Araştırma Makalesi
(Research Article)

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Key Words:

Sepet cheese, modified atmosphere packaging, dairy products, cheese quality

Ege Üniv. Ziraat Fak. Derg., 2017, 54 (2):149-155
ISSN 1018 – 8851

Physicochemical and Sensorial Properties of Sepet Cheeses Packaged under Different Modified Atmospheric Conditions

Farklı Modifiye Atmosfer Koşulları ile Paketlenen Sepet Peynirinin Fizikokimyasal ve Duyusal Özellikleri

Alınış (Received): 04.11.2016 Kabul tarihi (Accepted): 11.01.2017

ABSTRACT

The aim of the present study was to investigate the physical, chemical, and sensory properties of traditional sepet cheese samples which were packaged under different modified atmosphere conditions (MAP). All properties of the Sepet cheese samples were analyzed at the 1st, 45th, 90th and the 180th day of the storage period at +4°C. In packaging of the cheese samples, three different modified atmosphere packaging conditions were applied. The cheese samples were packaged into polystyrene packages containing 100% nitrogen, 80% nitrogen + 20% carbon dioxide or 100% carbon dioxide. According to the results obtained from statistical analyses, a significant difference was obtained by Modified Atmosphere Packaging (MAP) of Sepet cheese samples in terms of dry matter %, fat-in-dry matter %, salt-in-dry matter %. Examining the sensory properties including mass and texture, appearance, flavor and odor statistically, it was determined that there was a significant difference between the packaged Sepet cheese samples containing 100% CO_2 during storage period. In general, it could be said that Sepet cheeses that were only packaged under different modified conditions containing 100 % nitrogen or 80% nitrogen + 20% carbon dioxide provided a better protection in terms of physicochemical and sensorial properties.

Anahtar Sözcükler:

Sepet peyniri, modifiye atmosfer paketleme, süt ürünleri, peynir kalitesi

ÖZET

Çalışmanın amacı farklı modifiye atmosfer koşullarında paketlenen geleneksel Sepet peynirlerinin fiziksel, kimyasal ve duyusal özelliklerini incelemektir. +4 °C' de depolanan Sepet peynirlerinin tüm özellikleri depolamanın 1., 45., 90. ve 180. günlerinde incelenmiştir. Peynirlerin paketlenmesinde 3 farklı modifiye atmosfer koşulu denenmiştir. Üretilen peynirler % 100 N_2 (N), % 80 N_2 + % 20 CO_2 (NC), % 100 CO_2 (C) içeren atmosfer koşullarda polistiren ambalajlarda paketlenmiştir. İstatistiksel analiz sonucunda modifiye atmosfer koşullarında (MAP) paketlenen Sepet peyniri örneklerinin kurumadde, kurumadde de yağ % ve kurumadde de tuz % içeriklerinde meydana gelen değişimlerin önemli olduğu tespit edilmiştir. Kitle, tekstür, görünüş, lezzet ve aromayı içeren duyusal özellikler istatistiksel olarak incelendiğinde, sadece CO_2 içeren atmosferik koşullarda paketlenen peynirlerde depolama süresince farklılık olduğu gözlenmiştir. Genel olarak bakıldığında % 100 N_2 (N), % 80 N_2 + % 20 CO_2 (NC) gazlarını içeren farklı modifiye koşullarda paketlenmiş olan Sepet peynirlerinin fizikokimyasal ve duyusal özelliklerini daha iyi muhafaza ettiği görülmüştür.

INTRODUCTION

Cheese is an important traditional food in Turkish cuisine. Many cheese types which are produced only in restricted geographical areas are consumed locally in large quantities in Turkey (Turkoglu *et al.* 2003; Hayaloglu *et al.* 2007; Kamber 2008). It is estimated that 40–50 cheese types are known as regional in Turkey, but only three of them have national and economic value: Turkish White (*Beyaz peynir* in Turkish), Kaşar and Tulum cheeses (Hayaloglu *et al.* 2002, Kamber 2005; Cakmakci *et al.* 2008; Karagözlü *et al.* 2016). While some of the traditional cheese are produced in dairy industry, most

of them are produced only house conditions. Therefore, necessary quality standards couldn't be achieved (Cetinkaya 2005). In Turkey, the regional cheese types including mihalic, otlu, cerkez, kazikli, safak, kopanisti, otlu, sepet, yoruk and cimi are produced using traditional methods (Karagozlu *et al*. 2009).

