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Influence of Hydrocolloids on Dough Properties and Quality of Barbari: An Iranian Leavened Flat Bread

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ABSTRACT

Barbari is a traditional flat leavened Iranian bread and one of the most popular breads consumed in Iran and some other countries in the Middle East. Barbari stales very fast and its shelf life is very short. Therefore, addition of bread improvers and anti-staling agents, such as hydrocolloids, is a suitable method for extending the shelf life of the bread. In the present study, the effect of various hydrocolloids including hydroxypropyl methylcellulose (HPMC), xanthan, and κ-carrageenan at 0.2 and 0.5% levels were investigated on dough rheological properties, fresh bread quality, and bread staling. Dough water absorption was increased by all hydrocolloids tested and HPMC had the highest effect. Application of all hydrocolloids, except κ-carrageenan, resulted in increase in dough development time (DDT). Only xanthan addition at 0.5% level showed an increase in dough stability, while the other treatments showed a reduction in the stability of the dough. Anti-staling effect was observed for HPMC and κ-carrageenan, but not for xanthan. The effect of hydrocolloid addition on some sensory indexes of bread such as upper surface and chew-ability was more pronounced than other indexes. Sensory analysis showed that all hydrocolloid addition treatments, except 0.5% xanthan, were able to improve the overall acceptability of the bread. The highest improvement in bread overall acceptability was brought about by HPMC. Hydrocolloid addition to the bread formulation could improve the sensory properties of Barbari bread and retarded the staling process. Based on the present study, the highest improvement in Barbari dough and bread quality could be obtained by the addition of 0.5% HPMC into the formulation.

Keywords: Barbari, Bread, Dough, Hydrocolloids, Sensory properties, Texture.

INTRODUCTION

Bread is the main bakery product consumed in Iran. Generally, five types of bread are baked in Iran: Sangak, Taftoon, Barbari, Lavash and village breads (Faridi and Finney, 1980). Barbari is one of the most popular flat breads widely consumed in the northern and north-western parts of Iran. The bread is usually 70 to 80 cm long and 25 to 30 cm wide with a thickness of about 3.5 cm. It is produced by mixing all its ingredients to proper consistency and fermenting for two hours. Dough balls are flattened into an oval shape and rested for 20 minutes. Then, a teaspoonful of a concentrated and boiled mixture of flour, water, and oil is poured on the surface to make it shiny and brown after baking. The dough is then docked and grooved with fingers to form five or six one-centimetre deep rows, primarily for decorative purpose. Final proof and baking times are often 15 and 8-12 minutes, respectively. The bread weighs about 300-500 g and stales in a few hours (Maleki *et al*., 1980).

Because of improper formulation and lack of gluten, the resulting dough cannot raise enough and, therefore, the bread will have a poor volume and texture. In order to obtain a

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large, open-crumb, good volume flat bread, the cell wall of the dough should be strengthened to retain moisture (Upadhyay *et al*., 2012). Hydrocolloids are widely used as additives in the food industry because they are useful for modifying the rheology and texture of aqueous suspensions (Dziezak, 1991: Polaki *et al*., 2010). Hydrocolloids are able to retard the migration of moisture to the bread surface and, thus, retard the staling process during storage (Fennema, 1996; Sciarini *et al*., 2012). According to Guarda *et al*. (2004), water absorption increases by the addition of hydrocolloids to the bread formulation. Addition of hydrocolloids like alginate, κ-carrageenan, and xanthan increase, while pectin and hydroxypropyl methylcellulose (HPMC) decrease, dough maximum viscosity (Rojas *et al*., 2001). In addition, an improvement in wheat dough stability during proofing is obtained by the addition of hydrocolloids such as sodium alginate, κ-carrageenan, xanthan, and HPMC (Rosell *et al*., 2001a). HPMC has an improving effect on the specific volume index, width/ height ratio, and crumb hardness of the fresh bread. In addition, HPMC and alginate show anti-staling effects and retard the crumb hardening (Guarda *et al*., 2004). Tavakolipour and Kalbasi (2006) investigated the influence of carboxymethylcellulose (CMC) and HPMC on Lavash bread. According to their results, both gums enhanced significantly the dough quality due to increasing the water absorption and reducing resistances in Extensograph test. However, anti-staling properties of HPMC were better than CMC.

