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Full Length Research Paper

The effect of various additives on the sensory properties of traditional Turkish flat bread (Tirnakli Ekmek)

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In this research, effects of some additives on sensory properties of Turkish flat bread (tırnaklı ekmek) unique to Sanliurfa were investigated. For this purpose, bread samples were made from wheat flour was added with 10, 20 and 30% durum wheat flour (A) and 0.3, 0.6 and 0.9% DATEM (diacetyl tartaric acid ester of monoglicerids) (B), and 25, 50, and 75 mg kg^{-1} L-ascorbic acid (C), and stored for 48 h. Bread samples were investigated for taste and aroma, texture and appearance properties on the 1st, 24th and 48th h. According to sensory analysis, the effects of the additives on the appearance properties and taste and aroma scores were determined statistically insignificant. In general, throughout the duration of storage the bread samples containing the additive types A and B scored higher in terms of texture than control and the samples containing the additive C.

Key words: Additives, "tırnaklı", flat bread, sensory property.

INTRODUCTION

As in many countries, consumption of many types of bread in large numbers is the point at issue in Turkey. Although most of these are of the fine white bread loaves, the consumption of traditional types of bread is not to be undervalued. In many countries in the Middle East and in North Africa, including Turkey, flat bread types are among the most frequently used ways of wheat consumption. Flat bread types, which are considered among the bread classes with low specific volume, otherwise commonly known as the pita bread, diverge from other types by either their means of manufacture or by the properties that they possess (Coşkuner, 1993). "Tırnaklı ekmek", frequently consumed in Şanlıurfa and its surrounding area, falls in the flat bread category as well (Köten and Ünsal, 2006; Köten and Ünsal, 2007).

In addition to the properties of the raw material, the quality of the bread is under significant influence of the processes applied at various stages of manufacture and the rheological changes that occur within those stages (Unal and Boyacıoğlu, 1985). The use of various additives in the manufacture of bread to counter the flaws due to raw materials and the processes, to delay staling and to provide savings on time, location and man power becomes widespread by the day (Özer and Altan, 1995). Generally speaking, many types of additives have taken their place in bread manufacture and became widely used as a result of the studies conducted to serve basically four purposes, namely, to enhance the nutritional value of the bread, the enhance the quality of the bread, to delay its staling and to facilitate its storage (Ünal, 1988).

Williams et al. (1988) have reported that the rising type two layered flat bread made from the durum wheat flour, also known as the Arabian bread had a mellower texture than those made from the general wheat flour.

In their study, Toufeilli et al. (1995) have reported that when 0.25% SSL or DATEM was used in the Arabian bread, the sensory properties were not affected and that the bread is of higher quality than the reference and that on the other hand, when the same additives were used at a ratio of 0.5%, the bread quality was determined to be low. In the study that they have conducted, Faridi et al. (1983) have reported that the use of 50 mg/kg of ascorbic acid in the Moroccan bread and the use of 30 mg/kg of

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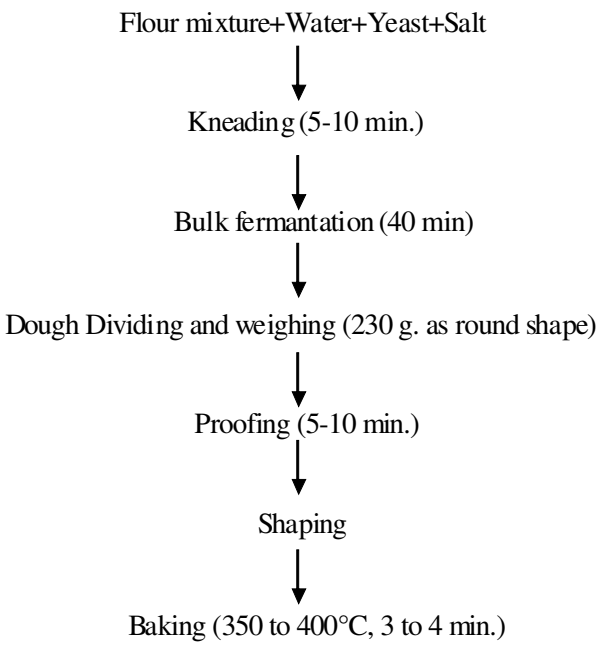

Figure 1. Manufacture scheme of flat bread.

ascorbic acid in the Arabian bread have yielded better results than the reference bread types without the additive.

