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Production of Lavash Bread by Yeast – Salt Method and Determining the Rheological Properties of Its Doug

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ABSTRACT: In this research, yeast-salt method was used to make flat bread dough. The yeast used for this process was *Saccharomyces cerevisiae* (PTCC-Code 5080), that was employed at the concentrations of 0.06% and 0.12% (w/w based on wheat flour). In order to carry out this research, a completely randomized design with three replications was used. Means were compared through Duncan's multiple range tests. The findings indicated that the increase in the yeast employed in this method, led to an increase in the degree of water uptake, dough development time, stability period, resistance and quality number as compared to the control. In addition, dough made through yeast-salt method, had a bigger area under the curve (energy), was more resistant to extensibility and had higher coefficient (correlation between resistance to stretching and extensibility) than the control. The results obtained from chemical analysis showed that samples of flat bread made through yeast- salt method contained higher moisture, protein and ash contents but had lower pH.

Keywords: *Extensograph, Farinograph, Lavash Bread, Yeast-Salt.*

Introduction

Since centuries ago, grains in various forms have constituted a principal part of nutrition for the majority of world's population. Among them, wheat bread is one of the commonest bread types and is regarded as the food for most nations in the world (Movahed *et al.*, 2012). In Iran, bread occupies a holy status in popular culture and various types of bread especially flat bread have been prepared and baked conventionally since thousands of years ago. Unfortunately, about 30% of the bread produced in this country is discarded as wastage due to some facts like low quality wheat produced and incorrect methods to prepare the dough and utilization of additives. Dough preparation is one of the steps of the technology of bread making that plays a significant role in the quality of the end product. In the case that dough preparation process is faulty or if dough is not prepared properly, there will be problems concerned with the subsequent steps of bread making (Movahed *et al.*, 2011a; Movahed *et al.*, 2014). Dough preparations are divided into two methods namely ordinary and modern. Ordinary method of dough preparation can be carried out either directly or indirectly. Direct method is defined as the flour and all other ingredients are added in a high speed mixer, and hence, dough is prepared during only one step. Amount of yeast, dough temperature and stability are of decisive factors in fermentation time that varies from

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one to eight hours (Dobraszczyk & Morgenstern, 2003). Indirect method is considered as one of the old ways of dough preparation and the fermentation time take between two to twelve hours. In this method, two types of dough (Initial dough and original dough) are prepared and after required storage time, initial dough is added to the original dough (Movahed *et al.*, 2012). Modern method of preparing yeast-salt dough is defined as the method in which dough is prepared with the possibility of salt addition. Technological effect of salt indicates that salt, yeast, and water mixture does not noticeably damage the yeast in a short time. The addition of salt to yeast has positive effects on white breads. Movahhed *et al*. (2012) suggested that using salt in yeast-salt method results in dough weight loss during plasmolysis. Existence of osmotic pressure can account for such a behavior and as the result, saline solution is enriched with protein and yeast enzymes. A large part of yeast cell loses its vital activity but the enzymes maintain their fermenting power. They added that in order to prepare proper yeast-salt solution in dough, it is required that fine-grained sifted salt be used. Careful consideration must be made that salt is completely dissolved in water because in the case it does not, this might lead to defects such as loosening and softening of dough (Gobbetti *et al.*, 2005). Other studies have also showed that storage time for yeast-salt solution to prepare desirable bread can be at least 4 and at most 48 hours. It was also made clear that any delay in adding yeast- salt solution to dough might result in delay in leavening the dough. Toyosaki & Sakane (2013) suggested the optimal amount of salt used in yeast-salt method in dough. Based on the findings in yeast-salt method, best results were obtained when all the salt used for dough was dissolved in 10 times more water and then the required yeast was added to the saline solution. Best storage temperature for the above solution is reported to be 20°C (Toyosaki & Sakane, 2013). Tsen (1964) reported that using large amounts of salt in yeast-salt solution resulted to delay the fermentation while using the right amount of salt causes firmness in dough, improved fermentation and finally bread quality. It was also clarified that using smaller amounts of salt is effective in increasing the stability of gluten and dough. In this study, we attempt to improve bread quality and consequently reduce wastage through the application of new method of making flat bread dough (Tsen, 1964).

