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Formulation and Production of Fresh Bread Using Jujube (*Ziziphus jujube*) Extracts

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Abstract : Bread is the main food, globally, for many people due to its high nutritional value and feasible price. In Iran annual consumption of bread is more than other diets. Through bread consumption some vitamins, iron, calcium and protein will be supplied for us. Today, it is known that some diseases, such as indigestion, anemia, malnutrition and under-developed children problem, can be due to low quality bread. Therefore, in order to achieve improved quality, food additives and process aid materials that improve the quality of the bread should be used. Jujube fruit is one of the indigenous fruits of Iran. High antioxidant properties of this fruit has oriented attention to this product (jujube-based bread). In this study, at first, the jujube dried fruit juice was mixed with water and using direct heatto obtain the brix mixture of 15, then by using a rotary vaporizer, the final brix of 60 was achieved. To prepare the dough, the mixture was made with 100% flour, 2.5% oil, 1% salt, 1% sugar, 1% yeast and 0.5% flour improvement agent, along with different amounts of dry jujube and its extract. After adding the water to the mixer, the mixture was stirred for 15 minutes and then rest for 15 minutes. The dough is then divided into 120g pieces and placed in rest for 5 minutes, finallythe dough was flattened and placed in the oven. It is steamed for 45 minutes at 45 °C and then cooked for 20 minutes at 200 °C. By analyzing the results of physicochemical tests, breads containing 4 and 6% jujube extracts were selected as the best treatments at all-time intervals. However, analyzing the sensory properties, especially evaluation of panelists, at all-time intervals, samples containing 6% jujube extract showedsignificant difference from other samples and was selected as the best treatment.

Keywords: Evaluation of panelists, physicochemical tests, Powder baking, Jujube fruit

Introduction

The jujube medicinal herb has unique properties. Jujube is a native and economic Iranian herb, that mostly has been cultivated in South Khorasan. Among the various varieties of jujube, the genus Ramonos and Zizifos are important in the pharmaceutical industry (Androli, 2007). Jujube is known as a stomach helper, sedative, laxative, anticoagulant, diarrhea, hypnotics, severe weakness eliminator, blood purifier, hair growth enhancer and anti-fever (Cheng, 2000). Jujube fruits contain sucrose, glucose and fructose, free amino acids (affecting jujube taste properties), flavoring compounds, high levels of vitamins A, B and C, phosphorus and calcium, and used as both fresh, dried or processed all over the world (Zhao, 2006).This fruit is rich in photo chemicals, antioxidant and vitamin C. In Britain, jujube is used dried or flavored with evening teas. In Korea, China and Taiwan, its juice as a sweet syrup is in use. In some areas, jujube is used to make vinegar, and it makes cakes in Africa (Li *et al.,* 2007). In the food industry, jujube is used as a food, food additive, flavoring and in the supply of various beverages (Gossel-Williams *et al.,* 2006). In recent years, preserving the foodstuff and increasing the shelf-life of them have a special place in the food industry.

Bakery products are the most important type of processed food throughout the world, among which the most consumable product is bread. Bread is mainly consumed as a cheap energy source. In fact, the bread is the main food of many people around the world, it provides a large portion of people energy, protein, and vitamin B for daily needs. In Iran, about 60-65% of daily required calorie and protein and 2-3 grams of nutrients are satisfied by bread (Decock and Cappelle, 2005). Long-term improvement in the nutritional properties of bread has been highly sought to enrich the bread with different compounds in order to promote nutritional value and the quality of its derivative products. For production of fresh bread, applying functional and substitute compounds such as various types of fiber, which are able to provide valuable nutritional properties, reduce the calories, and have least impact on the structural and sensory properties of bread is of great importance. Most studies that have tried to increase the bread storage time, have focused on changing formulations by using additives such as emulsifiers and hydrocolloids, and changing packaging conditions. Consumers prefer high quality products and longer storage. In order to achieve this goal, additive and processing aid materials should be used to improve the quality.

The results of Guarda *et al.* (2004) research on several hydrocolloids with different chemical structures in bulk bread showed that some of these hydrocolloids can reduce the amount of moisture loss during bread storage, decrease the rate of dehydration of the bread and prevent it from staling. Gomez *et al.* (2007), studied the performance of various hydrocolloids such as sodium alginate, carrageenan, hydroxypropylmethylcellulose, pectin, locust bean gum, carob, guar, jujube, and xanthan on delaying staling of layered yellow cake. The results showed that hydrocolloids improved the texture and sensory properties of cake. Sun *et al.* (2006), added guar hydrocolloids, carboxymethyl cellulose, hydroxypropylmethylcellulose and kalakaragajanianto breads used in Chapatti Breadshowed improvement of quality parameters such as extensibility, tearing withstand, color and sensory characteristics. Iqbal *et al.* (2005) studied the sensory characteristics of samples containing rice bran extract reported that breads with this extract well retained sensory characteristics (color, texture, flavor and odor) during storage and there was no significant difference between the samples containing the extract and the control samples. Singh *et al.* (2003) studied the sensory characteristics of short cake carrying potato puree extract and resulted that adding this extract to bread enhanced the bread sensory characteristics and delayed its staling without any change in its color, texture and taste. They concluded that the effect of adding extracts of this plant to bread would improve the sensory characteristics of the it, and delayed the bread stale without affecting the taste, texture and color of the product. Application of plants extracts in the processing of various types of cakes and bread has been reported that improved many qualitative characteristics of bread such as volume, porosity, stiffness, moisture and uniform tissue (Azizi *et al.* 2003; Turabi *et al.,* 2008).

