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## Development and consumer acceptability of little millet (*Panicum sumatrense*) based biscuits

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### Abstract

Little millet (*Panicum sumatrense*), is native to India and it is also called as Indian millet. Millets provide a wide range of health benefits and they are a good source of energy, proteins, dietary fibre, minerals, vitamins, essential amino acids and iron chelating activity is high compared to other millets. In the present study, biscuits were standardised with incorporation of little millet (LB) flour at 50, 60, 70, 80, 90 and 100 per cent with 20 % fat. The developed products were evaluated for sensory quality and consumer acceptability study. The significant result was observed only in taste and aroma, and crumb texture, with non-significant result in volume, crust colour and surface colour, crumb colour, mouth feel and overall acceptability. The overall acceptability score showed that 100 per cent of little millet flour biscuit was highly acceptable with improved nutritional quality and The most accepted product were further served to the consumers to test the general acceptance pattern. Majority (more than 90%) of the consumers accepted little millet based biscuits in terms of their nutrition, freshness, taste and appropriate labelling method. However more than 80 per cent of the consumers accepted all the products in terms of the variety, consistency, convenience and the ingredients used for the product development.

**Keywords:** Little millet, sensory quality, consumer acceptability

### 1. Introduction

The word Biscuit is obtained from Latin word Biscoctum, it means twice baked. Biscuits were called as sick-man's diet in earlier days and are most widely consumed by all age group people. Indian biscuits industry came into limelight and started gaining a sound status in the bakery industry in 20th century, the urbanized society called it as readymade food products at a sustainable cost. More consumption of biscuits was noted in the Maharashtra, West Bengal, Andhra Pradesh, Karnataka and Uttar Pradesh (Ahmad and Ahmed, 2014) [1]. Indian biscuit market stood at \$3.9 billion in 2016 and is projected to grow at a compound annual growth rate (CAGR) of 11.27 per cent, in value terms, between 2017 and 2022, to reach \$7.25 billion by 2022 (Sharma, 2019) [7]. Per capita consumption of biscuit in India is 2.1 kg, compared to more than 10 kg in the USA, UK and West European countries and above 4.25 kg in South-east Asian countries (Ahmad and Ahmed, 2014) [1].

Nowadays, biscuit industry accounts for a major part of the processed food market and this industry is rapidly changing with advancements in nutraceuticals and new product developments, even consumers have great concern for quality and nutritional contents. Hence there is a need for partial substitution of refined wheat flour by fibre and protein rich natural ingredients without much compromise on taste of the product. This can be accomplished by using millet flour having efficient, environmentally friendly for the conversion into functional ingredients for human consumption.

Millets are one of the oldest of cereals, cultivated since ancient times. Millets provide a wide range of health benefits and they are a good source of energy, proteins, minerals and vitamins. Millet proteins are a good source of essential amino acids except lysine and threonine but contain higher amount of methionine. Millets contain abundant phytochemicals and micronutrients and due to these nutritional benefits, millets are termed as "nutri-cereals" (Karupphasamy *et al.*, 2013) [4]. In view of this, millet flour can be considered as a good substitute for making various bakery foods with proper processing technique will definitely fetches good returns to the producer.

Little millet (*Panicum sumatrense*), is native to India and it is also called as Indian millet. It is adapted to both temperate and tropical climates. Millets provide a wide range of health benefits and they are a good source of energy, proteins, minerals and vitamins. Millet proteins are a good source of essential amino acids and highest soluble p-coumeric acid among the

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millets and iron chelating activity is high compared to other millets. Dietary fibre content of little millet is the contributing factor for low glycaemic index, provides significant amount of antioxidants and phytochemicals in diet (Ushakumari and Malleshi, 2007) [11].

The present study is an attempt to evaluate the little millet based biscuit in concern to sensory parameters and consumer acceptability of best accepted biscuit.

## 2. Materials and Methods

### 2.1 Procurement and processing of raw materials

Refined wheat flour, little millet, sugar, hydrogenated fat, sodium bicarbonate, ammonium bicarbonate, skim milk powder, vanilla essence and packaging materials were procured from local market Bangalore. The little millet grains were cleaned to remove dust and other foreign materials and then grounded in a commercial centrifugal food processing machinery (Serial number: CFPM-B44 with RPM of 2800) and equipment with a 250- $\mu$ m mesh sieve, flour was sieved using a BS 40 mesh sieve to obtain fine flour and was stored in stainless steel containers.

