collecting centers and chilling centers, which impacts the quality of milk. The main objectives of this study were to evaluate the microbiological quality changes during milk collecting chain and to identify possible sources of contamination at farm level. Raw milk samples were collected from 30 farms, 12 collecting centers, five chilling centers in Puttalam district and two bowser samples from Nestle factory receiving point. The all milk samples (n = 147) were collected aseptically, transferred to an ice box and transported to the University laboratory within two hours. The collected samples were serial diluted and Total Plate Count (TPC) was done to estimate the overall microbial count in each sample. Pre-milking practices, post- milking practices and farm environment condition were evaluated using survey based questionnaire. All the data obtained from TPC test and questionnaire was analyzed using Microsoft Excel 2010 and SPSS 20 version.

Results revealed that higher microbial counts for TPC were observed in collecting centers, chilling centers and transportation bowsers when compared to the company standards. The TPC results showed that there was a significant difference between population mean in TPC among tested milk samples ($P < 0.05$).Though the microbial population should be < log 5.25 at chilling center and log 5.30 at factory receiving point according to the Nestle factory standards in order to accept milk for further processing, TPC of tested chilling centers were log 6.63, 5.21, 6.30, 6.62 and 7.94 (CFU/ml) and TPC of tested bowser samples were log 7.45 and 7.58 (CFU/ml) respectively. According to the questionnaire results, most of the farmers' pre-milking practices and environment condition at the acceptable level. However, the post milking practices of the farmers' were below the acceptable level. The test result shows that chilling of milking within three hours of milking significantly affects the quality of milk. Therefore, proper awareness programs should be carried out effectively to educate dairy farmers and related workers on clean milk production.

Keywords: Milk; Collecting centers; Chilling centers; TPC method

Effect of curd setting pH on functional properties of mozzarella cheese

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Mozzarella is a prominent cheese originated in Italy which belongs to pastafilata, or stretched curd cheese family and itis consumed as fresh or after only a brief period of ageing [(1).]Functional properties specially the meltability and stretchability are key requirements of mozzarella cheese that are affected by pH [(2)].Commercial interest has built on direct acidification method due to cost effectiveness, less time consuming than starter culture method. This study was designed to investigate the effect of curd setting pH on meltability and stretchabilityof mozzarella cheese produced by direct acidification of citric acid.

Cheese samples were produced using fresh cow milk by direct acidification of citric acid at four different curd setting pH levels as T_1: 5.02, T_2: 5.3, T_3: 6.02 and T_4: 6.34. Fresh cheese samples were tested for stretchability, meltability and moisture content. Titratable acidity and pH of the cheese samples were measured after two days of each sample production. Effect of curd setting pH was significant on meltability and stretchability of produced mozzarella cheese ($P < 0.05$). Cheese produced at 6.02 curd setting pH through direct acidification of citric acid showed the best overall stretchability and meltability compared to tested other three different curd setting pH levels. Moisture content of produced cheese samples was significantly affected by curd setting pH ($P < 0.05$) and stretchability and meltability were significantly different at different moisture content of cheese samples ($P < 0.05$). Curd setting pH showed strong positive relationship with pH of the samples after two days of the production ($R^2 = 0.9978$) and strong negative relationship with titratable acidity after two days of the production ($R^2 = 0.9407$). Tested Curd setting pH (5.3) within commercially available mozzarella cheese pH range (5.1 – 5.4)did not show proper meltability and stretchability measures in cheese samples made by direct acidification of citric acid. In conclusion mozzarella cheese produced with citric acid at 6.02 curd setting pH showed best performances in stretchability and meltability compared other tested curd setting pH levels. Optimization of mozzarella cheese production process with acids is important with any change during production process to preserve the Quality of functional properties.

Keywords: Mozzarella; Curd setting pH; Sretchability; Meltability

Isolation and identification of common fungal species in poultry feed collected from selected area in Kurunegala District

