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Studies on physico-chemical and sensory quality of noodles incorporated with fenugreek leaves (*Trigonella foenum-graecum* L.) puree

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Abstract

Present investigation was carried out to study the effect of fenugreek leaves puree on physico-chemical and organoleptic quality of noodles. Fenugreek (*Trigonella foenum-graecum* L.) is one of the most ancient medicinal plants belonging to family *Leguminosae*. Fenugreek is a natural source of iron, silicon, sodium and thiamine. Noodles were prepared by using refined wheat flour, fenugreek leaves puree, eggs, salt etc. The puree were incorporated in noodles in different proportion with sample coding as F₀, F₁₀, F₂₀, F₃₀, F₄₀ and F₅₀ with 0, 10, 20, 30, 40 and 50 per cent respectively. The chemical analysis of noodles showed that with increasing proportion of puree moisture, ash and fiber content were increased with decreasing protein, fat and carbohydrate. The mineral content were increased significantly with increased proportion of puree. Sensory evaluation revealed that sample F₃₀ was superior among all the samples. From the present investigation it was concluded that noodles prepared with incorporation of fenugreek leaves puree having good nutritional and sensory quality attributes. It was also concluded that sample F₃₀ got highest score for overall acceptability and it was taken for further analysis.

Keywords: Fenugreek leaves, noodles, physicochemical properties, sensory properties

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is one of the most ancient medicinal plants belonging to family *Leguminosae*. It is cultivated world wide as semi-arid crop. The seeds are used as a spice and the leaves are consumed as a green vegetable. Fenugreek is native to Southern Europe, the Mediterranean region and Western Asia. India is a major producer of fenugreek and also a major consumer of it for culinary uses and medicinal applications. Over 80 per cent of the total world's production is contributed by India. Rajasthan accounts for over 80 per cent of India's output. It is known as "Methi" in Hindi (Parthasarathy *et al.* 2008)^[1].

Fenugreek is a natural source of iron, silicon, sodium and thiamine. Fenugreek contains mucilagins which are known for soothing and relaxing inflamed tissues. Fenugreek seeds contain alkaloids, including trigonelline, gentianine and carpine compounds. The seeds also contain fibre, 4-hydroxyisoleucine and fenugreekine, a component that may have hypoglycemic activity. The mechanism is thought to delay gastric emptying, slow carbohydrate absorption and inhibit glucose transport. Fenugreek may also increase the number of insulin receptors in red blood cells and improve glucose utilization in peripheral tissues, thus demonstrating potential anti-diabetic effects both on the pancreas and other sites. The amino acid 4-hydroxyisoleucine, contained in the seeds, may also directly stimulate insulin secretion. Methika is pungent in both taste and post digestive effect. It possesses light and unctuous attributes. It augments the appetite, relieves fever, alleviates swelling and reduces body fats but vitiates Pitta. Fenugreek seeds and leaves are anticholesterolemic, anti-inflammatory, antitumor, carminative, demulcent, deobstruent, emollient, expectorant, febrifuge, galactagogue, hypoglycaemic, laxative, parasiticide, restorative and uterine tonic, and useful in burning sensation.

Fenugreek (*Trigonella foenum-graecum* L.) plant is effective on blood lipids and sugar and on some bacterial strains, antioxidant activity of fenugreek causing protective of organs and inhibition of entrance diseases to body, to decrease body fats and is effective on obesity. The plant contains active constituents such as alkaloids, flavonoids, steroids, Saponins etc. It is an old medicinal plant. It has been commonly used as a traditional food and medicine.

Fenugreek is known to have hypoglycemic, and hypo cholesterolaemic, effects, Anti-inflammatory effects (Moradikor *et al.* 2013)^[9].

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 Ganesharane, 2009; Wani and Kumar, 2015)^[13, 15].

Noodles are widely consumed throughout the world and their global consumption is second only to bread. Instant noodles are widely consumed throughout the world and it is a fast growing sector of the noodle industry (Owen, 2001)^[10]. This is because instant noodles are convenient, easy to cook, low cost and have a relatively long shelf life. Wheat flour which is usually used to make instant noodles is not only low in fiber and protein contents but also poor in essential amino acid, lysine. Flour of hard wheat (*Triticum aestivum L.*) is the main primary ingredient (Fu, 2008) and the addition of alkaline salts can help strengthens the structure and hence improve the firmness of the final product (Hou and Kruk, 1998)^[5].

