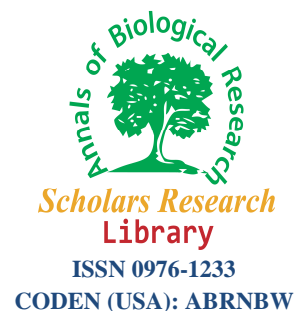




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## Effect of additional white bean flour on chemical and staling properties of Iranian industrial and traditional barbari breads

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### ABSTRACT

Flat breads are staple food and main source of carbohydrate in Iranian food cart. So to increase the nutritional value of bread and decrease its waste we can utilize proper mixing of wheat flour with white bean flour. Flour of white beans is rich source of protein, carbohydrates, minerals and some essential amino acids such as lysine that it could be used as a nutritional supplement. In the present study, the addition effects of 10, 15 and 20 percent of white bean flour on chemical and staling properties of Iranian industry and traditional Barbari breads has been studied. At first various chemical tests such moisture measurement, ash, protein, fiber, and pH was conducted on samples of wheat flour and white beans flour according to the AACC international standard with three replications. Then samples of bread traditionally and industrial has been produced and chemical tests including protein, fiber, moisture, ash and staling test were conducted with sensory method and according to AACC standard. On the other hand data statistical analysis with completely randomized design method, Duncan test and MSTATC software at the level of  $\alpha \leq 1\%$  was performed. Results of chemical test showed that the used flours for Iranian industry and traditional Barbari breads production is appropriate. Besides the performed chemical tests on bread samples showed that using higher levels of white bean flour increased amount of protein, fiber, moisture and ash of breads. Also in evaluation of staling with sensory method by panelists showed that, the industrial and traditional Barbari samples with 10% white bean flour were diagnosed more desirable.

**Keywords:** White Bean Flour, Chemical, Staling, Iranian Barbari Bread

### INTRODUCTION

cereals are the first agricultural products that human used for food and today in the most countries provides the highest amount of calories, protein, fiber, vitamins and minerals for the people. Among grains, wheat due to special nutritional and technological properties is under attention of the most people and the highest consumption of these food products that can be noted is bread [17]. Bread as a staple daily food for world people in many countries provides significant part of energy, protein, minerals and B group vitamins. In Iran daily 60 percent calories and 50 percent protein is provided by bread, especially in under privileged area [20]. In a general classification based on shape and form, breads can be divided into two main groups, flat bread and bulky bread [20]. Flat breads are one the main form of wheat consumption in many countries such as the Middle East and North Africa that allocated the most consumption to it among all of the bread in Iran because it has a good texture and flavor and next to other breads is slightly cheaper [23]. From common flat breads in the country we name of Barbari, Lavash, Taftoon, Sangak and rural or local breads [20]. Barbari bread is a flat and traditional bread which is made from Setareh flour, shell flour or the mixture of both, along with water, salt, yeast or sourdough has been prepared and then baked on the hot flat surface is [24]. Statistics have shown that more than 30 percent of traditional bread products due to low quality are waste. Among traditional breads which are used in the country the highest percentage of the waste belongs to Barbari bread, Lavash and Sangak that is about 16.4 to 16.7 percent. Also Taftoon waste is reported 10

and in industrial Lavash bread is 11.3 percent [12]. Nowadays, various combinations of other grains flour, soy flour, enzymes, emulsifiers, and the gum and ... are used in bread formulations [16]. one of the best additives is white bean flour which is one of the best alternatives for wheat flour in bread production and baking other product like tortillas and snack[6,5] . The nutritive value of white beans is rich source of protein (20-25%), carbohydrate (50-60%) and small amounts of fat (1percent) and vitamin and minerals [25, 9]. In addition legumes next to grains have higher protein content and composition of amino acids, many lysine essential amino acid and limited amounts sulfur amino acids(methionine, cysteine and tryptophan) [29,22]. From benefits of eating whole grains can be mentioned to being helpful in intestine health because beans are rich sources of dietary fiber that after entering the colon and fermentation by intestine flormicroby and creating short-chain fatty acids is effective in people health [9,8,27]. In addition, the legumes starch is slowly digested, which results in decreased glucose and glycemic index values [8, 19]. Other studies have shown that consumption of legumes, especially white beans reduce weight which this feature block the  $\alpha$ -amylase enzyme of starch bean that outcome will prevent complex sugar to simple sugars and decreased carbohydrates produced energy [28]. In addition, mixing different types of legume flours with food formulation that are prepared from cereals flour create a variety of flavours that complete texture quality protein that can balance the nutritional value of the final product [13]. Also try to find alternative sources of protein for human nutrition leads off to do research on various legumes in developing countries by making the reason for this extensive research, abundant and inexpensive legumes as a potential source of protein for people in these countries are less able to meet their protein from animal sources [7].

