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Research Article

Some Properties of Traditional Afşin Çemen

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Abstract

Afşin fenugreek, as a natural food culture in Kahramanmaraş and its surroundings, is made in almost every home with traditional methods and is a food that is consumed with pleasure. In this study, Afşin fenugreek was prepared by adding 0, 10, 20 and 30% garlic, and then the pH value, color, moisture content, dry matter amount, protein, fat and sensory analysis, antioxidant effect, mineral content, vitamin C, titratable acidity value, salt content and microbiological load were determined. pH value, color, moisture content, dry matter amount, protein, fat and sensory analysis, antioxidant effect, mineral substance content, vitamin C, titratable acidity value and salt content of the samples were determined. Average values were determined as follows; moisture 50.72%, dry matter 49.28%, fat 12.55%, ash 5.37%, salt 3.20%, protein 7.24%, titratable acidity 2.03%, pH 5.25. Antioxidant activity was found between 48.85-62.42%. In the color measurements of the samples, the L* value was found in the range of 19.76-30.11, a* value in the range of 7.84-13.56, and b* value in the range of 8.68-17.93. The average amount of mineral substances is phosphorus 1015.75 mg/kg, potassium 9001.5 mg/kg, calcium 1660.5 mg/kg, magnesium 789.5 mg/kg, iron 79.7 mg/kg, copper 27.13 mg/kg, manganese 13.12 mg/kg, zinc 5.202 mg/kg, sodium is 9458 mg/kg. As a result of sensory analysis, fenugreek containing 20% garlic was liked the most. The amount of vitamin C in fenugreek samples was determined as 2.7 mg/100g in the sample without garlic and 5mg/100g in the most popular sample with 20% garlic. Staphylococcus aureus and Escherichia coli O157:H7 could not be detected in the samples.

Keywords: Afşin çemen, Local product, Kahramanmaras, Çaman, Spice.

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Introduction

Culinary culture varies from country to country and from region to region. Turkish cuisine boasts a rich variety with its traditional flavors. Some products, when prepared and consumed in a specific region, gain distinctive characteristics thanks to the unique taste and aroma of that area. These foods, which are often preferred by consumers, are typically referred to by the name of the region where they are produced, and such highly demanded products are called "local products" [1].

These products also contribute economically to their respective regions [2]. In recent years, consumers have been shifting away from industrial products and opting for natural foods produced using traditional methods. Local products, which reflect the history, lifestyle, and culture of the society to which they belong, are produced using recipes, methods, and raw materials unique to each community [3].

Our local products are part of our cultural heritage. Kayseri mantı, Kahramanmaraş ice cream, Adana kebab, Gaziantep baklava, Afyon sausage, Kars cheese, Kayseri pastrami, Antep pistachios, Malatya apricots, Maraş tarhana, and Maraş pepper are just a few examples of the cultural richness of our country [4, 5, 6, 7].

In this study, Afşin çemen (locally known as Çaman) has been chosen as the subject of research. The main ingredients of Afşin çemen, which is consumed with great pleasure, are a mixture of various spices known as çemen spice, garlic, and bone (marrow) broth. The spices used in the product are as follows: fenugreek-*Trigonella foenum-graecum* L. (Fabaceae), red pepper flakes (*Capsicum annuum*) (Solanaceae), black pepper *Piper nigrum* L. (Piperaceae), clove (*Eugenia caryophyllata*), cumin (*Cuminum cyminum* L.), cinnamon (*Cinnamomum zeylanicum*), allspice (*Pimenta officinalis*), ginger (*Zingiber officinale roscoe*), and garlic (*Allium sativum* L.) [8].

In Kahramanmaraş, particularly in the Afşin and Elbistan districts, this product is known as "çaman" or "çemen" and is primarily consumed during the cold winter months as a hot sauce. In addition to being used as a sauce, it is most commonly spread directly on bread and eaten at breakfast. The bone broth and meat used in its preparation give the çemen a unique flavor and nutritional value. It is used as a breakfast spread, in dishes like eggs with çemen, as a sauce over fried foods, and as a flavor enhancer in meals and kebabs [9].

