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Studies on development technology of millets based nutri bar

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Abstract

The present investigation was aimed to development of nutri bar with incorporation of different proportions of puffed foxtail and finger millet grains. To standardize the processing technology and analyse the characteristics of nutri bar *viz.*, physical, chemical, sensory, textural and microbial characteristics of nutri bar. The formulation was carried out using puffed foxtail and finger millet grains and dates powder in preparation of nutri bar. Different formulation were made with variation in puffed foxtail millet level from 0 to 25% for A₀, A₁, A₂ and A₃ respectively. Prepared nutri bar then evaluated for organoleptic properties with respects to colour and appearance, flavour, texture, taste and overall acceptability using 9 point hedonic scale. The results revealed that nutri bar prepared with supplementation of 20% puffed foxtail millet (C₂) secured highest score (i.e. 8.5) was superior as compared to rest of samples. It was found that nutri bar prepared with puffed foxtail millet was rich source of proteins and fibber. Thus foxtail millet can be well utilized as a functional ingredient for preparation of nutri bar with good nutritional and medicinal value.

Keywords: Foxtail millet, nutri bar, functional food, textural, profile and microbial, sensory evaluation

Introduction

Finger millet is originated from Ugandian region of Africa and was transported to India in the pre-Aryan period (1500 BC). Even today, in Uganda, numerous tribal rural and religious ceremonies are associated with finger millet. Finger millet (*Eleusina coracana*), one of the oldest crops in India is referred as “nrta-kondka” in the ancient Indian Sanskrit literature, which means “dancing grain”, was also addressed as “rajika” or markataka” (Achaya, 2009)^[2]. Foxtail millet provides a host of nutrients has a sweet nutty flavour and is considered to be one of the most digestible and non-allergic grains available. It contains fibber, protein, calcium and vitamins. It is a nutritive food for children and pregnant women. It is rich in dietary fiber and minerals such as copper and iron that keep one’s body strong and immune. They are used in several forms such as in preparation of rice, porridgs, laddu, nippattu, maldi, annam, murukul, karappawosa, sangatti and roti (Vanithasri *et al.*, 2012)^[8].

Nutritional potential of millets in terms of protein, carbohydrate and energy values are comparable to the popular cereals like rice, wheat, barley or bajra. Finger millet gain has great importance, because of its nutritional strength in terms of dietary fibber, functional fiber, starch pattern as well as high calcium (344mg/100g), phosphorus (283mg/100g) and iron (3.9mg/ 100g) content. Proximate composition of finger millet is carbohydrate 72-81.5 per cent, crude fat 1.3-4.3 per cent, protein 3.8-7.3 per cent, crude fibber 3.6 per cent, mineral 2.7 per cent. Finger millet is richest source of calcium, about 10-fold higher as compared to other food grains. Finger millet protein content is relatively better balanced. It contains more lysine, methionine, threonine and valine (Gopalan *et al.*, 2004)^[3].

Puffing is a high temperature short time (HTST) treatment which sterilizes the product, gelatinizes its starch, develops a pleasant aroma and forms a ready-to-eat food at a very low processing cost. Popping also reduces some of the anti-nutrients *viz.* phytate phosphorus, tannin, lignin and cellulose (Reddy, 199)^[5]. It also increases the *in vitro* protein and starch digestibility (Mirza *et al.*, 2015)^[4]. Processing of the multigrain using traditional as well as contemporary methods for preparation of value added and convenience products would certainly diversify their food uses. Their exploitation for preparation of ready-to-use products would help in increasing the consumption and thereby nutritional security of consumers. (Verma and Patel, 2013)^[9].

The study on preparation of multigrain millet-based bar fortified with dry dates powder is rare and hardly reported so far.

In general, there is a considerable scope for optimizing and standardizing the process of multigrain millet-based bar incorporated with dry dates powder in order to improve its quality and also to enhance consumer preference. Foxtail and Finger millets are the most popular and the choices of millets of the tropics with excellent taste, pleasant aroma medicinal and nutritive value of Dry dates.

The present study was conducted to incorporate puffed foxtail millet in different food products and study the effect of addition on proximate composition, sensory and microbial quality of puffed foxtail millet incorporated food products such as nutri bar. The present research is helps to explore the public knowledge and perceptions of the efficacy, safety and reason to consume puffed foxtail millet.

Materials and Methods

Materials

The Raw material puffed foxtail millet, finger millet flour and dry dates powder, etc. will be procured from the local market of Prayagraj. Chemical and reagent will be obtained from laboratory, Department of food process engineering Vaugh institute of agricultural engineering and technology Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj-211007, (U.P) India

Proximate composition of nutri bar

Raw materials such foxtail millet, finger millet flour and dry dates powder and nutri bar were analysed for proximate composition including moisture, fat, protein, total carbohydrate, crude fibber, ash and mineral composition was carried out as per the methods given by AOAC, 2005 [1].

