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ORIGINAL ARTICLE

Quality Evaluation of Fasting Biscuit Prepared from *Rajgira* and *Sabudana*

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Abstract

The fasting biscuit is prepared using *Rajgira* flour and *Sabudana* (sago balls) flour for the preparation of fasting biscuits. The *Rajgira* flour and *Sabudana* flour (pearl *sabudana*, nylon *sabudana*) were brought from the local market at Jalgaon (Jamod), Maharashtra in India. *Rajgira* flour contains less amount of protein but good source of vitamin-A, vitamin-C, and also complementing source of some other vitamins, also contain some dietary minerals including calcium, iron, zinc, copper-comparable to common grains such as wheat germ, oats and other. *Sabudana* flour contains some amount of calorie, carbohydrate, fat and proteins, it also provide large amount of starch, low amount of minerals, vitamins however lack of these nutrition are made up by making the combination with *Rajgira* flour so it became nutritionally advantageous. In this experiment, *Rajgira* flour was blended with the *Sabudana* flour in the ratio of 3:1, 3:2, 1:1, 2:3 and 1:3 proportion to prepare blended flour samples, from which fasting biscuits were prepared. These samples were subjected to analysis of their functional properties. The proximate composition of the various flour blends used for the preparation of fasting biscuits were determined using standard methods. The physico-chemical analysis and sensory evaluation was done to know the acceptability of fasting biscuit. These were evaluated for sensory analysis that included colour, taste, flavor and overall acceptability. The biscuits were analyzed for analytical and chemical analysis, which includes moisture content, fat content and total ash content. On the basis of sensory evaluation, biscuit containing *Rajgira* flour and *Sabudana* in 3:2 proportion scored high score for overall acceptability i.e 7.8. From the result of proximate analysis of biscuits, the fat content of 3:2 proprtions of *Rajgira* and *Sabudana* flour is very low i.e 26.4%, which is beneficial for health. So according to quality evaluation and sensory evaluation, preparation of biscuits from *rajgira* and *sabudana* flour blend in proportion of 3:2 is recommended.

Keywords: Fasting biscuit, *Rajgira*, *Sabudana*, Sago flour, Overall acceptability.

1. Introduction

Biscuits may be regarded as a form of confectionery dried to very low moisture content. According to Fayemi (1981), biscuits may be defined as a small thin crisp cake made from unleavened dough. According to Okaka (1997), biscuit is a mixture of flour and water but may contain fat, sugar and other ingredients mix together into dough which is rested for a period and then passed between rollers to make a sheet. Biscuit may be classified either by the degree of enrichment and processing or by the method adopted in shaping them. Based on enrichment criterion, biscuit may be produced from hard dough, soft dough or from batters (Fayemi, 1981). Biscuits are popular food stuff consumed by a wide range of population due to their varied taste, long shelf life and relatively low cost. Because of competition in the market and increased demand for healthy, natural and functional products, attempts are being made to improve the nutritive value of biscuit and functionality by modifying their nutritive composition. Gayas *et al.* (2012) found the mean overall sensory acceptability scores of more than 8.50 for biscuit samples upto 5% carrot pomace powder, indicating the commercial scope for manufacturing

good quality vegetarian biscuits with carrot pomace powder. Biscuit for fasting purpose is made from the combination of *Rajgira* flour, *Sabudana* flour and potato flour, which are full of nutrition. The nutritional content however varies with the type of flour used. Shrestha *et al.* (2012) found that "over baking" of the biscuit likely to be responsible for the loss of the vitamin as well as less desirable physical properties of the biscuits.

Rajgira is also called *Ramdana*, Amaranth or *Nachni*. Its botanical name is *Amarantus paniculatus* and it belongs to family Amaranthaceae. The useful part of *rajgira* is mostly seed, now a days available in the form of *Rajgira* flour and *Rajgira* grain. *Amaranthus paniculatus* is a species of annual flowering plants. Many parts of the plants, including the leaves and seeds are edible, and are frequently used as a source of food in India and South America. Amaranth grain/ flour are a good source of vitamin A, vitamin C, and folate; they are also a complementing source of other vitamins such as thiamine, niacin, and riboflavin, plus some dietary minerals including calcium, iron, potassium, zinc, copper and manganese -comparable to common grains such as wheat germ, oats and others (Devadas *et al.*, 1996).