Boyacıoğlu (1993) has investigated the possibility of bread manufacture from the wheat flour suitable for bread manufacture together with the durum wheat flour, semolina residue flour and of semolina in various ratios and of the obtained results, he has concluded that the bread obtained by 75 mg/kg addition of ascorbic acid and 0.5% SSL added mixture of 75% wheat flour suitable for bread manufacture and 25% durum wheat or semolina residue flour provided preferable characteristics.

Basman and Köksel (2001) have investigated the effect of the addition of wheat bran (10, 20, 30 and 40%) and barley flour (5, 10, 15 and 20%) in increasing amounts on the thin layered Turkish flat bread (yufka) quality and the properties of the dough. They have reported that the addition of wheat bran and barley flour in increasing amounts has caused only a slight lowering of the sensory quality of the Turkish flat bread (yufka).

DATEM has been used as a dough structure strengthener by increasing the emulsion stability, as an enhancer of the inner bread structure and as a mellower (Krog, 1981; Pisesookbunterng et al., 1983).

Vitamin C, which is used for improving the properties of the dough and the bread, strengthens the gluten structure as well as it increases the ability of the dough to be processed. An enhancement of the dough structure, shortening of the leavening period, speeding of the maturation of the dough, an increase in the dough and bread volume, and the tenuity and homogeneity of the pores has been observed when vitamin C was added to the flour (Anonymous, 2005). In this study, which was planned taking into consideration these effects of the additives and the significance of bread in daily nutrition as well as the appreciated consumption of the lozenge-patterned bread in this area, the effect of each additive on the sensory properties of this type of bread was investigated.

MATERIALS AND METHODS

In the study, the flour obtained from ÖZKAR Flour Mill Industries Ltd. operating in the city of Adana has been used. Pressed moist yeast (TS 3522), salt (TS 933) and the water from the water network have been used in the manufacture of the bread. Beldem brand DATEM in powder form and Roche brand L-ascorbic acid (Vitamin C) were used as the flour additives. In addition, the durum wheat flour which was used as an extra additive was supplied from Ankara Field Crops Central Research Institute.

Making of the flat bread (tırnaklı ekmek)

The bread was made in a local bakery where the flat bread manufacture is routinely carried out. The bread was obtained by following the step by step manufacture instructions for the flat bread after the additives were separately mixed in the flour at different dosages (Figure 1).

Ten different flour mixtures obtained by mixing various amounts of flour and additives were used in bread making. The additives and their amounts in the mixtures were displayed in Table 1. In each mixture, water in the amount of 5 units above the Farinograph water absorption measure, 3 g of yeast and 1.5 g of salt was used per 100 g of flour was used.

The ingredients for the bread manufacture were kneaded in a kneading trough of Diosna brand until the optimum consistency of

Table 1. The additives and their amounts in bread making.

Additives	Control	A* (%)			B** (%)			C*** (mg/kg)		
Level of additive	0	10	20	30	0.3	0.6	0.9	25	50	75

*A: Durum wheat flour, **B: DATEM, ***C: L-Ascorbic acid (vitamin C).

Table 2. The composition of the flour that was used in the manufacture of the flat bread (tırnaklı ekmek).

	Properties of the flour						
	Moisture (%)	Ash(%)*	Protein*1 (%)	Wet gluten (%)	Dry gluten (%)	Falling number (sn)	Sedimantation (ml)
Mean scores	11.13	0.62	9.94	28.30	9.68	324.50	26.60

* %14 dry basis. [1]F= 5.7

the dough was attained (5 to10 min) (the temperature of the water used in the dough making was adjusted to 20±2°C). After that, the dough was bulk fermented for 40±2 min at 80±5% relative humidity and at 30±2°C.