Microbial examination of nutri bar

The microbial examination of samples was carried out as per the method cited in Indian Standard Institute (ISI) 1969. The results obtained for each count was recorded as colony forming unit per ml of sample i.e. CFU/ml.

Formulation of puffed foxtail millet incorporated nutri bar

Three different samples of multigrain bars were prepared by addition of puffed foxtail millet, finger millet flour and dry dates powder.

Table 1: Formulation of puffed foxtail millet incorporated nutri bar

Ingredients	Recipe combination (gm)			
	A-0	A-1	A-2	A-3
Puffed foxtail millet	0.0	5	15	25
Rice crisp	45	25	15	5
Puffed finger millet flour	0.0	10	10	10
Dry date powder	5	5	5	5
Soya chunk coarse powder	5	5	5	5
Almond coarse powder	5	5	5	5
Sugar	30	30	30	30
Chocolate slab	4	4	4	4
Ghee	3.5	3.5	3.5	3.5
Skim milk powder	5	5	5	5
Coco powder	0.5	0.5	0.5	0.5
Liquid glucose	1	1	1	1
Carboxy-methyl cellulose	0.5	0.5	0.5	0.5
Glycerol monostearate	0.5	0.5	0.5	0.5

Preparation of nutri bar

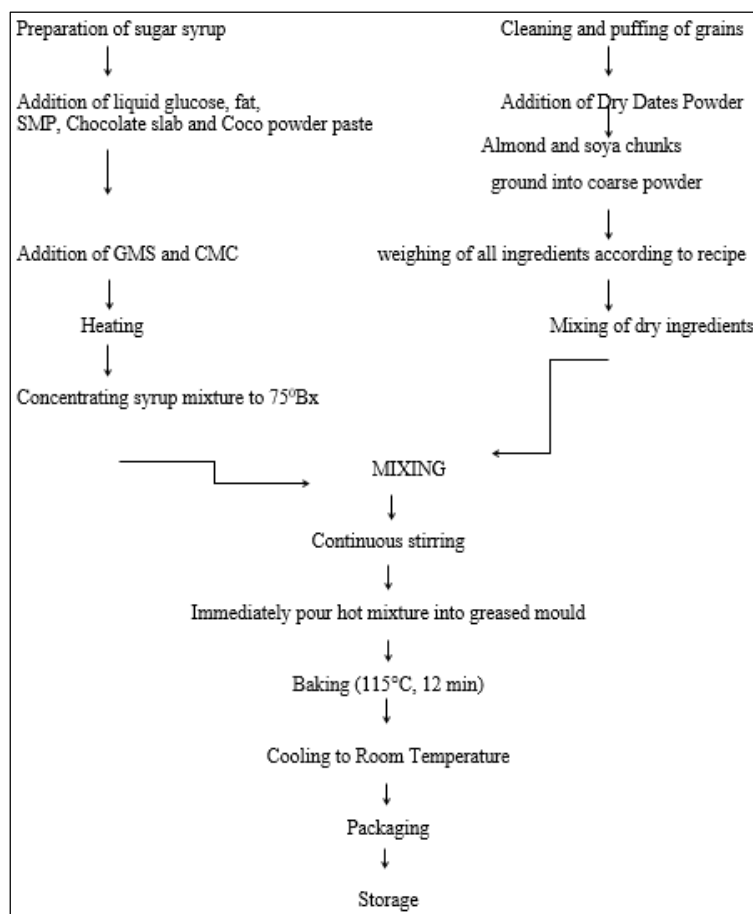


Fig 1: Flow chart showing preparation of multigrain bar

Results and Discussion

Puffing characteristics of the grains

Foxtail millet and finger millet grains were puffed and effect of puffing was measured in terms of thousand kernel weight, puffing yield, and expansion volume of grain during puffing. The results are presented in table 2

Table 2: Puffing characteristics of the grains

Particulars	Puffed grains	
	Foxtail Millet	Finger Millet
1000 puffed kernel weight (g)	0.73	2.8
1000 puffed kernel volume (ml)	4.4	4.2
Bulk volume (ml/g)	4.1	3.7
Puffing yield (%)	91	74
Expansion volume (ml/g)	6.8	6.2

Physical properties of prepared puffed grain incorporated nutri bar were analyzed and obtained values are statistically analyzed and presented in Table 2.

