

## Physicochemical and Rheological Properties of Toast Bread Baked by Yeast–Salt Method

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**ABSTRACT:** Baked goods are among the most important sources of human food. They may suffer from a limited shelf life due to use of low-quality wheat. However, there are a number of novel dough preparation methods that can improve bread quality. The current study analyzed the effect of the yeast-salt method on the physicochemical and rheological properties of toast dough and bread. Baker's yeast was used at two levels (0.5 and 1 wt% of flour) along with two levels of salt (1 and 2%) to prepare the yeast-salt solution and the bread dough. Data were analyzed using a completely randomized design and Duncan's multiple range tests. Study results showed that the treatment (1% yeast and 2% salt) had the lowest staleness after 72 hours, dough softening degree and pH, and also the highest water absorption, dough development time, dough stability time, valerimeter value, dough yield, moisture content, ash content, protein content, and sensory profile score compared to other treatments. In general, all yeast-salt method dough preparation treatments had better qualitative properties than the conventional dough preparation method (control). The treatment (1% yeast and 2% salt) was selected as the best study treatment.

**Keywords:** *Bread Yield, Dough Yield, Staleness, Toast Bread, Yeast-Salt.*

### Introduction

Bread is a food category prepared by baking, steaming and/or frying doughs made of flour and water. Since centuries ago, different forms of grains have been the base of nutrition of a large part of the world's population. Wheat is the most popular grain for bread and most worldwide cuisines (Movahed & Ahmadi Chenarbon, 2017). It is difficult to find any food in the human history that is the fruit of human thoughts and endeavor as much as bread has been, and can be entitled to praise and fondness as

much as bread has been (Movahed, 2011a). For Iranians, bread has had a special place and has been the staple food over this land. It supplies a considerable portion of protein and energy needs of the body, and is also a good source of B vitamins and fiber. The per-capita consumption of bread in Iran is 320 g per day (Arampoor & Torbati, 2011). Some of the breads baked in Iran and in the world include sangak, lavash, barbari, tafton, non-flat breads, toasts, white bread, whole grain bread, wheat germ bread, and grain bread. Dough preparation is an essential stage of the production technology of baking different types of bread. It determines the

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quality of the baked goods. Dough can be prepared manually or mechanically in continuous or batch systems (Movahed, 2011a). Dough treatment and development are also two important stages of the production process and play a role in formation of the 3D gluten lattice. In other words, during dough development, the protein and gliadin of the flour cause the formation of gluten with absorption of moisture. As the gluten strings bond, an elastic deformable lattice is formed in the dough. As the starch particles swell, and yeast and enzyme cells start to act, the dough mass takes its form. In addition, during dough kneading and mixing, some bonds are broken to form new bonds such as disulfide, hydrogen, and hydrophobic bonds. Once the intercellular bonds are created, the 3D structure of gluten is ready. It is when the dough assumes special viscoelastic properties (Rajabzadeh, 2007). Another important stage of bread production is to select whether use yeast or not. Accordingly, breads are classified into leavened and unleavened breads (Movahed, 2011b). The non-unleavened method is the simplest bread preparation method (such as chapati bread). However, breads containing sourdough, which is probably invented a long time ago when unleavened dough was accidentally mixed with soured dough, are made using the so-called leavened method. As a result of fermentation, short-chain fatty acids are created that induce the favorable flavor of breads. Currently, leavened breads are highly popular in both developed and developing countries due to their good flavor, long shelf life, and no chemical ingredient such as baking soda and propionic acid. Two fermentation methods are used in making leavened breads: first, using sourdough (previously made dough) and, second, using yeast. Yeasts are also used in two methods. First, making the baker's yeast using the leavening agent, water and flour; second, using (liquid) yeast nutrient and