Sepet cheese is a type of traditional semi-hard cheese in the Mediterranean Region of Turkey. Some of the cheese have been forgotten and these kinds of products are produced in houses and sold only at local markets (Karakas *et al*. 2006). Also, sepet Cheese is produced in towns at the Aegean Region which is close to the sea, especially in towns including Ayvalik, Dikili, Burhaniye, Foça, Çesme, Urla, Karaburun, Ödemis and Söke (Unsal 1997). In particular, Ayvalik, Karaburun and Çesme are renowned for its production. In Ayvalik, the cheese is known as "Kelle Cheese". The cheese was taught to the local people by immigrants in the region. In general, Sepet cheese is made using goat, sheep and cow's milk, however local people used goat milk in the production of Sepet cheese. The milk from woolly goats, which are still widely raised by shepherds and small herd owners in the area, is used in the production of the cheese. In Ödemis and Söke, a blend of cow's and ewe's milk is used for the production of Sepet cheese (Kamber 2008). In Ayvalık and Polonezköy, cow milk is usually used in the production of Sepet cheese. According to producers, 1 kg Sepet cheese can be produced from 9-10 L cow's milk or 6-7 L goat's milk or 4.5 L ewe's milk (Büke 1981, Kinik *et al*. 1999).

Technological advances in processing and packaging of dairy foods have influenced consumers. The consumer demands include convenient dairy products with enhanced nutrition and specific product functionalities (Henning *et al*. 2006; Singh *et al*. 2011). Food safety regulatory authorities have recommended the food industries to reduce the chemical and microbial overload in foods. These stringent regulations along with consumer preferences for natural and healthy products which are free of preservatives with extended shelf life have led the food industry to develop new packaging concepts. One of these concepts, MAP in combination with refrigeration has proven successful to increase the shelf life of milk and milk products (Rodriguez-Aguilera *et al*. 2011a, b).

The aim of this study was to investigate the physical, chemical, and sensory properties of Sepet cheese during manufacture and ripening, and to consider future studies on certain specific topics. Accordingly, sepet cheese was compared with other brined cheeses.

MATERIAL and METHODS

Cheese Manufacture

Production of cheese was carried out in a local manufacturer. Raw goat's milk provided from Saanen goats were used for production. Raw goat milk was filtered through a 5-6 layered thin muslin, heated up to 58-60° C and immediately cooled to renneting temperature. Renneting was carried out by adding 14 mL of rennet diluted with water to 100 L of milk. Time determined for the coagulation was 2 hours. At the end of coagulation period, milk was checked for coagulation. Determining the coagulation, curd was cut into small pieces using a perforated ladle. Then the curd's temperature was increased to 36-38 ºC by pouring hot water on for easier and faster draining. Meanwhile, curd was subsided and separated from whey. The curd at the bottom of container, was collected manually, a ball shape was given and stuffed in optionally 1, 3 or 5 kg capacity baskets made of reed stems called "kova" or guva" and top surface of the curd was flattened. The cheese in the basket was left to draining spontaneously without placing any weight on the basket. In the meantime, curd took the basket's shape during draining. Cheese have been turned upside down in order to make the top surface take the basket's shape. Cheese had been taken out of the basket 15 minutes after the whey started to drain. Top and bottom surfaces were salted with thin salt and relocated in the basket for further percolation. Approximately 18 hour later, when the curd became a single firm hoop, it was taken out of the basket and put on a wooden surface in a shady place. Cheeses were rubbed with salt every other day in a total of 15 days.

Materials

Goat milk was used in the production of these Sepet cheeses. Rennet, industrial enzyme (Mayasan, 1/16.000 MCU/ml) was used as the coagulant agent in the production. In the packaging of cheese samples, three different modified atmosphere conditions were applied. The cheeses were packaged with polystyrene material under different modified atmospheric conditions. The Sepet cheese (approximately 200 g) were packaged in expanded polystyrene (EPS) (0.2mm thickness, oxygen transmission rate 2.600-7.700 cm^3/m^2/day bar, CO_2 transmission rate 10.000-.26.000 cm^3/m^2/day bar at 25°C) trays placed in gas-barrier bags under three different atmosphere conditions (100% nitrogen, 80% nitrogen + 20 % carbon dioxide or 100% carbon dioxide). The cheeses were ripened for 6 months at +4°C and were analyzed at the 1st, 45th, 90th and the 180th day of the storage period. K, N, NC and C codes were given to the Control, 100% N_2, 80% N_2 + 20% CO_2, 100 % CO_2 cheese samples, respectively. Samples were stored under refrigeration conditions for physicochemical and sensory analysis. Before the analyses, the samples were taken from the cold storage and the edge of the cheese

blocks were removed and samples obtained from each cheese were homogenized in a blender.