Sabudana is also called as sago, Tapioca Pearl, Pearl Sago, its botanical name is *Manihot Esculenta Crantz Syn. Utilissima*, belongs to family Euphorbaceae. *Sabudana* is a vegetarian processed food. Commonly known as Sago in India, *Sabudana* is made from the starch extracted from Tapioca root (tuber). Commercial product of *Sabudana* is in the shape of small pearls. *Sabudana* is high carbohydrate, low fat food used across states in India. In India, *sabudana* is the first food item (apart from milk) most Indians feed to new-born and is also consumed by most to break their fast during festivals. *Sabudana* is preferred over other food items because it is full of starch and does not contain any artificial sweeteners or chemicals. *Sabudana* / Sago is also used as a health food for sick as it gives quick energy and is easy to digest. It is a well-known fact that *sabudana* has cooling effect on our system and hence *sabudana*-gruel is given to people who have excess bile. The 100 grams of *sabudana* contains 351 kcal, 87 grams carbohydrate, 0.2 gram fat and 0.2 gram protein. *Sabudana* provides just a large quantity of starch, with low amount of minerals, vitamins, calcium, iron and fiber, however lack of these nutritions are made up by adding other ingredients such as milk, vegetables and peanuts (Ohtsuka 1983). The similar work for fasting biscuits was conducted by Patil *et al.*, (2014) using sago, peanut, banana, potato, foxtail millet, barnyard millet in different proportions.

This study was aimed to make biscuit from blend of *sabudana* and *rajgira* flour and to examine its performance in biscuit production in terms of proximate composition and sensory evaluation.

2. Material and Methods

The experimental studies were carried out in laboratories of Collage of Agricultural Engineering and Technology, Jalgaon (Buldana). The methodology adopted has been described as given below.

2.1 Procurement of Raw Material

Good quality of *Rajgira* and *Sabudana* flour and other majour ingredients, i.e., sugar, baking powder were purchased from local market of Jalgaon Jamod.

2.2 Experimental Plan

The experimental plan used for the present research was as given Table 1 and 2. Fig 1 shows the flow chart for preparation of biscuits (Srivastava *et al*., 2012). Table 2 shows the different combinations of *rajgira* and *sabudana* flour for biscuit.

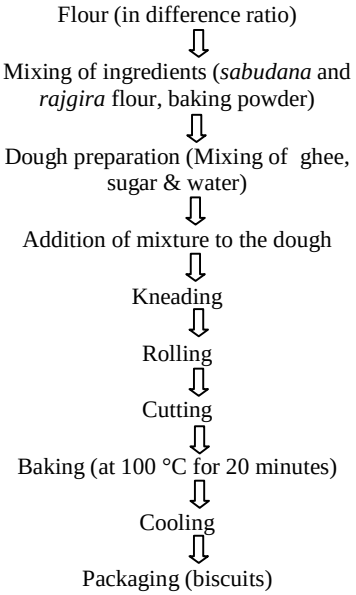


Fig 1: Process flow chart of Biscuit preparation

2.3 Proximate Analysis

2.3.1 Moisture Content

The moisture content of the developed biscuit was determined by the method describe in AACC (2000).

Table 1: Experimental plan

S. No.	Parameter	Level	Description
1.	Major Ingredients Proportions of *Rajgira* flour: *Sabudana* flour	5	T-1 (3:1), T-2 (3:2) , T-3 (1:1), T-4 (2:3) and T-5 (1:3)
2.	Packaging material	1	LDPE
3.	Storage condition	1	Ambient Temperature

Table 2: Different combinations of *sabudana* and *rajgira* flour for biscuit

Treatments	*Proportion of Rajgira* flour: *Sabudana* flour	*Rajgira* flour (%)	*Sabudana* flour (%)
T1	3:1	75	25
T2	3:2	60	40
T3	1:1	50	50
T4	2:3	40	60
T5	1:3	25	75

$$Moisture(\%)(w.b.) = \frac{(w1-w2)}{w1-w} \times 100 \quad (1)$$

Where,
W= weight in gram of the moisture dish.
W1= weight in gram of the moisture dish with the material before drying.
W2= weight in gram of the moisture dish with the material after drying

2.3.2 Ash Content

Ash content was determined as per the method given by AOAC (1965).

$$Total\ ash(\%) = \frac{(\text{Final weight})}{(\text{Initial weight})} \times 100 \quad (2)$$

2.3.3 Fat Content

The fat content was determine by the method describe in AACC (2000), method no. 30-25.

$$Fat(\%) = (W2 - W1)\frac{100}{S} \quad (3)$$

Where,
S= weight of sample (gm)

2.4 Physical Parameters

2.4.1 Spread Ratio

Three rows of five well-formed biscuits were made and the height measured. The biscuits were arranged horizontally edge to edge and the sum of the diameter measured with the height. The spread ratio was calculated by using formula.

$$Spread\ ratio = \frac{\text{Diameter (mm)}}{\text{Thickness (mm)}} \quad (4)$$

2.4.2 Thickness

The thickness was measured in mm using Vernier caliper (Muto Toyo Make, Japan).