mixing the baker's yeast with water and flour (Movahed, 2011a). Yeasts are made in two methods: by mixing yeast and lukewarm water with a small amount of sugar that provides nutrients for the yeast and prevents the bakery dough to go sour. The second method, which was used in this research, is the yeast-salt method (YSM) (Movahed, 2011b). In YSM, salt reacts with the yeast solution and forces a large amount of its moisture out due to differential osmotic pressure during the plasmolysis process. As a result, the saline becomes rich in protein and leavening enzymes leading to the bulk of leavening cells lose their vital activity. However, the enzymes keep their fermentation power. In order to compensate for the yeast cell mortality in the YSM, larger amounts of yeasts (about 1% w/w<sub>flour</sub>) can be used (Movahed, 2011a). Food losses are increasingly becoming a serious challenge in most countries, particularly the developing ones (Khoshnazar Porshokoohi & Kamali, 2009). Bakery wastes have roots in undesirable microbial, physicochemical and organoleptic changes that reduce bread safety and marketability (Altamirano-Fortoul & Rosell, 2011). Today, extensive research is underway to curb wastes and improve the quality of bakery products (Rajabzadeh, 2010). Industrially produced breads have small amounts of wastes compared to other breads, and have obtained a nutritionally good position thanks to their high quality baking, diversity, long shelf life, and complete fermentation. Toast is one of the most important industrially produced breads with large consumption around the world, particularly in the European countries and the USA (Mohamed & Jingyuan, 2010). Bread and bakery goods undergo different physicochemical changes once baked, which are generally termed "staling". An economically important concern of the baking industry is to delay staling. Staling is a process in which the appearance and contextual properties, scent, flavor, and

chewiness of the bread change giving rise to an aged or not fresh bread (Prabhansankar *et al.*, 2004). In industry, the baker's yeast is used to increase the volume, improve flavor, increase nutrient levels, enhance gluten quality, and improve digestion of breads. Baker's yeast follows a complicated process to convert starch and sugars in the flour into carbon dioxide and alcohol (Payan, 2001). The purpose of this study was thus to analyze the effect of the YSM on the physicochemical and rheological properties of toast dough and breads made using this method compared to the conventional method.

## Materials and Methods

### - Materials

The materials used in this study were wheat flour (specific to toast bread) with an extraction rate of 68% (Alborz Ard Co.), dry baker's yeast (*Saccharomyces cerevisiae*) (Iran Melas Co.), salt (Sadaf Co.), water, sugar (Ghand-i Karaj), and oil (Mahgol). In all experiments, the following designations were used: C = control treatment; Y1 = 0.5% yeast and 1% salt; Y2 = 1% yeast and 1% salt; Y3 = 0.5% yeast and 2% salt; and Y4 = 1% yeast and 2% salt.

### - Method

This study was conducted in 2017 in the Science and Industry laboratory, Department of Industries, Islamic Azad University, Karaj.

### - Flour chemical assays

The chemical assays of wheat flour included moisture content (AACC Method 44-16), ash (AACC Method 08-01), protein (AACC Method 46-12), pH (ISIRI Standard #37) (Anonymous, 2000).

### - Dough rheological assays

In order to determine a number of rheological properties of control and YSM-treated dough samples, the farinograph test

was employed according to AACC Method 54-21 (Anonymous, 2000).

### - Toast bread dough preparation method

Toast dough was prepared by first preparing the yeast-salt solution (0.5 and 1% yeast and 1 and 2% salt) with 10 liter of water for every 100 kg flour. After being kept for 22 hours at 28 °C, it was added to part of the wheat flour.

### - Toast bread production method and its assays

Toast dough was prepared by first preparing the yeast-salt solution (0.5 and 1% yeast and 1 and 2% salt) with 10 liter of water per 100 kg flour. After being kept for 22 hours at 28 °C, it was added to part of the wheat flour, which was tested for ash content, moisture content, pH, protein, staleness, volume analysis, dough yield, water absorption, dough stability and consistency, development time, bread yield, and sensory profile. The mixture was then stirred for 10 min for final preparation of the dough. Other dry substances and powders were also added to the mixture. The rest of the water and flour were also added and completely mixed with the deformable dough mass followed by the first period of rest (primary proofing). Dough rolls (approx. 450 g) were cut and rounded. They were left for the intermediate proofing stage for 10 min. The dough rolls were then transferred to the proofing chamber for final proofing at 30 °C and 80% RH for 40 min. Protein, moisture, ash and pH assays were also conducted. The toast dough molds were baked in a rotating oven at 220 °C for 45 min (Movahed & Ahmadi Chenarbon, 2017). The toast breads were then cooled down at room temperature.

