JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"Preparation and Evaluation of Nutraceutical Noodles from Banana Pseudo Stem for Prebiotic Activity"

Shital Diliprao Chavan [1], Dr Aditi Kulkarni [2]

Department of Pharmaceutics, Jayawantrao Sawant College of Pharmacy & Research,

Hadapsar, Pune. Email Id: shital8580@gmail.com

ABSTRACT

Background: Including the affection of noodles in children's, in India parents' belief that noodles are being made from Maida which has low fibres, carbohydrates, protein, etc. So, this attempt was compelled to form nutraceutical noodles of wheat by incorporating banana pseudo-stem powder (BPP) i.e., rich in nutrition, fibre contents that shows prebiotic activity & antioxidant activity by DPPH method.

Methods: BPP was incorporated at concentrations i.e., 10, 30, 50 %. From this 30 % was found to be best based on their cooking characteristics and by comparison of nutritional values with marketed product. The prepared noodles were packed in polyethylene pouches then stored at room temperature and were further analysed for cooking, physicochemical, colour characteristics at regular interval of time.

Result: In the present study, fibres enriched noodles were prepared by incorporating banana pseudo stem. It may help to avoid children obesity as it is in regular diet as a prebiotic food also reduce oxidative stress that common in obese fellows.

Key words: Nutraceuticals, Prebiotics, Banana pseudo-stem (BPP), Wheat flour (WF), Noodles, Gastrointestinal microflora, Antioxidant activity, DPPH (2,2-Diphenyl-1-picrylhydrazyl), Dietary fiber etc.

INTRODUCTION

Now days in India many scientists centre of attention is 'Nutraceutical' products. These are alternative product that vanish the line between medicine and food. It means 'Nutrition provides in the form of pharmaceuticals. As modern science reveals the key of balanced diet, population begins to pay attention mainly parents toward nutrition due to children obesity is now a global issue. From this perspective 'prebiotics' is considered to be one of the capital trails. The Prebiotics were basically proposed as dietary way of changing human gastrointestinal microflora toward more favourable community that stimulating the growth or/and activity of colonic microflora to improve host health. This includes mainly carbohydrates e.g., dietary fibres and resistant starch also proteins and lipids.[1, 2]

In India, approximately 51 million tons of 'Banana Pseudo-stem' is wasted annually. This is source of fungal contamination, if this incinerated in the open field, it creates air pollution but this biomass is reported to be rich in nutrition. So, efforts have been made for conversion of banana plant biomass into a value-added biomolecule. The properties of the banana pseudo stem powder indicate good fibres supplementation in the growth of new food products.[3]

Noodles are being consumed as a staple food for many years by Asian peoples. It is very, easy to cook and convenient, delicious, nutritionally rich and has now archived great rating outside and Asia also. Noodles and junk foods are being choice of food in the children, they are always attracted to this. So, in this present study, fibres enriched noodles were prepared by incorporating banana pseudo stem powder. It may help to

avoid children obesity as it is in regular diet as a prebiotic food that promotes the growth of gut microflora i.e., specific species of *Bifidobacterium* and *Lactobacillus* have anti-inflammatory action that prevent colonization of pathogenic bacteria's that beneficial to host that causes fermentation of fibres and production of short chain fatty acids (SCFA) that improves gut health and results in weight loss. [4]

MATERIAL & METHOD

Raw Materials:

The Banana pseudo-stem obtained from Go Green Agri Solutions, Dhule. While whole wheat flour (WF) was obtained from flour mill located in market of Hadapsar, Pune.

Analysis of Nutraceutical Powder:

The nutritional quality parameters of banana pseudo stem powder include moisture, ash, total protein, fat, carbohydrate, energy, crude fibres, DPPH & physical parameters like water & oil holding capacity were analysed using standard method.

Water holding capacity (WHC):

In various food system the water-holding capacity (WHC) is determine by a protein–water interaction. Functional properties are regulated by the composition and structure of proteins and the interactions of proteins with each other and with another substance. WHC of protein is an important because it affects the taste of food formulations, feel the texture, juiciness and especially in particular the shelf-life of all bakery products.