The purpose of this study was to produce a new product to increase the tendency to consume and increase the productivity of this product as a pragmatic nutritional product of jujube and expand the use of its medicinal properties in Iran.

Materials and Methods

Preparation of jujube extract

Dried jujube was bought from local market of Mashhad and stored under ambient conditions. In order to prepare jujube extract, they were well washed. Water as the solvent was added with ratio of 1: 4. The extraction temperature was 5 + 80 °C and the final brix was 60. After washing, scratches were made on the fruit and then extracted with a 1: 4 ratio with water at the above temperature for 3 hours. After reaching the brix 14, the extract was combined with the pulp and passed through a cotton cloth. To increase the efficiency of the residual waste, it was again washed and heated, then the extract was filtered under vacuum. Finally, rotary vacuum concentrator was used for increasing the concentration at 45 °C.

In order to reach the appropriate concentration with brix of 14, for concentrating after extraction, a rotary evaporator manufactured by Haydolf Corporation of Germany 4003 was used and the process was performed under vacuum of 72 mbat 45 °C for 2 hours.

Preparation of bread

White flour with extraction degree of 81% was purchased from Golmakan Flour Factory (Mashhad, Iran). For this purpose, the flour required for the tests was prepared together and stored in the refrigerator. Other needed ingredients for experiment including sugar, liquid oils, vanilla from a bakery supplier store, and fresh egg and yogurt were prepared one day before the daily production of cakes and kept in the refrigerator.

Cake dough contained 100% wheat flour, 55% sugar powder, 30% oil, 75% egg, 80% yoghurt or milk, 0.5% vanilla (Turabi *et al.,* 2008) and 2, 4 or 6% Jujube extract (for different samples) that were obtained from the previous stage. To make the cake dough, sugar powder, egg, oil and jujube extract were mixed with an electric stirrer (Electra EK-230M, Japan) at 128 rpm for 4 minutes till a cream containing air bubbles was formed. Then the vanilla was added to wheat flour and the resulting mixture was gradually added to the cream. In this study, the jujube extract concentration of 2, 4 and 6% levels, was added to the mixture. Afterwards, by using a cream pump a 40 gramssample of dough was made and placed in specially prepared cake paper cups. The baking operation was then carried out in a hot air oven (ZuccihelliForni, Italy) at 170 °C for a duration of 20 minutes. After cooling, each sample was packed in polyethylene bags for evaluation of different characteristics and stored at ambient temperature.

Physicochemical and sensory tests of bread

Measurement of pH

The pH of the bread was measured according to Arunepanlop *et al.* (1996) and measured by a pH meter (Metrohm 691, Switzerland).

Measuring the bread moisture percentage

AACC (2000) issue 44-16 was used for this experiment. For this purpose, specimens at intervals of 2 hours, 3 days and 6 days after baking were exposed to temperatures of 100-105 °C in oven (jet tech OF-O2G, South Korea).

Measuring the water activity of bread

In order to determine the water activity, equal weights of each sample were completely minced (2 hours, 3 days and 6 days after baking), and the water activity of the samples was measured by the aw meter (Novasina, ms1, made in England).

Measuring the bread specific volume

To measure the specific volume, a substitution volume method using rapeseed was used in accordance with AACC 2000, No. 10-72. For this purpose, at a specified time interval (2 hours, 3 days and 6 days after baking), a piece by 2   2 cm from the geometric center of the bread was prepared and its specific volume was determined.

Crumb texture assessment

Bread texture evaluation was carried out at specific intervals (2 hours, 3 days and 6 days after baking) using a bread texture analyzer (QTS model 25 made in England) according to (Qing Han Gao *et al.*, 2012). The maximum force required to penetrate a cylindrical end probe (2 cm in diameter at 2.3 cm height) at 60 mm / min from the center of the bread was calculated as a rigidity index.The starting point and target point were 0.05 N and 25 mm, respectively.

Evaluation of bread color

The analysis of the color of bread crust at specified intervals (2 hours, 3 days and 6 days after baking) was performed by determining the three L*, a*, and b* indices. The L* indicator measures the brightness of the sample and range from zero (pure black) to 100 (pure white). The index a * shows the close proximity of the sample color to green and red, and ranges from -120 (pure green) to 120+ (pure red). The b* index shows the close proximity of the sample color to blue and yellow, and range from 120 (pure blue) to 120+ (pure yellow). To measure these indices, breadwas first cut into 2 x 2 cm and scanned by a scanner (HP Scanjet G3010) with a resolution of 300 pixels, then images were taken by Image J application. By activating the LAB space in the Plugins section, the above indicators were calculated (Sun *et al.,* 2006).

Evaluation of the porosity of the crumb

In order to evaluate the porosity of crumb at specified intervals (2 hours, 3 days and 6 days after baking), the image processing technique was used. For this purpose, a slice of 2 to 2 cm of bread was prepared and scanned by a scanner (HP Scanjet G3010) with a resolution of 300 pixels. The images were taken by the Image J software. By activating the 8-bit portion, gray level images were created. To convert gray images to binary images, the binary part of the software was activated. These images are series of dark and clear points that estimate the proportion of bright to dark points as an indicator of the porosity of the samples. Obviously, the higher this ratio, the higher the pore volume in the bread tissue (porosity). B activating the analysis section of the software, this ratio was calculated and the porosity percentage of the samples was measured (Haralick *et al,* 1973).

