



Comparative Analysis of Almond and Oat Bread: Physicochemical, Mechanical, and Sensory Evaluation as Gluten-Free Alternatives

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Abstract

Bread is an essential carb source of diet in medial eastern and Asian counters as well as bakery products. With having massive nutrimental importance, almonds and oats have recently become a major topic in bread industry and health sections with being reliable alternative of wheat flour to make bread. Oat and almond bread can be easily made as we prepared them just by mixing baking soda as air incorporator, oat flour, pysllium husk, water, olive oil and salt. And almond bread by using almond flour instead of oat bread. Both tested for physiochemical properties, sensory analysis and mechanical testing. Almond bread demonstrates higher hardness values compared to oat bread, which can be attributed to the denser structure of almond bread.(Almond bread: Hardness 1 - 1215.667 g, Hardness 2 - 1157.333 g) but (Oat bread: Hardness 1 - 1163.533 g, Hardness 2 - 913.667 g) Almond bread is significantly more springy: 3.467 than oat bread 1.033, indicating a more resilient structure likely due to its higher protein content Almond bread received slightly more acceptance in sensory evaluation than oat bread, this due to more flavor and appearance of the bread. Physiochemical and mechanical testing were relatively close to each other. The two type can be a good carbohydrate or a what bread replacement for whom have celiac deses of having gluten intolerance.

Keywords: Bread, Almond, Oat, Human Health Physiochemical Properties, Sensory Evaluation

Recieved: 6/9/2024

Accepted: 26/9/2024



Introduction

1

Bread baking is a fundamental human activity, involving a mixture of flour, water, yeast, and sodium chloride, kneaded, fermented, and baked in an oven. (J,pico,J,bernal, et al .,2015). The almond kernel, a seed with two large cotyledons, is widely consumed as a snack, used in food preparation, confectionery, bakeries, chocolates, and pharmaceutical and cosmetic applications. (Prgomet, I.et al. 2017) Almond hulls, rich in triterpenoids, flavonol glycosides, phenolic acids, and polyphenolic compounds, are an interesting source of natural antioxidants and bioactive compounds. When incorporated into the diet, they reduce colon cancer risk, increase high-density lipoprotein cholesterol levels, and reduce LDL cholesterol levels. (Kahlaoui, M.et al., 2022). Almonds are used in traditional bakery and confectionery products like cookies, marzipan, and milk. Skins make up 6-8% of seed, with blanching water being a waste and disposal cost. (Garrido,et al 2008) The almond tree (*Prunus dulcis* (Mill.) D.A. Webb, *Prunus amygdalus* Batch, or *Amygdalus communis* L.) is one of the most popular nut trees worldwide and ranks number-one in nut production with over 3 million tonnes .of almond fruits yearly produced throughout an area of over 2 million ha

Almond kernel production produces by-products, including hulls, which account for 35-62% of almond fresh weight. In Tunisia, green almonds are harvested for special oil production, with green hulls removed before .(extraction. (Kahlaoui, M.et al., 2022

Almond hulls have varying sugar, protein, and crude fiber content, with varying amounts of acid detergent fiber, neutral detergent fiber, cellulose, and crude lignin. They are typically used as livestock feed or fuel. .((Kahlaoui, M.et al., 2022

Oat is a nutritious cereal grain rich in soluble fibers, proteins, unsaturated fatty acids, vitamins, minerals, and phytochemicals. Its health benefits mainly depend on its dietary fiber and β -glucan content. Oat bread has .high nutritional quality, pleasant aroma, and excellent moisture retention properties

Oats can enhance bread nutritional quality, but lack visco-elastic properties like wheat gluten. Studies have focused on composite breads made from wheat and oats, with oat bran, flakes, or flour levels ranging from .(10-51 %.(E.K, Hüttner et al.2010

Bakery products can use functional ingredients, but quality issues may arise due to alterations in physico-chemical and sensory features. This work evaluates the potential of using blanched water and blanched almond skins as food ingredients in cereal-based bakery products, assessing their physico-chemical properties, odor .(notes, antioxidant activity, and phenolic compounds. (Pasqualone, A., et al., 2018

Aim

In the study we aim to compare between (oat bread and almond bread) physical and propertied and sensory .evaluation to determine which one is better for human health and better in quality aspect

