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ORIGINAL ARTICLE

Comparison of the physical, chemical, rheological and baking properties of wheat bread and wheat fortified with oats and almond bread

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Abstract

The study was conducted in the laboratories of the Faculty of Agriculture, Department of Food Sciences, for the period from 1/5/2021 to 1/6/2021 It included the production of wheat bread and wheat bread fortified with oats and almond bread in order to compare the physical, chemical, rheological and baking properties of bread produced from wheat and from wheat fortified with different percentages of oats and almond bread
Different samples were taken from bread fortified by 100 percent, wheat bread fortified with oats by 10 percent, wheat bread fortified with oats by 15 percent, and wheat bread fortified with oats by 20 percent, oat flour in addition to almond bread.
The results of the physical characteristics showed a high percentage of moisture in almond bread and a decrease in wheat bread. The results also showed a high percentage of protein in wheat bread and a decrease in wheat bread, and the percentage of fat in almond bread increased compared to the rest of the samples, and the highest value of carbohydrates was in wheat bread and less in almond bread. As for the results of the rheological characteristics of the flour, the farinograph results showed that the highest absorption rate was in the almond sample 68.6 and the lowest in the wheat sample 60.6, while the longest period was for the time required for ripening in almond bread 17.2 and the lowest in wheat flour 4.8 and recorded the highest stability period in the almond sample was 11.3 and the lowest was in wheat 5.0, as for the sensory evaluation. The results showed the superiority of wheat bread in most of the traits. As for the smell and taste, the preference was for almond bread.

1. Introduction

Bread is the main food for most of the peoples of the Middle East due to its nutritional importance and the nutritional needs it provides for humans, which were addressed in many previous studies [1], The provision of bread has also become a goal that most countries of the world seek to achieve for their people, and it has become a mainstay for the stability and security of those countries. It should be noted that the consumption of bread is increasing day after day, especially in developing countries and rapidly due to the population increase [2]. Because of the high competition in the market and the increased demand for healthy, natural and functional products, there have been several attempts to improve the nutritional and functional value of bread by modifying its composition, by raising the proportion of wheat flour in the basic mixtures for the manufacture of bread, in order to increase the nutritional value and in terms of smell, and also increases the feature of Water conservation that delays the hardening of bread [3, 4], It can also be used by people with celiac disease in which people

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with gluten intolerance [5], and many studies recommend the use of oatmeal as a source of dietary fiber in wheat products such as bread and biscuits [6].

Wheat is one of the ancient grains that were grown in many parts of the world. It is important as a healthy food that benefits the body. Wheat is from the Poaceae family because it contains gluten protein and many nutrients, and it is one of the most cultivated types of cereals in the world, and its production has increased significantly in the past years to nearly 615 million tons annually worldwide, and is China, India, the United States, Russia, France, Canada and Australia are among the most producing countries. It is also one of the largest groups of grains used in human and animal food, as wheat consists of three main parts, endosperm, bran and germ, in proportions of (80-85%), (10-14%) and (2.5-3%), respectively [7], The manufacturing processes remove large quantities of bran and germ as by-products and break down the endosperm layer into fine particles called white flour [8]. Almond flour consists of 100% ground almonds, where the grinding process is by removing the shell and then grinding the almonds or nuts into a very fine powder, and according to the US Department of Agriculture, almonds contain many nutrients, vitamins and minerals, and many people By choosing almond flour, because almonds are an excellent source of nutrients, which makes this flour better for the health of the human body than other types of flour or ordinary flour, while people who suffer from wheat allergy or inability to digest gluten use almond flour because it does not contain gluten. This flour has a unique flavor. Oats are a gluten-free whole grain, and are a good source of vitamins, minerals, fiber and antioxidants that are important to the body, they provide many health benefits, as they help lose weight, reduce blood sugar levels, reduce the risk of heart disease. It is worth noting that there are many oat products, such as instant oats, rolled oats, or solid oats, they are prepared and cooked in water or milk, and some healthy ingredients such as fruits or nuts can be added. People with wheat allergy who follow a special diet are advised to make sure that the food label is gluten-free, because some oat products may be mixed with other grains such as wheat during the harvesting or processing process, Farinograph is one of the devices that depends on evaluating the quality of grain, including the rheological characteristics of the dough, especially with regard to protein quality. Farinograph standards (resistance, elasticity, production coefficient) are also used for flour quality indicators [9], these standards help direct manufacturers towards the optimum final use of flour [10], as well as the use of Farinograph to classify the quality of flour [11].

