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Development and shelf-life evaluation of pearl millets based extruded product

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ABSTRACT

Pearl millet (Bajra) is one of the major coarse grain cereals (millets) and is considered to be a poor man's food. It is widely grown in Africa and Asia since pre-historic times. Bajra grains contain about 11.6% protein, 5% fat, 67.5% carbohydrates and about 2.3% minerals. Vermicelli as a well established traditional food liked by all age groups having longer shelf life and good commercial importance. The cooking of these extruded products is very convenient and requires few minutes. The present study was undertaken to fortify vermicelli with millets and defatted soy flour to improve its nutritive value. Pearl millets flour, wheat and soy flours were used in the ratio of 30: 50: 20 for the development of cold extruded products and tested against other blends of Pearl millets flour, wheat and Bengal gram flour (50:30:20) pearl millet, refined wheat flour and Bengal gram flour (50:40:10). The extruded products were subjected to Cooking, sensory analysis, nutritional composition and storage study. Sensory evaluation revealed that highly acceptable nutrient rich extruded product was blends 30: 50: 20 was superior than those made from control and other blends and recorded highest sensory score 8.0. The nutritive value of selected vermicelli (blends 30: 50: 50) was found to be as follows moisture 11.70 per cent, protein 18.08 per cent, total carbohydrate 61.05 per cent, crude fat 7.05 per cent and crude fibre 1.0 per cent. The developed product can be stored upto six months without any deterioration in different flexible pouches under ambient storage conditions. Noodles, macaroni and pasta-like extruded products could be prepared from pearl millet flour. Vermicelli was found to be acceptable up to an incorporation level of 30 per cent.

Keywords: Pearl millet, Extrusion, Vermicelli, nutrients, Sensory properties

1. INTRODUCTION

The millets have been used in human consumption from pre-historic time and they are considered as the way of life, food of the people and food for hungry. The millets are with higher fibre content, and their protein quality and mineral composition contribute significantly to nutritional security of a large section of population residing in the millet growing areas, considered to be the most disadvantaged groups (Desai et al., 2010). Pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. Pearl millet is used a lot in rural India, it

has a high fiber content. India is the largest producer of pearl millet. Processed vermicelli products are commercially available in brand names and they are easy to cook with least time and effort. Since, the commercially available vermicelli is made out of only refined wheat flour/semolina, the calorific value as well as protein content and quality, rank equally well with any other cereal. In the developed countries, many convenience foods have been developed by extrusion technology and these extruded products are very popular among the consumers. These products include spaghetti, macaroni, vermicelli and noodles.

2. METHODOLOGY

Production of commercially important products such as vermicelli (ready to cook cold extruded product) is expected to attract the food industry as well as consumers due to the increasing demand for convenience foods, naturally healthy and gluten free foods. Different types of pearl millet vermicelli fortified with defatted soya flour were prepared. Pearl millets flour, wheat and soy flours were used in the ratio of 30: 50: 20 for the development of cold extruded products and tested against other blends of Pearl millets flour, wheat and Bengal gram flour (50:30:20) and vermicelli made from pearl millet, refined wheat flour and Bengal gram flour (50:40:10).

Formulation of millet grain flour:

The dried raw pearl millet rice was fed to the burr mill to get fine pulverized millet flour. This was further sieved using BS- 60 mesh to remove rough particles, if any, in the flour.

Procedure for preparation of vermicelli:

Sieve pearl millet, wheat and soya flours and mix thoroughly



After 5 minutes of mixing, add water to flour and mix thoroughly



Stop mixing add into the vermicelli making machine to allow vermicelli to pass through the die (Hand operated)



Dry in hot air oven at 60°C for 4-5 hours or sundry for 24hrs

Development of cold extruded (vermicelli) recipes:

Vermicelli kheer was prepared from the developed cold extruded products from pearl millets.

Sensory evaluation:

The developed products were subjected to sensory evaluation for their organoleptic properties viz., colour and appearance, flavour, texture, taste and overall acceptability by a panel of 10members using a five-point Hedonic scale. (Ranganna,1991). The mean score was obtained for all the characters.

Storage studies of cold extruded products:

The prepared vermicelli were packaged and stored for 2 months at ambient temperature. Low density polyethylene package was used with two thicknesses (300 and 400 gauges).

Nutrient analysis of developed products:

The nutritional components such as moisture, carbohydrate, crude protein, crude fibre and fat content of the cold extruded products were analyzed.

3. RESULTS AND DISCUSSION

The results of the proximate principles obtained were presented in the Table 1.