### -Examining the staling of Toast bread by the instrumental method

In order to examine the staling (tissue metric) of bread specimens, the instrument of Testometric M350-10CT, Germany, was

used by the instrumental method. The test was performed at periods of 24, 48 and 72 hours after cooking. Initially, the specimens were kept individually in plastic bags at ambient temperature. The cuts of the specimen with dimensions of 2.5cm × 2.5cm were separated from their cores in order to evaluate by Instron instrument. The applied compression rate was equivalent to 50% of the thickness of the specimen as mentioned in the standard method (Anonymous, 2000).

*-Evaluating the sensory properties of Toast bread*

In order to evaluate the sensory properties of bread specimens, their properties were analyzed by using five senses. Bread specimens were coded after cooling and cutting and evaluated by 10 trained evaluators. On the first day of baking, the evaluation was conducted based on the properties of bread such as crust color, core color, scent, taste and chewiness. The referees determined specific points for the bread specimens with respect to the points specified in the evaluation forms (Anonymous, 2000).

*- Statistical analysis*

Data were analyzed using a randomized

completely randomized design with three replications. The study consisted of five treatments. Mean values were compared using Duncan's multiple range test ( $p \leq 0.05$ ) in SPSS 21.

**Results and Discussion**

Table 1 shows the results of the chemical assays of the wheat flour. Table 2 presents the comparison results of the mean values from farinograph tests on toast dough samples. Finally, Table 3 lists the mean comparison results of the chemical assays of bread samples.

*- Chemical analysis of wheat flour*

According to the results of Table 1, the flour employed for producing toast breads has good quality.

*- Farinograph analysis concerned with dough samples*

According to Table 2, significant differences were observed between the two mentioned treatments and other treatments in terms of water absorption ( $p \leq 0.05$ ). Y4 had the highest water absorption and C had the lowest value in this parameter. This is because both yeast and salt are effective in increasing the water absorption of flour and

**Table 1.** Chemical assays on the wheat flour used in toast bread samples containing different levels of yeast and salt

Type	Moisture (%)	Ash (%)	Protein (%)	pH
Wheat flour	12.95	0.6	9.78	6.81

**Table 2.** Rheological tests on the wheat flour used in toast bread samples containing different levels of yeast and salt

Treatment	Water absorption	Dough development time	Dough stability time	Dough softening at 10 min	Dough softening at 20 min	Farinograph quality number (FQN)	Dough yield
C	55 ± 0.2 <sup>c</sup>	1 ± 0.1 <sup>d</sup>	1.5 ± 0.1 <sup>c</sup>	37 ± 0.1 <sup>d</sup>	110 ± 5 <sup>c</sup>	34 ± 0.3 <sup>d</sup>	165.4 ± 0.25 <sup>c</sup>
Y1	55.6 ± 0.1 <sup>b</sup>	1.75 ± 0.1 <sup>c</sup>	6 ± 0.3 <sup>b</sup>	40 ± 0.1 <sup>d</sup>	120 ± 5 <sup>c</sup>	30 ± 0.3 <sup>c</sup>	169.6 ± 0.45 <sup>b</sup>
Y2	56.6 ± 0.1 <sup>b</sup>	2 ± 0.1	6.5 ± 0.3 <sup>b</sup>	70 ± 0.3 <sup>c</sup>	140 ± 5 <sup>b</sup>	40 ± 0.3 <sup>c</sup>	169.9 ± 0.26 <sup>b</sup>
Y3	58.7 ± 0.2 <sup>a</sup>	3 ± 0.1 <sup>b</sup>	8.5 ± 0.2 <sup>a</sup>	80 ± 0.5 <sup>b</sup>	150 ± 5 <sup>b</sup>	46 ± 0.5 <sup>b</sup>	170.8 ± 0.6 <sup>ab</sup>
Y4	59 ± 0.1 <sup>a</sup>	4.5 ± 0.1 <sup>a</sup>	8.75 ± 0.2 <sup>a</sup>	120 ± 0.5 <sup>a</sup>	170 ± 1 <sup>a</sup>	53 ± 0.8 <sup>a</sup>	171.8 ± 0.8 <sup>a</sup>