### 2.2 Development and standardization of millets based biscuits

The formulation for the control biscuit was based on the recipe of Sudha *et al.*, 2007 [10] by creaming method.

### 2.3 Standardization of little millet based biscuits with replacement of refined wheat flour

After the successful preparation of the control biscuit, the experimental biscuits were prepared by replacing refined wheat flour with little millet flour at different levels viz., 50, 60, 70, 80, 90 and 100 per cent. Amount of fat, sugar, milk powder, ammonium bicarbonate, sodium bicarbonate, salt, vanilla essence were kept constant to 20 g, 30 g, 02 g, 01g, 0.5g, 01g, 01ml respectively on 100 g flour weight basis for all variations, differing in the amount of water added. The composition of millets based biscuits is presented in Table 1. The method of preparation remains the same as that of the control biscuit.

**Table 1:** Composition of little millet biscuits

Little millet flour based biscuits			
Treatments	Ingredients		
	Refined wheat flour (g)	Little millet flour (g)	Water (ml)
Control	100	00	35
LBT <sub>1</sub>	50	50	40
LBT <sub>2</sub>	40	60	43
LBT <sub>3</sub>	30	70	45
LBT <sub>4</sub>	20	80	45
LBT <sub>5</sub>	10	90	46
LBT <sub>6</sub>	00	100	50
<b>Other ingredients:</b> Sugar-30 g, Fat-20 g, Skimmed milk powder-02 g, Ammonium bicarbonate-01g, Salt-1g, Sodium bicarbonate-0.5 g, Vanilla essence-01 ml * All other ingredients are kept constant for all the variations in little millet based biscuits. <b>LB:</b> Little millet flour based biscuit			

### 2.4 Sensory evaluation of developed biscuits

Biscuits were evaluated for their sensory attributes by a panel

of 21 semi trained members using composite score test suggested by Ranganna (1986) [5]. The panellists evaluated organoleptic characteristics such as volume, crust colour and surface character, crumb colour, crumb texture, mouth feel, taste and aroma and overall acceptability.

### 2.5 Consumer acceptability of best accepted little millet based biscuit

The most accepted products were further served to the consumers to test the general acceptance pattern. Consumers were randomly selected and distributed with the products and were asked to score the products with simple evaluation test. Information obtained was analysed to find out the level of acceptance of the products and cost estimation of the best accepted products were done.

### 2.6 Statistical analysis

The data was tabulated and analysed by keeping in view of the objectives and parameters of the study. All the analyses were performed in triplicate and the data was analysed using EXCEL

## 3. Results and Discussion

### 3.1 Mean sensory scores of little millet based biscuits

The sensory analysis of biscuits was carried out by 21 semi trained panelmembers and by assigning a score for each sensory attribute such as volume (10), crust colour and surface character (10), crumb colour (10), crumb texture (20), taste and aroma (30), mouth feel (10) and over all acceptability (10) on composite sensory scale (Table 2 and Fig. 1).

The little millet flour substituted biscuit showed non-significant effect on all the sensory properties with the exception of crumb texture, and taste and aroma as compared to the control. The little millet flour based biscuit exhibited significant higher score for crumb texture (16.58-18.50) than the control (17.25). This may be due to increased level of millet flour and reduction in refined wheat flour.

The crumb texture was differed compared with the control. Fatma *et al.* (2016) also reported that texture of gluten free biscuit with germinated millet flour scored highest in sensory evaluation as compared with the control biscuit. The taste and aroma of the biscuits increased in incorporation levels of the little millet flour (25.75 - 28.00) than the control (25.33).