Sensory analysis

The sensory test was performed using the proposed method of Rajabzadeh (1991). The referees were selected from the trained people.The sensory characteristics of the bread consisted of form and shape (asymmetric shape, firmness and the presence of any cavity or empty space), upper surface property (burn, color abnormality, abnormal levels), bottom surface property (burns, wrinkles and abnormal surfaces), porosity (abnormal porosity, high density and compression), stiffness and softness of tissue (softness, tightness of bread, brittleness), chewing ability (dryness and rigidity of the bread, and sticking to the teeth) and odor, taste. Complexity or natural aroma of bread) were evaluated by 15 Panelist. The coefficient of evaluation of traits was ranged from very bad (1) to very good (5).

The studied characteristics in sensory evaluation do not have equal effectiveness. Therefore, based on literature a ranking coefficient was used for each of the features. Based on this information, the total score (bread quality number) was calculated using the following equation.

$$Q = (\Sigma \quad (P \times G) \ ) \ / \ (\Sigma P)$$

Where Q = Overall rating (Bread quality number)

P = coefficient of attribute rating

G = Attribution coefficient

Data analysis

The results of this study were analyzed using SPSS Statistic Version 23 software. For this research, jujube extract was added to the bread pastry formulation at 3 levels of 2%, 4% and 6%, and their effects on the physicochemical and sensory properties of the product was analyzed by one-way ANOVA based on randomized block design. Each specimen was prepared in three replications and the related tests were performed. Means were compared by Duncan's test at a probability level of 0.05. The Microsoft Excel software was used to draw charts.

Results and discussion

The results of analysis of variance for the effect of jujube extract on the physicochemical and sensory properties of bread have been shown in Table 1. The effect of jujube extract on all traits was significant (Table 1). In general, the addition of some herbal extracts to foods, in addition to strong antioxidants effects, they also play the role as an emulsifier. One of the roles that emulsifiers play in food is improving product quality. These positive results can be seen in Table 2.

Table 1. Analysis of variance (Mean Square) for the effects of sampling treatments on the physicochemical characteristics of jujube extracted beard

Source of variation	df	AW	Texture		Special Volume	pH	Moisture percent	Shell color assessment			Sample porosity
			N	mm				A	B	L	
Treatments	11	0.00139**	0.9978**	0.2778^{ns}	0.00074**	0.0979**	0.4079**	5.694**	17.77**	83.214**	317.903**
Error	24	0.000018	0.0003	0.5	0.00000625	0.000047	0.000081	0.000058	0.000045	0.0000305	1.0009
C.V. (%)		0.48	0.36	2.35	1.05	0.11	0.024	0.13	0.032	0.0098	0.63

Table 2. Mean comparison for the effects of sampling treatments on the physicochemical characteristics of jujube extracted cake Means with similar letters are not significantly different at p≤0.05

Treatments	AW	Texture		Special volume	pH	Moisture percent	Shell color assessment			Sample porosity
		N	mm				A	B	L	
Control sample (2 hours after baking)	0.8683 f	4.5307 h	30.50 a	0.2390 d	6.41 a	36.747 k	3.929 l	23.375 c	63.761 a	132.363 h
5% extraction and 5% dry jujube sample (2 hours after baking)	0.9083 b	4.7123 f	30.00 a	0.2547 b	6.11 c	37.057 g	5.851 f	23.099 e	60.499 d	159.666 d
6% extraction and 4% dry jujube sample (2 hours after baking)	0.9177 a	4.5913 g	30.50 a	0.2513 b	6.09 d	37.643 c	7.183 c	22.878 f	58.542 f	164.744 c
4% extraction and 6% dry jujube sample (2 hours after baking)	0.8883 d	5.0240 c	29.83 a	0.2623 a	6.14 b	36.977 i	5.020 i	23.193 d	58.729 e	153.621 f
Control sample (1 days after baking)	0.8593 g	4.5877 g	30.17 a	0.2200 g	5.97 f	36.813 j	4.220 k	23.417 b	62.190 b	151.594 g
5% extraction and 5% dry jujube sample (1 days after baking)	0.8977 c	4.7460 e	30.00 a	0.2413 cd	6.01 e	37.107 e	6.123 e	20.095 g	54.499 g	165.403 bc
6% extraction and 4% dry jujube sample (1 days after baking)	0.9060 b	4.6173 g	30.17 a	0.2440 c	5.97 f	37.747 b	7.984 b	19.659 i	51.306 i	168.426 a
4% extraction and 6% dry jujube sample (1 days after baking)	0.8793 e	5.9983 b	29.83 a	0.2507 b	5.89 g	37.087 f	5.610 h	20.079 h	53.327 h	154.212 f
Control sample (3 days after baking)	0.8467 h	4.6127 g	30.17 a	0.2067 h	5.88 g	37.033 h	4.264 j	23.692 a	61.021 c	157.744 e
5% extraction and 5% dry jujube sample (3 days after baking)	0.8840 de	4.7957 d	30.17 a	0.2267 f	5.87 h	37.323 d	6.184 d	18.168 j	51.281 j	166.707 b
6% extraction and 4% dry jujube sample (3 days after baking)	0.8987 c	4.6880 f	29.50 a	0.2313 e	5.80 i	37.913 a	8.02 a	17.270 l	47.889 l	169.840 a
4% extraction and 6% dry jujube	0.8693	6.2570	30.50	0.2383 d	5.73	37.310 d	5.636	18.108	50.710	155.331 f