This study aims to determine some previously unaddressed characteristics of Afşin çemen, contributing to its recognition, marketing, the region's economy, public nutrition, science, literature, and the process of obtaining geographical indication status.

Materials and Methods

The raw materials used in the preparation of traditional Afşin çemen include red pepper, seven types of çemen spices (cumin, black pepper, fenugreek, allspice, ginger, cinnamon, clove), and salt, all of which were obtained from a herbalist in Kahramanmaraş. The garlic used in the çemen was sourced from the Afşin district of Kahramanmaraş, specifically the Afşin Koçovası garlic variety. Traditionally produced olive oil was chosen to enhance the flavor and consistency of the çemen.

Method Preparation of Çemen Samples

Beef bones were obtained from a butcher in Kahramanmaraş, and bone (marrow) broth was prepared by boiling them for 6-7 hours to be used in the çemen. In a glass container, 600g of Maraş pepper and 100g of çemen spices were mixed, and a portion of the pre-prepared hot bone broth was added. As the çemen mixture absorbed the broth, additional hot bone broth was added (a total of 1 liter of bone broth), along with 6g of salt and 100ml of olive oil. The preparation steps are outlined in Table 1.

Four different samples of traditional Afşin çemen were prepared at the Kahramanmaraş Sütçü İmam University Food Engineering Application Laboratory by adding garlic at proportions of 0%, 10%, 20%, and 30% of the total sample weight. These samples were

coded as K, Ç1, Ç2, and Ç3, respectively, and the physical, chemical, and microbiological properties of the product were analyzed.

Analyses

Moisture content (%) [10], ash content (%) [10], protein content (%) [11], titratable acidity (g/100g) [12, 13], salt content (%) [12, 14], fat content (%) [15], antioxidant activity [16, 17, 18, 19], and pH measurements [13] were conducted for the prepared samples. Moisture, ash, protein, titratable acidity, salt, fat, antioxidant activity, and sensory analyses were carried out in triplicate for each sample upon initial preparation. pH (initially in duplicate) and color analyses were also performed in duplicate. Furthermore, the samples were examined for the presence of *Staphylococcus aureus* [20, 21], sensory evaluation [22], and the presence of *E. coli* O157 [23].

The vitamin C content in the çemen was determined using a quantitative analysis with an HPLC device, employing a C18 column at the ÜSKİM research laboratory at Kahramanmaraş Sütçü İmam University. The results were calculated as mg/100g.

In the study, mineral content (phosphorus, potassium, calcium, magnesium, iron, copper, manganese, zinc, and sodium) analyses were conducted on the most favored sample containing 20% garlic and the 0% control group sample. These were determined at the KSÜ ÜSKİM research laboratory using ICP-OES (Inductively Coupled Plasma-Optic Emission Spectroscopy), and the results were calculated as mg/kg. Additionally, the color measurements of the samples were made using the Hunter scale with the Konica Minolta CR-400 colorimeter to determine L* (lightness), a* (redness), and b* (yellowness) values on a monthly basis [12, 13].

Sensory Analyse.

A scoring test was conducted with 10 panelists aged between 25 and 45 to evaluate the çemen samples in terms of color appearance, visual texture, mouth feel, bitterness, aroma, smell, and overall liking. The sensory evaluation form used is shown in Table 2 [22].

Each panelist was presented with the four different çemen samples, coded randomly with four different numbers, served on white plastic plates along with slices of bread. Water was provided to neutralize the taste between samples. The panelists were asked to rate the çemen samples using a 5-point scale.

Statistical Analyses

The data related to the physical, chemical, and sensory properties of the Afşin çemen samples were calculated in terms of values like mean and standard deviation. The data obtained in the study were subjected to one-way analysis of variance (ANOVA) using the SPSS 22.0.0 software package. The differences between the groups that were found to be statistically significant according to the variance analysis were determined using the Tukey multiple comparison test.