After the bulk fermentation, the dough was divided into 230 g as round and they were abandoned for proofing for 5 to 10 min. Following that, the dough were flattened into elliptical shape to possess 70 to 80 cm length, 25 to 30 cm width and 1 to 1.5 cm thickness and their top surface had been formed by hand. Then they were stone baked at (350 to 400°C, 3 to 4 min.). Following baking, the bread samples were cooled off wrapped in cloths for 10 min and they were analyzed at ambient conditions.

Sensory analyses

The sensory analyses have been conducted in the Department of Food Engineering in the Faculty of Agriculture in Harran University by a panelist group comprised of 10 people using modified sensory evaluation form which had been described by Basman and Köksel (1999, 2001); Qarooni et al. (1993) and Farvili et al. (1997). The samples were evaluated in terms of their appearance properties on the 1st h and texture and taste-aroma properties on the 1st, 24th and 48th h.

Appearance properties

Shape and symmetry, crust color, top surface properties and the base properties were separately evaluated out of 5 and their average was taken to form the score of the appearance properties.

Texture properties

The mellowness of the bread, brittleness and crumb colour were separately evaluated out of 5 and their average was taken to form the score of the texture properties.

Taste and aroma properties

Feeling in the mouth (chew ability) and taste-aroma properties were separately evaluated out of 5 and their average was taken to form the score of the taste-aroma properties.

Statistical analyses

The SPSS package software has been used in the evaluation of the results (SPSSinc, 1998). The values that have been identified as being statistically similar within a 5% confidence interval were shown by the same letter on the tables.

RESULTS AND DISCUSSION

The properties of the flour used in the manufacturing of the flat bread and the identified chemical and sensory properties of the flat bread are provided in this section and the results were discussed through their statistical evaluation.

Properties of the flour used in the production of the flat bread

The values of the composition of the flour that was used in the manufacture of the flat bread are given in Table 2.

As it can be seen by the investigation of Table 2, the moisture content of the flour sample was 11.13% and the ash content was 0.62%. The moisture content was in accordance with the Turkish Food Codex. The ash content was also in accordance with the Turkish Food Codex for flour of Type 650 (Anonymous, 2000).The wet gluten content of the flour was 28.30% and the dry gluten content was 9.68% and it is in accordance with the TS4500 “Wheat Flour” standards. The falling number of the flour was 324.50 s, the protein content was 9.94% and the sedimentation value was determined as 26.62 ml. Based on these values, the used flour had low amylase activity with medium level sedimentation value.

Sensory properties determined during storage of the flat bread appearance

The values regarding the appearance of the flat bread

Table 3. Appearance scores of the flat bread (tırnaklı ekmek).

Additives	Level of additive	Appearance score
control	0.0	4.05 ±0.01$^{ab\ (**)}$
	10	3.86 ±0.42^{b}
A (%)	20	4.54 ±0.03^{a}
	30	4.52 ±0.02^{a}
	0.3	4.39 ±0.28^{ab}
B (%)	0.6	4.28 ±0.06^{ab}
	0.9	4.35 ±0.02^{ab}
	25	3.84 ±0.76^{b}
C (mg/kg)	50	4.30 ±0.20^{ab}
	75	4.25 ±0.15^{ab}

* A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).**The mean values displayed by the different words were statistically significant ($p<0.05$).