A review of literature shows that hydrocolloids can improve the quality of breads. However, little data are available on the effect of hydrocolloids on the dough rheological properties and bread quality in relation to flat breads, specially Barbari bread (Majzoobi *et al*., 2011). Therefore, the aim of this study was to investigate the effect of some hydrocolloids on rheological properties of Barbari dough. Organoleptic properties and staling process of the resulting bread were also studied.

MATERIALS AND METHOTHS

Commercial wheat flour with extraction rate of 85-88% containing 11.2% protein, 13.7% moisture, 29.1% wet gluten, and 1.2% ash was obtained from local market. HPMC [viscosity (1% in water): 1563 cp, moisture: 9.8%, purity: 99.51)], xanthan [viscosity (1% in water): 1724 cp, moisture: 15%, polysaccharides: 65%, protein: 9%, ash: 10%] and κ-carrageenan [viscosity (1% in water): 93 cp, moisture: 7%, ash: 12%] were purchased from Sun Rose Co. ltd (Tokyo, Japan). Baker's yeast was obtained from Fariman Company (Fariman, Iran).

Chemical Composition of Wheat Flour

The chemical composition of the flour including moisture content, ash, wet gluten, and protein were determined according to the standard methods of American Association of Cereal Chemists (AACC, methods 44-16A, 08-03, 56-81B and 46-13, respectively, 2000).

Rheological Properties of the Dough

Water absorption, dough development time (DDT), and dough stability were determined using a Brabender Farinograph (Model OHG, Duisburg, Germany). Viscoelastic behavior of dough samples was determined by Brabender Extensograph (Model OHG, Duisburg, Germany) according to the standard methods of AACC (Method 54-21 and 54-10) (AACC, 2000). The parameters studied were resistance to extension (R), extensibility (E), ratio figure (R/E), and energy (Area) with resting time of 45, 90, and 135 min.

Baking Tests

Barbari dough was prepared according to the following formula: wheat flour (100 g), salt (0.5 g), compressed yeast (2 g), water (according to Farinograph water absorption). Hydrocolloids were added when required at 0.2 and 0.5% (flour basis). The complete mixing of the dough samples was performed in a fork-type mixer at 75 rpm within 5 minutes. The dough was fermented at 30°C and a relative humidity of 90% for 30 minutes in a fermentation cabinet, divided into 650 g balls and then the intermediate proofing conducted for 10 minutes. The process was followed by flattening and final proofing for 5 minutes. The baking of Barbari bread was performed for 10-12 minutes in a traditional oven at 240°C. Baked loaves were then allowed to cool down to room temperature, packed in polypropylene bags and kept in room temperature till analysis.

Texture Evaluation (Puncher Test)

To determine bread firmness, rectangular strips of 3×6 cm were cut from the center of the bread and stored for 24 hours at room temperature. Strips were then tested for puncture using an Instron universal testing machine (Instron Company, Model 1140, England). Bread samples were then seated on the platform and a cylindrical probe loaded at speed of 0.5 mm s^{-1} to penetrate the sample. The puncher curve was obtained to show the amount of power for penetration in the bread crumb. Staling rate was calculated by the formula $S= F/\pi DT$, where S, F, D, and T were the maximum shear stress (g cm^{-2}), force (g), probe diameter (cm), and sample thickness (cm), respectively (Mohsenin, 1986; Salehifar and Shahedi, 2007).

