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Technology development for preparation of fenugreek leaves puree noodles incorporated with additives and its quality assessment

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Abstract
In the present investigation, the technology was developed to standardize the process for preparation of Fenugreek leaves puree noodles incorporated with additives. Noodles were prepared from refined wheat flour, fenugreek leaves puree, egg, salt and additives (Guar gum and Carboxy methyl cellulose) at the levels of (0.5 per cent, 1 per cent and 1.5 per cent). Prepared noodles were analyzed for chemical and organoleptic properties. The prepared noodles was analysed for chemical composition like moisture, fat, carbohydrates, protein, fibre and ash. Sensory evaluation revealed that sample FG_2 contain 1 per cent guar gum and sample FC_1 contain 0.5 per cent CMC was superior among all the samples. From the present investigation it was concluded that Fenugreek puree noodles prepared with incorporation of Guar gum and CMC having good nutritional and sensory quality attributes.

Keywords: fenugreek leaves, noodles, guar gum, carboxymethyl cellulose (CMC), chemical composition

Introduction
Wheat flour noodles are an important part in the diet of many Asians. It is believed that noodles originated in China as early as 5000 BC, then spread to other Asian countries. Today, the amount of flour used for noodle making in Asia accounts for about 40% of the total flour consumed. In recent years, Asian noodles have also become popular in many countries outside of Asia. Asian noodles are different from pasta products in ingredients used, the processes involved and their consumption patterns. Pasta is made from semolina (coarse flour usually milled from durum wheat) and water, and extruded through a metal die under pressure. It is a dried product. After cooking, pasta is often eaten with sauces. Asian noodles are characterized by thin strips slit from sheeted dough that has been made from flour (hard and soft wheat), water and salt, common salt or alkaline salt. Noodles are often consumed in soup. Eggs can be added to each product to give a firmer texture. Asian noodles are sold in many forms. Wheat flour is the main ingredient for making Asian noodles (Hou and Kruk, 1998) [4].

Noodles are still increasingly popular worldwide for their convenience, nutritional properties, special flavour, and taste. Pasta and noodles are essentially the same type of food but differ in their raw materials and shaping process, as well as the people and regions in the world consuming them. Many additives have been developed and are being used today in pasta and noodle products for various purposes. Various natural additives used in the noodles are Starch, Edible gums, Enzymes, organic acids, Natural polyols, Phytochemicals, protein concentrates etc. (Li *et al.*, 2014) [8].

Nowadays Consumers all around the world are more at the risk of diseases such as diabetes due to obesity, high cholesterol, cardiovascular diseases, high blood pressure and irregular blood sugar levels. These risk factors are because of the unfit diet which is low in essential nutrients like dietary fiber, phytochemical and antioxidants. Functional foods provide health benefits and help in the avoidance of diseases by incorporating nutraceutical ingredients and other essential nutrients (Yadav and Gupta, 2015) [17].

Fenugreek has been used for the development of extruded snack with low glycaemic index level. These findings suggest that the nutritional, functional and therapeutic characteristics of fenugreek can be used further in the development of healthy extruded products (Shirani and Ganesharanee, 2009; Wani and Kumar, 2015) [14, 16].

Gums/hydrocolloids are widely used in starch-based Noodles mainly to improve stability, modify texture and facilitate processing.

Hydrocolloids used in gluten-free formulations are derived from various sources like seeds, fruits, plant extracts, seaweeds and micro-organisms. The hydrocolloids protect the starch granules against shear during cooking and improve product texture. Pectin, carboxy methyl cellulose, agarose gum, xanthan gum, β glucan, hydroxyl propyl methyl cellulose, locust bean gum, guar gum and carrageenan are some of the hydrocolloids used in food industry among which guar and xanthan gums are most widely used (Norton and Foster, 2002) [12].

Carboxymethyl cellulose (CMC), xanthan, guar, and arabic gum, which are water-soluble heteropolysaccharides with high molecular weights, are often used together with starches to provide desirable texture, control moisture and water mobility, and improve overall product quality and/or stability (Li *et al.* 2008) [9].

Although many researchers have studied the utilization of hydrocolloids in several food products, little study has been undertaken on the use of hydrocolloids in instant noodle products. (Jarnsuwan and Thongngam, 2012) [7]. Therefore the present study was performed to produce and identify the effects of selected hydrocolloids, namely guar gum and carboxymethyl cellulose at 0.5, 1 and 1.5% on Chemical and sensory properties of noodle.

