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Original research

Investigating the effect of emulsifiers and enzymes on the physicochemical and organoleptic characteristics of flat bread fermented by direct and sponge method

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A B S T R A C T

The present study was performed at two separate stages, the aim of the first stage was to study the effect of two different yeast types (active dry and compressed yeast) using sponge and dough method on various properties of flat bread (pita and Taftoon)prepared by different methods compared to the straight method. The most positive effects on physicochemical and sensory desirability were found in bread samples treated by compressed yeast in the sponge and dough method. After selecting the best sample, adding emulsifiers including SSL and DATEM, and α-amylase as an enzyme at higher level played a key role in increasing the physicochemical and textural values such as moisture, water activity, extensibility, L*, a* and in decreasing the hardness. Furthermore, the general acceptance score of Taftoon bread containing 2 g/kg SSL, 2 g/kg DATEM, and 0.05 g/kg α-amylase was desired more by the panelist, compared with other formulas.

Keywords: Flat bread; Sponge dough; Color values; Emulsifier; Enzyme

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1. Introduction

Flat bread which made from a flattened dough is consumed all over the words particularly in the Middle East (Eshak, 2016). Among the flat bread, Pita and Taftoon's consumption has been increasing in recent decades. In order to improve the flat bread quality and decrease the amount of produced waste, a new method and formula should be performed. To this aim, some methods such as sponge dough may play a key role in physicochemical and organoleptic properties of bread. Yeasts are a single cell of *Saccharomyces. Cerevisiae* is commercially used in bread making as a leaving agent. Gas expansion in the gluten network and accordingly an increase in dough volume are most commonly associated with yeasts. Thus, the yeast type may have an important role in the properties of bakery products with different baking method (Morreale et al., 2019).

In addition, some components such as emulsifiers and enzymes can be utilized in the bread-making process (Han et al., 2012). Emulsifiers are used for improving the crumb softness, developing the structure consistency and increasing the shelf life due to their capability in binding with gluten network (Van Steertegem et al., 2013). Additionally, emulsifiers positively affect the crumb softness without having an impact on the rigidity and elasticity of cell walls of bakery products. Sodium stearoyl-2-lactylate (SSL) and diacetyl tartaric acid ester of mono- and diglycerides (DATEM) have become increasingly common emulsifiers in the baking industry, due to their positive function on bread (Colakoglu & Özkaya, 2012).

Enzymes, especially amylases, are expected to function as a modifier in bakery manufacturing processes. The α-amylase catalyzes starch degradation. The shorter-chain dextrin, produced from starch hydrolyze, is responsible for the anti-firming property. The dextrin inhibits the development of hydrogen bonds between remained starch granules and gluten network (Durán et al., 2001). It is preferred to use fungal alpha-amylase rather than cereal alpha-amylase derived from malted wheat or barley, due to its lower heat inactivation. This means they could be utilized at much higher concentration, they form a better texture, volume, and appearance and longer shelf-life in bread. In this regard, the risk of creating an excessive level of dextrin is diminished. Otherwise, the baked loaf has a dark crust and a sticky texture (Cauvain & Young, 2007). Although the exact mechanism of enzymes is not exactly clear, their anti-staling ability may be due to their reactions with starch. Enzymes are able to combine with linear amylose, and accordingly integrate with outer linear branches of amylopectin. Further, the

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mentioned compounds retard the amylopectin re-crystallization stage (Champenois et al., 1999; Durán et al., 2001).

Flat Pita bread preparation included final fermentation while this step is not observed in the preparation of Taftoon bread. There is a lack of information about the effect of the sponge dough method and emulsifier-enzyme coordination on the flat bread quality with different preparation methods. Therefore, the purpose of the present study was to understand the impact of the sponge dough method on bread features and, at the second stage, to examine the influence of different concentrations of emulsifiers and enzyme on the dough and bread properties.

2. Material and Methods

2.1. *Materials*

Wheat flour with an extraction rate of 72% (Golmakan Co, Iran), emulsifiers including Sodium Stearoyl-2-Lactylate (SSL) and Diacetyl Tartaric Acid Ester of Mono- and Diglycerides (DATEM) (Pars Co, Iran) and α-amylase (DSM Co, Netherland) were carefully purchased. Other bread ingredients including active dry and compressed yeast (Razavi Co, Iran), vegetable oil (Ladan Co, Iran), sugar, and salt were supplied from local markets.

