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Effect of Different Levels and Particle Sizes of Wheat Bran on the Quality of Flat Bread

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ABSTRACT

Due to the positive effects of fiber on human health, production and distribution of high fiber containing foods is on the increase. Amongst different foods, bread is a suitable option to convey fiber in human diets. Flat breads which are very common in Asian countries, are mainly produced from white flour and hence are low in fiber. The main objectives followed in this study were to produce high fiber Barbari bread (a popular flat bread) using wheat bran, while minimizing the adverse effects of inclusion of bran in the bread recipe. To achieve this, wheat bran of different levels (0-20%, w/w flour basis) and particle sizes (170, 280, 425 and 750 µm) were added to Barbari bread recipe. Using Brabender Farinograph, it was found that with increase in bran level and its particle size, the water absorption of the dough increased. Color determination results showed that the bread crust color became darker as the level of the bran and its particle size increased. The results of determination of the bread texture using Texture Profile Analyser, showed that the bread became harder and less cohesive with increase of the fiber in the dough and for each bran particle size. According to the panelists, barbari breads constituted the most appropriate breads with up to 15% bran with particle sizes of shorter than 280 µm. In total, it was concluded that by a control of the level and particle size of the bran, it is possible to increase the fiber content of the bread without any significant adverse effects on the quality.

Keywords: Barbari bread; Bread quality, Particle size, Wheat bran.

INTRODUCTION

Despite the ample benefits of high fiber containing foods, nutritionists are concerned over a too low intake of fibrous diet by many people. To get the needed benefits from fibers the American Dietetic Association (1993) suggests 25-30 g of dietary fiber intake per human per day. Nevertheless, recent surveys report an average of only 16.5 to 17.9 g day^{-1} and 12.1 to 13.8 g day^{-1} for men and women, respectively. These values are much less than the recommended ones (Slavin, 2005; Wolk *et al.,* 1999). There is an increasing world demand for foods of high fiber content. Because of the wide consumption of bread throughout the world, bread has been considered as a suitable food material to contribute to an increase in the human intake of dietary fibers in their diets (Gan *et al.,* 1992; Lai *et al.,* 1989; Zhang and Moor, 1999).

Wheat bran, as a low cost and rich source of dietary fiber (about 45-50%), is produced as a by-product in wheat milling factories. It is compatible with bread other bakery products in terms of taste and aroma. Apart from fiber, bran contains good quality proteins (albumin and globulins), minerals (e.g. Ca, Fe, Zn) and

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antioxidants (Hoseney, 1994). All these have made bran an attractive component to be used in many foods particularly in bakery products. Previous studies have reported the inclusion of bran in bread recipe. For instance, Sidhu *et al.* (1999) reported that production of high fiber white toasts with excellent sensory quality could successfully be achieved by addition of 20% coarse plus short brans, 7.5% wheat germ and 0.5% sodium stearoyl-2-lactylate in the recipe instead of using whole wheat flour. Başman and Köksel (1999) added wheat and barley bran in the production process of a Turkish Flat Bread (Bazlama). Shenoy and Prakash (2002) reported that inclusion of more than 5% wheat bran in unleavened flat breads could decrease the sensory attributes of the samples. Salehifar, and Shahedi (2007) replaced oat flour in production of a common type of Iranian flat bread; Taftoon. Sanz Penella *et al.* (2008) studied the effects of bran level and particle size on the functional performance of bread dough. They found that bran concentration and particle size significantly affected water absorption and dough rheological properties. Noort *et al.* (2010) studied the effects of bran particle size on pan bread quality. They indicated that fiber-gluten interactions were the main cause for the negative effects of the bran. Nikoozad *et al.* (2011) added oat bran in the production of Sangak, a traditional flat bread in Iran.

Bran also contains phytic acid, the well-known anti-nutrient responsible for reduction of bioavailability of minerals, proteins and vitamins in human body (Harland and Oberleas, 1991; Palacios *et al.,* 2008). The amount of phytic acid is high in bran breads which can be considered as a negative point (Tavajjoh *et al.*, 2011). Fortunately, several methods are available to reduce the phytic acid content of the bran such as fermentation and reduction of the bran particle size (Lioger *et al.,* 2007; Servi *et al.,* 2008).