Physicochemical Analyses

The total solids (TS) content of the cheese samples was measured by gravimetric method (AOAC 2006); titratable acidity was determined titrimetrically as lactic acid % (Kosikowski 1982). Salt was measured according to the titration method using $AgNO_3$ (Bradley *et al.* 1993) and the fat values were determined by the Gerber method using Van–Gulik butyrometer (Ardo and Polychroniadou 1999). The pH values of cheese samples were measured using a pH meter combined with an electrode (Hanna pH 211 Microprocessor, Portugal). Total nitrogen (TN) values of cheese were determined by Kjeldahl method (Barbano et al., 1990), using approximately 1 g of cheese. The water–soluble fraction (WSN) was prepared essentially as described by Ardo and Polychroniadou (1999), using 20 g of cheese with 100 mL H_2O. The mixture was homogenized for 5 min using an Ultraturrax (Heidolph Cilent Crusher M, Germany). Water-soluble N content of the cheese extract was determined by the Kjeldahl method, using 10 mL of cheese extracts (Katsiari et al., 2001). Additionally, protease peptone nitrogen (PPN) content was calculated by the derivation of NPN content from WSN content (Gripon *et al.* 1975) and the ripening index was estimated using the formula of WSN / TN x 100 (Venema *et al.* 1987). The acid degree value is determined according to Renner (1993). Ripening index was calculated as percentage of pH 4.6 soluble nitrogen fraction and total nitrogen ratio (Metin 2006).

Sensory Analysis

Sensory analysis of the cheese samples during the ripening period was carried out by seven individuals who were selected from university staff based on their availability, interest, a demonstrated liking for cheese and experience in sensory evaluation of Sepet cheese. Panelists assessed the cheese samples according to scheme by the (IDF 1987) guide for the sensory evaluation of cheese. Samples of Sepet cheese were placed in white plates coded with four-digit random numbers.

The samples were kept at ambient temperature (18±2°C) for 1 hour and then presented to the panelists in a random order for testing. Water was provided for mouth-washing between samples. The parameters investigated in sensory evaluation were color (0-7), body and texture (0-7), odor (0-7), salt (0-7), adverse taste (0-7) and overall appearance (0-9).

Statistical Analysis

Analyses were performed in three repetitions. Data were analyzed using the general linear model procedure of the SPSS software (version 20; SPSS Institute Inc., Chicago, IL). Analysis of variance for each set of data was conducted and the Duncan's multiple range tests was used to compare the means when the difference was significant ($p<0.05$). In addition, confidence interval for the statistical analyses were 95% ($p<0.05$).

