International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 2453-2457

Received: 09-09-2020
Accepted: 19-11-2020

D Sharika
Department of Food Science and Nutrition, Community Science College and Research Institute, Tamil Nadu Agricultural university, Madurai, Tamil Nadu, India

Saravanakumar R
Department of Apparel Design Management, Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India

Hemalatha G
Department of Food Science and Nutrition, Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India

Anand G
Department of Plant Breeding and Genetics, Agriculture College, Tamil Nadu agricultural university, Madurai, Tamil Nadu, India

Corresponding Author:
D Sharika
Department of Food Science and Nutrition, Community Science College and Research Institute, Tamil Nadu Agricultural university, Madurai, Tamil Nadu, India

Development, nutritional evaluation and enhancement of functional characteristics of multigrain noodles incorporated by jamun seed powder

D Sharika, Saravanakumar R, Hemalatha G and Anand G

DOI: https://doi.org/10.22271/chemi.2020.v8.i6ai.11141

Abstract
The study were designed to develop jamun seed powder incorporated multigrain noodles. Efforts were made to prepare multigrain noodles having different combinations of whole wheat flour (WWF), foxtail millet flour (FMF), defatted soya flour (DSF) and jamun seed powder (JSP) were prepared by mixing them in different proportions *viz*.,T_0-100% WWF, T_1-58%+10%+30%+2%, T_2-56%+15%+25%+4%, T_3-54%+20%+20%+6%, T_4-52%+25%+15%+8%, T_5-50%+30%+10%+10%. The prepared multigrain noodles were subjected to organoleptic and nutritional quality analysis. The results revealed that multigrain noodles with 4% incorporation of jamun seed powder (T_2) was organoleptically secured maximum score for colour, taste, flavor and overall acceptability compared to all other samples and found to contain moisture (8.58%), ash (3.28%), protein (17.58%), fat (1.93%), crude fiber (3.32%) and carbohydrate (64.21%). Therefore T2 was more acceptable so it was optimized treatment than others.

Keywords: Whole wheat flour, foxtail millet flour, defatted soya flour and jamun seed powder, multigrain noodles

Introduction
Noodles are widely consumed throughout the world, and it is a fast-growing sector because noodles are convenient, low cost, easy to cook and have a relatively long shelf-life [1]. Noodles belongs to China as early as 5000 BC, and then spread to other Asian countries such as Japan, Thailand, Korea and Malaysia, and now days it has become one of the fastest budding sectors in the world with the compound annual growth rate (CAGR) reaching 4% [2]. Worldwide, China ranks first in the consumption of noodles followed by Indonesia, Japan, and Vietnam [3]. Noodles are one of the favorite food products that are well loved by many people of all ages [4]. Refined wheat flour which is usually used to make noodles are rich in carbohydrates however they lack nutrients like dietary fibre, protein, minerals and vitamins [5].
Consumers all around the world, nowadays, are more at the risk of many diseases such as cardiovascular diseases and diabetes due to obesity, high cholesterol, high blood pressure and irregular blood sugar levels. These risk factors are because of the diet which is low in dietary fibre, phytochemicals and antioxidants. Foods that are excess in antioxidants and low in Glycemic Index (GI) can decrease the risk of increased postprandial oxidative stress, which is responsible for chronic diseases [6].
Jamun (*Syzygium cumini*) also known as *Syzygium jambolanum*, *Eugenia jambolanum* and Eugenia cumini is an evergreen tropical tree in the flowering plant family Myrtaceae and is native to Bangladesh, India, Nepal, Pakistan, Sri Lanka, the Philippines, and Indonesia [7]. The jamun seeds are claimed to contain alkaloid, jambosine, and glycoside jambolin or antimellin, which halts the diastatic conversion of starch into sugar [8]. The seeds have been reported to be rich in flavonoids, a well-known antioxidant, which accounts for the scavenging of free radicals and protective effect on antioxidant enzymes [9, 10] and also found to have high total phenolics with significant antioxidant activity [11] and are fairly rich in protein and calcium.
Soybean [*Glycine max*.] is the most important legume in relation to total world grain production and the most frequently used because of its high protein contents and relatively low

prices. It is rich in lysine and are therefore, a good complement to wheat protein that is deficient in lysine contents. It contains good amount of isoflavones, genistein and daidzein, which have recently been implicated as contributors to its hypocholesterolaemic effect [12]. Soy isoflavones as antioxidants have been reported to reduce the risk of coronary heart disease [13], to inhibit lipid peroxidation [14], to prevent low density-lipoprotein oxidation [15] and to reduce oxidative DNA damage [16]. Soybean is an excellent source of dietary protein providing complete human requirement of almost all the amino acid. It is also an excellent source of minerals and vitamins [17].