Materials and Methods

- *Materials*

In order to produce flat bread, flour without bran with the extraction degree of 85.5 was obtained from Azadegan Company (Tehran, Iran). Dry baker's yeast (*Saccharomyces cerevisia* PTCC, Code 5080) was received from Iran Mayeh Company (Tehran, Iran). All the analyses, control treatment (consisting of 0.25 % baking soda, 0.5% yeast and 1.8% salt), yeast-salt treatment with the least amount of yeast (consisting of 0.06% yeast and 1.8% salt), and the yeast-salt treatment containing the most yeast (consisting of 0.12% yeast and 1.8% salt) were given codes C, Y_1 and Y_2, respectively.

- *Methods*

The present study was carried out in the laboratory of the Department of Food Science and Technology at Islamic Azad University, Varamin- Pishva branch in 2015.

- *Chemical analysis of flour*

Chemical analyses of flour samples in this study consisted of moisture (based on AACC International Standard number 16-44), ash (based on AACC International Standard number 01-08), protein (based on AACC International Standard number12-46), wet gluten (based on ICC International Standard number 3811) and pH (based on

AACC International Standard number 02-52).

- *Rheological analysis of dough*

In order to determine some of the rheological properties of the control dough samples and yeast-salt samples, Farinograph test based on standard method of AACC number 21-54 and Extensograph test based on standard method of AACC number 10-54 were applied (Anonymous, 2003).

- *Preparation of flat bread dough*

In order to prepare flat bread dough, yeast-salt method was used. In this method, salt was first dissolved in some of the consumed water at the temperature of 23°C and then required yeast was added and the solution was mixed, therefore, by this method, yeast-salt solution was prepared. The solution was then stored for 22 hours at the temperature of 20°C. Finally, the solution was mixed with the flour as well as with the rest of the water (Dobraszczyk & Morgenstern, 2003). Furthermore, in order to compensate for yeast mortality, little amount of yeast (about 1/10th of consumed flour weight) was added to dough before adding the yeast-salt solution. The prepared dough was kept at 23°C for 30 minutes for the fermentation to take place and after dividing and shaping, the dough underwent final fermentation and baking process (Movahed *et al.*, 2012).

- *Methods of flat bread preparation and analysis*

In order to make flat bread through yeast-salt method, first, ingredients were prepared and weighed in order to prepare yeast-salt solution. After salt was dissolved in water at 23°C, the required dry yeast was added and the mixture was blended. After storing the above solution at 20°C for 22 hours, yeast-salt solution was prepared and was then added to flour. In order to mix and prepare the dough, these ingredients were mixed in a kneader reactor for five minutes, and were then mixed again for three minutes and were kept at 30°C for thirty minutes for fermentation to take place. Later, other steps of dough preparation like dividing it into pieces (150g), secondary fermentation (10 minutes rest) shaping (in form of thin loaves) and final fermentation (10 minute rest) were carried out and dough was put into the oven for 25-35 seconds to prepare the flat bread (Movahed *et al.*, 2012).

- *Statistical analysis method*

In order to analyse the data, a completely randomized design with 3 replications was used. Means were compared through Duncan's multiple range tests at the probability level of 5% and by using SPSS software version 14.

Results and Discussion

The results of chemical analysis for wheat flour are shown in Table 1. Tables 2 and 3 present the results of mean comparison of flat bread dough samples concerned with Farinograph and Extensograph applications. Table 4 presents the results of comparing means of chemical tests in samples of flat bread containing yeast salt solution and the control.