Table 1: Nutritional analysis of millet-based vermicelli (per 100 g)

Nutrients	I (30:50:20)	II (50:30:20)	III (40:50:10)
Moisture (g)	11.7	12.02	12.46
Carbohydrate(g)	61.05	67.32	64.85
Crude Protein(g)	18.08	14.34	12.98
Fat(g)	7.05	4.05	3.01
Crude Fibre(g)	1.0	1.02	1.05

The highest protein content was recorded in Trial I vermicelli (18.08g) followed by and pearl millets, wheat and bengal gram flour vermicelli (14.34g) and the control sample (12.98g). Highest protein content observed in millets vermicelli is due to high protein content of millets and soya flour. The carbohydrate value of all the three-vermicelli ranged from 61.05 to 67.32g. The highest was recorded in the trial II (67.32g), and the lowest in trial I vermicelli.

The moisture content of vermicelli/pasta from all the five millets along with control was found to be in the range of 6.88 to 9.74 per cent (Table 1). The highest moisture content was recorded in the control sample (12.46 %) and the lowest in trial I vermicelli (11.7 %). The mean crude fibre content of all three-vermicelli ranged from 1.0 to 1.05g (Table 1). The highest was recorded in control (1.05g) and the lowest in trial I (1.0g). The mean values of small millets ranged from 0.12 to 2.88g (Table 1). Highest fat content was recorded in trial I vermicelli (7.05g) followed by trial II vermicelli (4.05g) and the lowest in control sample (0.12g). Sumathi et al. (2007) showed that extruded pearl millet products prepared from a blend of 30% grain legume flour or 15% defatted soybean had, respectively, 14.7% and 16.0% protein, and 2.0 and 2.1 protein efficiency ratio.

Sensory evaluation of cold extruded millet products:

The organoleptic evaluation of prepared small millets' vermicelli and pasta masala was done by a panel of ten judges on a Five-point Hedonic scale.

Table 2: Sensory evaluation of vermicelli kheer

Millet vermicelli	Appearance	Texture	Flavour	Taste	Overall acceptability
Trial I (30:50:20)	3.80	4.00	3.70	3.90	4.00
Trial II (50:30:20)	3.40	3.70	3.50	3.40	3.50
Trial III (40:50:10)	5.00	3.90	4.40	4.00	4.50

Appearance:

The mean sensory scores showed that there was a major difference among two vermicelli control (Table 2). The scores for appearances ranged from 3.40 to 5.00. The highest was recorded for control followed by trial I 3.80.

Texture:

The mean texture scores ranged from 3.70 to 4.00. A major difference was observed between the trial I and II kheers and control. The highest score (4.00) was recorded for trial I vermicelli.

Flavour:

The millets' vermicelli kheer exhibited little bit of millets' flavor compared to control (addition of refined wheat flour), and therefore highest score was recorded for control (4.40).

Taste:

Major differences were observed among millets' kheers and control. The highest sensory score was recorded (4.00) for control sample followed by trial I (3.90). The least was recorded for trial II kheer (3.40).

Overall acceptability:

The highest sensory score (4.50) was recorded for control sample followed by trial I (4.00) kheers. Dod et al. (2003) performed sensory evaluation of pearl millet-based vermicelli using pearl millet flour, chick pea flour and refined wheat flour in different proportions. Almost similar results were observed for the vermicelli cooked in salted form whereas Type 1 (50:30:20) scored the

highest mean scores for all sensory attributes. Varsha and Grewal (2003) showed that supplementation of pearl millet and soy flour at 15 per cent each in the preparation of noodles did not affect the physical and sensory qualities of noodles.

Storage of pearl millet vermicelli:

Packaging of extruded products is necessary to prevent contamination and damage during transport and storage. Cellophane material is used primarily for packaging of extruded products. It provides clarity as well as protection against insect and moisture. Low density polyethylene bags are often used for packaging of extruded products. The developed product can be stored upto six months without any deterioration in different flexible pouches under ambient storage conditions.

4. CONCLUSION

The storage studies demonstrated that there was hardly any change observed in the physical characteristics like appearance, flavor and texture even after six months of storage. The study showed that the small millets' flours could be successfully incorporated for developing cold extruded products like vermicelli, as they supplement additional protein and fibre which could be safely preserved for six months to enable marketing and consumption. Vermicelli was found to be acceptable up to an incorporation level of 30 per cent and all the attributes were favourable for trial I vermicelli. Trial I combination will be commercialized and marketed through KVK Rural Mart. Grain quality and nutritional studies now show that pearl millet grains are more appropriate choices for the nutritional security of the rural and urban poor who have limited access to other sources of dietary components.

Informed consent

Not applicable.

Ethical approval

The ethical guidelines for plants & plant materials are followed in the study.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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