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The quality of the poultry feed can be compromised with microbial contamination. The organoleptic attributes and the nutritional qualities of the feeds are highly affected due to the contamination. Further, the consumption of contaminated poultry feeds would cause negative impacts such as poor growth, poor production, acute and chronic symptoms and mortality on the health of chicken.Feed contamination with mycotoxins canaffect humans due to secondary contamination.Fungal speciesare considered as the major contaminant, which produces various mycotoxins such as Aflatoxin, Zearalenone, T2- toxin, Deoxynivalenol and Ochratoxin[1]. The major mycotoxin producing fungal species are Penicillium, Aspergillus, Rhizopus and Fusarium[2].According to the Department of Animal Production and Health, poultry sector forecasts report in 2017 over 1.2 million MT of poultry feed is produced annually in Sri Lanka. The highest percentage of poultry production (40%) is at the Kurunegala district, it was assumed that Kurunegala had the highest poultry feed production also. However, there had been fewer attempts so far on any quantitative or qualitative analysis of major fungal species in Sri Lankan poultry feed. This study aimed at isolation and identification of the commonly abundant fungal species in locally available poultry feedin Kurunegala district. A total of 30 market samples (19 pellet feed samples and 11 mash feed samples) were aseptically collected in to sterile plastic bags and the fungal species were isolated using standard microbiological methods.The isolated fungal species were identified using their morphological characteristics using sticker method and inoculation method for microscopic observation. Fungal growth was observed in all of the samples. Among the tested samples *Aspergillus* spp., *Penicillium* spp. and *Rhizopus* spp. were identified. The highest frequency of occurrence was observed for*Aspergillus* spp. (93.33%) followed by *Penicillium* spp. (50.0%) and *Rhizopus* spp. (40.0%). The level contamination inthe pellet type feeds were at the range of $2.0x10^6$ - $2.4x10^6$ CFU/g and for the mash type feeds it was between $2.3x10^6$ - $6.1x10^6$CFU/g.In conclusion, almost every tested poultry feed product contained fungal species, yet the less frequency of occurrence in the pellet type. Since the fungal contamination causes many negative outcomes regular monitoring and application of quality assurance system will ensure production and health of poultry.

Keywords: Fungal spp.; Poultry feed; Isolation; Morphological Characteristics.

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Potential for a commercial industry using extracted collagen from seer fish waste

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During fish processing nearly fifty percent of fish is discarded as waste causing negative effects on food security and harmful effects on the environment. Fish waste including some damaged muscle parts, skin, bones, fins etc. Although this waste is nutritionally high as the edible part, only a limited attention has been given for its utilization. Recently, many efforts have been taken for effective utilization of fish discards and extraction of collagen is one such recent advance in post-harvest utilization of fish waste. Although utilization of fish collagen has drawn greater attention as the bovine, porcine and poultry originated collagen reported with recent disease infections and religious concerns only a little attention has been given in extracting fish collagen. Collagen is a fibrous protein which is abundant in the connective tissues of fish. Therefore, this study attempts to investigate the percentage of Acid Soluble Collagen (ASC) from different waste parts of Seer fish (*Scomberomoruscommerson)*. Biochemical characterization of extracted collagen was conducted. The ASC extracted from skin, muscle, bone and fins were 55.70%, 26.82%, 3.35% and 2.38% respectively on dry weight basis. Results indicated a significantly high ($p < 0.05$) percentage of ASC in seer fish skin. Results of the fourier transform infrared spectroscopy proved that the helical structures of extracted collagen were reserved properly in good conditions and extracted collagen from the skin, bone and fin found to be belonged to type –I. Results also indicated that the extraction conditions used in the present study were able to preserve the native conformation of the collagen which is an important aspect in future application of collagen. Results of the ultraviolet spectra measurements conformed that the isolated collagen were highly pure. X-ray diffraction analysis indicated that the extracted collagen had triple helix structure. Results of the scanning electron microscope indicated the possibility of producing collagen nano-composites. This study indicates the possibility of value addition to seer fish waste by at a comparatively low cost in initiating a novel industry.

Keywords: Acid soluble collagen; Nano-composites; Seer fish waste

Application of seaweed *(Kappaphycusalvarezii)* powder as a substitution of gelatine in yogurt production

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Seaweeds *Kappaphycusalvarezii* is important tropical red seaweed, which cultured in Sri Lanka,has high demand for its kappa carrageenan. Kappa carrageenan is a hydrocolloid that used as a food additive, acting as a gelling, emulsifying, thickening and stabilizing agent in both pharmaceutical and nutraceutical products.Even though commercial gelatine is widely used as a stabilizing agent, there are serious doubts of its safety on human health. Commertialgelatine are neither physio-chemically nor nutritionally important but used as an additive. Therefore, this study investigated potential use of dried seaweed powder as a substitute for commercial gelatine used in yogurts to promote an organic yogurt product which enriched with natural nutrients comes from seaweed. Different concentrations of dried *K. alvarezii* powder were used for the development of yogurt and subsequently the selected composition of yogurt was subjected to analyze proximate composition and microbial properties. Commercial gelatin added yogurt was used as a control. The data obtained from proximate and microbial analysis were analysed using Minitab 17 software by analysis of variance.In the proximate analysis, moisture content of both control yogurt (73.52 ± 4.14) and seaweed enriched yogurt (76.21 ± 1.24) were not significantly different ($p > 0.05$) and also ash content of dried agar powder indicates the content of impurities while ash content of seaweed enriched yogurt (1.20 ± 0.14) was significantly higher ($p < 0.05$) than ash content of control yogurt (0.45 ± 0.12). Fiber content of the seaweed enriched yogurt (3.290 ± 0.401) was significantly ($p < 0.05$) higher than control yogurt (0.016 ± 0.004). In present study, the total bacterial count has significantly increased in the seaweed powder added yogurt sample compared with control yogurt sample ($p < 0.05$) and both total mouldcount and total yeast count of seaweed powder enriched yoghurt are significantly higher than control sample ($p < 0.05$). High consumer preference was observed for newly developed seaweed added yogurt and the first author of this paper initiated a yogurt production venture in catering the local market by supplying 700 yogurt per month.

