Development of functional biscuit from soy flour & rice bran

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Abstract

The research intended to explore the possibility of fortifying the soy flour and rice bran to formulate the functional biscuit which have the ability to improve the quality of food products due to various functional properties. Supplementation of wheat flour with soya and rice bran was tried at 10 %, 15%, 20%, 25% level each. Prepared biscuit is subjected to physical, Sensory and nutritional analysis to evaluate the suitability of biscuit for consumption. The width of biscuit decreases from 44 to 36.2 with increasing in the level of substitution of composite flour of rice bran and soya. Similar tread shown by spread radio. However, biscuit thickness increases from 9.2 to 10.6 with increasing level of substitution. Nine Point Hedonic Score System was used for sensory evaluation of prepared biscuit which is generally decreases with increasing the level of substitution. From overall acceptability rating, 15% soy flour +15% rice bran incorporated biscuit obtained the highest rating compare to other treatments. At p≤0.05, there were no significant difference between the control treatment and best rated supplemented biscuit (70:15:15) in general preference of sensory rating. Nutritional evaluation of best rated supplemented biscuit were protein (15.7%), fat (19.5%), fiber (2.2%), moisture (3.6%). Thus supplementation of soy flour and rice bran at 15% level each, would improve the nutritional quality without adversely affecting the sensory parameters.

Key words: Soya flour, Rice bran, Composite flour

Introduction

Biscuit is most popular bakery product worldwide. They are high in carbohydrates, fat and calorie but low in fiber, vitamin, and mineral which make it unhealthy for daily use. Because of its acceptability in all age group, longer self life, better taste and its position as snacks it is consider as a good product of for protein fortification and other nutritional improvement. Soyabean is an excellent source of protein contain 35-45% [1] with all essential amino acids required for proper growth and maintenance of body. Beside this, it is high in vitamin, mineral and antioxidant like Isoflavones which helps in cholesterol reduction, preventing cancer and regulation of menopause. The main ingredients of any bakery products is wheat, which is having deficiency of essential amino acid lysine [2, 3, 4].Whereas soyabean is richer in lysine and can be complement to wheat in bakery products. Soyabean protein is more economical than high priced meat protein and so they are considered as best source of protein especially in vegetarian diet. Study carried out by Shakuntale b. Masum, 2008 found that enrichment of defatted soya flour up to 20% improves the nutritional quality of bakery products like biscuit, bread muffins without affecting its taste, textural and overall acceptability of product. Nutritional quality and consumer acceptability of soya cereal blends improves the nutritional status of vulnerable groups like pregnant woman, nursing mother, school going & young children [5]. Protein energy malnutrition (PEM) is one of the most serious health problems in many part of country esp. in developing countries like India [7]. High protein soya bakery product reduce incidence of malnutrition [6] and encourage the farmers to grow more soyabean due to increasing demand in the market [8].

Rice bran is one of the most important cereal product produced in Asia [9] and used as staple food crop by 50% of population of the world. Rice bran contains 20% oil and 15% protein, 50% carbohydrate (majorly starch) dietary fibers like beta-glucan, pectin, and gum [10, 11, 12]. The rice bran also rich in antioxidant compounds viz polyphenols, carotenoids,
vitamin-E gamma oryzanol, and tocotrienol which help in preventing the oxidative damage of body tissues and DNA. In the study by Ling et al. [13] showed significant reduction in atherosclerotic plaque by feeding rice bran fraction. Rice bran is rich in soluble fiber like beta-glucan, pectin, gums which helpful in reduction of chronic ailments like in serum cholesterol [14 15], certain forms of cancer [16, 17, 18, 19] and constipation [20, 21]. In another study it is found that rice bran serves as an important functional food that has cholesterol lowering properties, cardiovascular health benefits and anti-tumor activity [22].In addition of high nutritive value rice protein is hypoallergic [20, 23] which is easily digestible and have an anticancerous property [24] until recently it was used as feed additives for animal fodder [25] due to presence of anti-nutritional factors such as lipases, trypsin inhibitors, haemagglutinin- lectin and phytates. Rice bran effectively utilized as a supplement for bakery products like cookies, muffins, bread, crackers, pastries, pancakes [26]. Stabilized rice bran were supplemented in cookies up to 20 % [27]. With increasing awareness of a healthy and functional food, fortified bakery product becomes the emerging market in the bakery industry [28]. Nutritional and functional properties of soyaflour and rice bran efficiently utilize to prepare bakery products like bread, biscuit, muffins etc [29].