Foxtail millet (*Setaria italica* (L.) Beauv.), one of the oldest of the cultivated millets in the world, is cultivated in about 23 countries in Asia, Africa and America. It is also known as Italian millet, German millet, Chinese millet or Hungarian millet. Like other millets, foxtail millet is highly nutritious and have low glycemic index (GI) and high fiber content. The protein content is higher among millets and major cereals and also the amount of fibers (as a-glucans; 42.6%). The metabolism of sugar and cholesterol gets increased due to a-glucans resulting in hypoglycemic and hypocholesterolemic effects, which is beneficial for prevention of diabetes and cardiovascular diseases. Because of this, foxtailmillet is used in the preparation of low GI foods for treating diabetes and also cardiovascular diseases [18].

However, a single whole grain will not provide wholesome nourishment. Grains differ in their nutritional composition; some are stronger in one nutrient and others in different nutrients. Different grains can be selected based on their nutritional composition and combined to produce flours to get more wholesome and balanced food.

Therefore, the objective of this study was to develop noodles using multigrain flour made from whole wheat flour, foxtail millet flour, defatted soya flour incorporated by jamun seed powder, a waste obtained in excess amounts from jamun processing.

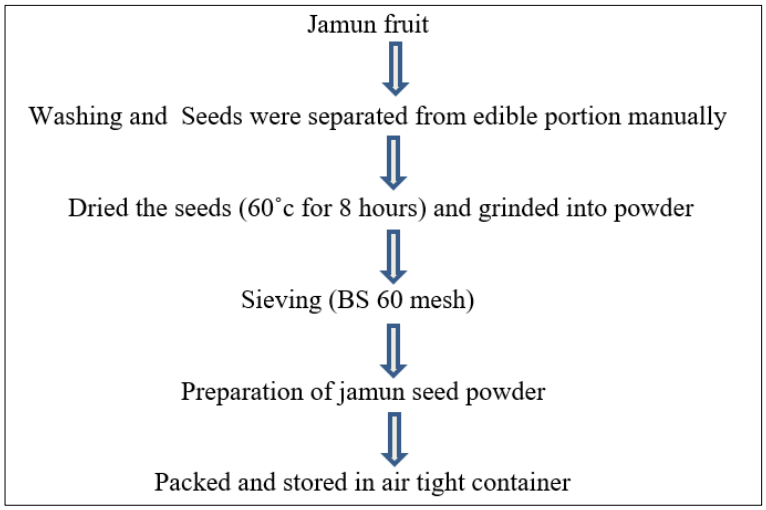
Materials and Methods

Procurement of Raw materials: Jamun seed powder, whole wheat flour, foxtail millet flour, defatted soya flour was used in this study. Whole wheat flour, foxtail millet flour, defatted soya flour was used as based materials for the preparation of the noodles.

Fresh, uniformly ripened and disease free jamun fruits were purchased in a single slot from local market in Madurai to avoid differences in varieties.

Whole wheat, foxtail millet, defatted soya flour, xanthan gum and salt were purchased from the departmental stores at Madurai.

Preparation of Jamun seed powder: The purchased fruits were cleaned thoroughly in water to remove dust and dirt. The jamun seeds and edible part were separated manually. Then, jamun seeds were dried in oven at 60˚c temparatute for 8 hours till complete drying. The dried seeds were milled in electric churner to make fine powder and sieved using (BS 60 mesh). The prepared jamun seed powder was packed and stored in airtight container.



Preparation of whole wheat flour: Wheat grains were cleaned thoroughly to remove dust and dirt. The cleaned grains were ground in the electric grinder to make fine flour and sieved by 60 mesh sieve. The flour sample was kept in air tight container before use.

Preparation of foxtail millet flour

Foxtail millet grains were cleaned to remove the foreign materials. The cleaned grains were ground in electric grinder to make fine powder and sieved by 60-80 mesh sieve.

