E-ISSN: 2602-2834

FOOD and HEALTH

Food and Health, 4(3), 147-158 (2018) • DOI: 10.3153/FH18015 E-ISSN: 2602-2834 Original Article/Full Paper

THE EFFECT OF SORBATE ON MICROBIOLOGICAL, SENSORY PROPERTIES AND RIPENING PARAMETERS OF KASHAR CHEESE

Ayşen Babacan[1], Salih Özdemir[2]

Cite this article as:

Babacan, A., Özdemir, S. (2018). The Effect of Sorbate on Microbiological, Sensory Properties and Ripening Parameters of Kashar Cheese. Food and Health, 4(3), 147-158. DOI: 10.3153/FH18015

[1] Ankara University, Kalecik Vocational School, Kalecik, Ankara, Turkey

[2] Atatürk University, Department of Food Engineering, Faculty of Agriculture, Erzurum, Turkey

Submitted: 26.07.2017

Accepted: 11.11.2017

Published online: 09.03.2018

Correspondence:

Salih ÖZDEMİR

E-mail: ozdemirs@atauni.edu.tr

Available online at
www.scientificwebjournals.com

ABSTRACT

In this study, two different salting methods (dry salting and salted in scalding water) and also application of potassium sorbate to prevent mold growth (in 5% concentration for 2 minutes immersion method) were investigated effects on quality properties of Kashar cheese. Kashar cheese samples were ripened at 4 ±1ºC for 5th, 30th, 60th, 90th days and ripening parameters compared during ripening periods. According to the microbiological analysis results, total aerobic meshophylic bacteria (TAMB), lactic acid bacteria (LAB) growth on MRS and M-17 agar and mould counts of Kashar cheeses were found statistically different among all samples ($P<0.01$). The highest mold count (3.58 log cfu/g) was found at control samples salted in scalding water. The lowest count (1.48 log cfu/g) was found at sorbated samples salted as dry. The mould counts of the Kashar cheese samples treated with potassium sorbate were under of standart level (maximum 2 log cfu/g). But, sorbate was not completely prevent mold growth. Coliform group bacteria counts were determined <1 log cfu/g and S. aureus counts were determined <2 log cfu/g at all samples. It was found that acidity values increased in all Kashar cheese samples during the ripening periods. Acidity values of all control groups were higher than that of sorbated samples. The WSN, TCA-TN, PTA-TN and RI values increased in all Kashar cheeses during ripening periods. According to the sensory analysis results, it was determined that there was no adverse effect of sorbate on the sensorial quality of samples during all ripening periods. Panelists preferred the samples salted in scalding water than that of dry salted samples.

Keywords: Kashar cheese, Sorbate, Ripening, Mould, Sensorial analysis

Introduction

Today, most of cheese types have registered trademarks and have protected geographic indications. Kashar cheese is one of the most important cheese types in Turkey and it can also be seen as the most typically stretched curd or pasta-filata cheese (Yangılar and Yıldız, 2016). It is also known as Kashkaval, Kasseri and Caciocavallo in different countries (Güler, 2005). The scalding and kneading stages at Kashar cheese production are the most important stages to form the characteristic properties of the cheese. Kashar cheese has smooth, dry and yellowish rind, homogenous structure without gas holes, its flavor is piquant and slightly salty (Üçüncü, 2004; Yalman et al., 2015).

Food additives are generally added to processed foods for prolong the shelf-life by protecting them from deterioration caused by microorganisms (Mpountoukas et al., 2008). The chemical preservatives widely used at food industry are benzoic and sorbic acids and their salts (sodium benzoate and potassium sorbate) (Tfouni and Toledo, 2002; Gül and Dervişoğlu, 2013). Potassium sorbate (PS) is commonly used as a food preservative because of considered as a "generally recognized as safe" (GRAS) (Famá et al., 2006; Kristo et al., 2008; Türe et al., 2013).

The salting of cheese generally can be made with as dry salting and in scalding water in our country. Cheese salting stage is both consumer demand, as well as charter and other technological process for the realization of the desired qualities of a cheese production standards. The salting of Kashar cheese is an important process for the Kashar cheese quality (Üçüncü, 2010). Generally, cheeses are salted for being of colour and texture and increasing the storage times (Payne and Morison, 1999). Salt in the cheese controls the enzyme activity and ripening (Güven and Karaca, 2001). Generally, dry salting method is used at old Kashar cheese making. There are some disadvantages of dry salting of Kashar cheese. In dry salting, salt is used at more amounts and salting isn't homogen.The other method of salting of Kashar cheese is salting in scalding water. This method provides the homogen salt penetration. In this method, Kashar cheese is salted in hot brine of 75-85°C for 3-5 minute (Say, 2008).

