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Original research

Physicochemical, textural and sensory analysis of bread made from bakery premixe

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A B S T R A C T

Today, various methods have been developed to reduce the cost and time needed for the preparation and production of bread. One of these methods is using baking premixes to increase ease and create uniformity for bread quality. This research was carried out with the aim of investigating the possibility of producing baking premixes to improve quality and delay the staling of Baguette and Barbary breads. For this purpose, the pre mixture was prepared ready for baking and stored in three convenient packaging (polyethylene, polypropylene and paper bag) for 60 days. Qualitative, rheological and sensory tests were evaluated for 0, 30 and 60 days. The samples stored in the paper bag had better bread quality and longer shelf life. In the breads produced from the prepared powders, the special volume of samples in paper bag increased significantly ($p \leq 0.05$). In Barbary bread, the comparison of the average treatments with the color and crust appearance in polyethylene packaging did not have favorable results for 60 days. Packing and formulation were effective in bread shelf life. If both formulations were stored in paper bags, baking premixes can be used for up to 60 days.

Keywords: Barbary bread, Baguette bread, Packaging, Qualitative characteristics, Shelf-life, Baking premixes

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1. Introduction

According to the Standard & Industrial Research Organization of Iran No. 2628, traditional breads obtained from the main materials of water, flour, salt, dough or sour pastry, or a mixture of both, in steps by hand (traditional hand wheat bread) or by machine (traditional machine bread) like in Sangak, Barbary, Tafton and Lavish breads (Sluimer et al., 2005).Bread as an essential commodity has a special significance in the consumer basket of households .It is the main source of food for many people in the world.

Each day, it provides the bulk of energy, protein, mineral salts and vitamins of group B (thiamine, riboflavin and niacin). The use of bakery mixes or semi-ready baking mixtures is one of the newest methods in the food industry. These blends are made in flour mills including ingredients such as flour, yeast, salt and other additive (Eugenia et al., 2003).

Complete mixes are the perfect dry mix. Thus, the final product requires only the addition of water, molding, pouring the dough into the mold and the middle rest (if required) and baking. This group is mostly consumed by domestic consumers and restaurants and small producers, while it is not cost-effective for breadbasket and other baking products for the guilds.

These mixtures not only save time, but also do not hurt with the selection of additives and ingredients needed. So changes made to the raw materials. The product produced from these mixtures, will have a constant quality and will reduce waste naturally (Hegenbart, 2000).

Bakery products have very short shelf life, and their quality is closely related to the time of production and consumption. During the storage of bread, the decrease in freshness and the increase in the firmness of the brain reduce the product's quality. The sum of these factors caused bread staling (Majzoobi et al., 2010). Various methods have been used to reduce bread waste by improving its quality.

For example, the use of authorized additives with proper methods for the production of dough and bread can have a significant effect on the quality of the bread and reduce its losses (Barcenas et al., 2004).

Usually the packaging of food is against the influx of external factors and also to preserve the properties of its internal contents. The presence of air inside the package can cause penetrating of material inside it. In this regard, the evacuation of air or injection of

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inert gases into the food package is the perfect solution to counteract the growth of bacteria without losing properties, the freshness of the product. Today, the use of multi-layers, especially polyethylene film, has become more popular and efficiency of these materials has increased. The major use of polypropylene films is in the production of flexible packaging such as chips, snacks, biscuits, ice cream, pasta and samples, which are laminated, single-layered, metallized, and so on. The effect of formulations of semi-ready mixtures on specific volume was evaluated by (Faiza et al., 2015). The results indicated an increase in specific volumetric capacity and increased scoring points and sensory characteristics. Dhinda et al. (2012) evaluated the nutritional properties of products from baking premixes. In terms of nutritional value, the produced products had high protein, minerals, fiber, and at the same time contained less carbohydrate.

The effect of semi-ready mix and time duration in the bread bakery specifications of rice flour was evaluated by (Lee et al., 2011). According to their findings, the volume decreased during storage and the crust rigidity increased over a period of 4 months.