In Iran, Barbari bread is the second most consumed bread after Lavash. It is a flat bread that is produced from white wheat flour (Qarooni, 1996). Therefore, the fiber content of Barbari bread is low. It is generally believed that Barbari bread should be of white color and soft texture. Therefore, flours of high extraction rate (higher bran content) are not used in the production of Barbari bread.

The main aim followed in this study was to increase the fiber content of Barbari bread by inclusion of wheat bran and to determine the optimum level as well as the particle size of bran in order to have the minimum adverse effects on the bread quality. The results of this study may fall useful to bread producers who would like to produce a healthier commodity for the costumers.

MATERIALS AND METHODS

Wheat flour with an extraction rate of 87% according to the manufacturer, along with coarse wheat bran with an average particle size of 1,000 µm were gifted from Sepidan milling factory in Zarghan, Fars Province, Iran. Active dried bakery yeast (Bakery Chef, France) and iodine free table salt were purchased from the local market. All analytical grade chemicals used throughout the study were obtained from Merck (Germany).

Moisture, ash, fat and total fiber contents were determined following the Approved Methods of the AACC (2000), numbers 44-15A, 08-01, 30-25 and 32-07, respectively. Nitrogen content was found out through micro-Kjeldahl method with 5.7 used as the nitrogen to protein conversion factor (AACC, 2000, number 46-12).

Bran Milling

To obtain different particle sizes of the bran, it was first ground using a laboratory mill (Alexanderwerck, Model WEL82, Germany) and then hand sieved using a multi-tray sieve (ASTM E:11, Iran) to obtain average particle sizes of 170, 280, 425 and 750 µm.

Dough and Bread Making

To make bread dough, bran of varying particle sizes replaced wheat flour at 0, 5, 10, 15 and 20% (w/w, flour basis). Activated dry yeast (2%, w/w, flour basis), salt (1.5%, w/w, flour basis) and water (determined through Brabender Farinograph, FE022N, Germany according to the AACC, 2000, number 54-21) were mixed in a laboratory dough mixer (Iypto, Model EB12, Germany) at 140 rpm for 15 minutes. The dough was then placed in a proofing cabinet with relative humidity of 85% at 38°C for 1 hour. During this time the volume of the dough increased due to the yeast activity. Then the dough was divided into portions of 400 g, rounded by hand and placed in the proofing cabinet once again for 45 minutes. The dough pieces were shaped in round metallic molds with thicknesses of 1.0±0.2 cm and diameter of 40 cm and were baked in an electrical baking oven (Model Karl Welkerkg, Germany) at 210°C for 30 minutes. The breads were left at room temperature for one hour to be cooled. The thickness of the bread was estimated at 1.5±0.2 cm after being cooled. They were packed in polyethylene bags and stored at ambient temperature for no longer than 2 hours before further experiments. The experiments were performed on the samples on the same day as they were prepared.

Determination of Bread Moisture Content

Bread moisture content was determined through drying out of a homogeneous sample of bread using the air-oven drying method (method number 44-15 A, AACC, 2000)

Textural Characteristics of the Bread

The textural characteristics of the breads were studied using a Texture Analyser (TA-XT2, Stable Micro Systems Ltd., Surrey, UK). Texture Profile Analysis (TPA) test was carried out by performing a two-bite compression test at pretest speed of 5 mm s^{-1}, test speed of 0.25 mm s^{-1}, time interval of 10 seconds and strain deformation of 25%. To determine the texture of the bread, 0.5 cm of the crust was removed to make the surface leveled off, and then the rest of the sample was tested using an aluminum cylindrical probe of a diameter of 70 mm. From the force-distance curve, the ratio of the positive area under the first and second compression points was defined as cohesiveness (A2/A1). The slope (gradient) of force-deformation curve and maximum force of first bite of TPA test (F1) were taken as indications of bread hardness. The maximum force (F1) was also determined as the force required to puncture the bread (Steffe, 1996).