Keywords: *Kappaphycusalvarezii; S*eaweed, Yogurt; Gelatine.

Jellyfish baited trap-net fishery off the Eastern coastal waters of Sri Lanka

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The knowledge and experience of association of different species have been use by fisheries in targeting fish. Small-scale fishers in the eastern province in Sri Lanka use jellyfish (*Acromitusflagellatus)* as live-bait for a trap-net constructed by metal (rarely plastics with heavy sinkers) to deployed into the deep coastal waters. These jellyfish baited traps, is a popular fishing method in catching Rabbitfish (*Siganaus* sp.) and expensive Groupers. Anyhow, the reason behind the attraction of these species for jellyfish bait is unknown. Therefore, this study tried to determine what type of association leads Rabbit fish and Groupers to get attracted to jellyfish. Therefor, gut content analysis of the main targeted species were conducted colleting randomly elected samples from trap-nets operated at Pulmoddai, Mutur, Valachchenei and Komari in east coast of Sri Lanka from March to July 2018. For expensive Groupers, removed guts were collected at the landing sites. In all sampled species, total length and standard length were recorded and removed guts were preserved separately in 10% formaldehyde for future analysis at the Wayamba university laboratory. All collected fish species were identified to the lowest possible taxa using identification keys and guides. The gut contents of sampled fish were observed under light microscope and identified and counted the different organism; their numbers and relative sizes. All trap net catchers were dominated by Rabbit fish and Groupers. Significantly high number of jellyfish parts was identified in the gut contents of Rabbitfish compared to other food items like phytoplankton and zooplanktons. Interestingly gut content of Grouper had a high number of fish parts, specially Rabbit fish parts, when compare to other food items such as crustacean parts. Gut content analysis of Rabbitfish and other fish species showed that they have been attracted to the trap to feed on jellyfish while the Groupers seems to be attracted to feed on other species specially Rabbit fish. Therefore this study revealed that jellyfish-Rabbit fish association depends on feeding behavior while expensive Groupers show predatory behavior over the other species.

Keywords: Association; Jellyfish; Grouper; Gut content analysis; Trap-net

Design and development of a mobile-app-based system for the collection and analysis of small-scale fishery data

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Small-scale fishers provide essential services to more than 180 million people living in developing countries. But, high diversification and multitude of small-scale gear types and vessels, dynamic patterns in their spatial and temporal usage had been a long-discussed issue of gathering fishery information for successful management of fisheries resources. Therefore, in order to collect data, we have developed a computer assist system. The system provides free mobile app, which runs on Android™ 4.0 or later versions, to be used by fishers; sellers and even fishery scientists. As this app completely relies on the user data inputs, the users should initially agree to share anonymous data to a centralized database. Further, the system consists of backend and analytical software tool in order to analyse user provided data towards managerial or informative usage. For fishers, species-wise trends of catches; catch locations (at least landing sites) and buying-price can be obtained as simple line graphs with descriptive statistics or as geographical maps, which produced by the backend, in daily, weekly, monthly or in yearly basis. For fish buyers and sellers, species-wise buying and selling price fluctuations in regional, provincial or country levels and facilities to maintain personalized vendor log book can be obtained. For fishery scientists, all the raw data can be obtained upon succeeding the user rights to access the backend of the software. With higher user data inputs, the geographical maps which display the patterns of fish catch locations/landing site could be useful for fishers as a forecasting tool even to identify catch trends at least for short durations. Ability to access the updated information on spatiotemporal catch, catch-locations, price etc. could be an incentive to use the app as it will support fishers and buyers for their decision making.User-friendly interface; use of pictorial icons are the features contribute for the simplicity of the app even for the easy usage, by layman. Facilitating the data entry even at the locations has no internet connection, and later transferring temporary saved data when connection is re-established will enable to use the app at any location. At the moment the storage limit of app hinders further modifications for facilitating multi-gear users; migratory fishers; usage of different fishing efforts etc. Perhaps, providing compensation for fishers those who use this app when they renew their license could be an approach for authorized bodies to popularize this app, in collecting small-scale fishery data.