The effect of enrichment of semi-prepared mixture with calcium carbonate and ferrous sulfate on rheological properties and bread quality has been investigated by Sudha et al. (2008). According to their findings, there was no significant effect on crust apparent properties and sensory evaluation of the bread except crust color and also had no effect on the parameters of rheological even after storage.

Therefore, considering the above, this research was conducted with the aim of evaluating the quality of breads produced from baking premix at different storage times and selecting suitable packaging for storage.

2. Material and Methods

2.1. Materials

Flour (86%) Moisture (13.5%), protein (10.5%), wet gluten (26%) and falling number (57) which were determined according to AACC-approved methods (AACC, 2003), was extracted from the Tous Company in Mashhad. Other materials used include sugar and salt, which were made from the market. The used liquid was oil (Laden Company).In addition to the SSL emulsion from Belgrade, Malta powder was also used by the Maltese Force Mashhad Company and Ascorbic Acid from the Merck Company as Flour Conveyor. The yeast in formulas was in dry active form and prepared by Iran Mollas Co.

The baking premixes were prepared using the formulas shown in Table 1. Baking premixes were then stored in packages containing polyethylene (140 μm) polypropylene (so called 100% thick polypropylene or OPP) and paper bags for food industry. All of these coatings were packed inpacks of 10 kg capacity and were used. Samples were tested at specific times (0, 30 and 60 days). To test the quality of the baked bread with baking premixes at a given time, the packages were opened and placed inside the dough and water was added to the second formula in mixture. Then they were rested in the condition of the room for 30 min.

The dough was divided into 250 g chips. Chin rest time was 45 min. After the rest, the chains were stacked with roller rollers of the dough, and then placed inside the room equipped with steam and heat in the vicinity of the oven at a temperature of 35-30°C and a relative humidity of 85-80%. Dough was cooked after 60 the minutes at 160°C for final cooking.

Baking premixes were packed in 10 pack bags of three types. First, the polyethylene cover, second the propylene bags and third paper bags, which were stored in room conditions for 2 months, were tested at specific times (0, 30 and 60 days). The Abbreviations used for different packages are presented in Table 2.

2.2. Methods

Texture: Bread texture tests (using the CNS Farrell apparatus) were carried out as follows: According to the instructions of the machine, the same parts of the bread samples, prepared from the test treatments (in terms of thickness and uniformity of the surface), were inserted under the probe a diameter of 10 mm and a hole with a diameter slightly larger than the probe and cutting force, which was recorded as a bread stiffness (Purfarzad et al., 2011).

Bread sensory tests: For sensory evaluation, a 5-point Hedonic scoring method was used, which includes features such as crust color, crust appearance, texture, perfume, taste and general appearance (Anon, 1987; AACC, 2003).

Bread volume measurement: The specific volume of bread was measured according to the standard method (AACC, 2003) according to the seed replacement method.

2.3. Statistical design and results analysis method

This research was carried out in the form of a 2 *3*3*3 statistical design for Barbary and Baguette breads. The first factor was the type of formula used, the second was the types of packaging and the third was three storage times. All experiments were performed in three replications. To analyze the data and compare the meanings with Duncan's test at 95% level, the MSTATC software version 1.42 was used.

3. Results and Discussion

3.1. Texture

The effect of storage times and types of packaging on the staling and the stiffness of bread are shown in Table 3 and Fig. 1 and 2 respectively. According to Table 3, the analysis of the staling of Baguette breads was more extensive. However, this difference was not significant, and there was no significant difference in the Baguette bread during storage for 24 hours in polypropylene packaging ($p \leq 0.05$). The study of the staling process of breads from 0 to 72 hours showed that samples stored in polypropylene packages showed higher staling and the samples kept in the paper bag had the lowest stale.

Also, there was no significant difference between the samples made from the preserved powder in the packaging of ethylene and propylene in 60 and 30 days ($p \leq 0.05$). The amount of staling, indicated that the storage of these powders didn't decrease quality. In Baguette bread, there was no significant difference between two packages of polypropylene and polyethylene during 30 and 60 days of staling in 24 hours and 72 hours ($p \leq 0.05$).