2.4.3 Volume

Volume of biscuit is defined as the area of the biscuit multiplied by the thickness.

$$Volume(cm^3) = \frac{d^2\pi T}{4} \quad (5)$$

Where,
T= average thickness of biscuit (mm)
d= diameter of biscuit in (mm)

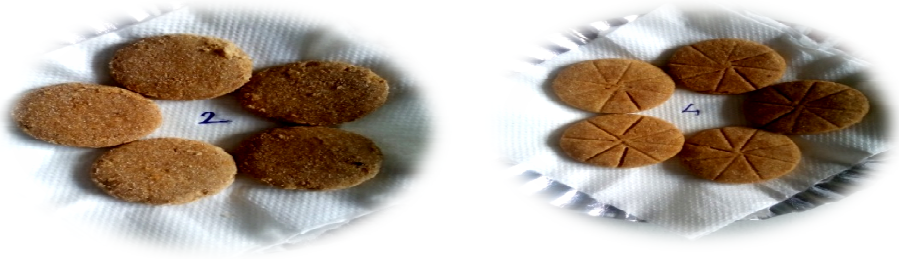
2.4.4 Density

After calculating volume, density was obtained by ratio of weight of volume (AACC, 1983).

$$Density = \frac{\text{mass of sample(g)}}{\text{volume of sample}(cm^3)} \quad (6)$$

2.4.5 Sensory Evaluation

Sensory characteristics of biscuits were evaluated for the different sensory attributes like colour, flavour, texture, taste and overall acceptability by a untrained panel of judges in the College of Agricultural Engineering and Technology, Jalgaon, Jamod. The 9 point hedonic scale was used for evaluation for assigning the numerical values for different quality attributes of biscuits.



(a) Treatment T2 (b) Treatment T4

Fig 2: Fasting flour biscuit prepared form *Rajgira* and *Sabudana*

In the 9 point hedonic scale, 9 represents 'extremely liked' and 1 represents 'extremely disliked'.

3. Results and Discussion

3.1 Physical Parameters of Prepared Biscuit

Table 3 shows that there was a significant increase in the diameter of biscuit with the addition of *Sabudana* flour i.e, 3.22 cm to 4.0 cm. With addition of *Sabudana* flour, the thickness, spread ratio and density remains constants for different treatments like T1, T2, T3, T4 and T5 with the value of 0.69 cm, 5.82, 0.74 g/cm^3, respectively. The result was in conformity with Fig 2, which shows the effect of treatments on weight, diameter, thickness, spread ratio, volume, and density.

It was found that, after addition of *sabudana* flour, diameter of biscuit prepared increases with the decrease in its thickness. According to Balijeet *et al*. (2010), these two parameters always move in opposite directions. Spread ratio, the ratio between the diameter and the thickness of biscuits, is the most important parameter to assess the quality of biscuits (Bose and Shams–Ud-Din, 2010). The spread ratio was highest in case of treatment T2. Biscuits with high values of spread ratio are best (Eissa *et al*., 2007).

3.2 Proximate Analysis

Ash content of the biscuits ranges from 0.5 to 2 %. Significant differences exist on the ash content of the biscuits. Ash is a non-organic compound containing mineral content of food and nutritionally it aids in the metabolism of the other organic compound such as fat and carbohydrate. Biscuit produce from 3:2 *rajgira* and *sabudan*a flour had the highest value i.e., 2%. Biscuit produced from 1:3 *rajgira* and *saudana* flour had the smallest value i.e., 0.5% and value of the other proportion i.e., 3:1, 1:1 and 2:3 was 1%.

Fat plays a significant role in the shelf life of a food products and such relatively high fat content could be undesirable in baked food product this is because fat can promote rancidity in food, leading to development of unpleasant and odorous compound. The fat content of biscuit ranged from 26.4% to 35.3%. Significant differences exist on the fat content of various biscuits. The fat is energy source of for biscuits (Olaoye *et al*., 2007). It contributes to the appearance of biscuits, improves the flavor and gives a good feeling in mouth (Pareyt and Delcour, 2008; Odoemelam, 2005). The increase in fat content of biscuit could be due to the application of fat during biscuit production in which 1:1 of *rajgira* and *sabudana* flour had the largest fat content i.e., 35.3% and 3:2 of *rajgira* and *sabudana* flour had the smallest value of fat content i.e. 26.4%.

