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Development and Sensory Evaluation of Pearl Millet Based Value Added Biscuits Blended with Different Non-wheat Flours

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Abstract

The present study was an attempt to develop value added biscuits containing pearl millet with non-wheat flours for its acceptability among consumers. Biscuits were prepared using different concentrations of pearl millet flour, rice flour, chickpea flour, sesame flour, and peanut flour. The different formulations prepared were Type 1, Type 2, Type 3, Type 4, Type 5, and Type 6 in the ratios of (bajra flour: Rice flour: Chickpea flour: Sesame flour: Peanut flour) 100, 90:10, 80:10:10, 75:10:10:05, 75:10:10:0:05, and 70:10:10:10:05:05, respectively, to make cookies. The developed biscuits were sensory evaluated by semi-skilled panelists using nine point hedonic scales. The results showed that biscuit Type 6 was highly acceptable as scored (8.3 ± 0.13) whereas biscuit Type 3 was least acceptable as scored (7.6 ± 0.15). The result shows that biscuit prepared with different concentrations of composite flour (Type 6) was found to be highly acceptable by the panel of judges, thus it will be used further for technology dissemination among masses.

Key words: Pearl Millet, Sensory evaluation, Value added biscuits, Composite flour

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Introduction

Cereal based baked snacks, namely, biscuits, cookies, wafers, and bread are very popular, worldwide. Biscuit and biscuit such as products were consumed by different age groups for many years. Biscuit is most popular bakery product having wider consumption base, longer shelf life and with its higher acceptability among Indian consumers. Main ingredient in biscuits is wheat flour, is high in carbohydrates, fat, and calories but low in fiber, vitamin, and mineral which make it unwhole some food choice for children, elderly, and persons of different age groups, on daily basis. To enhance the nutritional quality of biscuits, composite flours based on various staple cereals and millets consumed in a particular country have been developed till now.[1] Composite flour has been defined as a mixture of different ratios of non-wheat flour from cereals, legumes, roots, and tubers with or without flour.[2] Enrichment of cereal based foods with other protein sources has been receiving considerable attention to curtail protein deficiency.[3] In addition, composite flours enhance the utilization of underutilized local and inexpensive food ingredients in production of bakery products. Millets (*Penisetumglaucum*) are groups of small seeded species of cereal crops or grains, widely grown around the world for food and staples for human consumption.[4] Millet can be dehulled and milled into flour; and malted or brewed into various drinks. Millet is predominantly starchy and the bran layer of millet is good sources of Vitamin B complex.[5] It also serves as a source of antioxidants in our diets. Because of the acceptability of biscuits in all age group, longer shelf life, delightful taste and its position as snacks it is considered as a suitable product nutritional improvement through value addition. Pearl Millet (*Bajra*) is a coarse cereal crop in Western India (Rajasthan, Haryana, and Gujarat).[6] It is basic staple food in developing countries and included in dietaries of poor masses. As a food source, it is non-glutinous and non-acid forming, so is soothing and easy to digest. For human consumption, it can be used in varied ways including in the form of leavened and unleavened breads, porridges, and boiled or steamed food products. Nutritionally, pearl millet makes an important contribution to human diet due to high amount of calcium, iron, zinc, lipids, and high quality proteins in it. Besides, starch is the major constituent of pearl millet and it is also a rich source of dietary fiber.[7,8] Rice (*Oryza sativa*) is among the most important staple foods in human diet. It is mainly consumed as white grain and provides 27% of the total energy intake in the developing countries. Similar to other cereals, rice is a cheap source of protein and rich in complex carbohydrates, minerals, and vitamins with no cholesterol content in it.[9] Rice flour is considerably lower in protein content as compared to wheat flour and does not contain gluten; hence, it is good source of flour for people who are gluten intolerant or suffer from celiac disease.[10]

Chickpea (*Cicer arietinum*) is one of the affordable sources of protein, carbohydrates, minerals, vitamins, dietary fiber, and folate. It is also rich in antioxidants. Various studies provided evidences to support the potential components present in chickpea in lowering the risk of various chronic diseases such as cardiovascular diseases, obesity, cancer, and diabetes.[11]

Peanut (*Arachis hypogaea*) is an important oilseed crop, cultivated globally. Commercially, it is used mainly for oil production but apart from oil, by-products of peanut contains

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many other functional compounds such as proteins, fibers, polyphenols, antioxidants, vitamins, and minerals which can be added as a functional ingredient into many processed foods.[12]

Sesame seeds (*Sesamum indicum*) are tiny, flat oval seeds with a nutty taste. Sesame is an important source of oil (44–52.5%), protein (18–23.5%), and carbohydrate (13%).[13] The seeds are consumed fresh, dried, or blended with sugar. Sesame seed flour can be added to various basic recipes to provide a better nutritional composition to value added food products.