Standardization of jamun seed powder incorporated multigrain noodles

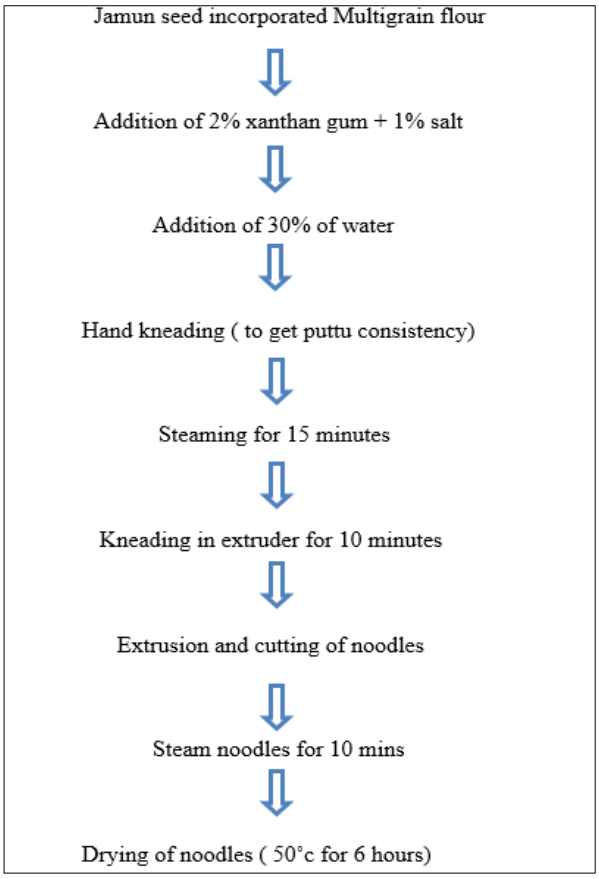
Jamun seed powder incorporated multigrain noodles was prepared by replacing the base material refined wheat flour with whole wheat flour, foxtail millet flour and defatted soya flour were used for preparation of noodles and the jamun seed powder was incorporated in multigrain flour at different proportions.

Table 1: Standardization of jamun seed incorporated multigrain flour noodles

Ingredients(g)	T_0	T_1	T_2	T_3	T_4	T_5
WWF	100	58	56	54	52	50
FMF	-	10	15	20	25	30
DSF	-	30	25	20	15	10
JSF	-	2	4	6	8	10
Xanthan gum	2	2	2	2	2	2
Salt	1	1	1	1	1	1
Water(ml)	30	30	30	30	30	30

WWF- Whole wheat flour, FMF- Foxtail millet flour, DSF- Defatted soya flour, JSF- Jamun seed flour

Process of preparation of noodles



Proximate analysis of noodles

Moisture, ash and crude fibre were determined according to AOAC (1995). Crude protein was estimated by using micro-kjeldahl method, AOAC (1995) using the factor 6.25 for converting nitrogen content into crude protein. For fat content of noodles, 5 g sample was placed in Soxhlet extraction apparatus and subjected to extraction for 6 h using petroleum ether as solvent and percent fat content of noodle samples were calculated on a weight basis. Amount of carbohydrates was calculated from the sum of moisture, crude protein, crude fat, ash and crude fibre and lastly subtracting it from 100 (AOAC, 1995) [19].

Sensory evaluation of noodles: Acceptance was tested by sensory evaluation using 9-point hedonic scale at Food Science and Nutrition Department, community science college, TNAU, Madurai. Product with different treatments was coded with three-digit number and is analyzed by different subjects in our college faculty and students. They were provided with standard evaluation sheets and asked to score the product based on nine-point hedonic scale for colour, texture, flavour, taste, appearance and overall acceptability. To avoid overlapping of taste of other treatments they were provided with water to rinse mouth and scored from 1-9 with 1 being I dislike extremely *i.e.*, very bad and 9 being I like extremely *i.e.*, the product is excellent in that particular attribute [20].

Results and Discussion

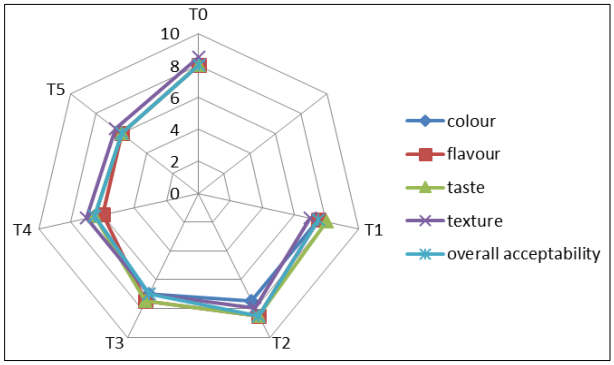
Sensory evaluation

The jamun seed incorporated multigrain noodles was evaluated organoleptically. The T_2 that is 4% incorporation of jamun seed powder was best according to flavour, taste and overall acceptability