2.2. *Chemical composition measurement*

The chemical composition of the flours was determined according to the international methods of American Association of Cereal Chemist (AACC, 2000) such as moisture content (method 44-16), protein content (method 46-12), ash content (method 08-01) and wet gluten content (method 38-11). To estimate enzyme activity of the flour, the falling number test was applied according to Approved Method 56-81B (AACC, 2000).

2.3. *Bread preparation*

In order to prepare two breads, the sponge and dough method was applied and active dry and compressed yeast were added as two different treatments (Cauvin et al., 2007). The base bread ingredients consisted of wheat flour (1000 g), water (500 g), vegetable oil (10 g), sugar (10 g), salt (10 g), active dry yeast (5 g) or compressed yeast (15 g). The important point to consider is that the straight method was used to make bread for the control sample (Koocheki et al., 2009).

2.4. *Pita*

Dough samples were prepared following the procedure described by Borsuk et al. (2012) with some modifications. Using the sponge and dough method, at the first step, 700 g of wheat flour (70% of wheat flour), 5 g salt, 5 g sugar, active dry (2.5 g) or compressed yeast (7.5 g) and 200 g water were carefully mixed in a spiral mixer (Kitchenaid, USA) and then kept at 4°C for 16 h. At the next step, the remained ingredients in the main formula were added to prepared dough and left for 20 min. The dough was divided into 100 g pieces, after 12 min, put on baking sheets with 15 cm in diameter and 4 mm in thickness and placed in an incubator at 43°C and 85% RH for 25 min. Following fermentation, it was baked at 400°C for 1.5 min in a rotary baking oven (Mashhad backing industry). After baking, the bread loaves were cooled at room temperature and packaged in polyethylene packages until further experiments.

2.5. *Taftoon*

Formulation and method for preparation and baking Taftoon were similar to Pita. Just only there is no final fermentation in Taftoon bread preparation and dough was sheeted with docker after putting on the baking sheet to form the required dough (Rezaei et al., 2019).

2.6. *Rheological measurement*

2.6.1. *Farinograph*

In order to determine the dough quality, the dough rheological parameters could be estimated through Brabender Farinograph (O. H. Duisburg, Germany). In the present study, some parameters of dough including water absorption (%), dough development time (min), stability (min), mixing tolerance index (BU) and farinograph quality number or FQN (mm) affected by SSL, DATEM and α-amylase were evaluated according to method No. 59-21 (AACC, 2000).

2.6.2. *Extensograph*

The stretching behavior of dough was also measured through Extensograph by AACC, method 54-10. The dough resistance to constant deformation after 50 mm stretching (R_{50}), the extensibility (E), and the ratio (R_{50}/E) were provided by Brabender extensograph (AACC, 2000).

2.7. *Physicochemical properties*

2.7.1. *Water activity and moisture*

Water activity was calculated according to the method described previously (Akesowan, 2009) and moisture content was measured by the method of 44-16 (AACC, 2000).

2.7.2. *Textural analysis*

The textural properties of the fresh bread were evaluated through a texture analyzer (QTS, CNS Farnell, UK) equipped with an aluminum cylindrical probe 30 mm in diameter and 50 mm/min for the cross speed. Regarding the apparatus instruction, the puncture test was performed and the maximum force required for compressing the bread slices (10 * 10 cm) was considered as the bread hardness. Additionally, bread stretch length was reported as the bread extensibility (Pourfarzad et al., 2011).

2.7.3. *Color*

In order to visualize the flat bread color, image processing has been used in most of the studies in food science and technology (Sun, 2016). Lightness (L*), red-green (a*), and yellow-blue (b*) color components were calculated by using Image J software. A flatbed scanner (HP Scanjet G3010, China) with a resolution of 600 DPI was utilized to observe the images of the bread slices (12 * 25 cm^2), which were saved as JPEG format (Sheikholeslami et al., 2018).