Sensory Evaluation

The sensory evaluation of fresh breads was carried out by five experienced persons. The attributes evaluated were shape and form, taste and aroma, lower and upper surface characteristics, void and porosity, chew-ability, and texture (firmness or softness). Sensory indexes of bread samples (1 hour after the baking process) were evaluated in a hedonic manner. Each attribute was scored from 1 (lowest) to 5 (highest). The following formula was used to calculate the overall score (Q) of each bread sample: $Q= \sum(P.G)/(\sum G)$, where, P and G were the sensory score and assessment coefficient of each attribute, respectively. The G value for appearance (form and shape), lower surface specification, upper surface specification, void and porosity, chew-ability, texture (firmness and softness) and taste and aroma were 1, 1, 2, 2, 2, 3 and 9, respectively (Rajabzadeh, 1991).

Statistical Analysis

Three types of hydrocolloid, namely, HPMC, xanthan, and κ-carrageenan were tested at two levels (0.2 or 0.5 %-flour basis). Thus, there were 6 hydrocolloid-added samples and one control sample. All experiments were replicated 3 times. Data were analyzed by a three-factor factorial arrangement in a completely randomized block design. Statistical analyses were performed using SPSS statistical package (version 17). $P< 0.05$ was selected as the decision level for significant differences.

RESULTS AND DISCUSSION

Effects of Hydrocolloids on Dough Rheological Properties

The effect of hydrocolloid addition on Farinograph results is summarized in Table 1. The addition of hydrocolloids to flour increased its water absorption significantly ($P< 0.05$). This property of hydrocolloids has been attributed to the hydroxyl groups in the hydrocolloid structure which allows more water interactions through hydrogen bonding (Guarda *et al*., 2004; Friend *et al*., 1993). Increased water absorption of the dough may be due to the hydrophilic nature

Table 1. Effect of different hydrocolloid addition on Farinograph results.

Hydrocolloid	Dosage (%)	WA (%)	DDT (Min)	Stability (Min)
None	–	60.1[d]	3.9[b]	7.8[b]
k-Carrageenan	0.2	62.1[c]	4.1[ab]	6.9[c]
	0.5	62.5[c]	3.9[b]	6.4[d]
HPMC	0.2	65.4[b]	4.2[a]	7.1[c]
	0.5	67.1[a]	4.3[a]	7.8[b]
Xanthan	0.2	64.8[b]	4.1[ab]	7.7[b]
	0.5	65.5[b]	4.3[a]	8.9[a]

Values are the mean of three replications; different letters in each column indicate significant differences (P< 0.05).
WA: Water Absorption; DDT: Dough Development Time, HPMC: HydroxyPropyl MethylCellulose.

of added hydrocolloids. They are able to absorb and maintain water and decrease the free water molecules and amylopectin recrystallization (Bárcenas and Rosell, 2006; Ghodke, 2009). Water absorption is an important dough property, which, if increased, may result in slower bread staling rate (Pomeranz, 1988). An increase in κ-carrageenan or xanthan dosage from 0.2 to 0.5% did not influence water absorption significantly (P< 0.05). However, wheat flour containing 0.5% HPMC had higher water absorption than that containing 0.2% (P< 0.05, table 1). The effect of hydrocolloids on water absorption of flour was in the following order: HPMC> xanthan> κ-carrageenan. The results agree with those of Friend *et al*. (1993), Rosell *et al*. (2001a), Rosell *et al*. (2001b), Guarda *et al*. (2004) and Smitha *et al*. (2008).

DDT is the time required for the dough development or time necessary to reach the maximum consistency. *DDT* increased with all hydrocolloids, except for κ-carrageenan (P< 0.05, Table 1). Generally, stronger dough has higher *DDT* and there is a positive correlation between dough protein content and *DDT* (Pomeranz, 1988).

