

Preparation of gluten free rice flour biscuits

K.D. MORE, S.V. GHODKE AND D.H. CHAVAN

Gluten is the main structure-forming protein in wheat flour, and is responsible for the elastic characteristics of dough, and contributes to the appearance and crumb structure of many baked products. The component of gluten that causes problems for people with coeliac disease. The only effective treatment for coeliac disease is a strict adherence to a gluten-free diet throughout the patient's lifetime. This can be achieved by formulation of gluten free products. The present investigation was undertaken to prepare gluten free rice flour biscuits. Three samples were prepared with 2:1, 1:1 and 1:2 proportions of brown rice flour and white rice flour. Overall acceptability of rice flour biscuits was found in the range from 7.3 to 8.0. Acceptable gluten free biscuits can be prepared from rice flour.

Key Words : Brown rice flour, White rice flour, Biscuits, Coeliac disease, Gluten free

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INTRODUCTION

Rice (*Oryza sativa*) has been, throughout history, one of the most important foods in the human diet and one of the most extended cereal crop (9% of the total cultivated soil). It is the grain with second largest worldwide production, after maize (corn). Rice is mainly consumed as white grain, but in the last decade dozens of products containing rice as an ingredient have appeared on the food market. Rice provides 27% of the total energy intake in the developing countries, and only 4% of the total energy intake in the developed countries. Like other cereals, rice is a cheap source of proteins. The rice grain is rich in complex carbohydrates, and represents a source of protein, minerals, vitamins (Vit. B) and does not contain cholesterol (Cristina and Cristina, 2008).

Gluten is a protein found in wheat, rye, barley, triticale and oats that adds stickiness and sponginess to dough. The component of gluten that causes problems for people with coeliac disease. The prolamine fraction in wheat is called gliadins. The reaction to gluten ingestion by sufferers of coeliac

disease is inflammation of the small intestine leading to the malabsorption of several important nutrients including iron, folic acid, calcium and fat soluble vitamins (Feighery, 1999; Kelly *et al.*, 1999). Murray (1999) concluded that coeliac disease is the end result of three processes (genetic predisposition, environmental factors and immunologically-based inflammation) that culminates in intestinal mucosal damage. The only effective treatment for coeliac disease is a strict adherence to a gluten-free diet throughout the patient's lifetime, which, in time results in clinical and mucosal recovery.

Gluten is the main structure-forming protein in flour, and is responsible for the elastic characteristics of dough, and contributes to the appearance and crumb structure of many baked products. Gluten removal results in major problems for bakers, and currently, many gluten-free products available on the market are of low quality, exhibiting poor mouth feel and flavor (Arendt *et al.*, 2002). This presents a major challenge to the cereal technologist and baker alike, and has led to the search for alternatives to gluten in the manufacture of gluten free bakery products. This review discusses the concept of coeliac disease and its increasing prevalence, and focuses on advances in the formulation of gluten free cereal-based products. Gluten free rice flour biscuits are beneficial than wheat flour biscuits in the sense that rice flour biscuits has a low fat, low calorie, low sodium, low cholesterol and high fibre content and rarely has an allergic reaction in comparison with wheat flour biscuits (Gallagher *et al.*, 2004).

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METHODOLOGY

Ingredients :

Brown rice and white rice of local variety were obtained from local market. Ingredients such as corn flour, light brown sugar, shortening, salt, baking powder and vanilla essence were obtained from local market.

Equipments :

Equipments such as rice mill, dough kneader, cutter, baking oven were used for preparation of rice flour biscuits.

Packaging material :

Polyethylene bags of 300 gauges were used for packaging of biscuits.

Methods :

The detailed process for preparation of rice flour biscuits is shown in Fig.A.

Preparation of rice flour biscuits :

Preliminary operations :

Good quality brown rice of local variety was obtained from local market. It was cleaned. Then some of it was milled in flour mill to obtain brown rice flour and remaining was polished. After that polished rice was milled to obtain white rice flour.

Mixing of flours :

Brown rice flour was added to white rice flour in three proportions such as 2:1, 1:1 and 1:2.

Mixing of all ingredients :

All ingredients were mixed in appropriate proportions as per Table A.

Dough formation :

For preparation of dough required water was added up to desired consistency. The whole mass was then kneaded to make smooth dough of desired consistency.

Sheeting and cutting :

The dough was sheeted by using bellan to 5mm thick. Then it was cut into desired size of 3.3 x 3.3cm by using cutter.

Baking :

The cut pieces were placed on perforated trays and baked in oven at 180°C for 25 min to obtain rice flour biscuits.