Ndife et al (2011), as a evaluation of the nutritional and sensory quality of breads produced from whole wheat and soya bean flour blends mentioned that adding of levels 10,20,30 and 40%, soybean flour bread formulation, the increased levels of protein, fat, fiber , ash and moisture and also reduce the food energy value (calories), carbohydrate and volume of bread. Evaluation of sensory breads of fortified with soy flour in terms of color, texture (except the flavour, aroma) gained a higher degree than the control sample [18].

## MATERIALS AND METHODS

At first wheat flour with extraction rate 82% from consumption of Tehran Bakhtar flour factory in Tehran and white beans flour, yeast (Iran molass Co.), salt (Hedieh Co.) and polyethylene bags used for packaging Barbari breads was prepared .Then white beans flour in quantities of 10, 15 and 20% added to the star flour was used and industrial and traditionally Barbari bread were produced .Control samples (with wheat flour and no white beans flour) with code C<sub>1</sub> (industrial) and C<sub>2</sub>(traditional) and samples contain levels of 10, 15 and 20 percent white bean flour, respectively industrial Barbari bread with codes I<sub>1</sub>, I<sub>2</sub> and I<sub>3</sub> and traditional Barbari breads with codes T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> has been specified. Then the chemical test conducted with three replicates on wheat flour and white bean flour and after that chemical tests on all samples with different mixing percentage of white bean flour (10, 15 and 20%) were done. The tests include measurement of moisture (AACC, No. 44-16), pH (AACC, No. 2-52), Ash (AACC, No. 08-01), Protein (AACC, No. 46-12), Crude fiber (AACC, No. 32-10) were[4].Then to evaluate samples of Iranian industrial and traditional Barbari bread staling by sensory method used International standards AACC, No 74-30 were used[4].The staling testing by sensory method, in the period of 24, 48 and 72 hours after baking the samples were performed separately in polyethylene bags at ambient temperature together were Barbari bread and then all samples were given to evaluate the panelists. Taste test criteria based on the questionnaire were touching criteria by panelists. Taste criteria were: Time assessment to get ready to swallow a mouthful and survey of flavour, smell bread terms, such this test was to evaluate the force required to fritter bread.

### Statistical analysis

For statistical analysis tests, from variance analysis, Duncan test and MSTATC software was used.

## RESULTS AND DISCUSSION

The results of chemical analysis of wheat flour and white bean flour are presented in table 1. Also in Tables 2 and 3, respectively, the results of chemical test and staling rate evaluation of Iranian industrial and traditional Barbari bread samples has been mentioned.

**Table1 .Results of the chemical characteristics test of wheat flour and white bean flour**

Materials	Protein (%)	Fiber (%)	Ash (%)	Moisture (%)	pH
Wheat flour	11.32	0.71	0.84	13.24	6.3
White bean flour	21.66	3.42	4.01	8.45	6.5

**Table 2. Results of chemical tests of Iranian industrial and traditional Barbari breads containing of white bean flour and control**