Results and Discussion Chemical Analysis

For the four different çemen samples prepared (K, Ç1, Ç2, Ç3), moisture, ash, protein, and fat analyses were conducted in triplicate, while other analyses were performed in duplicate. The average values and standard deviations of the results were calculated and listed in Table 3. Since there are no studies in the literature specifically on Afşin çemen, a traditional product, the results have been discussed in comparison with similar products.

Moisture Content

The moisture percentages of the K, Ç1, Ç2, and Ç3 çemen samples were calculated, with average values found to be 49.54%, 50.44%, 50.95%, and 51.96%, respectively, as shown in Table 3. It was observed that the çemen samples with added garlic had higher moisture content compared to the control group (K) without garlic. The lowest moisture content was observed in the K sample, while the highest value was identified in the Ç3 sample. The differences in moisture content between the samples were found to be statistically significant ($p<0.05$).

Different superscripts in the same column indicate a significant difference between samples ($p<0.05$). [1]Data: mean value ± standard deviation. [2]K: 0% Garlic Çemen (Control group), Ç1: 10% Garlic Çemen, Ç2: 20% Garlic Çemen, Ç3: 30% Garlic Çemen.

In a study determining the quality characteristics of Kastamonu pastırma, the average moisture content was found to be 44.44% in rib pastırma and 50.14% in kuşgömü pastırma [23]. In another study examining the effect of turmeric on the physicochemical and microbiological quality of fermented sausages, the average moisture content on day 0 for sausage samples containing various amounts of turmeric was found to be 54.89% [21]. In a study investigating the effect of using tomato paste in Çemengilik (a dried, spice-coated meat product from Tokat province), the moisture content ranged from 47.95% to 54.74% [3]. Our study results also yielded values close to these findings.

Ash Content

The ash content of the Çemen samples was calculated, yielding values of 5.94%, 5.56%, 5.03%, and 4.96% respectively, as shown in Table 3. The highest ash content was found in sample K, and the lowest in sample Ç3, with a decrease in ash content observed as the garlic content increased, likely due to a reduction in the amount of çemen. The inclusion of garlic led to significant differences in ash content ($p<0.05$), with values ranging from 4.96% to 5.94%.

In a study on pastırma samples obtained from various establishments, ash content was found to be 3.65%–6.91% in rib pastırma and 5.53%–8.22% in kuşgömü pastırma, noting that samples with higher salt content had higher ash levels [23]. Another study, on pastırma samples prepared with 3% and 6% salt content, found average ash content values of 4.49% and 7.76%, respectively [24]. In a study of 60 sausage samples from the Kahramanmaraş market, the ash content ranged from 3.4% to 12.3%, with an average of 5.20% [25]. In another study examining the effect of turmeric on the quality of fermented sausages, ash content ranged from 4.04% to 8.25% [21]. In Elazığ, a study on 100 fermented sausages found ash content between 1.70% and 8.85%, with an average of 5.39% [26].

The average ash content in our study was found to be 5.37%, aligning with studies on sausage samples. This could be due to the bone broth used, its fatty composition, and the spices added to the çemen.

Protein Content

Protein content of the Çemen samples was 7.84%, 7.10%, 6.81%, and 7.21% (g/100g) respectively, with an average of 7.24% as shown in Table 3. The highest value was in the control group, and the lowest in Ç2. The differences in protein content between samples were statistically significant ($p<0.05$). In a study on çemen dough used in Çemengilik production, protein content was reported to be 5.82%, and similar spices used contributed to similar results [3]. In another study on Maraş Kelle Paça soup, the average protein content was reported as 8.00% [27]. The proximity of the protein content in Afşin çemen to this value may be due to the inclusion of bone (marrow) broth.

