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Effect of Sourdough and the Addition of Hydroxy Propyl Methyl Cellulose Gum on the Sensorial Attributes and Shelf Life of Barley Bread

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ABSTRACT: One of the additives used in the food industry to improve the quality of bread and increase its shelf life is Hydrocolloids which is able to improve the starch gelatinization properties and enhance the final product's quality. In this research, Sourdough (spontaneously) in 4 levels of 0, 10, 20, 30 percent as the natural preservatives and hydroxyl propyl methyl Cellulose gam in 3 levels of 0, 1/5 and 3 percent are used and their effects on rheological dough properties and the produced barely flour bread's quality are studied. The properties of rheological dough (dough stability, dough development time, water absorption and the Valorimetry number) are determined through Farinograph, pH, the acidity of bread and dough. The results show that the increase of density of this gam leads to increase of viscosity, dough stability and the absorption of flour water. The increase of this gam's density causes the decrease of stiffness and gam-like properties of the bread which indicates the increase of bread's quality. So, hydroxyl propyl methyl Cellulose gam is used as an appropriate additive in order to enhance the quality of bread. Increasing the use of Sourdough due to the reduction of pH leads to improvement of color and flavor, rheological properties of produced barely flour dough and bread and the increase of its durability.

***Keywords*:** Quchan,Iran,Sourdough,barely bread, HPMC.

INTRODUCTION

Todays, the use of additives in food industries, especially bakery industries becomes a common issue. The purpose of using this additives and the usage of these ingredients is to enhance the bread quality and maintaining their quality during shelf life. To achieve this goal, different additives with various chemical structures are used. One group of additives which is widely used in farinaceous products is hydrocolloids, which is able to able to improve the starch gelatinization properties and enhance the final product's quality (Koochaki, 2011). On the other hand,the use of Sourdough was implemented by Egyptian around the Nile River. European Communication stated that the yeast is a complicated microbial ecosystem which mainly created by lactic acid bacteria and yeasts. Micro-organisms in yeast have a significant role in producing high quality bread. The activity of these micro-organisms which reduce the pH cause the enhancement of color and flavor, rheological properties of the produced barely flour bread and dough and its increase of durability. Different hydrocolloids ae used in bread formulation, such as pectin, sodium alginate, kappakaragynan, cellulose and its derivatives and guar gam, and among them, hydroxyl propyl methyl Cellulose gam has more absorption ability than guar gam and karagynan and Cellulose (Russel , 2001).Among hydrocolloids, hydroxyl propyl methylCellulose , due to its hydrophilic property has more positive effects on bread and yeast properties than other hydrocolloids, such as guar gam and karagynan and Cellulose (Shalini and Lakshami, 2007).In 2005, McCarthy and his colleagues explained in some studies that by adding HPMC in bread formulation which does not contain Gluten have the lowest level of stale. Hydroxyl propyl methylCellulose cause the enhancement of gas maintenance and water absorption and such that it acts like Gluten (Kadan , 2001). Kakaee and his co-workers and

Ghanbari and Farmani in 2013, studied on HPMC gam and concluded that this gam affects water distribution, increase of Glycosil Amin and finally by impact on the intensity of Maylard reaction which lead to enhancement of color and also due to water absorption in bread texture and preventing it from drying out causes the increase of volume and the softness of bread texture and reduction of its stiffness. The protein of the barely bread is more than wheat bread which affects the improvement of nutritional value on produced bread as well as enhancement of bread's texture quality. Microorganisms of fermentation group are yeasts and lactic acid bacteria which are respectively responsible for acidification of the dough (Bastati, 2001). Lactic acid bacteria have the proper potential to inhibit the growth of mold (Khorasanchi , 2011). In 2006, Aleck and his colleagues concluded that yeast causes improvement of bread texture and nutritional properties of bread by means of increase of minerals and decrease of Fitat. Yeast has the positive impact on bread texture through activity of the lactic acid bacteria and producing such metabolic, such as organic acids, exo-polysaccharide and enzymes. The yeast as the improver is used by the impact of organic acids on starch and flour protein. The decrease of pH leads to increase of protease and amylase which are existed in the flour, so, as a result, it causes to reduce the level of stale. So, the impact of the Sourdough and HPMC gam on rheological dough properties and the maintenance of produced barely flour bread are considered to be studied.

MATERIALS AND METHODS

The sample of the barely flour and its chemical properties

The barely bread is provided from Sahar bread Co. Physical and chemical features of the flour, such as moisture, fat, ash and protein were studied according to Iran Standard with the number of 2337, Fiber was studied according to Standard method of AACC with the number of 10-32, Fitic Acid studied based on AACC method, 1984, pH was studied according to Iran standard number 37, the particles were measured according to proposed method by the producer of the device, acidity was studied by the Iran standard method with number of 103 and the rheological experiments was done through approved method of AACC with the number of 21-54.