In view of the scarcity of local research on the use of oats in the bread industry, the research aims to studying the physical and chemical properties of bread produced from almonds and different percentages of oats and comparing them with wheat bread. Study of the rheological properties of bread produced from almonds and different proportions of oats and compared to wheat bread.

2. Materials and Method

The chemical was used in this work as ether, ethanol, sulfuric acid, salt, yeast, distilled water.

Table 1: Device used

The device	Origin
Farinograph	Japan
Sensitive scale	Switzerland
Incineration device	U.S.A
Kendall device	Brazil
Soxhlet device	China
Drying oven	Germany

2.1 How to prepare the loaf (local bread)?

The home method was used to prepare the local loaf of bread (tannour bread) for each of the whole wheat flour as mentioned by (Al-Nasiri 2009) based on the mixing ingredients:

- 100gm flour (zero flour or whole meal flour)
- Water according to the absorbency of the flour
- Salt 1.5 gm
- Yeast (Turkish origin) 1 gm.

2.2 The method of work

The materials were mixed by hand and kneaded until the degree of maturity was reached, then the dough was fermented for two and a half hours, then the dough was cut into pieces and baked in the oven at a temperature of (185 ± 5) for 2 to 5 minutes.

2.3 Treatments

- 100% Wheat flour has been added
- 100% almond flour has been added
- Wheat flour was added by 90%, and 10% oat flour was added
- Wheat flour was added at 85%, and 15% oat flour was added
- Wheat flour was added at 80%, and 20% oat flour was added

2.4 Determination of Chemical Properties

2.4.1 Moisture determination

The percentage of moisture was estimated according to the method mentioned in (A.O.A.C, 2004) with a weight of 3 g of the raw material and it was dried in a thermal oven at 105 ° C for three hours.

2.4.2 Ash determination

The ash was estimated according to what was mentioned by burning 3 gm of the sample in an incineration oven at a

temperature of 550°C until a light gray ash was obtained or until the weight was stable.

2.4.3 Fat determination

The fat was determined by the method of intermittent extraction in the Soxhlet apparatus as mentioned by A.O.A.C (2012) at a temperature of (50) degrees Celsius for four hours with a weight of 3 g of the raw material and the use of petroleum ether 40-60 as a solvent.

2.4.4 Portion determination

Nitrogen was estimated in 0.2 g of the raw material sample using the standard Kildall's method and the protein percentage was extracted by multiplying the percentage of nitrogen in the sample by the protein factor of 6.25, according to A.O.A.C (2012).

2.4.5 Total carbohydrate determination

The percentage of carbohydrates was estimated by calculating the difference after adding the percentage of moisture, ash, fat and protein and subtracting them from 100 (person, 1970).

2.5 Estimation of rheological properties

Farinograph test was carried out as mentioned in A.C.C (1998) using a farinograph device supplied by the Grain Trading Company in Tikrit / Salah al-Din. The farinograph device was used to study the rheological changes of the dough according to the 1/115 method [12]. The following readings were estimated:

2.5.1 Water Absorption

It is the amount of water needed for the Development of the dough and the formation of the gluten network.

2.5.2 Dough Development time

It is the time since the start of adding water (water descent from the burette to the dough basin) and for the graph to reach the highest peak.

2.5.3 Stability

It is the difference in time between the point of contact with the graph line 500 Brabender units.