Stability of dough, indicating the time the curve remains at 500 BU (Brabender Units, 500 BU= 1.1 Nm) and showing the flour mixing tolerance, had an obvious change by hydrocolloid addition. Dough with proper stability show good gluten network forming (Pomeranz, 1988). Only xanthan addition at 0.5% level showed significant increase in dough stability while the other treatments showed a reduction in the stability of dough (P< 0.05). Lowest stability was produced by adding 0.5% κ-carrageenan (Table 1).

Smitha *et al*. (2008) reported that *DDT* increased with the addition of xanthan and decreased by the addition of Arabic gum, guar, κ-carrageenan, and HPMC. The latter hydrocolloids also caused a decrease in dough stability. Guarda *et al*. (2004) studied the influence of different hydrocolloids (sodium alginate, κ-carrageenan, xanthan and HPMC) on dough rheology and bread quality. They reported that *DDT* slightly increased with all hydrocolloids; nevertheless, alginate was the one that promoted the highest effect. They also found that the stability of dough was clearly affected by hydrocolloid concentration tested, obtaining a lower stability at the lowest hydrocolloid concentration tested, with an exception of κ-carrageenan. Our data was also compatible with that of Tavakolipour and Kalbasi, (2006) who found a decrease in stability time by addition of CMC or HPMC to the dough formulation.

Extensograph

For Extensograph test, each test piece was stretched at 45, 90, and 135 minutes after the end of the mixing. This procedure was designed to simulate the fermentation period in conventional bread baking. The following characteristics of the Extensograph are widely used for determination of dough quality: the extensibility (E), expressed as the length of the curve until the point of rupture; the resistance at a fixed extension, usually corresponding to 50-mm transportation of the chart paper (R_{50}); R_{50}*: E* ratio (R_{50}/E); the area under the curve (A) which is proportional to the energy that is required to bring about rupture of the test piece along the predetermined path (Dempster *et al*., 1952).

Results of Extensograph analysis are shown in Table 2. The viscoelastic behaviour of the dough was affected by hydrocolloid addition. In all treatments, the extensibility of dough was significantly decreased with an increase in the resting time from 45 to 135 minutes, probably owing to the water-biding ability of hydrocolloids (P< 0.05). Smitha *et al*. (2008) have commented on this issue elsewhere. Results, also, showed that higher concentration of gums gave significantly shorter extensibility (P< 0.05). As compared with dough having no added gum, dough containing HPMC had longer or the same extensibility, whereas dough samples containing κ-carrageenan or xanthan had shorter (P< 0.05). Addition of xanthan to the dough formulation was more effective than κ-carrageenan in terms of reduction in dough extensibility. The difference in the effect of hydrocolloids may be attributed to their different chemical structure and functionality. The addition of xanthan into dough formulation can strengthen the dough by forming a strong interaction with the flour protein (Rosell *et al*., 2001a; Collar *et al*., 1999; Pressini, 2011). When used as a dough additive, κ-carrageenan has an ability to interact with gluten proteins, too (Leon, 2000). Furthermore, κ-carrageenan molecules can form interaction with each other without competing with gluten and starch for the water available in the system (Sharadanant and Khan, 2006). The etherification of hydroxyl groups of the cellulose by methoxyl and hydroxypropyl groups increases the water solubility of HPMC and also confers some affinity for the

Table 2. Effect of different hydrocolloids on Extensograph characteristics of wheat flour.