Treatment	Protein (%)	Fiber (%)	Ash (%)	Moisture (%)
I <sub>1</sub>	12.78±0.15 <sup>a</sup>	1.703±0.09 <sup>c</sup>	3.04±0.18 <sup>b</sup>	30.53±0.21 <sup>c</sup>
I <sub>2</sub>	12.84±0.21 <sup>a</sup>	2.117±0.08 <sup>b</sup>	3.45±0.17 <sup>b</sup>	30.82±0.67 <sup>b</sup>
I <sub>3</sub>	12.98±0.20 <sup>a</sup>	2.917±0.04 <sup>a</sup>	4.467±0.12 <sup>a</sup>	31.11±2.12 <sup>a</sup>
T <sub>1</sub>	12.77±0.12 <sup>a</sup>	1.68±0.02 <sup>c</sup>	3.01±0.11 <sup>b</sup>	30.5±3.14 <sup>c</sup>
T <sub>2</sub>	12.81±0.17 <sup>a</sup>	2.1±0.1 <sup>b</sup>	3.44±0.13 <sup>b</sup>	30.8±2.89 <sup>b</sup>
T <sub>3</sub>	12.86±0.15 <sup>a</sup>	2.9±0.12 <sup>a</sup>	4.43±0.21 <sup>a</sup>	31.1±2.45 <sup>a</sup>
C <sub>1</sub>	11.43±0.16 <sup>b</sup>	0.753±0.11 <sup>d</sup>	1.44±0.09 <sup>c</sup>	30.45±2.64 <sup>c</sup>
C <sub>2</sub>	11.4±0.11 <sup>b</sup>	0.733±0.13 <sup>d</sup>	1.43±0.07 <sup>c</sup>	30.43±3.15 <sup>c</sup>

In each column, means that at least one common letter are not significantly different according to Duncan's test at level 1%

**Table 3. Test results of staling level with sensory method in Iranian industrial and traditional Barbari breads containing of white bean flour and control**

Treatment	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	C <sub>1</sub>	C <sub>2</sub>
24	6±0.2 <sup>a</sup>	6±0.21 <sup>a</sup>	6±0.22 <sup>a</sup>	5.33±0.31 <sup>ab</sup>	5.33±0.51 <sup>ab</sup>	5.3±0.67 <sup>ab</sup>	4.33±0.39 <sup>c</sup>	4.33±0.54 <sup>c</sup>
48	5.66±0.33 <sup>a</sup>	5.33±0.47 <sup>a</sup>	5.33±0.35 <sup>a</sup>	4.6±0.12 <sup>ab</sup>	4.66±0.27 <sup>ab</sup>	4.63±0.49 <sup>ab</sup>	4±0.28 <sup>b</sup>	4±0.79 <sup>b</sup>
72	5.33±0.31 <sup>a</sup>	4.66±0.36 <sup>ab</sup>	4.66±0.38 <sup>ab</sup>	3.66±0.24 <sup>b</sup>	3.66±0.19 <sup>b</sup>	3.66±0.18 <sup>b</sup>	3.66±0.41 <sup>b</sup>	3.66±0.91 <sup>b</sup>

In each row, means that at least one common letter are not significantly different according to Duncan's test at level 1%

Results of chemical tests showed in table 1 that wheat flour and white bean flour were suitable for the production of industrial and traditional Barbari breads.