In each column, means with at least one letter in common have no significant difference at the significance level of 5%. C = Control toast bread; Y1 = Toast bread containing 0.5% yeast and 1% salt from the total weight; Y2 = Toast bread containing 1% yeast and 1% salt from the total weight; Y3 = Toast bread containing 0.5% yeast and 2% salt from the total weight; and Y4 = Toast bread containing 1% yeast and 2% salt from the total weight

**Table 3.** Chemical assays of toast bread samples containing different levels of yeast and salt

Treatment	Moisture (%)	Ash (%)	Protein (%)	pH
C	20.14 ± 0.13 <sup>d</sup>	0.55 ± 0.05 <sup>e</sup>	9.79 ± 0.03 <sup>c</sup>	6.76 ± 0.02 <sup>c</sup>
Y1	25.34 ± 0.17 <sup>c</sup>	1.30 ± 0.01 <sup>d</sup>	10.48 ± 0.01 <sup>b</sup>	6.68 ± 0.01 <sup>c</sup>
Y2	25.67 ± 0.17 <sup>c</sup>	1.55 ± 0.05 <sup>c</sup>	10.49 ± 0.03 <sup>b</sup>	6.95 ± 0.26 <sup>b</sup>
Y3	27.41 ± 0.18 <sup>b</sup>	1.8 ± 0.02 <sup>b</sup>	10.83 ± 0.01 <sup>ab</sup>	6.98 ± 0.01 <sup>b</sup>
Y4	28.59 ± 0.42 <sup>a</sup>	1.97 ± 0.03 <sup>a</sup>	10.87 ± 0.04 <sup>a</sup>	7.52 ± 0.01 <sup>a</sup>

In each column, means with at least one letter in common have no significant difference at the significance level of 5%. C = Control toast bread; Y1 = Toast bread containing 0.5% yeast and 1% salt from the total weight; Y2 = Toast bread containing 1% yeast and 1% salt from the total weight; Y3 = Toast bread containing 0.5% yeast and 2% salt from the total weight; and Y4 = Toast bread containing 1% yeast and 2% salt from the total weight

thus its absorption by dough. In other words, salt and the enzymes secreted by the yeast in the yeast–salt solution have high hydrophilicity that facilitates hydrogen bonding and increases water exchange. This in turn enhances water absorption by dough (Movahed, 2011b). In terms of dough development time, significant differences were observed between the two mentioned treatments and other treatments in terms of water absorption ( $p \leq 0.05$ ). Treatment C had the lowest and Y4 had the highest dough development time. This can be explained by the fact that addition of salt reinforces the gluten lattice, and addition of baker’s yeast can increase proofing and finally its consistency. These factors increase development time in YSM-treated samples compared to C samples (Butow *et al.*, 2002). In terms of stability time, C had the lowest and Y4 had the highest scores ( $p \leq 0.05$ ). This is because the baker’s yeast can increase proofing and improve the fermentation process, and the added salt can improve the development of the gluten lattice. These factors can also enhance the stability of dough in YSM-treated samples compared to the control. At the same time, the presence of NaCl ions as ion pairs neutralizes the electric charges of dough protein. This process in turn lead to increased distances between molecules, which further affect the dough stability positively (Salovaara, 1982). In terms of softening degree at 10 min, significant differences were observed between the two mentioned treatments and

other treatments in terms of water absorption ( $p \leq 0.05$ ). C and Y4 had the highest and lowest dough softening in 10 min (DS10). In other words, use of the yeast–salt soluble in preparation of the toast bread enhanced the dough structure as compared to the C treatment and reduced its softening degree. The strong structure of the YSM-treated doughs is the result of the hydrophilicity of these ingredients that creates strong bonds with the flour protein. Consequently, a strong dough gluten lattice is created, and DS10 is reduced (Movahed, 2011b). In terms of dough softening at 20 min (DS20), significant differences were observed between the two mentioned treatments and other treatments in terms of water absorption ( $p \leq 0.05$ ). C and Y4 had the highest and lowest dough DS20 results. In other words, use of the yeast–salt soluble in preparation of the toast bread enhanced the dough structure compared to the C treatment and reduced its softening degree after 20 minutes. The strong structure of the YSM-treated doughs is the result of the hydrophilicity of these ingredients that creates strong bonds with the flour protein. Consequently, a strong dough gluten lattice is created that reduced DS20 (Movahed, 2011b). In terms of FQN, C and Y4 had the lowest and highest results, respectively ( $p \leq 0.01$ ). In other words, the yeast–salt solution increased stability of dough compared to the control samples and thus enhanced the FQN. In YSM-treated toast breads, FQN showed higher results due to

the better proofing of their dough and improved and stable dough gluten lattice.