Parameters	E^a (mm)			$R_{50}{}^b$ (g)			R_{50}/E^c			A^d (mm^2)		
Rest time (min)	45	90	135	45	90	135	45	90	135	45	90	135
Treatments												
None	145.0±3.7	135.4±2.2	130.0±1.1	252.1±4.1	338.0±0.9	351.9±3.2	1.743±0.02	2.5±0.09	2.7±0.02	43.1±1.8	51.2±0.2	54.1±1.1
k-CG[e] 0.2%	139.2±2.0	131.0±0.9	130.3±1.1	354.0±4.4	390.2±3.9	406.3±4.1	2.54±0.09	2.98±0.92	3.12±0.03	47.0±2.0	53.0±0.3	56.0±0.9
k-CG 0.5%	133.2±1.1	128.2±1.6	127.5±1.1	368.0±2.7	402.1±1.7	409.2±0.8	2.76±0.10	3.14±0.12	3.21±0.12	51.5±1.9	55.8±2.8	58.3±1.0
HPMC[f] 0.2%	153.0±2.1	142.6±1.5	137.8±1.2	290.2±4.9	350.9±3.8	370.6±1.3	1.90±0.02	2.46±0.15	2.65±0.03	35.0±2.1	40.3±1.9	43.3±2.4
HPMC 0.5%	145.8±1.9	137.0±0.7	132.0±1.0	303.8±4.0	369.4±1.8	382.3±3.8	2.08±0.15	2.69±0.01	2.90±0.02	42.3±1.5	51.0±2.8	52.9±0.1
XN[g] 0.2%	132.6±0.8	127.4±1.1	124.1±1.0	366.5±3.0	415.6±2.3	441.2±4.2	2.76±0.04	3.26±0.12	3.55±0.12	52.4±2.5	58.0±0.8	61.8±2.9
XN 0.5%	129.0±1.9	124.1±2.1	118.3±2.2	401.5±4.0	458.8±4.5	460.8±4.9	3.11±0.05	3.70±0.03	3.90±0.10	60.0±3.9	68.7±3.1	70.4±3.4

Values are shown as mean of three replication±Standard deviation (P< 0.05).
[a] Extensibility; [b] Resistance to deformation after 50 mm stretching; [c] Ratio figure; [d] Energy; [e] k-carrageenan; [f] HydroxyPropyl MethylCellulose, [g] Xanthan.

non-polar phase in dough. Hence, in a multiphase system like bread dough, this bifunctional behaviour allows the dough to retain its uniformity and to protect and maintain the emulsion stability during baking (Bell, 1990). Another reason for higher extensibility with HPMC may be its higher Farinograph water absorption.

Table 2 shows the effect of hydrocolloids on dough resistance (R_{50} value). With an increase in resting time from 45 to 135 minutes, the R_{50} value for both the control and gum-added samples was significantly increased (P< 0.05). The R_{50} value was also affected by hydrocolloid concentration. The higher the hydrocolloid concentration, the higher was the R_{50} value (P< 0.05). Application of hydrocolloids in dough formulation caused a significant increase in R_{50} value of dough samples, compared to the control sample (P< 0.05). Among hydrocolloids, xanthan and HPMC presented the highest and the lowest effect on dough R_{50} value at all resting times, respectively, may be due to interactions between xanthan and flour proteins, as described previously (Rosell *et al*., 2001a; Rosell *et al*., 2001b). Our results also agree with those of Smitha *et al*. (2008).Tavakolipour and Kalbasi (2006) reported that CMC and HPMC at 0.1 and 0.3% level increased dough resistance. Pomeranz (1988) reported that by increasing the water content, an increase in extensibility occurs that accompanies a decrease in resistance. As the R_{50} predicts the dough handling properties and fermentation tolerance (Brabender OHG NO: 1702 E), the increase promoted by hydrocolloids addition suggests a good handling comportment and a large dough tolerance in the fermentation stage (Rosell *et al*., 2001b) As shown in Table 2, the overall effect of hydrocolloids resulted in augmented R_{50}/E.

As the resting time increased from 45 to 135 minutes, the dough deformation energy (A) value also increased for all samples (P< 0.05, Table 2). As compared with the control sample, the addition of κ-carrageenan or xanthan to the dough formulation caused an increase in the deformation energy (A, P< 0.05, Table 2), while higher concentration of gum gave higher deformation energy (P< 0.05). However, deformation energy of dough samples containing HPMC was lower than (or equal to) the control dough (P< 0.05).