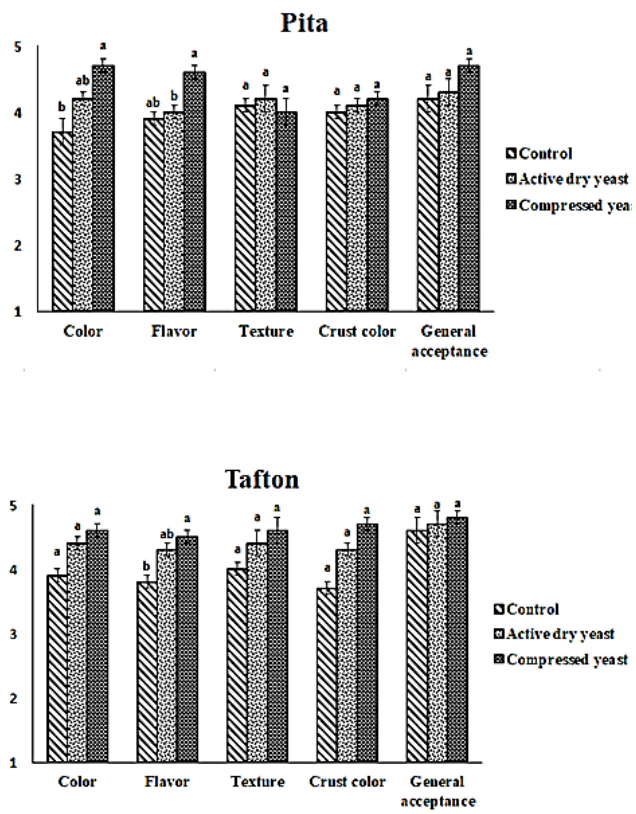

Fig 1. Sensory evaluation of bread affected by different yeast type a) Pita b) Taftoon.

2.8. Sensory analysis

Sensory evaluation was performed in terms of odor, flavor, texture, crust color, and general acceptance. For this vein, 20 panelists who were staff in the department of agricultural engineering research center in Iran were selected. The selected panelists were taught how to assess and report the analysis, before beginning the practical analysis of bread. The samples were scored on a 1–5 point hedonic scale (1 =dislike extremely, 2= dislike moderately, 3 =neither like nor dislike, 4= like moderately, and 5 =like extremely) (Rezaei et al., 2019).

2.9. Statistical analysis

Firstly, dough was provided using straight and sponge and dough method affected by two different yeast type (active dry and compressed yeast). After selecting the best sample, SSL, DATEM, and α-amylase at diverse concentration were added and then dough properties (rheological) and bread properties (physicochemical, textural, and organoleptic) were examined. In order to analyze the data and measure differences among the samples, a completely randomized design was performed using Minitab software (version 17) at a significance level of $p < 0.05$. All of the experiments were carried out in triplicate and for drawing the curves, MS-Office Excel 2013 was applied.

3. Results and Discussion

3.1. Chemical composition of wheat flour

The experiment of the proximate chemical composition of wheat flour with an extraction of 72% showed that the flour contained 136 g/kg moisture, 103 g/kg protein, 6.4 g/kg ash and 267 g/kg wet gluten. It can be observed that the falling number of wheat flour was 402 s, so that the wheat flour was appropriate to make flat bread. The results obtained from the present study were congruent with results reported by Ugwuona et al. (2012) and Okorie and Onyeneke (2012) who have analyzed the chemical compounds of wheat flour.

3.2. Rheological properties

Table 1 represents the impact of fortified wheat flour with SSL, DATEM, and α-amylase on rheological properties (i.e. water absorption, dough development time, stability, mixing tolerance index and FQN) and extensograph features (i.e. deformation after 50 mm stretching (R_{50}), the extensibility (E) and the ratio (R_{50}/E). Changing the ratio of emulsifiers and enzyme had a significant effect on the rheological parameters such as dough development time and stability. Among all samples, the sample included 2 g/kg SSL, 2 g/kg DATEM and 0.1 g/kg α-amylase illustrated the highest stability. Raising the SSL level led to an increase in stability and dough development time, while increasing DATEM concentration had a positive effect on the mentioned parameters only at present of 2 g/kg of SSL. It can be hypothesized that SSL with a high hydrophilic-lipophilic balance can bind with lipophilic sites of gluten proteins by its hydrophobic chains, resulting to develop the strong dough (Ferrer et al., 2011). The results were agreement with the study applied by Van Steertegem et al. (2013). They hypothesized that SSL inhibits gliadin proteins from participating in cross-linking reactions, instead, these proteins interact with SSL.

In general, the addition of α-amylase had no impact on dough stability. Although the function of these types of enzymes is considered as a modifier, Liu et al. (2017) showed that amylase considerably causes to decrease the dough stability due to its ability in the hydrolysis of starch. Based on the results, adding emulsifiers and enzyme failed to affect the water absorption and FQN dramatically. In addition, no considerable difference was observed on the mixing tolerance index after adding the emulsifiers except at the concentration of 2 g/kg SSL and DATEM.