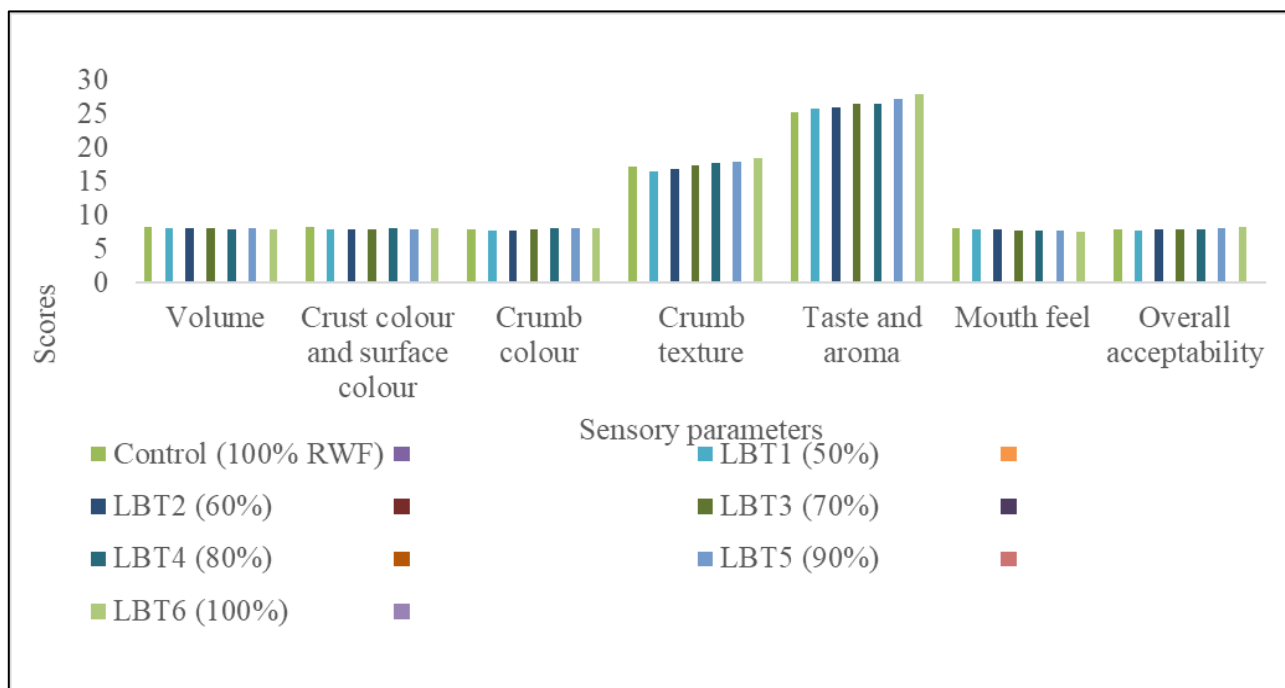
Subbalakshmi and Malathi (2017) [9] also observed an increase in the taste and texture of cookies as increase in the level of multi millet flour in biscuit while compared with the control.

Volume and mouth feel of the little millet flour incorporated biscuit showed gradual decrease in the mean score value at increased levels of little millet flour from 50, 60, 70, 80, 90 and 100 per cent was ranged from 7.91-8.16 and 7.56 to 8.00 than the control (8.30 and 8.05). As less wheat gluten in the formulation may contributed for less retention of gas, this may be the reason for decline in volume and thickness of biscuit with incorporated millet flour. The present results were on par with the study conducted by Karuppswamy *et al.* (2013) [4]. Where due to coarse nature of millets, the decrease in mouth feel of the little millet flour biscuit was observed. There was no difference in crust colour between the little millet flour incorporated biscuit and control.

**Table 2:** Mean sensory scores of little millet based biscuits (Mean±SD)

Treatments	Sensory parameters						
	Volume	Crust colour and surface colour	Crumb colour	Crumb texture	Taste and aroma	Mouth feel	Overall acceptability
Control (100% RWF)	8.30 ±0.93	8.20 ±0.95	8.00 ±0.95	17.25 ±1.35	25.33 ±3.17	8.05 ±1.30	8.00 ±1.08
LBT <sub>1</sub> (50%)	8.16 ±0.49	7.95 ±1.35	7.75 ±1.21	16.58 ±1.31	25.75 ±0.96	8.00 ±0.79	7.80 ±0.99
LBT <sub>2</sub> (60%)	8.08 ±0.79	8.00 ±0.73	7.80 ±1.13	16.91 ±0.90	26.00 ±0.95	7.95 ±0.88	7.95 ±1.03
LBT <sub>3</sub> (70%)	8.01 ±0.99	8.00 ±0.71	7.83 ±1.02	17.41 ±0.66	26.58 ±1.31	7.80 ±0.60	7.98 ±0.66
LBT <sub>4</sub> (80%)	8.00 ±1.12	8.16 ±1.11	8.08 ±0.99	17.83 ±0.93	26.50 ±1.24	7.66 ±0.65	8.00 ±0.75
LBT <sub>5</sub> (90%)	8.06 ±0.71	8.00 ±0.85	8.03 ±0.88	18.00 ±1.31	27.33 ±1.07	7.66 ±1.13	8.08 ±0.79
LBT <sub>6</sub> (100%)	7.91 ±0.90	8.10 ±0.52	8.08 ±0.99	18.50 ±0.79	28.00 ±0.73	7.56 ±1.07	8.20 ±0.39
F-value	NS	NS	NS	*	*	NS	NS
SEm±	0.35	0.38	0.42	0.44	0.63	0.39	0.35
CD @ 5%	0.71	0.76	0.84	0.87	1.27	0.77	0.69