#### - Chemical analysis of bread

According to Table 3, treatments C and Y4 showed the lowest and highest water absorption by dough, respectively. The two treatments also had significant differences with other treatments ( $p \leq 0.05$ ). This is because the yeast-salt solution has a high water holding capacity. The hydrophilicity of yeast and salt further improves water absorption in the treated samples as compared to the control samples (Movahed, 2011b). The enzymatic activity of the baker's yeast enhanced the hydrolysis of the starch that produced free water inside the dough and increased break moisture content (Whitehurst & Oort, 2010). The pH results were highest in C and lowest in Y4. The two treatments also had significant differences with other treatments ( $p \leq 0.05$ ). This is because *Saccharomyces cerevisiae* consumes flour carbohydrates more extensively in the YSM approach than in the conventional method as a source of hydrocarbons for its metabolism and the result is the production of alcohol, CO<sub>2</sub> and acids. The most important acids are lactic and acetic acids that acidify the medium. Thus, the pH of YSM-treated samples was lower than the control samples (Movahed, 2011b). Similar results were also observed for other chemical factors such as protein

and ash, as Y4 had the highest and C had the lowest results in these parameters. The higher protein and ash content of YSM-treated breads was due to the high protein and mineral levels of the yeast-salt solution.

#### - Analysis of bread staling

According to Table 4, C and Y4 had the highest and lowest staleness. The two treatments also had significant differences with other treatments ( $p \leq 0.05$ ).

This means that the yeast-salt solution and higher levels of baker's yeast retarded the staling process in breads compared to the control samples. The lower staleness score of YSM-treated samples compared to control samples can be due to the higher yeast-salt levels that increased the hydrolysis of starch, consumption of sugars by the yeast, development of the yeast, activity of the yeast, dough proofing, and gas formation. All these factors improved bread quality and reduced staling. According to Table 4, within 24 to 72 hours after baking, staling increased in toast breads. In analysis concerned with instrumental staleness, higher scores refer to higher staleness, lower freshness, and increased hardness (Movahed & Ahmadi Chenarbon, 2017). This is completely natural as bread staling occurs over the time at ambient temperature. In other words, when storing breads, their kinetic energy decreases, and cross-linking increases. As

**Table 4.** Results from the mean comparison of interactions (Yeast and Salt Levels  $\times$  Time) on staleness in toast samples (N)

Treatment	Time (hour)		
	24	48	72
C	14.28 $\pm$ 0.02 <sup>c</sup>	15.35 $\pm$ 0.03 <sup>b</sup>	16.80 $\pm$ 0.03 <sup>a</sup>
Y1	6.57 $\pm$ 0.03 <sup>g</sup>	7.95 $\pm$ 0.05 <sup>e</sup>	8.96 $\pm$ 0.05 <sup>d</sup>
Y2	5.32 $\pm$ 0.03 <sup>i</sup>	6.60 $\pm$ 0.05 <sup>g</sup>	8.05 $\pm$ 0.05 <sup>e</sup>
Y3	5.26 $\pm$ 0.04 <sup>i</sup>	6.58 $\pm$ 0.02 <sup>g</sup>	7 $\pm$ 0.01 <sup>f</sup>
Y4	4.48 $\pm$ 0.05 <sup>j</sup>	6 $\pm$ 0.02 <sup>h</sup>	6.56 $\pm$ 0.05 <sup>g</sup>

Means with at least one letter in common have no significant difference at the significance level of 5%.