Then, as shown in Table 1, the effect of SSL, DATEM, and α-amylase on the extensograph properties of dough was emphasized. Regarding the extensibility parameters, all of them including the initial resistance to deformation (R_{50}), the extensibility (E), and the ratio (R_{50}/E), at 45, 90, and 135 min resting time, significantly rose by increasing the emulsifiers and enzyme concentration compared to control. The results illustrated that combination of SSL, DATEM, and α-amylase meaningfully causes to enhance the resistance to extension and extensibility of dough due to the interactions among emulsifiers and enzyme activities. The resistance to deformation of fortified wheat flour with 2 g/kg SSL was superior compared to fortified wheat flour with 1 g/kg SSL. This could be due to the fact that SSL with higher concentration has stronger interactions with gluten proteins during dough mixing, which may result in gluten aggregation and dough firmness (Gómez et al., 2013). The extensibility of gluten increased by raising the emulsifier dose, and the optimum extensibility of the dough was equal to 146 mm at 90 min resting time. Compared to control, there were no significant variations in the extensibility parameters at 1 g/kg of emulsifiers when the concentration of α-amylase increased from0.05 to 0.1 g/kg.

3.3. Physicochemical and sensory properties

The main aim of this stage was selecting the best method to produce two flat breads. The influence of yeast type on the physicochemical properties of Pita and Taftoon bread made by straight and sponge dough method was investigated (Table 2). Two different types of yeast considerably affected moisture content, extensibility, and crust color compared to control. Utilizing the compressed yeast caused a significant increase in the mentioned parameters. The moisture content of Pita and Taftoon bread was 31.2 and 29.5 g/kg which in control bread produced by the straight method, respectively. Yeast can produce materials that retain moisture in the matrix network of bread; therefore, the water capacity in bread will be increased. In addition, the moisture migration from the curb to crust in bread structure would be reduced meaningfully (Kamel, 1987). In both bread, the samples made by compressed yeast in the sponge method indicated a higher score in extensibility, L*, and a*. It can be concluded that the sponge method with compressed yeast was more effective in maintaining the moisture and increasing the brightness. Conversely, among the physicochemical and textural parameters, water activity, hardness, and b* were not impacted by the yeast type. The most widely recognized role of yeasts is ascribable to their fermenting ability in bread. Baker's yeast is required to have high-leavening capability to ensure high-quality baking products. The success of the technological process in bread making is conditioned by the formation of gas in the final hours of the technological process. It was shown as a positive correlate between dough volume increasing and capabilities of yeast viability (Homayouni Rad et al., 2017). It seems that the speed of gas release in the use of active dry yeast is faster than that of compressed yeast, which releases gas slowly and gradually. This condition causes the difference in the rheological properties of the dough and the sensory properties of the bread.

After evaluating the sensory features, the results presented that odor of pita and flavor of Taftoon bread baked by sponge method with compressed yeast obtained a higher score than those treated by active dry yeast, while there were no significant changes among other sensory parameters for both bread (Fig. 1). In fact, yeast plays an important role in sugar breakdown, alcohol synthesis, and flavor development, particularly during fermentation.

After choosing the sample prepared by compressed yeast in the sponge method as the best sample, compared to other samples, the effect of different emulsifiers and enzyme on physicochemical properties and sensory evaluation of Pita and Taftoon bread was evaluated.

3.4. Moisture and water activity

Moisture and water activity in Pita bread increased by enhancing the emulsifier concentration. Conversely, these parameters were not changed meaningfully in Taftoon bread by raising the SSL, DATEM, and α-amylase level. This can be explained by the fact that Pita bread has a final fermentation in its preparation; therefore, there is an appropriate time for emulsifier function while there is no final fermentation in Taftoon bread preparation. The results are in agreement with an earlier study which reported that adding emulsifier into Barbari bread increased moisture and water activity of bread (Porfarzad et al., 2014).