Keywords: Mobile Android app; Data collection; Fishery assessment; Fisheries management

Evaluation of shrimp pond bottom sediment for crop production as an organic fertilizer.

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In this study, the use of shrimp pond bottom sediment as a fertilizer component with sand, in germination and growth media for four plant varieties belonging to four different families; okra (*Abelmoschus esculentus),*bushitamae *(Vignaunguiculata),* kankun (*Ipomeaaquatica),* andmaize (*Zea mays)* was evaluated. To this end, bottom sediment samples were collected, sun dried, pulverized and pass through 2 mm size mesh. Then the effect of bottom sediment on seed germination and plant growth using plant growth parameters were evaluated. Shoot length, root length, fresh root weight, fresh stem weight, fresh leaf weight, total fresh weight, leaf area, dried root weight, dried stem weight, dried leaf weight and dried total weights of plants were measured as plant growth parameters. Further, relationship between bottom sediment and plant growth was also identified. Five treatments were established, based on the bottom sediment to sand ratio (6%, 12%, 18%, 25%, and 50% v/v). Soil was used as the control experimental medium. Soil colour of bottom sediment was determined as a physical property by using Munsel soil colour chart. pH, electrical conductivity, salinity using digital multiparameter (HACH, HQ 40D, 8506000) and total nitrogen content using kjeldhal method were determined as chemical properties. Seed germination was not affected by the ratios below 18% and above 18% considerable reduction in seed germination could be observed. Further, seeds of *Abelmoschus esculentus* and *Zea mays* did not germinate in 25% and 50% bottom sediment added mediums. For *Abelmoschus esculentus,* all measured plant performance parameters did not exhibit a considerable deviation compared to the control. For *Vignaunguiculata, Ipomeaaquatica,* and *Zea mays* most of the measured plant performance parameters were lower than the control. However, shrimp pond bottom sediment had higher level of total nitrogen than soil. In the experiment, sand might be reducing the effect of salinity partially. Thus, with an effective salinity reducing method, better plant growth could be achieved using shrimp pond bottom sediment as an organic fertilizer.

Keywords: Shrimp pond bottom sediment; Germination; Plant performance; Salinity; Total nitrogen content

Growth and survival of cage-cultured mud crabs fed with different feeds

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The common mud crab, *Scylla serrate*, which also known as "Black crab" found in the estuarine and mangrove areas, is one of the potential species for fattening. The most essential requirement for crab fattening is cost effective feed which optimize high growth rates and survival. But the absence of suitable feed, either in pellets or other forms, to promote growth and survival is one of the main constrain in popularizing the carb fattening. Therefore, this study was conducted in determining the efficiency of locally available foods which can be used to gain high growth performance of mud crabs fattened in cages under different stocking densities. The crabs stocked in three different stocking densities: 15; 25 and 35 in $3m^3$ cages constructed in Poonagary lagoon in Northen province of Sri Lanka were fed with two diets regimes from March to July 2018. Experimental setup was designed according to the complete randomized design and crabs with ~30g were initially stocked in each cage irrespective to the sex. Three replicates of each of the stocking densities were fed with trash fish with crustacean meat and three more replicates of same stocking densities were fed with trash fish with bivalve meat while three replicate of same stocking densities were fed with both feed regimes subsequently on every other day. Feed quantities equal to 5% of the weight of crabs in each respective cage were fed twice a day. Growth rate measured in terms of total weight (g), carapace width (cm), carapace length (cm) and number of survivals reported from each cage were recorded weekly and compared by ANOVA. Growth parameters of mud crab were significantly higher in the crabs fed with trash fish (75%) + bivalves (25%) meat than the crabs fed with trash fish (75%) + crustacean meat (25%). After being fed with bivalves mix feed for 15 weeks, crabs in the socking density of 25 crabs per cage had the highest body weight gain (13.08%), specific growth rate (1.27%/day), carapace length growth rate (24.22%) and carapace width growth rate (12.45%). On the other hand, crabs fed with crustacean mix feed had highest average moderate body weight gain (6.12%), specific growth rate (0.36%/day), carapace length growth rate (13.27%) and carapace width growth rate (7.11%). Mud crabs fed with both the feed regimes showed significantly lower growth performance at 35 crabs per cage while no significant difference reported between 15 and 25 stocking densities. Crabs fed with both feed at different stocking density had the highest survival rate (100%) and all the treatments showed higher than 95% survival rate. There were no significant differences in survival of crabs fed with different diet and at different stocking densities. All feeds were cheap, easily available and easy to prepare and the crabs fed with trash fish (75%) + bivalves (25%) seems to be the best option under 25 individuals per $3m^3$ stocking density seems to be a best option in gaining high growth rate and relatively high survival.