Materials and Methods

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.

Methods

Proximate analysis

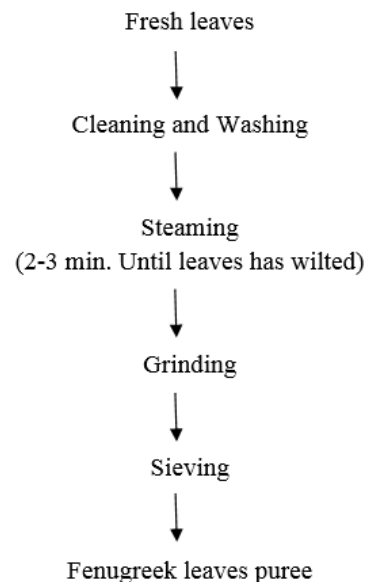
All samples were analyzed for moisture, crude protein, crude fat, total ash, mineral and total carbohydrate contents according to their respective standard methods as described in (A.O.A.C., 2000).

Sensory evaluation of noodles

The sensory evaluation was carried out to assess the overall acceptability of the noodles incorporated with fenugreek leaves puree. The samples were cooked in boiling water for 8-10 minutes and quality attributes (colour, flavor, taste and texture) of prepared noodles were evaluated against the control 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 were done using de-ionized water and then leaves were steamed for 2-3 min. Until leaves has wilted. Then the leaves were grinded, sieved to produce puree and it is filled in cleaned and sterilized jar and stored at low temperature for analysis and noodle production.



Flow Sheet 1: Preparation of fenugreek leaves puree

Table 1: Formulation of noodles incorporated with Fenugreek leaves puree

| S. No | Ingredients | Quantity | | | | | |
|-------|------------------------|----------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | Control | F ₁₀ | F ₂₀ | F ₃₀ | F ₄₀ | F ₅₀ |
| 1 | Refined wheat flour | 100 | 100 | 100 | 100 | 100 | 100 |
| 2 | Fenugreek leaves puree | 0 | 10 | 20 | 30 | 40 | 50 |
| 3 | Egg | 8 | 8 | 8 | 8 | 8 | 8 |
| 4 | Salt | 2 | 2 | 2 | 2 | 2 | 2 |

F₀ = Control 100 per cent wheat flour noodles

F₁₀ = 10 g fenugreek leaves puree in 100g flour

F₂₀ = 20 g fenugreek leaves puree in 100g flour

F₃₀ = 30 g fenugreek leaves puree in 100g flour

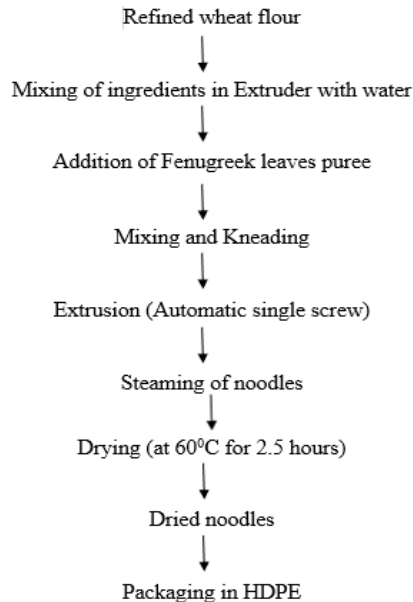
F₄₀ = 40 g fenugreek leaves puree in 100g flour

F₅₀ = 50 g fenugreek leaves puree in 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, 30.0 ml water, 8.0 g egg, 2.0 g salt. Five different formulations of dried noodle samples were prepared with addition of 10, 20, 30, 40 and 50% fenugreek leaves puree. The different formulations were processed into noodles using an automatic extruder. In brief, salt was dissolved in the water and this solution was added to the flour in the extruder. 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 a total drying time of 2.5 hours.