Table 2: Sensory evaluation of jamun seed powder incorporated multigrain flour noodles

Treatment (Sample)	Sensory Attributes				
	Colour and appearance	Flavour	Taste	Texture	Overall acceptability
T_0	8.0±0.14	8.0±0.08	8.0±0.20	8.5±0.08	8.0±0.19
T_1	7.5±0.03	7.5±0.01	8.0±0.09	7.0±0.17	7.5±0.11
T_2	7.5±0.14	8.5±0.19	8.5±0.10	8.0±0.01	8.5±0.26
T_3	7.0±0.02	7.5±0.14	7.5±0.23	7.0±0.19	7.0±0.22
T_4	6.5±0.10	6.0±0.08	6.5±0.10	7.0±0.05	6.5±0.08
T_5	6.0±0.10	6.0±0.04	6.0±0.18	6.5±0.07	6.0±0.16

Values are the mean ±standard deviation. All the samples were taken in triplicates



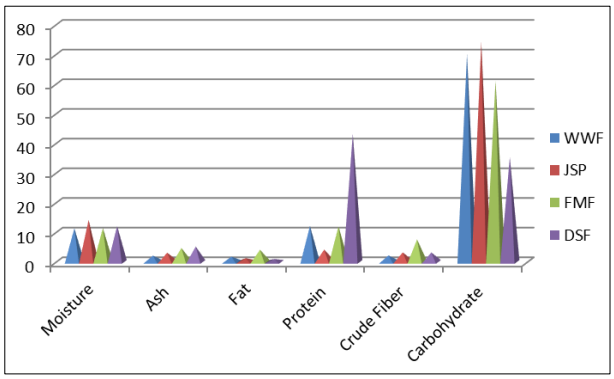
Graph 1: sensory evaluation of jamun seed powder incorporated multigrain noodles

Chemical composition of major ingredients

The proximate composition of WWF, JSP, FMF, DSF were assessed and findings are presented in table no.3 according to results obtained the moisture content of JSP (14.12%) is higher and WWF (11.34%) is lower. Ash content of DSF (5.2%) is higher and WWF (2.12%) is lower. Fat content of FMF (4.1%) is slightly higher and DSF (1.0%) is lower. protein content of DSF (43.2%) is higher and JSP (4.18%) is lower. crude fiber content of FMF (7.6%) is higher and JSP (1.21%) is lower. Carbohydrate content of JSP (75.28%) and DSF (35.24%) is lower. Similar results with respect to proximate composition of JSP were recorded by Prasad *et al*., (2010) [21] and DSF were recorded by Pakhare K.N *et al*., (2017) [22] and FMF, WWF were recorded by Nitya Sharma *et al*., (2017) [23].

Table 3: Chemical composition of major ingredients

Ingredients	Moisture	Ash	Fat	Protein	Crude Fiber	Carbohydrate
WWF	11.34	2.12	1.8	12.18	2.20	70.23
JSP	14.12	3.12	1.28	4.18	3.21	74.28
FMF	11.45	4.7	4.1	12.01	7.60	61.15
DSF	12.08	5.2	1.0	43.2	3.20	35.24



Graph 2: chemical composition of major ingredients

Chemical composition of jamun seed powder incorporated multigrain noodles

Chemical composition of noodles prepared by different level incorporation of jamun seed powder in multigrain flour is presented in table 4. Moisture content is of great significance in noodles for storage stability and acceptability. Generally low moisture content is desired in noodles for increasing their shelf life. The moisture content is partially affected by fibre content in a sample. The moisture content of noodles increased linearly from 8.43-8.95% with increased level of jamun seed powder and foxtail millet in noodles. Noodles with 100% whole wheat flour (T_0) showed highest moisture content (9.12%) where as lowest moisture content (8.43%) was recorded in noodles with 2% jamun seed powder and 10% foxtail millet flour (T_1).

Protein content of noodles decreased linearly from 19.2-12.42% with decreased level of defatted soya flour. Noodles with 100% whole wheat flour (T_0) showed the lowest protein content(11.87%). Where as highest protein content (19.2%) was recorded in noodles with 2% jamun seed powder and 30% defatted soya flour.