3.5. Texture

The results of the texture of Pita and Taftoon bread affected by emulsifiers and enzyme during 72 hours after baking is illustrated in Table 3. Adding 1 and 2 g/kg of SSL, to DATEM and α-amylase-containing formulae significantly decreased the hardness of Pita bread. In Taftoon, the formula containing 2 g/kg SSL, 2 g/kg DATEM, and 0.1 g/kg α-amylase cause a reduction in hardness compared to other formulas ($p < 0.05$).The results were agreement with the results published by Azizi and Rao (2005), bread containing SSL and DATEM were softer than those without these emulsifiers. Koocheki et al. (2009) also confirmed that DATEM has a softening effect on bread. A decrease in the hardness of cake crumb using SSL has been reported Jyotsna et al. (2004). This phenomenon can be explained by the ability of emulsifiers in forming a complex with starch, preventing the staling, and maintaining the bread freshness. The effect of emulsifiers and enzyme at higher proportion on increasing the extensibility of both breads was significant (Table 3). This may be due to the fact that emulsifiers can make a network with gluten, thus preventing the migration of gas bubbles.

A large number of researchers evaluated the effect of malt on bread formula, they concluded that amylolytic activity in malt positively affects the bread softness and the retrogradation delay. Malt has a tendency to combine the starch; in this case, the starch retrogradation will be delayed (Mäkinen & Arendt, 2012; Adewale et al., 2006).

3.6. Color

Table 3 indicates the color parameters of Pita and Taftoon bread crust. As shown, an increase in emulsifiers and enzyme concentration leads to a significant rise in slice brightness (L*) in both bread. In other words, the crust color of bread enriched with emulsifiers and enzyme exhibited higher L* values than the control sample. Measurements demonstrated the samples containing 2 g/kg of SSL, 2 g/kg of DATEM, and 0.1 g/kg α- amylase showed the maximum L* value. An improvement in the brightness of baking products by adding the surface-active materials is contributed to the ability of these compounds to increase the water holding capacity of bread, which prevents adverse changes in bread crust such as wrinkling. It is also observed samples containing emulsifier have the smooth surface which can reflect the light and elevate the L* value (Purlis & Salvadori, 2009). Pita bread has a flat form with two thin layers that are totally exposed to heat. Accordingly, this could cause a reduction in weight loss after baking. Because both sides are exposed to temperature and this could promote moisture loss during baking. Colour is substantial product acceptability. This implies it has a main role in the decision of rejecting and/or accepting the food product (Angioloni & Collar, 2009). Therefore, it seems that the role of additives in this research, especially the alpha-amylase enzyme, is more effective in the color characteristics of pita.

Table 1. The rheological parameters of dough affected by SSL, DATEM, and α-amylase.

SSL (g/kg)	DATEM (g/kg)	α-amylase (g/kg)	Farinogragh: Water absorption (%)	Farinogragh: Dough development time (min)	Farinogragh: Stability (min)	Farinogragh: Mixing tolerance index (BU)	Farinogragh: FQN (mm)	Extensograph R50 (BU): 45 min	R50 (BU): 90 min	R50 (BU): 135 Min	E (mm): 45 min	E (mm): 90 min	E (mm): 135 min	R50/E: 45 min	R50/E: 90 min	R50/E: 135 min
0	0	0	60.0^{a}	2.46^{e}	3.11^{f}	120^{a}	60.1^{a}	90^{c}	125^{c}	118^{cd}	128^{c}	130^{c}	118^{d}	0.70^{e}	0.96^{ef}	1.00^{d}
1	1	0.05	61.5^{a}	2.49^{e}	3.41^{e}	118^{a}	60.1^{a}	100^{c}	135^{c}	129^{c}	130^{c}	134^{c}	126^{cd}	0.92^{d}	1.00^{e}	1.02^{d}
		0.1	62.0^{a}	2.66^{de}	3.51^{de}	110^{ab}	60.5^{a}	122^{bc}	126^{c}	125^{c}	135^{bc}	139^{abc}	121^{d}	0.94^{d}	0.90^{ef}	1.03^{cd}
	2	0.05	62.0^{a}	2.58^{de}	3.44^{e}	110^{ab}	60.8^{a}	131^{b}	149^{b}	146^{ab}	144^{a}	146^{a}	139^{a}	0.91^{cd}	1.02^{de}	1.05^{c}
		0.1	63.0^{a}	2.68^{de}	3.64^{cd}	102^{b}	61.0^{a}	130^{b}	146^{b}	140^{b}	142^{ab}	146^{a}	135^{ab}	0.91^{cd}	1.07^{bc}	1.08^{b}
2	1	0.05	61.0^{a}	2.64^{de}	3.71^{cd}	110^{ab}	60.5^{a}	144^{a}	151^{ab}	146^{ab}	144^{a}	146^{a}	139^{a}	1.00^{bc}	1.03^{de}	1.05^{c}
		0.1	61.5^{a}	2.71^{cd}	3.81^{c}	110^{ab}	60.3^{a}	145^{a}	149^{b}	139^{b}	142^{ab}	142^{ab}	136^{ab}	1.02^{bc}	1.05^{cd}	1.02^{d}
	2	0.05	62.5^{a}	2.95^{ab}	4.11^{b}	101^{b}	60.5^{a}	150^{a}	156^{ab}	140^{b}	144^{ab}	143^{ab}	128^{bc}	1.04^{ab}	1.10^{ab}	1.09^{b}
		0.1	63.5^{a}	3.10^{a}	4.32^{a}	103^{b}	61.3^{a}	155^{a}	161^{a}	155^{a}	141^{ab}	143^{ab}	121^{d}	1.09^{a}	1.12^{a}	1.28^{a}