Table 1. Barbary and baguette breads formula.

Type of breads	Flour 81%	Flour 86%	Salt (g)	Sugar(g)	Dough(g)	Ascorbic Acid (mg)	Malt powder (g)	Whey less powder (g)	Oil (g)	SSl (g)
Barbary bread	700	--	70	70	70	210	70	70	70	35
Baguette bread	3500	3500	70	20	50	210	------	------	-----	-----

Table 2. Abbreviations used for different packages.

number	treatments
1 PE	polyethylene
2 PP	polypropylene
3 PB	Paper bag

The highest rigidity of breads in the ethylene bundle bags during the storage period were significant ($p \leq 0.05$) in two combinations. As it shown in Fig. 1 and 2, Bread stiffness in formula 2 in the samples stored in the paper bag, was the smallest amount.

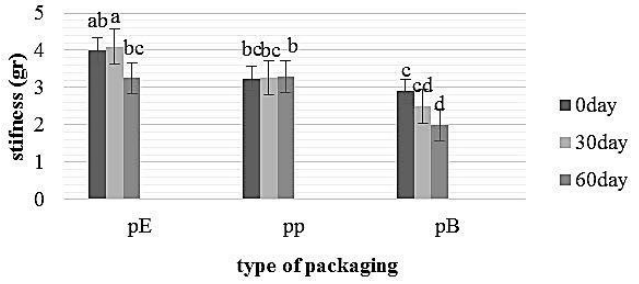

Fig.1. Evaluation of the storage times and types of packaging on the stiffness of the Barbary bread - Texture (formula 1).

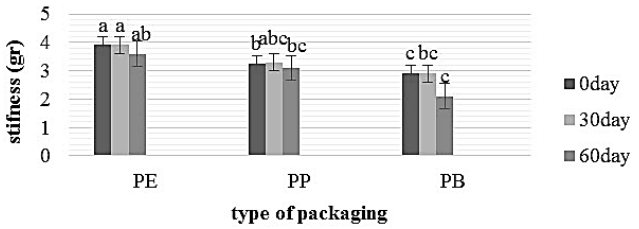

Fig. 2. Evaluation of the storage times and types of packaging on the stiffness of the Baguette bread - Texture (formula 2).

The texture of the breads stored in the paper bag was softer because of the higher moisture content. As a result, the starch rejection and the staling process in theses breads had slowly occurred. Of course, according to Fig. 1, it should be noted that in 30 days of storage, rigidity values were increased in Formula 1. Reduction of moisture content caused the pro``duction of hydrogen bonds between starch polymers or between starch and proteins (Schiraldi et al., 2001).

Bread staling is mainly due to the retro gradation of starch and the formation of cross-links between Starch in gluten chains and the migration of water to the crust (Karaoglu et al., 2006).The effect of the duration of bread storage had been reported by researchers. Shelf- life of these breads which stored about less than 11 weeks had less effect on bacteria (Fik et al., 2002). By increasing the shelf-life, decreasing the stiffness in the texture, resulted in moisture loss, starch deficiency and staling. The average of the above-mentioned characteristics of the breads indicated a softer and more favorable bread texture. Breads staling usually occur due to moisture transfer from the brain to the crust, which results in disappearing firm crust gradually. Gluten and starch had very important role in creating firm crust. In addition to formation of a new crystal in the starch molecule which was previously gelatinized during the baking process, cross- links between starch and gluten, resulted in bread rigidity. These hydrogen types of bonds made up the complex between the bread polymers (Majzoobi et al., 2010).

One method for determining the staling is to determine the stiffness of the bread texture. Starch regression, migration of water from the brain to the shell, creating interactions between starch and protein molecules are among the main factors affecting the staling and bread firmness. The results obtained in the texture test of different treatments confirmed the results of moisture test and the weight of these breads. These results were consistent with the findings of (Carr & Tadini, 2003). The effect of formulations of baking premixes on a batch was evaluated by Fiza et al. (2008), the results indicated texture improvement.