Determination of the Bread Crust Color

The color of bread crust was evaluated using the method described by Afshari-Jouibari and Farahnaky, (2011). High resolution pictures of whole crust were separately taken from bread surface by a digital camera (Fujifilm, 2.0 Megapixels, China). Resolution, contrast and lightness of all images were set at 300 (dpi), 62 and 62 (%), respectively. The pictures were saved in JPEG format and analyzed quantitatively using the Adobe Photoshop 8 software installed on a Pentium 4 computer while the color parameters of "*L*" (lightness), "*a*" (redness-greenness) and "*b*" (blueness-yellowness) were determined in the "Lab" mode of the software.

Sensory Analysis

Bread texture, taste, flavor and color were studied through sensory evaluation with the participation of 12 semi-trained panelists using a five point hedonic test (Salehifar and Shahedi, 2007). Characteristics of a standard Barbari bread were explained to the panelists as follows; crust color: light golden brown; the texture so soft that could easily be torn by hand. When chewing, the bread should not be either sticky or grainy in the mouth. The breads should be palatable without any off-flavor. The samples were then coded with three random digits and simultaneously given to the panelists in a standard booth under day light illumination. Scores in the range of 0-1 were given to the worst, 1-2 to the bad, 2-3 to the fair, 3-4 to the good and 4-5 to the excellent samples.

Statistical Analysis

The experiments were performed in a completely randomized design conducted in triplicates, with the mean values and standard deviations then calculated. Analysis of Variance (ANOVA) was performed and the results separated, using the Multiple Range Duncan Test ($P < 0.05$) and using the statistical software of SPSS 16 (Peck *et al.,* 2011).

RESULTS AND DISCUSSION

Chemical compositions of the wheat flour and bran are presented in Table 1. The wheat flour contained only 0.52% fiber along with 10.45% protein content, while the bran samples contained significantly (P< 0.05) higher levels of fiber (2.2-13.3%) as well as protein (11.57-13.33%). Therefore, inclusion of the bran in Barbari recipe causes the increase of fiber content of the bread. Moreover, it was observed that with reducing bran particle size, fiber, protein, fat and ash contents decreased. This is because of particle sizes being closer to the endosperm and hence containing less fiber, fat, protein and ash than the outer bran layers. Similar observations have been reported by Shenoy and Prakash (2002).

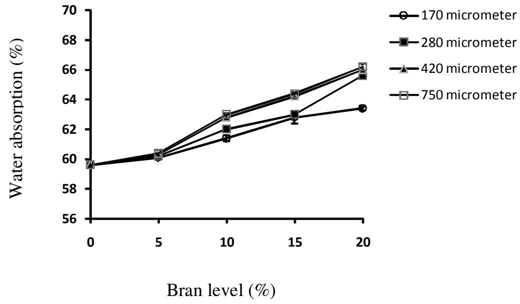

Figure 1. Water absorption of the flour as a function of the quantity and particle size of the bran.

A determination of the water absorption of the mixture of flour and bran (Figure 1) showed that increasing bran content and particle size promoted the water absorption of the flour. As an instance, water absorption increased from 58.2% for the control to 66.0% for the samples containing 20% bran with particle sizes of 750 µm. The great number of hydroxyl group of the bran hydrocolloids (proteins, cellulose and other polysaccharides) are proved to allow more water interactions through hydrogen bonding. Higher water absorption of the larger particle size bran can be related to presence of more fibrous materials in these particles which contribute to the absorption of more moisture. As mentioned before, the smaller particle size bran contained more starchy materials than fiber (see Table 1) and hence was of less capability to absorb more moisture during dough formation.

Table 1. Chemical composition of wheat flour *vs.* wheat bran in order of particle size and on a dry basis*.