Materials and Methods

The present investigation was carried out in Department of Food Process Technology with collaboration of Department of Food Chemistry and Nutrition in College of Food Technology, VNMKV, Parbhani during year 2018-19.

Materials

The raw material such as fenugreek (*Trigonella foenum-graecum* L.) leaves, refined wheat flour (*Triticum aestivum* L.), egg, salt, etc. were purchased from local market of Parbhani. Guar gum and CMC required for research work were available in the department of Food process Technology and the department of Food chemistry and Nutrition.

Chemicals and glasswares

The chemicals of analytical grade and glasswares required during investigation were used in the department of Food process Technology.

Methods

Proximate analysis

All samples were analyzed for moisture, crude protein, crude fat, total ash, mineral and total carbohydrate contents according to their respective standard methods as described in (A.O.A.C., 2000) [1].

Sensory evaluation of noodles

The sensory evaluation was carried out to assess the overall acceptability of the fenugreek leaves puree noodles incorporated with Guar gum and CMC. The samples were cooked in boiling water for 8-10 minutes and spices are added. The quality attributes (colour, flavor, taste and texture) of prepared noodles were evaluated against the control sample and Market Sample. Optimally cooked noodles were then analyzed for overall acceptability of the samples by 10 members using a nine-point hedonic scale.

Preparation of fenugreek leaves puree

Fresh fenugreek (*Trigonella foenum-graecum* L.) leaves were separated from its stem, cleaning and washing was done using de-ionized water and then leaves were steamed for 2-3 min. The leaves were ground and passed through sieve to get puree and it was filled in cleaned and sterilized jar and stored at low temperature for analysis and noodle production.

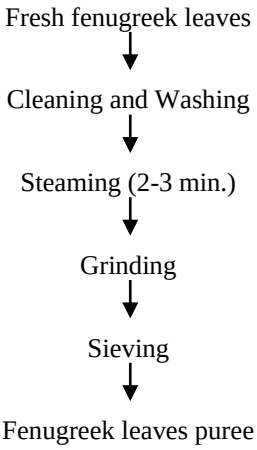

Fig 1: Flow Chart for Preparation of Fenugreek Leaves Puree

Table 1: Formulation of noodles incorporated with fenugreek leaves puree and Additives

Sr. No.	Ingredients	Quantity (g)						
		Control	FG_1	FG_2	FG_3	FC_1	FC_2	FC_3
1	Refined wheat flour	100	100	100	100	100	100	100
2	Fenugreek leaves puree	30	30	30	30	30	30	30
3	Whole Egg	8	8	8	8	8	8	8
4	Water	10 ml	10 ml	10 ml	10 ml	10 ml	10 ml	10 ml
5	Salt	2	2	2	2	2	2	2
6	Guar Gum	0	0.5	1	1.5	0	0	0
7	CMC	0	0	0	0	0.5	1	1.5

Control = 100 per cent wheat flour and 30 g fenugreek leaves puree
FG_1 = 0.5 g Guar Gum in 30 g fenugreek leaves puree and 100g flour
FG_2 = 1 g Guar Gum in 30 g fenugreek leaves puree and 100g flour
FG_3 = 1.5 g Guar gum in 30 g fenugreek leaves puree and 100g flour
FC_1 = 0.5 g CMC in 30 g fenugreek leaves puree and 100g flour
FC_2 = 1 g CMC in 30 g fenugreek leaves puree and 100g flour
FC_3 = 1.5 g CMC in 30 g fenugreek leaves puree and 100g flour

Preparation of noodles

The noodles were prepared with slight modification according to the method given by Inglett *et al*. (2003) [6]. Noodles were prepared in the laboratory. The basic ingredients used for making control dried noodle were 100.0 g refined wheat flour, 10.0 ml water, 8.0 g whole egg, 2.0 g salt and 30 per cent fenugreek leaves puree .Three different formulations of dried noodle samples were prepared with addition of 0.5 per cent, 1 per cent and 1.5 per cent guar gum and Three different formulations of dried noodle samples were prepared with addition of 0.5 per cent, 1 per cent and 1.5 per cent carboxymethyl cellulose (CMC). The different formulations were processed into noodles using extruder (Model no. 16009, Kent Noodle and Pasta Maker). In brief, salt was dissolved in the water and additives such as guar gum and CMC was mixed thoroughly one by one in different formulations this solution was added to the flour in the noodle making machine. After mixing of all ingredients extrusion was occurred and strands of 2.0 mm thickness of noodles were obtained. The noodle strands were then cut to 15 cm in length and steaming was carried out over boiling water for 10 min. Subsequently, the steamed noodles were dried in a cabinet tray drier at 60 °C for 2-3 hours.