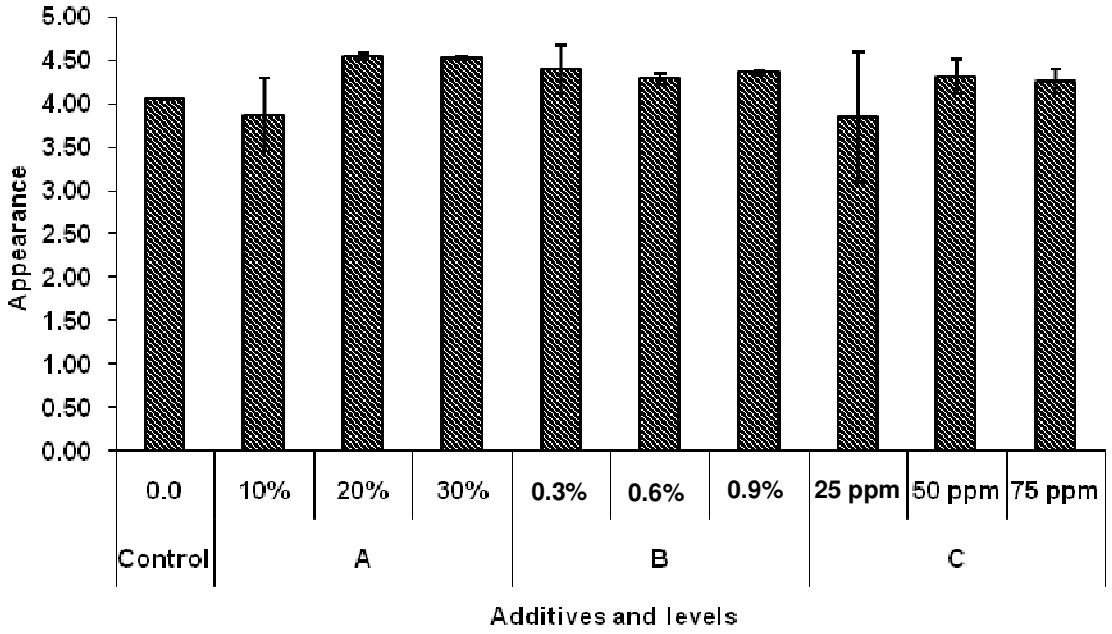

Figure 2. The change graphic of the appearance scores. * A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).

with various additives used at various levels on the 1st h are provided in Table 3.The changes observed in terms of the appearance of the flat bread based on the additive ratios that were evaluated out of 5 points are displayed in Figure 2.

The extent of the use of additives has been determined to be effective on the appearance scores statistically ($p<0.05$) although the effect of the additives was determined to be statistically insignificant. Investigation of the appearance of the bread samples indicated an irregular change of bread appearance. As a general overview, the bread samples, in which 20 or 30% additive A was used, scored higher in terms of appearance than the other samples and the highest appearance score with 4.54 was determined to belong to the sample with 20% additive A. The lowest appearance score with 3.84 belonged to the sample bread with 25 mg/kg of additive C in it. Except for the bread samples containing 10% additive A and 25 mg/kg of additive C, all other bread samples have scored higher in terms of appearance than the control samples.

Varinli et al. (2002) have reported that the use of various flour types including the corn flour, rye flour, rice flour and the oat flour to various extents was determined to be insignificant on the appearance scores of the pita bread.

In their study where they manufactured bread from the durum wheat, Boyacıoğlu and D'Appolonia (1994) have

Table 4. The texture scores of the stored bread samples with additives.

Additives	Level of additive	The period of storage (H)		
		1	24	48
control	0.0	3.87 ±1.00	2.85 ±0.27	2.55 ±0.07
A (%)	10	4.19 ±0.71	3.13 ±0.31	2.65 ±0.21
	20	4.50 ±0.04	3.07 ±0.22	2.89 ±0.20
	30	4.27 ±0.47	3.43 ±0.11	2.68 ±0.29
B (%)	0.3	4.09 ±0.06	3.24 ±0.78	3.03 ±0.33
	0.6	4.40 ±0.25	3.26 ±0.26	2.74 ±0.20
	0.9	4.69 ±0.08	2.99 ±0.47	2.39 ±0.11
C (mg/kg)	25	4.21 ±0.02	3.13 ±0.18	2.50 ±0.44
	50	3.96 ±0.06	2.68 ±0.33	2.57 ±0.04
	75	3.65 ±0.25	3.16 ±0.54	2.79 ±0.35

* A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).