WHC was determined by taking 2.5 gm of pre-weighed BPP in 30 ml centrifuge tube. Then 10 ml of distilled water was added and mixed well with sample. The sample stood in room temperature (22 ± 2°C) for next 30 min. The mixture was centrifuged for 30 min. at 1200 g (3709 rpm). After centrifugation supernatant formed was decanted carefully and mass of sample was recorded. The WHC (g water / g powder) was calculated as follow.[5]

$$\% \text{ WHC} = \frac{\text{Weight of tube with sample And water after decanting} - \text{Weight of tube with sample}}{\text{Weight of sample}} \times 100$$

Oil holding capacity (OHC):

The OHC of BPP was measured by taking 2 gm of sample in a 30 ml of centrifuge tube. The 20 ml of vegetable oil add in centrifuge tubes, then mix well and for 30 min. samples stood in room temperature, then centrifuged at 3500 rpm for again 30 min. after that supernatant was decanted slowly and the new mass of sample was recorded. The OHC (goil / g powder) was calculated as follow.

$$\% \text{ OHC} = \frac{\text{Weight of tube with Sample And oil after decanting} - \text{Weight of tube with sample}}{\text{Weight of sample}} \times 100$$

Bulk Powder Characteristics:

The bulk powder characteristics includes Bulk density, Tapped density, % Compressibility, and Hausner's ratio. A pre-weighed BPP was taken in cylinder and volume was recorded (V0). The cylinder was tapped for till the final volume remained same (Vt). The bulk and tapped densities were then calculated by the following equations.

Bulk Density: m / V0, g per cm3.

Tapped Density**:** m / Vt, g per cm3

m = weight of powder

V0 = bulk volume

The Carr's index is shows to flow property of the powder.

$$\text{Carr's index (\%)} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$$

Determination of DPPH radical scavenging properties.

Procedure:

1. For this assay UV-spectrophotometer was used to perform this assay. Fresh DPPH stock solution (0.004%) was prepared and stored in dark place until used.
2. As a positive control, Ascorbic acid (50 mg/50 ml) was prepared in distilled water and dilutions 10, 20, 30, 40, 50 µg/ml were made.
3. Test solutions were made in DMSO and allowed to react with DPPH solution at room temperature in dark place for 30 min then filtered and the absorbance values were measured at 517 nm against blank.
4. The radical scavenging activity was expressed as % DPPH radical (% inhibition). Calculated according to equation concentrations were transformed to log concentrations and were plotted against % inhibition for 5 concentrations.

$$\text{\% Inhibition} = \frac{\text{Absorbance of Control} - \text{Absorbance of Test}}{\text{Absorbance of control}} \times 100$$

Determination of Prebiotic Value of Nutraceutical Powders:

Prebiotics are foods for probiotic bacteria which grow in intestine and improve gastrointestinal health along with many health benefits. Prebiotic potential of BPP was determined by streak plate method. The MRS nutrient media was positive control & plain agar medium was used as negative control. The following medias were prepared for the prebiotic activity evaluation:

a. MRS nutrient media (25ml)

b. Plain agar medium (25ml)

c. Plain agar (25ml) + BPP

All nutrient media were sterilized in an autoclave for 15 min at 121°C.The suspension of *Lactobacillus Acidophilus* was prepared. Aseptically suspension was added altogether nutrient media in Petri plates. All Petri plates were transferred within the BOD incubator for twenty-four hand temperature of 37°C was maintained with anaerobic conditions. The growth of *Lactobacillus Acidophilus* was observed after 48 hr.[11]

Blending Formulations Development:

Blending Formulations as healthy noodles (as prebiotics) were prepared of BPP & WF respectively.

Table 1: Blending formulations of Banana Pseudo-Stem Powder (BPP) & Wheat Flour (WF).

Sr. no.	Sample BPP:WF	Banana pseudo-stem powder (g)	Wheat flour (g)
1	F1 10:90	10	90
2	F2 30:70	30	70
3	F3 50:50	50	50

Noodles Preparation:

The material for preparation of noodles were WF, salt, banana pseudo-stem powder, and water. Salt was first dissolved in water and therefore the solution was added to the flour alongside BPP at the various concentrations i.e., 10, 30, 50 %. and mixed well to form crumbly consistency dough. Noodle dough is making out for about 30 min. to form the dough to be smooth consistency for sheeting. The dough was first formed into a sheet by process of folding and spending through the rollers of the noodle machine several times. The thickness of the sheet was reduced stepwise by minimizing the roller spacing before cutting into strands of 4 mm thick. Steaming of freshly prepared noodles is completed for about 15-20 minutes until noodles were partially cooked. The steam cooked noodles were settled on trays and were kept it for sun drying about 6-8 hours for permanently effective drying then kept during a hot air oven at 60°C for 6-8 hours until the merchandise has reached to about 12% moisture content. That trays then allowed to chill down for half-hour within the ambient conditions at room temperature. Then packed in loose packet, sealed properly then stored at ambient temperature. [15]

Fig 1. Prepared Noodles

Evaluation Parameters:

Water absorption and soluble loss of dry noodles:

The prepared noodle samples were firstly dried at 110°C for twenty-four hrs. in an oven. Then samples were taken out then, cooled during a desiccator and weighed. The pre-weighted 2 gm of dried noodles were taken during a Petri dish and were soaked at 25°C for twenty-four hr. in a water. Then noodles were weighed accurately that indicates the water absorption of the dry noodle samples. The pre-weighted soaked noodles were next dried within the same manner at 110°C, 24 hrs. and were reweighed again. The difference between the load of dried sample and original sample gave the percent soluble loss of noodles. This Calculated by the subsequent equations.[16]

$$\text{Water absorption} = \frac{\text{Wt. of wet Noodles}}{\text{Wt. of dry Noodles}}$$

$$\text{Soluble loss} = \frac{\text{Wt. of Loss}}{\text{Wt. of Sample}}$$

Texture Analysis:

The texture of noodles was determined using Brookfield CT3 Texture Analyser fitted with a 10 kg load cell equipped with the Texture pro CT V1.8 Build 29 software. That was measured through the tension test using 0.30 mm s^{-1} test speed, for this evaluation 5-4 cm long noodle strands were laid side by side, touching each other, perpendicular to the cylinder probe on a flat aluminium base. The cylinder probe was adjusted to be at 15 mm distance from the lower plate at the start of the test, and was forced down through the noodle strips at the speed of 5 mm s−1 until it touches the flat base to the noodle thickness, and was drawn back to at the end of the test. The curve obtained using a texture analyser software.[23]

Cooking properties of Noodles:

All the prepared noodle samples were studied for cooking properties including cooking time, cooked weight, percent rehydration and cooking loss.

1. **Cooking time:**
   The 1 gram of dried noodle samples were dig small pieces about 2 cm length. Then during a beaker, cooked with time to time stirring containing 60 ml boiling water. The cooking time decided by squeezing the noodles after every 30 sec. between two glass slides and recording the time of vanishing of white core of noodle threads, which shows the cooking time.
2. **Cooked weight:**
   The noodles were cooked in boiling water for respective cooking time as calculated, then cooked noodle samples were rinsed with 20 ml water and drained for two min. then taken a wet mass of noodles that indicated a cooked weight of noodles.
3. **Percent rehydration and cooking loss:**
   Both percent rehydration and cooking loss were determined by the tactic of Hormdok and Noomhorm. For the determination of percent rehydration, noodle strands were cooked 1 min quite their respective cooking time. Then washed with water and drained for two min. to the cooked noodles, then weight was then taken understand the percent rehydration. The cooking water and washing water were collected separately in pre-weighed Petri dishes and were dried in an oven at 105°C till constant weight was obtained, to work out cooking loss, the residues were weighted after cooling the sample in desiccator. The cooking loss was calculated by measuring the amounts of solid residues remained within the cooking and rinse water after drying. The Percent rehydration and cooking loss were calculated by following equations.[17]

$$\text{Rehydration \%} = \frac{\text{Weight of cooked Noodles} - \text{Weight of uncooked Noodles}}{\text{Weight of uncooked noodles}} \times 100$$

$$\text{Cooking Loss} = \frac{\text{Weight of dried residues}}{\text{Weight of uncooked noodles}}$$

RESULT AND DISCUSSION:

Banana Pseudo-Stem Powder:

1. The banana pseudo-stem was cleaned under the water. Then outer sheaths were removed till the inner tender core reached.
2. The inner tender core was made into slices with slicer.
3. Then the slices were soaked in 0.2 % of the citric acid solution for 10 minutes to regulate the browning reaction.
4. Then these tender core pieces were blanched at 100 °C for two minutes and dried employing a laboratory tray dryer at 60 °C. It took 12 hours to dry completely.
5. The dried sample was powdered employing a mixer. Then the powder was sieved with a 400-micron sieve and stored in airtight containers, also WF sieved with 100 mesh screens to obtain uniform flour particles.
6. The flours were then stored during a refrigerator by packing in airtight plastic bags.