Samples/particle size (µm)	Moisture (%)	Protein (%)	Fiber (%)	Fat (%)	Ash (%)
Wheat flour/130	8.17 ± 0.07[b]	10.45 ± 0.14[e]	0.52 ± 0.10[e]	1.31 ± 0.00[c]	0.80 ± 0.12[e]
Bran/170	8.06 ± 0.05[b]	11.57 ± 0.23[d]	2.20 ± 0.21[d]	1.95 ± 0.04[b]	2.08 ± 0.07[d]
Bran/280	8.51 ± 0.22[a]	12.04 ± 0.06[c]	6.38 ± 0.07[c]	2.57 ± 0.23[a]	3.23 ± 0.02[c]
Bran/425	8.88 ± 0.25[a]	12.38 ± 0.03[b]	11.20 ± 0.60[b]	2.46 ± 0.10[a]	3.31± 0.01[b]
Bran/750	8.08 ± 0.03[b]	13.33 ± 0.56[a]	13.30 ± 0.57[a]	2.45 ± 0.03[a]	3.47 ± 0.01[a]

* Values are the averages of Triplicates±Standard deviations. Different letters in each column are indicative of significant statistical difference (P<0.05) between the values.

Table 2. Color parameters of Barbari bread crust in the order of quantity and the particle sizes of wheat bran*.

Bran particle size (µm)	Bran level (%)				
	L-value				
	0	5	10	15	20
170	80.3 ± 0.3^{aA}	74.9 ± 0.2^{bA}	73.3 ± 0.2^{cA}	72.6 ± 0.2^{cA}	69.5 ± 0.3^{dA}
280	80.3 ± 0.3^{aA}	72.0 ± 0.3^{bB}	69.0 ± 0.3^{cB}	68.0 ± 0.3^{dB}	67.0 ± 0.3^{eB}
425	80.3 ± 0.3^{aA}	71.4 ± 0.2^{bC}	68.0 ± 0.1^{cC}	66.5 ± 0.3^{dC}	65.0 ± 0.2^{eC}
750	80.3 ± 0.3^{aA}	70.0 ± 0.4^{bD}	67.0 ± 0.3^{cD}	65.0 ± 0.1^{dD}	63.0 ± 0.3^{eD}
	a-value				
170	-1.6 ± 0.1^{dA}	0.8 ± 0.2^{cB}	1.2 ± 0.3^{bcD}	1.4 ± 0.1^{bC}	1.7 ± 0.2^{aC}
280	-1.6 ± 0.1^{dA}	1.8 ± 0.3^{cA}	1.9 ± 0.3^{cC}	2.6 ± 0.2^{bB}	3.6 ± 0.2^{aB}
425	-1.6 ± 0.1^{dA}	1.9 ± 0.3^{cA}	2.7 ± 0.2^{bB}	2.9 ± 0.3^{bB}	3.8 ± 0.3^{aB}
750	-1.6 ± 0.1^{dA}	2.0 ± 0.3^{cA}	3.0 ± 0.2^{bA}	4.3 ± 0.3^{aA}	4.5 ± 0.1^{aA}
	b-value				
170	33.7 ± 0.2^{aA}	33.0 ± 0.3^{bA}	32.4 ± 0.3^{cA}	29.0 ± 0.1^{dA}	28.6 ± 0.4^{eA}
280	33.7 ± 0.2^{aA}	32.6 ± 0.4^{aB}	31.8 ± 0.1^{bB}	30.7 ± 0.2^{cA}	27.5 ± 0.2^{dB}
425	33.7 ± 0.2^{aA}	32.0 ± 0.3^{aB}	31.0 ± 0.3^{bC}	28.7 ± 0.4^{cB}	27.0 ± 0.2^{dB}
750	33.7 ± 0.2^{aA}	32.0 ± 0.3^{bB}	31.1 ± 0.2^{bC}	28.0 ± 0.4^{cB}	26.0 ± 0.3^{dC}

* Values are the averages of Triplicates±Standard deviations. Different small letters in each row and capital letters in each column are indicative of the significant statistical differences ($P< 0.05$) between the values.

