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Development and evaluation of barnyard millet dietary food for better nutrition

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ABSTRACT

Millets are group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for both human food and fodder. It is gluten free and rich in calcium, fiber, protein and minerals. It has high nutritional values when compared with rice and wheat. Barnyard millet (Echinochloa frumentacea) known as Kuthiraivali in Tamil which has six times high fibre content when compared with wheat. It is gluten free millet with high calcium, and phosphorous. It is a great food for people looking for weight loss, diabetic and cardiac patients. The millet had 10.5% protein 3.6% fat, 68.8% carbohydrate and 398 kcal/100 g energy. The total dietary fibre content was high (12.6%) including soluble (4.2%) and insoluble (8.4%) fractions. As health-conscious foods is gaining interest for the effective management of obesity and diabetes mellitus, efforts have been accelerated in this direction to bring into light various foods of high fibre content. Hence an attempt was made to develop barnyard millet-based value-added high fibre foods (Gruel a semisolid food). Trials were conducted by incorporating horse gram flour and soya flour at different levels to barnyard millet to develop plain and pulse gruel mix respectively and were evaluated organoleptically. The best accepted variations of plain and pulse gruel mix were evaluated for nutrient composition. The storage study was carried out to assess the shelf life of the prepared products. The products were also checked through quality control and packed in flexible pouches and can be stored upto six months.

Key words: Barnyard Millet, fibre, gruel mix.

1. INTRODUCTION

Millets are called as miracle grains or wonder grains. Barnyard millet (Echinochloa frumentacaea) is one of the hardest millets, which is called by several names viz., Japanese barnyard millet, ooda, oadalu, sawan, sanwa, and sanwank. Nutritionally, Barnyard millet is an important crop. Besides, barnyard is a fastest multipurpose crop, which yields food and forage in a short duration and at low inputs even under adverse climatic conditions. It is a fair source of protein, which is highly digestible and is an excellent source of dietary fibre with good amounts of soluble and insoluble fractions. The carbohydrate content is low and slowly digestible (Veena et al. 2005), which makes the Barnyard millet a natural designer food. Although barnyard millet like any other minor millet is

nutritionally superior to cereals, yet its utilization is limited.

Today there is a significant change in the lifestyle of people owing to the rapid industrialization, improved socio-economic status, enhanced health facilities and increased life expectancy. Economic affluence coupled with sedentary lifestyles and changing food patterns are contributing to several chronic degenerative diseases such as diabetes mellitus, cardiovascular diseases, cancer, etc barnyard millet is an ideal food for all such diseases. Thus, for the health conscious genera of the present world, minor millet especially Barnyard millet is perhaps one more addition to the existing list of healthy foods, owing to its nutritional superiority. Apart from this, the grain has high utilization potential owing to its excellent capacity to blend with other food grains without imparting any off flavor or after taste. Thus the millet can be incorporated in traditional foods and valuarized to novel food uses.

2. MATERIALS AND METHODS

Processing of raw ingredients

Barnyard millet and other ingredients such as soybean horse gram were purchased from local market. Barnyard millet constituted the main ingredient and other ingredients were added either as a source of lysine, antioxidants, minerals or dietary fiber. The millet grains were cleaned to separate sand grits and other heavy particles and stored in air tight containers for further use. Barnyard millet grains was soaked in water for one hour drain completely and sundry till completely dry and without any moisture. Horse gram was soaked in water for six hours, drain excess water and germinate for overnight. Sprouted horse gram was dried completely without any moisture. Roast dried barnyard millet and sprouted and dried horse gram separately and to this add cumin seed, asofoetida and salt to taste. The prepared mixture was ground coarsely to prepare gruel. The soy flour was made by roasting the whole soybean for 5-10 minutes at 800 C on low flame. Later, it was made into dhal by passing through household grinder. During this process dhal was dehusked. The ground dhal was cleaned and separated from husk and then made into fine flour, which was then used for preparation of value-added products.

Product development

Three variations of Gruel mix namely plain, horse gram incorporated gruel and soya incorporated gruel were prepared with barnyard millet. Each variation comprised of barnyard millet flour, soybean flour and horse gram flour in different ratios as, plain 100% (variation I), 70:30 (variation II) Barnyard millet and horse gram combination and 80:20 (variation III) Barnyard millet and soya combination.