Fat Content

Fat content analysis was conducted on the control group and the sample containing 30% garlic. The average fat content was 14.86% in the control sample, while it was 10.23% in Ç3, with an average of 12.55% (Table 3, $p<0.05$).In a study, fat content in minced meat and çemen dough used in Çemengilik was 8.86% and 2.36%, respectively, while the fat content in tomato paste-free and paste-added Ç1-Ç2 groups was 7.63%, 12.57%, and 11.56%, respectively [3]. The fat content in our study was similar to these values. Another study on 60 sausage samples reported fat content ranging from 30.30% to 49.80% [21]. In a study on sausages containing different amounts of turmeric, fat content ranged from 37.37% to 37.92% at the end of maturation [21]. Our study did not include meat; instead, bone broth, çemen spices, and garlic were used. The variation in values may be due to differences in raw materials and quantities used.

Titratable Acidity

The average titratable acidity as citric acid was 2.03% in the samples, as shown in Table 3. In a study on the effect of different amounts of olive leaf extract on the quality of pepper paste, titratable acidity values were between 1.05% and 1.52% in Type I industrial paste and between 1.05% and 1.38% in Type II canned paste [13]. Our findings were higher than those in other studies, likely due to the spices in the çemen.

Salt Content

The average salt content in the samples was 3.18%, 3.11%, 3.17%, and 3.34%, respectively (Table 3). No significant difference was found between the groups ($p>0.05$); the lowest salt content was observed in Ç1 and the highest in Ç3, with an average of 3.20%.

In a study, salt content of Çemengilik samples (Control, Ç1, and Ç2) was reported as 1.39%, 1.73%, and 1.78%, with Ç1 and Ç2 having higher salt content than the control [3]. Another study on 100 sausages found salt content between 1.63% and 6.41%, with an average of 4.36% [26]. A different study on sausages found salt content between 2.30% and 5.23%, with an average of 3.01% [25]. Our values are similar to these findings.

pH Analysis

pH analysis of Çemen samples was conducted at 20°C at the start of production, with results of 5.27±0.01, 5.30±0.01, 5.37±0.01, and 5.40±0.01 in K, Ç1, Ç2, and Ç3, respectively ($p>0.05$). In a study on 60 sausage samples, pH values ranged from 4.76 to 5.75, with an average of 5.40 [25]. Another study on fermented sausages found pH values between 4.75 and 6.76, with an average of 5.18 [26]. In another study, the pH value of çemen dough (50% fenugreek, 35% garlic, 15% red pepper, salt, and water) was reported as 5.86, while the pH value of çemengilik samples prepared without paste, with çemen and minced meat, ranged from 5.94 to 4.94 in the first week [2]. In a study on pastırma samples from various establishments, the average pH was reported as 5.99 in kuşgömü pastırma and 6.14 in rib pastırma [23]. The pH values of our samples align with some studies [2, 25, 26] but were lower than in others, which may be due to the inclusion of bone broth, salt, and spices in the çemen.

Antioxidant Content

Antioxidant activity analysis of Afşin çemen samples revealed inhibition percentages for samples prepared with varying amounts of garlic. The control (K) sample had an average inhibition of 48.85%, which increased to 58.94% in Ç1, 62.42% in Ç2, and 54% in Ç3. These results indicate that garlic enhances the antioxidant activity of çemen, with the highest inhibition observed in the sample containing 20% garlic (62.42%), emphasizing the potential antioxidant properties of garlic. Garlic, known for its strong antioxidant properties, can inhibit free radical formation, thus reducing cellular damage caused by oxidative stress. The findings of this study suggest that garlic can significantly enhance the antioxidant capacity of çemen, supporting the functional food potential of garlic-enriched çemen products. The lowest inhibition was observed in the garlic-free control group (48.85%), highlighting the contribution of garlic compounds to the antioxidant activity of çemen.

In another study, the inhibition percentage of çemen dough with different concentrations of red cabbage juice extract ranged from 40.40% to 54.09% [29]. In a study on the antimicrobial and antioxidant activities of certain spices, cumin, thyme, and rosemary were found to have the highest antioxidant activity, while onion and garlic showed moderate activity, and red pepper, black pepper, and hot red pepper had weaker antioxidant effects [16]. The inhibition percentage of our samples, containing various spices and garlic, ranged from 48.85% to 62.42%.