Moisture content of the biscuits was found to be optimum. Moisture content of biscuits increased and ash content decreased with increasing the incorporation percent of rajgira flour. The moisture content of the biscuit ranges from 1% to 4.5%. Significant difference exists on the moisture content of the biscuit. The moisture content of the different biscuit varies according to the type of biscuit produced. The highest moisture content of the biscuit i.e., 4.5% was observed in the proportion such as 3:2 and 1:1 of *rajgira* and *sabudana*.

3.3 Organoleptic Quality Evaluation of Biscuit

The result of sensory evaluation is shown in Table 5. From the result, texture of biscuit samples was fairly good. Based on texture, the sample with 60% rajgira flour and 40% sabudana flour (T2 with 3:2 proportion of *rajgira* and *sabudana flour)* ranked highest with a mean value of 8. This was very close to treatment T5 (1:3 proportion of *rajgira* and *sabudana flour)* and to treatment T4 (2:3 proportion of *rajgira* and *sabudana flour)* substitution which was mean value 6.4 and 6.5. For treatment T1 (3:1 proportion of *rajgira* and *sabudana flour*) sensory scores were fairly high i.e., a score of 6.2.

Based on flavor there was no significant difference upto the 1:3 substitution of *rajgira* and *sabudana*. Also there was no significant difference

from 2:3 (6.8 score) substitution upto 1:1 (score 6.3) the product where like slightly. Since flavour is determining factor in consumer acceptance of biscuit it can deduct that the biscuit is accepted up to 2:3 substitution with *sabudana* flour, i.e, the mean value 7.6.

Table 3: Physical characteristics of biscuits

Sample Code	T1	T2	T3	T4	**T5**
Weight (g)	6.79±0.19	6.47±0.44	6.69±0.34	6.83±0.30	6.41±0.39
Diameter (cm)	3.22±0.82	3.93±0.04	4.09±0.04	4.0±0.06	4.05±0.04
Thickness (cm)	0.69±0.04	0.67±0.04	0.69±0.04	0.69±0.04	0.69±0.04
Spread Ratio	5.82±0.35	5.93±0.42	5.88±0.31	5.64±0.08	5.87±0.35
Volume (cm^3)	8.12±0.67	9.14±0.21	9.06±0.68	8.96±0.28	8.88±0.63
Density (g/cm^3)	0.74±0.02	0.79±0.07	0.76±0.04	0.75±0.02	0.72±0.03

Table 4: Proximate compositions of biscuit samples

Biscuit Samples	T1	T2	T3	T4	T5
Ether extract (%)	27.2	26.4	35.3	26.6	31.9
Ash content (%)	1.0	2.0	1.0	1.0	0.5
Moisture content (%)	2.5	4.5	4.5	1	3.0

Table 5: Mean values of the sensory scores for biscuits made from the flour composites.

Sample code	Color	Taste	Flavor	Texture	Overall Acceptability
T1	7.3 (±1.10)*	6.7 (±0.78)	6.2 (±0.74)	6.2 (±0.74)	6.55 (±0.63)
T2	7.9 (±0.83)	8.1 (±0.94)	6.7 (±0.91)	8.0 (±1.00)	7.80 (±0.73)
T3	7.3 (±0.78)	6.8 (±0.87)	6.3 (±1.18)	5.7 (±1.30)	6.52 (±0.74)
T4	7.0 (±1.09)	6.7 (±0.90)	6.8 (±0.87)	6.5 (±0.92)	6.77 (±0.73)
T5	7.2 (±0.87)	6.9 (±0.94)	6.7 (±0.78)	6.4 (±1.49)	7.77 (±0.63)