Packaging :

Baked biscuits were then packed in 300 gauge polythene bags.

Determination of chemical analysis :

Raw material and final products were analyzed for moisture, carbohydrates, proteins, fats, ash, total sugar, reducing sugar, gluten content.

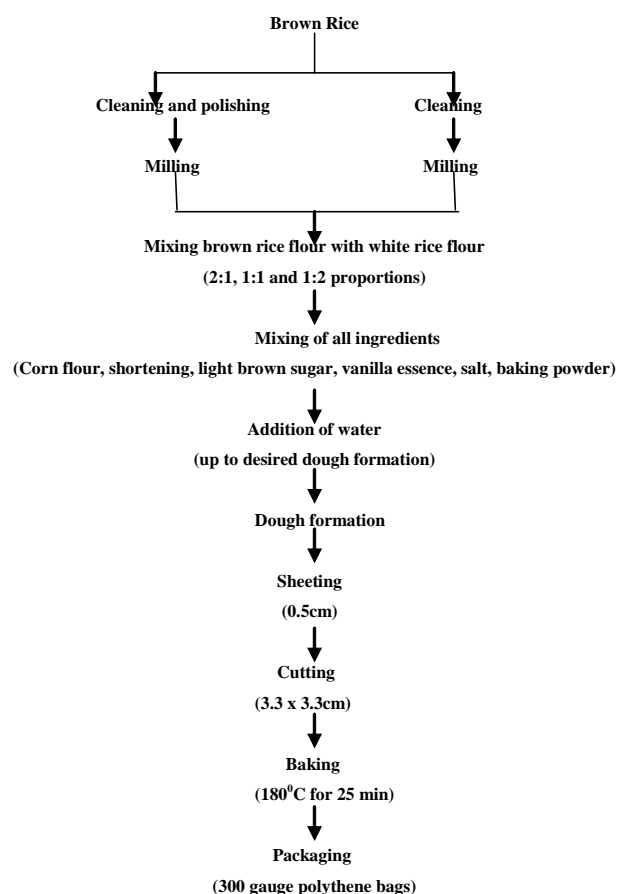


Fig. A. Process flow chart for preparation of gluten free biscuits

Table A. Samples prepared for rice flour biscuits

Sample (g)	Brown rice flour (g)	White rice flour (g)	Corn flour (g)	Shortening (g)	Light brown sugar granulated (g)	Sunflower oil (g)	Baking powder (g)	Salt (g)	Vanilla essence (g)
S ₁	100	50	16	60	32	16	1	1	0.2
S ₂	100	100	16	60	32	16	1	1	0.2
S ₃	50	100	16	60	32	16	1	1	0.2

Moisture :

For determination of moisture content standard oven method was used (AOAC, 1990). Samples were taken in Petri plates and dried in hot air oven at 105°C temperature until the material were bone dry. The samples were then removed from oven and cooled in desiccators for 20 min. The samples were then weighed. The moisture content was calculated by using following formula:

$$\text{Moisture Content (\%w.b.)} = \frac{W_1 - W_2}{W_1} \times 100$$

where,

W_1 = Weight of sample before drying, g.

W_2 = Weight of bone dry sample, g.

Fat :

For determination of fat Soxhlet method was used (Ranganna, 2007).

Protein :

For determination of protein Micro-kjeldahl method was used (Ranganna, 2007).

Carbohydrates :

For determination of carbohydrates Anthrone method was used (Ranganna, 2007).

Total sugar :

For determination of total sugar G. M. Miller method was used (Ranganna, 2007).

Total reducing sugar :

The total reducing sugar was determined by Nelson's Somogyi's / DNSA method was used (Ranganna, 2007).

Determination of physical properties of biscuits :

Three different samples of biscuits were analyzed for size and weight.

Size :

Lengths, breadth, thickness of the biscuit were measured by using vernier caliper. From this size of biscuit was determined by using formulae.

$$\text{Size} = (\text{length} \times \text{breadth} \times \text{thickness})^{1/3}$$

Weight :

Weight of biscuit was measured using weighing balance.

Sensory evaluation :

The sensory evaluation of different organoleptic properties viz., colour, appearance and texture, taste, flavor and overall acceptability were carried by panel of 10 judges of

different groups and food habits on basis of 9 point hedonic scale (Anonymous, 1971). The average score was calculated for individual organoleptic properties. The overall acceptability score 7 to 9, 5 to 6 and below 5 were evaluated as more acceptable, acceptable and not acceptable products, respectively.

OBSERVATIONS AND ASSESSMENT

The experimental findings as influenced by different parameters are discussed below :

Chemical composition of raw material :

Chemical properties of raw materials were determined and tabulated in Table 1.