Keywords: Mud crab; Cage culture; Feed; Stocking density; Growth performance

Antimicrobial activity of leaves, seeds and bark extracts of Pond Apple (*Annonaglabra*)

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Annonaglabra belongs to Family Annonacea and is considered as an invasive nuisance plant in Sri Lanka. But this plant is used in indigenous medicine and pest controlling in its native regions of Central America and West Africa. Although, previous researches have revealed that the plant derivatives of Annonacea family exhibit antitumor, antioxidant, antifungal, antibacterial, cytotoxic, immunosuppressive activities; studies on *A. glabra* is rare in the literature. This study attempted to investigate the antibacterial and antifungal activity of derivatives of leaves, bark and seed of *A. glabra*. Petroleum ether was used as the solvent for soxhlet extraction method and methanol and water were used as solvents for maceration extortion extraction method. Agar well diffusion assay is performed to test the antimicrobial activity of *A. glabra*derivatives. The antimicrobial activity of *A.glabra* extractions were evaluated against two species of bacteria; *Staphylococcus aureus* and *Streptococcus pyogenes* (human pathogenic)and three fungi species; *Candida albicans* (human pathogenic), *Penicilliumchrysogenum and Aspergillusniger* (fruit spoiling). Human pathogenic bacteria and fungus were cultured on Mueller Hinton Agar and Sabouraud Dextrose Agar respectively. Fruit spoilage causing fungi were cultured on Potato Dextrose Agar medium. The experiment was carried out in triplicate and the inhibition zones were measured to nearest 0.01mm with a Vernier calliper after 24 hours of incubation. Amoxicillin was used as the control treatment for humen pathogenic bacteria while using Itraconazole as the control treatment for *P. chrysogenum* and *A. niger*. Flucinazole was used as the control treatment for *C. albicans*. Water was used as the solvent for antibiotics and fungicides while using dimethyl sulfoxide as the solvent for plant extractions in inhibition trials. Diameter of the inhibition zones equal or higher than 7 mm were considered as the effective inhibition.Soxhlet extraction of seed and bark resulted oil and a resin respectively but no quantifiable derivative from leaves was observed. Seed extraction of petroleum ether resulted the positive inhibition of all microbes tested. Bark extraction of Soxhlet method and Methanol extractions of maceration method of seed, bark and leaves have responded only for humen pathogenic bacteria (Table shows the zones of inhibition for different extractions). No inhibition was observed from plant derivatives extracted to water.

The study confirmed that *A. glabra* seed derivatives extracted to petroleum ether have strong antibacterial and antifungal activity against all tested micro-organisms. Results revealed that the high potent of the seed, bark and leaf extraction of both method against bacteria. Results also revealed that the active anti-fungal compounds are soluble in petroleum ether and antibacterial compounds are soluble in both petroleum ether and methanol.

Species	Soxhlet extraction method (Solvent petroleum ether) Diameter of inhibition zone (mm)		Maceration extortion extraction method (solvent methanol) Diameter of inhibition zone (mm)		
	Seed	Bark	Seed	Bark	Leaves
Staphylococcus aureus	13.09	16.27	10.90	17.09	15.18
Streptococcus pyogenes	12.00	13.00	10.18	13.18	20.00
Candida albicans	17.18	Nill	Nill	Nill	Nill
Penicilliumchrysogenum	13.00	Nill	Nill	Nill	Nill
Aspergillusniger	11.30	Nill	Nill	Nill	Nill

Keywords: Annonaceae*; Annonaglabra;* Antibacterial property; Antifungal property

Utilization of house hold food waste for fish feed production.