Methodology for preparation of Noodles

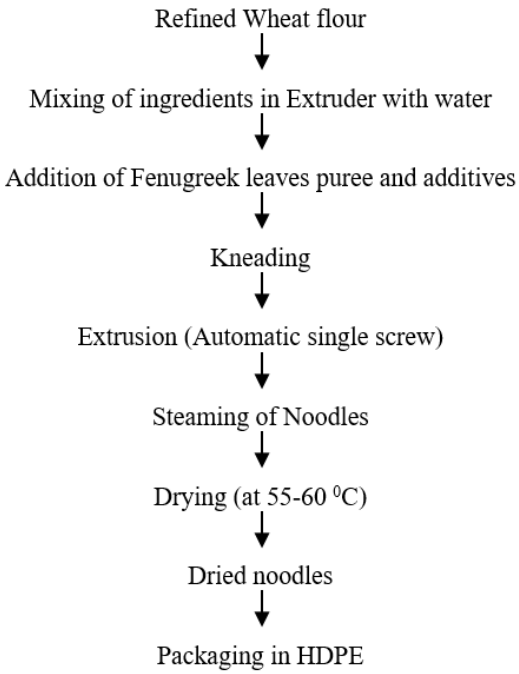

Fig 2: Flow Chart for Preparation of Noodles

Statistical analysis

The data obtained was analyzed statistically by Completely Randomized Design (CRD) as per the procedure given by Panse and Sukhatme (1967) [13]. The analysis of variance revealed at significance of P< 0.05 level, S.E. and C.D. at 5% level is mentioned wherever required.

Results and Discussion

Table 2: Chemical composition of raw materials

Sample	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Fibre (%)	Ash (%)
Refined wheat flour	10.00	1.40	10.50	75.70	1.10	1.28
Fenugreek leaves puree	86.90	1.1	2.84	5.95	1.75	1.56
Egg	73.30	11.20	12.5	0.20	0.063	1.8

The results pertaining to chemical analysis of raw materials are presented in (Table 2). It was revealed that, the moisture for refined wheat flour (10.00 per cent), crude fat (1.40 per cent), protein (10.50 per cent), carbohydrate (75.70 per cent), crude fiber (1.10 per cent) and ash (1.28 per cent). The chemical analysis of refined wheat flour was found similar to that of results of Bhatt *et al*. 2015, and Mohammed najeeb *et al.* 2018) [3, 11].

The results of the chemical analysis of the fenugreek leaves puree summarized in Table 2 are moisture (86.90 per cent), crude fat (1.1 per cent), protein (2.84 per cent), carbohydrate (5.95 per cent) crude fiber (1.75 per cent) and ash (1.56 per cent). The results of fenugreek leaves puree was close agreement to the results obtained by (Srinivasan, 2006, and Mohammed najeeb *et al.* 2018) [15, 11].

The results of the chemical analysis of the egg are moisture (73.30 per cent), crude fat (11.2 per cent), protein (12.5 per cent) carbohydrate (0.20 per cent) and ash (1.5 per cent). These values of chemical properties recorded in the present study are similar to the values reported earlier by (Miranda *et al*. 2015, and Mohammed najeeb *et al.* 2018) [10, 11].