Table 1. Chemical composition of raw material

Composition	Brown rice flour	White rice flour
Moisture(%)	7.0	4.2
Carbohydrate(%)	87.2	66.8
Protein(%)	8.7	13.2
Fat(%)	6.09	8.09
Ash(%)	2.0	1.0
Total sugar(%)	1.2	0.8
Reducing sugar(%)	0.6	0.2

Table 2. Chemical composition of rice flour biscuits

Composition	(S1) Biscuits	(S2) Biscuits	(S3) Biscuits
Moisture(%)	6.7	3.7	5.5
Carbohydrate(%)	57.75	48.15	52.32
Protein(%)	8.6	7.6	10.7
Fat(%)	9.14	8.32	10.13
Ash(%)	2.2	1.2	1.5
Total sugar(%)	1.2	0.8	1.0
Reducing sugar(%)	0.6	0.2	0.4

Chemical composition of rice flour biscuits :

Chemical composition of rice flour biscuits is shown in Table 2.

Moisture :

Moisture content in the rice flour biscuit was found in the range from 3.7-6.7%. It was found maximum (6.7%) in the biscuit with 2:1 proportion of brown rice flour and white rice flour whereas minimum (3.7%) in biscuit with 1:1 proportion.

Carbohydrate :

Carbohydrate content in the rice flour biscuit was found in the range from 48.15 - 57.75%. It was seen that there was marked effect of rice flour on carbohydrate content. It was found maximum (57.75%) in the biscuit with 2:1 proportion of brown rice flour and white rice flour whereas minimum (48.15%) in biscuit with 1:1 proportion.

Protein :

Protein content in the rice flour biscuit was found in the range from 7.6-10.7%. It was seen that there was marked effect of rice flour proportion on protein content. It was found maximum (10.7%) in the biscuit with 1:2 proportion of brown rice flour and white rice flour whereas minimum (7.6%) in biscuit with 1:1 proportion.

Fat :

Fat content in the rice flour biscuit was found in the range from 8.32-10.13%. It was seen that there was marked effect of rice flour proportion on fat content. It was found maximum (10.13%) in the biscuit with 1:2 proportion of brown rice flour and white rice flour whereas minimum (8.32%) in the biscuit with 1:1 proportion.

Ash :

Ash content in the rice flour biscuit was found in the range from 1.2-2.2%. It was seen that there was marked effect of rice flour proportion on ash content. It was found maximum (2.2%) in the biscuit with 2:1 proportion of brown rice flour and white rice flour whereas minimum (1.2%) in the biscuit with 1:1 proportion.

Table 3. Physical properties of rice flour biscuits

Sample	Size (cm)	Weight (g)
S ₁	1.80	7.00
S ₂	1.78	6.80
S ₃	1.76	6.60

Total sugar :

Total sugar content in the rice flour biscuit was found in the range from 0.8-1.2%. It was seen that there was no marked effect of rice flour proportion on total sugar content. It was found maximum (1.2%) in the biscuit with 2:1 proportion of

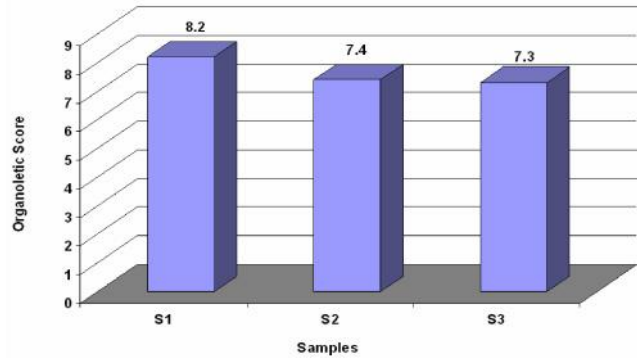


Fig. 3. Effect of different brown and white rice flour ratios on taste of biscuits

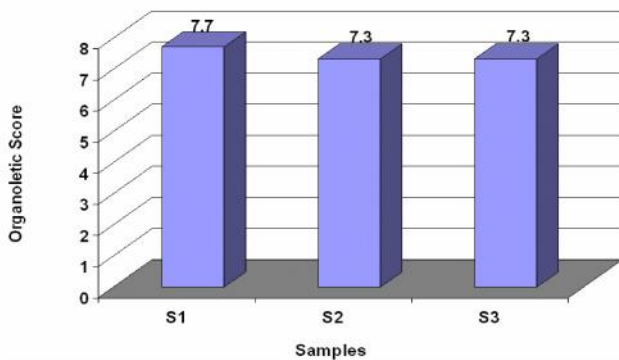


Fig. 1. Effect of different brown and white rice flour ratios on colour and appearance of biscuits