According to Turkish Standard (3272) (TSE, 2006), this cheese is classified as 'fresh Kashar cheese' and 'old or matured Kashar'. Most cheese varieties (is one of Kashar cheese) require a period of ripening (least 90 days) (TSE, 2006) for development of flavour and texture characteristics (McSweeney and Fox, 1997). But, at this ripening period the most important problem is moldy surface of Kashar cheese during ripening. For this reason, the Kashar cheese must be cleaned from moldys before eating. Mold growth on the cheese surface both causes economical loses (cheese lost of approximately 8%) and results healty problems because of mycotoxins producing (Türe et al., 2011). So, Kashar cheese must be controlled the fungal growth by different antimicrobial agents. They can be applied to food surfaces with different methods (dipping, spraying, or brushing). According to the Turkish Food Codex Regulations on Food Additives, potassium sorbate (E 202) is one of the allowed antimicrobial agent to the ripened cheese surface and have not determined any maximum limit (Anonymous, 2013). In a lot of country (ABD, Australia, Finland and Canada) of world are permitted to potassium sorbate at 3000 ppm level. In Turkey, it is permitted to potassium sorbate adding at 1000 ppm levels (Üçüncü, 1980).

Materials and Methods

Material

Raw milk samples used at Kashar cheese making were obtained from by the Research and Application Farm of Atatürk University. Salt and potassium sorbate (Fluka) were used at cheese making process. Commercial microbial liguid rennet (1/15 000 strength) was obtained from Mayasan Company, commercial rock salt used for salting and it was diluted in the sized of 1-2 x 10^{-3} m.

Methods

Kashar cheese samples for using this search were produced Atatürk University Faculty of Agriculture, Department of Food Engineering in the pilot plant.

Kashar cheese samples were made with cow milk. The fat ratio of milk was standardized to 3% with a skim milk addition (Üçüncü, 1980). The procedures of producing the various Kashar cheese samples were:

Cheese 1 (A): The cheese samples were produced with salted in scalding water. The potassium sorbate application was not made the cheese samples.

Cheese 2 (B): The cheese samples were produced with salted in scalding water and treated with potassium sorbate (5%) for 2 minutes.

Cheese 3 (C): The cheese samples were produced with dry salting. The potassium sorbate application was not made the cheese samples.

Cheese 4 (D): The cheese samples were salted as dry and treated with potassium sorbate (5%) for 2 minutes.

Microbiological Analysis

In this research, 10 g Kashar cheese samples were homogenized in 90 mL of a sterile solution (0.85% NaCl) using a stomacher (Lab. Stomacher Blander 400 BA 7021,

Swardmedical). Further decimal dilutions were prepared with the same diluent (Harrigan, 1998). Analyses were carried out using the following procedures:

Total aerobic mesophilic bacteria were enumerated on plate count agar (Merck) following the pour-plate method and with aerobic incubation at 30 ±1°C for 48 h (Messer et al., 1985). Coliform counts were determined by the Violet Red Bile Agar (Oxoid) with plate incubation at 35 ± 2°C for 48 h (Diliello, 1982). LAB counts were determined by MRS-agar (Oxoid) M-17 agar (Gilliand et al., 1984) following the pour-plate method and incubated at 30°C for 48 h. Moulds were enumerated on Potato Dextrose Agar (PDA) (Merck) following the pour-plate method and incubated at 25°C for 5-7 days (Koburger & Marth, 1984). *Staphylococcus aureus* enumeration of samples were made on Baird Parker Agar and incubated at 37°C for 48h. Then, kathalase and cuagulase tests were made on the bacteria colonies (Tatini et al., 1984).

Chemical Analysis Methods

The protein, water soluble nitrogen (WSN), ripening index, pH and titratable acidity (%) were carried out according to the methods by Kurt et al. (2007). For nitrogen analysis solubled in TCA, TCA solution (24%) added to filtrate of 25 mL and sold for 2 hours. Then mix was filtrated and protein analysis was made with filtrate (Polychroniadou et al., 1999). The nitrogen analysis solubled in PTA was made according to Jarret et al. (1982). The 5 mL WSN extract, 3.5 mL 3.95 M H_2S0_4 and 1.5 mL 33.3% PTA solition were mixed. Then, the solution was hold for 12 hours and filtrated with whatman no: 42. Then, nitrogen amount in the solution was found with Kjeldahl method.

Sensory Evaluations

Six panellists experienced in the sensorial evaluation of cheese assessed the cheese samples on 5^{th}, 30^{th}, 60^{th} and 90^{th} days of ripening considering the method of Bodyfelt et al. (1988) and Altuğ (1993). Samples were scored considering five sensorial features e.g., colour, texture, taste and aroma, bitterly, salty and general acceptability ranging from 1 (poor) to 9 (excellent).