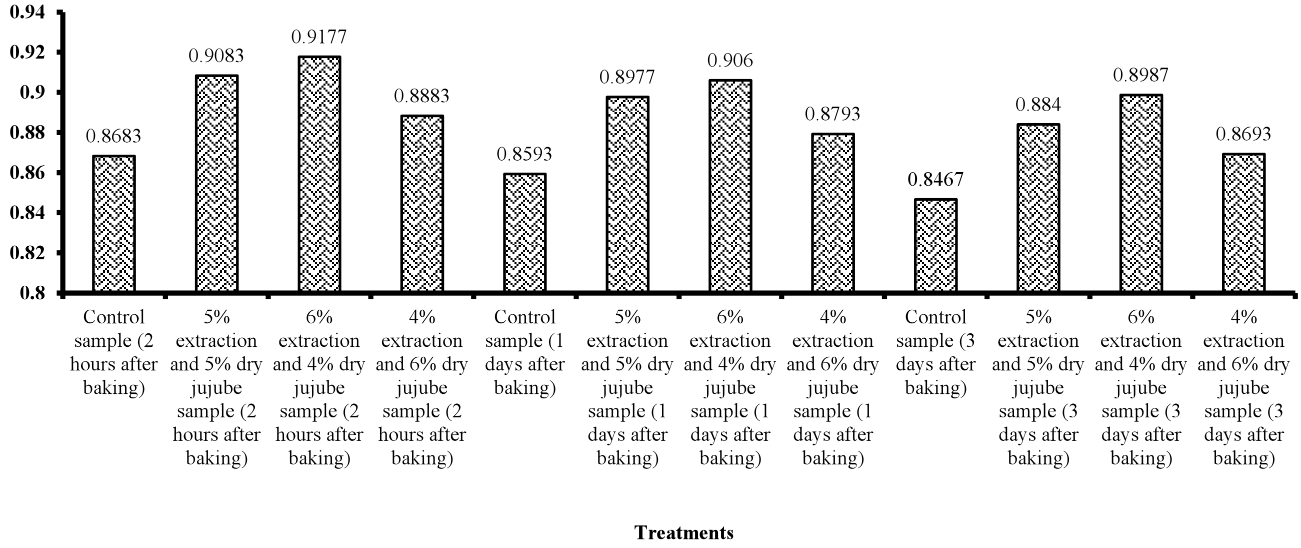

Fig. 1. The comparison of AW on different levels of sampling using Duncan method.

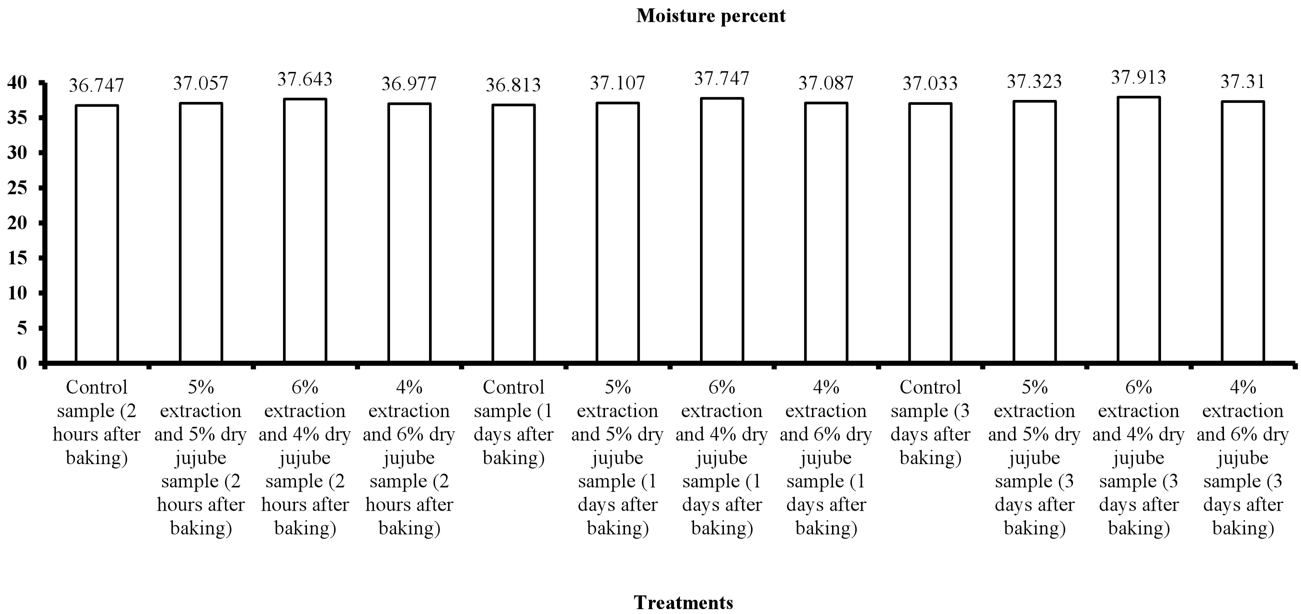

Fig. 2. The comparison of moisture percent on different levels of sampling using Duncan method.