It is found from Table 2 that 1000 kernel weight of puffed Foxtail millet and finger millet was 0.73 and 2.8 g respectively. The weight was higher in finger millet as compared to foxtail millet. This indicated that grains of finger millet were larger and sound than foxtail millet. 1000 puffed kernel volume of foxtail was 4.4 ml and finger millet 4.2 ml respectively. Similar findings with respect to 1000 puffed kernel weight and puffed kernel volume was also recorded by Mirza *et al.* (2015)^[4] in popping quality of millet grains. Bulk volume of foxtail (4.1 ml/g) was more as compared to finger millet (3.7ml/g). This clearly indicated that puffing quality of foxtail millet was quite better than finger millet grains. This was further supported by per cent puffing yield which was also higher in foxtail millets (91 per cent). Present findings of bulk volume and per cent puffing yield are in close agreement with the findings of Shukla *et al.*, (1986)^[7].

Physico-Chemical analysis of puffed foxtail millet incorporated nutri bar

During present investigation nutri bars were prepared to explore nutritious but under-utilized grains having potential to contribute the alleviation of dietary nutritional deficiencies. Protein, mineral and fiber rich multigrain bar was formulated using puffed Foxtail millet, finger millet grains and dry dates powder.

Table 3: Proximate composition of puffed foxtail millet incorporated nutri bar

Nutri bar	Proximate components (%)					
	Moisture	fat	protein	Ash	fiber	Carbohydrate
A0	5.20	6.30	5.90	0.90	0.31	81.39
A1	5.21	7.20	6.90	1.18	0.73	78.78
A2	5.20	7.60	7.50	1.46	1.15	77.09
A3	5.24	8.58	8.30	1.79	1.58	74.51
SE	0.040	0.020	0.020	0.022	0.030	0.032
CD @5%	0.120	0.080	0.050	0.066	0.100	0.092

Where

A1: Multigrain bar with 5% puffed foxtail and 10% Finger Millet

A2: Multigrain bar with 15% puffed foxtail and 10% Finger Millet

A3: Multigrain bar with 25% puffed foxtail and 10% Finger Millet

Results given in above Table 3 indicated that the moisture content of the experimental control and all multigrain bars was within range of 5.20 to 5.24 per cent. This might be due to initial moisture content of the ingredients and environmental condition during nutri bar formulation. From the table 3, it is found that crude fat and protein content of the A1, A2 and A3 bar was 7.2, 7.6, 8.58 and 6.9, 7.5, 8.3 per cent respectively. Crude fat and protein content of the nutri bar was significantly increased with increase in foxtail percentage in formulation as well as Dry dates were rich in crude fat and protein content. Total ash content of the nutri bar A1, A2 and A3 was 1.88, 1.46 and 1.79 per cent respectively. Experimental control bar showed the least value for total ash content. Total ash content of the A3 bar was significantly increased. The crude fiber content of the multigrain bars. A3 bar had highest crude fiber value (1.58 per cent) which was significant over Experimental control, A1 and A2 bars. Crude fiber content of the A1 and A2 bar was 0.73 and 1.15 per cent. Similarly increase in proximate values was observed for dry date-based products by Sharma *et al.*, (2010)^[6].

Sensory analysis of puffed foxtail millet incorporated nutri bar

Puffed foxtail millet incorporated nutri bar were subjected to the sensory evaluation and recorded values are depicted in Table 4.

Table 4: Sensory analysis of puffed foxtail millet incorporated nutri bar

Treatments	Sensory Characteristics				
	Colour & Appearance	Flavour	Texture	Taste	Overall Acceptability
A ₀	7.5	7.5	7.0	8.5	7.3
A ₁	7.5	8.5	7.5	7.5	7.5
A ₂	8.0	8.0	7.5	7.5	7.8
A ₃	8.5	8.5	8.0	8.0	8.5
S.E. ±	0.047	0.03	0.025	0.01	0.003
CD. at % 5	0.097	0.063	0.075	0.03	0.007

* Each value is average of three determinations

Sensory analysis was carried out using 9-point hedonic scale. Sensory quality of whole Nutri bar on the basis color and appearance, flavour, texture, taste and overall acceptability are as shown in Table 4. The overall acceptability of the nutri bar has highest sensory score (8.5) followed by 4 weeks stored (8.0), 10 weeks stored (7.5), 4 weeks stored (7.0).

Conclusion

It can be concluded from results that nutri bar prepared with 20% proportions of puffed foxtail grain was found to highly acceptable and recorded maximum score in case of all the sensory attributes. It could be concluded that good quality of nutri bar can be prepared using foxtail grain as it is rich source of fibers has beneficial effect on human health. Thus, foxtail millet can be well utilized as a functional ingredient for preparation of nutri bar with good nutritional and medicinal value which act as functional food product.

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