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Development of Nutri-Rich Bhakri (snack) instant mix

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Abstract

Millets are claimed to be the future potential food crop for better health and nutrition security. Finger millet also known as ragi in India is one of the important cereal which occupies highest area under cultivation among the small millets. It is a major source of dietary carbohydrates for a large section of society. Additionally ragi has enormous health benefits and also a good source of valuable micro-nutrients along with the major food components. Hence, the present study was undertaken to develop different finger and pearl millet based snack product with addition of flaxseed and dried fenugreek leaf powder, so that people can use these products in their day to day life, add variety to their diet and enjoy the novel foods even during fasting. Instant mix of bhakri (snack item) was developed using ragi flour, bajra flour, wheat flour, flaxseeds and dry methi leaves with two variations and a basic. The basic instant mix had wheat flour of 96 % and 4 % spices (dry red chilli and garlic powder) where as variation I and variation II had wheat flour, ragi flour, bajra flour, flaxseeds and dried methi leaves in the ratio of (%) 55:18:18:4:1 and 37:27:27:4:1 respectively. Incorporation of flaxseeds and dried methi leaves quantity was same for both the variations and spices quantity of 4 % was maintained constant for all the variations. The instant mix of all three variations was analyzed for nutritional composition. The highest protein content of 9.34g/ 100 g was recorded in variation I and the highest moisture of 7.57g/100g and energy content of 430 kcal/100 g was observed in variation II instant mix. The highest calcium and iron content was recorded in variation II instant mix with 113.76 mg/100g and 4.68 mg/100g respectively.

Keywords: Finger millet flour, wheat flour, bajra flour, flax seeds, dried fenugreek leaf powder, bhakri instant mix.

Introduction

Millets is a collective term referring to a number of small seeded annual grasses. Millets belong to various genera in the subfamily 'Panicoidae' that are a part of the grass family 'Poaceae'. In Africa and India, millet has been used as a staple food for thousands of years. Today millets ranks as sixth most important grain in the world, sustain 1/3 of the world's population and is a significant part of diet in India, northern China, Japan, Manchuria and various areas of the former Soviet Union, Africa and Egypt.

Millets are a major food source in semi-arid parts of the world. They are not only comparable to major cereals with respect to their nutritional features but are very good sources of carbohydrates, micronutrients and Phytochemicals with nutraceutical properties. The millets contain 7-12% protein, 2-5% fat, 65-75% carbohydrates and 15-20% dietary fibre. Among them, pearl millet contains considerably high proportion of proteins (12-16%) as well as lipids (4-6%) whereas; finger millet contains lower levels of protein (6-8%) and fat (1.5-2%). The essential amino acid profiles of the millet protein is better than maize. The niacin content in pearl millet is higher than all other cereals whereas, finger millet proteins are unique because of the sulphur rich amino acid contents.

Millets like foxtail, pearl, little and finger are the important grains for human consumption. Because of paradigm shift from traditional crops to cash crops the farmers are showing least interest in these millets though the millets are having high nutritional content, dietary fibre, micronutrient and B-vitamins [1]. In order to awaken, Krishi Vigyan Kendra, Gadag in Karnataka state undertook a study to create awareness about importance of millets in daily diet, imparting skill training and conducting demonstration of value added products. The study reported a increased consumption of millets in the form of dosa, idli, khichadi, sweets, pulav, upama, laadu etc.

Finger millet (*Eleusine coracana* L.) is commonly known as ragi or Mandau is extensively cultivated in various regions of India and in the entire world. India is the major producer of finger millet contributing nearly 60% of the global production Finger millet is a staple food in many African and South Asian countries. It is also considered a helpful famine crop as it is easily stored for lean years [2].

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The grain is readily digestible, highly nutritious and versatile, and can be cooked like rice, ground to make porridge or flour, or used to make cakes.

Pearl millet (*Pennisetum glaucum*) is a staple food in many developing countries and constitutes the major source of essential nutrients in semi-arid and arid regions of India. Pearl millet has antioxidant, anti-carcinogenic, hypocholesterolemic, hypoglycemic and antiulcerative properties. The presence of all these required nutrients and health-promoting properties in pearl millet makes it suitable for food utilization such as the manufacture of baby and snack foods and bakery products [3].

Flaxseed has a potential health benefits besides the nutrition due to three main reasons: first due to its high content of omega-3 alpha- linolenic acid; second being rich in dietary soluble and insoluble fibers and third due to its high content of lignans, acting as anti-oxidants and phytoestrogens. ALA can be metabolized in the body into docosahexanoic acid DHA and eicosapentaenoic acid EPA.