**Flow Sheet 2:** Preparation of noodles

Results and Discussion

Table 2: Chemical composition of raw materials

| Sample | Moisture (%) | Fat (%) | Protein (%) | Carbohydrate (%) | Fibre (%) | Ash (%) |
|------------------------|--------------|---------|-------------|------------------|-----------|---------|
| Refined wheat flour | 10.86 | 1.36 | 10.60 | 74.38 | 1.10 | 1.2 |
| Fenugreek leaves puree | 87.00 | 0.9 | 2.8 | 6.1 | 1.7 | 1.50 |
| Egg | 73.30 | 11.20 | 12.5 | 0.20 | 0.063 | 1.8 |

*Each value is average of three determinations

The results pertaining to chemical analysis of raw materials are presented in (Table 2). It was revealed that, the moisture for refined wheat flour (10.86 per cent), crude fat (1.56 per cent), protein (11.6 per cent) carbohydrate (71.38 per cent) crude fiber (1.67 per cent) and ash (0.59 per cent). The chemical analysis of refined wheat flour was found similar to that of results of Bhatt *et al.* (2015).

The results of the chemical analysis of the fenugreek leaves puree summarized in Table 2 are moisture (87.00 per cent), crude fat (0.9 per cent), protein (2.8 per cent) carbohydrate (6.1 per cent) crude fiber (1.7 per cent) and ash (1.5 per cent). The results of fenugreek leaves puree was close agreement to the results obtained by Srinivasan, (2006)^[14].

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).

Table 3: Mineral content of fenugreek leaves puree (mg/100g)

| Sample | Calcium | Phosphorus | Potassium | Copper | Ferrous | Zinc | Manganese |
|------------------------|---------|------------|-----------|--------|---------|------|-----------|
| Fenugreek leaves puree | 392 | 54.00 | 68.50 | 0.60 | 20.00 | 0.45 | 0.18 |

*Each value is average of three determinations

The data presented in (Table 3) revealed that fenugreek leaves puree contain calcium, phosphorus, potassium, copper, ferrous, zinc, and manganese are 395, 51, 198.5, 60, 20.00, 0.45 and 80 mg/100gm respectively. The similar results were obtained by the research work done by Srinivasan, (2006)^[14].

Table 4: Sensory evaluation of noodles incorporated with fenugreek leaves puree

| Sample | Colour | Flavor | Taste | Texture | Overall acceptability |
|-----------------|---------|---------|---------|---------|-----------------------|
| F ₀ | 7 | 7.0 | 7.5 | 7.5 | 7.5 |
| F ₁₀ | 7.50 | 7.25 | 7.50 | 7.75 | 7.75 |
| F ₂₀ | 8.0 | 7.50 | 8.25 | 8.00 | 8.25 |
| F ₃₀ | 9.0 | 8.0 | 8.50 | 8.70 | 8.75 |
| F ₄₀ | 9.0 | 8.0 | 8.5 | 8.5 | 8.5 |
| F ₅₀ | 8.50 | 8.0 | 8.25 | 8.25 | 8.0 |
| SE± | 0.02343 | 0.01713 | 0.02291 | 0.01076 | 0.01076 |
| CD at 5% | 0.07054 | 0.05157 | 0.06895 | 0.03239 | 0.03239 |

*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 data presented in (Table 4) revealed that sample F₃₀ and F₄₀ got highest score for colour among all samples. Sample F₃₀, F₄₀ and F₅₀ found good score for flavour. Sample F₃₀ and F₄₀ got highest score for taste

among all samples. The sample F₃₀ got good score for texture. The overall acceptability of noodles showed that sample F₃₀ was highly acceptable among all samples. Hence sample F₃₀ was selected for further studies. The similar results were found in close agreement of Ramu *et al.* (2016)^[12].