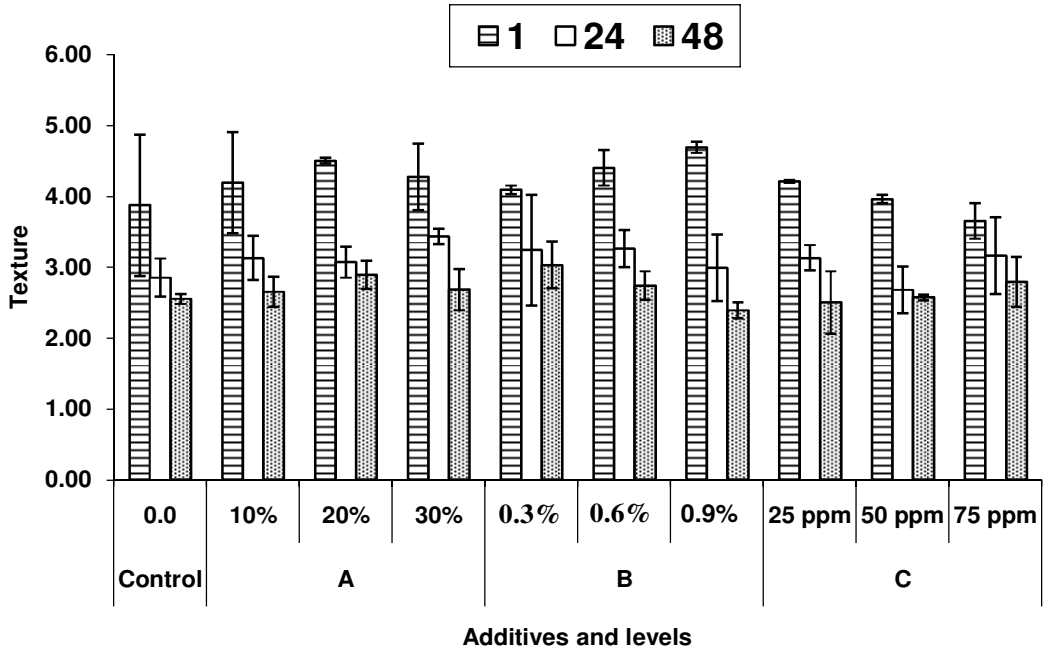

Figure 3. The change graphic of the texture scores. * A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).

reported that increasing amounts of ascorbic acid addition had a lowering effect of the appearance scores. Boyacıoğlu (1993) has reported in his study that increasing the durum wheat content over 25% resulted in a decrease in the bread scores.

Texture

The texture scores of the bread types are given in Table 4 and the changes in these scores are displayed in Figure 3. Investigation of the table yielded considerable differences in texture scores in terms of the type of additive and these differences were determined to be significant at a level of $p<0.01$.

The texture scores of all stored bread samples with additives were determined to decrease during the period of storage. While during the 1st h of storage, the bread samples containing additive B with a composition of 0.9% scored the highest with 4.69, the lowest score of 3.65

Table 5. The taste and aroma scores of the stored bread samples with additives.

Additives	Level of additive	The period of storage (H)		
		1	24	48
control	0.0	4.16 ±0.75	3.16 ±0.23	2.43 ±0.33
	10	4.33 ±0.47	2.93 ±0.50	2.44 ±0.27
A (%)	20	4.29 ±0.57	2.99 ±0.07	2.63 ±0.09
	30	4.36 ±0.47	3.13 ±0.13	2.99 ±0.02
	0.3	3.99 ±0.06	3.10 ±0.49	2.86 ±0.16
B (%)	0.6	4.38 ±0.57	3.15 ±0.54	2.87 ±0.25
	0.9	4.02 ±0.47	3.18 ±0.52	2.93 ±0.06
	25	4.04 ±0.13	3.02 ±0.24	2.55 ±0.07
C (mg/kg)	50	3.92 ±0.18	2.91 ±0.13	2.30 ±0.11
	75	3.74 ±0.29	2.96 ±0.37	2.51 ±0.45

* A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).

was acquired by the bread sample containing additive C at a composition of 75 mg/kg. At the end of the storage period, the highest texture score (3.03) belonged to the bread sample with the B additive at a composition of 0.3% and the lowest texture score (2.39) belonged to the bread sample with the B additive at a composition of 0.9%. These differences observed during storage were determined to be statistically significant ($p<0.05$). On the other hand, the effect of the additive x additive level, additive x storage, additive level x storage and additive x additive level x storage interactions on the texture scores of the bread samples was determined to be insignificant ($p>0.05$).