2.5.4 Degree of Softening

It is the area between the farinograph curve at the end of the analysis time and the central line that passes through the curve, which gives an indication of the Visco Elastic properties of gluten.

2.5.5 Farinograph Quality Number

It is the reading that gives the final indication of the condition of the dough, that is, it is the final result of all previous readings.

2.5.6 Rheological properties of flour

Knowing the information related to the rheological properties of the dough is important for predicting the use of wheat flour and the quality of the final product later (Mohammed et al., 2012).

3. Results and discussion

3.1 Results and discussion of the chemical composition of bread

Table 2 shows a high percentage of moisture in almond bread compared to wheat bread and oat bread, which amounted to (22.90) %, and the percentage of protein increased, which amounted to (06.34) %, in addition to a high percentage of fat, which amounted to (22.5) % in comparison with wheat bread and oat bread, while we note from Table (4-1) a decrease in the percentage of carbohydrates in almond bread, which amounted to (9.21) %, compared to wheat bread, which amounted to (59.69) %. We also note the high percentage of ash in bread Almond and oat bread compared to wheat bread.

Table 2: Chemical composition of bread

laboratory bread samples	Moisture	Protein	Fat	Carbohydrates	Ash
Wheat bread A	11.20	9.10	6.5	69.59	2.5
B1 oat bread 10%	12.55	19.21	8.6	55.56	2.9
B2 oat bread 15%	12.40	12.22	8.5	50.19	3.0
B3 Oat Bread 20%	12.41	12.12	8.9	51.00	3.1
Almond Bread C	22.90	34.03	22.5	21.9	3.90

3.2 Estimation of the rheological properties of flour

Farinograph test: The farinograph test was carried out by a device in the grain trading company in Tikrit / Salah al-Din according to the methods approved by AACC (1984) using (300) grams of flour on the basis of 14%.

3.3 4-2-1 water absorption ratio

It is the amount of water required at a temperature of 30 °C to reach the Developmental dough to the line 500 Brabender unit. We note from the table that the water absorption values of % ¾ were 60.6, 63.6, 65.2, 67.7, and 68.6 for samples, respectively, of wheat and wheat fortified with oats 10%, 15%

and 20 % and almond flour that the percentage and quality of protein is of great importance in the absorption of flour because it is necessary for the formation of the gluten network and also has a relationship with the percentage of moisture content of the fortified flour, as it is noted from the table that the water absorption rates of flour increased by increasing the protein in the compound flour with a different substitution ratio, which has a great ability to absorb compared to wheat flour gluten.

Table 3: Rheological properties of wheat flour and wheat flour fortified with oats in different proportions and almond flour

Samples	Absorption rate	Time required for Development	Stability per minute
A sample of wheat	60.6	4.8	5.0
B1 Sample of wheat fortified with oats 10%	63.6	6.2	5.3
B2 Sample of wheat fortified with oats 15%	65.2	6.5	6.6
B3 Sample of wheat fortified with oats 20%	67.6	7.7	6.6
C Almond sample	68.6	17.2	11.3

3.4 4-2-2 Dough Development time

It is the time in minutes starting from adding until the dough reaches the required consistency at the highest point in the farinograph curve at the line 500 Brabender unit, (B.U), which is the stage after which the process of absorbing the flour components for water. The dough is formed or built by absorbing all the water added to it. Table 3 shows that the increase in the development time was in the almond sample, which amounted to 17.2 per minute, compared to the 10% of the wheat sample fortified with oats. This is explained by previous sources, as the short time for the dough to reach the line 500 Brabender is considered a desirable trait and is due to the good ratio and quality of gluten, which helps in the formation of the gluten network, as explained by Evoneri (2010) that one of the factors affecting the degree of maturity is the amount of gluten formed in the dough The speed of its formation leads to a short arrival time, that is, the dough reaches the required consistency, and this is what concerns and this is what God Almighty is concerned with the grain of wheat. Therefore, we note from the graphs below that the least amount of development was in the wheat flour, which amounted to 4.8 minutes, while we note the high time in the wheat fortified with oats 20%. As well as in the almond sample 17.2,7.7, respectively, as it retains water and hinders the gluten present in the flour from reaching the required consistency [13].