Preparation and fermentation of Sourdough samples (spontaneous)

Sourdough was produced from barely flour through spontaneous method. This means that, 600 cc of neutralized distillated water is mixed with 400 gr of barely flour and is placed 24 hours in 32°C to get ready (Najafi, 1390).

Providing final dough

To prepare the dough, first of all, yeast suspension with the weight of 3% of barely flour which was boiled in warm water (neutral water) with sugar was solved separately in 10 minutes in order to activate the yeast cells. This combination was added to barely flour and mixed some minutes.Finally, salt which was already solved in water was added to the dough (if salt adds first to mixed water and yeast, it will prevent yeast from optimal activity). The required water wasdetermined according to the desired empirical evaluation in order to molding. After preparing the dough and doing final fermentation (75 minutes), the obtained yeast was gone for baking (Haghparast , 1384). The percentage of replacement of Sourdough and barely flour dough was in four levels of 0, 10, 20 and 30 percent and the percentage of HPMC which was added to the formulation was in three levels of 0, 1/5 and 3 percent of weight.

Measurement of Farinography features

Farinography test was done by means of proved method of AACC with number of 21-54.

Measurement of pH of the dough

Iran standard with number of 37 was used in order to measure the pH.

Mold decay measurement

To measure the mold decay, first of all, al the breads were cut in dimensions of 5*5 and were kept in plastic freezer. Then, they were studied for decay corruption in 24, 48, 72, 96, 120 and 144 hours after production. In this way, terance prance paper (more economical than photo paper) was used and striped in dimensions of 0/5 * 0/5 (Najafi, 2011).

The evaluation of the level of stale of the produced breads

The triangular test was used according to the Gasula and his colleagues (1984) in order to select the judges. Sensory evaluation was used according to (AACC 38-11) to test the level of stale.

Statistical analysis

This research was done based on the completely randomized plan and with three duplications. The determination of significant difference between data and ranking them were done respectively through factorial and Duncan test and by use of SAS Version 9.1 software. The correlation between variables and parameters and also between parameters themselves was determined by means of SAS version 9.1 software. The charts also was traced and reported by Microsoft Office Excel 2007.

RESULTS AND DISCUSSION

The chemical composition of used flour

The chemical combination of used barely four in this research are shown in Table 1.

Table1. Chemical composition of barely flour

Types of flour features	Complete barely flour	Wheat flour of 82%	Wheat flour of 75%
Humidity	8.7	13.3	15.2
pH	5.56	6.49	6.7
Acidity	6.1	5.4	5.5
Ash	1.72	0.70	0.86
Protein	12.3	9.98	10.3
Fat	2.93	1.47	1.6
Fitic acid (%)	2.31	5.24	5.56
Crude fiber (%)	4.91	2.52	2.76
Size of the particles			
		Sift 475	0.9 gr
		Sift 180	53.25 gr
		Sift 125	19.22 gr
		Under sift	26.61 gr

Rheological dough properties

In Table2, the impact of different levels of HPMC gam on rheological properties of barely flour dough is shown.

Table2. the results of the mean of the rheological properties of the barely flour

Dough stability (minute)	Valorimetry number (Brabender)	The level of looseness of the dough (after 10 minutes) Brabender	The time of the expansion of the dough (minute)	Water absorption (%)	HPMC gam
3.30 a	42.00 a	40.60 a	3.53a	80.06 a	0%
4.36 a	44.33 b	30.53 b	5.06b	80.80 b	1.5 %
4.80 b	48.00 c	20.73 c	6.26c	82.23 c	3%
0.52	1.99	1.89	0.38	0.33	LSD 5%

The percentage of water absorption

Water absorption is an important factor in producing bread due to economic reasons, quality improvement of bread maintenance and the problems of processing the stiff and loose dough. The amount of added water to reach the specific level of consistency is known as the percentage of water absorption. The results of this research showed that the percentage of water absorption of the flour was significantly increased by the increase of the percentage of the gam (P≤0/05). So that the treatment with 3% of gam had the most amount of water absorption (82.23%) and the lowest amount of water absorption was related to the sample with 0% of gam (80.06%). The studies show that the hydroxyl group in fiber structure would increase the water absorption by creating hydrogen bonding (Russel , 2001).

The time of the dough expansion

The results showed that there is significant different between various treatment(P≤0.05). According to the obtained results, the increase of gam leads to increase of the time of the dough expansion. So that the most amount of dough stability is for provided treatment from gam of 3% (6.26 minutes) and the least amount of the dough stability is for provided treatment of gam with 0% (3.53 minutes). Of course, generally, due to the high fiber of barely flour, the time of the dough expansion is so low, but by increase of the percentage of the gam, the time of the dough expansion would be high. The results show that the more fiber and the barely flour without Gluten can explain the weak inability features of the barely bread. But, HPMC gam, due to water absorption and the displacement of the gluten net of the wheat bread causes the increase in the time of the dough expansion (Russel , 2001).

