

Nutritional and Sensory Evaluation of High Fiber Biscuit using Kodo Flour

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ABSTRACT

Background: Healthy eating is the latent health benefits of precise foods and food ingredients. Supplementation of foods is current interest because of increasing nutritional awareness among consumers. **Aim:** The present study aims to evaluate the sensory and nutritional properties of high fiber biscuits using kodo flour. **Method:** Biscuits from kodo millet (*Paspalum scrobiculatum*) were prepared by substituting kodo flour at various levels of substitution at 30%, 40% and 50% supplemented with refined wheat flour. Nutritional and Sensory evaluations of biscuit samples were evaluated by standard procedure. **Results:** The sensory evaluation result revealed that 40% kodo flour incorporation with refined wheat flour was found to be the most acceptable combination in making of high fiber biscuits. The analysis of nutritional quality of biscuits containing high fiber amount of (4.55%), lowest amount of protein (10.21%), calories (491.13 Kcal/100g) and carbohydrate (42.56%). Thus, the result shows that formulated high fiber biscuit is healthy and acceptable based on its sensory properties and fiber rich nutritional quality.

1. Introduction

Millets are small seeded annual granular cereals grown throughout the world. Millets are stable cereals like wheat and rice. Millets are rich in vitamins, minerals, sulphur containing amino acids and phytochemicals, and therefore millets are called as “nutri-cereals”. Millets include five genera: *Panicum*, *Setaria*, *Echinochloa*, *Pennisetum* and *Paspalum*. The cultivated species include kodo millet (*Paspalum scrobiculatum*), little millet (*Panicum miliare*) and Italian Millet (*Setaria italica*) (Karuppasamy et al., 2013). Millets are nutritionally comparable or even superior to staple cereals such as rice and wheat (Gopalan et al., 2004).

Kodo millet (*Paspalum scrobiculatum*) is one of the earliest grains of the world. It is one of the minor millets. The kodo millet is also known as cow grass, rice grass, ditch millet, Native *Paspalum*, or Indian Crown Grass. Kodo millet is rich in dietary fiber and antioxidant (Despande et al., 2015). Several traditional Indian food items have been prepared specially from kodo or blended with other cereal and legume flours to improve the nutritional value, palatability and functionality.

Baking Industry is one of the major sections of food processing in India. Baked products are highly popular because of their availability, ready to eat suitability and rationally good shelf life (Vijayakumar et al., 2013). Biscuits are one of the most consumed nutritive snacks food separately from bread or other baking products because they are easily available in local shops as ready to eat, appropriate and low-cost food products comprising digestive and dietary principles of energetic importance. Biscuits become popular both in rural and urban population in India.

In the present study, Kodo millet was used in the preparation of biscuits at various treatments of substitution and compared with refined wheat flour based biscuits as standard in terms of sensory characteristics and nutritional properties to formulate high fiber biscuits. In view of this, the present work was undertaken to study the sensory and nutritional properties of newly formulated millet based high fiber biscuit.

2. Materials and Methods

2.1. Procurement of raw materials

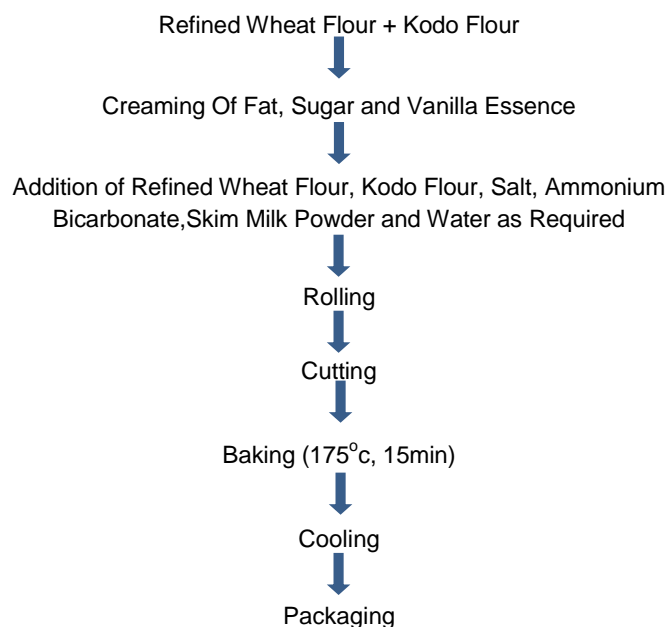
Refined wheat flour, kodo flour, sugar powder, hydrogenated fat, vanilla essence and ammonium bicarbonate were purchased from local market.

2.2. Preparation of biscuits

Kodo millet Biscuits were prepared using the traditional creamery method described by Whitley (1970):

Table 2.1
Preparation of biscuit formulations

Ingredients(g)	B1 (g)	B2 (g)	B3 (g)	B4 (g)
Refined wheat flour	100	70	60	50
Powdered sugar	50	50	50	50
Vegetable fat	40	40	40	40
Skim milk powder	5	5	5	5
Vanilla essence	2-4 drops	2-4 drops	2-4 drops	2-4 drops
Water	7-10 ml	7-10 ml	7-10 ml	7-10 ml
Common salt	01	01	01	01
Ammonium bicarbonate	1.5	1.5	1.5	1.5
Kodo	-	30	40	50

Flow chart for preparation of biscuits**2.3. Chemical Analysis**

All the determinations were done in triplicate using the AOAC standard methods. The protein content of the food samples were analyzed according to Lowry's method (Lowry et al., 1951). The carbohydrate was determined by the method of

Sadasivam and Manickam (1991). The fat content of the food sample was determined by soxhlets extraction method as described in A.O.A.C. (1990). Crude fibre of the sample was estimated by the method described in A.O.A.C. (1992). While calorific value, moisture content and ash content of the food samples were determined by (A.O.A.C., 1990).