Sensory evaluation

The value added barnyard millet gruel mix were evaluated for organoleptic quality attributes by ranking the responses using a 5 point ranking test method (Ranganna,1991) by a panel of ten judges from Krishi Vigyan Kendra, Kattupakkam.

Storage studies of the products

The prepared barnyard millet gruel mix were packaged and stored for six months at ambient temperature. Low density polyethylene package was used with two thicknesses (300 and 400 gauges).

Nutritional quality

The proximate principles namely protein, fat, carbohydrate, total ash, crude fiber, vitamins such as vitamin C and minerals such as iron, calcium, magnesium and phosphorus content of all the three types of gruel mixes has been assessed.

3. RESULTS AND DISCUSSION

The results of the present study indicated that gruel mix with horse gram (70:30) incorporation of barnyard millet was highly acceptable after organoleptic evaluation, followed by plain barnyard gruel mix and finally soya incorporated mix. Even though Soya has high nutritional value but due to its flavor the acceptance score reduced. The detail of variations taken for development of three types of gruel is given in materials and methodology (Tables 1 to 3).

Table 1: Sensory evaluation of Gruel mixes

S. No.	Variations	Mean value of sensory score				
		Color	Taste	Appearance	Flavor	Overall Acceptability

1.	I (100:0)	4.30	4.40	4.10	4.40	4.40
2.	II (70:30)	4.40	4.80	4.30	4.80	4.60
3.	III (80:20)	4.20	4.00	4.20	4.10	4.30
	Mean	**4.3**	**4.4**	**4.2**	**4.4**	4.4
	SE ±	0.1	0.4	0.1	0.3	0.1
	CD	NS	NS	NS	NS	NS

NS-Non Significant

Table 2 and 3 exhibits the macronutrient composition of all the three products developed from barnyard millet.

Table 2: Macronutrient composition of Developed Gruel mixes

Macronutrient Composition	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Total ash (g/100g)	Crude fibre (g/100g)
Plain gruel	10.9	5.8	1.8	2.8	9.9
Horse gram gruel	11.9	10.9	3.3	2.78	10.5
Soya gruel	11.1	13.6	4.9	3.0	7.9
Mean	**11.3**	**10.1**	**3.3**	**2.86**	**9.4**
SE ±	0.56	3.96	1.55	0.12	1.02

Table 3: Macronutrient composition of Developed Gruel mixes

Macronutrient Composition	Carbohydrate (g/100g)	Energy (Kcal/100g)	Iron (mg/100g)	Calcium (mg/100g)	Phosphorus (mg/100g)
Plain gruel	72.3	301.0	5.2	19	274.0
Horse gram gruel	67.1	311.2	5.5	100	289.3
Soya gruel	49.3	332.0	6.1	64	362.0
Mean	**62.9**	**314.7**	**5.5**	**61**	**308.4**
SE ±	12.06	15.79	0.45	40.58	47.01

Plain gruel mix had significantly high total carbohydrates (72.30%) and total ash (3.16 %) content than horse gram and soya gruel mix. The plain gruel mix contained 100 per cent barnyard millet flour and barnyard millet comparatively had higher amounts of minerals and carbohydrates than pulses (Gopalan et al., 2010). Horse gram gruel mix had significantly high content of crude fiber, calcium than other two mixes. The increase in macronutrient composition of II and III variation is possibly due to the addition of protein and dietary fiber rich food ingredients such as horse gram flour and soya flour (Sankeshwar, 2000). Similar increase in protein content were also observed by Mridula et al. (2006) Significant increase in protein, Phosphorus and iron was noted in soya gruel mix (Ganiyu, 2005).

Storage of Gruel mixes

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

4. CONCLUSION

Barnyard millet is one of the hardiest millets, which thrives well under adverse agro-climatic conditions. Nutritionally barnyard millet is a superior grain with good amounts of macronutrients and dietary fiber. It is an important grain, which possesses good cooking and sensory qualities. Thus, from the present investigation it is clear that barnyard millet could be successfully value added as a dietary food and to increase nutrition.

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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The study has not received any external funding.

Data and materials availability

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

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