

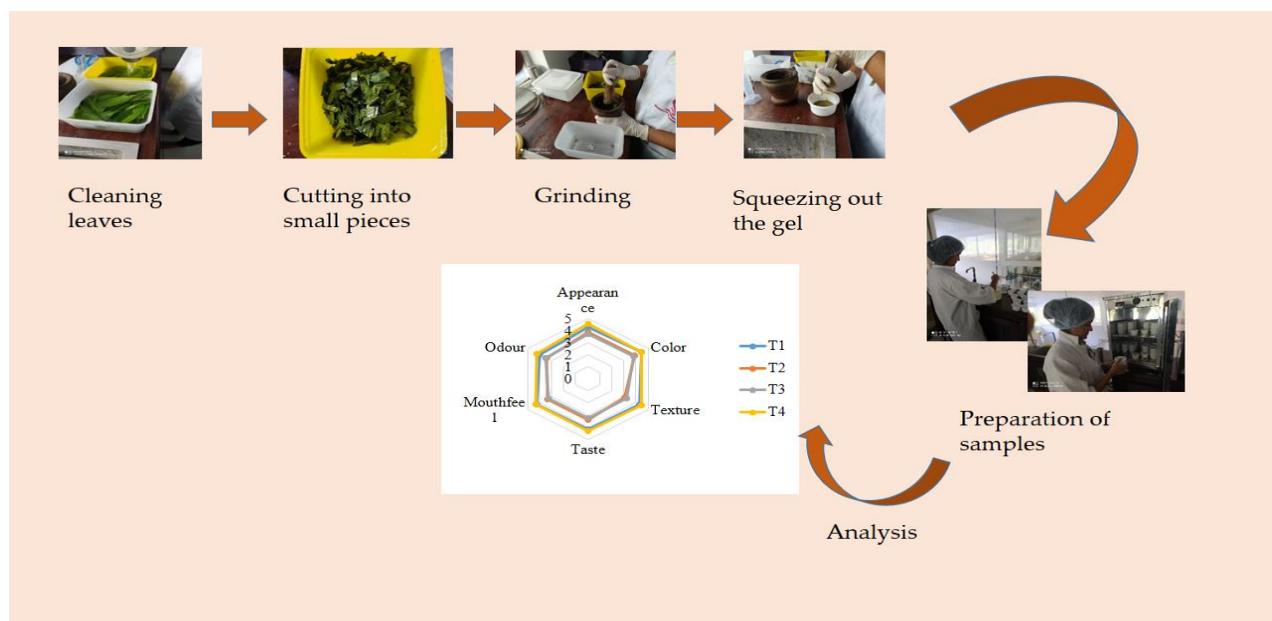
## “Dawul Kurundu” (*Neolitsea involucrate*) leaf extract as a natural stabilizer in set-yoghurt: Effect on physicochemical and sensory qualities

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The use of natural or plant-derived stabilizers in food processing and preservation has gained considerable attention. In the production of commercial yoghurt, the incorporation of stabilizers are important as they bind water to prevent potential syneresis, enhanced the viscosity, and texture. Dawul Kurundu (DK) (*Neolitsea involucrate*) leaf extract has been shown as a potent plant-derived stabilizing agent in the food industry. Hence, the present study evaluated the potential of using DK leaf extract as a natural stabilizer in producing set-yoghurt, by assessing the physicochemical properties, composition, nutrients (calcium & phosphorous) and microbial quality parameters (*E- coli*, yeast & mould) during the storage at 4°C. Dawul Kurundu leaf aqueous extract of 0.4% w/v (T2), 0.6% w/v (T3) and 0.8% w/v (T4) were used as treatments to replace 0.6% w/v gelatin (T1). There were no differences in colour, taste, texture or mouthfeel in all DK leaf extract mixed yoghurts compared to the control. Based on the sensory and physicochemical results, it was found that a 0.8% mixing of DK leaves extract is the best incorporation level. A decreasing pattern of pH value was observed during 21 days of the storage period in all treatments, whereas total titratable acidity (TTA) increased significantly with time. Further, the lowest syneresis value was obtained by T4 (0.8%) demonstrating ideal stabilizing properties. Proximate, nutrient and microbial compositions remained similar to the control (T1). Accordingly, results showed the 0.8% DK leaf extract can be used as a stabilizing agent in set-yoghurt by totally replacing the gelatin while maintaining its sensory and physicochemical properties. Further studies focus on nutritional, preservative and antioxidant properties of DK incorporated yoghurt will merit the popularity of future usage of DK as a natural stabilizer in yoghurt production.

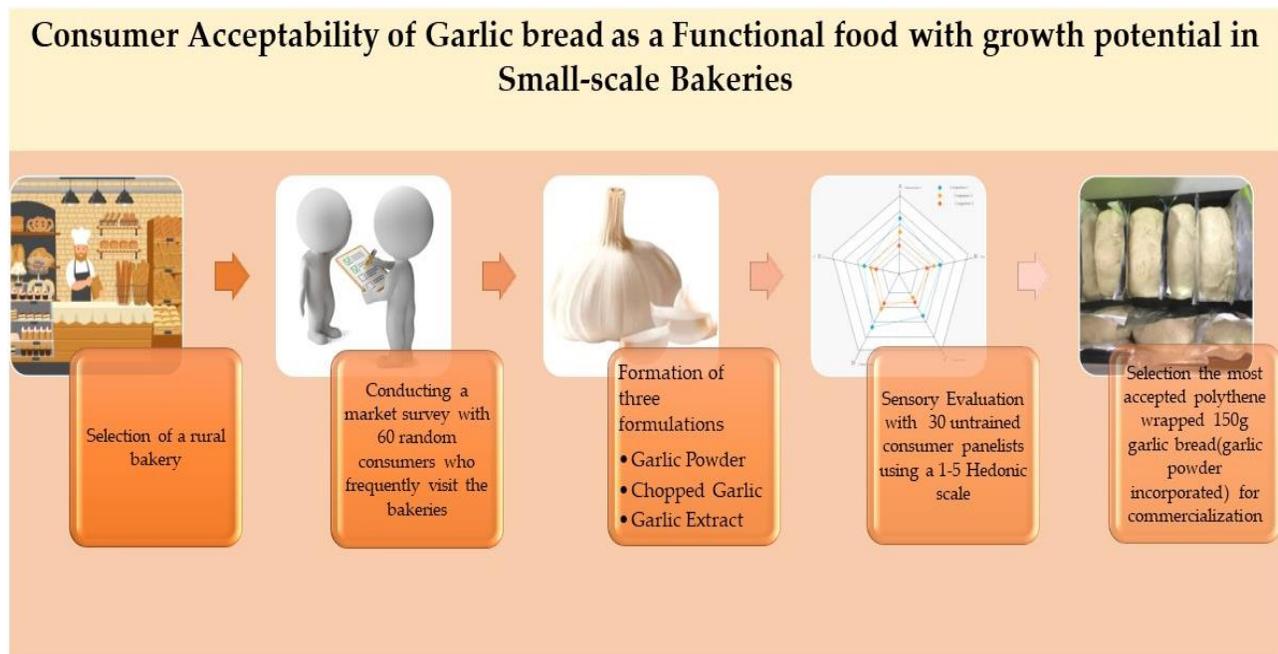
**Keywords:** Dawul Kurundu (*Neolitsea involucrate*), mucilaginous material, natural stabilizer, yoghurt