3.2. Bread volume measurement

The examination of the types of packaging showed that samples kept in the paper bag had the highest volume. As shown in Fig. 3 and 4, there were significant differences in the volume between the samples of breads produced from polyethylene and polypropylene in 60 and 30 days ($p \leq 0.05$).

A review of the specific volume of bread between the two formulations showed that the breads prepared with formula 2 are higher than the breads prepared by Formula 1, however, this difference was not significant at 95% level in PE package. The reason for an increase in the specific volume of breads prepared by

Formula 2 than in Formula 1 was to reach its maximum volume at different baking stages. Specific volume reduction of breads produced by Formula 1 can be due to the breads staling, which resulted in wall wrinkling of gas bubbles in the breads and stiffening of the texture. Fick et al. (2002) found that keeping storage times increased breads size.

Table 3. Evaluation the storage times and types of packaging on the Barbary and Baguette bread staling.

bread types	Package type	Storage (day)	Staling (0 hours)	Staling (24 hours)	Staling (72 hours)
Barbary bread	Polyethylene	0	4.7^{ab}	4^{ab}	4^{a}
		30	4.3^{ab}	3.3^{b}	3.3^{ab}
		60	5^{a}	4^{ab}	4^{a}
	Polypropylene	0	4.7^{ab}	4^{ab}	3.3^{ab}
		30	4.3^{ab}	3.3^{b}	3.3^{ab}
		60	5^{a}	4^{ab}	4^{a}
	Paper bag	0	4^{b}	3.3^{b}	3.3^{ab}
		30	5^{a}	4^{ab}	4^{a}
		60	4.7^{ab}	4.3^{a}	4^{a}
Baguette bread	Polyethylene	0	5^{a}	4^{ab}	3.3^{ab}
		30	4.3^{ab}	3.3^{b}	3.3^{ab}
		60	5^{a}	4^{ab}	4^{ab}
	Polypropylene	0	4.7^{a}	4^{ab}	3.3^{ab}
		30	5^{a}	4^{ab}	4^{ab}
		60	4.7^{ab}	4^{ab}	4^{ab}
	Paper bag	0	4.7^{ab}	3.3^{b}	3^{b}
		30	4.3^{ab}	3.7^{ab}	3^{b}
		60	5^{a}	4^{ab}	3.7^{ab}

*Different letters show the statistical significant differences ($p \leq 0.05$).

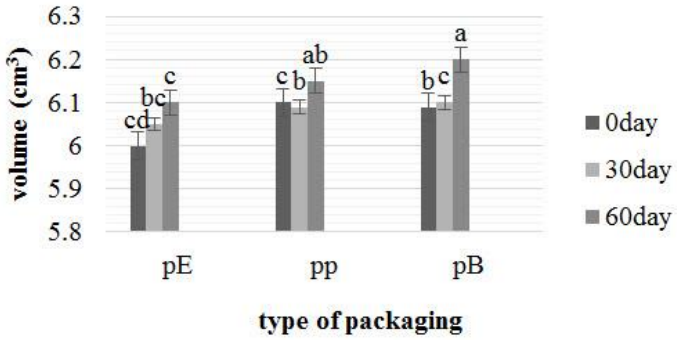

Fig. 3. Effect of compound composition, packaging types and storage times on a special volume of Barbary bread (formula 1).

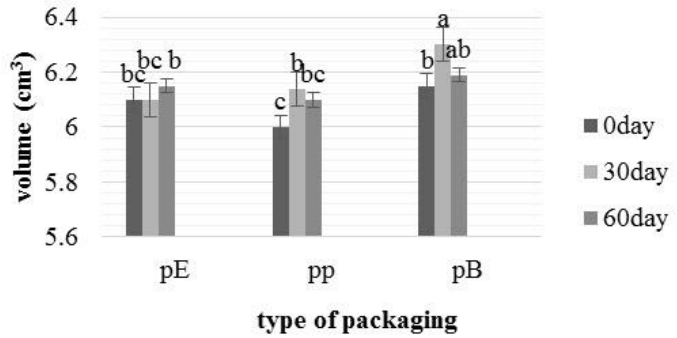

Fig. 4. Effect of compound composition, packaging types and storage times on a special volume of Baguette bread (formula 2).