Vitamin C and Mineral Content

The vitamin C content was 2.7 mg/100g in sample K and 5 mg/100g in sample Ç2. A study on the ascorbic acid content of dried red pepper stored for 5 months found levels of 16.233 mg/100 g at 4°C, 8.267 mg/100 g at 25°C, and 6.833 mg/100 g at 38°C, with complete oxidation of ascorbic acid at 45°C, indicating a decrease in vitamin C content with increasing temperature [30].

The mineral content of K and Ç2 çemen samples is shown in Table 4. The mineral values of the garlic-free çemen (K) are listed in the first sample, while the second sample (Ç2) with garlic showed a linear increase in mineral content. According to independent sample t-test results, the difference between the two groups was statistically significant ($p<0.05$). The highest increase was observed in zinc content, and the lowest in phosphorus content, indicating that the minerals in garlic affected the results.

Different letters between rows indicate a statistically significant difference between the samples, while the same letters indicate no statistically significant difference. K: Control group (Garlic-free Çemen) Ç2: 20% Garlic Çemen

In a study examining certain nutritional and physical properties of garlic from the Kastamonu Taşköprü region, the ash content was reported to be 2.30%, and the mineral contents were calcium 363.61 mg/kg, potassium 21378.84 mg/kg, magnesium 1056.15 mg/kg, phosphorus 6009.37 mg/kg, sodium 532.78 mg/kg, and iron 52.91 mg/kg [31]. In our study, garlic, which is rich in minerals, increased the values in the Ç2 sample; however, compared to this study, a greater increase in potassium and phosphorus was expected.

Color Analysis

The L* value obtained from the color analysis indicates brightness, the a* value represents redness, and the b* value indicates yellowness. As shown in Table 5, the color changes in the Çemen samples over an 8-week period are presented.

Lowercase letters in the same row indicate whether storage has a significant effect on color values. Uppercase letters in the same column indicate whether there is a statistically significant difference between the samples.

In the first week, as the garlic content in the samples increased, the L* values also increased sequentially. In the fourth week, for çemen samples stored at +4°C, the L* value increased in the K and Ç1 samples but decreased in Ç2 and Ç3. In the sixth week, spoilage was observed in the control group, making it impossible to measure color, whil

The L* values of Ç1, Ç2, and Ç3 samples showed a slight decrease. By the eighth week, the brightness value increased in Ç1 and decreased in Ç2 and Ç3, indicating a reduction in brightness due to storage. The L* value in çemen ranged from a minimum of 19.76 to a maximum of 30.11. In the first week, as the garlic content increased, the a* values also increased sequentially. In the fourth week, the a* values of K and Ç1 samples increased, while those of Ç2 and Ç3 decreased. This decrease continued across all samples in the sixth and eighth weeks, likely due to darkening and a shift from red to brown in the color of the çemen samples. The a* value in çemen ranged from 7.84 to 13.56. As the garlic content increased, the b* values also rose sequentially in the first week. In the fourth week, the b* values of K and Ç1 samples increased rapidly, while those of Ç2 and Ç3 decreased. This decrease in b* values continued during the sixth and eighth weeks of storage. The b* value in çemen ranged from a minimum of 8.68 to a maximum of 17.93.

In one study, the L*, a*, and b* values of çemen dough used in Çemengilik production were reported as 38.19, 25.13, and 65.03, respectively [2]. Another study found the L*, a*, and b* values of çemen dough to be 29.59, 20.29, and 50.53, respectively [3]. Our results do not match these values, likely due to different conditions, spice ratios, and garlic content.

Microbiological Analysis

Coliform bacteria, *S. aureus*, and *E. coli* O157 were not detected in the samples.

Sensory Analysis

Sensory analyses were conducted with a panel of 10 participants, using scoring tests. The results, calculated as averages and standard deviations, are presented in Table 6.

[1] Data: Mean value ± standard deviation. Different letters between rows indicate a statistically significant difference between the samples, while the same letters indicate no statistically significant difference.