C = Control toast bread; Y1 = Toast bread containing 0.5% yeast and 1% salt from the total weight; Y2 = Toast bread containing 1% yeast and 1% salt from the total weight; Y3 = Toast bread containing 0.5% yeast and 2% salt from the total weight; and Y4 = Toast bread containing 1% yeast and 2% salt from the total weight

a result, breads become harder and stale (Rajabzadeh, 2007). According to Table 4, the control treatment had the highest staleness score after 72 hours whereas Y4 had the lowest staleness score after 24 hours. Moreover, there were significant differences between most treatments ( $p \leq 0.05$ ). It was determined that the addition of the yeast-salt solution led to significant differences between the YSM-treated toast breads and the control samples in terms of staleness score. Different factors such as gluten content, gluten to starch ratio, starch swelling, ingredients and their levels, proofing type, proofing time, yeast level, and sourdough level are effective in bread staling. The staling process was slower and hardness was lower in the treated samples due to the use of the yeast-salt solution that reduced starch swelling and inhibited cross-linking. The increase in the moisture content of treated breads compared to the control sample reduced the staling rate (Movahed, 2011a).

- Sensory analysis of bread

According to Table 5, in terms of crust color, C had the lowest score and Y4 received the highest score in this sensory property. The two treatments had significant differences with other treatments ( $p \leq 0.05$ ).

It indicates that higher levels of the

yeast-salt solution in toast bread samples only led to a significant difference in crust color. The reason for the improvement in the crust color of Y4 (toast bread treated with higher levels of yeast-salt solution) compared to the control was higher hydrolysis of polysaccharides starch and the conversion into mono- and di-saccharides due to an improved proofing process. As a result, the Maillard reaction was enhanced, which led to a golden-brown bread crust (Whitehurst & Oort, 2010). In terms of crust color, C had the lowest and Y4 had the highest scores in this sensory property ( $p \leq 0.05$ ). This indicated that the addition of the yeast-salt solution led to significant differences between the YSM-treated toast breads and the control samples in terms of crust color. This is because the proofing process was improved due to the use of the yeast-salt solution, and the release of proofing enzymes into the solution also boosted the enzymatic activity. These enzymes (such as amylase, zymase, lipase, and phosphatase) changed the molecular structure of the bread core and shrank and smoothed air cells, which in turn led to a more uniformly distributed texture. All these factors caused a reduction in the dark color of the bread core and developed a bright colored texture in this part of the bread (Moayedallaie *et al.*, 2010). Regarding the

**Table 5.** Sensory assays of toast bread samples containing different levels of yeast and salt

Treatment	Crust color	Core color	Scent	Taste	Chewiness	Total score
C	3.8 ± 0.1 <sup>c</sup>	3.5 ± 0.1 <sup>b</sup>	3 ± 0.1 <sup>c</sup>	3.6 ± 0.1 <sup>c</sup>	3.4 ± 0.03 <sup>c</sup>	3.4 ± 0.04 <sup>c</sup>
Y1	4.2 ± 0.1 <sup>b</sup>	4.4 ± 0.1 <sup>a</sup>	4 ± 0.1 <sup>b</sup>	4 ± 0.1 <sup>b</sup>	4 ± 0.05 <sup>b</sup>	4 ± 0.03 <sup>b</sup>
Y2	4.4 ± 0.1 <sup>ab</sup>	4.4 ± 0.1 <sup>a</sup>	4.2 ± 0.1 <sup>ab</sup>	4.2 ± 0.1 <sup>b</sup>	4.4 ± 0.05 <sup>a</sup>	4.1 ± 0.03 <sup>b</sup>
Y3	4.4 ± 0.1 <sup>ab</sup>	4.4 ± 0.1 <sup>a</sup>	4.2 ± 0.1 <sup>ab</sup>	4.2 ± 0.1 <sup>b</sup>	4.4 ± 0.05 <sup>a</sup>	4.2 ± 0.03
Y4	4.6 ± 0.1 <sup>a</sup>	4.6 ± 0.1 <sup>a</sup>	4.4 ± 0.1 <sup>a</sup>	4.4 ± 0.1 <sup>a</sup>	4.4 ± 0.05 <sup>a</sup>	4.4 ± 0.03 <sup>a</sup>