## Consumer acceptability of garlic bread as a functional food with growth potential in small-scale bakeries

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This paper examines the consumer acceptability of garlic bread as a potential opportunity for market expansions in small-scale bakeries along with the prevailing trend of functional and nutraceutical food consumption. Implementation of a new garlic bread production line in remotely situated, Rathna bakery is the main focus. Garlic (*Allium sativum* L., Liliaceae.) is one of the essential vegetables used for both culinary purposes and herbal remedies along with antibacterial, antioxidant, hypercholesterolemic and hyperglycemic properties due to the dominant bio active compound allicine. A market survey was conducted with the participation of 60 random consumers of three main bakeries in the area initially, showing a percentage of 85% in favor of consumption. Three formulations with the same garlic concentration were developed to identify the most acceptable sample by using garlic powder, garlic extract, and chopped garlic pieces. According to the Friedman test statistics, no significant difference ( $P > 0.05$ ) between the three products with regards to appearance was observed but there were significant differences with regards to odor, texture, taste, and overall acceptance. Moreover, the formulation of garlic powder was determined as the best option according to the hedonic scale ranging from scale 1 (extremely dislike) to scale 5 (extremely like) with the participation of 30 untrained consumer panelists. Conclusively, a polythene wrapped 150g garlic bread has been introduced as a healthier bakery option for dietary modifications owing to consumers' preference and as a potential growth opportunity for small-scale bakeries in the local context with low cost of production.

**Keywords:** consumer acceptability, functional food, garlic bread, growth opportunity, small-scale bakeries

## Development of carotenoid powder as a natural food colorant from pumpkin varieties available in Sri Lanka

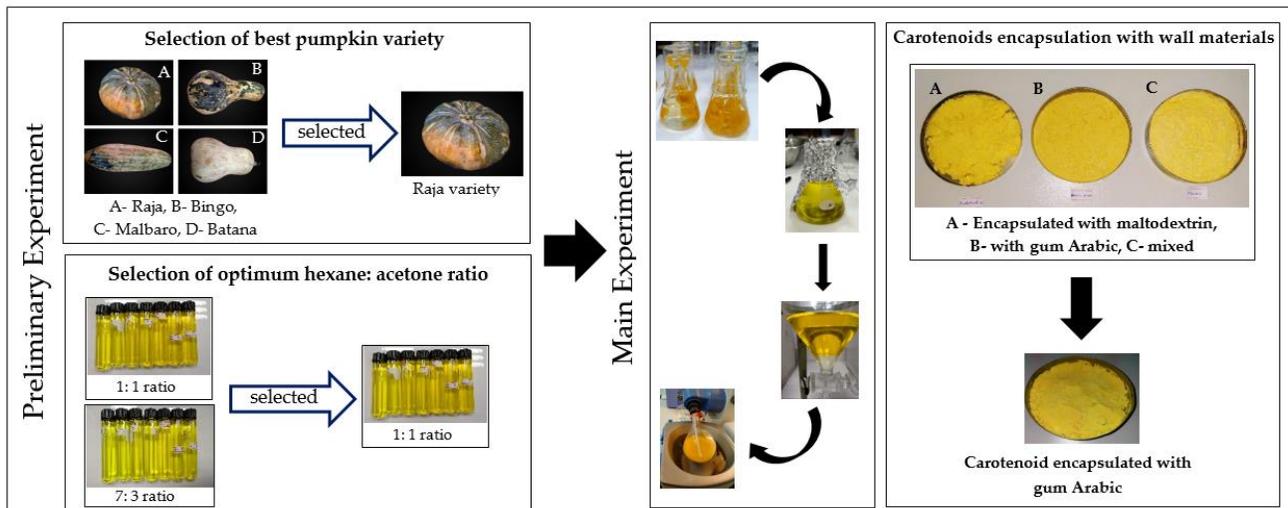
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Carotenoids are natural pigments with significant health beneficial properties. Among different carotenoid sources, pumpkin is a widely grown vegetable in Sri Lanka. Today there is a higher demand for carotenoids as natural food colorants due to the negative health impacts of artificial food colorants. However, the utilization of plant pigments as a food colorant is limited due to their instability, which can be overcome by encapsulating carotenoids. This study aims to develop a natural carotenoid powder from pumpkin as a substitute for artificial food colorants investigating optimum extraction conditions and encapsulating agents. Moreover, the physicochemical properties of the developed food colorant were also analyzed. The best pumpkin variety, having the highest carotenoid content was selected among four common varieties (Raja, Malbaro, Bingo, Batana) in Sri Lanka and carotenoids were extracted by the conventional solvent extraction method using hexane and acetone. The ratio of 1:1 was selected as the optimum ratio for hexane and acetone. Among four varieties, the Raja variety showed the highest carotenoid yield of  $24.63 \pm 0.52 \mu\text{g/g}$ . Maltodextrin, gum arabic, and a mixture of maltodextrin and gum arabic were tested as carotenoid encapsulating agents. Encapsulation with gum arabic yielded a higher total carotenoid content, carotenoid retention, and 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity of  $18.89 \pm 0.17 \mu\text{g/g}$ ,  $76.70 \pm 0.70\%$  and  $56.02 \pm 0.17\%$ , respectively. Encapsulation using maltodextrin yielded lower carotenoid retention ( $70.26 \pm 1.32\%$ ) and DPPH radical scavenging effect ( $37.82 \pm 0.70\%$ ) in comparison to the mixed sample. The color of all three treatments displayed high lightness and yellowness. The results revealed that the properties of encapsulated carotenoids highly depend on the type of the encapsulating agent, and gum arabic was proved to be effective as the best wall material for encapsulation of carotenoid extracted from pumpkin.