RESULTS and DISCUSSION

Chemical Composition and Acidity

The chemical compositions of the Sepet cheeses are given in Table 1. Dry matter values of the cheeses produced in our study varied between 51.75 % and 59.12 %. These results depend substantially on the composition of milk. They also depend on the conditions during the cheese process (Ucuncu 2004; Karakas 2006). The highest dry matter in all samples were in N and NC Sepet cheese samples. The changes in the dry matter was statistically significant only in NC sample ($p<0.05$). At this point, it could be said that this impact was related with the atmospheric packaging conditions. Kinik *et al.* (1999) found the dry matter of the Sepet cheeses as 53.1 % in their study. Ercan (2009), found that the dry matter of their Sepet cheeses produced from goat's milk changed between 44.56 % and 63.39 %. The results of these studies were similar with our results. Results showed that packaging in two atmospheric conditions containing 100 % nitrogen and 80 % nitrogen + 20 % CO_2 have significant effects on the preservation of dry matter during storage period. Fat content in dry matter of Sepet cheeses varied between 44.4 % and 32.68 %. Kinik *et al.* (1999) found the fat in dry matter as 53.1 %. Karakas *et al.* (2006) found the fat content in dry matter of Sepet cheese 45.10%. Comparing the cheeses packaged under different atmospheric conditions to the control sample, it was seen that packaging conditions containing 80% nitrogen + 20% carbon dioxide and 100% carbon dioxide had no significant effect on the preservation of fat in dry matter during storage period. In our study, salt content in dry matter of Sepet cheese samples were high according to Anonymous, 2006a, Anonymous 2006b, and Anonymous 2007 cheese standards. The amount of 14% salt in the dry matter determined in the first days of storage dropped to 11% levels in the further days due to different packaging conditions. Compared to the first day of storage, only sample C was considerably able to preserve the salt content in dry matter until the 90th day. However, salt content in all samples dropped on the 180th day. Lactic acid content of Sepet cheeses changed between 1.04% and 2.14%. Lactic acid values reached their highest point in sample K and N on the 180th day of the storage. Compared to the control sample, lactic acid contents of samples NC and C were effected by different packaging conditions. Kinik e*t al.* (1999) and Karakas *et al.* (2006), found the lactic acid contents of their cheeses 1.42 % and 0.72 %, respectively. Ercan (2009), reported that lactic acid content of Sepet cheeses varied between 0.6 % and 2.85 % and had an average of 1.66 %. These results

were similar to the results determined in our study. Kırkın (2009) sliced fresh and ripened white cheese blocks in 2x2x2 cm^3 dimensions and packaged under five different atmospheric conditions (0% O_2+0% CO_2, 10% O_2+0% CO_2, 0% O_2+ %75 CO_2, 10% O_2+ 75% CO_2 and aerobic). Oxidation, titratable acidity, pH values and sensory evaluations were not different between the package types.

Table1. Chemical composition of Sepet Cheese samples ripened under different atmosphere packaging conditions[1]