Nutritional parameter analysis of BPP:

Table No. 2. Nutritional Analysis

Sr. no.	Nutritional parameters	Values
1	Moisture	9.0 %
2	Ash	14.50%
3	Crude fibre	41.11%
4	Protein	6.60 gm
5	Carbohydrate	39.00 gm
6	Total Dietary fibre	32.86 gm
7	Total Fat	2.40 gm
8	Energy	204 kcal
9	Water holding capacity	429.2 %
10	Oil holding capacity	182.5 %

Bulk Powder Characteristics:

The WF and BPP showed angle of repose quite 40 degrees, Carr's index 10 and 20 %, Hausner's ratio was quite 1.25 and 1.11, indicating fair and excellent flow resp. and compressibility characteristics.

Determination of Antioxidant Activity:

The methanol extract was obtained by successive extraction method by Soxhlet apparatus.

The results are expressed at least % inhibition. Nutraceutical ingredient i.e., banana pseudo stem powder showed antioxidant potential.

Result showed that as concentration rises activity increases in following figure.

As we are focusing child obesity, better antioxidant activity of formulation may help to control oxidative stress, which common in obese fellows

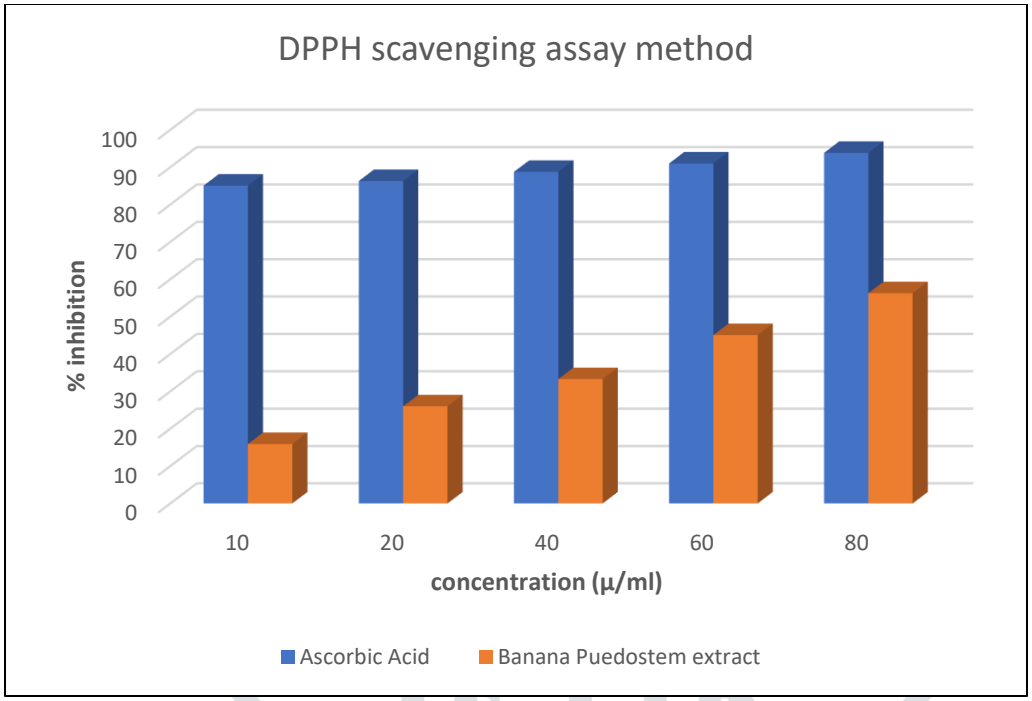
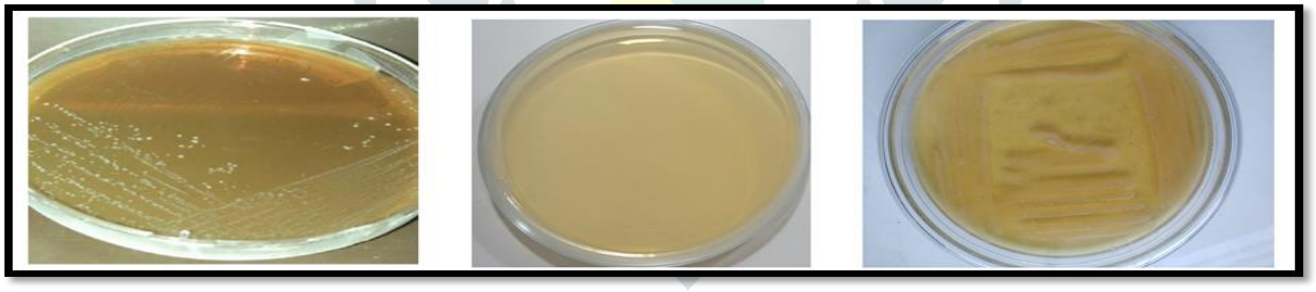