**Keywords:** carotenoid, encapsulation, extraction, food colorants, pumpkin

# Nitric oxide and superoxide radical scavenging activities of Sri Lankan low grown orthodox orange pekoe grade black tea (*Camellia sinensis* L.)

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Tea is the most consumed beverage in the world besides water and Sri Lankan tea which is known as Ceylon tea is the world's finest tea. Currently Sri Lanka remains the main orthodox black tea exporter globally and it is reported to have an array of health benefits. Although antioxidant properties of Sri Lankan low grown orthodox Orange Pekoe (OP) grade black tea are scientifically proven, its nitric oxide (NO) and superoxide radical scavenging activities (RSA) are not yet reported. Therefore, the present study evaluated the NO and superoxide RSA of Sri Lankan low grown orthodox OP grade black tea *in vitro*. Freeze-dried hot water extract of orthodox OP grade black tea was used in this study. NO (7.81, 15.63, 31.25, 62.5, 125 µg/ml) and superoxide (37.5, 75, 150, 300, 600 µg/ml) RSA were evaluated using 96-well micro plates-based bioassay protocols *in vitro* (n=3 each). Rutin (7.81, 15.63, 31.25, 62.5, 125 µg/ml) and quercetin (12.5, 25, 50, 100, 200 µg/ml) were used as the reference drugs for NO and superoxide radical scavenging assays respectively. Results clearly revealed that hot water extract of orthodox OP grade black tea possesses both NO and superoxide RSA in a concentration-dependent manner. However, it showed significantly higher ( $p < 0.05$ ) NO radical scavenging activity ( $IC_{50}$ :  $7.47 \pm 0.01$  µg/ml) than superoxide radical scavenging activity ( $IC_{50}$ :  $131.18 \pm 10.9$  µg/ml). Further, it exhibited potent NO radical scavenging activity and moderately potent superoxide radical scavenging activity compared to the reference drugs studied ( $IC_{50}$ : rutin and quercetin:  $17.62 \pm 0.01$  and  $75.58 \pm 1.92$  µg/ml respectively). In conclusion, orthodox OP grade black tea possesses potent NO and moderately potent superoxide RSA. This is the first report on NO and superoxide RSA of orthodox OP grade black tea and results highlighted its potential use in managing oxidative stress associated chronic diseases.

**Keywords:** Ceylon black tea, nitric oxide radical scavenging activity, superoxide radical scavenging activity

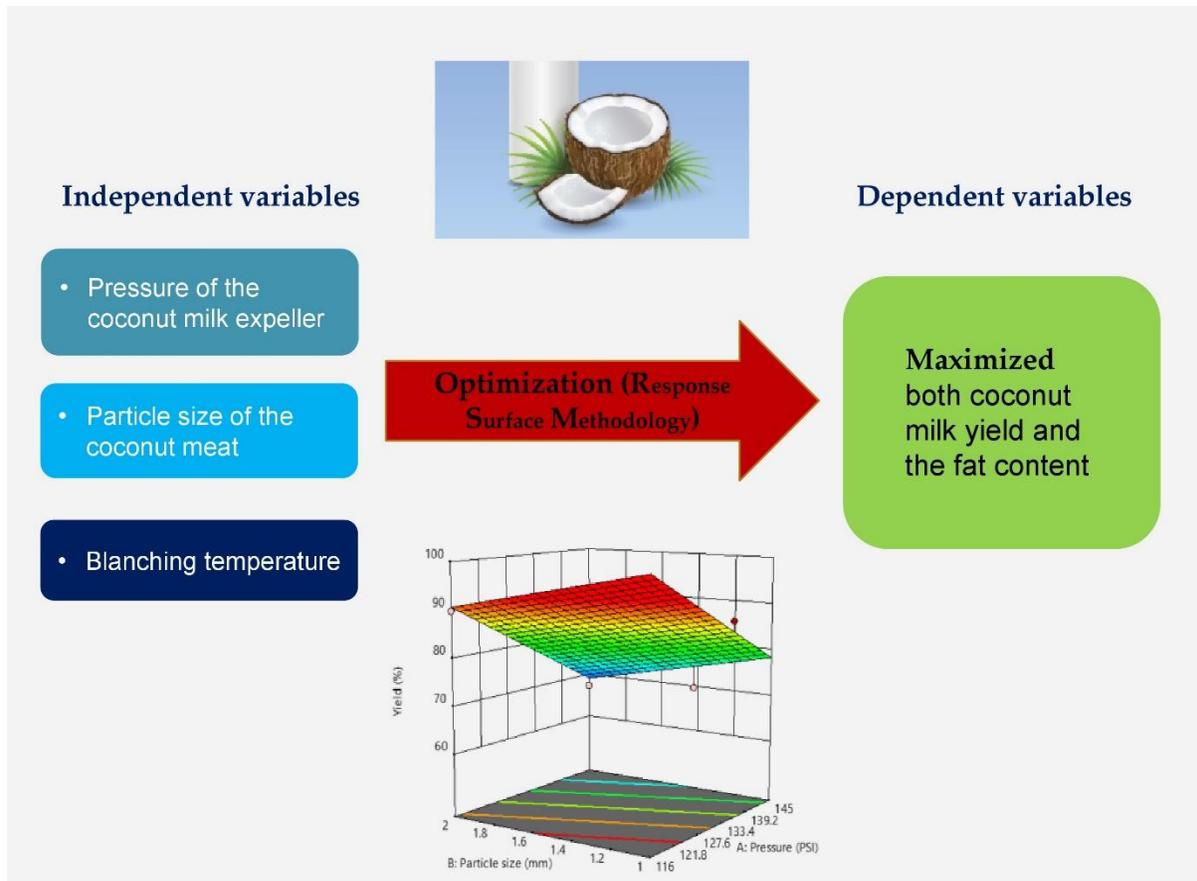
# Enhancing the coconut milk extraction yield through optimization of the mechanical extraction process using response surface methodology

