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Studies on Preparation of Finger Millet Vermicelli and effect of Guar Gum on Chemical and Sensory Characteristics

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ABSTRACT: Most of the consumers demand convenience food, ready to eat snacks or food which add to bulk and satisfy their appetite. The diet consumed by a vast majority of people is deficient in nutrients like proteins, minerals. Therefore, one of the great challenges is to develop inexpensive foods that are nutritionally superior and at the same time highly acceptable to intended consumer.

In the present investigation, the technology was developed to standardize the process for preparation of finger millet fortified vermicelli incorporated with guar gum. Vermicelli is an extruded product commercially prepared using refined whole wheat flour. From previous years, vermicelli has been prepared from refined wheat flour which is high in gluten, which causes gluten intolerance. To overcome this problem of gluten intolerance, the utilization of finger millet in vermicelli will help to solve such a problem. Regarding the health benefits of finger millet, formulated vermicelli will be a good source of calcium and iron. With the addition of guar gum, it will improve its cooking and textural quality, and current efforts have been made to formulate the vermicelli by optimizing the ingredients based on quality parameters. Vermicelli was prepared from wheat semolina flour, finger millet flour, salt and guar gum at the levels of (1 per cent, 1.5 per cent, 2.0 per cent and 2.5 per cent). Prepared vermicelli was analysed for chemical and sensory properties. The prepared vermicelli was analysed for chemical composition like moisture, fat, carbohydrates, protein, fibre and ash. Sensory evaluation revealed that the TG3 sample, which contained 2% guar gum, was the best of the bunch. From the present investigation, it was concluded that finger millet fortified vermicelli prepared with incorporation of Guar gum has good nutritional and sensory quality attributes.

Keywords: Finger millet fortification, vermicelli, Guar gum, chemical composition, sensory properties.

INTRODUCTION

The accelerated speed of modern living, there is a greater awareness of health and a preference for fast food items, which has made vermicelli a very popular and widely consumed item. Vermicelli is a common instant food product that is classified as an extruded product, which means it is produced through an extrusion process that involves unit operations such as mixing (hydration of protein and starch), kneading (homogenization) and shearing (extrusion). Production of vermicelli is expected to attract the food industry for its utilization due to increasing demand for naturally healthy and gluten free food (Devi *et al*., 2015). Vermicelli is a popular instant food product which falls under the category of extruded product and is made from wheat flour. It is a snack food item rich in proteins and liked by people from all walks of life, irrespective of age.

In India wheat crop is cultivated in Rabi season. It is normally sown during November and harvested between March and April. The cultivated area under wheat at national level has shown increasing trend, from 29.04 million hectare to 30.54 million hectare with a magnitude of 1.5 million hectare (5%) net gain in terms of area. Uttar Pradesh has largest share in area with 9.75 million hectare (32%), followed by Madhya Pradesh (18.75%), Punjab (11.48%), Rajasthan (9.74%), Haryana (8.36%) and Bihar (6.82%). However, a major expansion in wheat area was observed in the states such as Jharkhand (51%), Madhya Pradesh (27%) and Rajasthan (13%). The sharp rise in minimum support price and government's procurement are the two important drivers which led to significant increase in the area under wheat cultivation. The production of wheat has also showed an increasing trend, from 87.39 to 94.57 million tonnes from 2012–2013 to 2017–2018 with a magnitude of 7.18 million tonnes (8.22%) (Longvah *et al*., 2017).

Maharashtra's most important crop is finger millet. Millets output and consumption have both dropped significantly in the last year. Finger millet chemical composition and carbohydrate content Finger millet's content has been reported to be between 72 and 79.5

percent. Although finger millet contains about 7% protein, studies have found considerable differences in protein concentration ranging from 5.6 to 12.70 percent. In comparison to finger millet, finger millet has higher total ash content. The total calcium contained in Finger millet varied from 162 to 487 mg/100 gm. It is the most abundant source of calcium (Ca) and iron (Fe). Calcium insufficiency causes bone and tooth problems. Anemia caused by iron deficiency can be treated. Mineral content could be enhance by Using techniques such as popping and roasting, malting and fermentation are two steps in the malting process. The application of these methods not only reduces the amount of anti-nutrients in the body, but enhances the bioavailability of some minerals, such as calcium and magnesium (Singh and Srivastava, 2006).