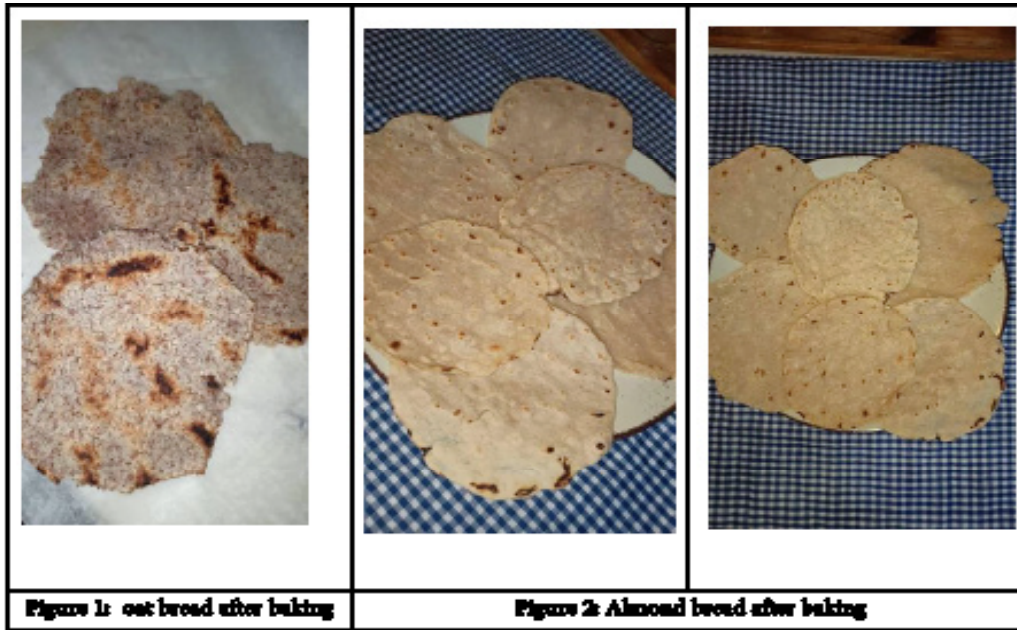
Material and method

2

Preparing Almond bread and oat bread

2.1

The two types of breads was made with very basic ingredients as seen in ((Espinosa Páez, E., et al 2023) baking soda as air incorporator, oat flour, psyllium husk, water, olive oil and salt. And used same ingredients for almond bread by using almond flour, psyllium husk, baking soda, water, olive oil and salt. And Total almond .bread dough made was 125.67g of almond dough and 230.46g oat dough. Bread was made on stove as a Nan



2.2 Physiochemical determinations

2.2.1 Moisture measurement

The principle of the test was based on weight loss in oven drying. The percentage of moisture was estimated according to the method used in (Al-Janabi, M.I.A., 2022). After T.S determination, water from the sample was removed in a thermal oven at 130 °C for 1 hour. Determining moisture content by comparing the weight of the sample before and after heating. The moisture content is calculated by the following formula:

$$\text{Moisture \%} = \frac{\text{loss in moisture (g)}}{\text{initial weight of sample (g)}} * 100$$

Equation 1 moisture content

Moisture % =

Equation 1 moisture content

Loss in moisture: initial weight (g) – final weight (g)

Initial weight = wet or original weight of sample before drying

Final weight = weight of sample after drying

2.2.2 Ash measurement

Total Ash is an inorganic residue remaining after the material has been completely burnt at a temperature of 550°C in a muffle furnace. It is the aggregate of all nonvolatile inorganic elements present in a material as its oxides. The sample (5 g) was weighed into previously cleaned and weighted crucibles. The ash content was then



cooled in desiccators and weighed. The difference in weight between the empty crucible and crucible with ash residue expressed as a percentage of the original sample weight and recorded as ash content (W.N Baba, et al., 2015).

Equation 2 ash determination

$$\text{Ash (\%)} = \frac{(\text{wt. of ashed sample} + \text{crucible}) - \text{wt. crucible}}{\text{wt. sample} + \text{crucible} - \text{wt. crucible}} * 100$$

Ash (%) = = *100

2.2.3 Kjeldahl nitrogen method:

The kjeldahl procedure measured the nitrogen content of a sample. Ratio can be calculated assuming a ratio of protein to nitrogen for the specific food being analyzed. The kjeldahl procedure can be basically divided into following stages: digestion-distillation-titration

In the digestion step, organic nitrogen converted to an ammonium in the presence of a catalyst (K₂SO₄, CuSO₄, H₂O₂, and PERCLORIDE) at approximately 370C. The amount of ammonia nitrogen in the solution is quantified by titration with a standard HCL solution. A reagent blank is carried through the analysis and volume of HCL titrant required for this blank is subtracted from each determination. (Prentice, N., et al 1979)

Equation 3 protein determination

$$\text{Protein \%} = \frac{(\text{nitrogen content } x - 6.25)}{\text{sample weight (g)}} * 100$$

2.3 Mechanical testing

Bread crumb hardness, cohesion, adhesion, springiness, were measured on Texture analyzer (Stable Microsystem) is used to analyze the samples, according to AACC method 74-09 modified with a press the strip twice at a test speed of 2.00 mm/sec, and we use a TA9 needle (1mm diameter with 43 mm length) pressure probe with a 60 mm barrel (Gillespie, R. and Ahlborn, G.J., 2021.)

