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Formation of high fiber biscuit

NEHA MISHRA

Due to increasing nutritional awareness among consumer for high fiber, the present study was conducted to explore the possibility to incorporate rice bran in biscuit to increase fiber content. Supplementation of wheat flour with rice bran was tried at 10 per cent, 15 per cent, 20 per cent, 25 per cent level each. Prepared biscuit was subjected to physical, sensory and fiber content analysis to evaluate the suitability of biscuit for consumption. The width of biscuit decreased from 44 to 38.5 mm with increasing in the level of substitution of composite flour of rice bran. Similar trend shown by spread radio (47.5 to 40.8 mm). However, biscuit thickness increased from 9.2 to 9.6 mm with increasing level of substitution. Nine-point hedonic score system was used for sensory evaluation of prepared biscuit which was generally decreased with increasing the level of substitution. At $p<0.05$ physical and sensory evaluation indicated that there were no significant differences between control treatment and composite biscuit of 85 per cent wheat flour and 15 per cent rice bran. Thus incorporation of rice bran not only improve the fiber content of biscuit (3.1%) but also add way to utilizing rice bran to increase fiber content in bakery product.

Key Words : Fiber biscuits, Wheat flour, Rice bran

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INTRODUCTION

Dietary fiber provides several health benefits including reducing the risk of coronary heart disease (Wolk *et al.*,1999; Pietinen *et al.*, 1996), type 2 diabetes (Kaline *et al.*, 2007), obesity (Pereira and Ludwig, 2001) metabolic syndrome and maintaining a healthy body weight (Howarth *et al.,* 2001 and Slavin, 2005).The recommended daily intake of adult men and women are 38 and 25g/d, respectively. But usual daily intake of dietary fiber was low enough and it to be of concern (John *et al*., 2008). Supplementation of rice bran in basic recopies of biscuit is one way to increase the fiber content in bakery product.

Biscuits are ready-to-eat, convenient and inexpensive food product with longer self life which increase its consumption and demand (Kulkarni, 1997). The principal ingredients of bakery products are refined flour, fat, sugar and water (Wade, 1988). Biscuits are typically high in both fat and sugar and low in fiber and have been identified as a food contributing to negative health (Department of Health and Social Services,1995). It has been recommended that the intake of biscuits and related products should be reduced (Adachi and Hino, 2005; Ashwell, 1993). This study concentrated on one of the best selling biscuits in the UK that is consumed regularly by both children and adults. Consumption of high fiber products have several health benefits such as in hypertension, diabetes, colon cancer and many others. The role of dietary fiber in controlling chronic disorders like diverticulitis, bowel cancer, cardiovascular diseases, diabetes constipation etc. has been well documented. The dietary fiber content of baked goods may be increased by adding various plant components rich in dietary fiber like oat fiber, wheat bran, rice bran. Rice bran is the byproduct of milled rice which have been underutilized from many year inspite of it is a valuable source of nutrients (Kestin *et al.,* 1990). Rice bran is an excellent source of total dietary fiber ranging from 20-51 per cent (Saunders, 1990), which have many health benefits include increased faecal bulk and reduced blood cholesterol (Abdul and Yu, 2000). Defatted rice bran (DFRB) is rich in proteins, minerals and vitamins. Rice bran could be use as a supplement for bakery products like cookies, muffins, bread, crackers, pastries, pancakes (Barber, 1981) and in cookies up to 20 per cent (Singh *et al.*, 2000).

Due to increasing urbanization demand of convenience food like bread, biscuits have increased worldwide (Ogunjobi and Ogunwolu, 2010) so it acts as a good vehicle for fiber fortification especially in children. The present study was designed to made supplement wheat flour with fiber rich rice

AUTHOR FOR CORRESPONDENCE

NEHA MISHRA, Department of Food Science and Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, ALLAHABAD (U.P.) INDIA
Email: nehadesire2011@gmail.com

bran to formulate high fiber biscuit. At the same time incorporation of rice bran encourage the utilization of rice industrial by product.

METHODOLOGY

Raw material:

Raw material required for the preparation of biscuit were the wheat flour, sucrose, sodium bicarbonate, egg, hydrogenated fat was purchased from local market of Allahabad. Rice bran from parboiled rice was obtained from rice mill situated in Mauiama, Pratapgarh district, Uttar Pradesh.