Ash content in food substances indicate inorganic remains when the organic matter has been burnt away. Ash content varied significantly from T_0 (2.07%) to T_5 (3.69%). High ash content was observed in T_5 sample of noodles followed by other treatments. Increase in ash content may be due to addition of jamun seed powder and foxtail millet flour. The increase in level of millets in blend increased ash content has been also reported by Kamaraddi and Shantakumar, (2003)

Fat content of noodles increased from 1.56 (T_0) to 2.34 (T_3). Highest fat was observed in T_5 (2.34) where as lowest fat was observed in T_0 (1.56). This increase in fat may be due increasing the incorporation of jamun seed powder and addition of foxtail millet flour.

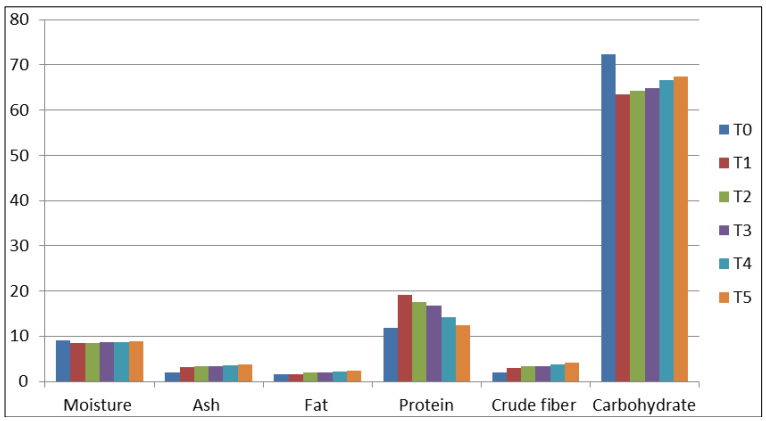
Progressive increase in fiber content of noodles was observed from T_0 (2.0%) to T_5 (4.20%) the increase in fiber content might be due to high fiber in jamun seed powder and foxtail millet flour.

The carbohydrate content ranged from 67.49-72.29%. The highest carbohydrate content was observed in T_0 (72.29) and lowest carbohydrate was observed in T_5 (67.49). Singh *et al*., (2005) reported that addition of milled millet flour to wheat flour increased the concentration of protein, fat and ash but decreased carbohydrates.

Table 4: Chemical composition of jamun seed powder incorporated multigrain noodles

Treatments	Moisture	Ash	Fat	Protein	Crude fiber	Carbohydrate
T_0	9.1±0.03	2.1±0.04	1.6±0.01	11.9±0.13	2.0±0.03	72.3±0.42
T_1	8.4±0.13	3.2±0.06	1.7±0.01	19.2±0.50	2.9±0.04	63.5±1.16
T_2	8.6±0.15	3.3±0.05	1.9±0.01	17.6±0.09	3.3±0.09	64.2±0.21
T_3	8.6±0.17	3.3±0.05	2.1±0.04	16.9±0.20	3.4±0.02	64.8±1.27
T_4	8.7±0.22	3.5±0.10	2.2±0.03	14.1±0.06	3.7±0.10	66.6±1.72
T_5	8.95±0.15	3.69±0.03	2.34±0.00	12.42±0.22	4.20±0.04	67.49±1.19

Values are the mean ±standard deviation. All the samples were taken in triplicates



Graph 3: chemical composition of jamun seed powder incorporated multigrain noodles

Conclusion

It can be concluded from the study that the jamun seed powder incorporated multigrain noodles had significant effect on proximate and sensory properties of noodles. Increasing the level of jamun seed powder in the noodle formulation resulted in noodles with a higher ash and crude fibre content. Jamun seed powder blending upto 4% was acceptable for the preparation of best multigrain noodles. Development of multigrain products is also advantageous for consumers seeking alternative products containing healthy ingredients.

Acknowledgement

The authors thank honourable Dean of Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai for her encouragement.

References

1. Kulkarni SS, Desai AD, Ranveer, Dr. Rahul, Sahoo A. Development of nutrient rich noodles by supplementation with malted ragi flour. International Food Research Journal 2012;19:309-313.
2. Lee SJ, Kim JJ, Moon HI, Ahn JK, Chun SC, Jung WS. Analysis of isoflavones and phenolic compounds in Korean soybean (*Glycine max* L.) seeds of different seed weights. Journal of Agricultural and Food Chemistry 2008;56:2751-2758.
3. Anonymous B. WINA (World instant noodle association) Expanding market. http:// instantnoodles.org/ noodles /expanding-market.html 2016.
4. Afalla A. Nutria-enriched seaweed noodles. Aquatic Technology Competition and Marketplace 2010, 70-77.