2. Material and method

2.1 Raw Material: Following material has been collected to prepare biscuit, which is arranged from local market:
- Wheat flour
- Soyabean seed
- Sucrose
- Sodium bicarbonate
- Egg

Soyabean seed were milled to flour in local mill whereas rice bran from parboiled rice was obtained from Rice Mill situated in Mauiama, Pratapgarh district, Uttar Pradesh.

2.2 Preparation of Composite Flour

Composite flour is prepared by substituting the wheat flour with soya flour and rice bran in the ratio of 100:0:0, 80:10:10, 70:15:15, 60:20:20, 50:25:25 as shown below:

Treatments:
- T1 - Biscuit made by 100% wheat flour
- T2 - 10% soya flour + 10% rice bran + 80% wheat flour.
- T3 - 15% Soyabean flour + 15% rice bran + 70% wheat flour.
- T4 - 20% Soyabean flour + 20% rice bran + 60% soyaflour.
- T5 - 25% Soybean flour +25% rice bran + 50% wheat flour.

2.3 Composite biscuit production

A known weight of hydrogenated fat and powdererd sugar was creamed together at medium speed until light and fluffy appearance is formed. Then all purpose composite flour and baking powder is mixed together. The mixed flour and egg were added to the creamed paste and mixed until uniform smooth dough was obtained. The dough was rolled out to 3mm thickness on a board and cut into round shape of about 5 cm in diameter with a biscuit cutter. The biscuit were placed in a greased baking tray and baked in a laboratory preheated oven at 180°C for 10 min, according to the methods of AOAC (2000)[30].

2.4 Physical analysis

Soy-rice bran supplemented biscuit was analyzed for width, thickness and spread factor by following the procedure of AOAC (2000) [30].

A: Width (W): Six biscuit were placed horizontally (edge to edge) in a row and taken their average diameter using digital venier caliper with 0.01 mm accuracy.
B: Thickness: Six biscuit were placed one another and taking their average thickness using digital venier caliper with 0.01 mm accuracy.
C: Spread factor: The spread factor (SF) were calculated using relationship between SR, W, T and correlation factor CF as shown in the formula given below

\[ SF = (W/T \times CF) \times 10 \]

2.5 Sensory Evaluation:

Sensory attributes like color, flavor, taste, texture, crispness and overall acceptability were evaluated by trained judges using 9-Point Hedonic Score System. The panelist gives score 9-1 to the product, ranging from ‘like extremely’ to ‘disliked extremely’ to find out the most suitable composition of biscuit. The mean squares were analyzed using analysis of variance (ANOVA) method.

2.6 Nutritional analysis of composite biscuit:

The moisture, fat, protein crude fiber, mineral content of best rated composite flour is determined by standard AOAC (2000) methods [30].

3. Results and Discussion

3.1 Physical analysis of supplemented cookies:

The result of the physical analysis of the functional biscuit produced from wheat, soyabean and rice bran flour blends is shown in (Table 1), which shows that the supplementation of various levels of composite flour has a significant effect on width, thickness and spread ratio of cookies. The result obtained agreed with result reported by Bunde MC et al. [31]. The width of biscuit decreases from 44 to 36.2 with increasing in the level of substitution of composite flour of rice bran and soya. The result shows that control treatment T0 has the maximum width 44mm, followed by T1(41.35) and T2 (39.5) while minimum width was observed in T4 (36.2). However, biscuit thickness increases from 9.2 to 10.6 with increasing level of substitution (Table 1). The result shows that T4 has maximum thickness 10.6 followed by T3 (9.95) and T2 (9.6) while minimum width was observed in control treatment T0 (9.2). The spread ratio was affected by
Table 1: Mean for effect of treatments on physical characteristic of biscuits

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Width</th>
<th>Thickness</th>
<th>Spread Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>44</td>
<td>9.2</td>
<td>47.8</td>
</tr>
<tr>
<td>T1</td>
<td>41.35</td>
<td>9.35</td>
<td>44.2</td>
</tr>
<tr>
<td>T2</td>
<td>39.5</td>
<td>9.6</td>
<td>41.4</td>
</tr>
<tr>
<td>T3</td>
<td>38.5</td>
<td>9.95</td>
<td>38.6</td>
</tr>
<tr>
<td>T4</td>
<td>36.2</td>
<td>10.6</td>
<td>34.1</td>
</tr>
</tbody>
</table>

Overall acceptability was determined on the basis of quality scores obtained from the evaluation of color, flavor, and texture of the biscuit. The mean regarding overall acceptability of biscuit are shown in Figure 6 revealed that the overall acceptability of T2 (15% soya flour + 15% rice bran) was highest while 25% soya flour has lowest acceptability. The decrease in overall acceptability was due to decrease in color, flavor, and taste texture score. At 30% (15% soya flour + 15% rice bran) level of incorporation, biscuit had highest scores for the entire sensory attributes than other treatment.