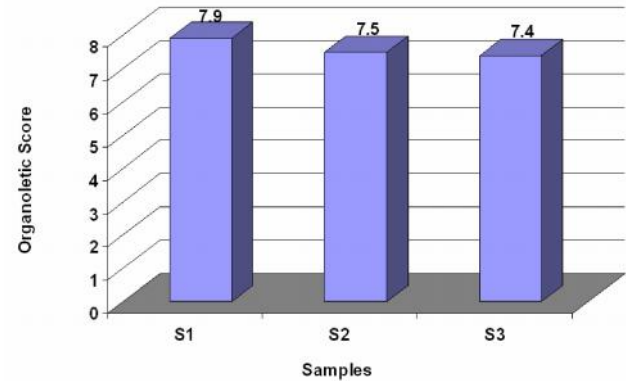


Fig. 4. Effect of different brown and white rice flour ratios on flavour of biscuits

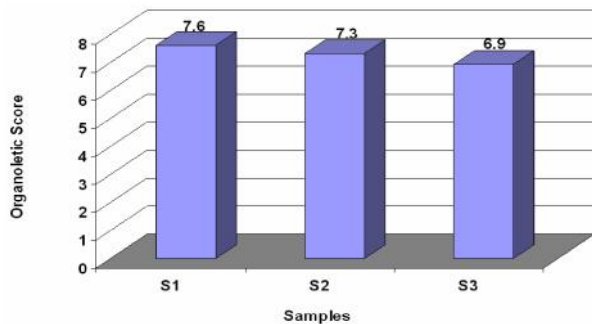


Fig. 2. Effect of different brown and white rice flour ratios on texture of biscuits

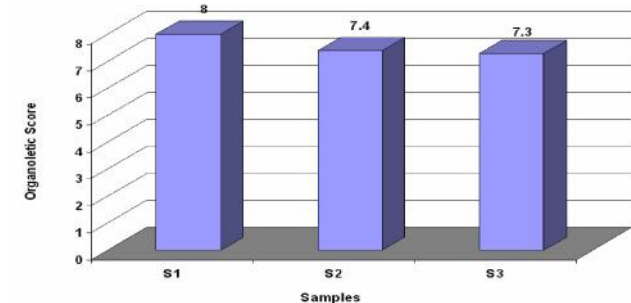


Fig. 5. Effect of different brown and white rice flour ratios on overall acceptability of biscuits

brown rice flour and white rice flour whereas minimum (0.8%) in biscuit with 1:1 proportion.

Reducing sugar :

Reducing sugar content in the rice flour biscuit was found in the range from 0.2-0.6%. It was seen that there is no marked effect of rice flour proportion on reducing sugar content. It was found maximum (0.6%) in the biscuit with 2:1 proportion of brown rice flour and white rice flour whereas minimum (0.2%) in biscuit with 1:1 proportion.

Physical properties of rice flour biscuits :

Physical properties of rice flour biscuits is shown in Table 3.

Size :

The size of biscuit before baking was 1.65cm. After baking it was increased to 1.80cm. It is seen that there was no influence of proportion on the size of biscuits. The length, breadth and thickness of the biscuits after baking were found 3.3cm, 3.3cm and 0.5cm, respectively.

Weight :

The average weight of the biscuits prepared with 2:1 proportion of brown rice flour and white rice flour (S_1) was found maximum (7.00g). It was found minimum (6.60g) in the biscuits prepared with 1:2 proportions (S_3). The average weight of biscuit with 1:1 proportion (S_2) was intermediate (6.80g).

Organoleptic properties :

Effect of rice flour proportion on organoleptic properties (color, appearance, texture, taste, flavor and overall acceptability) is plotted and shown in Fig.1 to 5.

The overall acceptability of rice flour biscuit was found in the range from 7.3 to 8.0. So the biscuits prepared from rice flour were found to be more acceptable. The maximum organoleptic score was found in biscuit containing 2:1 proportion of brown rice flour and white rice flour.

Conclusion :

Gluten free biscuits can be prepared from rice flour. Moisture content in the rice flour biscuit was found in the range from 3.7-6.7%. Protein content was found maximum (10.7%) in biscuits with 1:2 proportion and minimum (7.6%) with 1:1 proportion. The overall acceptability of rice flour biscuit was found in the range from 7.3 to 8.0. So biscuits prepared from rice flour were found more acceptable. There is a major need for more research and development in the area of gluten-free cereal-based products.

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