The coded çemen samples received similar and consistent scores from the panelists across the criteria of color-appearance, visual texture, mouthfeel, and bitterness. Overall preference scores were more influential in determining the final ranking. In terms of visual texture and aroma, the most favored sample was Ç2, while the lowest score for odor was observed in sample Ç3. This could be due to the 30% garlic content in the Ç3 sample, which may have masked the distinctive aroma of çemen. When looking at overall preference, 10% of panelists awarded full marks to sample K, 30% to sample Ç1, 50% to sample Ç2, and 10% to sample Ç3. The highest average score, 4.60, was given to sample Ç2, which contained 20% garlic. The second most preferred was sample Ç1, containing 10% garlic, followed by the control sample in third place, and finally sample Ç3 with 30% garlic in fourth place.

In another study, sensory evaluation results of pastırma samples containing different levels of red pepper were found to be very similar, with averages for color, odor, texture, taste, and general acceptability ranging between 6.72 and 7.67, with no statistically significant difference among these average scores [32]. In a different study, sensory analysis of cooked sausages with added turmeric revealed that the control group was the most favored in terms of color and texture, while the Z2 group (containing turmeric) scored the highest for aroma, taste, and overall preference, and the Z1 group received the lowest scores across all criteria [33].

Conclusion

When the chemical analysis of garlic and non-garlic Afşin breakfast çemen samples was conducted, moisture was found to range between 49.54% and 51.96%, ash between 4.96% and 5.94%, salt between 3.11% and 3.34%, protein between 6.81% and 7.84%, titratable acidity between 1.86% and 2.33%, fat between 10.23% and 14.86%, pH between 5.14 and 5.40, and antioxidant activity between 48.85% and 62.42%. The sensory effects introduced by the garlic added to the formulation were presented to consumers, and the sample containing 20% garlic was the most preferred product. Vitamin C content ranged from 2.7 to 5 mg/100 g. The spices and garlic used in çemen, due to their natural antioxidant, antimicrobial, and antiviral properties, allow the product to be considered functional. Due to its slight bitterness, çemen is thought to stimulate appetite, and the collagen in the bone broth (marrow) used in its preparation is considered beneficial for health. This study, conducted with the intention of contributing to public nutrition, the food sector, regional economy, and literature, may also serve as a resource for obtaining a geographical indication for the product.

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Kaynakça

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Table1. Preparation of Afsin Cemen

Mix red pepper flakes (600g) and çemen spice mix (100g)
↓
Gradually add hot bone broth
↓
As the spices absorb the broth, add more hot bone broth (total 1L) and salt (6g)
↓
Add olive oil (100ml) and adjust the consistency.
↓
Add garlic as desired (added in the following proportions in the study)
↓

Garlic-free Control group (K)	10% Garlic (30g) (Ç1)	20% Garlic (60g) (Ç2)	30% Garlic (90g) (Ç3)

Table 2. Sample Five-Point Sensory Evaluation Form [22].

SCORING TEST
Panelist's Name-Surname: Date:
Product: Afşin Çemen
Score Values: (1 - Very Bad) - (2 - Bad) - (3 - Average) - (4 - Good) - (5 - Very Good)
Instructions: Please evaluate the coded çemen samples provided to you based on the quality criteria below, using a 5-point scale.

Sample Codes:	**201**	**303**	**105**	**402**
Quality Criteria				
Color-Appearance				
Visual Texture				
Mouth feel				
Bitterness				
Aroma				
Odor				
Overall Preference				

Table 3: General Chemical Composition of Çemen Samples[1]

Sample[2]	% Moisture	% Ash	% Protein	% Acidity	% Salt	% Fat
K	49.54±0.14^{a}	5.944±0.08^{c}	7.84±0.29^{b}	2.33±0.08^{b}	3.18±0.03^{a}	14.86±0.27^{c}
Ç1	50.44±0.52^{b}	5.557±0.04^{b}	7.10±0.08^{a}	2.0±0.15^{ab}	3.11±0.03^{a}	-
Ç2	50.95±0.15^{b}	5.031±0.19^{a}	6.81±0.21^{a}	1.91±0.10^{a}	3.17±0.14^{a}	-
Ç3	51.96±0.07^{c}	4.963±0.04^{a}	7.21±0.18^{a}	1.86±0.06^{a}	3.34±0.08^{a}	10.23±0.42^{a}
Ort±std	50.72±1.01	5.37±0.46	7.24±0.43	2.03±0.21	3.20±0.1	12.55±3.27