2.4 Sensory evaluations

Taste Oder color and texture the sensory evaluation of samples was judged by students of TCAS students. Samples were evaluated for color, Oder taste and texture (mouth fell), the intensity rating (0-9 hedonic point scale) and preference rating (10-point scale) for each attribute... Water was provided to rinse the mouth between each sample (Zhao, J., al ., 2024).

2.5 Statistical analysis

Data collected in excel sheet, for result analysis XLSTAT 7.5.2 version program was used. The obtained results were subjected to statistical analysis ANOVA. In order to determine the significance of differences between the average values, Fisher's LSD-test was applied to determine the direction of the differences between mean values (De Wit, M., et al ., 2015).



3 Result and Discussion

3.1 Physiochemical properties

Table 1 physiochemical attributes of almond and oat bread

Tests Samples	Moisture %	Ash%	Protein %
Oat bread 1	6.330 ^a	1.600 ^b	14.348 ^b
Oat bread 2	6.315 ^a	1.500 ^b	12.950 ^b
Almond bread 1	4.600 ^b	4.500 ^a	22.600 ^a
Almond bread 2	4.450 ^b	4.300 ^a	22.575 ^a

Moisture as a quality attribute is important factor affecting shelf life and preservation of bread .as shown in table 1 The two types of bread showed slightly high difference in moisture with oat bread ranging from (6,330 %to 6.315%) and almond ranging from (4.600 %to 4.450%). and both breads were lower comparing to (R Gillespie, GJ Ahlborn,m 2021) In which almond bread was 11.2% and oat bread 12.5% indicating oats having much more water content then almonds this may be due to different flour processing.

Regards of moisture ash of almond bread was highest by(4.500%) showing high levels of carbonic compounds and compared with (MIA Al-Janabi 2022) which found almond to be 3.90% and oat bread 20% to be 3.1% ash Oat bread by being lowest was (1.600%). this might be due to low

Protein of almond bread was higher than oat bread ranging from 22.575% and 22.600%, however oat bread with way less protein content ranged from 14.348% to 12.950%, this is considered very low comparing to (E Espinosa Páez., et al .,2023) in which they resulted in 23%.

3.2 Mechanical evaluation

Table 2 mechanical testing values

Tests Samples	Hardness 1	Hardness 2	Springiness	Cohesiveness
Almond bread	1215.667 ^a	1157.333 ^a	3.467 ^a	0.497 ^a
Oat bread	1163.533 ^a	913.667 ^a	1.033 ^a	0.390 ^a

Hardness of almond bread ranged from 1215.667% to 1157.333% and oat bread was ranging from 1163% to 913.667% Springiness of breads showed signifying change with highest of almond (3,467%) and lowest of oat bread (1.033%) Cohesiveness showed no obvious change results were almond bread of (0.497%) and oat bread (0.390%) as referred in (R Gillespie, GJ Ahlborn., 2021)



3.3 Sensory evaluation

Table 3 sensory evaluation of oat and almond bread by 0-9 point hedonic scales

Tests Samples	Taste	Color	Oder	Texture
Almond bread	8.000 ^a	8.667 ^a	8.500 ^a	7.333 ^a
Oat bread	7.833a	8.333 ^a	7.833 ^a	6.333 ^a

Sensory analysis was limited to taste, color, Oder and texture evaluation. almond bread showed high acceptance according to 0-9 hedonic pointing scale .in taste attribute almond bread was higher 8% and not by far oat was 7.833% .in color both were relatively close in result, almond bread was 8.67% and oat 8.33%, in Oder the difference was much higher almond bread scored 8, 50% and oat bread was 7.83% this might be due to phenolic compounds in almond flour. the texture however they both results decreased then usual with almond bread 7.33% and oat bread 6.33% this might be due to the presence of oat granules in the bread(R Gaglio., et al .,2023)

4 Conclusion

The present study after using two types of flour to determine physiochemical, mechanical and sensory determinations for both samples concludes that Almond bread was significantly higher in ash and protein content, while oat bread was superior to almond bread in its moisture content. Almond bread has a higher sensory acceptance in all four attributes (color, taste Oder and texture) and oat bread had less sensory acceptance. 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. It's noted that almond bread distinguished in smell and taste, from bread produced from wheat. And in general both bread types are acceptable to consumption but oat bread is less nutrient quality.

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A graduation project conducted by a group of undergraduate students under the supervision of the course instructor, with the names of the supervisor and all participating students included in the research.