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Coconut milk can be extracted by pressurizing finely grated matured coconut meat. Industrially, it is important to have commercial coconut graters and coconut milk expellers to enhance the efficiency of the coconut milk extraction process. Generally, the coconut milk extraction procedure directly influences the composition of coconut milk. However, the currently practiced milk extraction process does not have a scientific basis in terms of operation and optimization. Therefore, possible to have the inconsistencies that occurred in coconut milk frequently as well as reduced the extraction yield and the fat content. By overcoming those shortages, to enhance the efficiency of the coconut milk extraction process, the Response Surface Methodology was successfully applied to optimize the mechanical extraction conditions; the pressure of expeller [ $X_1$ ], the particle size of coconut meat [ $X_2$ ], and the blanching temperature [ $X_3$ ]. The experimental and statistical analysis resulted in an optimized solution of 125 psi of expeller pressure, 1 mm of particle size, and 80 °C of blanching temperature with predicted values of 93±5% and 33±1% for yield and fat content respectively, with the desirability of 0.94. Based on the obtained model equations and response surfaces it was revealed that the enhancement of blanching temperature and decrement of particle size contributed to maximum extraction yield and fat content of coconut milk. However, an increment in the pressure of the expeller reduced the extraction yield while enhancing the fat content of coconut milk indicating careful operation control. Obtained results were experimentally validated successfully showing no statistical significance between the actual and model-predicted values.

**Keywords:** coconut milk extraction, process optimization, response surface methodology

# Development of jackfruit flesh flour incorporated composite flour mixture with selected grains and pulses

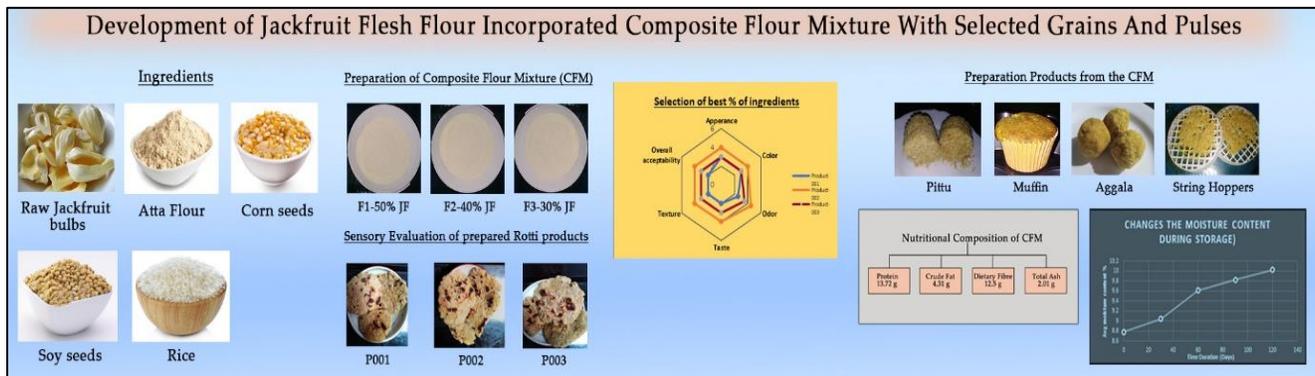
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Consumption of highly purified wheat flour-based food may cause non communicable diseases (NCDs). Thus, this study aimed to formulate a jackfruit flesh flour (JF) based composite flour mixture (CFM) using atta (AF), corn flour (CF), soy flour (SF) and rice flour (RF). Three formulations (50%, 40%, 30% JF) were tested. Best formula with highest preference was selected with sensory evaluation conducted for rotti prepared with the CFM and with thirty semi trained panelists, analyzed by paired comparison test. The proximate composition and microbiological safety of the selected formula were determined using AOAC methods. Data were analyzed with MINITAB-19 version at 0.01 significance levels. Shelf life of the CFM packed in triple laminated packaging was determined for four months. Moisture variation and microbial content was determined in monthly intervals during storage under ambient conditions (75% RH, 27 °C). Based on the sensory evaluation, the formula containing 40% JF, 40% AF, 10% CF, 7% SF and 3% RF was selected as the best CFM. The proximate analysis revealed that 100 g of the CFM contains  $13.72 \pm 0.15$  g of protein,  $4.31 \pm 0.09$  g of fat,  $2.01 \pm 0.05$  g of ash and  $12.5 \pm 0.04$  g of dietary fiber. Coliforms, yeasts, and molds were not detected in the CFM throughout the storage period. Possibility of preparing products such as pittu, cakes, muffins, aggala and string hoppers were also tested and proved possible. Thus, it can be concluded that, the developed composite flour mixture can be used as a substitute for wheat flour for preparing rotti, pittu, aggala, cake, muffin and string hoppers and it can be successfully stored for four months under ambient conditions packed in triple laminated packaging.