Table 2. The effect of different yeast type on the physicochemical properties of Pita and Taftoon bread.

Bread	Dough type	Moisture (g/kg)	Water activity	Textural properties: Hardness (N)	Textural properties: Extensibility	Crust color: L^{*}	Crust color: a*	Crust color: b*
Control	Straight	28.6^{a}	0.835^{a}	34^{a}	14.31^{c}	39.1^{b}	3.61^{a}	21.5^{a}
Pita	Sponge (Active dry)	29.3^{a}	0.931^{a}	33^{a}	15.40^{b}	40.2^{ab}	5.9^{b}	22.5^{a}
	Sponge (Compressed)	31.2^{b}	0.826^{a}	33^{a}	16.35^{a}	41.5^{a}	5.81^{b}	23.1^{a}
Control	Straight	26.3^{a}	0.825^{a}	37^{a}	13.65^{b}	38.5^{a}	7.39^{a}	24.2^{a}
Taftoon	Sponge (Active dry)	28.8^{b}	0.821^{a}	36^{a}	14.44^{b}	39.1^{a}	7.40^{a}	21.9^{a}
	Sponge (Compressed)	29.5^{b}	0.820^{a}	36^{a}	17.52^{a}	40.2^{a}	7.31^{a}	22.3^{a}

Table 3. The physicochemical parameters of dough affected by SSL, DATEM, and α-amylase.

Bread	SSL (g/kg)	DATEM (g/kg)	α-amylase (g/kg)	Moisture (%)	Water activity	Hardness (N)		Extensibility (mm)		Crust color		
						0	72h	0	72h	L*	a*	b*
Control	0	0	0	24.7^{d}	0.888^{fg}	270^{a}	294^{a}	28.1^{cd}	25.7^{b}	32.5^{f}	5.2^{d}	21.7^{a}
Pita	1	1	0.05	25.2^{d}	0.895^{f}	149^{c}	180^{d}	26.3^{df}	23.4^{c}	34.9^{e}	6.7^{c}	22.5^{a}
			0.1	25.5^{cd}	0.902^{ef}	140^{c}	171^{d}	25.5^{df}	22.9^{c}	35.7^{e}	8.5^{ab}	20.9^{a}
		2	0.05	26.2^{cd}	0.912^{de}	175^{c}	230^{b}	27.2^{de}	25.5^{b}	37.9^{d}	7.2^{bc}	21.0^{a}
			0.1	27^{bcd}	0.920^{cd}	181^{c}	234^{b}	23.1^{df}	20.7^{d}	37.5^{d}	8.9^{a}	22.2^{a}
	2	1	0.05	27.6^{bc}	0.929^{c}	201^{b}	237^{b}	28.5^{bc}	26.0^{b}	40.2^{c}	6.9^{c}	21.6^{a}
			0.1	27.8^{abc}	0.932^{bc}	190^{b}	222^{b}	28.1^{cd}	25.4^{b}	41.0^{bc}	9.1^{a}	21.0^{a}
		2	0.05	29.2^{ab}	0.944^{b}	240^{b}	259^{c}	29.5^{ab}	27.5^{a}	42.5^{ab}	7.0^{c}	22.0^{a}
			0.1	30^{a}	0.959^{a}	228^{b}	264^{c}	30.7^{a}	27.9^{a}	43.1^{a}	8.8^{a}	20.5^{a}
Control	0	0	0	27.9^{bc}	0.891^{a}	229^{ab}	258^{a}	22.2^{bc}	17.9^{b}	31.8^{d}	5.9^{c}	23.1^{bcd}
Taftoon	1	1	0.05	28.6^{ab}	0.889^{a}	220^{bc}	237^{b}	21.4^{cd}	16.2^{c}	33.6^{c}	5.9^{c}	22.1^{d}
			0.1	28.8^{ab}	0.882^{ab}	226^{bc}	231^{b}	21.8^{bcd}	16.5^{c}	34.1^{bc}	6.5^{bc}	23.5^{bc}
		2	0.05	27.4^{c}	0.881^{ab}	231^{ab}	264^{a}	21.9^{bcd}	16.8^{c}	33.9^{bc}	6.2^{bc}	22.6^{cd}
			0.1	27.3^{c}	0.879^{ab}	236^{a}	270^{a}	22.1^{bc}	18.0^{b}	34.5^{bc}	6.1^{c}	23.1^{bcd}
	2	1	0.05	27.6^{bc}	0.881^{ab}	222^{bc}	240^{b}	23.5^{a}	20.2^{a}	35.1^{ab}	6.1^{c}	22.6^{cd}
			0.1	26.9^{c}	0.876^{ab}	225^{bc}	236^{b}	22.8^{ab}	17.6^{b}	36.1^{a}	8.4^{a}	23.5^{bc}
		2	0.05	27.5^{c}	0.885^{ab}	229^{ab}	265^{a}	23.6^{a}	20.5^{a}	34.2^{bc}	6.2^{bc}	24.1^{b}
			0.1	27.1^{c}	0.881^{ab}	218^{cd}	232^{b}	22.9^{ab}	19.8^{a}	36.3^{a}	7.1^{b}	25.6^{a}