According to Smitha *et al*. (2008) the energy or work output necessary for the deformation at 135 minutes was reduced by the addition of some hydrocolloids (Arabic gum, guar, HPMC and κ-carrageenan), with the exception of xanthan. Rosell *et al*. (2001b) also reported that addition of some hydrocolloids (HPMC, alginate and κ-carrageenan) decreased the energy for the deformation, with the exception of xanthan.

Effect of Various Hydrocolloids on Bread Quality

Texture (Puncher Test)

As the staling of bread occurs, its texture becomes stiffer and more extending force is required for cutting (Gujral and Pathak, 2002). Regarding the hardness increase during storage, HPMC gave the lowest value, reflecting a better effect as anti-staling agents (Figure 1). Compared to the control sample which did not contain hydrocolloid, bread samples containing κ-carrageenan or HPMC at 0.2 and 0.5% levels showed delayed staling (P<0.05). The improving effect of the HPMC on bread texture has also been reported by several researchers (Guarda *et al*., 2004; Rosell *et al*., 2001a; Tavakolipour and Kalbasi-Ashtari, 2006; Friend *et al*., 1993). HPMC network formed during baking could act as barrier to the gas diffusion, decreasing the water vapour losses, and thus increasing the softness of the loaves (Rosell *et al*., 2001a). Our results were in agreement with that of Abu-Ghoush *et al*. (2002) and Tavakolipour and Kalbasi (2006), who reported anti-staling effect of CMC and HPMC on Arabic flat bread and Lavash (a traditional Iranian bread), respectively. The softening effect of

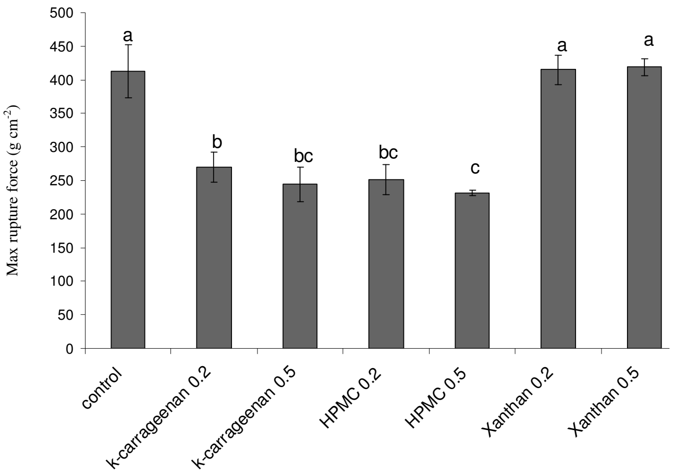

Figure 1. Effect of hydrocolloids on Barbari bread max rupture force (puncture test). HPMC, hydroxypropyl methylcellulose; Different superscripts indicate significant differences at $P< 0.05$.

hydrocolloids, mainly HPMC, may be attributed to their water retention capacity. They likely prevent the amylopectin retrogradation. Furthermore, HPMC preferentially binds to starch and decreases the starch-gluten interactions (Collar, 1999).

It was noteworthy that bread containing xanthan showed no significant difference in terms of maximum rupture force, as compared with the control bread ($P< 0.05$). This may be a consequence of the thickening effect of xanthan on the crumb walls surrounding air spaces (Rosell *et al* 2001a, Upadhyay *et al*., 2012). Ghodke and Laxmi (2007) incorporated various levels of hydrocolloids ranging from 0.25 to 1.0% into whole wheat flour. They showed that the forces required for tearing the fresh Chapatti bread decreased with hydrocolloids addition, and guar addition at 0.75% level gave the softest Chapatti, followed by CMC and HPMC at 0.75 and 0.5%, respectively.