Gums/hydrocolloids are commonly used in starch-based noodles to improve stability, texture, and ease processing. Hydrocolloids are generated from a variety of sources, including seeds, fruits;plant extracts, seaweed, and microorganisms, and is employed in gluten-free formulations. The hydrocolloids protect the starch granules from shear during cooking and improve the finished product's texture. Some of the hydrocolloids used in the food business include pectin, carboxymethyl cellulose, agarose gum, xanthan gum, glucan, hydroxyl propylmethylcellulose, locust bean gum, guar gum, and carrageenan, with guar and xanthan gums being the most extensively used (Norton and Foster, 2002).

CMC, xanthan, guar, and arabic gum are water-soluble heteropolysaccharides with high molecular weights that are frequently employed in conjunction with starches to give ace potable texture, manage moisture and water mobility, and improve overall product quality and/or stability (Li *et al*., 2008).

Although many researchers have investigated the usage of hydrocolloids in a variety of foods, there has been minimal research into the usage of hydrocolloids in instant noodle products (Jarnsuwan and Thongngam 2012). There is a need to increase finger millet consumption by integrating it into popular food products like vermicelli. As a result, the goal of this study was to create and detect the impacts of hydrocolloids, specifically guar gum, on the chemical and sensory qualities of vermicelli.

MATERIALS AND METHODS

The present investigation was carried out in Department of Food engineering with collaboration of Department of Food Chemistry and Nutrition in College of Food Technology, VNMKV, Parbhani during year 2020-21.

A. Materials

The raw material such as Finger millet flour (*Eleusine coracana*), wheat semolina (*Triticum Durum* L.), salt, etc. were purchased from local market of Parbhani. Guar gum required for research work was available in the department of Food Engineering and the department of Food chemistry and Nutrition.

Chemicals and glassware's. The chemicals of analytical grade and glasswares required during investigation were used in the department of Food Engineering.

B. Methods

Preparation of wheat semolina (suji). Preparation of wheat suji Wheat grains were cleaned and subjected to tempering and conditioning treatment. Water was added to wheat sample to increase moisture by 3% and conditioned overnight. The conditioned grains were milled to obtain suji using laboratory flour mill.

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 (A.O.A.C., 2000).

Sensory evaluation of vermicelli. The sensory evaluation was carried out to assess the overall acceptability of the ragi fortified vermicelli incorporated with Guar gum. The samples were cooked in boiling water for 5-6 minutes and spices are added. The quality attributes (color, flavor, taste and texture) of prepared vermicelli were evaluated against the control sample. Optimally cooked vermicelli were then analyzed for overall acceptability of the samples by 10 members using a nine-point hedonic scale

Preparation of finger millet fortified vermicelli incorporated with guar gum. Hard dough was prepared by mixing ingredients like wheat semolina flour, finger millet flour, salt and guar gum in the varying composition as shown in the Table 1.

Water was slowly added, mixed and kneaded into stiff, plastic and homogeneous dough. Prepared dough was placed inside the traditional cold extruder and pressure was applied at the top of the extruder.

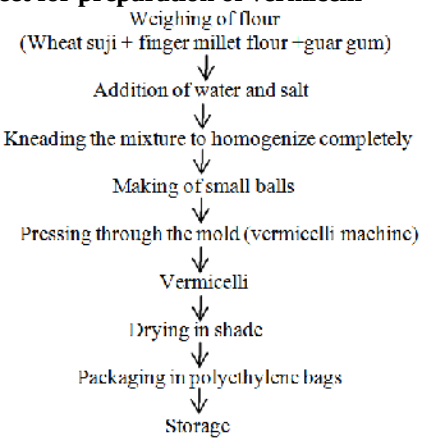
Table 1: Formulation of finger millet fortified vermicelli incorporated with guar gum.

Sample	Wheat semolina	Ragi flour	Guar gum	Salt
Control	80	20	0	2
TG_1	80	20	1	2
TG_2	80	20	1.5	2
TG_3	80	20	2.0	2
TG_4	80	20	2.5	2

*Each value is average of three determinations

Due to high pressure, the dough emerges through circular hole mould to form a rod shaped vermicelli of diameter 1.25mm. Extruded dough was dried in shade (Yadav *et al*., 2012) in cabinet dryer. Dried vermicelli was packed in a high density polyethylene bags for prolong storage. The vermicelli were prepared with slight modification according to the method given by Lande *et al*., (2017).

Flow sheet for preparation of vermicelli



RESULTS AND DISCUSSION

A. Chemical composition of raw materials

The results pertaining to chemical analysis of wheat flour (semolina) are presented in (Table 2). It was revealed that, the moisture for wheat flour (semolina) (11.45±0.87 per cent), crude fat (0.81±0.06 per cent), protein (11.88±0.65 per cent), carbohydrate (71.68±1.2per cent), and ash (0.7±0.02 per cent). These values of chemical properties recorded in the present study are similar to the values reported earlier by (Jeffrey *et al.*, 2019). The value of crude fiber obtained in present investigation (0.48±0.12per cent) was closely agreement with Lande *et al*., (2017).