3.5 4-2-3 Stability time/minute

It is the time in minutes starting from the contact of the curve with the line 500 Brabender unit until after it leaves this line. Table 3 shows the stability time in minutes for dough samples, as it reached 5.3, 6.6, 6.6, 11.3 for all samples, respectively: the sample of wheat fortified with oats 10%, the sample of wheat fortified with oats 15%, the sample of wheat fortified with oats 20%, and the almond sample compared with the wheat sample that reached 5.0, the reason for the decrease in stability is due to the low percentage of fibers in the studied samples [14].

Table 4: Sensory assessment table

Traits	A1	B1	B2	B3	C
Face color	8.1	7.1	6.9	7.2	7.3
Loaf back color	7.9	7.3	6.8	7.0	6.8
Color homogeneity	8.5	7.0	6.1	6.5	7.0
Elasticity and chew ability	7.8	6.1	5.7	6.3	5.9
Odor	8.2	6.1	5.8	7.2	8.7
Taste	8.1	5.5	5.9	7.1	8.8
Regular shape of the loaf	8.3	5.9	5.5	7.2	6.1
Water absorption of the loaf	9.0	6.0	5.7	5.9	6.5
Loaf edges	8.2	6.5	6.4	6.0	5.9

3.6 4-3 Sensory assessment

The sensory assessment was conducted on the produced bread on the first day of production at room temperature by ten specialized professors in the Department of Food Sciences. Table 4 shows the results of dividing the sensory traits of the bread produced from wheat and wheat fortified with different percentages of oats and almonds. The results show the presence of Differences between treatments manufactured with different types of flour immediately after production at room temperature. The results of sensory assessment showed the superiority of wheat bread over the rest of the treatments in terms of face color. While. The highest value of wheat bread was for the color of the back of the loaf, and the lowest was for almond bread.

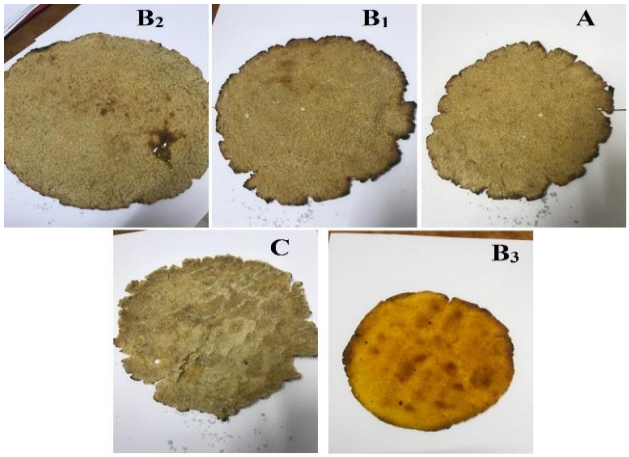

Figure 1: The external appearance of bread produced from wheat, oats and almonds.

The highest assessment of color homogeneity was shown in wheat bread and the lowest in almond bread. The elasticity and chewability were highest in wheat bread and lowest in wheat bread fortified with oats 15%, and the best smell was for almond bread and the best taste for almonds bread. while regarding the shape of the loaf. The best of it is wheat bread, and the least of it is the wheat bread fortified by oats. The

regular of the edges was the highest rated in the wheat bread and the lowest in the almond bread.

4. Conclusion

Almond bread was significantly higher in moisture, Fat and protein content, while wheat bread was superior to oat bread in its carbohydrate content. Almond bread has a higher water absorption rate than wheat and oats bread. The wheat bread was distinguished in the characteristic of the color of the face and the color of the back of bread, compared to the bread produced from almonds. Its noted that almond bread distinguished in smell and taste, from bread produced from wheat.

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