Table 4. Examination of storage time and types of packaging on sensory characteristics and breads color.

bread types	Package type	Storage (day)	Crust Color	Texture	Aroma	Taste
Barbary bread	Polyethylene	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4.7^{a}	4.3^{ab}	4.3^{ab}	4.3^{ab}
		60	4.3^{ab}	3.7^{b}	3.4^{c}	4.3^{c}
	Polypropylene	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4.5^{a}	4.7^{a}	4^{b}	4^{b}
		60	4.3^{ab}	4.3^{a}	3.7^{c}	3.7^{c}
	Paper bag	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		60	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
Baguette bread	Polyethylene	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4^{ab}	4^{ab}	4^{b}	4^{ab}
		60	4^{b}	3.7^{b}	3.3^{c}	3.3^{c}
	Polypropylene	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4.5^{ab}	4.5^{a}	4^{b}	4^{b}
		60	4.3^{ab}	4^{b}	3.7^{b}	3.7^{b}
	Paper bag	0	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		30	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
		60	4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}

*Different letters show the statistical significant differences ($p \leq 0.05$).

3.3. Bread sensory tests

In Table 4 sensory characteristics were shown. It was found that the types of storage times in paper bag did not affect the changes in the rating of sensory properties, also did not change the taste by increasing the shelf life from 30 days to 60 days. The color scores in breads which prepared in the dough and kept in paper bag was higher than other specimens. Comparison of the average of treatments with the Barbary bread flavor, also showed storage for 60 days in polyethylene and propylene was not suitable, and it decreased with increasing of shelf-life, color and appearance of the crust. In both types of bread (composition) in polyethylene and polypropylene packaging, the color and appearance and even the flavor did not have a significant differences ($p \leq 0.05$). Moreover, it was determined that the type of storage times in paper bag, did not affect sensory properties , also did not change taste by increasing the shelf life from 30 days to 60 days . So there was not a significant difference in types of packaging in these factors ($p \leq 0.05$). Table 4 shows that the bread crust color was not significantly different in polyethylene bags except in stored treatments for 60 days ($p \leq 0.05$). Reducing the color and appearance of the crust after increasing the shelf-life was due to starch retro gradation. Also decreasing the moisture content of the crust was due to the migration of water from the brain to the crust during period (Majzoobi et al., 2010). The best type of paper bag package was for 60 days, which samples could be kept unchanged and desirable. These results, in fact, preserved the lower moisture content and the slower process of the staling of this bread. Vulicevic et al. (2004) reported similar results. Thus the results of the color test showed that with increasing in the storage times of breads, the brightness and yellowness of bread crust improved. According to Fik et al. (2002), there was no significant relationship between overall sensory parameters and baking times of baking premixes.

4. Conclusion

Bread as essential commodities has particular importance in the consumer basket of households and the main source of food for many people in the world. The results obtained from the evaluating of two formulas for preparing baking premix and three types of packaging for Barbary and Baguette bread showed that: adding yeast before or during puffing had a significant ($p \leq 0.05$) peculiarities in shell color, shell appearance but had no general acceptance. The amount of staling scored less, after the 0 and 24 hours of baking, only in treatments stored in the polyethylene packages. Sensory scores were higher for samples stored in the paper bag. The results also showed that, if both types of formulas were stored in paper bags, consumed for 60 days, breads would have desired properties. Texture measurements showed that the samples prepared in the paper bag had better bread quality, however, the breads which maintained for 60 days in all packages had acceptable quality. Of course, when dry yeast was later added to the compound (formula 2), the quality was desirable.

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