**Keywords:** composite flour mixture, flour-based products, grain, pulses

## Development of ash-plantain based sauce with incorporation of functional ingredients

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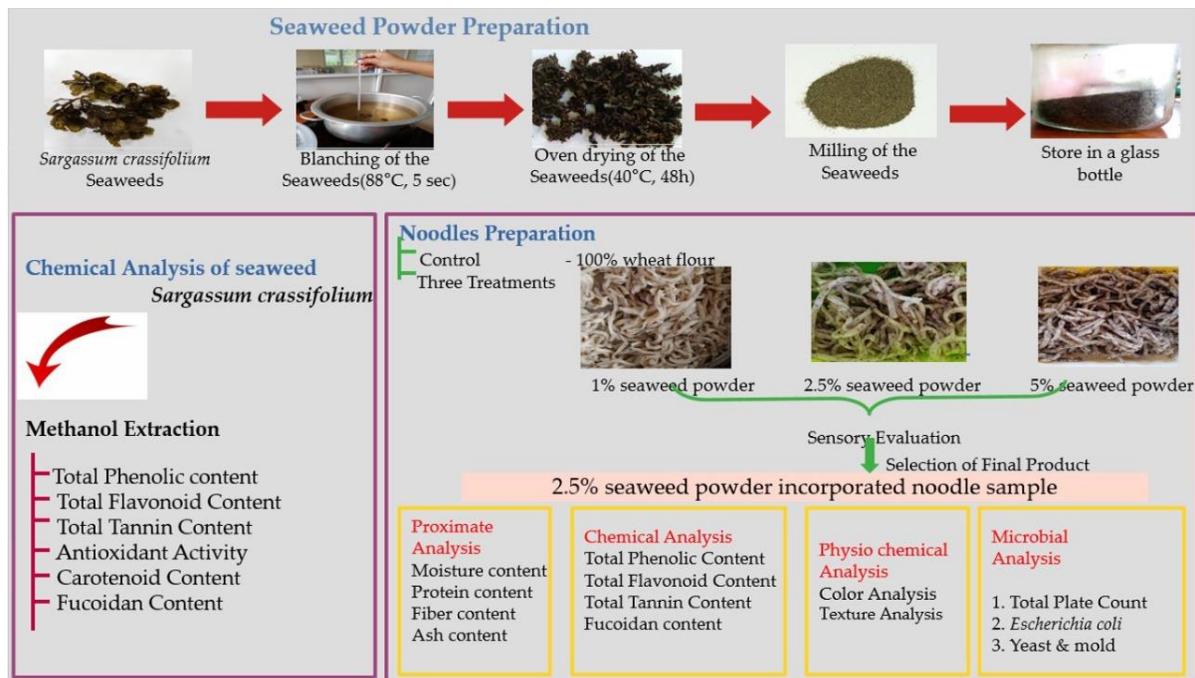
Ash plantain (*Musa paradisiacea*) is the fourth most important food crop in the world after rice, wheat and maize and a major source of energy. As an enrich with nutraceutical value based supplementary food for everyone, the sauce medium was selected. Also, when the plantains cooked with spices (onion, garlic and ginger), it is a very successful treatment for erectile dysfunction, low sperm count, kidney failure, diabetes and high blood pressure. Therefore, this study was focused to introduce the Ash-plantain based sauce as a supplementary food being ash plantain puree with functional ingredients. The best formula was selected by sensory analysis with a help of thirty (30) semi trained panelists (both male and female) using three different formula that prepared to conventional recipe of sauce only changing amount of ingredients. Proximate properties (moisture%, protein%, fat%, and ash%) and pH, brix values were analyzed. Microbiological properties of the final product were determined within one week interval for 30 days of storage period in refrigerated condition (5 °C-10 °C). The results of analysis revealed that, higher sum ranks, scored for all the sensory attributes and overall acceptability in Formula 3, which contained 30.3% ash-plantain, 37% boiled water, 8.4% of tamarind puree, 3.8% of dried mushroom powder, 3.4% of chili powder, 16% of other condiments, 0.3% of vinegar, 0.8% of salt and 0.2% of stevia powder. pH and Brix values of the final product were recorded as 4.35 and 31° respectively. The percentage of moisture, protein, ash, and fat were recorded as 27.5, 1.95, 1.8, and 1.44 respectively. For the selected sample within one month, the total coliform test was negative, Yeast and Mold recorded with a range of 25-50 CFU/g, total colony counts were shown between 25-250 CFU/g. Thus, this product development would be an excellent source of supplementary diet for fighting non-communicable diseases while maintain the good quality and nutritional value.

**Keywords:** ash-plantain, ash-plantain based sauce, mushroom powder, supplementary food

# Development of a noodle product incorporating dehydrated *Sargassum crassifolium* seaweed powder

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Seaweeds have many nutrients, many biologically active compounds whereas noodles considered as low with some nutritional sources. The objective of the study was to analyse the bioactive compounds present in the *Sargassum crassifolium* collected along the coastal area of Dikwella and Godawaya, Sri Lanka and to determine the use of *S. crassifloium* seaweed powder as an ingredient to make noodles. Seaweeds powder was prepared by removing impurities, blanching (88°C/5 sec), dehydrating (oven dried 40°C/48 h) and milled using a blender. From the methanol extraction of the seaweed there was 1.1±0.1(mg GAE/g) of total phenolic content (TPC), 21.1±0.8(mg RE/g) of total flavonoid content (TFC), 43.2±1.5(mg GAE/g) of total tannin content (TTC), 1.9±0.1(µg/g) of carotenoid content, 23.2±1.5 % of antioxidant activity and 23.2±0.3mg/200ml of fucooidan content. Control noodle sample was made with 100% wheat flour. Three treatments of the noodles were prepared by substituting wheat flour with 1%, 2.5% and 5% *S. crassifolium* seaweed powder. The effect of substituting wheat flour with *S. crassifolium* seaweed powder was determined by proximate analysis, chemical analysis, physiochemical and sensory analysis of the noodles. The most preferable noodle product was determined by using sensory qualities and it was 2.5% seaweed powder incorporated noodle sample which has better color and texture. It was composed with 11.3% of moisture, 1.9% of ash, 8.5% of protein and 2.1% of fiber. When compare with the control, 2.5% seaweed powder incorporated noodle sample had higher amount of TPC (0.8±0.1 mg GAE/g), TFC (9.9±2.5 mg RE/g) and TTC (36.9±0.9 mg GAE/g). Further, final product had 18.5±0.8mg/200ml of fucooidan content. This study shows that incorporating of 2.5% *S. crassifolium* seaweed powder to the noodles significantly increases the fiber level and ash content of noodles and it has many biologically active compounds. So, we can use this as a functional food.