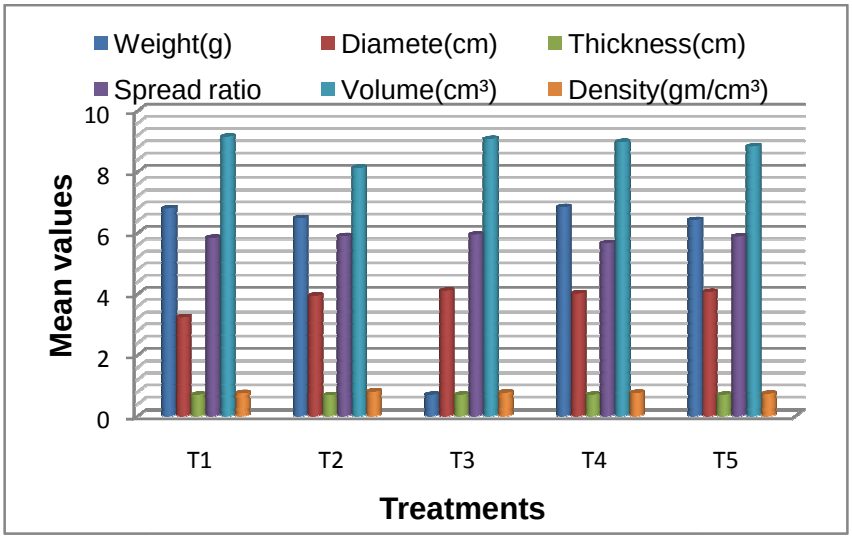


Fig 3: Physical characteristics of Biscuits

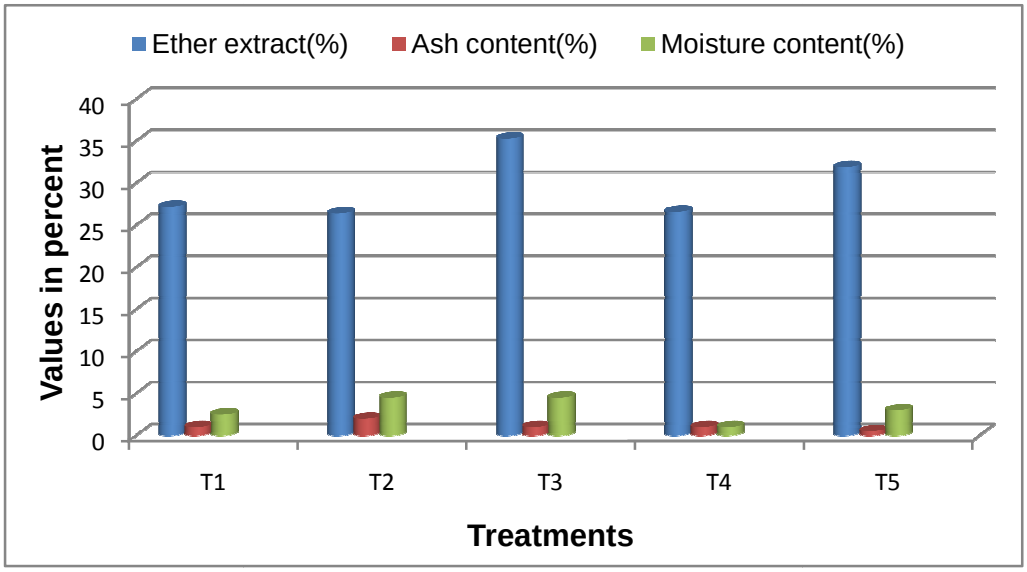


Fig 4: Proximate analysis of standardized Biscuits after baking

The taste result shows that the biscuits made from *rajgira* and *sabudana* flour in 3:2 ratio had the highest mean score of 8.1 and this was closely followed by that 1:3 and 1:1 substitution with *rajgira* and *sabudana* flour with mean score of 6.9 and 6.8 respectively and there was no significant difference between them. This result has prove that this 3 samples were equally accepted in terms of taste of the biscuit sample. There was no significant difference between 3:1 and 2:3 (*rajagira* and *sabudana*). From the results, it could be deduct that upto 75:25% substitutions with *rajgira* and *sabudana* flour (3:1 proportion) could not be accepted by the panelists because it was sour in taste and 3:2 substitutions with *rajgira* and *sabudana* flour could be accepted by panelists with mean score of 8.1.

Sensory evaluation of biscuits highlighted their sensory characteristics. Clarity of biscuits is partly due to the whiteness of the *sabudana* flour. Color is the important parameter to correctly asses the baked biscuits (Hussain *et al*., 2006). The colors of the product were fairly accepted (slightly liked) 1:1 and 3:1 proportion (i.e., *rajgira* and *sabudana*) with same mean score of 7.3. There was no significant difference in colour upto 1:3 proportion. From the result 3:2 proportion of *rajgira* and *sabudana* flour could be accepted by the panellists with the mean score of 7.9.

4. Conclusion

Incorporation of *rajgira* flour with *sabudana* flour in 3:2 proportions was found to be the most acceptable combination in biscuit making with respect to nutritional, textural and organoleptic qualities of biscuits. Biscuits with incorporation *of rajgira* flour with *sabudana* in 3:1 proportion were found to be nutritionally superior but not well accepted with respect to sensory qualities. Incorporation with *rajgira* flour enriched the energy content of biscuits. As the fat content of biscuits prepared from *rajgira flour* and *sabudana* flour in 3:2 proportion, was less i.e. 26.4% and thus it was beneficial for health. So according to quality evaluation and sensory evaluation the biscuits prepared from *rajgira* flour with *sabudana* flour in 3:2 proportions were giving comparatively higher quality.

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