The results of bread color determination are presented in Table 2. Based on the presented results it was found that increasing the particle size and level of the bran resulted in a darker (less L-value), more reddish (higher a-value) and less yellowish (less b-value) color of the crust. This can be related to the presence of dark pigments in the increased bran, becoming more visible when larger sizes along with higher levels of the bran involved. Maillard and caramelization reactions during baking of the dough are the main reasons for the formation of the brown color of the crust. The main elements required for these reactions are amino acids and reducing sugars, abundant in the bran. Thus, inclusion of the bran can enhance these reactions resulting in darker color of the crust. Similar findings have been reported by Gomez *et al.* (2010) for cakes containing bran. Azizi *et al.* (2006) also indicated that, with increase in flour extraction rate, the lightness of the breads decreased.

A determination of the bread texture (Table 3) showed that with increasing the level and particle size of the bran, the bread texture became coarser. The hardness of the control bread increased from 2.8 N to a maximum of 5.9 N for the sample containing 20% bran with a particle size of 750 µm. Accordingly, the maximum force required to puncture the sample increased, significantly ($P< 0.05$). The highest force of 6.3 N was obtained for the bread made with 20% bran with particle size of 750 µm. A determination of the bread cohesiveness showed that the cohesiveness of the samples increased with increase in the level and particle size of the bran. Bran supplementation, exerts both mechanical and chemical effects on the structure of the gluten network. It has been indicated that the bran particles cause physical disruption of the foam structure of the dough causing a reduction in bread volume (Gan *et al.,* 1992; Lai *et al.,* 1989; Mosharraf *et al.,* 2009). By replacing the flour with bran, the gluten content of the dough decreased considerably. It is well

Table 3. Textural parameters of the Barbari bread in the order of the quantity and the particle sizes of wheat bran*.

	Hardness (N)			
	Particle size (μm)			
Bran level (%)	170	280	425	750
0	2.80 ± 0.02^{Ca}	2.80 ± 0.02^{Ea}	2.80 ± 0.02^{Da}	2.80 ± 0.02^{Ea}
5	2.51 ± 0.01^{Bd}	3.00 ± 0.03^{Dc}	4.00 ± 0.02^{Cb}	4.30 ± 0.01^{Da}
10	3.00 ± 0.05^{Ad}	3.10 ± 0.01^{Cc}	4.35 ± 0.02^{Cb}	4.90 ± 0.02^{Ca}
15	3.01 ± 0.01^{Ad}	3.33 ± 0.00^{Bc}	4.54 ± 0.02^{Bb}	5.30 ± 0.01^{Ba}
20	3.00 ± 0.01^{Ad}	3.91 ± 0.01^{Ac}	5.00 ± 0.01^{Ab}	5.90 ± 0.00^{Aa}
	Maximum force (N)			
0	3.70 ± 0.02^{Ca}	3.70 ± 0.02^{Da}	3.70 ± 0.02^{Ea}	3.70 ± 0.02^{Ea}
5	3.72 ± 0.01^{Cd}	3.98 ± 0.02^{Cc}	4.30 ± 0.02^{Db}	4.71 ± 0.02^{Da}
10	3.80 ± 0.02^{Bd}	4.10 ± 0.03^{Bc}	4.80 ± 0.03^{Cb}	4.90 ± 0.03^{Ca}
15	3.85 ± 0.03^{Bd}	4.21 ± 0.02^{Ac}	5.21 ± 0.01^{Bb}	6.01 ± 0.03^{Ba}
20	4.14 ± 0.02^{Ad}	4.20 ± 0.01^{Ac}	5.37 ± 0.03^{Ab}	6.30 ± 0.01^{Aa}
	Cohesiveness			
0	0.95 ± 0.01^{Ba}	0.95 ± 0.01^{Ba}	0.95 ± 0.01^{Ba}	0.95 ± 0.01^{Ba}
5	0.90 ± 0.03^{Bc}	0.95 ± 0.01^{Bb}	0.97 ± 0.01^{Ba}	0.99 ± 0.01^{Aa}
10	0.91 ± 0.02^{Bc}	0.96 ± 0.02^{ABb}	0.99 ± 0.02^{ABa}	1.01 ± 0.02^{Aa}
15	0.95 ± 0.02^{ABb}	0.98 ± 0.01^{Aa}	1.00 ± 0.01^{Aa}	1.00 ± 0.01^{Aa}
20	0.97 ± 0.01^{Ab}	1.00 ± 0.01^{Aa}	1.01 ± 0.01^{Aa}	1.01 ± 0.02^{Aa}