- *Evaluation of the results of farinograph for dough samples*

Table 2 presents the results of mean comparison of Farinograph applications on different samples. There were significant differences in all the treatments considering

Table 1. Mean of chemical analyses of wheat flour to produce flat bread

Treatment	Wet (%)	Ash (%)	Protein (%)	Wet Gluten (%)	pH
Flour	10.3	1.3	10.2	27	6.5

Table 2. Mean comparison of Farinograph applications on the samples of flat bread containing yeast-salt solution

Treatment	Water absorption (%)	Dough development time (min)	Dough stability time (min)	Dough softening after 10 min (B.U)	Dough softening after 12min (B.U)	Quality number
Control	60.5^{c}	4.7^{c}	6.2^{b}	61.2^{a}	90^{a}	77^{b}
Y_1	62.3^{b}	5.4^{b}	7.1^{a}	52.9^{b}	82.2^{b}	85^{a}
Y_2	64.57^{a}	6.4^{a}	7.1^{a}	46.9^{c}	70.1^{c}	87^{a}

In each column, means which have at least one letter in common do not have a significant difference at the probability level of 5% according to Duncan multiple range tests.
C: Control treatment (containing 0.25% baking soda, 0.5% yeast and 1.8% salt) Y1: yeast - salt treatment with the lowest amount of yeast (containing 0.06% yeast and 1.8% salt) Y2: yeast-salt treatment with the highest amount of yeast (containing 0.12% yeast and 1.8% salt).

Table 3. Mean comparison of Extensograph applications on the samples of flat bread containing yeast-salt solution

	Energy (cm^2)			Resistance to stretch (B.U)			Ability to stretch (mm)			Resistance to stretch / Ability to stretch		
Fermentation time(min)	45	90	135	45	90	135	45	90	135	45	90	135
Control	82^{a}	87^{c}	97^{b}	238^{c}	320^{b}	350^{b}	167^{a}	154^{a}	152^{a}	1.42^{c}	2.07^{c}	2.33^{c}
Y_1	83^{a}	95^{b}	106^{b}	250^{b}	400^{a}	357^{a}	160^{a}	150^{a}	149^{b}	1.56^{b}	2.66^{b}	2.46^{b}
Y_2	85^{a}	105^{a}	106^{a}	290^{a}	420^{a}	359^{a}	157^{b}	150^{a}	149^{b}	1.84^{a}	2.8^{a}	4.18^{a}

In each column, means which have at least one letter in common do not have a significant difference at the probability level of 5% according to Duncan multiple range tests

Table 4. Chemical analyses of samples of flat bread containing yeast- salt solution

Treatment	pH	Wet (%)	Protein (%)	Ash (%)
Control	7.01^{b}	30.02^{c}	13.01^{c}	0.6109^{c}
Y_1	6.2^{a}	34.18^{b}	13.44^{b}	0.6747^{b}
Y_2	6^{a}	42.01^{a}	14.76^{a}	0.769^{a}

In each column, means which have at least one letter in common do not have a significant difference at the probability level of 5% according to Duncan multiple range tests

water uptake ($p<0.05$). The amount of water uptake in Y_2 treatment (with higher levels of yeast) was the highest while it was the least in the control sample. In other words, using yeast-salt method to prepare flat bread dough resulted in an increase in water uptake as compared to the control flat bread. The reason for the increase in the amount of water uptake is the presence of salt and enzymes produced for yeast-cells in yeast-salt solution due to hydrophilic property, both of these factors can lead to an increase in dough water uptake by creating more hydrogen bonds and subsequently more interactions with water (Movahed *et al.*, 2013; Rosell *et al.*, 2001). Regarding dough development time, there were significant differences among all the treatments. In addition, Y_2 sample had the highest dough development time while the control had the lowest. In other words, consumed yeast-salt solution was effective in improving dough development time (Tsen, 1964; Clarke *et al.*, 2004). Regarding to stability, the highest obtained points belonged to Y_1 and Y_2 treatments (no significant difference between the two) and the lowest belonged to the control treatment ($p<0.05$). Therefore, using normal concentration of yeast-salt was effective in increasing the stability of gluten as well as improving dough stability. The reason might be attributed to the formation of strong bonds between wheat gluten and the aforementioned compositions. The results obtained from this study was in agreement with the results obtained from