Flax is increasingly popular as an ingredient in breads, cereal bars, and baked goods. Aside from contributing a rich, nutty taste, the viscosity of ground flax, when mixed with water, makes it a suitable vegan alternative to eggs as a binding agent in baked goods. Researchers have also looked at palatability of varying degrees of flax supplementation to determine whether and how flax may be added to products without compromising appearance or flavor [4].

Green leafy vegetables can be utilized in several ways by incorporating them into existing products as principle and side ingredient and formulations are being made with various other food materials using dehydration. Similarly, soup powders (fenugreek enriched), mustard sausages, spinach-coriander purees are developed which are simpler convenient foods that are recognized to stimulate appetite and gives instant nourishment. Such foods are prepared, stored and handled easily, and function as an adaptable ingredient in noodle, pasta and other foods [5].

Consumer demand for convenience foods is now on the rise around the globe. Convenience has an immense impact on the food choices of today's consumers. This suggests that food products offering less convenience will be deemed less preferable to consumers. It has been argued by many individuals that convenience is a barrier to achieving proper nutrition using adequate servings. In order to incorporate the nutritional benefits of minor millets, it has become mandatory to process them into food that reaches the consumer.

Nutritional quality of food is a key element in maintaining human overall physical well-being because nutritional well being is a sustainable force for health and development and maximization of human genetic potential. Snacks as miniature versions of meals with a good mix of protein, fat fiber, iron and calcium will help keep hunger at bay and energy level on an even keel throughout the day.

Bhakri is round flat unleavened bread often used in the cuisine of the Gujarat state. Bhakri is typically biscuit-like bread flavored. Generally there are two types of bhakris – one is cooked like biscuit while the other is puffed and served with ghee

The traditional bhakri is made of whole wheat flour which was substituted with bajra flour, ragi flour with two variations of different ratio. Flax seeds were incorporated as an important food ingredient because of its rich contents of alpha linolenic acid, lignin and fiber. The product was developed in the form of bhakri (thin cracker) which can be consumed as a snack during mid day or tea time.

In view of the aforesaid points, the present study was focused on modification of traditional recipe of bhakri to make it more nutritious and healthier and development of nutri-rich bhakri (snack) instant mix.

Material and methods

The raw materials such as wheat flour, ragi flour, bajra flour, flaxseed, dry red chillies and oil were procured from provision store. Fenugreek leaves and garlic were procured from local market.

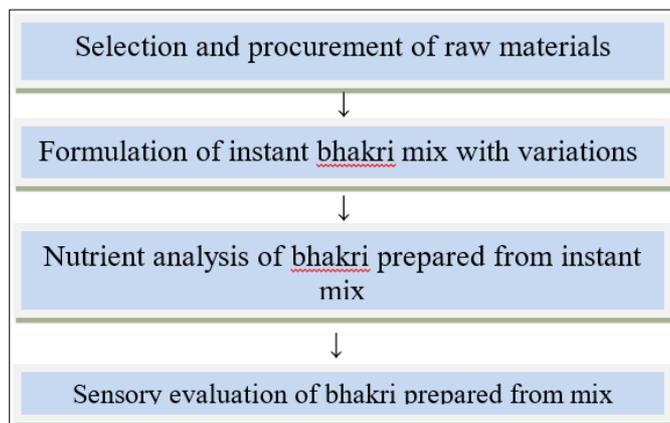


Fig 1: Research Design

Formulation of instant bhakri mix with variations

The basic recipe for preparation of bhakri was standardized using wheat flour, dried garlic powder and red chillies. Two modified recipe were formulated by incorporation of ragi flour, bajra flour along with flax seeds, dried fenugreek leaves, dried garlic powder and dried chillies to enhance the nutritive value of the product.

Table 1: Ingredients used for formulation of instant mix of bhakri

Ingredients	Basic	Variation 1	Variation 2
Wheat flour	96 %	55 %	37 %
Ragi flour	–	18 %	27 %
Bajra flour	–	18 %	27 %
Flax seeds	–	4 %	4 %
Dried methi leaves	–	1 %	1 %
Dried garlic powder	2 %	2 %	2 %
Dry red chilli	2 %	2 %	2 %

Process for development of bhakri instant mix

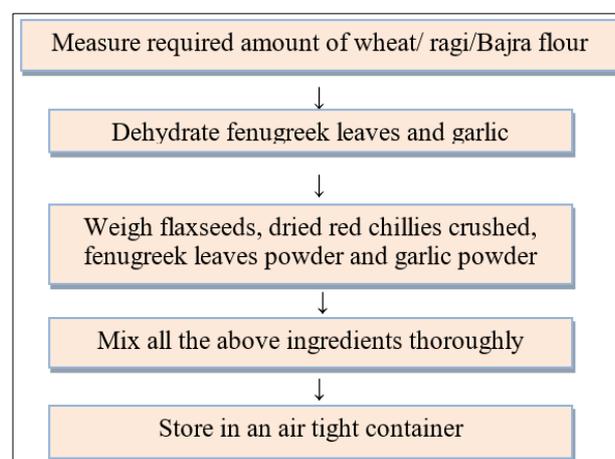


Fig 2: Flow chart for development of bhakri instant mix Preparation of bhakri from instant mix