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Rising food waste generation rates around the world has become a vast problem and predicted to be continued for future. Since the food waste is high in nutrient content, converting it into fish feed with a small value addition would be a timely solution for the problem and a cheaper alternative for fish feed. In this study, the feasibility of using food waste to develop as a fish feed was evaluated using *Oreochromisnitoticus*. To this end, food waste (leftover) was collected from university canteen, dried at 80 ^{0}C and then the leftover feed pellet was prepared. In the first experiment, 35-day feeding trial was conducted to evaluate the suitability of leftover feed as a diet for *Oreochromisniloticus* using three feed formulations; 100% leftover pellet, 50% leftover pellet + 50% commercial feed, and 100% commercial feed. Three replicates were used for each formulation. Fish growth (length and weight) was investigated at the end of every week. Water quality parameters were measured regularly and maintained at a desirable level. Protein content was measured using Kjeldhal method. Due to the low protein content of the leftover feed, it showed the lowest growth increment compared to the other two feed formulations. Thus, another (second) experiment was carried out with protein added leftover feed. Three types of feed formulations were used; 20% protein added leftover feed (with binder), 20% protein added leftover feed (without binder), and commercial feed. Moreover, fish growth and water quality parameters were measured as described previously. In the first experiment, there was a significant difference ($p < 0.05$) between mean growth (length and weight) of fish fed with 100% leftover pellet and 50% leftover pellet + 50% commercial feed, and between mean growth (length and weight) of fish fed with 100% leftover pellet and 100% commercial feed. In the second experiment, a significant difference ($p < 0.05$) was observed between mean growth (length and weight) of fish fed with 20% protein added leftover feed (without binder) and commercial feed, 20% protein added leftover feed (without binder) and 20% protein added leftover (with binder). However, there was no any significant difference ($p > 0.05$) between mean growth of fish fed with 20% protein added leftover feed (with binder) and commercial feed. Taken together, the best growth increment was observed in the 20% protein added leftover feed (without binder) compared to the other feed formulas. In conclusion, 20% protein added leftover feed (without binder) might be a better formulation in terms of the overall performance on fish growth.

Keywords: Leftover; Fish feed; Growth rate

Phytoplankton diversity of "Gin Oya" river in North Western province of Sri Lanka

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Gin Oya a small river located in North western coast had a lagoon moth of seasonal opening due to sand barrier formation until tsunami created a new permanently open mouth in 2004. This change may have significant influence on the plankton communities no data available on plankton diversity of this river. Present study attempted to generate baseline information on plankton assemblages of Gin Oyariver in North western province. Plankton samples of five locations along the river in 1km intervals from lagoon mouth were collected at one month intervals from May to July 2018. A plankton net with mesh size of 55µm and diameter of 12.5cm was drag 10m distance just below the water surface and samples were added with formalin and Lugol to preserve zooplankton and phytoplankton respectively. Planktons were identified using standard keys and other published information including plankton guides and AlgaeBase website. A total number of 91 plankton species were recorded form the five locations of the sampled stretch of the river. Among all planktons 50 (55.5%) species were phytoplankton and 41 (45.5%) species were zooplanktons. Six Classes of phytoplankton species; Bacillariophyceae (36) Dinophyceae (04), Cyanophyceae (03), Chlorophyceae (03) Euglenophyceae (03) and Conjugatophyceae (01) have been reported during the study period. Bacillariophyceae was the most diverse group of phytoplankton and the Genus *Actinocyclus* was the most abundance genera reported during the study. There were 18 centric diatoms species and 18 pennate diatoms species were reported from Class Bacillariophyceae. Among centric diatoms; *Aulacoseira* sp., *Thalassiosira* sp., *Skeletomacostatum* and two unidentified specie were found in all five sites. *Bascillaria* sp., *Navicula* sp., *Neocalyptrellarobusta*, *Nitzschiaclosterium,* two *Synedra*species and three unidentified species, which belongs to pennate diatoms were reported form all sampling sites. Four dinoflagellate species; *Prorocentrummicans*, *Oodiniumpouchetii*, *Ceratium* sp. and one unidentified sp. were reported form Gin Oya during the five sampling occasions. There were three *Cyanobacteria* species; *Anabaena* spp. *Oscillatoria* sp. and *Planktothrixisothrix* recorded in this study. *Anabaena* spp. were reported only from the lagoon mouth and other two species were recorded form all sampling sites. Three genera; *Euglena*, *Phacus*, and *Trachelomonas* were reported from class Euglinophyceae in three sampling occasions. *Euglena* species were the most abundance among them. *Phacus* sp. was reported at one sampling occasion in the most distance location from river the mouth. *Trachelomonas*sp. were reported from only two sampling sites, which were the most distance from river the mouth. *Closterium* was the only genera reported from class Conjugatophyceae. Gin Oya has a very rich phytoplankton diversity and actions to protect this river environment is important to secure its ecosystem services.