During the measurements texture within the 1st h of storage, higher texture scores were obtained for the bread samples containing additives A and B in comparison to the control sample. Contrarily, the sample with additive C at a composition of 75 mg/kg scored lower than the control sample whereas, the samples in which lower compositions were used scored higher than the control. According to the results of the analysis conducted at the end of the 1st h, the bread sample containing 0.9% additive B scored the highest with 4.69 and the bread sample containing 75 mg/kg additive C scored the lowest with 3.65.

As a result of the evaluations conducted at the end of the 24th h, all bread samples except for the sample containing 50 mg/kg of additive C scored higher in terms of texture than the control. The highest and lowest texture score at the end of 24 h (3.43) was obtained by the bread samples containing additive A at a composition of 30% and by the bread samples containing additive C at a composition of 50 mg/kg, respectively.

At the end of the 48th hour of storage, 0.3% additive B containing bread samples scored the highest in terms of texture (3.03) during the sensory evaluations. All other bread samples scored below 3.00 and the lowest score (2.39) was given to the bread samples with additive B at a composition of 0.9%.

Generally speaking, throughout the duration of storage the bread samples containing the additive types A and B scored higher in terms of texture than the samples containing the additive C.

In their study on the Barbari flat bread, Maleki et al. (1981) have reported an increase in the texture scores through the use of emulsifiers and shortenings. Williams et al. (1988) have determined that the Arabian bread made from the durum wheat flour has usually a mellower texture than the bread manufactured from the general wheat flour.

In their research on the Arabian bread, Toufeili et al. (1995) have reported a decrease in the texture scores of the bread through the use of DATEM in increasing amounts.

Taste and aroma

The taste and aroma scores of the lozenge patterned bread samples during storage are given in Table 5 and the change in these scores are provided in Figure 4. Investigation of the taste-aroma scores of the bread samples yielded that the effects of the additives and the amount of those additives were determined to be statistically insignificant ($p>0.05$). With this respect, it can be concluded that the use of additives does not affect the user appreciation and taste adversely in terms of taste-aroma.

Storage was determined to be significant on the taste-aroma scores of the bread samples based on the statistical analyses ($p<0.01$). The taste-aroma scores of all bread samples showed a decrease during storage (Figure 4). Except for the bread samples with additive C at a concentration of 50 mg/kg, all bread samples scored higher than the control at the end of the storage period and the highest score (2.99) was obtained by the bread samples with additive A in them at a concentration of 30%.