According to Guarda *et al*. (2004), the most evident changes during storage of bread are related to moisture content loss and crumb hardening. It was reported that breads containing hydrocolloids showed lower loss of moisture content and thus reduced dehydration rate of crumb during storage. Friend *et al*. (1993) reported that rollability characteristics of Tortilla bread were retained for a longer period with addition of CMC and cellulose-based commercial blends. Staling is a very complex process, which cannot be explained by a single effect and involves amylopectin retrogradation and reorganization of polymers within the amorphous region (Rojas *et al*., 2001; Davidou *et al*., 1996; Martin *et al*., 1991). Biliaderis *et al*. (1997) proposed that the effect of addition of hydrocolloids results from two opposite phenomenon. First, an increase in the rigidity as a consequence of the decrease in the swelling of the starch granules and amylose, and, secondly, a weakening effect on the starch structure due to the inhibition of the amylose chain associates, although the weight of each effect will be dependent on the specific hydrocolloids.

Sensory Characteristics of Bread

The effect of various hydrocolloids on sensory properties of Barbari bread is shown in Table 3. Each attribute was scored from 1 (lowest) to 5 (highest). According to Table 3, all gum-added breads received scores higher than 3 in all evaluated parameters. Regarding the shape and form , bread containing xanthan received the smallest

Table 3. Effect of different hydrocolloids on the bread sensory evaluation.

Treatments	Levels (%)	Shape and form	Lower surface	Upper surface	Voids	Chew-ability	Texture	Taste and aroma	Overall acceptability
Control	–	3.98[c] [a]	4.20[ab]	3.33[d]	3.90[c]	2.91[f]	2.78[d]	4.36[c]	3.80[b]
K.Carrageenan	0.2	4.17[bc]	4.13[b]	4.19[b]	4.30[b]	4.10[c]	3.8o[cd]	3.65[e]	3.89[b]
	0.5	4.28[b]	4.2[8ab]	4.41[b]	4.69[a]	4.22[c]	3.91[c]	4.58[b]	4.40[a]
HPMC	0.2	4.11[bc]	4.3[1ab]	4.62[a]	4.55[a]	4.50[b]	4.11[b]	4.81[a]	4.57[a]
	0.5	4.53[a]	4.40[a]	4.74[a]	4.67[a]	4.81[a]	4.39[a]	4.51[bc]	4.56[a]
Xanthan	0.2	4.10[bc]	4.15[b]	4.00[c]	3.81[cd]	3.42[d]	3.71[d]	4.08[d]	3.93[b]
	0.5	3.79[d]	4.22[ab]	4.16[bc]	3.70[d]	3.11[e]	3.95[bc]	3.70[c]	3.75[b]

[a] Values are the mean of three replications. Different letters in each column indicate significant differences (P< 0.05).

score, being even the worst at the high concentration (0.5%) while 0.5% HPMC scored the highest (P< 0.05). With the exception of xanthan, other hydrocolloids improved significantly bread voids, as compared to the control bread (P< 0.05). Bread chew-ability received significantly (P< 0.05) better scores when hydrocolloids were added. Regarding the taste and aroma, 0.2% HPMC got the highest scores, while breads with 0.2% κ-carrageenan received the smallest score (lower than the control bread). Addition of hydrocolloids, with the exception of 0.2% xanthan, resulted in significantly higher scores regarding softness, as compared with the control bread. HPMC and κ-carrageenan improved overall acceptability of bread (P< 0.05). Regarding the overall acceptability, bread containing xanthan had the lowest score (among hydrocolloid-added breads), being the worst at the highest concentration (0.5% xanthan). Among different sensory attributes, the upper surface and chew-ability of the resulting bread samples showed higher scores than the control bread. Tavakolipour and Kalbasi (2006) in their investigation about Lavash bread showed that dough samples containing CMC and HPMC at 1% level had significantly better organoleptic attributes (firmness, softness, and chew-ability) than the control breads. Smitha *et al*. (2008) reported that addition of hydrocolloids improved the shape of Parotta bread. In general, Parottas with hydrocolloids had a soft and pliable hand-feel. They concluded that hydrocolloids improved the overall quality of Parotta and the highest improvement in the overall quality was brought about by guar, followed in decreasing order by HPMC, xanthan, carrageenan, and Arabic gum. The improving effect of the HPMC and κ-carrageenan on the sensory quality of bread could be due to their influence on the crumb texture that yields softer crumbs. The reasons for the adverse effects of xanthan on some sensory attributes are not completely understood, although some hypotheses have been proposed. For example, it seems that through a strong interaction with the protein, xanthan may reduce aroma release from bread. Strengthening effect of xanthan observed in the Extensograph resistance may explain the low scores in bread voids, chew-ability, and texture.