Table 3: Sensory evaluation of Fenugreek puree noodles incorporated with Guar gum

Sample	Colour	Flavor	Taste	Texture	Overall acceptability
Market sample	7.2	6.9	7.3	7.1	7.3
Control	7.3	7.1	7.4	6.9	7.1
FG_1	7.3	7.2	7.5	7.8	7.2
FG_2	7.5	7.5	8.1	8.5	8.5
FG_3	7.3	7.2	7.9	8.3	8.0
SE±	0.02981	0.04807	0.03569	0.04146	0.03174
CD at 5%	0.08745	0.141	0.10469	0.12159	0.09309

*Each value is average of three determinations

Organoleptic evaluation is one of the important quality characteristics of food products. It is important in preference of product in market place. The prepared noodles were subjected for sensory evaluation based on 9-point hedonic scale to colour, flavour, taste, texture and overall acceptability which was compared with control sample and Market sample results obtained are tabulated in Table 3.

The data presented in (Table 3) revealed that sample FG_2 got highest score for colour among all samples. All Sample FG_1, FG_2, FG_3, control and Market sample found good score for flavor and taste. The sample FG_2 got good score for texture. i.e. 8.5. The overall acceptability of noodles showed that sample FG_2 was highly acceptable among all samples. . Results reported are in close agreement with (Hymavathi *et al.* 2014) [5].

Table 4: Sensory evaluation of noodles incorporated with carboxy methyl cellulose (CMC)

Sample	Colour	Flavor	Taste	Texture	Overall acceptability
Market sample	7.2	6.9	7.3	7.1	7.3
Control	7.3	7.1	7.4	6.9	7.1
FC_1	7.5	7.5	8.1	8.5	8.2
FC_2	7.5	7.3	7.5	7.8	7.5
FC_3	7.0	7.3	7.9	7.6	7.5
SE±	0.02309	0.03528	0.04355	0.05683	0.04251
CD at 5%	0.06774	0.10347	0.12773	0.16669	0.1247

*Each value is average of three determinations

The prepared noodles were subjected for sensory evaluation based on 9-point hedonic scale to colour, flavour, taste, texture and overall acceptability which was compared with control sample and Market sample results obtained are tabulated in Table 4.

The data presented in (Table 4) revealed that sample FC_1 and FC_2 got highest score for colour among all samples i.e.7.5. All Sample FC_1, FC_2, FC_3, control and Market sample found good score for flavor and taste. The highest score for flavor and taste was found to be 7.5 and 8.1 in FC_1 sample. The sample FC_1 got good score for texture i.e.8.5. The overall acceptability of noodles showed that sample FC_1 was highly acceptable among all samples. Results reported are in close agreement with (Hymavathi *et al.* 2014) [5].

Table 5: Chemical composition of Sensory selected noodle sample incorporated with guar gum

Sr. No	Parameters (%)	Contents
1	Moisture	8.66
2	Fat	4.27
3	Protein	13.42
4	Carbohydrate	67.65
5	Crude fiber	3.32
6	Ash	2.68

*Each value is average of three determinations

The sample FG_2 selected on the basis of organoleptic evaluation and analyzed for the chemical composition which was shown in table 5. The data presented in (Table 5) revealed that the moisture content in noodle sample was 8.66 per cent. The fat, protein, carbohydrate, crude fibre content found to be 4.27 per cent, 13.42 per cent, 67.65 per cent and 3.32 per cent. The ash content in sample was 2.68 per cent. Similar results were found in close agreement of (Ayedin and Gocmen, 2011, and Mohammed najeeb *et al.* 2018) [2, 11].

Table 6: Chemical composition of Sensory selected noodle sample incorporated with CMC

Sr. No	Parameters (%)	Contents
1	Moisture	8.62
2	Fat	4.26
3	Protein	13.41
4	Carbohydrate	67.66
5	Crude fiber	3.34
6	Ash	2.71

*Each value is average of three determinations

The sample FC_1 selected on the basis of organoleptic evaluation and analyzed for the chemical composition which was shown in table 6. The data presented in (Table 6) revealed that the moisture content in noodle sample was 8.62 per cent. The fat, protein, carbohydrate, crude fibre content found to be 4.26 per cent, 13.41 per cent, 67.66 per cent and 3.34 per cent. The ash content in sample was 2.71 per cent. Similar results were found in close agreement of (Ayedin and Gocmen, 2011, and Mohammed najeeb *et al.* 2018) [2, 11].

Conclusion

From the present investigation it was concluded that fenugreek leaves puree noodles prepared with incorporation of additives guar gum and CMC had good nutritional and sensory quality attributes. It was also concluded that sample FG_2 and FC_1 got highest score for overall acceptability and it was taken for further analysis.

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