Varinli et al. (2002) have reported that a 20% of additive

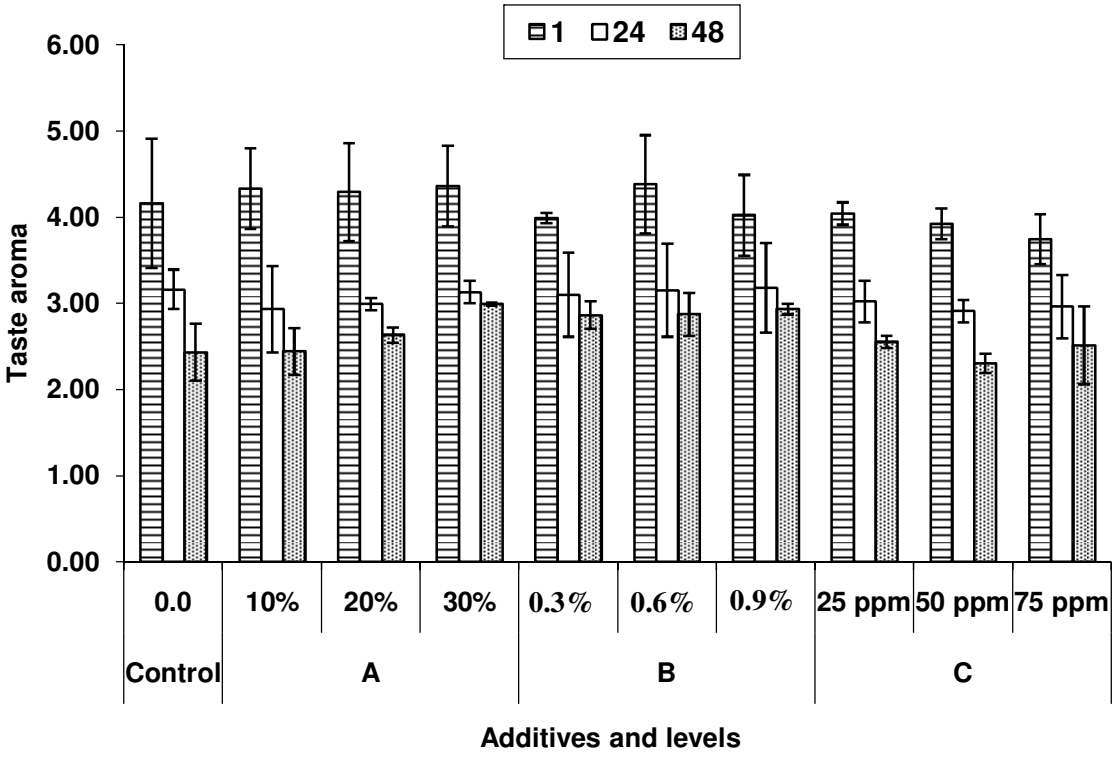

Figure 4. The change graphic of the taste and aroma scores. * A: Durum wheat flour, B: DATEM, C: L-Ascorbic acid (vitamin C).

level had caused a degradation of the taste-aroma in the pita bread made with soy flour and corn flour.

Coşkuner and Karababa (2005) have determined that triticale flour additive has increased the taste-aroma scores of flaked bread and thin crispy pita. In their study on the Turkish flat bread (bazlama), Başman and Köksel (1999) have determined that the barley flour and the wheat bran additives lowered the taste-aroma scores of the bread. Toufeili et al. (1995) have reported that an addition of 0.25% DATEM in the manufacture of the Arabian bread did not affect the sensory properties and when used at a concentration of 0.50%, the quality of the bread was determined to be low.

Conclusion

The effect of the use of various additives (durum wheat flour, DATEM and L-ascorbic acid) in the manufacture of the lozenge patterned bread (flat) specific to the Şanlıurfa region on its quality was investigated. The bread samples manufactured using various additives were stored for 48 h. In this study that was run in duplicates, the sensory analyses of the bread during the 1st, 24th and the 48th h storage period were conducted. The conclusions reached in this study are summarized as below:

When the sensory properties of the bread samples were investigated, the composition of the additive was determined to significantly affect the appearance scores ($p<0.05$) whereas the effect of the additives was statistically insignificant ($p>0.05$). The investigation of the appearance scores displayed an irregular fluctuation. Except for the bread samples containing 10% additive A and 25 mg/kg additive C, all other samples scored higher than control in terms of appearance. Considerable differences have been detected among the texture scores and these differences were also determined to be statistically significant at a confidence level of $p<0.01$. Generally speaking, throughout the duration of storage the bread samples containing the additive types A and B scored higher in terms of texture than the samples containing the additive C. The effect of the duration of storage on the texture scores of the bread samples was determined to be statistically significant ($p<0.01$). All bread samples with additives were noted for a decrease in their texture scores throughout the period of duration.

Storage was determined to be significant on the taste-aroma scores of the bread samples based on the statistical analyses ($p<0.01$) and the additives and the composition of these additives were determined to be insignificant ($p>0.05$). The taste-aroma scores of all bread samples showed a decrease during storage. Except for the bread samples with additive C at a concentration of 50 mg/kg, all bread samples scored higher than the control at the end of the storage period and the highest score (2.99) was obtained by the bread

samples with additive A in them at a concentration of 30%.

According to the obtained results, DATEM (except for the 48th h measurements for the highest additive containing samples) and the durum wheat flour had affirmative effects on the texture properties.

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