Preparation of composite flour:

The wheat flour was substituted with rice bran in the ratio of 100:0,90:10, 85:15, 80;20, 75:25 as shown below:

Treatments:

T_1 - Biscuit made by 100% wheat flour
T_2 –10% rice bran + 90 % wheat flour.
T_3 -15 % rice bran + 85% wheat flour.
T_4 -20% rice bran + 80% wheat flour
T_5 -25% rice bran + 75% wheat flour.

Composite biscuit production:

Hydrogenated fat and powdered sugar were creamed together by electric beater. The flour with baking soda and egg were added to the creamed paste. As per the treatment, firm dough was prepared from all mixture. The dough was rolled out to 2.5mm thickness in a baking tray and cut into round in shape having 5cm diameter with a biscuit cutter. The biscuits were placed in greased aluminum trays and baked in a pre-heated oven at 150ºC for 4min, according to the methods of (AOAC, 2000; Grover and Singh, 1994).These biscuits were assessed for nutritional and organoleptic qualities.

Physical analysis:

Rice bran supplemented biscuit were analyzed for width, thickness and spread factor by following the procedure of AOAC (2000).

Width (W):

Six biscuit were placed horizontally (edge to edge) in a row and taking their average diameter using digital vernier caliper with 0.01 mm accuracy.

Thickness :

Six biscuit were placed one another and taking their average thickness using digital vernier caliper with 0.01 mm accuracy.

Spread factor:

The spread factor (SF) were calculated using relationship between spread ratio, width, thickness and correlation factor as shown in the formula given below:

$$SF=(W/T\times CF)\times 10$$

Sensory evaluation:

By using 9-point hedonic score system sensory evaluation of cookies were done. The trained judges evaluated the cookies for colour, flavour, taste, texture, crispness and overall with individual scores from liked extremely-9 to disliked extremely-1 to find out the most suitable composition of biscuit. The mean square was analyzed using analysis of variance (ANOVA) method.

Fiber contents of biscuits:

The fiber content of biscuit was estimated by AOAC (2000) method.

OBSERVATIONS AND ASSESSMENT

The result of the present study have been discussed and presented under the following heads with figure and graph:

Physical analysis of supplemented cookies:

The Table 1 and Fig. 1 show that the supplementation of various levels of rice bran has a significant effect on width, thickness and spread ratio of cookies. The result obtained agreed with result reported by Bunde *et al.* (2010).

The width decreased from 44 to 38.5 mm with increasing level of substitution (Table 1). The result shows that the control treatment T_0 has the maximum width 44mm, followed by T_1(43.2)

Table 1. Physical attributes of biscuit incorporated with different levels of defatted rice bran

Treatments	Width (mm)	Thickness (mm)	Spread ratio
T_0	44	9.25	47.5
T_1	43.2	9.32	46.3
T_2	40.05	9.39	42.6
T_3	39.39	9.4	41.9
T_4	38.5	9.42	40.8

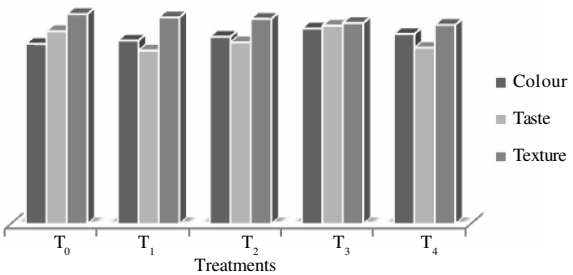

Fig. 1. Organoleptic evaluation of fiber biscuit

Table 2. Sensory attributes of biscuits incorporated with different levels of defatted rice bran

Treatments	Colour	Taste	Texture	Flavour	Overall acceptability
T_0	6.54	7	7.62	6.9	7.03
T_1	6.66	6.3	7.5	6.5	6.74
T_2	6.8	6.6	7.45	6.7	6.88
T_3	7.1	7.2	7.3	7.05	7.16
T_4	6.9	6.4	7.23	6.32	6.71

and T_2 (40.05) while minimum width was observed in T_4 (38.5). However, biscuit thickness increased from 9.25 to 9.42 with increasing level of substitution (Table 1). The treatment T_4 had maximum thickness 9.42 followed by T_3 (9.4) and T_2 (9.39) while minimum width was observed in control treatment T_0 (9.25). The spread ratio was affected by the competition for the available water. The spread factor of biscuit decreased from 47.5 to 40.8 with increasing the supplementation. .The control treatment T0 has the maximum spread factor 47.5mm, followed by T_1(46 .3) and T_2 (42.6) while minimum width was observed in T_4 (40.8) (Fig. 1).