		Cheese			
Variable	Days	K	N	NC	C
Dry matter %	1	51.75 ± 0.71	51.75 ± 0.71	51.75 ± 0.71^{a}	51.75 ± 0.71
	45	62.72 ± 0.27	56.42 ± 2.60	58.65 ± 1.26^{b}	56.86± 3.11
	90	57.75 ± 4.08	59.12± 3.14	58.11 ± 0.75^{b}	55.83±0.30
	180	57.08 ± 3.85	58.19 ± 2.68	57.66 ± 0.98^{b}	55.68±0.46
Fat-in-Dry Matter %	1	44.44 ± 0.86	44.44 ± 0.86^{a}	44.44 ± 0.86^{a}	44.44 ± 0.86
	45	39.71 ± 3.76	37.80 ± 0.03^{b}	35.51 ± 2.82^{b}	39.37 ± 7.29
	90	39.09 ± 2.68	36.41 ± 2.3^{b}	34.11 ± 1.03^{b}	37.76 ± 8.08
	180	35.08 ± 0.21	35.62 ± 2.67^{b}	32.68 ± 1.83^{b}	33.51 ± 2.59
Salt-in-Dry Matter %	1	14.46 ± 0.63^{a}	14.46 ± 0.63	14.46 ± 0.63	14.46 ± 0.63^{a}
	45	11.60 ± 1.67^{ab}	12.61 ± 3.30	12.46 ± 0.75	14.05 ± 1.43^{a}
	90	11.34 ± 1.74^{ab}	11.76 ± 1.44	12.04 ± 0.00	14.00 ± 1.10^{a}
	180	9.94 ± 1.18^{b}	10.43 ± 0.78	11.26 ± 1.36	11.14 ± 3.21^{b}
pH	1	4.84 ± 0.15	4.84 ± 0.15	4.84 ± 0.15	4.84 ± 0.15
	45	4.70 ± 0.19	4.77 ± 0.17	4.79 ± 0.25	4.71 ± 0.17
	90	4.69 ± 0.00^{X}	4.68 ± 0.01^{Y}	4.64 ± 0.00^{Z}	4.69 ± 0.00^{X}
	180	4.54 ± 0.03	4.58 ± 0.04	4.57 ± 0.01	4.54 ± 0.42
Titratable acidity[2] %	1	1.17 ± 0.82	1.17 ± 0.82	1.17 ± 0.82	1.17 ± 0.82
	45	1.29 ± 0.10	1.04 ± 0.23	1.27 ± 0.56	1.34 ± 0.39
	90	1.44 ± 0.71	1.46 ± 0.54	1.27 ± 0.37	1. 40± 0.09
	180	2.04 ± 0.80	2.14 ± 0.26	1.50 ± 0.35	1. 99 ± 0.56
TN	1	3.40 ± 0.04	3.40 ± 0.04	3.40 ± 0.04	3.40 ± 0.04
	45	4.17 ± 0.79	4.04 ± 0.23	3.78 ± 0.01	4.03± 0.36
	90	4.38 ± 0.77	3.80 ± 0.26	4.00 ± 0.34	3.97 ± 0.16
	180	4.11 ± 0.62	3.68 ± 0.31	3.95 ± 0.18	3.88 ± 0.13
Total protein %	1	21.71 ± 0.25	21.71 ± 0.25	21.71 ± 0.25	21.71 ± 0.25
	45	26.61 ± 5.04	26.03 ± 4.49	24.11 ± 0.07	25.70 ± 2.34
	90	28.16 ± 4.69	24.21 ± 1.85	25.50 ± 2.19	25.31 ± 1.10
	180	26.22 ± 3.98	23.48 ± 0.33	25.21 ± 1.17	24.78 ± 0.85
WSN	1	0.24 ± 0.06	0.24 ± 0.06	0.24 ± 0.06	0.24 ± 0.06
	45	0.25 ± 0.12	0.21 ± 0.07	0.21 ± 0.05	0.22 ± 0.04
	90	0.26 ± 0.12	0.23 ± 0.03	0.23 ± 0.09	0.22 ± 0.04
	180	0.26 ± 0.12	0.24 ± 0.07	0.24 ± 0.07	0.24 ± 0.07
Ripening index	1	7.22 ± 1.96	7.22 ± 1.96	7.22 ± 1.96	7.22 ± 1.96
	45	6.15 ± 4.22	5.51 ± 2.86	5.55 ± 1.47	5.53 ± 1.55
	90	6.15 ± 3.81	5.97 ± 1.37	5.73 ± 2.79	5.57 ± 1.30
	180	6.50 ± 3.90	4.38 ± 1.06	6.25 ± 2.25	6.15 ± 1.61
Acid degree value	1	2.60 ± 0.96	2.60 ± 0.96	2.60 ± 0.96	2.60 ± 0.96
	45	3.00 ± 0.97	1.86 ± 0.89	4.04 ± 1.02	6.33 ± 2.48
	90	3.43 ± 1.02	3.58 ± 1.40	4.27 ± 1.06	4.72 ± 1.83
	180	4.97 ± 1.27	3.70 ± 1.59	5.67 ± 1.44	4.21 ± 1.66

$^{a-d}$ Means ± SD within a column with different superscripts are statistically different (P< 0.05).

$^{X-Z}$ Means ± SD within a row with different superscripts are statistically different (P< 0.05).

[1] Presented values are the means of two replicate trials. K refer to the cheeses ripened under normal conditions ; N, NC and C refer to the cheeses ripened under 100% nitrogen, 80% nitrogen + 20% carbondioxide and 100% carbondioxide conditions, respectively.

[2] Titratable acidity values are expressed as grams of lactic acid/100 grams of cheese

Protein contents of Sepet cheese samples varied between 21.71 % and 28.16 %. Comparing the samples between each other, control sample was found to have higher protein content than those of the other samples. Packaging under different conditions had no significant effect on the preservation of protein content. Kinik *et al.* (1999) found that the protein content of their Sepet cheeses varied between 18.49 % and 24.22 %. Karakas *et al.* (2006) have reported that the protein content of Sepet