Keywords: Centric diatoms; Diversity; Lagoon; Plankton assemblage; Pennate diatoms

Perceptions of Beche-de-mer market actors on Sri Lanka standard specification

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Beche–de–mer is the processed sea cucumber, which is produced at primarily small-scale processing plants. The entire annual production is currently exported to Singapore, Hong Kong, Taiwan and China. In obtaining high competitive price at the export market, Sri Lanka Standard Institute recently developed beche-de-mer processing standard. Still the standard has not yet been implemented but guiding beche-de-mer market actors to follow on. Due to consist high diversity of processing methods, Sri Lankan market actors do not adhere to better management of infra-structure, reduction of cost and time during processing. Therefore, perceptions of beche-de-mer market actors on the proposed standard were evaluated here. The objectives of this study were to determine the degree of adherence and perceptions on proposed Sri Lanka standard specification for beche-de-mer products. Finally, to estimate the additional cost associated to the proposed standard. The study was conducted with randomly selected 50 fishers and 25 processors including exporters in Northern Province and other places. Primary survey data were collected separately from fishers and processors conducting mini-interviews; discussions and using a structured questionnaire. Data were statistically analyzed using SPSS 16.0 and Minitab18. Empirical findings reveal that, the perception towards the beche-de-mer standard specification on the "type of water", was common among both fishers and processors ($P > 0.05$). But the perception levels of fishers and processors were different on other 14 standard described in the beche-de-mer processing standard. The association of socio-demographic characteristics with perception showed that, non-parametric ranking variables such as, age group and experience are found to be significantly associated with the perception of fishers and only district is significantly associated with the perception of processors. In the case of parametric variable characters, only pursuance of current regulation by fishers was having strong significant association with the perception of fishers. The study concludes, processors strongly agreed with all 15 processing standards while fishers strongly agreed only with10 processing standards defined in beche-de-mer processing standard. All of the processors have positive attitudes while 30% of fishers have negative attitudes towards the beche-de-mer processing standard. To uplift beche-de-mer processing industry to international standards, responsible authorities need to conduct strong awareness programme to the fishers to create more positive attitudes towards all proposed beche-de-mer processing standards.

Keywords: Degree of adherence; Sri Lanka standard specification; Beche-de-mer; perceptions

Perception of Batticaloa lagoon fisher on different lagoon management options

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Coastal lagoons are amongst the most used and valuable ecosystems. Valuation of natural ecosystem is becoming one of the important aspects which useful in taking management decisions but little is known on valuing ecosystem services. Valuing natural resources is a difficult task but several methods have been developed in valuing natural ecosystems. Among them Willingness to Pay (WTP) approach is one of the simplest and easily applicable methods for valuing ecosystems. Willingness of lagoon stakeholders to accept any proposed lagoon management strategies could be evaluated using "choice card" method and knowing the acceptance and supportiveness of fisher community is important for implementing any lagoon management options. Developing and implementing management options is challenging as serious resistance could be anticipated from stakeholders. Hence, willingness-to-pay (WTP) of East-Sri Lankan fishers' for different management options, will showcases whether proposed management options can be implemented in Batticaloa lagoon without serious resistance. Therefore, this study attempted to find out the WTP by fisher on environmental safety attributes by using a choice experiment. A sample of 248 fishers who involve in fishing at Batticaloa lagoon were interviewed from March to June, 2018 from 10 fishing communities settled at Batticaloa district. A conditional logistic regression model was used to elicit WTP by Fishers for preserving the seven selected attributes of lagoon management options: distractive fishing methods; releasing domestic pollutants to lagoon; releasing industrial pollutants to lagoon; catching immature juveniles from lagoon; clearing mangrove area; unauthorized construction in lagoon and promoting recreational activity in lagoon. As a result fishers significantly believed that all the tested attributes were affected on the Batticaloa lagoon. Among the seven attributes, fishers strongly like/support only to promote recreational activities in the lagoon. Nevertheless, on the WTP values estimated, fishers in the sample place emphasis the importance of establishing lagoon management options. Mainly, releasing industrial pollutants to lagoon and clearing mangrove area were highly affect for fishers' decision that 28930.83 LKR, and 28824.95 LKR will be payed in future when damage the lagoon due to particular attributes but gain 6.39 LKR from due to promoting recreational activities in the lagoon. Thus, revealed information on fisher perception should be important for management tools and further fishes perception ensured the sustainability of fisheries and their wiliness to conserve the lagoon.

Keywords: Choice experiment; Lagoon management; Willingness-to-pay

Diversity, above ground biomass and soil organic carbon content of *Annonaglabra* (Pond apple) and mangrove ecosystems in Gin Oya, Sri Lanka

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Annonaglabra is an invasive species, which has rapid expansion in wetlands ecosystems in the country. Although, it is an invasive species the contribution of environmental service rendered by *Annonaglabra* has not much studied in locally. Thus present study attempted to create baseline information of above ground biomass, soil organic matter production and comaire biodiversity of *Annonaglabra* with mangrove ecosystems in Gin Oya ecosystem in north western Sri Lanka.