Table 4. Sensory evaluation of bread affected by SSL, DATEM, and α-amylase on Pita and Taftoon.

Bread type	SSL (g/kg)	DATEM (g/kg)	α-amylase (g/kg)	Crust Color		Texture		Flavor		Odor		General acceptability	
				0	72h	0	72h	0	72h	0	72h	0	72h
Control	0	0	0	3.6^{a}	3.0^{a}	3.5^{a}	3.2^{a}	3.6^{a}	3.4^{a}	3.6^{a}	3.0a	3.8^{a}	3.0^{a}
Pita	1	1	0.05	3.8^{a}	3.2^{a}	4.1^{a}	3.6^{a}	4.3^{a}	4.0^{a}	4.3^{a}	3.8a	4.2^{a}	3.5^{a}
			0.1	4.1^{a}	3.4^{a}	4.0^{a}	3.8^{a}	4.4^{a}	4.0^{a}	4.3^{a}	3.4a	4.2^{a}	3.2^{a}
		2	0.05	4.0^{a}	3.2^{a}	3.9^{a}	3.5^{a}	4.4^{a}	4.2^{a}	4.5^{a}	3.8a	4.5^{a}	3.2^{a}
			0.1	3.9^{a}	3.0^{a}	4.3^{a}	3.9^{a}	4.3^{a}	4.0^{a}	4.3^{a}	3.6a	4.4^{a}	3.6^{a}
	2	1	0.05	4.3^{a}	3.6^{a}	4.1^{a}	4.0^{a}	3.9^{a}	3.6^{a}	3.9^{a}	3.2a	4.0^{a}	3.4^{a}
			0.1	4.1^{a}	3.4^{a}	4.0^{a}	3.7^{a}	4.5^{a}	4.0^{a}	4.1^{a}	3.7a	4.3^{a}	3.8^{a}
		2	0.05	4.0^{a}	3.6^{a}	3.9^{a}	3.6^{a}	3.9^{a}	3.4^{a}	3.9^{a}	3.1a	3.8^{a}	3.4^{a}
			0.1	3.9^{a}	3.2^{a}	4.1^{a}	3.8^{a}	3.8^{a}	3.6^{a}	3.8^{a}	3.4a	3.8^{a}	3.2^{a}
Control	0	0	0	3.8^{a}	3.4^{a}	3.6^{a}	3.0^{a}	3.8^{a}	3.2a	3.7^{a}	3.3a	3.7^{a}	3.4^{a}
Taftoon	1	1	0.05	4.2^{a}	4.0^{a}	4.3^{a}	3.4^{a}	4.3^{a}	3.8^{a}	4.4^{a}	3.7^{a}	4.3^{a}	3.4^{a}
			0.1	4.2^{a}	3.6^{a}	4.2^{a}	3.6^{a}	4.0^{a}	3.6^{a}	4.2^{a}	3.4^{a}	4.6^{a}	3.6^{a}
		2	0.05	4.0^{a}	3.4^{a}	4.3^{a}	3.7^{a}	3.9^{a}	3.6a	4.0^{a}	3.4^{a}	4.9^{a}	3.7^{a}
			0.1	3.9^{a}	3.2^{a}	4.0^{a}	3.2^{a}	3.8^{a}	3.8^{a}	3.8^{a}	3.1^{a}	4.7^{a}	3.4^{a}
	2	1	0.05	3.9^{a}	3.4^{a}	4.0^{a}	3.0^{a}	4.0^{a}	3.6^{a}	4.0^{a}	3.6^{a}	4.8^{a}	3.4^{a}
			0.1	3.8^{a}	3.4^{a}	3.9^{a}	3.3^{a}	3.8^{a}	3.2^{a}	3.8^{a}	3.4^{a}	4.9^{a}	3.6^{a}
		2	0.05	3.8^{a}	3.6^{a}	3.8^{a}	3.3^{a}	4.0^{a}	3.8^{a}	.1^{a}	3.9^{a}	5.0^{a}	4.0^{a}
			0.1	3.6^{a}	3.1^{a}	3.7^{a}	3.4^{a}	4.0^{a}	3.6^{a}	4.0^{a}	3.4^{a}	4.9^{a}	3.6^{a}