cheese was 29.34% . Ercan (2009) have reported that protein content of Sepet cheeses varied between 24.40 % and 33.69 % and had an average of 28.99%. Total nitrogen and corresponding decline in protein contents may be associated with casein, hydrolyzed by enzymes, transforming into water soluble low weighted peptides and amino acids and obtaining a passing tendency to bile (Gursoy 2005). The ripening index changed between 4.38 and 7.22. Compared to the control sample, samples N, NC and C had lower ripening indices. N sample had the lowest ripening index . Packaging conditions can be shown as a reason for this decrease. However, sample C had close values of ripening index to that of the control sample. Acid Degree Value (ADV), one of the methods to analyze the degree of lipolysis is described as; the equivalent amount of alkaline needed to neutralize the free fatty acids found in milk fat (Kesenkas, 2005). Free fatty acids content of Sepet cheese samples varied between 2.60 % and 6.33 %. Previous studies report an increase in free fatty acids contents in different types of cheeses during storage period (Dinkci 1999; Karaman 2007). In a study by Gonzalez-Fandos et al. (2000), Cameros cheese was packaged under 20% CO_2+80% N_2, 40% CO_2+ 60% N_2, 50% CO_2 + 50% N_2, 100% CO_2 and vacuum conditions. At the end of the study, it was observed that proteolysis and lipolysis reaction levels were higher in samples packaged under aerobic conditions. Packaging under different atmospheric conditions in Sepet cheese had a significant effect only on sample NC during storage period.

Sensory Profile

Sensory characteristics of cheese have critical importance just as much as their physical, chemical and microbiological qualities. Customers tend to prefer foods with good flavor, aroma and appearance (Akbulut and Kinik 1991; Uysal *et al.* 2004). Sensory analysis of Sepet cheese samples packaged under different atmospheric conditions was performed to determine color, firmness, structure, appropriate salinity, odor, and distinctive flavor properties (Table2).

Table 2. Sensory profile values of Sepet cheese samples ripened under different atmosphere packaging conditions[1]

		Cheese Sample			
Variable	Days	K	N	NC	C
Colour	1	5.62 ± 0.17	5.62 ± 0.17	5.62 ± 0.17	5.62 ± 0.17
	45	6.08 ± 0.11	6.15 ± 0.01	6.07 ± 0.09	6.05 ± 0.31
	90	6.10 ± 0.55	6.25 ± 0.57	6.05 ± 1.09	5.84 ± 0.01
	180	5.54 ± 0.29	5.75 ± 1.06	5.54 ± 0.41	5.79 ± 0.76
Body	1	5.81 ± 0.09	5.81 ± 0.09	5.81 ± 0.09	5.81 ± 0.09
	45	6.39 ± 0.15	6.39 ± 0.15	5.90 ± 0.33	6.12 ± 0.41
	90	6.14 ± 0.19	6.05 ± 0.31	6.14 ± 0.19	5.98 ± 0.21
	180	6.12 ± 0.17	6.37 ± 0.17	6.00 ± 0.00	6.20 ± 0.06
Texture	1	5.81 ± 0.26	5.81 ± 0.26	5.81 ± 0.26	5.81 ± 0.26
	45	6.30 ± 0.42	6.35 ± 0.03	5.83 ± 0.24	6.05 ± 0.31
	90	5.86 ± 0.41	6.00 ± 0.21	5.57 ± 0.60	5.83 ± 0.24
	180	5.92 ± 0.24	6.00 ± 0.70	6.00 ± 0.00	5.83 ± 0.24
Odor	1	6.25 ± 0.70	6.25 ± 0.70	6.25 ± 0.70	6.25 ± 0.70
	45	6.42 ± 0.81	6.34 ± 0.69	6.27 ± 0.79	6.17 ± 0.45
	90	6.75 ± 0.13	6.48 ± 0.48	6.33 ± 0.46	6.30 ± 0.03
	180	6.41 ± 0.58	6.08 ± 0.11	6.08 ± 0.11	5.79 ± 0.65
Salt	1	5.25 ± 0.00	5.25 ± 0.00	5.25 ± 0.00	5.25 ± 0.00^{ab}
	45	6.18 ± 0.45	5.95 ± 0.53	5.95 ± 0.53	5.84 ± 0.01^{c}
	90	5.39 ± 0.15	5.61 ± 0.06	5.48 ± 0.48	5.00 ± 0.00^{a}
	180	5.58 ± 0.11	5.16 ± 0.47	5.50 ± 0.70	5.54 ± 0.29^{bc}
Adverse taste	1	5.87 ± 0.17	5.87 ± 0.17	5.87 ± 0.17	5.87 ± 0.17
	45	6.26 ± 0.56	6.27 ± 0.79	6.20 ± 0.89	6.00 ± 0.21
	90	6.54 ± 0.16	6.25 ± 0.57	6.17 ± 0.45	5.93 ± 0.31
	180	6.60 ± 0.00	5.79 ± 0.95	5.75 ± 0.96	5.41 ± 0.12
Overall appearance	1	6.56 ± 0.79	6.56 ± 0.79	6.56 ± 0.79	6.56 ± 0.79
	45	8.25 ± 0.35	7.79 ± 0.72	7.54 ± 0.16	7.43 ± 0.38
	90	7.16 ± 0.98	7.07 ± 0.98	6.61 ± 0.63	6.42 ± 0.60
	180	7.50 ± 0.00	7.90 ± 0.14	7.54 ± 0.99	7.25 ± 0.35

