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# The Effect of Adding Rice Bran Fibre on Wheat Dough Performance and Bread Quality

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**Abstract:** There has been an evident corrolation between an increased intake of dietary fibre and the prevention of cardiovascular diseases ,diabetes,diverticlosis and colon cancer. Rice bran contains 25 to 30% fibre and its soluble fibre can affect blood cholesterol level when combined with biliary acid. Moreover, due to the emulsifier property, rice bran has a good effect on the texture of bread. The stabilized rice bran, unlike wheat bran as well as other fibres, has sweet and palatable taste. In order to increase the fibre amount of bread, four samples with 5, 10, 15 and 20 % rice bran were prepared. To improve the quality of flour, ascorbic acid was used as an oxidizing agent. The Control dough, based on the weight of flour, contained 2.5% yeast, 1.8% salt and 100 ppm ascorbic acid. Baking and rheological tests on breads showed that an increase in the amount of rice bran leads to a rise in the extension coefficient as well as water absorption, but it decreases flour resistance to extension. The sensory evaluation and statistical analysis of the results revealed that the sample containing 10 % rice bran had the best quality and it was significantly different at 5% level.

**Key words:** Stabilized rice bran · High fibre bread · Ascorbic acid

## INTRODUCTION

Dietary fibre is composed of total dietary fibre (TDF), which includes both soluble (SDF) and insoluble dietary fibres (IDF). The importance of the dietary fibre is increasing due to its beneficial effects on the reduction of cholesterol levels and the risk of colon cancer [1, 2].

Compared to the other cereal brans, rice bran contains more fibre, and its protein is considerable. The amount of ash in rice bran is more than other cereals except millet. Rice bran is rich in silica and its phosphor rate is quite high due to phytate. The amount of protein content (lysine) of rice bran is much higher than the ground rice [1].

Rice bran equilibrium moisture content is lower than those of the brown and ground rice. This difference is due to less starch content in rice bran which in turn is considered to be moisture absorbent [1, 2].

Volumetric density of rice bran is equal to 0.2-0.4 gr/ml. Defatted rice bran can absorb moisture more than the full fat rice bran [3, 4].

Rice bran mixture is greatly influenced by the type of mill being used to grind it. The rice bran obtained from the multi stage conical mills contains a higher percentage of fat, protein and B vitamins, while rice bran obtained from the uni stage mills contains a higher percentage of fibre [3].

There is a great tendency to increase the daily fibre intake and a proper way to provide fibre consumption is adding rice bran to the bakery products [4, 5].

Rice bran has a considerable water binding capacity as well as an emulsifying property. It also has less viscous than the other fibre source [3,5].

In this study the effects of different levels of rice bran on the rheological properties of wheat dough were determined.

## MATERIALS AND METHODS

**Materials:** A commercial blend of wheat flour (12.4% moisture, 9.7% Protein and 0.48% ash) was used. Rice bran (*Tarom* var.) was obtained from Ghaemshahr, Iran (5.2% moisture, 6.4% protein, 17.7% ash). Milled rice bran was passed through a 600 μm sieve to achieve appropriate particle sizes and stabilized by oven at 110°C in 20 minutes. Commercial compressed yeast was used for the bread making.

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## Methods

**Chemical Analysis:** Moisture, ash and protein were determined by the following standard AACC method 08-01. Nitrogen content was measured by the semi micro-Kjeldahl method. Nitrogen was converted to protein by using a factor of 5.7. Soluble, insoluble and total dietary fibre content was determined according to the AACC methods. 44-15A, 46-13, 54-20 [6].

**Baking Tests:** A straight dough bread making process was performed. Basic dough formula on 100 g flour basis consisted of salt (1.8g), compressed yeast (2.5g), ascorbic acid (100 ppm) and the amount of water required to reach 500 BU of consistency. The doughs were optimally mixed, fermented for 15 min, then dough pieces (400g) were divided and hand moulded. Dough was proofed at 38°C and relative humidity 85 % for 35 min up to optimum volume increase and baked at 250°C for 25 min. The bread quality attributes were evaluated after cooling for 1 h at room temperature.

**Dough Characteristics:** The effect of the different level of rice bran on dough rheology during mixing was determined by a Farinograph (Brabender, Duisburg, Germany), following the AACC Method 08-3. The parameters determined were water absorption or percentage of water required to yield dough consistency of 500 BU (Brabender Units), dough development time (DDT, time to reach maximum consistency in minutes), stability (time dough consistency remains at 500 BU), mixing tolerance index (MTI, consistency difference between height at peak and that 5 min later, BU) and elasticity (band width of the curve at the maximum consistency) viscoelastic behavior of the dough was determined by Extensograph (Duisburg, Germany).

**Bread Quality Evaluation:** Bread quality parameters included weight, volume (determined by seed displacement in a loaf volume meter), specific volume, moisture content, acceptance and texture of crumb. Overall acceptability was carried out as follows: one slice of bread, identified by code numbers, was served to each panelist under normal (daylight) illumination. They evaluated each product for quality attributes: crumb color, smoothness, aroma, flavor chewiness, crust color and hardness. Overall acceptability of each quality attribute was rated with a score of 0 (lowest) to 5 (highest). Three replicates from two different sets of baking were analyzed and averaged.