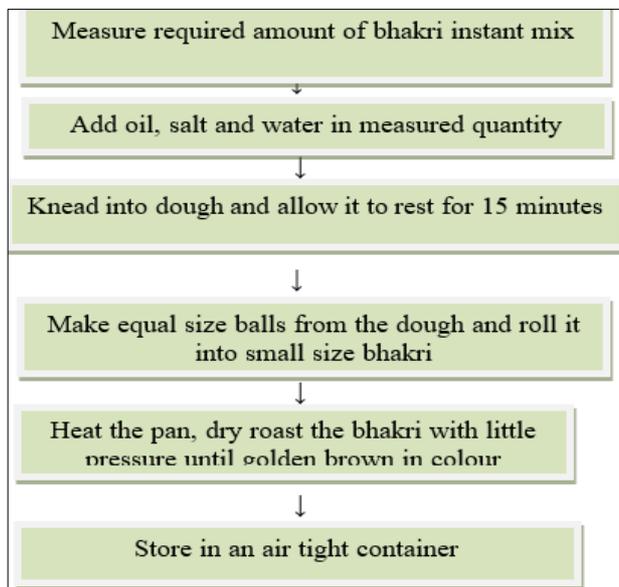


Fig 3: Flow chart for preparation of bhakri

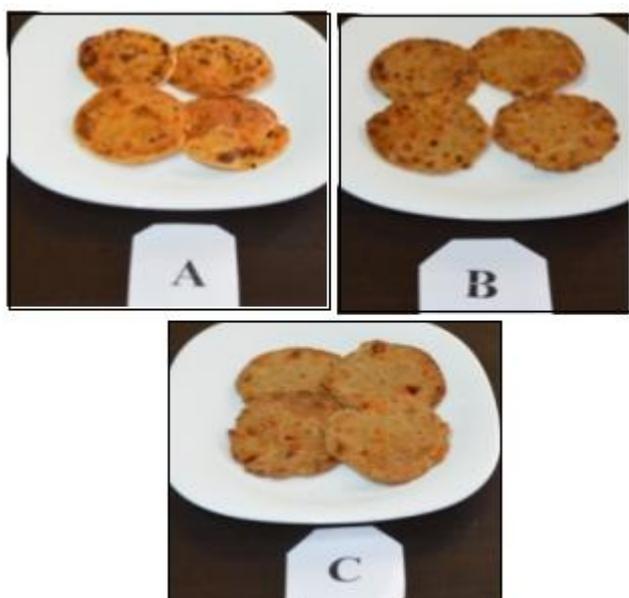


Plate 1: Bhakri developed from instant mix

Nutrient analysis of bhakri prepared from instant mix

The nutritional composition of all variation of instant mix in terms of moisture content, protein, fat, fibre, ash and carbohydrates were done according to AOAC methods.

Tristimulus color of bhakri

The tristimulus color (L^* , a^* , b^*) values of bhakri were determined using a Spectrophotometer (Konica Minolta Instrument, Osaka, Japan, Model CM-5). The L^* indicated lighter of the sample (0-100); a^* indicated greenness (-ve) or yellowness (+ve) and b^* indicated blueness (+ve) or redness (-ve).



Plate 2: Spectrophotometer

Sensory evaluation of bhakri prepared from instant mix

The developed products were organoleptically evaluated by a trained panel of 20 judges from Department of Food and Nutrition, UAS GKVK College, Bangalore. The judges were served each with one control and two test samples. The samples were coded to avoid any bias. Each product was tested thrice and mean scores were calculated. Judges were asked to score the samples based on the 9 point Hedonic Rating Scale. They are given below:

- Colour
- Appearance
- Flavour
- Texture
- Taste and
- Overall acceptability

Results and Discussion

Nutritional analysis of bhakri instant mix

The nutritional composition of all variation of instant mix in terms of moisture content, protein, fat, fibre, ash and carbohydrates are presented in Table 2.