In each column, means with at least one letter in common have no significant difference at the significance level of 5%. C = Control toast bread; Y1 = Toast bread containing 0.5% yeast and 1% salt from the total weight; Y2 = Toast bread containing 1% yeast and 1% salt from the total weight; Y3 = Toast bread containing 0.5% yeast and 2% salt from the total weight; and Y4 = Toast bread containing 1% yeast and 2% salt from the total weight

aroma, C had the lowest and Y4 had the highest scores. The two treatments also had significant differences with other treatments ( $p \leq 0.05$ ). The improved scent of YSM-treated toast breads compared to the control was due to the intensified fermentation activity and improved activity of  $\alpha$ -amylase of the baker's yeast. As a result, more aromatics—including acetic acid, lactic acid, ketones, and aldehydes—were produced, all of which were effective in intensifying the aroma of the YSM-treated toast breads compared to the control (Movahed & Ahmadi Chenarbon, 2017). In general, the baker's yeast and lactic bacteria can produce different aromatic compounds such as acetic and lactic acid during proofing, and acetic acid seemingly had the largest effect on aroma (Movahed, 2012). In terms of flavor, C had the lowest and Y4 had the highest scores ( $p \leq 0.05$ ). This finding can be explained by the hydrolysis of polysaccharides namely starch by the yeast's enzymes, particularly  $\alpha$ -amylase, that converted them into mono- and disaccharides. These compounds are effective in improving the browning reaction and forming compounds effective in flavor. As a result, the flavor score of treated breads was higher than the control samples (Movahed, 2012). The highest and lowest chewiness scores were recorded for C and Y4, respectively, and both treatments had significant differences with other treatments ( $p \leq 0.05$ ). This indicated that the addition of the larger amounts of yeast-salt solution led to significant differences between the YSM-treated toast breads and treated samples with samples in terms of chewiness. The higher score of the treated samples can be due to better hydrolysis of starch by the enzymes in the baker's yeast. Therefore, more  $\text{CO}_2$  was produced by the yeast, which in turn created more bubbles inside the dough and increased its surface per volume unit. This was transformed into softer bread core and better

chewiness of the YSM-treated breads (Hyun Kim *et al.*, 2006). In terms of total sensory profile score, the lowest score belonged to C and the highest score to Y4. The two treatments had significant differences with other treatments ( $p \leq 0.05$ ). In other words, the use of higher amounts of the yeast-salt solution caused a significant difference in the total sensory profile score by improving this score as compared to the control. The improvement in the total sensory score of the treated samples can be explained by better hydrolysis of starch by the yeast's enzymes and its conversion to mono- and disaccharides. Accordingly, fermentation was improved, the Maillard reaction was intensified, and the total sensory score of the treated breads was enhanced compared to the control score (Movahed, 2012).

## Conclusion

Today, new dough preparation methods are widely used in the industry to improve the quality of breads. This study used the new Yeast-Salt Method (YSM) to compare its effect with the conventional method on the physicochemical and rheological properties of toast bread dough. The YSM is a novel dough preparation technique. In this method, the baker's yeast is first used at two levels of 0.5 and 1% (of the flour weight) along with 1 and 2% salt to prepare the yeast-salt solution. The solution is then used in the dough preparation process. Different chemical (moisture, ash, protein and pH), rheological, organoleptic (sensory), staleness and volume measurements and assays were performed on the YSM-treated bread samples and control. Data were also analyzed using completely randomized design and Duncan's multiple range test ( $p < 0.01$ ). The results of experiments showed that the treatment containing 1% yeast and 2% salt had the lowest staleness, dough softening degree and pH, and also the highest moisture absorption, dough

development time, dough stability time, FQN, dough yield, moisture content, ash content, protein content, and sensory profile score. In other words, the YSM strengthened the gluten lattice, increased the stability, dough development time, water absorption, and dough consistency, and also decreased dough softening. Ultimately, it improved the dough quality. Addition of salt to dough led to an improvement to flour strength, Ionic strength, and physical properties of the dough. This method can be used as an effective solution to improvement in the overall quality of bread dough and other similar products. According to the results of all experiments, the treatment concerned with the addition of 1% yeast and 2% salt was selected as the best treatment.

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