Table 5: Effect of blend proportion on proximate composition of noodles incorporated with fenugreek leaves puree

| Sample | Moisture (%) | Fat (%) | Protein (%) | Carbohydrate (%) | Fibre (%) | Ash (%) |
|-----------------|--------------|---------|-------------|------------------|-----------|---------|
| F ₀ | 6.83 | 4.30 | 13.85 | 69.93 | 1.85 | 1.57 |
| F ₁₀ | 8.60 | 4.29 | 13.67 | 68.52 | 3.12 | 2.58 |
| F ₂₀ | 8.73 | 4.28 | 13.52 | 68.02 | 3.21 | 2.66 |
| F ₃₀ | 8.78 | 4.27 | 13.39 | 67.62 | 3.33 | 2.76 |
| F ₄₀ | 8.88 | 4.27 | 13.21 | 67.14 | 3.48 | 2.84 |
| F ₅₀ | 9.57 | 4.26 | 13.02 | 66.42 | 3.60 | 3.06 |
| SE± | 0.01721 | 0.00544 | 0.00471 | 0.00272 | 0.00397 | 0.00333 |
| CD at 5% | 0.05182 | 0.01639 | 0.01419 | 0.00819 | 0.01194 | 0.01003 |

* Each value is average of three determinations

Results showed that the chemical composition of the papered noodles having different levels of fenugreek leaves puree. It can be revealed from the above results (Table 5) that the moisture content was found highest in the sample F₅₀ (9.57 per cent) as compared to different formulations and control sample and shows the increase in the moisture content due to the increase in quantity of the fenugreek leaves puree from 10 per cent to 50 per cent. There was negligible difference in the protein and fat content of all the samples. Further the

carbohydrates content found to be decreased. Carbohydrate content was found to be highest in the control sample (69.93 per cent) and decreased from F₁₀ to F₅₀. The dietary fiber content was found to be lowest in the control sample (1.85 per cent) and gradually increased from F₁₀ to F₅₀ due to the increase in quantity of the fenugreek leaves puree from 10 per cent to 50 per cent. Ash content increased with increasing the concentration of fenugreek leaves puree. Similar results were found in close agreement of Ayedin and Gocmen (2011)^[2].

Table 6: Mineral content of noodles incorporated with fenugreek leaves puree (mg/100g)

| Sample | Calcium | Phosphorous | Potassium | Copper | Ferrous | Zinc | Manganese |
|-----------------|---------|-------------|-----------|---------|---------|---------|-----------|
| F ₀ | 32.5 | 132.7 | 140.39 | 0.25 | 2.5 | 0.90 | 0.40 |
| F ₁₀ | 41.5 | 135.8 | 159.1 | 4.87 | 3.81 | 0.91 | 60.18 |
| F ₂₀ | 48.2 | 138.2 | 172.4 | 9.20 | 7.10 | 0.93 | 64.28 |
| F ₃₀ | 57.8 | 139.8 | 189.3 | 12.80 | 8.30 | 0.95 | 69.45 |
| F ₄₀ | 62.1 | 141.2 | 198.7 | 15.21 | 9.20 | 0.97 | 76.80 |
| F ₅₀ | 69.7 | 152.8 | 210.3 | 19.8 | 9.90 | 0.99 | 82.38 |
| SE± | 0.0043 | 0.0043 | 0.00397 | 0.0043 | 0.0043 | 0.00448 | 0.00471 |
| CD at 5% | 0.01295 | 0.01295 | 0.01194 | 0.01295 | 0.01295 | 0.01348 | 0.01419 |

* Each value is average of three determinations

The data presented in (Table 6) depicted that the effects of fenugreek leaves puree on mineral content of noodles. It was found that calcium content was increased from 41.50 to 69.70 mg/100g with the increased proportion of puree from 10 to 50 per cent. Phosphorous content were increased from 135.8 to 152.8 mg/100g. potassium contents were increased from 159.1 to 210.30 mg/100 g. copper, ferrous, zinc and manganese were increased from 4.87 to 19.80, 3.81 to 9.90, 0.91 to 0.99 and 60.18 to 82.38 mg/100g respectively. There was increment in mineral content in noodles with increased proportion of fenugreek leaves puree to noodles. Similar results were found with the research finding of mahmoud *et al.* (2012)^[7].

Conclusion

From the present investigation it was concluded that noodles prepared with incorporation of fenugreek leaves puree having good nutritional and sensory quality attributes. It was also concluded that sample F₃₀ got highest score for overall acceptability and it was taken for further analysis.

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