Jeffrey *et al*., (2019) studied the proximate composition of wheat flour (semolina) was moisture content (per cent) 6.17 ±0.03, ash (per cent) 0.58±0.01, fat (per cent) 0.81± 0.04, protein (per cent) 11.56.

The results of the chemical analysis of the finger millet summarized in Table 2. The moisture (12.23±0.30 per cent), fat (1.2±0.02per cent), protein (7±0.2 per cent.) carbohydrate (75.4±0.25 per cent), crude fiber (3.3±0.15 per cent) and ash (2.06±0.02 per cent). The results of chemical composition of finger millet is in close agreement with the results of Ladkat *et al*., (2019). He observed the proximate composition of plain finger millet was found to be moisture (13.10 per cent), fat (1.28per cent), protein (7.30 per cent.), carbohydrate (72.30per cent), crude fiber (3.56 per cent), and ash (2.63 per cent), calcium 163/100mg and iron 6.63 mg/100gm.

The results of the chemical analysis of the guar gum summarized in Table 2 moisture (8.47±0.24 per cent), fat (0.82±0.04 per cent), protein (5.16±0.02 per cent.) carbohydrate (83.40±1.07 per cent), crude fiber (2.23±0.15) and ash (0.63±0.03per cent).These values of chemical properties recorded in the present study are similar to the values reported earlier by Amir *et al*., (2015).

B. Sensory evaluation of finger millet fortified vermicelli incorporated with Guar gum

Data given in Table 3 revealed that, the overall acceptability score recorded for sample TG_3 was found to be higher (8.3) followed by TG_4 (8.1) than other samples. The overall acceptability among samples was significantly varied statistically. The color serves as important parameter for the acceptance of food samples. The highest score for color of Guar gum incorporated vermicelli was recorded for sample TG_3 (7.5). Whereas the lowest score received for control sample (7). There was notable difference between the samples in context to color.

Table 2: Chemical composition of raw materials.

Sample	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Fibre (%)	Ash (%)
Wheat semolina	11.45±0.87	0.81±0.06	11.88±0.65	71.68±1.2	0.48±0.12	0.7±0.02
Ragi flour	12.23±0.30	1.2±0.02	7±0.2	75.4±0.25	3.3±0.15	2.06±0.02
Guar gum	9.83±0.82	0.82±0.04	4.36±0.15	83.40±1.07	1.72±0.22	0.63±0.03

*Each value is average of three determinations

Table 3: Sensory evaluation of finger millet fortified vermicelli incorporated with Guar gum.

Sample	Color	Flavor	Taste	Texture	Overall acceptability
Control	7	7.3	7.5	7.2	7.4
TG_1	7.3	7.8	7.6	7.6	7.6
TG_2	7.2	7.7	7.7	8.0	7.9
TG_3	7.5	7.9	8.2	8.5	8.3
TG_4	7.1	7.4	8.0	8.2	8.1
SD±	0.09537	0.04073	0.05998	0.03692	0.04989
CD@5%	0.27974	0.11948	0.17562	0.10828	0.14633

*Each value is average of three determinations

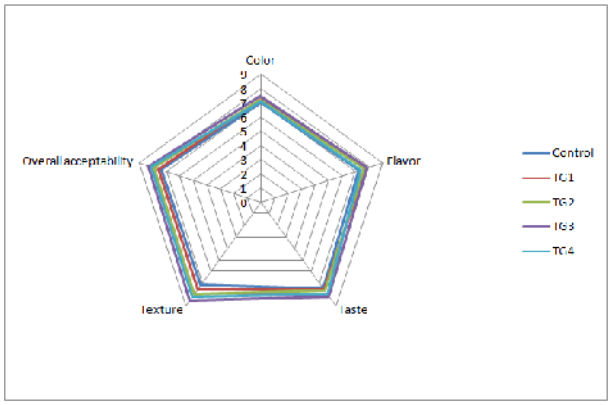


Fig. 1. Sensory evaluation of finger millet fortified vermicelli incorporated with Guar gum.