RWF: Refined wheat flour LB: Little millet based biscuits \* Significant at 5% NS-Non Significant



**Fig 1:** Mean sensory scores of little millet based biscuits RWF: Refined wheat flour biscuit LB: Little millet based biscuit

The texture of control biscuit was crisp showed clean mouth feel, whereas little millet flour biscuits were hard and showed slightly gritty mouth feel with decreased crispiness and slight residue formation. Saha *et al.* (2011) [6] also didn't observe much difference in the crust colour of wheat and finger millet flour biscuit.

The overall acceptability scores for control and at 50, 60, 70, 80, 90 and 100 per cent incorporation level of little millet flour were 8.00 and 7.80, 7.95, 7.98, 8.00, 8.08, 8.20 respectively. Biscuit with cent per cent of little millet flour scored highest while compared with the control and all other treatments. Singh *et al.* (2006) [8] also reported overall acceptability of cake containing pearl millet, colour and appearance, flavour, texture and taste which gives over all acceptances by combining all attributes.

Sangwan and Dahiya (2013) [4] also reported increased in overall acceptability score as increased level of sorghum flour in biscuits. Rai *et al.* (2014) also reported that, the gluten free cookies prepared with the pearl millet flour and sorghum flour was more acceptable by the consumers as compared with the control cookies.

**3.2 Consumer preference study of best accepted little millet based biscuit**

The results indicated that among all the parameters, majority (more than 90%) of the consumers accepted little millet based biscuits in terms of their nutrition, freshness, taste and appropriate labelling method. However more than 80 per cent of the consumers accepted all the products in terms of the variety, consistency, convenience and the ingredients used for the product development (Table 3).

**Table 3:** Consumer acceptability of best accepted little millet based biscuit (n=120)

Statements	LMB					
	Accepted		Partially accepted		Not accepted	
	n	%	n	%	n	%
Nutrition	110	91.6	5	4.2	5	4.20
Freshness	112	93.3	5	4.2	3	2.50
Taste	100	83.3	9	7.5	11	9.16
Variety	94	78.3	6	5.0	20	16.6
Consistency	105	87.5	6	5.0	9	7.50
Convenience	104	86.6	6	5.0	10	8.33
Ingredient	105	87.5	8	6.6	7	5.80
Labelling	111	92.5	6	5.0	3	2.50
Appropriate packaging	94	78.3	7	5.8	19	15.83

LMB: Little Millet Based Biscuit RWF: Refined wheat flour biscuit LB: Little millet based biscuit

The lesser percentage (below 80%) of consumer preference level was recorded for taste and appropriate packaging. This may be due to the accustomed habit of consuming refined wheat flour-based bakery products for a long time. Further more than 15 to 17 per cent of the consumers not accepted packaging technology for which the product packed. in MPP.

### 3.3 Cost estimation of little millet based biscuit

The production cost was estimated by taking the prevailing cost of all the ingredients in the market. Overhead cost including the cost of labour, cost of power, cost of machinery, packaging and labelling cost.

The highest production cost was observed for little millet based biscuit (Rs. 252 /kg) compared to control (Rs. 140 /kg). Based on the final yield of the product on flour weight basis was considered for estimation of final product cost.

### 4. Conclusion

It can be concluded from the salient findings of the study would be efficient in utilization of millet by replacing refined wheat flour in bakery products will add more functional and nutritional value to the biscuit. Millet based biscuits were found to have comparable sensory characteristics compare to control. The best accepted little millet biscuit had got consumer acceptability as that of refined wheat flour biscuit. This also helps to increase the domestic consumption of healthy products over junk foods. The newer product development would help in promoting locally grown crops such as millets to enhance farmer life in many regions of the country and help to fetch good return and enhancing the economic status of the millet growers.

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