Table 2: Nutritional analysis of bhakri instant mix (Macronutrient)

Parameters	UNITS	Basic	Variation I	Variation II
Moisture	g/100 g	6.83	7.50	7.57
Protein	g/100 g	10.73	11.04	10.95
Ash	g/100 g	1.42	1.98	2.16
Fat g	g/100 g	1.62	4.07	4.36
Total Dietary fibre	g/100 g	11.69	10.19	9.13
Carbohydrate	g/100 g	63.65	64.28	65.46
Energy Kcal	Kcal/100g	312	338	345

Basic – Wheat flour 96 % + spices 4 %, Variation I - Wheat flour, ragi flour, bajra flour, flaxseeds dried methi leaves 55% :18% :4% :1 %, Variation II - Wheat flour, ragi flour, bajra flour, flaxseeds and dried methi leaves 37% :27% :27% :4% :1%

The macronutrient composition of value added instant mix revealed that moisture content of value added instant mix ranged from 6.83 g to 8.0 g/100 g. High moisture content of 7.57 g was recorded for variation II and in variation I instant mix, moisture content of 7.50 g was observed. The least was noticed in the basic variation which was about 6.83 g.

The protein content of variation I instant mix was 11.04 g/100 g which was more compared to other combinations because of incorporation of more wheat flour along with ragi flour, bajra flour and flaxseeds which have contributed for an increase in protein content. In variation II it was about 10.95 g where as in basic instant mix the protein content was about 10.73 g/100 g respectively.

Fat content of value added instant mix ranged from 1.62 g – 4.36 g/100 g. There was an increase in fat percent in all three types of instant mix which is due the increase in millet flour quantities. There was no significant difference between all the three types of instant mix with respect to total ash.

The total dietary fibre of all three instant mixes ranged from 9.13 – 11.69 g/100 g and there was decreasing trend in dietary fibre content as the percentage of wheat decreases.

Carbohydrate content of all three types of instant mix ranged from 63.65 – 65.46 g/100 g. Basic instant mix has 63.65 g of carbohydrate while variation I has 64.28 g and variation II has 65.46 g of carbohydrate respectively.

The micronutrient content of value added instant mixes are.

- Iron
- Calcium

The iron content of 5.53 mg/100 g was recorded in variation II which is high compared to all other variations. Variation I has 5.20 mg/100 g of iron content and in basic 4.19 mg/ 100 g was recorded. The calcium content of all three types of value added instant mix differed significantly. The calcium content of all three instant mixes ranged from 33.19 to 134.44 mg/100 g. The highest 134.44 mg/100 g was observed in Variation II because of addition of ragi flour and the least was noticed in basic variation.

Table 3: Micro-nutrient content of bhakri instant mix

	Units	Basic	Variation 1	Variation 2
Iron	mg/ 100g	4.19	5.20	5.53
Calcium	mg/ 100g	33.19	104.43	134.44

Tri-stimulus color analysis of bhakri prepared from instant mix

The tri-stimulus color in terms of L*a*b* values of bhakri prepared from all three variations were recorded. The bhakri

prepared from variation I was darker, reddish and yellow than basic and variation II which might be due to addition of roasted ragi flour and flaxseeds that has imparted the reddish color.

Table 4: Tri-stimulus color value of bhakri developed from instant mix

Treatments	L* (D65)	a* (D65)	b* (D65)
Basic	50.5	22.4	38.61
Variation I	46.05	12.63	28.17
Variation II	50.35	9.6	23.1

Sensory evaluation of bhakri prepared from instant mix

Bhakri was prepared from all the three instant mixes and were subjected to sensory evaluation by expert panel of judges using 9 point hedonic scale.

Table 5: Mean sensory scores of bhakri prepared form instant mix

Samples	Colour /Appearance	Aroma	Mouth feel	Taste	Overall acceptability
A	7.80	7.80	7.35	7.45	7.55
B	7.65	7.15	7.35	7.35	7.30
C	6.90	7.15	7.40	7.20	7.25
S. Em	0.255	0.283	0.275	0.278	0.265
CD value	0.739	0.822	0.799	0.806	0.769
F Test	S	NS	NS	NS	NS

A- Basic, B- Variation I, C – Variation II

The mean sensory score for color, aroma, mouth feel, taste and overall acceptability for bhakri are presented in the Table 5. The control sample A has scored high values for color (7.80), aroma (7.80), taste (7.45) and overall acceptability (7.55) but least mouth feel score (7.35). Among combinations, Sample B has scored more in terms of colour and taste compared to sample C where as sample C has scored more for mouth feel parameter (7.40) which might be due to incorporation of more quantities of millets flour that as attributed to more texture. The overall acceptability of variation II was on par with variation I and there was no significant difference among all variations. There was a significant difference observed in term of color between control and variations.

Conclusion

Supplemented instant mix of bhakri was found to have higher carbohydrate, ash, energy, protein, calcium and iron as compared to the basic instant mix of bhakri. Dried methi leaves and flax seeds were added for development of bhakri instant mix. All the products (Bhakri) were found acceptable. The products were acceptable and safe for consumption up to 30 days of storage period. In terms of packaging materials polyethylene pouch was most suitable in terms of preserving moisture uptake, free fatty acid generation and sensory attributes for instant mix.

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