In present paper, an effort has been made to develop value added pearl millet based biscuits through developing composite flours by combining pearl millet flour and rice flour at different incorporation levels to explore its potential to form nutritious biscuits.

Objectives

The objectives of the study are as follows:

- To develop value added biscuits using pearl millet and rice flour
- To evaluate developed biscuits for their sensory characteristics.

Materials and Methods

Raw Material

Raw ingredients, namely, pearl millet, rice, chickpea, peanut, and sesame seeds along with other bakery ingredient such as butter, sugar, and ammonium bicarbonate were purchased from local market, S.A.S. Nagar, Punjab, India. After grading, these ingredients were soaked in water for 24 h and washed thoroughly. Then, these were dried in a hot air oven at 60°C for 24 h to attain the moisture content up to 11%. Then, those ingredients were ground in a grinding machine and sieved through sieve shaker using 1 mm and the finally obtained flour for each commodity was stored in air-tight containers, separately to use the same for the development of pearl millet based value added biscuits.

Preparation of Composite Flour

Composite flour for the development of value added biscuits was prepared as shown in Table 1.

Development of Biscuits

Pearl millet based value added biscuits were developed using ingredients mentioned in Table 2.

Method for preparation

Biscuits were prepared using traditional creamery method. Procedure for the development of value added biscuits is explained in Figure 1. Elaborately, butter and sugar were creamed until the mixture becomes light and fluffy. Different flour blends were sieved with ammonium bicarbonate and were added to the different creamed mixture prepared beforehand, to form uniform dough by adding sufficient quantity of milk. The dough was covered with cling wrap and kept in fridge for about half an hour. After that, the dough was rolled out to 3 mm thickness and cut into round shape of about 5 cm diameter with a biscuit cutter. Biscuits were placed in the baking tray lined with fat and parchment paper and baked in a preheated oven at 180°C for 15 min. Biscuits were allowed to cool, packed in zip pouches and stored at room temperature.

Table 1: Different flour blends for pearl millet based value added biscuits

Samples	*Pearl millet flour (PMF), %*	*Rice flour (RF), %*	*Chickpea flour (CF), %*	*Sesame flour (SF), %*	*Peanut flour (PF), %*
T1	100	0	0	0	0
T2	90	10	0	0	0
T3	80	10	10	0	0
T4	75	10	10	5	0
T5	75	10	10	0	5
T6	70	10	10	5	5

Table 2: Ingredients used for pearl millet based value added biscuits

Ingredients	*T1*	*T2*	*T3*	*T4*	*T5*	*T6*
PMF	100	90	80	75	75	70
RF	0	10	10	10	10	10
CF	0	0	10	10	10	10
SF	0	0	0	5	0	5
PF	0	0	0	0	5	5
Butter	50	50	50	50	50	50
Sugar	50	50	50	50	50	50
Ammonium bicarbonate	1.5	1.5	1.5	1.5	1.5	1.5
Milk	As required to prepare dough					

Sensory Evaluation

Pearl millet based value added biscuits were evaluated for different sensory attributes, namely, appearance, color, flavor (aroma/taste), texture, mouth feel, and overall acceptability by 15 semi-trained judges using nine-point hedonic score system. The panelists were either regular or occasional consumer of biscuits and were not allergic to any food. Biscuit sample prepared from each flour blend was presented in coded language as T1, T2, and so on. The order of presentation of samples to the panelist was randomized. Water was provided to every panelist for rinsing the mouth during evaluation. The panelist were instructed to evaluate the coded samples and assigned scores 9-1 ranging from "like extremely" to "disliked extremely" to each biscuit sample to find out the most suitable composition of value added biscuit.