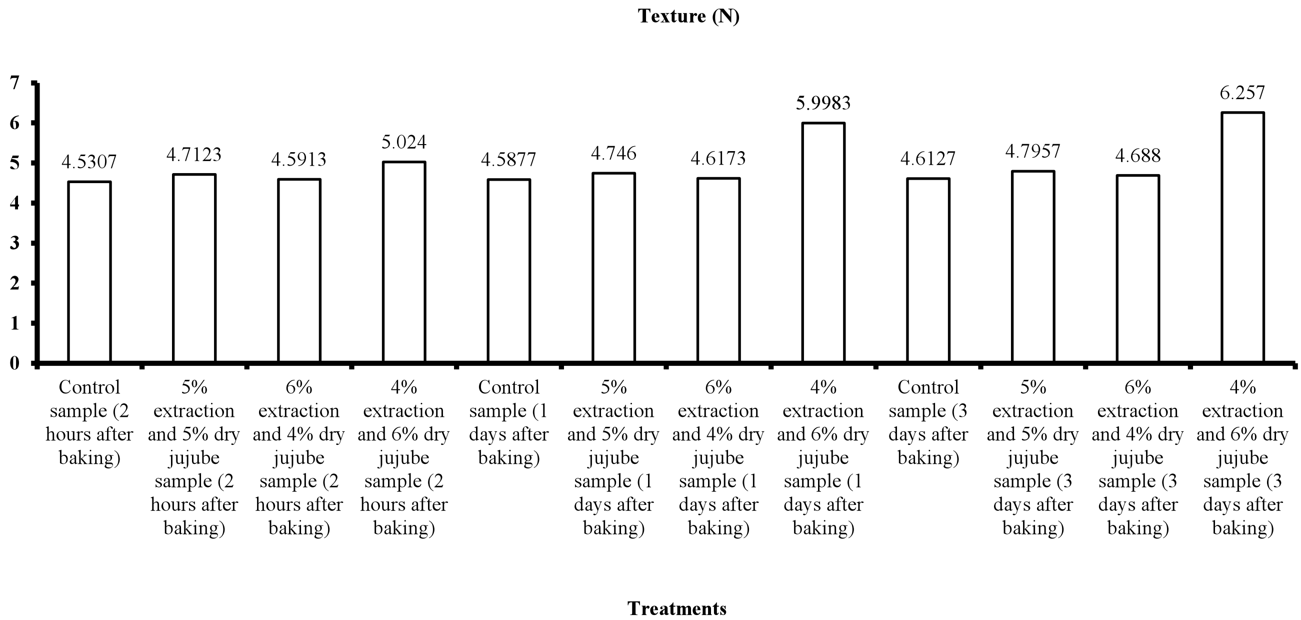

Fig. 3. The comparison of texture (N) on different levels of sampling using Duncan method.

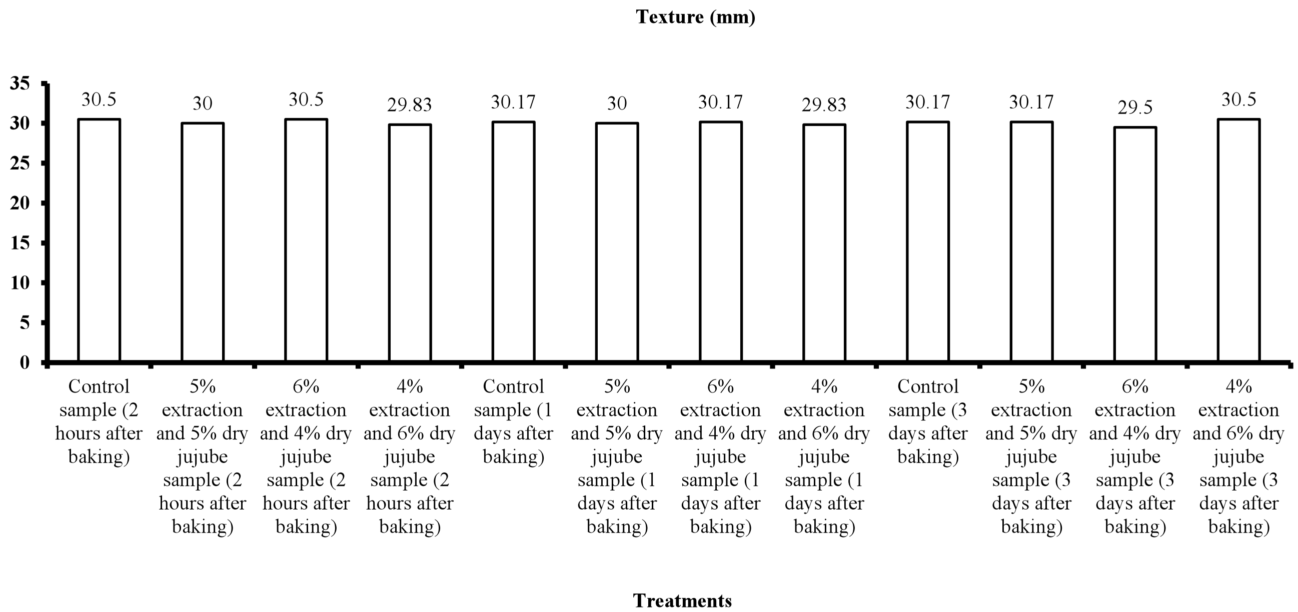

Fig. 4. The comparison of texture (mm) on different levels of sampling using Duncan method.