3.3 Nutritional analysis of composite biscuit
The result of proximate composition of 100% Wheat and best rated composite biscuit 70% Wheat + 15% Soya flour + 15% rice bran as shown in Table 3.

4. Discussion
4.1 Protein Content
The protein content of the biscuit increased with the increase in supplementation. The increase in protein content could be due to the soya fraction of the blended flour as the soya flour has higher protein (40.2%) as compare to rice bran (13.5%) and wheat flour (12.1%). Soyabean is an excellent source of protein & complement to lysine-limited cereal protein. Addition of soy flour improve the quantity & quality of protein content of the food product, thereby has the great potential in combating with protein energy malnutrition [42]. The protein content of the most preferred composite biscuit has higher protein content (15.7) than the control (9.43), similar trend were also reported by VD Banureka and T Mahendrars et al. [43] (Figure 7.8).

4.2 Fiber Content
The fiber content of the biscuit increased with the increase in supplementation. The increase in fiber content could be due...
to the rice fraction of the blended flour. Since dehulled soya flour was used. Thus rice bran has higher fiber content than both soyaflour and wheat flour.Total dietary fiber (TDF) intake for adult men and women are 38 & 25g/d respectively (IOM 2002). Rice bran’s fiber comprised of a relatively low proportion of soluble fiber (7 to 13 %) and rest is insoluble fiber. Soluble fibers are effective in reducing total blood cholesterol and promoting satiety, and insoluble fibers help in treating constipation and reduce the risk of colon cancer and diverticular disease (33,8,28;36).The rice bran enriched biscuit may be helpful incurring the constipation [44] and other ailments related to fast food habits like CVD [45]. The fiber content of the most preferred composite biscuit has higher fiber content (2.2) than the control (0.18) (Figure 7, 8).

4.3 Fat Content:
The fat content of the most preferred composite biscuit has higher fat content (19.5) than the control (12.5). The increase in fat content of the 30% supplemented soy-rice bran flour for wheat biscuit could be due to both soya and the rice fraction of the blended flour as both of these ingredient are rich in oil, which is (15-19.7%) and (18 to 20 %) respectively. Soyabean have 20-22% high valued oil which is cholesterol free (31). The oil of soybean contains 85% unsaturated fatty acid which includes 61% of polyunsaturated fatty acid and 24 % of monounsaturated fatty acid. Polyunsaturated fats includes the linoleic & linolenic acids that are not produced in the body but essential for proper development and maintenance of human health.[46]. Soybean has 3% lecithin which is helpful for brain development. (Figure 7, 8).

4.4 Moisture Content:
The moisture content of the most preferred composite biscuit has slightly higher moisture content (3.6) than the control (3.4). The moisture content of the biscuit increase with the increase in supplementation this is could be due to the fact that soya and rice bran absorb moisture in baked product.A high level of moisture content may be indicate short self life of composite biscuit as they encourage microbial growth leads to spoilage. (Figure 7, 8).
Table 2

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Taste</th>
<th>Colour</th>
<th>Texture</th>
<th>Flavour</th>
<th>Overall Acceptability</th>
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<tr>
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<td>5.2</td>
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Table 3

<table>
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<tbody>
<tr>
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<tr>
<td>Fiber</td>
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<td>19.5</td>
</tr>
<tr>
<td>Moisture</td>
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</tr>
<tr>
<td>Minerals</td>
<td>0.19</td>
<td>1.9</td>
</tr>
</tbody>
</table>

4.5 Mineral Content:

These are the inorganic material present in ash. Ash content indicated an estimate of the total mineral content in a given quantity of food substance. The mineral content of the most preferred composite biscuit was higher mineral content (1.9) as compare to the control (0.19). The increase in mineral content could be due to the rice fraction of the blended flour as the rice bran has higher mineral content as compare to soyaflour and wheat flour. (Figure 7, 8).

5. Conclusion

It is evident from the experiment that biscuit can be made with substitution of soy flour & rice bran upto 15 % each without adversely affecting the sensory characteristic of biscuit. This functional biscuit al is nutritionally more superior to that of whole wheat flour biscuit. It can be use as a vehicle for protein fortification and other nutritional improvement as biscuit is widely accepted bakery product in India.

References:

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