Fig.3: DPPH scavenging assay method

Determination of Prebiotic Potential:

The visual growth of *Lactobacillus Acidophilus* ATCC 4356 developed for the banana pseudo stem powder as it shown the prebiotic activity that presented in following figures.

As the drug support growth, it may maintain the gut flora & thus help in better digestion.



A) Positive control- Growth B) Negative control – No growth C) Sample – Growth

Fig.4: Prebiotic- potential Determination

Proximate Composition of Uncooked Noodles:

The proximate combination of flours with BPP to make proper noodles tried with 'Wheat, Ragi, Jawar' flours. From that it observed wheat-based noodles shows an increase in protein content which help in formation of strong gluten network resulted in well-formed noodles. Proximate uncooked noodles combinations were importantly impressed with the wheat flour incorporation in different proportions. The WF had shown an excellent flowability, also wheat is reach in proteins, carbohydrates, fibres that results good nutrition too.

Evaluation Parameters:

Table No.3: Evaluation Parameters

Evaluation parameters	F1	F2	F3
Water absorption (gm)	1.90	2.21	3.50
Soluble loss (gm)	0.04	0.08	0.12
Cooking weight (gm)	4.62	4.92	5.12
Cooking loss (gm)	0.24	0.25	0.27
Rehydration (%)	131	146	156
Cooking time (min.)	9-11	7-10	8-9

The prepared noodle's water absorption index depends on proximate composition, hydrogen bonding, and gluten matrix. The water absorption of uncooked noodles ranging from 1.90-3.50g/g, water absorption index maximises with low protein and weak bonding. The pure WF noodles showed less Water absorption and soluble loss.[15]

The value reported to be lower than the 0.09 g/g for Soluble loss in noodles made from the WF and composite flour. Soluble loss of prepared noodles was found to be 0.04-0.1 g/g, lower the WF in blends of noodles higher will be the soluble loss which result in less strong texture of noodles. The cooking parameters, i.e., cooked weight, cooking time, percentage rehydration and cooking loss of BPP based noodles were guided with addition of WF in various proportions (Table 4). With the addition of WF, Cooking time increased in the blended noodles. Pure WF noodle cooked slowly (11.23 min), while prepared noodles cooked quickly. The values for wheat based BPP noodles are in accord with the work of Ritthiruangdej et al.,2011, By substituting of other ingredients with WF causes broken off in the gluten network, which resulted in enhanced moisture penetration, thus reducing cooking time.

Cooked loss, percent rehydration and cooked weight, values ranged from 0.24 to 0.27 g/g, 101 to 156 % and 4.62 to 5.12 g/g, respectively, and were decreased by the addition of WF. In the present findings cooked weight are supported by the observation of Yadav et al.,2014 who observed variation (2.67–2.89 g) in cooked weight of noodles formed by blending WF with BPP. The increased cooked weight of noodles might be due to greater swelling power and viscosity. The ability to resist structural breakdown during cooking by the noodles is cooking loss. The cooking loss values are in accord with Inglett et al., noted low-cooking loss values (0.057–0.074 g/g). The prepared noodles by WF with BPP at various proportions ranged from 0.24–0.27 g/g. Greater cooking loss in noodles has been due to the structural protein network discontinuity as with the addition of BPP with WF. This caused more solids to be leaked out in cooking water.