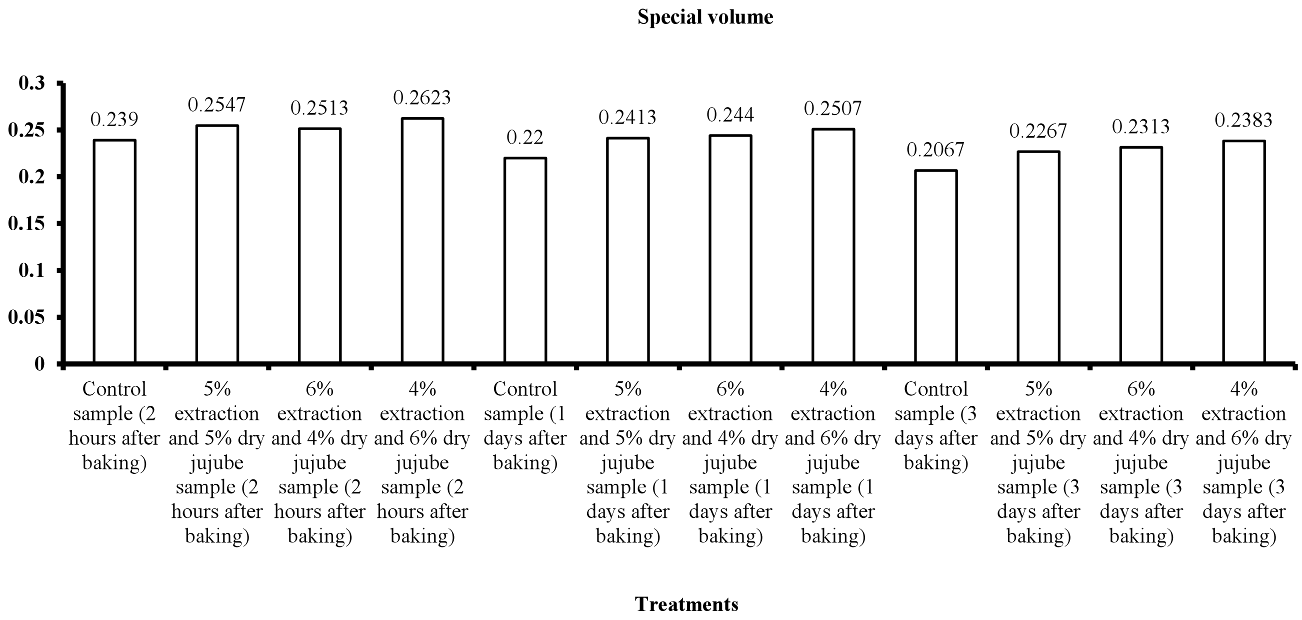

Fig. 5. The comparison of special volume on different levels of sampling using Duncan method.

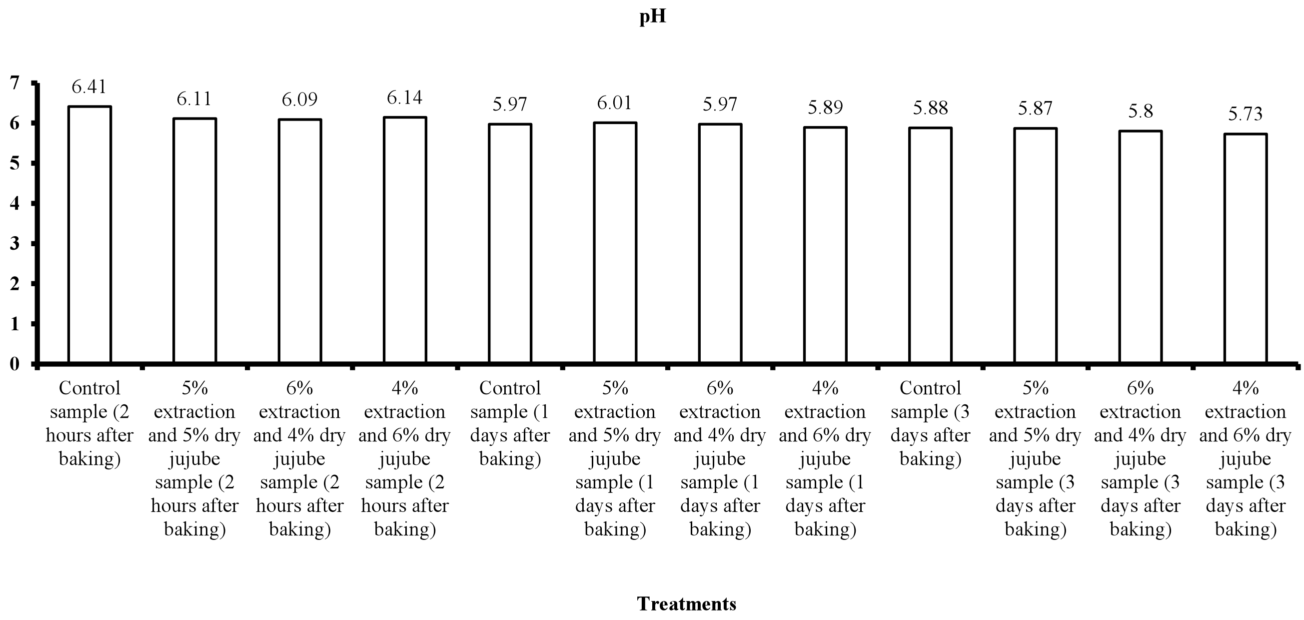

Fig. 6. The comparison of pH on different levels of sampling using Duncan method.