**Statistical Analysis:** Data obtained were analyzed using the statistical analysis program (SPSS).

Significance of difference between control and treated samples was evaluated using Duncan's multiple range test at 5% level.

## RESULTS AND DISCUSSION

**Results of Flour Tests:** The flour had the following characteristics 12.4 % moisture, 9.7 % protein, 0.8% fat, 0.15% fiber, 0.48% ash, 30.6% wet gluten and sedimentation value was 32 ml and Falling number was 657 seconds.

The rice bran had the following characteristics: 5.2% moisture, 6.4% protein, 4.7% fat, 17.7% fiber, 17.7% ash, (all these numbers have an average of triple repetitions).

Dough samples including $T_1$, $T_2$, $T_3$ and $T_4$ respectively contained 5, 10, 15 and 20 % rice bran on flour basis and T5 samples were taken as control without any rice bran being added.

For all the samples 100 ppm of ascorbic acid was used to improve the texture of bread.

**Results of Baking Tests:** The amount of required water for the fermentation of dough was different according to the farinogragh results. The physical, Organoliptical and gravimetrical properties of the bread samples were examined. The scores presented by the test panel, according to the hedonic 5 point scales were analyzed and average numbers based on triple repetitions of the samples Table 1.

Additional percentage of bran, made the bread darker and the size of the holes smaller. The emulsifier property of bran caused the dispersion of the holes to be more regular. Acceptability of taste and flavor of the bread severely decreased when the additional bran was over 10%.Since an increase in the percentage of bran leads to more absorption of water, the textures of the samples were softer and, chewing was much easier. The 20% sample was easily chewed with little material getting stuck to the teeth.

According to the results in Table 1 the 10% sample shows only a little difference with the ideal bread.

**Results of Gravimetric Measurement:** Two hours after baking, cold bread was weighed and the volume measurement was done by the replacement of seed grains in the graded column of volume measuring system. Table 2 shows a decrease of 5.7, 10, 18.6, 27.1% specific volume in samples containing 5, 10, 15, 20% bran respectively. The simultaneous changes of a decrease in the volume and an increase in the weight of high fiber bread, led to a decreasing trend in the specific volume changes of the bread. This result confirms Sosulski reports [4,7,8].

Table 1: The effect of adding rice bran on the sensory scores of breads

| Level of rice bran added (%) | Crust colour | Crust hardness | Crumb colour | Crumb porous division | Crumb porous size | Crumb chewiness | Taste | Odor | Overall score |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 4.5 | 3.55 | 3.77 | 3.53 | 4.29 | 3.59 | 4.67 | 4.69 | 4.07 |
| 5 | 4.21 | 3.23 | 3.35 | 4.16 | 3.77 | 3.79 | 4.49 | 4.54 | 3.94 |
| 10 | 3.44 | 2.99 | 3.3 | 4.08 | 3.46 | 4.13 | 4.41 | 3.81 | 3.7 |
| 15 | 3.l5 | 2.04 | 2.97 | 4.21 | 2.19 | 4.29 | 3.02 | 3 | 3.10 |
| 20 | 2.11 | 2.11 | 2.77 | 4.37 | 2.07 | 4.87 | 2.31 | 2.5 | 2.88 |

*Five point hedonic scale rating: 5= like extremely 0= dislike extremely

*Control is referred to dough without added fibre.

Table 2: The effect of adding rice bran on Gravimetric characteristics of breads

| Level of rice bran added (%) | Water absorption (%) | Weight (gr) | Volume ($cm^3$) | Specific weight ($cm^3$/gr) |
|---|---|---|---|---|
| 0 | 62.5 | 219.3 | 1535 | 7 |
| 5 | 65.8 | 228 | 1505 | 6.6 |
| 10 | 72.2 | 235.2 | 1482 | 6.3 |
| 15 | 69.2 | 250 | 1425 | 5.7 |
| 20 | 70.2 | 275.5 | l405 | 5.l |

All these numbers have an average of triple repetitions.

Table 3: The effect of adding rice bran on bread crumb compressibility

| | Resistance time (sec.) After baking | | | | Peak height (B U) After baking | | | |
|---|---|---|---|---|---|---|---|---|
| Level of rice bran added (%) | 2 (hr) | 24 (hr) | 48 (hr) | 72 (hr) | 2 (hr) | 24 (hr) | 48 (hr) | 72 (hr) |
| 0 | 14.00 | 12.5 | 10.25 | 10.15 | 258 | 180 | 78 | 58 |
| 5 | 12.35 | 12.25 | 12.20 | 11.45 | 240 | 200 | 173 | I07 |
| 10 | 11.20 | 11.20 | 11.00 | 10.40 | 210 | 180 | 160 | 138 |
| 15 | 11.30 | 10.5 | 10.10 | 10.00 | 190 | 102 | 100 | 80 |
| 20 | 11.40 | 10.30 | 11.1 | 11.00 | 170 | 138 | 98 | 80 |

All these numbers have an average of triple repetitions.