The maximum score for flavor attribute was received by sample TG_3 (7.9). While, the lowest score was noted in case of control sample (7.3). All Samples TG_1, TG_2, TG_3, TG_4 and control sample found good score for flavor and taste. An appraisal of Table 3. Showed that, the sample TG_3 got good score for texture (8.5). It was found that sample TG_3 had the highest score for taste (8.2) followed by TG_1 (7.6), TG_2 (7.7) and TG_4 (8.0). There was notable difference among the samples in context to all the sensory parameters. Overall, by considering the different sensory attributes, the vermicelli formulation TG_3 was found to be superior to the other samples hence it was selected for further studies.

C. Chemical composition of selected vermicelli sample incorporated with guar gum

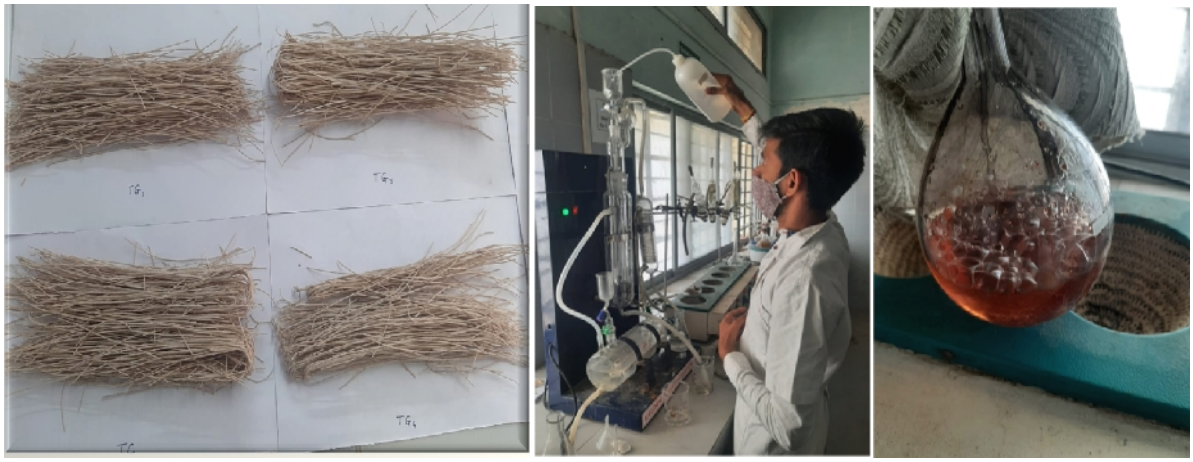
The sample TG_3 selected on the basis of organoleptic evaluation and analyzed for the chemical composition which was shown in Table 4. The data presented in (Table 4) revealed that the moisture content in vermicelli sample was 5.79 per cent. The fat, protein, carbohydrate, crude fiber content found to be 1.20 per cent, 10.39 per cent, 75.28 per cent and 3.20 per cent. The ash content in sample was 2.49 per cent. Results were in agreement with the findings of (Joshi, 2019). The chemical composition of finger millet fortified vermicelli incorporated with guar gum showed marginal changes as compare to finger millet fortified vermicelli without guar gum (control). It means a guar gum does not affect the chemical composition of vermicelli.

Table 4: Chemical composition of selected vermicelli sample incorporated with guar gum.

Sr. No.	Parameters (%)	Contents
1	Moisture	5.79
2	Fat	1.20
3	Protein	10.39
4	Carbohydrate	75.28
5	Crude fiber	3.20
6	Ash	2.49

*Each value is average of three determinations

Joshi *et al.*, (2019) investigated the chemical composition of fenugreek puree noodle with the incorporation of additives. It was observed that chemical composition of noodles with incorporation of guar gum was moisture 8.66, per cent, fat 4.27 per cent, protein 13.42, carbohydrate 67.65 and crude fiber 3.32 receptively. The chemical composition of noodle with the incorporation of carboxy methyl cellulose (CMC) was found to be moisture 8.62 percent, fat 4.26 per cent, protein 13.41 per cent, carbohydrate 67.66 and crude fiber 3.34 per cent receptively.



CONCLUSION

From the present investigation it was concluded that finger millet fortified vermicelli prepared with incorporation of guar gum had good nutritional and sensory quality attributes. It was also concluded that sample TG_3 got highest score for overall acceptability and it was taken for further analysis.

FUTURE SCOPE

There is a need to increase the consumption of finger millet by incorporating into extruded products like

vermicelli, which are liked by all age of group people . Due to changing lifestyle there is change in food habits of people. Nowadays everybody is in a hurry of time and want the food items on the go which require less time for cooking and convenient for preparation and owing to nutritional superiority of millets, there is a need to develop millet based processed foods such as vermicelli.

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Conflict of interest. The author(s) declare that there is no conflict of interest

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