



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 1992-1994
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www.thepharmajournal.com

Received: 16-12-2022

Accepted: 30-01-2023

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Development and nutritive evaluation of foxtail millet (*Setaria italica* L.) biscuits

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Abstract

Foxtail millet biscuit was utilizing varying amount of foxtail millet flour and biscuits were evaluated for organoleptic characteristics and highly accepted foxtail millet biscuit was analyzed for nutrient content. Five variations of foxtail millet biscuits were developed by utilizing foxtail millet flour with 0%, (T1) 10%, (T2) 20%, (T3) 30%, (T4) 40% and (T5) 50% and other ingredients like refined wheat flour, fat, cumin seed, omum, milk and salt were in proportion. 40 percent incorporation of foxtail millet flour received an overall acceptability score of 7.8 and was liked by the sensory panel members. The highly accepted i.e. 40 percent of foxtail millet biscuit was subjected for the nutrient analysis and foxtail millet biscuit was rich in protein, total mineral, calcium, iron and zinc.

Keywords: Foxtail millet, Foxtail millet biscuits

Introduction

Millet is one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. It is mentioned in the Bible, and was used during those times to make bread. Millet has been used in Africa and India as a staple food for thousands of years. It is suggested that people were farming millet in India about 2500 B.C. Millets can be source of value-added healthy food-products with different varieties for traditional and nontraditional millet users (Sarita and Eakta 2016) [5]. Among the major and minor millets, the minor millets include 6 main crops, which are *Eleusine coracana* (ragi or finger millet), *Paspalum scrobiculatum* (varagu or kodo millet), *Panicum sumatrense* (samai or little millet), *Setaria italica* (tenai or foxtail millet), *Panicum miliaceum* (panivaragu or proso millet), and *Echinochloa esculenta* (kudiraivali or barnyard millet) (<http://chetday.com/millet.html>).

Foxtail millet, considered as a crop of poor people, which is grown mainly in China, Bangladesh and India. It grows well in dry zones as rainfed crop, under marginal conditions of soil fertility and moisture in the semi-arid tropic region. Practically foxtail millet is devoid of grain storage pest and has a long storage life. Nutritionally comparable or even superior to staple cereals such as rice and wheat (Gopalan *et al.*, 2004) [2]. Foxtail millet has good nutritional profile and is comparable to staple cereals as rice and wheat in terms of protein, fiber, minerals and vitamins and it has non-glutinous and non-acid-forming foods. In addition, foxtail millets contain water-soluble gum β -glucans which improve glucose metabolism. This millet has been proved to be suitable for people suffering from metabolic disorders (Itagi and Naik 2012) [3]. Hence, in the present study foxtail millet was chosen for development of nutritious foxtail millet biscuit.

Materials and Methods

Collection of materials: Foxtail millet (*Setaria italica*), refined wheat flour, fat, omum, cumin seed, milk, baking powder and salt were procured from local market of Parbhani. Foxtail millet was cleaned, grinded with the help of roller mill and stored in the air tight container till the end of study period.

Development of foxtail millet biscuits: Recipe of biscuit was prepared basic (control) following the procedure. Five variations of foxtail millet biscuits were developed by utilizing foxtail millet flour with 0%, 10%, 20%, 30%, 40% and 50%. The detail description of development of foxtail millet biscuit is as follows.

This study also reported that foxtail millet flour was structurally more stable and resistant to gelatinization than other millet flours. All the nutritional properties have made foxtail millet an important ingredient for preparing noodles, nourishing gruel or soup, brewing alcoholic

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beverages, cereal porridges, and pancakes in China (Krishna *et al.*, 2013) [4].

Organoleptic Quality evaluation: The sensory attribute including colour and appearance, flavor, texture, taste and

overall acceptability, were evaluated by semi trained panel members using a nine point hedonic scale. The highly accepted foxtail millet biscuits analyzed for nutritional composition.

Table 1: General description of development of foxtail millet biscuit Composition The composition of FMFB and control RWFB is given below

Ingredient Variation	RWF (gm)	FMF (gm)	Milk (ml)	Fat (gm)	Omum (gm)	Cumin seeds (gm)	Salt (gm)	Baking powder
Control	35	-	4	10	0.5	0.5	0.5	1 pinch
I	31.5	3.5	4	10	0.5	0.5	0.5	1 pinch
II	28	7	4	10	0.5	0.5	0.5	1 pinch
III	24.5	10.5	4	10	0.5	0.5	0.5	1 pinch
IV	21	14	4	10	0.5	0.5	0.5	1 pinch
V	17.5	17.5	4	10	0.5	0.5	0.5	1 pinch

FMF (foxtail millet flour), RWF (refined wheat flour), FMFB (foxtail millet flour biscuits) and RWFB (refined wheat flour biscuits)

Nutritional Evaluation

The nutrient content of biscuit was analyzed for basic and accepted variation of foxtail millet biscuit. The nutrient analysis consists of moisture, protein, fat, carbohydrate, total mineral, calcium, iron, zinc. The proximate content was determined standard procedure of A.O.A.C. (1975) [1].