other researchers (Movahed *et al.*, 2014; Maher Galal *et al.*, 1998). Regarding the degree of dough softening after 10 minutes, significant differences were noticed among all the treatments. Sample C had the highest degree regarding this point while Y_1 and Y_2 exhibited the least ($p<0.05$). In other words, utilization of yeast-salt solution to prepare flat bread dough results in strengthening dough structure and decreases the degree of dough softening as compared to the control. The reason for the formation of firm structure in dough which contained yeast-salt solution was hydrophilic composition of the compounds and creation of strong bonds with wheat flour proteins that subsequently enhance the gluten network in dough and decrease its softening (Movahed *et al.*, 2011b). The degree of dough softening after 12 minutes corresponded to the results of dough softening after 10 minutes. The enhancement of mentioned figure is the reason for improvement of rheological properties of dough. The highest quality number was calculated for Y_2 sample and lowest figure was calculated for the control although no significant differences were noticed among the treatments containing yeast-salt solution ($p<0.05$).

- *Evaluation of the results of extensograph for dough samples*

Table 3 presents the results of mean comparison of Extensograph applications on different samples and as indicated the fermentation times of 45, 90 and 135 minutes, had the highest level of energy on Y_2 sample and control had the lowest ($p<0.05$). In other words, utilization of yeast-salt method in flat bread dough samples was effective in increasing dough resistance and strengthening of its gluten stability as much as possible (Arendt *et al.*, 2007; Movahed *et al.*, 2011b). In addition, the highest degree of resistance to dough extensibility, during all three fermentation times, belonged to Y_2 sample and the lowest degree belonged to the control and in all the three time intervals, significant differences were noticed among all the treatments ($p<0.05$). Enhancement of this factor is an indication of great stability of dough during fermentation times. The results corresponded with the results from the research carried out by Rosell *et al.* (2001). The highest degree of dough extensibility, during all fermentation times belonged to the control while the lowest degree belonged to Y_2 sample ($p<0.05$). There were not significant differences concerned with some of the time intervals. This property is an indication of the degree of dough extensibility, water and CO_2 holding capacity and the resulting reduction in staling and bread freshness (Doxastakis *et al.*, 2002). The results from Table 3 suggest that using yeast-salt method led to an increase in the extensibility coefficient in the mentioned treatments as compared to the control in a way that in each of the selected times of 45, 90, and 135 minutes, Y_2 sample had the highest amount while control had the lowest amount of the respective property. The results obtained agreed with the results from other studies (Doxastakis *et al.*, 2002; Clarke *et al.*, 2004; Maher Galal *et al.*, 1998).

- *Evaluation of bread chemical test*

Table 4 presents chemical analyses of flat bread samples and as indicated Y_2 sample had the lowest and control had the highest values of pH and there were not significant differences between the treatments concerned with Y_1, Y_2 and control samples ($p<0.05$). In other words, utilizing yeast-salt solution led to decrease in pH levels in the samples as compared to the control. The reason was the presence of high yeast activity and production of enzymes. The highest amount of moisture was related to Y_2 sample and the lowest amount belonged to the control. The reason for the increase in the moisture in the samples containing yeast-

salt solution might be due to the existing high water holding capacity as well as yeast hydrophilic property and consumed salt in the bread prepared. The results obtained corresponded with the results of other researches (Arune panlop *et al.*, 2002). It should be noted that similar results were obtained concerning other chemical factors mamely protein and ash.

Conclusion

Considering the results of this study, using yeast-salt method to prepare flat bread dough resulted in improvement of rheological properties as well as enhancing other qualitative properties of bread. In other words, dough preparation through yeast-salt method resulted in easier processing, better malleability, improved gas holding capacity, increase in water uptake, increase in dough development time and stability, increase in resistance to dough extensibility and improvements in the qualitative properties.

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