2.4. Sensory evaluation of the biscuits

Sensory characteristics of biscuits were evaluated for the different sensory attributes by trained panel of 15 persons selected from the Department of Food & Nutrition, Govt. M.H. College of Home Science and Science for Women (Autonomous), Jabalpur. The assessment of sensory attributes like colour and appearance, taste, texture, flavor, crispness, mouthfeel, overall acceptability were selected using 9 point hedonic scale (Amerine et al. 1965). In the 9 point hedonic scale, where 1=dislike extremely, 2=dislike very much, 3=dislike moderately, 4=dislike slightly, 5= neither like nor dislike, 6= like slightly, 7= like moderately, 8=like very much, 9=like extremely.

2.5. Statistical analysis

SPSS version 16 software was used for the purpose of statistical analysis.

3. Result and Discussion**3.1. Nutritional properties of kodo millet flour biscuit**

Table no. 3.1
Nutritional properties of kodo millet flour biscuit

Treatments	B1	B2	B3	B4	level of significance
Protein	10.79±0.15	10.53±0.06	10.24±0.11	10.21±0.09	p>0.05
Fat	30.69±0.19	31.04±0.02	31.14±0.04	31.16±0.01	p>0.05
Carbohydrate	48.02±0.01	46.33±0.1	44.47±0.02	42.56±0.01	p>0.05
Fibre	1.93±0.01	2.68±0.01	3.53±0.00	4.55±0.03	p<0.05
Moisture	6.43±0.01	7.27±0.01	7.74±0.02	8.4±0.01	p>0.05
Ash	1.80±0.01	2.15±0.01	2.92±0.01	3.2±0.07	p>0.05
Energy (kcal)	514.04±0.05	507.33±0.03	498.92±0.01	491.13±0.01	p<0.05

Values are presented as Mean±SD

Table no. 3.1 shows the nutritional properties like moisture, ash, protein, fat, carbohydrate, crude fiber, and energy value of kodo millet biscuits made from different treatments. It's revealed that, with the increase in the level of kodo flour in different treatments, level of protein, carbohydrate and energy content were decreased whereas the level of crude fiber, fat, moisture and ash content were significantly increased. The protein, carbohydrate and energy content of biscuits in different treatments ranged from 10.79 to 10.21%, from 48.02 to 42.56% and from 514.04 to 491.13% respectively. The crude fiber, fat,

moisture and ash content ranged from 30.69 to 31.16%, from 6.43 to 8.4% and from 1.80 to 3.2% respectively. The fiber content of the biscuits increased from 1.93 to 4.55% by increasing the kodo flour from 0 to 50% in different treatments. It was observed that the increased fiber content in biscuits might be due to their higher contents of kodo flour. It was clear from (Table 3.1) that the treatment B4 containing maximum level of kodo flour have high content of crude fibre, fat, ash and moisture as compare to B1, B2, B3. Lizia et al. (2012) and Hemlata et al. (2006) also found similar results in their studies.

Table no. 3.2
Sensory properties of the kodo millet flour based biscuit

Treatments	B ₁	B ₂	B ₃	B ₄	Significance
Colour & Appearance	8.32 ± .79	7.52 ±1.03	7.82 ± .77	8.29 ±1.09	p>0.05

Taste	8.31 ± .41	7.63 ±1.44	8.13 ± .99	7.94 ±1.48	p>0.05
Texture	7.86 ± 1.12	7.12 ± .65	7.96±1.07	7.81 ±1.08	p>0.05
Flavour	7.73 ± 1.57	7.12 ± .84	7.83±1.24	7.73 ±1.09	p<0.05
Crispness	7.78 ± 1.47	7.62 ± .91	8.26 ± .79	8.41 ± .91	p<0.05
Mouthfeel	7.53 ± 1.92	7.23 ±1.39	7.81±1.32	7.73 ±1.27	p<0.05
Overall acceptability	8.21 ± .56	7.16 ±1.09	8.1 ± 1.12	7.86 ± .99	p>0.05
<i>Values are presented as Mean±SD</i>					

Table no 3.2 presents the sensory evaluation of kodo millet flour biscuit and its revealed that biscuit with treatment B₁ obtained highest scores of mean value of colour and appearance (8.32), taste (8.31) and overall acceptability (8.21) as compared to the treatment of B₂, B₃ and B₄. It was observed that mean score of mouth feel (7.81), flavour (7.83) and texture (7.96) was higher in treatment B3 formulation while mean score of crispness (8.41) was higher in treatment B4 formulation.

Thus the overall acceptability score of B1 and B3 were considered as standardized and used for further studies. Mishra et al. also found similar result in their study.

4. Conclusion

The study concluded that formulation of kodo millet flour biscuits are not only acceptable based on sensory properties, but also nutritionally compressed with high fiber content. It is gaining importance of kodo millet that it is gluten free food and is a constituent in multigrain gluten free food products. It is right time for possible minor millets to be included as part of the daily diet. New research findings in this area indicate that the kodo millet is grinded into flour and used to make various snacks.

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