Percent rehydration may affect the eating quality of noodles. The wheat-based blended noodles' rehydration assorted mainly from 167 to 189 % reported by Yadav et al.,2014. The decrease in protein content and substituted gluten network might be responsible for enlarge in water uptake. The prepared noodles had High-rehydration values i.e.,131 to 156 % gave noodle a sticky and soft texture.

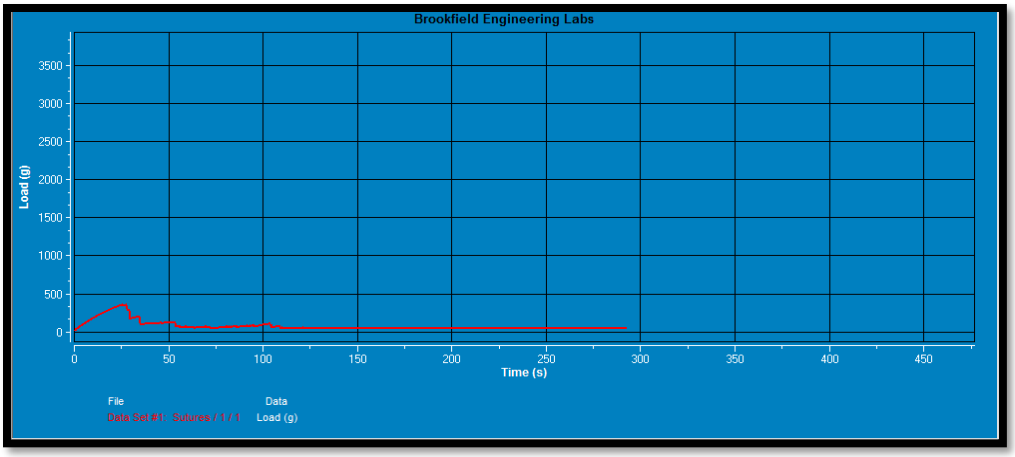


Fig.5: Tensile Strength of Noodles

The Tensile strength of noodles dictates noodle bite, as soft bite or hard bite, in the present study noodle's strength was appropriate $p < 0.05$. The peak load in above fig. 5 shows the strength i.e.,0.394 kg/cm^2 of dry noodles.

CONCLUSION:

In present study revealed that the noodles prepared from different blends of WF and BPP showed acceptable quality attributes. The Proximate compositions are rich in Moisture, Ash, Proteins, Carbohydrates, Crude fibres, Dietary fibres, Low fat content with good water and oil holding capacity that provide good nutrition. Due to dietary fibres these noodles given prebiotic activity that may overcome the children obesity with nutrition.

The noodles have good tensile strength that help in storage & indicate soft bite. From the different blends F2(30:70) batch was selected as an optimised batch, which given proper noodle formulation compare with F1 and F3 batch. F2 also given appropriate nutrition with low fat and high fibre content as serving 100g of noodles to children when compared with marketed 'Maggi Masala Veg Atta Noodles' as a formulation.

This one also better when compared with nutraceutical standard prebiotic marketed formulation i.e., prebiotic 'Dark Orange Peel Chocolate' by high protein, carbohydrate, fibre content and by low fat content. And the DPPH assay shown remarkable antioxidant activity to BPP. The context shelf-life storage study was 180 days for prepared noodles with no notable difference in characteristics of BPP fibre noodles. So, shelf life of fibre riched noodles was found to be 180 days. And the nutraceutical noodles of BPP as prebiotics was successfully prepared and evaluated.

ACKNOWLEDGEMENT

The author is thankful to the Department of Pharmaceutics, JSCOPR, Hadapsar, Pune for providing lab facilities during research work.

REFERENCES

1. Gibson GR, Roberfroid MB. Dietary modulation of the human colonic microbiota. Introducing the concept of prebiotics. J Nutr. 1995;125(6):1401-12.
2. Gibson GR, Probert HM, Loo VJ, Rastall RA, Roberfroid MB. Dietary modulation of the human colonic microbiota: updating the concept of prebiotics. Nutr Res Rev. 2004;17(2):259-75.