5. Dnyaneshwar Kudake C, Amesh Pawar V, Abhijeet Muley B, Vishal Parate R, Mohammed Talib I. Enrichment of Wheat Flour Noodles with Oat Flour: Effect on Physical, Nutritional, Antioxidant and Sensory Properties. Int. J Curr. Microbiol. App. Sci. 2017;6(12):204-213.
6. Yadav S, Gupta RK. Formulation of noodles using apple pomace and evaluation of its phytochemicals and antioxidant activity. Journal of Pharmacognosy and Phytochemistry 2015, 4(1).
7. Razoanul H, Mariya KS, Najmuj S, Omar SS, Tanjir TIS, Saddam H *et al*. Antimicrobial activity of Jambul (*Syzygium cumini*) fruit extract on enteric pathogenic bacteria. Advances in Microbiology 2017;7(3):195-204.
8. Morton J. Fruits of warm climates. Miami: Julia Morton Winterville North Carolina 1987.
9. Ravi K, Ramachandran B, Subramanian S. Protective effect of Eugenia jambolana seed kernel on tissue antioxidants in streptozotocin induced diabetic rats. Biol Pharm Bull 2004;27:1212-1217.
10. Ravi K, Ramachandran B, Subramanian S. Effect of Eugenia jambolana seed kernel on antioxidant defense system in streptozotocin induced diabetes in rats. Life Sci. 2004a;75:2717-2731.
11. Bajpai M, Pande A, Tewari SK, Prakash D. Phenolic contents and antioxidant activity of some food and medicinal plants. Int J Food Sci Nutr 2005;56:287-291.
12. Ridges L, Sunderland R, Moerman K, Meyer B, Astheimer L, Howe P. Cholesterol lowering benefits of soy and linseed enriched foods. Asia Pacific Journal of Clinical Nutrition 2001;10(3):204-211.
13. Barnes S, Boerma B, Patel R *et al*. Isoflavonoids and chronic disease: mechanisms of action. Biofactors 2000;12:209-210.
14. Arora A, Nair MG, Strasburg GM. Antioxidant activities of isoflavones and their biological metabolites in a liposomal system. Archives of Biochemistry and Biophysics 1998;356:133-141.
15. Kerry N, Abbey M. The isoflavone genistein inhibits copper and peroxyl radical mediated low density lipoprotein oxidation *in vitro*. Atherosclerosis 1998;40:341-347.
16. Mitchell JH, Collins AR. Effects of a soy milk supplement on plasma cholesterol levels and oxidative DNA damage in men. European Journal of Nutrition 1999;38:143-148.
17. Hoeck JA, Fehr WR, Murphy PA, Welke GA. Influence of genotype and environment on isoflavone contents of soybean. Crop Science 2000;40:48-51.
18. Hariprasanna K. Foxtail millet: Nutritional importance and cultivation aspects. Indian Farming 2016;65(12):25-29.
19. AOAC. Official methods of analysis. 14th edition. Association of Official Analytical Chemists, Washington, DC 1995.
20. Meilgaard M, Civille GV, Carr BT. Sensory Evaluation Techniques. 3rd Ed. CRC Press, Boca Raton 1999.
21. Prasad K, Janve B, Sharma RK, Prasad KK. Compositional characterization of traditional medicinal plants: Chemo-metric approach. Arch. Appl. Sci. Res 2010;2(5):1-10.
22. Pakhare KN, Dagadkhair AC, Udachan IS. Enhancement of nutritional and functional characteristics of noodles by fortification with protein and fiber: a review. J Pharmacognosy Phytochem 2018;7(1):351-357.
23. Sharma N, Niranjan K. Foxtail millet: Properties, processing, health benefits, and uses. Food reviews international 2018;34(4):329-36.
24. Kamaraddi V, Shanthakumar G. Effect of incorporation of small millet flour to wheat flour on chemical, rheological and bread characteristics. In recent trends in millet processing and utilization. CCS Hisar Agricultural University 2003, 74-81.
25. Singh P, Singh G, Srivastava S, Agarwal P. Physicochemical characteristics of wheat flour and millet flour blends. Journal of food Science and Technology 2005;42(4):340-343.