CONCLUSIONS

The present study showed that addition of some hydrocolloids improved the rheological characteristic of Barbari dough. Dough water absorption, which has a great effect on bread quality and its shelf-life, was increased by all hydrocolloids tested and HPMC had the highest effect. DDT increased with all hydrocolloids, except for κ-carrageenan. Only xanthan addition at 0.5% level showed an increase in dough stability while the other treatments showed a reduction in the stability of dough. HPMC and κ-carrageenan addition could retard the staling process while xanthan addition had no effect on bread staling. Sensory analysis revealed that when hydrocolloids were added to the bread formulation, some sensory indexes of the bread, such as upper surface and chew-ability, were enhanced more pronouncedly than the other indexes. Addition of HPMC or κ-carrageenan into formulation resulted in an increase in overall acceptability of breads, and the highest improvement was brought about by HPMC. Overall, the best treatment in terms of dough and bread quality was obtained by the addition of 0.5% HPMC to the flour.

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اثر هیدروکلوئیدها بر ویژگی های خمیر و کیفیت بربری، یک نان مسطح حجیم ایرانی

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چکیده

بربری، نوعی نان مسطح حجیم ایرانی، یکی از رایج ترین نان های مصرفی در ایران و برخی کشورهای خاور میانه است. بربری خیلی زود بیات می شود و عمر قفسه ای آن خیلی کوتاه است. افزودن بهبود دهنده های نان و عوامل ضد بیاتی مانند هیدروکلوئیدها به فرمولاسیون خمیر راه حل مناسبی برای طولانی کردن عمر قفسه ای نان است. در مطالعه حاضر، بررسی هایی به منظور مطالعه اثر هیدروکلوئیدهای مختلف شامل هیدروکسی پروپیل متیل سلولز (HPMC)، زانتان و کا-کاراگینان در سطوح ۰/۲ و ۰/۵ درصد بر ویژگی های رئولوژیکی خمیر، کیفیت نان تازه و بیاتی نان انجام شد. جذب آب خمیر بوسیله همه هیدروکلوئیدها افزایش یافت و HPMC بیشترین اثر را داشت. بکارگیری همه هیدروکلوئیدها غیر از کا-کاراگینان باعث افزایش زمان توسعه خمیر (DDT) شد. تنها افزودن زانتان به میزان ۰/۵ درصد باعث افزایش پایداری خمیر شد در حالیکه سایر تیمارها باعث کاهش پایداری خمیر شدند. اثر افزودن هیدروکلوئیدها بر برخی شاخص های حسی نان مانند کیفیت سطح رویی و قابلیت جویدن نان بیشتر از سایر شاخص ها بود. آنالیزهای حسی نشان دادند که همه تیمارهای افزودن هیدروکلوئید غیر از تیمار ۰/۵ ٪ زانتان باعث افزایش قابلیت پذیرش کلی نان شدند. افزودن هیدروکلوئید به فرمولاسیون نان باعث بهبود ویژگی های حسی و به تاخیر افتادن فرایند بیاتی نان شد. بر اساس مطالعه حاضر بیشترین بهبود در کیفیت خمیر و نان بربری با افزودن ۰/۵ ٪ HPMC به فرمولاسیون بدست آمد.