3. Noor, A.A., Ho, L.H., Azahari, B., Bhat, R., Cheng, L.H. and Ibrahim, M.N.M. (2011). Chemical and functional properties of the native banana (Musa acuminata balbisiana Colla cv. Awak) pseudo-stem and pseudo-stem tender core flours. Food Chemistry. 128(3): 748-753.
4. Tomás Cerdó, José Antonio García-Santos, Mercedes G. Bermúdez and Cristina Campoy, The Role of Probiotics and Prebiotics in the Prevention and Treatment of Obesity, Nutrients 2019, 11, 635.
5. Heywood AA, Myers DJ, Bailey TB, Johnson LA; Functional properties of low-fat soy flour produced by an extrusion-expelling system. Journal of the American Oil Chemists' Society, 2002; 79(12): 1249-1253. 24.
6. Chakraborty P; Coconut protein isolate by ultrafiltration. Food engineering and process applications. 1986.
7. Molyneux, P. The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity,2003.
8. Fu, B. X., Asian noodles: History, classification, raw materials, and processing. Food Res. Int. 2008, 41, 888–902.
9. Hou, G., Oriental noodles. Adv. Food Nutracuetical. Res. 2001, 43, 141–193.
10. Jideani VA; Functional properties of soybean food ingredients in food systems. In Ng PT-B editor; Soybean - Biochemistry, Chemistry and Physiology: In Tech, 2011.
11. Meera Chandradatt Singh, Kishore N. Gujar, Preparation and Evaluation of Nutraceutical Product Mixture of Seeds of Cucumis melo, Punica granatum, Linum usitatissimum, for Antioxidant, Prebiotic and Nutraceutical Potential, Pharmacogn J. 2019; 11(2): 383-387.
12. Nur AM, Nusrat JB, Rafiquzzaman M. Review on in vivo and in vitro methods evaluation of antioxidant activity. Saudi Pharmaceutical Journal. 2013;21(2):143-52. 11.
13. Moharram HA, Youssef MM. Methods for Determining the Antioxidant Activity: A Review. Alex Journal of Food Science and Technology. 2014;11(1):31-42.
14. Scott, K.P., Martin, J.C., Duncan, S.H. and Flint, H.J. (2014) Prebiotic stimulation of human colonic butyrate producing bacteria and bifidobacteria, in vitro. FEMS Microbiol Ecol 87, 30–40.
15. Fari, M. J. M., Rajapaksa, D., Ranaweera, K. K. D. S., Quality characteristics of noodles made from selected varieties of Sri Lankan rice with different physicochemical characteristics. J. National Sci. Found. Sri Lanka 2011, 39, 53–60.
16. Kasemsuwan, T., Baileyb, T., Jane, J., Preparation of clear noodles with mixtures of tapioca and high-amylose starches. J. Carbohydr Poly. 1998, 3, 301–312.
17. Hormdok, R., Noomhorm, A., Hydrothermal treatments of rice starch for improvement of rice noodle quality. J. Food Sci. Technol. 2007, 40, 1723–1731.
18. Yadav, B. S., Yadav, R. B., Kumar, M., Khatkar, B. S., Studies on suitability of wheat flour blends with sweet potato, colocasia and water chestnut flours for noodle making. LWT- Food Sci Technol. 2014, 57, 352–358.
19. Fiber Enrichment in Noodles using Banana Pseudo-stem (Musa paradaisiaca) A. Karthiayani, M. Udaya Ganga, C. Ashok Kuma, 2021
20. Nura, M., Kharidah, M., Jamilah, B., Roselina, K., Textural properties of laska noodle as affected by rice flour particle size. J. Int Food Res. 2011, 18, 1309–1312.
21. Hatcher, D. W., in: Owens, G. (Ed.), Cereals Process, Technology Woodhead Publishing, Cambridge, UK 2001, pp. 131–157.
22. Yalcin, S., Basman, A., Effects of gelatinisation level, gum and transglutaminase on the quality characteristics of rice noodle. Int J. Food Sci. Technol. 2008
23. Leila Nouri, Abdorreza Mohammadi Nafchi and A. A. Karim, Mechanical and Sensory Evaluation of Noodles Incorporated with Betel Leaf Extract, Int. J. Food Eng. 2015; 11(2): 221–227, DOI 10.1515/ijfe-2014-0183.