**Keywords:** functional foods, *Sargassum crassifolium* seaweed, noodles

# Antioxidant activity of leaf of Sri Gemunu and Sri Wijeya (*Cinnamomum zeylanicum* Blume) high yielding cinnamon varieties in Sri Lanka

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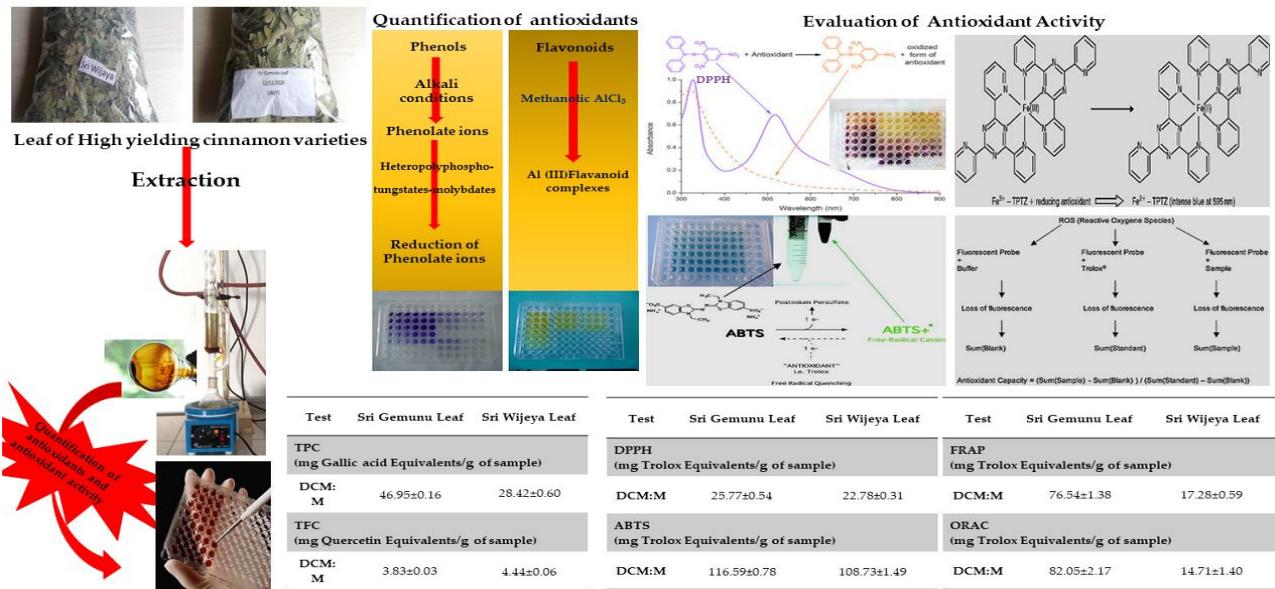
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Oxidative stress plays an essential role in pathogenesis of numerous non communicable diseases and aging. Managing oxidative stress through natural antioxidants has increased dramatically throughout the world during the last few decades. We have previously reported the leaf of Ceylon cinnamon as a rich source of natural antioxidants. However, the antioxidants and antioxidant activity (AC) of leaf of two high yielding cinnamon varieties in Sri Lanka namely Sri Gemunu (SG) and Sri Wijeya (SW) are not yet investigated. Therefore, the present study evaluates the antioxidants and AC of the leaf of SG and SW in vitro. Dichloromethane: methanol (DCM:M, 1:1, v/v) leaf extracts of SG and SW were used in this study. Antioxidants [total polyphenolic content (TPC) and total flavonoid content (TFC)] and AC [1,1-diphenyl-2-picryl-hydrazyl (DPPH), 2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), oxygen radical absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP)] were evaluated using 96-well microplates-based antioxidant bioassay protocols in vitro (n=4 each). Results clearly revealed that DCM:M leaf extracts of both SG and SW possessed antioxidants and AC with varying potential. However, the leaf extracts of SG showed significantly higher ( $p < 0.05$ ) antioxidants and antioxidant activity for all the studied assays (except for TFC) compared to that of SW. The mean TPC, TFC, DPPH, ABTS, ORAC and FRAP values of leaf extracts of SG were 46.95±0.16 mg gallic acid equivalents, 3.83±0.03 mg quercetin equivalents, 25.08±0.54 mg Trolox equivalents (TE), 116.59±0.78 mg TE, 36.66±1.30 mg TE and 76.54±1.38 mg TE per gram of sample respectively. In conclusion both leaf extracts of SG and SW possessed marked antioxidants and AC via radical scavenging and reducing power mechanisms. Further, this is the first report on antioxidants and AC of leaf of SG and SW high yielding cinnamon varieties in Sri Lanka and results highlight its potential use in managing oxidative stress associated chronic diseases.

**Keywords:** antioxidants, Ceylon cinnamon, Sri Gemunu, Sri Wijeya, total polyphenolic content

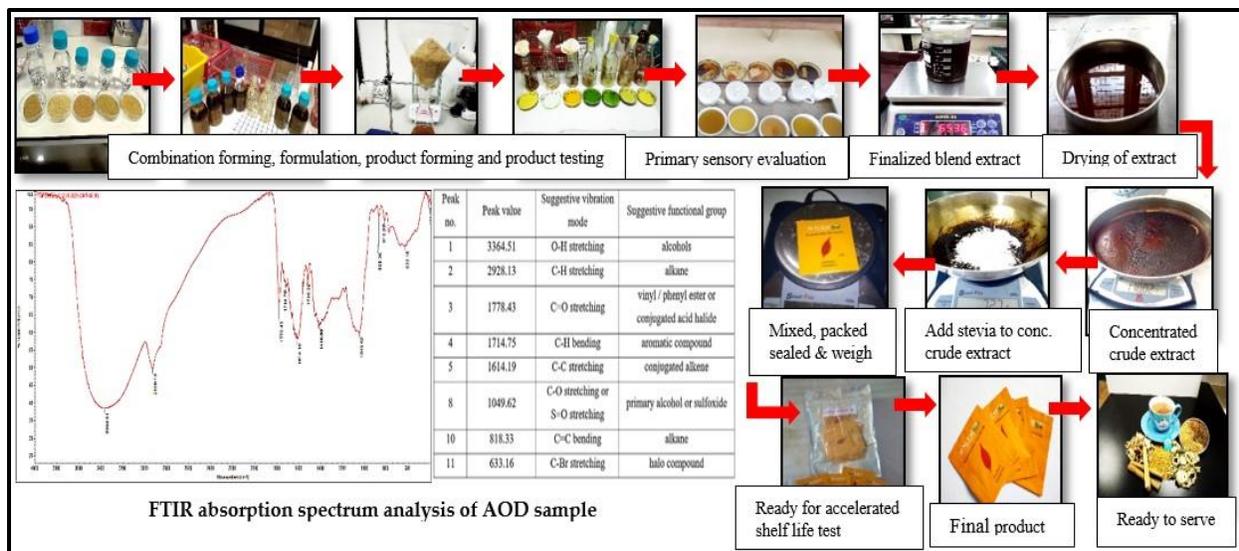
## Development and semi-characterization of an edible tea with possible anti-diabetes properties