Table 4. Mineral Content of Cemen Samples

Mineral Content	K (mg/kg)	Ç 2 (mg/kg)
Phosphorus (P)	987.5^{b}	1044^{a}
Potassium (K)	8049^{b}	9954 ^{a}
Calcium (Ca)	1584^{b}	1737 ^{a}
Magnesium (Mg)	752.1^{b}	826.9 ^{a}
Iron (Fe)	71.30^{b}	88.10 ^{a}
Copper (Cu)	24.88^{b}	29.38 ^{a}
Manganese (Mn)	12.65^{b}	13.59 ^{a}
Zinc (Zn)	3.96^{b}	6.45 ^{a}
Sodium (Na)	8576^{b}	10340 ^{a}

Table 5. Color Values of Cemen Samples

Örnek	1. Hafta	4. Hafta	6. Hafta	8. Hafta
L*value				
K	$19.76^{b,B}$	$26.00^{a,B}$	-	-
Ç1	$21.24^{c,B}$	$27.00^{a,B}$	$23.51^{b,A}$	$26.60^{a,A}$
Ç2	$29.09^{a,A}$	$27.93^{b,B}$	$24.64^{c,A}$	$24.62^{c,B}$
Ç3	$30.11^{a,A}$	$29.61^{a,A}$	$23.77^{b,A}$	$23.25^{b,B}$
a* value				
K	$8.70^{b,C}$	$12.64^{a,B}$	-	-
Ç1	$9.57^{b,B}$	$13.56^{a,A}$	$9.71^{b,A}$	$7.84^{c,A}$
Ç2	$13.38^{a,A}$	$12.96^{a,AB}$	$9.07^{b,A}$	$8.25^{c,A}$
Ç3	$13.39^{a,A}$	$12.95^{a,AB}$	$9.40^{b,A}$	$8.31^{c,A}$
b* value				
K	$10.94^{b,C}$	$16.43^{a,B}$	-	-
Ç1	$13.13^{b,B}$	$17.93^{a,A}$	$9.98^{c,A}$	$8.68^{d,A}$
Ç2	$17.30^{a,A}$	$17.19^{a,AB}$	$9.76^{b,A}$	$9.24^{b,A}$
Ç3	$17.56^{a,A}$	$17.35^{a,A}$	$9.87^{b,A}$	$8.94^{c,A}$

Table 6. Sensory Analysis Results [1]

Quality Criteria	(K)	(Ç1)	(Ç2)	(Ç3)
Color-Appearance	4.00 ± 0.47^{b}	4.30 ± 0.48^{a}	4.30 ± 0.48^{a}	4.10 ± 0.57^{ab}
Visual Texture	4.20 ± 0.42^{b}	4.20 ± 0.42^{b}	4.40 ± 0.52^{a}	4.10 ± 0.32^{b}
Mouthfeel	3.80 ± 0.63^{c}	4.30 ± 0.48^{a}	4.10 ± 0.32^{b}	4.00 ± 0.47^{b}
Bitterness	4.10 ± 0.73^{a}	4.20 ± 0.79^{a}	4.20 ± 0.79^{a}	3.60 ± 0.70^{b}
Aroma	3.90 ± 0.56^{b}	4.40 ± 0.52^{a}	4.50 ± 0.53^{a}	3.20 ± 0.63^{c}
Odor	4.10 ± 0.57^{a}	4.10 ± 0.57^{a}	4.00 ± 0.82^{a}	3.20 ± 0.42^{b}
Overall Preference	3.70 ± 0.67^{c}	4.20 ± 0.58^{b}	4.60 ± 0.53^{a}	3.30 ± 0.68^{d}