Sensory analysis:

Mean score for sensory evaluation of biscuit given in (Table 2). Sensory rating of biscuit for colour shows that treatment T_3 (7.1) ranked at top due to excellent appearance, followed by T_4 (6.9) and T_2 (6.8) while minimum colour observed in in control treatment (6.54). Results show that defatted rice bran supplemented biscuit had darker colour than untreated biscuit. With increasing level of substitution the colour of biscuit turned from light brown to dark brown, leading to lower acceptance. The darker colour may be due to the non enzymatic reaction (Maillard reaction) between reducing sugar molecules and l protein (Tsuji *et al.,* 2001 and Decker *et al.,* 2002). Browning colour of bakery product like bread, biscuit might be due to caramelization, dextrinisation of starch or maillard reaction (Sudha *et al.*, 2007). Mean for taste shown in (Table 2) revealed that the judges ranked treatment T_3 (7.2) at top position followed by control treatment T_0 (7.0) followed by treatment T_2 (6.6) while T_1 (6.3) placed at the bottom.

Mean for flavour shown in Table 2 revealed that the judges ranked control treatment T_3 (7.05) at top position followed by control treatment T_0 (6.9), T_2 (6.7) while T_4 (6.32) placed at the bottom. Mean for texture shown in Table 2 revealed that the control treatment had highest scoreT_0 (7.62) followed by treatment T_2 (7.5), T_1 (7.45) while T_4 (7.23) had least score (Fig. 2).

Overall acceptability was determined on the basis of quality scores obtained from the evaluation of colour, flavour, and texture of the biscuit. The mean regarding overall acceptability of biscuit is shown in Table 2 revealed that the overall acceptability of T_3(15% rice bran) was highest while T_4 (20%) rice bran has lowest acceptability. The decrease in overall acceptability was due to decrease in colour, flavour and taste

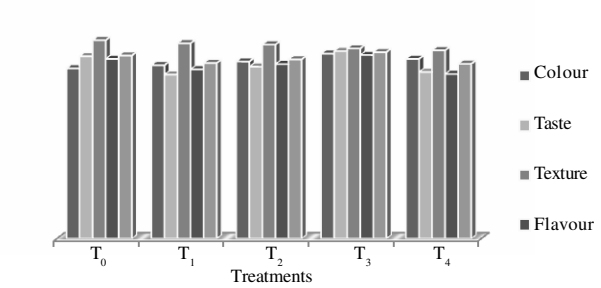

Fig 2: Organoleptic analysed fiber biscuit

texture score. At 15 per cent rice bran level of incorporation, biscuit had highest scores for the entire sensory attributes than other treatment.

The fiber content of the biscuit increased with the increase in supplementation of rice bran. High fiber diet play important role in reduction of blood cholesterol and incidence of cancer (Kawamura and Muramoto, 1993). Rice bran's fiber comprised of a relatively low proportion of soluble fiber (7 to 13 %) and rest is insoluble fiber (Anderson *et al.,* 1990). The rice bran enriched biscuit may be helpful incurring the constipation (Wadsworth, 1992) and other aliments related to fast food habits like CVD (Gordon, 1999). The fiber content of the most preferred composite biscuit was higher fiber content (3.1) than the control (0.18).

Conclusions:

This research was conducted to utilize the waste product of rice processing industry-rice bran to increase the fiber content of biscuit. The result of this research revealed that biscuit produced from substitution up to 20 per cent improved the fiber content, without adversely affecting the physical and sensory attributes. The biscuit with substitution with 15 per cent had highest physical and sensory qualities could provide fiber. Since rice is the leading and staple crop of Asian country, its byproduct rice bran is relatively cheaper. Thus substitution of rice bran upto20 per cent in the formulation of biscuit will be more economical to increase the fiber content of biscuit.

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