* Values are the averages of Triplicates±Standard deviation. Different small letters in each row and capital letters in each column are indicative of the significant statistical differences ($P< 0.05$) between the values.

recognized that bread volume has a strong positive relationship with gluten content and bread softness (de Kock *et al.,* 1999). Accordingly, increasing the hardness of the breads containing bran can be due to the formation of less air bubbles in the dough. Similar results have been reported by Wang *et al.* (2002) for the bread containing different sources of fiber. Reduction of the bread cohesiveness may be related to the less adhesion between starch and gluten in the samples containing bran and as well related to the formation of an uneven crumb (Mosharraf et al, 2009).

Sensory analysis of the samples (Table 4) showed that increasing bran concentration could affect bread flavor while, increasing bran particle size had no significant effect on the flavor. In terms of flavor, the control and samples containing 5% bran were recognized as good while those produced with 10-20% bran were recognized as excellent. Bread flavor is generally formed during the last stage of baking as a result of Maillard and caramelization reactions (Hoseney, 1994). Bran contains reducing sugars and proteins which can enhance these reactions and hence promote the flavor of the samples. Similar findings have been reported by Wang *et al.* (2002).

Based on the obtained results it was found that the taste of the breads was affected by both bran level and its particle size. Increasing the level of the bran (with particle sizes of 170 and 280 μm), improved bread taste. However, when larger particle sizes were employed (425 and 750 μm) the scores decreased with increasing bran level. Furthermore, bran particle size, particularly at higher levels imposed negative effects on taste. The panelists found undesirable mouth feel and

Table 4. Sensory characteristics of Barbari bread in the order of the quantity and particle size of wheat bran*.

Particle size (μm)	Bran level (%)				
	0	5	10	15	20
			Flavor		
170	3.3±0.2^{bA}	3.5±0.3^{bA}	4.0±0.3^{aA}	4.2±0.3^{aA}	4.3±0.2^{aA}
280	3.3±0.2^{bA}	3.3±0.3^{bA}	4.3±0.2^{aA}	4.1±0.3^{aA}	4.1±0.1^{aA}
425	3.3±0.2^{bA}	3.6±0.1^{bA}	4.6±0.2^{aA}	4.4±0.1^{aA}	4.4±0.3^{aA}
750	3.3±0.2^{cA}	3.9±0.2^{bA}	4.5±0.2^{aA}	4.5±0.2^{aA}	4.5±0.3^{aA}
			Taste		
170	3.5±0.2^{bA}	3.5±0.1^{aA}	4.0±0.2^{aA}	4.2±0.2^{aA}	4.5±0.1^{bA}
280	3.5±0.2^{aA}	3.7±0.3^{aB}	3.6±0.2^{bB}	3.5±0.2^{bB}	4.0±0.3^{bB}
425	3.5±0.2^{aA}	3.2±0.2^{bC}	3.1±0.1^{bB}	3.0±0.1^{bB}	2.0±0.1^{bB}
750	3.5±0.2^{aA}	3.0±0.3^{bC}	3.0±0.4^{bB}	2.5±0.1^{bcC}	2.0±0.3^{cC}
			Hardness		
170	3.2±0.2^{aA}	3.0±0.1^{aA}	3.1±0.1^{aA}	3.0±0.3^{aA}	2.5±0.1^{bA}
280	3.2±0.2^{aA}	3.0±0.2^{aA}	3.3±0.2^{aA}	3.2±0.3^{aA}	2.5±0.2^{bA}
425	3.2±0.2^{aA}	3.1±0.2^{aA}	3.0±0.3^{aA}	2.7±0.2^{abAB}	2.5±0.1^{bA}
750	3.2±0.2^{aA}	3.0±0.1^{aA}	2.6±0.3^{abA}	2.4±0.2^{bB}	2.0±0.3^{bB}
			Color		
170	4.0±0.2^{aA}	4.1±0.3^{aA}	4.0±0.2^{aA}	3.1±0.1^{bA}	3.0±0.1^{bA}
280	4.0±0.2^{aA}	4.3±0.4^{aA}	4.1±0.2^{aA}	3.0±0.2^{bA}	2.2±0.3^{bB}
425	4.0±0.2^{aA}	3.2±0.2^{bB}	3.0±0.3^{aB}	2.6±0.1^{bB}	2.2±0.2^{cB}
750	4.0±0.2^{aA}	3.3±0.1^{aB}	3.0±0.1^{aB}	2.5±0.3^{bB}	2.0±0.3^{bB}