Dough Stability

The study of the comparison between means shows that there is a significant difference in the 5% of level in treatment. By increase of gam percentage, the dough stability will also increase. So that the most amount of dough stability is related to the treatment which is provided of 3% of gam (4.8 minutes) and the least amount of dough stability is about treatment that is prepared of 0% gam (3.3 minutes). As it can be seen in Table 2, there is no significant difference in the level of 5% between prepared treatments of 1.5% and the one of 0%. The time of flour expansion and its stability indicates the flour's power and the higher amount shows more powerful flour. Kadan and his co-workers (2001) discovered that the hydroxyl propyl methyl Cellulose cause the improvement of gas maintenance and water absorption and in this way it acts like the Gluten and increase the flour stability.

The level of flour looseness

In this case, it should be said that, more weaker the Gluten in the dough, the more the degree of dough looseness is, and more durable the Gluten in the dough, the less the degree of the dough looseness is. This index is used to determine the impact of natural enzymes in the flour. The more the degree of dough looseness, the less the time of the fattened is. On the other hand, the flour has the less mechanical toleration (Sodha , 2007). According to the means' comparison, the prepared treatment of 3% gam has the least degree of flour looseness (20.73 unit of Brabender) and the most degree of flour looseness is related to the prepared treatment of 0% gam (40.6 unit of Barbender).

Valorimetry value

There is an important difference between prepared treatment of 3% (gam) and the provided treatment of 0% (gam) in the level of 5 percent. Treatment which is provided of 3% gam has the most amount of Valorimetry value (48 units of Brabender) and the least degree of Valorimetry value is related to the treatment which is prepared of 0% gam (42 units of Brabender). The increase of valoremetry number is the reason o the improvement of rheological dough.

pH of the bread

according to Graph 1-3, by the increase of gam and Sourdough , the pH would be reduced (of course the pH is less due to the increase of gam), such that the most amount of pH is related to the treatment of 0% gam and 0% of Sourdough (4.87%) and the least pH is related to the treatment of 3% gam and 30% of Sourdough (4.20%). The reduction of the pH is born out of the lactic acid bacteria activity and a result the production of the organic acids. This reduction of the pH causes that protease and Amylase increase in the flour and thus leads to the delay in staling bread (Aleck , 2006).

Based on the averages' comparison there is no significant difference between the treatment which contain 20% of Sourdough including different percentages of gam and prepared treatment of 30% and 0% gam with prepared treatment of 10% Sourdough and 3% of prepared treatment of 10% Sourdough and 1/5% of gam and prepared treatment of 0% Sourdough and 0% gam with the treatment of 0% of Sourdough and 1/5% gam ($P \leq 0.05$).

Changes of the mold decay in produced barely bread

In relation to mold decay, as is seen in Figure 3.1, by the increase of gam and Sourdough , the percentage of mold decay would be decreased. So that after 96 hours, the most amount of mold decay is related to the prepared treatment if 0% Sourdough (100%) and the least percentage of mold decay is related to the treatment which is prepared of 30% of Sourdough (11.3%). The yeast is essentially a complex combination of lactic acid bacteria and yeasts. The antifungal activity of the lactic acid bacteria is so varied and it is so diverse considering the race and species. There are many factors which impact the amount of effectivenessof the antifungal compounds produced by lactic acid bacteria, such as time, pH and environment compounds. The present research shows that the lactic acid bacteria have the proper potential to inhibit the growth of mold (Khorasanchi , 2011).

The evaluation of stale

As is seen from Figure 1-3, with regard to the staling, the prepared treatment of 30% of Sourdough and 3% gam is the best treatment after 72 hours, because a while it preserves its quality with respect to the other treatments. In 2013, Kakee and his colleagues and Ghanbari and farmani studied on the HPMC gam and found that by the increase of this gam the bread durability would be increased and the staling would be postponed.

CONCLUSION

One of the additives used in the food industry to improve the quality of bread and increase its shelf life is Hydrocolloids which is able to improve the starch gelatinization properties and enhance the final product's quality.Yeast is also affected by the internal and external factors and its microbial population influences the final production's characteristics, such as volume, texture, flavor and nutritional value, and causes the amount of mineral availability to increase and the amount of staling to decrease. Yeast also leads to improvement of sensory characteristics of bread, reduction of Gluten effects on patients with celiac, development of antimicrobial substance and antifungal effects and enhancement of rheological features of the dough. The results indicates that, by the increase of Sourdough due to the reduction of the pH and HPMC gam which is born out of the preventing water loss, the quality of the barely bread would be increased. So that, the highest quality is related to the treatment which is prepared of 30% yeast and 3% gam and the lowest quality is related to the prepared treatment of the 0% Sourdough and 0% gam. Also, the results of the rheology tests show that by the increase of HPMC, the Farinograph features would also be improved.

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