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Effect of additives on cooking quality of fenugreek leaves (*Trigonella foenum-graecum* L.) puree noodles

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Abstract
The present investigation was focused to investigate the effect of Additives (Guar gum and Carboxy methyl cellulose) at the levels of (0.5 per cent, 1 per cent and 1.5 per cent) on the noodle characteristics prepared from refined wheat flour, fenugreek leaves puree, egg and salt. The prepared noodles were analysed for cooking qualities. Results indicated that cooking time was increased with increasing hydrocolloids concentration in fenugreek noodles. Cooking loss was found to be decreased with increase in level of additives it was related to the structural strength of noodle. The lower this value, the higher structural strength. Water uptake and cooked weight was increases with increase in hydrocolloids concentration.

Keywords: fenugreek leaves, noodles, guar gum, carboxymethyl cellulose (CMC), cooking quality

Introduction
Noodles are one of the staple foods consumed in many Asian countries. Instant noodles have become internationally recognized food, and worldwide consumption is on the rise. Many researchers are exploring the potential of noodle fortification as an effective public health intervention and improve its nutritional properties. The properties of instant noodles like taste, nutrition, convenience, safety, longer shelf life, and reasonable price have made them popular. Quality factors important for instant noodles are color, flavor, and texture, cooking quality, rehydration rates during final preparation, and the presence or absence of rancid taste after extended storage (Gulia *et al*. 2014) [2].

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) [10].

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) [8, 9].

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) [6].

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) [5].

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) [4]. Therefore the present study was performed to identify the effects of selected hydrocolloids, namely guar gum and carboxymethyl cellulose at 0.5, 1 and 1.5% on cooking properties 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.

Methods

Preparation of noodles

The noodles were prepared with slight modification according to the method given by Inglett *et al*. (2003) [3]. 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

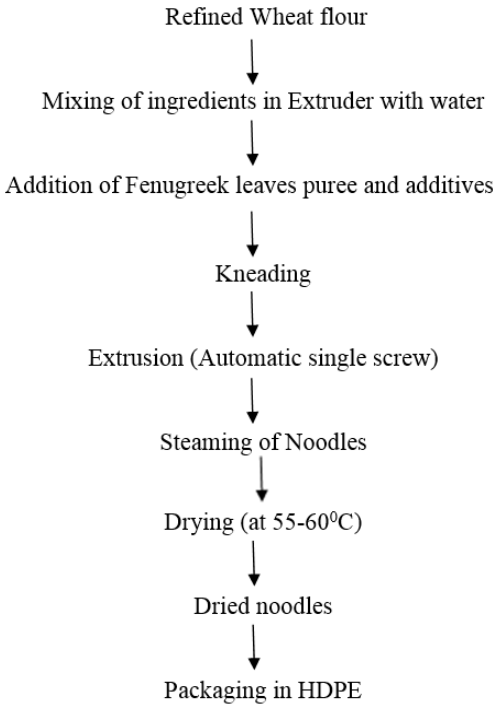

Fig 1: Flow Chart for Preparation of Noodles

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

Cooking quality evaluation of noodle

The cooking qualities of the dried noodles were evaluated with respect to cooking time, water uptake and cooking loss according to Gatade and Sahoo, (2015) [1]. Optimal cooking time was evaluated by observing the time of disappearance of the core of the noodle strand during cooking (every 20 s) by squeezing the noodles between two transparent glass slides. The water uptake was calculated by getting the difference between weight of cooked noodles and weight of dried noodles. The cooked noodles were placed on filter paper for 5 min before weighing, to blot the excess adhered water. The cooking loss was determined by measuring the amount of solid substance lost to cooking water. A 10 g sample of noodles was placed into 100 ml of boiling water in a 500 ml beaker. Cooked water was collected in a pre-weighed glass dish and was placed in a hot air oven at 105 °C and evaporated to dryness. The dry residue was weighed and reported as a percentage. For each quality parameters three determinations were performed to obtain the mean values.