$^{a–d}$ Means ± SD within a column with different superscripts are statistically different ($P< 0.05$).

[1] Presented values are the means of two replicate trials. K refer to the cheeses ripened under normal condition ; N, NC and C refer to the cheeses ripened under 100% nitrogen, 80% nitrogen + 20% carbondioxide and 100% carbondioxide conditions, respectively.

The changes in color, body, texture, odor, adverse taste and overall appearance during the storage period were found statistically not different ($p>0.05$). At the same time, changes in values between storage days were found statistically not significant ($p>0.05$) However, the changes in the salt taste during storage period were only significant statistically in C sample. The changes in the appropriate salinity validation performed by panelists during storage period were statistically significant ($p<0.05$). Sepet cheese samples received higher scores in terms of firmness, structure, appropriate salinity compared to those of the control sample, however received lower scores in odor and distinctive flavor properties. Papaioannou et al. (2007), in their study on Greek whey cheese Anthotyros, packaged the samples under 30% CO_2+ 70% N_2, 70% CO_2+ 30% N_2 and vacuum conditions. Both MAP applications increased the shelf-life of the cheese, compared to the vacuum application. It was also stated that the sensory properties of MAP samples were preserved. Erkan and Aksu (2006), in their study on the effects of MAP applications on the shelf-life and cheese quality of the sliced fresh kashar cheese, found that the best aroma and taste results were obtained in samples packaged under 50% N_2 - 50% CO_2 conditions. Sensory analysis revealed that the samples packaged under aerobic conditions could not be consumed after 90 days while the samples packaged under 100% CO_2 and vacuum conditions could not be consumed after 120 days and the cheese samples packaged under 25% N_2 -75% CO_2 conditions could not be consumed after 150 days. Gonzalez et al. (2000), obtained the best results in the samples packaged under 40-50% CO_2 conditions. The researchers determined a sourish taste formation in cheese samples packaged under 100% CO_2 conditions. In the study performed by Kırgın (2009), none of the cheese packaged under modified atmosphere conditions was found to be different from the control in terms of sensory properties. Excluding the control sample, sample N was the most favored cheese by the panelists. Generally speaking, Sepet cheese samples packaged under different atmospheric conditions were favored more than the control sample, creating a preserved sensory profile impression.

CONCLUSIONS

In this study, some physical, chemical and sensory properties of Sepet cheese packaged under modified atmosphere conditions were investigated during their storage period. Accordingly, the cheese samples were compared with the control Sepet cheese. Comparing the Sepet cheese samples to the control sample, no significant differences were seen between samples in terms of physical, chemical and sensory properties of sepet cheese, except for pH values. In addition, the results of physical, chemical and sensory analyses of sepet cheese was in compliance with the standards. The values were found to be close and similar.

For the local community, Sepet cheese, with its high nutritional values, is an important source of food for the families' protein needs, Total dry matter, fat and protein contents were relatively higher, compared to other types of cheese. There is no standard method for the production of Sepet cheese. Standard and industrial production technologies of traditional cheeses must be necessarily conserved. Local cheeses should be manufactured in high capacities using modern technologies. There is vital importance in choosing the appropriate packaging material for the preservation of the characteristics and immediate packaging following their production. In the further studies, Sepet cheese and other traditional cheeses must be scientifically researched and the methods should be established for production to obtain standard products complying with the food safety regulations for public.

ACKNOWLEDGEMENTS

This research was supported by Ege University Scientific Research Fund (Project Number: 2009-ZRF-051) and was presented as a poster communiqué in 11th Food Congress held in Hatay-Turkey between 10th-12th October 2012 and included in the congress book as an abstract text.

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