There were 21 sampling plots (10m x10m) were laid in areas were following plant species are dominating *Rhizophoraapiculata* (RA,04), *Excoecariaagallocha*(EA,06), *Avicenniaofficinalis*(AO,03) *and Annonaglabra* (AG,08). All plant species in sampling plots were identified using identification keys and guides. All plant below the 2.5cm circumference were excluded from measurements. Plant girth at 1.3m height was measured for all species except RA. For RA girth was measured above 30cm from the final prop root. From each plots five soil corer samples up to 45cm were taken and separated into 15cm portions for the analysis of organic carbon by Walkley-Black method. Soil pH and salinity were measured in the field. Above ground and below ground biomasses (AGB and BGB) were estimated. Shannon-Wiener index (H), Simpson's index were estimated to estimate the diversity in different plant assemblages. Important value Index (IVI) was calculated to understand the vegetative structure of the studied plant communities.

Soil pH and salinity in sampled plots were reported respectively as follows; RA (6.13, 18.0‰), EA (4.83, 13‰), AO (4.53, 15.2‰) and AG (5.05, 2.6‰). Soil Organic carbon reported as 14.1%, 15.4% and 15.9% in consecutive 15cm depth ranges respectively. In mangrove plots considering all depths, the lowest and highest organic content was reported as 8.9% and 11.2%. AGB was reported in AO (663.6Kgm^{-2}), RA(484.7Kgm^{-2}), AG (129.2Kgm^{-2}) and EA (86.09Kgm^{-2}) respectively. Species diversity was comparatively higher in AG(mean H, 0.77)and in all other plots H was comparatively low (mean H; RA 0.03,EA (0.25) andAO (0.37). Mean Simpson index in RA (0.98),EA(0.84), AO (0.74) and AG (0.52) were reported indicating the signal species dominancy in mangrove plots. IVI also a measure of overall importance of a single species in the community structure and was reported in RA, 185.3; EA, 215.1, AO, 128.2 and AG, 183. Present study indicate that the soil organic carbon content is comparatively higher in the A. glabra than mangrove communities in Gin Oya River. The AGB and BGB were comparatively higher in mangrove communities than *A. glabra*. Although *A. glabra* is an invasive its environmental service should be further studied.

Keywords: Soil organic matter; *Annonaglabra*; Above round biomass

Evaluation of different cultivation technologies for *Bacopamonnieri* production

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Bacopamonnieri (L) family: Scrophulariaceae (also known as brahmi, water hyssop), is a creeping perennial plant with small oblong leaves and purple flowers, found in warm wetlands, and native to India. This is an aquatic plant with high medicinal value and useful for preparation of cosmetic and food supplements. Further its product is used in traditional ayurvedic medicine, as memory enhancing, anti-inflammatory, analgesic, antipyretic, sedative, anti-oxidant, and cardiotonic drug. The objective ofthis study is to evaluate the different cultivation methods for *B. monnieri* production. To this end, *B. monnieri*samples were collected from Dankotuwa area and cut into pieces with similar size (10 cm) and weight (nearly 1-3 cm) and planted in 10 cm size polythene bags using a common soil mixture. Planted samples were treated with three different experimental conditions as natural growing condition, open field system, and vertical system with 50% shade and without shade. Plants under natural growing condition were submerged and it was used as the control. Natural terrestrial environment used as the open field condition. Vertical system was supplied in a special vertical structure made of bamboo sticks. Growth parameters such as length of the roots, number of branches, number of leaves, shoot height, thickness of stem, wet weight, and dry weight of the samples were measured in weekly intervals. Moreover, chemical composition and the bio-activity of *B. monnieri*samples were evaluated at harvesting stage.

Significant difference ($P < 0.05$) was observed in shoot height compared to the control. However, other growth parameters did not show any significant difference ($P > 0.05$) compared to the control. In Thin Layer Chromatography plate, 12 chemical compounds were identified in the extracts of *B. monnieri* for all treatments. All *B. monnieri* cultivation methods showed potent cytotoxic activity. The highest cytotoxicity was exhibited in *B. monnieri* samples collected from vertical system with 50% shade (3.37 ± 0.77 mg/mL). Furthermore, easy harvesting and less pest attacks were observed in vertical system compared to other treatments. In commercial level it may increase the production of *B. monnieri*.

Based on this study results, full sunlight or shade level lower than 50% is recommended for *B. monnieri* cultivation in commercial scale. In conclusion, vertical system could be more effective for commercial cultivation of *B. monnieri* to obtain an enhanced production.

Keywords: *Bacopamonnieri*,bio activity; Vertical system; Growth parameters; Chemical composition

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