Statistical Analysis

Obtained scores for each sensory attribute were analyzed by applying one-way analysis of variance (ANOVA) method using GraphPad Prism software (version 5.01).

Results and Discussion

The study has been carried with the objective to develop value added pearl millet based biscuits by combining pearl millet flour and rice flour at different concentrations to explore its potential to form nutritious biscuits. A nine-point hedonic scale was used to evaluate the acceptability of the consumers in the sensory attribute of appearance, color, flavor, mouth feel, and texture [Table 3 and Figure 2]. The result of different parameters showed that there was significant difference ($P > 0.05$) between biscuits blended with different non-wheat flours. The addition of different flours increased the mean score of different sensory parameters except one (color) evaluated under the study [Table 3]. The mean score of appearance ranged from 6.0 to 8.0 with maximum value

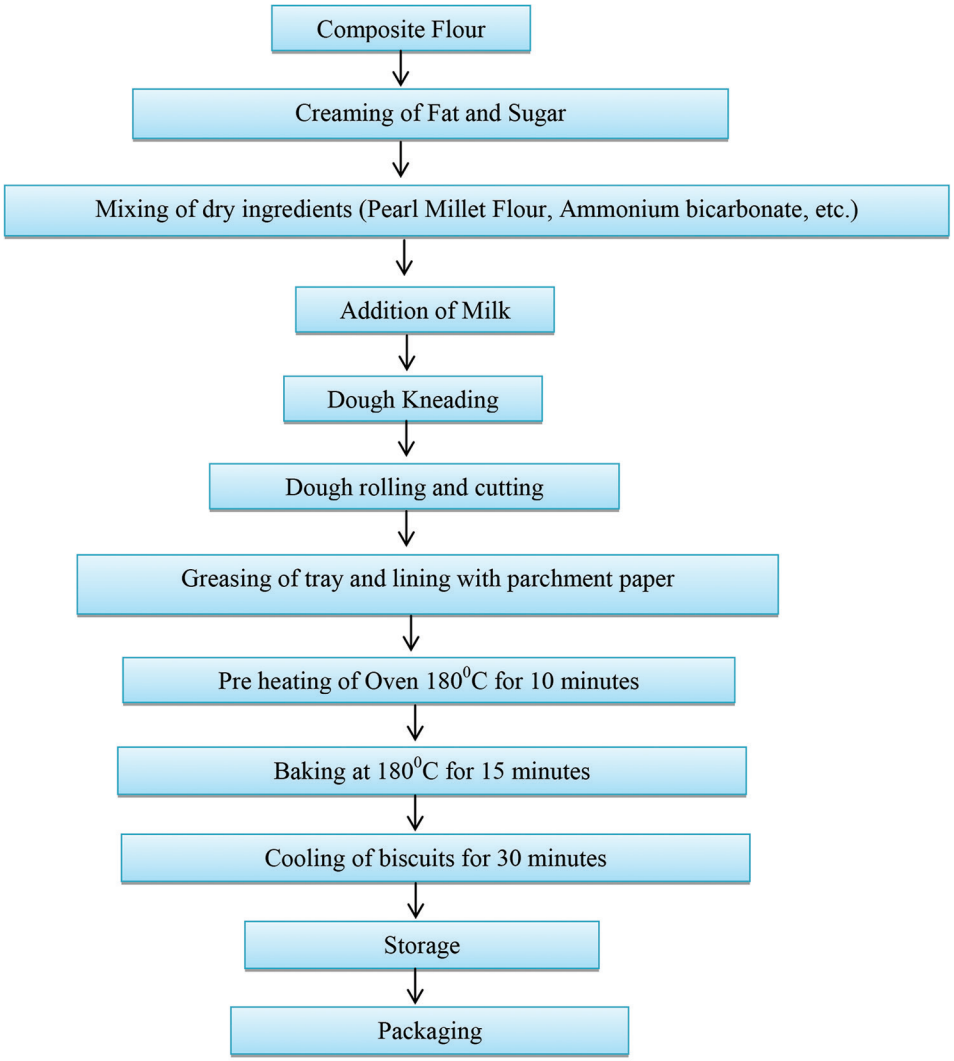

Figure 1: Flowchart for development of pearl millet based value added biscuits

Table 3: Sensory characteristics of pearl millet based value added biscuits

Sensory characteristics	*T1*	*T2*	*T3*	*T4*	*T5*	*T6*
Appearance	6.0±0.23^f	6.8±0.21^d	7.4±0.18^b	7.0±0.25^c	6.7±0.15^e	8.0±0.20^a
Color	6.2±0.12^f	7.1±0.17^d	7.7±0.10^a	7.2±0.15^c	6.5±0.13^e	7.6±0.15^b
Flavor	6.1±0.22^f	7.0±0.20^d	7.5±0.25^b	7.0±0.11^c	6.3±0.17^e	8.1±0.21^a
Texture	5.6±0.15^f	7.0±0.12^d	7.4±0.16^b	7.1±0.13^c	6.6±0.12^e	8.3±0.13^a
Mouth feel	6.1±0.10^f	7.2±0.12^c	7.6±0.13^b	7.0±0.15^d	6.5±0.11^e	8.1±0.18^a

in T6. The maximum score for color (7.7) was observed in T3 and minimum (6.2) in T1 biscuits. The PMF percentage has great impact on the color of the biscuits with the increase in PMF up to 80% the color of biscuits increased; with the further increase/decrease in PMF percentage there is reduction in color of biscuits. Also with the addition of substitution, the color of biscuit turned to dark brown which makes it non-acceptable.[14] Color is considered as major factor affecting the quality of the food products.[15] Starch dextrination, sugar caramelization, and non-enzymatic browning (Maillard) between reducing sugars and amino acids during baking gives color to the biscuit.[16,17]