Statistical analysis: The data analysis from sensory evaluation and nutrient content of foxtail millet biscuits and refined wheat flour biscuit were consolidated, tabulated and analyze statistically. Analysis of variation (ANOVA) was used to compare organoleptic scores to select the most acceptable variation of the product. Student't' test was used compare the difference in nutritional composition of the refined wheat flour biscuit and foxtail millet biscuit.

Result and Discussion

Sensory evaluation of the biscuits: The mean score for

organoleptic characteristics of biscuits prepared without and with varying level of incorporation of foxtail millet are presented in Table 2. Six variations were prepared with selected level of incorporation of foxtail millet at 0, 10, 20, 30, 40 and 50 per cent. The highest score 8.1 was recorded for texture of biscuits 0 per cent level incorporation of foxtail millet. The maximum score of 7.9 was obtained for colour of biscuits prepared with 40 and 50 per cent level of incorporation. From the finding it can be concluded that 40 and 50 per cent level of incorporation were found to be most acceptable in the context of texture. The highest value was recorded for flavour by the 40 per cent level of incorporation of foxtail millet. The 40 percent level of incorporation was found to be highly acceptable and recorded 7.8 score in terms of taste. The acceptable maximum scores for all the organoleptic characteristics were recorded for 40 percent level of incorporation of foxtail millet in biscuits preparations. This finding is in accordance with (Yang *et al.*, 2012) [7]

Table 2: Sensory evaluation score of control and foxtail millet biscuits

Level of incorporation of foxtail millet (%)	Colour	Texture	Flavour	Taste	Over all acceptability
Control (0)	7.6	8.1	7.3	7.6	7.7
10	7.8	7.8	7.5	7.4	7.3
20	7.6	7.7	7.4	7.3	7.8
30	7.5	7.7	7.4	7.3	7.5
40	7.9	7.9	7.6	7.8	7.8
50	7.9	7.9	6.0	6.1	6.9
'F' value	0.95 NS	0.67 NS	6.49**	9.60**	6.0**
S.E.	0.17	0.18	0.23	0.21	0.14
C.D.	0.49	0.52	0.66	0.60	0.40

NS

Non significant

** Significant at 1% level

Table 3: Nutrient composition of control and foxtail millet biscuits

Nutrient	Control biscuit Mean \pm SD	Foxtail millet biscuit Mean \pm SD	't' value
Moisture (g/100g)	3.66 \pm 0.02	2.77 \pm 0.01	179.0**
Protein (g/100g)	8.30 \pm 0.42	8.75 \pm 0.26	0.91 NS
Fat (g/100g)	18.03 \pm 0.75	17.71 \pm 1.64	0.50 NS
Carbohydrate (g/100g)	63.16 \pm 0.26	53.77 \pm 1.76	6.66 NS
Total mineral (g/100g)	1.45 \pm 0.00	2.10 \pm 0.01	129.0**
Calcium (mg/100g)	57.75 \pm 1.62	62.30 \pm 1.55	91.00**
Iron (mg/100g)	2.14 \pm 0.58	2.27 \pm 0.22	0.540 NS
Zinc (mg/100g)	0.48 \pm 0.22	1.00 \pm 0.01	18.81 NS

NS Non significant

*Significant at 5% level

** Significant at 1% level

Nutrient composition of foxtail millet biscuits

The Nutrient analysis of biscuits showed (Table 3). The moisture (2.77 ± 0.01), fat (17.71 ± 1.64) and carbohydrates (53.77 ± 1.76) content of foxtail millet biscuit was less than control biscuits moisture (3.66 ± 0.02), fat (18.03 ± 0.75) and carbohydrates (63.16 ± 0.26). The protein content in foxtail millet biscuits (8.75 ± 0.26) was higher than control biscuits (8.30 ± 0.42). The average protein content in foxtail millet was reported to be about 11.07 per cent (Veena *et al.*, 2005)^[6]. Total mineral (2.10 ± 0.01) and calcium (62.30 ± 1.55) was significantly increased in foxtail millet biscuits than control biscuits total mineral (1.45 ± 0.00) and calcium (57.75 ± 1.62). Iron (2.27 ± 0.22) and zinc (1.00 ± 0.01) of foxtail millet biscuits was increased than the control biscuits Iron (2.14 ± 0.58) and zinc 0.48 ± 0.22).

Summery and Conclusion

Incorporation of foxtail millet biscuits had significant impact on sensory and chemical composition of control biscuits. Sensory evaluation revealed that addition of 40 per cent foxtail millet was excellent in all the sensory parameters. Nutrient compositions of foxtail millet biscuits found to have increased protein, iron and zinc. Total mineral and calcium significantly increased in foxtail millet biscuits and moisture, fat and carbohydrate were decreased non significantly.

It can be concluded from the present study that the foxtail millet biscuits help to enhance protein, iron, zinc, total minerals and calcium content. Incorporation of 40 per cent foxtail millet was found to be ideal in term of sensory and Nutrient composition parameters.

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