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Type 2 diabetes (T2D), a metabolic disorder affecting people worldwide with increasing prevalence in the South Asian region. The present study was conducted to develop and semi-characterize an edible herbal tea using common Asian spices, namely organic cinnamon (OC), organic ginger (OG), and organic fenugreek (OF), with organic bitter melon (OB), which are known to be having therapeutic effects in T2D, with a coating of stevia. The composition in the finalized herbal blend was evaluated by trained and untrained panelists for aroma, liquor colour, infusion, taste, and overall acceptability, whereas the OC, OG, OB, and OF blend was set at 5:2:2:1, respectively. The final product combination for crude extract and stevia showed highest sensory performance at 7:3 (w/w). Fourier transform infrared spectroscopy analysis of the oven dried sample (AOD) detected peaks of major functional groups responsible for diabetes, such as C-H stretching vibration of alkane, and O-H stretching of alcohols/ phenols at 2928.13, and 3364.51  $\text{cm}^{-1}$ , respectively. Further, C=O stretching of vinyl/ phenyl ester/ conjugated acid halide, C-H bending of aromatic compounds, C-C stretching of conjugated alkene, C-O stretching/ S=O stretching of primary alcohol or sulfoxide, C=C bending of alkane and C-Br stretching of halo compounds were recorded at 1778.43, 1714.75, 1614.19, 1049.62, 818.33 and 633.16  $\text{cm}^{-1}$ , respectively, which are similar to that of cinnamic acid derivatives, tannins and flavonoids with anti-diabetic properties. The accelerated shelf-life test was performed for the packed product, by providing temperature stress conditions (room temperature, 4°C, and 60°C) throughout 27 days (36 h  $\times$  18 cycles) showed no significant growth of fungi, *Salmonella enterica*, *Salmonella bongori*, *Escherichia coli*, or other harmful bacteria, highlighting the safe consumption of the product with one-year of shelf-life. The developed herbal tea can be utilized at number of tea times during a day with possible anti-diabetic properties, high palatability, with minimum waste generation due to the edible properties of the infusion.

**Keywords:** Asian spices, edible tea, flavonoids, tanning

# Development and quality evaluation of coconut milk-based whipping cream

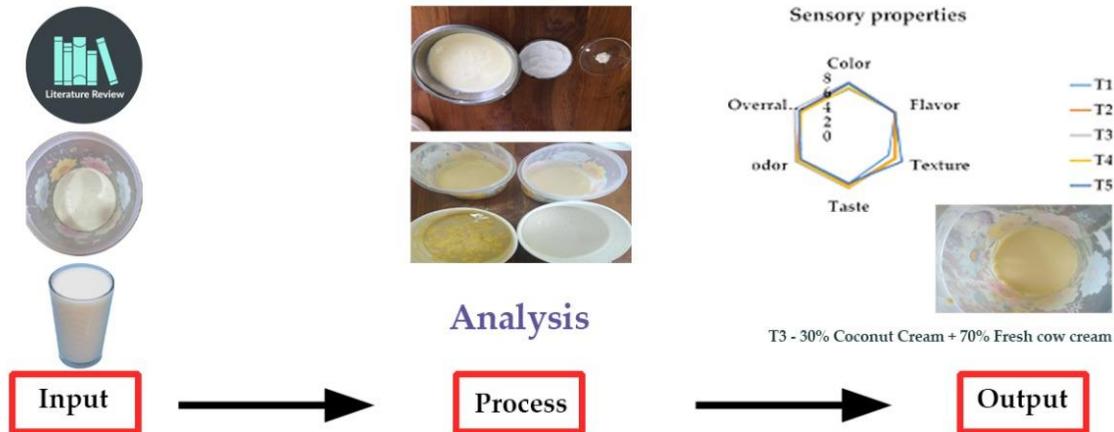
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## Development and quality evaluation of coconut milk based whipping cream



This study was carried out to develop coconut milk-based whipping cream and to determine the quality of composites. Coconut (*Cocos nucifera* L.) is an important commercial plant that gives various products. Because of the fashionable western diet, the high and exorbitant expense of animal milk, the replacement of coconut milk reduces the expense of whipping cream. The whipping cream was prepared using coconut cream and fresh cow cream with different proportions as 100% coconut cream, 100% fresh cow cream (control), 30% coconut cream + 70% fresh cow cream, 10% coconut cream + 90% fresh cow cream. Sensory evaluation was conducted for developed different formulas with commercially available whipping cream using the nine-point hedonic scale to determine color, flavor, texture, taste, odor, and overall acceptability. The whipping properties and physicochemical properties were determined, and the data were analyzed at 0.05 significant level. There was a significant difference observed among treatments. All the results of the treatments were compared with the results of the control sample, and 30% coconut cream + 70% fresh cow cream sample was selected as the best formation and had 96s whipping time, 1.43% overrun, 47% moisture, 52% total solids, and 45% fat. Eventually, the blending of coconut milk and cow milk improves the whipping properties, physicochemical properties, and sensory properties.

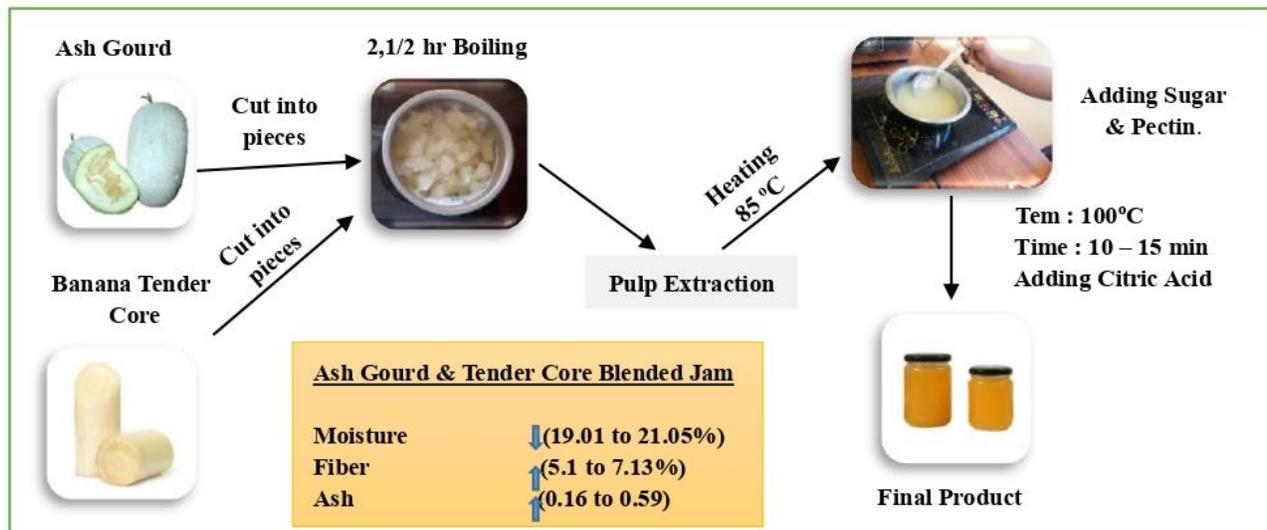
**Keywords:** coconut cream, physicochemical properties, sensory properties, whipping cream, whipping properties