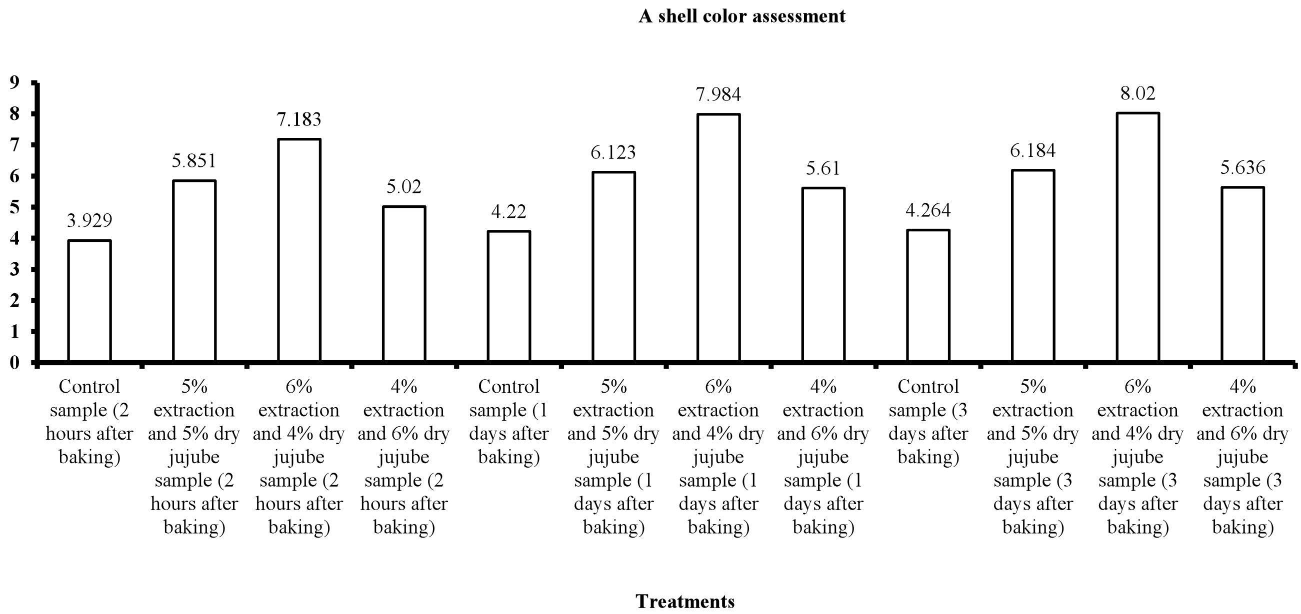

Fig. 7. The comparison of A shell color assessment on different levels of sampling using Duncan method.

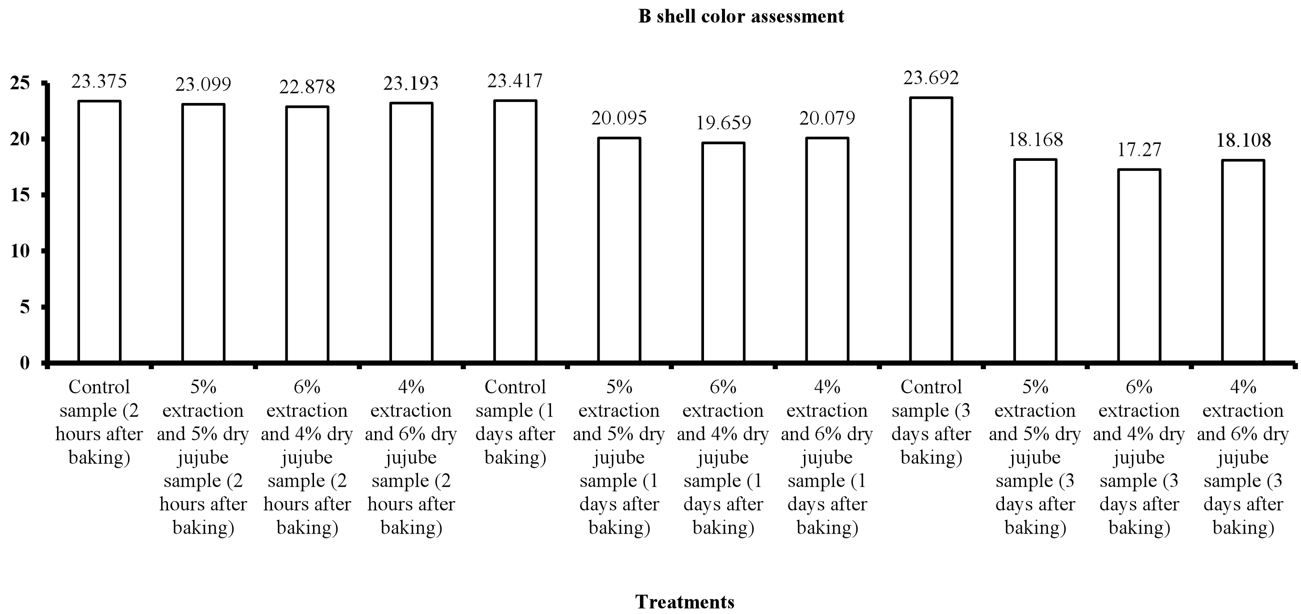

Fig. 8. The comparison of B shell color assessment on different levels of sampling using Duncan method.