Regarding a* estimation, the experiments showed this parameter increased meaningfully by increasing the α-amylase concentration. One of the responsibilities of this enzyme is to break the polysaccharides and produces dextrin which participates in caramelization and Millard reactions, thus improve the crust color of baking products. Compared to control, formulas containing emulsifiers and enzyme had greater a* value, whereas it was not observed any statistically different ($p > 0.05$) in b* value by addition emulsifiers concentration to the bread formulation.

3.7. Sensory evaluation

Evaluation of the organoleptic properties in bakery products is very important, because it plays a key role in food acceptability. Crust color, texture, flavor, odor, and general acceptance of Pita and Taftoon bread supplemented with different levels of SSL, DATEM, and α- amylase are described in Table 4. Based on the results, it can be concluded that adding emulsifiers and enzyme had no negative impact on the sensory properties of both bread. Although all of the five scores mentioned above had no significant difference compared to each other during 72 hours after baking, the highest general acceptability score (Table 4) was obtained in Taftoon bread containing 2 g/kg SSL, 2 g/kg DATEM, and 0.05 g/kg α-amylase among all formulas during 72 hours after baking. According the score obtained, Pita bread tended to be favored more by consumers compared to Taftoon bread. Purhagen et al. (2011) and Gómez et al. (2013) reported that adding emulsifiers and enzymes, especially in mixture manner has a significant positive effect on sensory properties of bakery product.

4. Conclusion

Pita and Taftoon are well-known flat bread in the Middle East; therefore, evaluating their different properties is essential to increase consumer acceptance. The purpose of the present study was to investigate the effect of different concentrations of emulsifiers and enzyme on rheological, physicochemical, textural, and sensory properties of selected flat bread after treated by different yeast types in sponge dough method compared to straight method. Among yeast type, compressed yeast had a positive effect on the properties of flat bread, while no significant effect was observed after adding active dry yeast. After selecting the best sample, emulsifiers (SSL and DATEM) and enzyme (α-amylase) were added and the rheological, physicochemical, textural, and sensory properties were analyzed. Estimating the dough rheology indicated that dough development time and stability value were increased, although the mixing tolerance index decreased with an increase in the emulsifier and enzyme concentration. According to data, the addition of emulsifier and enzyme at higher concentration to the Pita bread formulation caused higher moisture content, water activity, extensibility, and brightness while results of the physicochemical parameters of Taftoon bread indicated that adding emulsifier and enzyme had no significant effect on moisture content and water activity. The hardness of both breads was reduced by increasing the emulsifier and the replacement level of α-amylase. The analysis of data pertaining to the b* showed that there was no difference between the bread containing the emulsifiers and enzyme and the control sample. Although there was no considerable change in sensory evaluation of both flat breads compared to bread control, the highest general acceptance score was shown in Taftoon bread containing 2 g/kg SSL, 2 g/kg DATEM, and 0.05 g/kg α-amylase.

Acknowledgment

Not applicable.

Conflict of interest

Authors declare that they have no conflict of interest.

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