Table 4: Farinogragh analysis of wheat dough added rice bran

| Level of rice bran added (%) | Water absorption (%) | Dough development time (min) | Dough stability (min) | Degree of Softening (10min) | Degree of Softening (20min) | Valorimetric Number |
|---|---|---|---|---|---|---|
| 0 | 62.5 | 7 | 12.10 | 20 | 40 | 71 |
| 5 | 65.8 | 5.30 | 10.30 | 30 | 80 | 62 |
| 10 | 67.2 | 5.45 | 8.45 | 25 | 100 | 63 |
| 15 | 69.2 | 5.30 | 6.30 | 50 | 130 | 60 |
| 20 | 70.2 | 6.10 | 30.5 | 50 | 140 | 62 |

Values are means of triplicate readings

Table 5: extensograph analysis of wheat dough added rice bran

| | 45 min. fermentation | | | | 90 min. fermentation | | | |
|---|---|---|---|---|---|---|---|---|
| Level of rice bran added (%) | Dough extensibilit y (mm) | Dough stability (BU) | Maximum height (BU) | Extensibilit y index | Dough extensibilit y (mm) | Dough stability (BU) | Maximum height (BU) | Extensibility index |
| 0 | 200 | 300 | 485 | 1.5 | 182 | 260 | 404 | 1.42 |
| 5 | 233 | 320 | 458 | 1.37 | 196 | 255 | 365 | 1.3 |
| 10 | 155 | 350 | 435 | 2.25 | 180 | 250 | 300 | 1.38 |
| 15 | 155 | 322 | 428 | 2 | 162 | 242 | 300 | 1.49 |
| 20 | 133 | 300 | 342 | 2.24 | 136 | 255 | 252 | 1.87 |

Values are means of triplicate readings

**Results of Farinograph:** The Farinogram charts of dough obtained from the samples Table 1 show that Adding 5, 10, 15 and 20% rice bran increases water absorption to 5.3, 7.5, 10.7 and 12.35% respectively as compared with the control dough. These results are confirmed by the results [3, 5, 9].

The development time in dough containing 5, 10, 15, and 20% rice bran decreased to 21.4, 25, 21.4, and 16.6% respectively in comparison with the control dough. Dough mixing stability showed a decrease of 14.6, 29.2, 47.1, and 55.28% respectively. These Dough results agree with the results of Pomeranz *et al.* [3], Symons and Brennan [9] and Santos and Collar [10].

The degree of softening in dough containing 5, 10, 15 and 20% rice bran increased to 50, 25, 150 and 150% respectively after a ten minute time, while it decreased to 12.7, 11.3, 15.5 and 12.7% respectively after twenty minutes. Volumetric values in dough containing 5, 10, 15 and 20% rice bran showed a decrease of 12.7, 11.3, 15 and 12.7% respectively. According to the Farinogragh increasing fibre amount of dough caused a decrease in the quality of dough by the reduction of resistance of the dough to mixing. Ascorbic acid as an oxidizing agent, improves the low quality of the dough [3, 9, 11].

**Results of Extensorgragh:** The extensogragh assessments of the sample in table 2 show that, the extension capacity in a forty five minute fermentation in 5, 10, 15 and 20%, as compared with the control, had an increase of 16.5% and a decrease of 22.5, 22.5 and 33.5 respectively. In all the samples except the 5%, the extension capacity increased in a 90 minute time, whereas it decreased afterwards. In 5, 10, 15, 20% samples dough resistance to extension in a 45 minute fermentation showed a decrease of 6.6, 16.6, 7.3% and a decrease of 6% respectively. Time had a direct effect in decreasing extension capacity as well as resistance to extension in samples containing 5% rice bran had a decrease of 88.6% whereas samples containing 10, 15, 20% rice bran had an increase of 50, 33.3, 49.3% respectively [7, 8, 12].

The maximum height in a 45 minute fermentation in 5, 10, 15, and 20% bran compared with the control, showed a decrease of 5.5, 10.3, 11.7, and 41.8% respectively. ln all these samples, the rate of reduction in the maximum height increases as time goes on. Regarding the Extensogragh charts, when the amount of bran increases, the elasticity of the dough decreases. As a result forming such dough would be very difficult. The result is confirmed by [3, 5, 13].

**Test Results for the Compressibility of Crumb:** Stretchtogragh curve of the bread was made in 24, 48 and 72 hours after backing. Due to the diluting effect of gluten caused by the bran, an increase in the bran amount reduces bread resistance to extension, which leads to more water absorption and a softer bread crumb. Meanwhile, this property of bran, causes a decrease in the height of Strectogragh curve and less energy is needed to get the bread sheared. In all samples, the staleness process was quite fast in the first 24 hours of baking, whereas it was quite slow 72 hours after that. This is mainly because of the water absorption and water holding capacity of rice bran. Also ascorbic acid delays the staleness of bread [4, 7, 12].

This study showed that rice bran can be used as additive in bread making in order to fortify the diet.

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