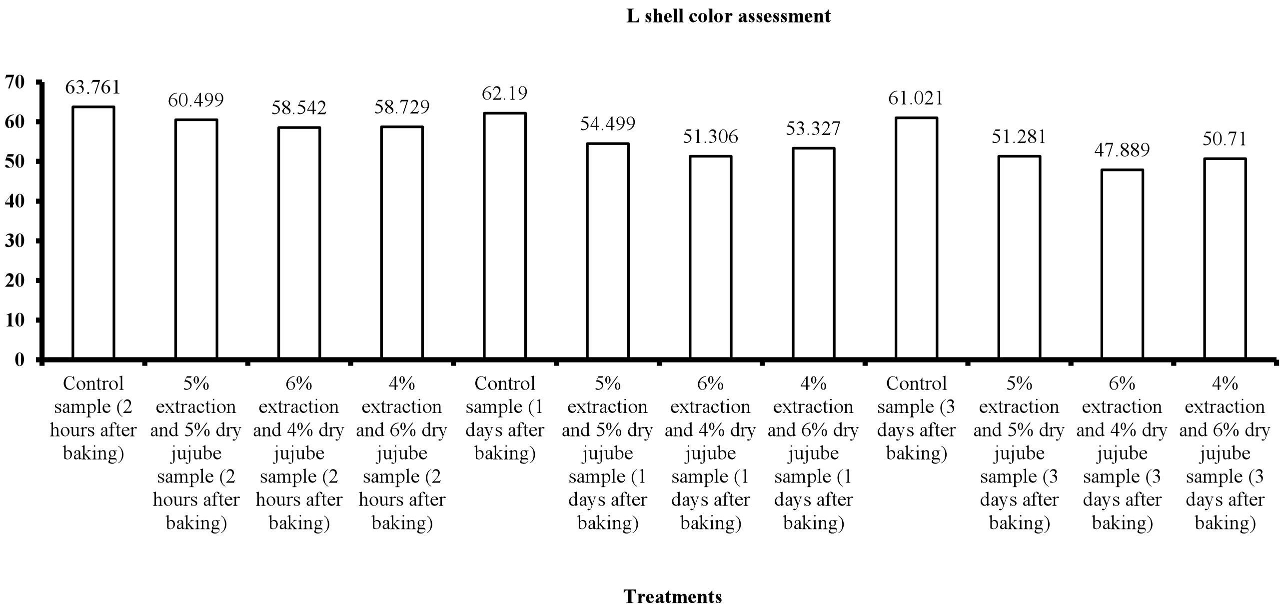

Fig. 9. The comparison of L shell color assessment on different levels of sampling using Duncan method.

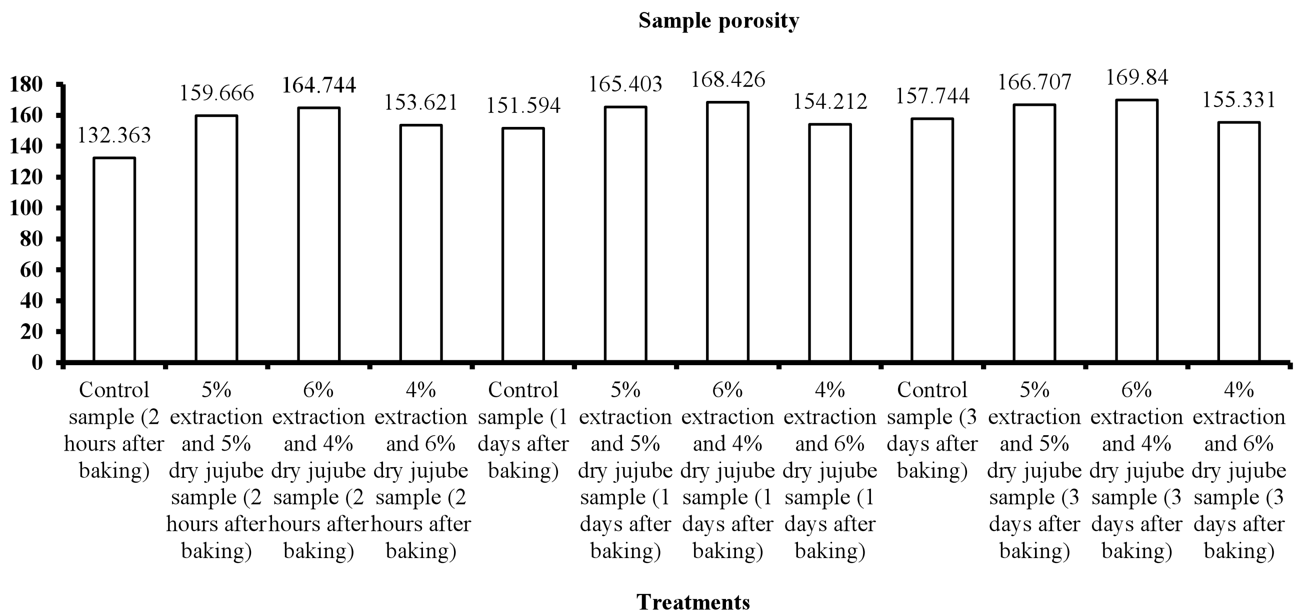

Fig. 10. The comparison of sample porosity on different levels of sampling using Duncan method.

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