## Quality determination of banana (*Musaceae*) stem tender core and ash gourd (*Benincasa hispida*) blended jam

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Banana tender core and ash gourd have more fiber and protein which are beneficial for human health. Jam is a conventional food item, usually utilized as desserts, and bread spreads, which is set up by using fruit pulp, sugar, acid, pectin and has an exceptionally sweet taste. The blended jam was produced with five treatments (T1: only ash gourd, T2: only tender core, T3: ash gourd 50% & tender core 50%, T4: ash gourd 30% & tender core 70%, T5: ash gourd 70% & tender core 30%,) with sugar (60g), pectin (3g) and citric acid (2g). Physicochemical (Ash, Fiber, moisture, pH, Color, and Titratable Acidity) and sensory properties (flavor, taste, texture, color, odor and overall acceptability) were evaluated using AOAC (2000) and nine-point Hedonic scale. Statistical data were analyzed at 0.05 significant level. Data were analyzed within different five treatments. Moisture content ranged from 19.01% to 21.52%. The ash content varied from 0.16% to 0.59%. Fiber content ranged from 5.10% to 7.14%. pH of the jam varied from 2.8% to 2.9%. Titratable acidity ranged from 1.08% to 1.59%. Moisture, ash, fiber, and titratable acidity had the significant difference and pH had not significant difference. Based on the experiment, the lower moisture content was observed in T4, it can select as best sample. It had 0.16% ash content, 6.18% fiber content, 2.8 pH content and 1.15% titratable acidity.

**Keywords:** ash gourd, banana tender core, jam, quality evaluation

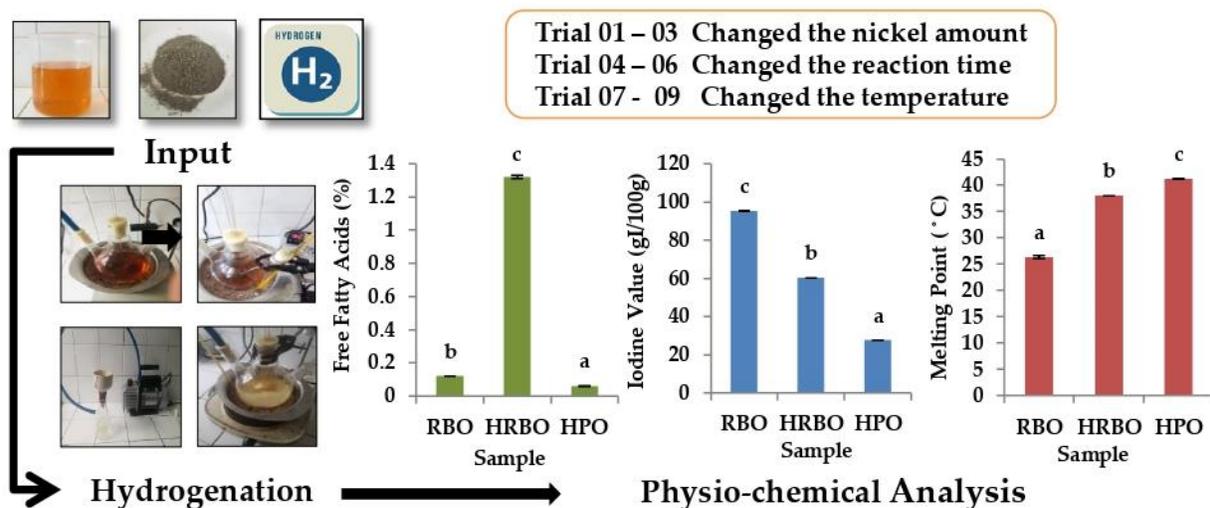
## Determination of optimal processing conditions for hydrogenation of rice bran oil

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Hydrogenation has been practiced for over a century to improve the oxidative stability of vegetable oils for improved shelf life and to modify the solids content and melting characteristics of oil to formulate shortening and margarine products with desired physical properties. Based on that, this research was carried out to produce hydrogenated rice bran oil (RBO) using refined, bleached, and deodorized oil from rice bran. Nickel (Ni) is used as the catalyst. The key factors that change during pretreatment were identified as reaction time, temperature, and the amount of catalyst. The amount of catalysts used for the trials was filtered by using vacuum filtration after the reaction was completed. Moisture content, melting point, iodine value, peroxide value, fatty acid (free), and acid value were analyzed to check the oil properties. The above-mentioned physio-chemical properties of RBO, hydrogenated palm oil (HPO), and hydrogenated RBO (HRBO) were determined, and the data were analyzed at 0.05 significant level. There was a significant difference between the samples. The optimum conditions for HRBO were reported as; 2g of Ni for 200g of RBO under the temperature of 180° C for 6 hours based on the results of less iodine value: 60.31 and, high melting point: 38°C than raw RBO. The HRBO was resulted free fatty acid value: 1.32%, acid value: 1.57%, peroxide value: not detected, iodine value: 60.31, melting point: 38°C, moisture content: 0.02%. Those values were compared with the HPO and RBO, and the raw RBO was shown free fatty acid value: 0.14%, acid value: 1.57%, peroxide value: not detected, iodine value: 95.21, melting point: 26.3°C, moisture content: 0.09%.

**Keywords:** hydrogenation, hydrogenated rice bran oil, physio-chemical parameters, rice bran oil