### Evaluation of results of the chemical test in Iranian industrial and traditional Barbari breads

Results of Comparison between samples chemical test of traditional and industrial Barbari bread in table 2 indicates that in terms of protein, fiber, ash, in the all white bean flour containing samples compared to control samples, there are significant differences. So that the protein level by adding white bean flour in samples of industrial and traditional Barbari bread compared to control samples has increased significantly. Research has shown that the reason of protein increase in samples containing white bean flour bread is generally due to the higher protein content of legume next to grains [26]. So, adding the white beans flour in different amounts to bread increased the quantity of protein production in both industrial and traditional Barbari bread and treatments of I<sub>3</sub> and T<sub>3</sub> has the highest amount of white beans flour (20 percent white beans flour) were the highest protein and control samples C<sub>1</sub> and C<sub>2</sub> (without white bean flour) were the lowest rate of that. Obtained results were similar with the results of studies Lee et al in 1998 and Mahadevamma and Tharanthan in 2003 [14, 26]. Also the result of table (2) was founded that in term fiber level between all of the treatment there are significant different. On the other hand, by increasing level of white bean flour instead of wheat flour in produced bread, fiber level has increased. In every two samples Industrial and traditional Barbari bread treatments I<sub>3</sub> and T<sub>3</sub> have the highest fiber content an every two control samples C<sub>1</sub> and C<sub>2</sub> (no white bean flour) had the lowest it. Findings with the results of Perez-Navarrete et al in 2006 matched that expressed high levels of alternative white bean flours products, baking the fiber was increased [21]. On the other hand, adding white beans flour increases samples ash compared with control, while in the two sample traditional and industrial Barbari bread treatments, I<sub>3</sub> and T<sub>3</sub> (containing 20% white bean flour) with highest ash and two control samples C<sub>1</sub> and C<sub>2</sub> (no white bean flour) had the lowest it. Also in Barbari bread industrial between treatments I<sub>1</sub> and I<sub>2</sub> and in Barbari bread traditional between T<sub>1</sub> and T<sub>2</sub> the difference was not significant (p≤0.01). The reason of ash increase in samples bread containing white bean flour there was a high mineral in white bean flour. Also ash content of white bean flour, which is far higher than wheat flour the natural increase of the ash-rich products has been [10]. According to the results Dhingra and Jood in 2001 and Ndife et al in 2011 by increasing the levels of legume flour instead of wheat flour in products fortified has increased ash level [11,18]. Moreover, the results of (2) was found that adding white beans flour, moisture content samples compared to control treatments significantly increased slightly, while both industrial and traditional Barbari bread treatments I<sub>3</sub> and T<sub>3</sub> (containing 20% white bean flour) highest moisture and every two control samples C<sub>1</sub> and C<sub>2</sub> (with out white bean flour) were the lowest. In addition, it was found that I<sub>1</sub> and I<sub>2</sub> and I<sub>3</sub> industry Barbari bread showed significant differences between treatments were observed, but no significant difference between treatments I<sub>1</sub> and C<sub>1</sub>. Also traditional Barbari bread in the same situation was observed between treatments (p≤0.01). The Reason of moisture increase in samples bread containing white bean flour is generally duo to increase fiber content. The results with Akhtar et al research results in 2008 and Maneju et al in 2011 was consistent and they reported that with the increase in moisture content with increasing fiber content has a direct relationship [3,15].

### Results evaluation of staling test of Iranian industrial and traditional Barbari bread with sensory method

Samples staling test results of industry and traditional Barbari bread after cooking by panelist was investigated by Weber came in table 3 after 24 hours of cooking time were observed, treatments I<sub>1</sub>, I<sub>2</sub> and I<sub>3</sub> had the lowest staling (no significant difference between the treatments containing white beans flour) and C<sub>1</sub> and C<sub>2</sub> treatments had the highest rate of staling (significantly different with all treatments) (p≤0.01). In addition, after 48 hours of cooking

time, treatment I<sub>1</sub> had the lowest staling (no significant difference with other treatments containing white beans flour) and treatments control C<sub>1</sub> and C<sub>2</sub> had the highest rate of staling. While the control treatments with all traditional treatments containing white beans flour (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>) no significant differences ( $p \leq 0.01$ ). After 72 hours of cooking time, the least staling quantitatively belonged to I<sub>1</sub> (no significant difference with I<sub>2</sub> and I<sub>3</sub>, and significant differences with other treatment) and between other traditional treatments including white bean flour and control treatments with equals point and lack of significant difference, had the highest rate of staling ( $p \leq 0.01$ ). These results with observations of Abdel-Rahman in 1978, Abdelkader in 2000 was consistent that expressed with different beans flour substitution with wheat flour in the formulation prepared Bread, 5 and 10 percent levels duo to increase of water uptake and levels 15 and 20 percent is reduced of water absorption in rich products, texture will be rigid [2,1].

### CONCLUSION

The results revealed that the addition of white bean flour has different effects on chemical parameters of product staling. So that the chemical characteristics, with the addition of white bean flour to traditional and industrial Barbari bread samples, protein, fiber, ash and moisture increased compared to control samples and samples contained 20% white bean flour had of the rated characteristics and treatment control had the lowest score. The staling sensory method, it was observed that with increasing percent enrichment increased staling. Evaluators so that the samples fortified with 10% of white bean flour preferred the other sample. So, high intake of Barbari and Lavash bread as second in the nation, offering cooperation to reduce waste and improve the nutritional quality is of great importance.

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