Result and Discussion

Cooking quality of noodles

The cooking quality of noodles is the most important characteristic for consumers and therefore of great importance to processing industry. Cooking quality including cooking time, cooking weight, cooking loss and water uptake of noodles are presented in Table.

Table 2: Cooking quality of prepared noodles incorporated with Guar Gum

Sample	Cooking time (min)	Cooking loss (%)	Cooked weight (%)	Water uptake (%)
Control	5.31	8.32	25.54	155.49
FG_1	5.48	8.29	26.60	166.00
FG_2	6.28	7.32	27.44	174.41
FG_3	7.10	6.58	28.71	187.15
SE±	0.06517	0.00391	0.00204	0.00527
CD at 5%	0.19116	0.01146	0.00599	0.01546

*Each value is average of three determinations

The data presented in (Table 2) depicted that the incorporation of guar gum in fenugreek leaves puree noodles influenced the cooking properties of noodles. The cooking time of control noodles was 5.31 min and cooking time of fenugreek noodles ranged from 5.48 min to 7.10 min. The highest cooking time was observed in FG_3 sample. Cooking time increased with increase in hydrocolloids concentration. The cooking loss is the amount of dry matter in the cooking water of optimally cooked noodles. The results showed less cooking loss in FG_3 noodle sample. The cooking loss of control sample was 8.32 per cent. The decrease in the cooking loss with noodles incorporated with Guar gum from FG_1 to FG_3 ranging from 8.29 per cent to 6.58 per cent The cooked weight and water uptake were observed to increase due to increase in hydrocolloids concentration. The cooked weight found to be lowest in control sample 25.54 per cent and it increased from FG1 to FG3 in the range of 26.6 per cent to 28.71 per cent. The water uptake of control sample was 155.49 per cent. The water uptake of noodles increased with increase in level of guar gum and it ranged from 166.00 per cent to 187.15 per cent. Results reported are in close agreement with (Rafiq *et al.* 2016) [7].

Table 3: Cooking quality of noodles incorporated with carboxy methyl cellulose (CMC)

Sample	Cooking time (min)	Cooking loss (%)	Cooked weight (%)	Water uptake (%)
Control	5.31	8.32	25.54	155.49
FC_1	5.40	8.19	25.74	157.48
FC_2	5.50	8.05	29.59	195.97
FC_3	6.30	7.85	29.75	197.59
SE±	0.05412	0.00391	0.00333	0.00527
CD at 5%	0.15874	0.01146	0.00978	0.01546

*Each value is average of three determinations

The optimum cooking time, cooking loss, cooked weight and water uptake of noodles are shown in table 3. Regarding the optimum cooking time the addition of CMC at 1.5 per cent concentration had longest cooking time 6.30 min. The cooking time of control noodles was 5.31 min and cooking time of Fenugreek noodles with CMC ranged from 5.40 min to 6.30 min. The results showed less cooking loss in FC_3 noodle sample. The cooking loss of control sample was 8.32 per cent. The decrease in the cooking loss with noodles incorporated with CMC from FC_1 to FC_3 ranged from 8.19 per cent to 7.85 per cent. Table 3 indicates that the cooked weight found to be lowest in control sample 25.54 per cent and it increased from FC_1 to FC_3 ranging from 25.74 per cent to 29.75 per cent. The water uptake of noodles incorporated with CMC was 157.48 per cent in FC_1, 195.97 per cent in FC_2 and 197.59 per cent in FC_3 sample. Results reported are in close agreement with (Jarnsuwan and Thongngam 2012, and Rafiq *et al.* 2016) [4, 7].

Conclusion

On the basis of obtained results, it could be concluded that increasing concentration of additives such as guar gum and CMC in fenugreek puree noodles decreases cooking losses while, cooking time, cooked weight and water uptake increased with increasing concentration of guar gum and CMC in noodles. Therefore, incorporation of guar gum and CMC in fenugreek puree noodles results in enhanced cooking characteristics of noodles.

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