* Values are the averages of Triplicates±Standard deviations. Different small letters in each row and capital letters in each column are indicative of the significant statistical differences ($P < 0.05$) between the values.

taste when the level and particle size of the bran increased. Previous results obtained by Texture Analyser showed that the texture of the bread became coarser when bran was included. Increasing the hardness of the samples was only recognized by the panelists when the level and size of the bran exceeded 15% and 425 μm, respectively. Similarly, Zhang and Moore (1999) reported that the panelists preferred the texture of the bread containing fine particle size bran than those containing coarse bran.

The score given to the crust color decreased as the level and particle size of bran increased to more than 10% and 280 μm, respectively. These samples received lower scores since the panelists expected a more white color for Barbari bread. In a research conducted by Zhang and Moore (1999), panelists preferred the color of the samples containing coarse bran, while, they admitted that the samples containing fine bran were of a more uniform color.

CONCLUSIONS

The results of this study indicated that it is possible to include wheat bran in Barbari bread formulation and to produce bread with very similar sensory characteristics as to the control. However, selection of the appropriate size and percentage of wheat bran is crucial to reduce the adverse effects of bran on bread quality. With reducing bran particle size, less adverse effects on crust color and texture hardness were observed. According to the taste scores, no more than 15% bran with particle sizes of less than 280 μm should be employed in order to produce quality bread.

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تاثیر سطوح و اندازه ذرات مختلف سبوس گندم بر کیفیت نان مسطح

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چکیده

به دلیل اثرات مثبت فیبر بر سلامت انسان تولید غذاهای با فیبر بالا در حال افزایش است. در میان انواع غذاها، نان گزینه مناسبی برای انتقال فیبر به رژیم غذایی انسان می باشد. نانهای مسطح که در کشورهای آسیایی بسیار متداول می باشند عمدتا از آرد سفید تولید می شوند و لذا دارای مقدار فیبر اندکی می باشند. هدف اصلی این تحقیق تولید نان بربری (یک نوع متداول نان مسطح) با فیبر بالا با استفاده از سبوس گندم و کاهش اثرات نامطلوب افزودن سبوس در فرمول نان می باشد. به این منظور سبوس گندم در سطوح مختلف (۰ تا ۲۰٪ وزنی/وزنی آرد) و اندازه ذرات متفاوت (۱۷۰، ۲۸۰، ۴۲۵ و ۷۵۰ میکرومتر) در فرمول نان بربری اضافه شدند. با استفاده از دستگاه برابندر فارینوگراف مشخص شد که با افزایش مقدار و اندازه ذرات سبوس مقدار جذب آب خمیر افزایش یافت. نتایج تعیین رنگ نشان داد که تیرگی رنگ پوسته نان با افزایش درصد و اندازه ذرات سبوس افزایش یافت. تعیین بافت نان با استفاده از دستگاه بافت سنج نشان دهنده افزایش سفتی و کاهش پیوستگی نان با افزایش درصد و اندازه ذرات سبوس بود. بر اساس نتایج بدست آمده از گروه چشایی مناسبترین نانها با مقدار سبوس کمتر از ۱۵٪ و اندازه ذرات کوچکتر از ۲۸۰ میکرومتر تهیه شده بودند. در مجموع نتیجه گیری شد که با کنترل سطح و اندازه ذرات سبوس می توان مقدار فیبر نان بربری را بدون داشتن اثرات منفی قابل توجهی بر کیفیت نان افزایش داد.