The data for the score of flavor of the biscuits ranged from 6.1 to 8.1 with T6 having great flavor and T1 the least, among all the different-blend biscuits. The reason for the lowest score in T1 might be due to the composition of T1 as T1 biscuits were made of only pearl millet flour. With the increase of the substituent the flavor of biscuits also got enhanced. Flavor and mouth feel parameters have almost same range of mean score. In both of these parameters, minimum score (6.1) was found in T1 whereas maximum score (8.1) was found in T6. The maximum score for texture was observed in T6 (8.3) and minimum in T1 (5.6). The addition of sesame flour (SF) and peanut flour (PF) enhanced the texture quality in T6 biscuits. It can be concluded from the results that T3 which have only three different flour composition, that is, PMF, RF, and CF have second highest sensory score values in each parameter except color which means that addition of both

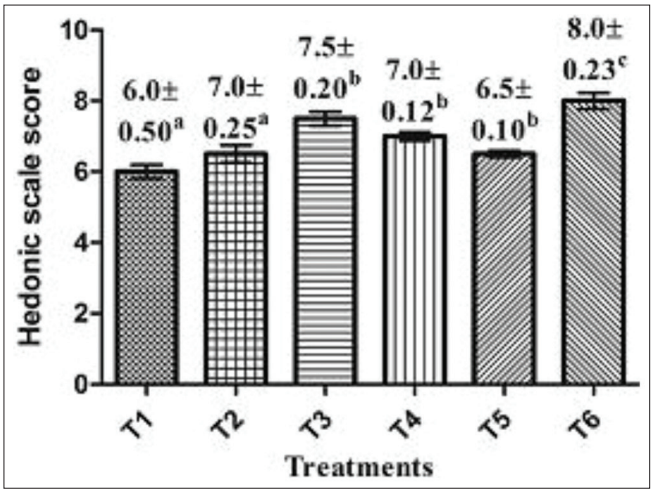

Figure 2: Mean scores for overall appceptability of pearl millet based value added biscuits

the SF and PF have contributed a major change in enhancing the quality of biscuits. However, it can also be concluded that only PMF, RF, and CF contributed to color parameter in the present study.

Conclusions

The bakery products are in use since ages. These products are used by every ethnic group globally. With the increase in demand of nutritionally enriched bakery product, there is need to fortify the biscuits with different highly nutritional crop flour. In the present investigation, we tried to develop biscuit with various combinations of composite flours. The results of the present study revealed that all the biscuits developed under different treatments were better for different sensory parameters. However, the T6 formulations resulted in highest score of all the sensory parameters except color which was recorded highest in T3.

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