Statistical Analysis

All statistical analysis was performed using SPSS Statistical Software, version 17. Mean values with a significant difference were compared by Duncan's multiple range tests. All analyses were performed in duplicate.

Results and Discussion

The some microbiological and chemical anlysis results of raw milk sample were summarized in Table 1.

The logarithmic counts of the microorganisms enumerated throughout ripening time for Kashar cheese samples are presented in Table 2.

Table 1. The chemical and microbiological analysis results of raw milk sample

Microbial groups (log cfu/g)	**Raw milk**
TAMB Counts	7.60
LAB growth on MRS agar	6.84
LAB growth on M-17 agar	7.37
Coliform groups	4.70
Moulds-yeasts	3.48
Chemical Characteristics	
Dry matter (%)	12.66
Fat (%)	4.00
Protein (%)	2.93
Acidity (lactic acid%)	0.18
pH	6.65

Table 2. The some microbiological analysis results of Kashar cheese samples (log cfu/g)

Samples	Ripening Times (days)	Total mesophilic bacteria	Lactobacilli	Streptococci	Moulds
A	5	7.85±0.050^{B,d}	8.13±0.184^{B,b}	7.79±0,050^{B,c}	<1.00^{A,a}
	30	7.67±0.078^{A,ab}	7.31±0.014^{A,a}	7.53±0.085^{A,a}	3.40±0.141^{B,b}
	60	7.67±0.028^{A,b}	7.48±0.035^{A,b}	7.45±0.035^{A,a}	4.75±0.021^{C,d}
	90	7.62±0.000^{A,c}	7.44±0.014^{A,c}	7.49±0.035^{A,b}	5.26±0.106^{D,d}
B	5	7.44±0.021^{A,b}	7.51±0.000^{B,a}	7.54±0.035^{A,b}	<1.00^{A,a}
	30	7.77±0.021^{C,b}	7.43±0.070^{B,b}	7.72±0.021^{B,b}	2.25±1.061^{A,ab}
	60	7.66±0.021^{B,b}	7.31±0.014^{A,a}	7.63±0.057^{AB,b}	<1.00^{A,a}
	90	7.63±0.050^{B,c}	7.47±0.014^{B,c}	7.62±0.021^{AB,c}	2.12±0.170^{A,b}
C	5	7.63±0.042^{B,c}	8.17±0.007^{C,b}	8.14±0.007^{C,d}	<1.00^{A,a}
	30	7.61±0.014^{B,b}	7.31±0.007^{B,a}	7.58±0.085^{B,ab}	<1.00^{A,a}
	60	7.32±0.028^{A,a}	7.28±0.035^{B,a}	7.48±0.000^{B,a}	1.30±0.000^{B,c}
	90	7.28±0.000^{A,a}	7.01±0042^{A,a}	7.26±0.007^{A,a}	3.94±0.007^{C,c}
D	5	7.31±0.000^{A,a}	7.30±0.000^{B,a}	7.10±0.028^{A,a}	<1.00^{A,a}
	30	7.75±0.035B,a	7.57±0.028^{D,c}	7.62±0.021^{C,ab}	2.76±0.106^{C,b}
	60	7.76±0.120^{B,b}	7.50±0007^{C,b}	7.63±0.042^{C,b}	1.00±0.000^{A,b}
	90	7.36±0.000^{A,b}	7.19±0.028^{A,b}	7.49±0.028^{B,b}	1.24±0.000^{B,a}

*Samples showing capital letters (during storage days) and lower letters (between cheeses at the same storage day) do not differ significantly (P>0.05)

The TAMB counts of Kashar cheese samples changed at arround 7.28 log cfu/g and 7.85 log cfu/g (Table 2). The differences of cheese species, salting methods and ripening periods were found significant (P<0.01). The TAMB counts at A and C samples decreased as ripening periods increased. It was found that the TAMB counts of cheese samples salted as dry were lover than that of in scalding water. This state can be sourced from begining of the early coat and anaerobic state at samples dry salted (Johnson and Law, 2010).

The lactobacilli counts at samples salted as dry were lower than that of scalding water (P<0.05). It says that dry salting of Kashar cheese was decreased the lactobacilli counts because of irregular distribution of salt. The streptococci counts were between 7.26 log cfu/g and 8.14 log cfu/g (Table 2). Generally, as ripening periods increased, streptococci counts of samples decreased. At all samples, the coliform counts were under 1.00 log cfu/g. The mould counts of Kashar cheese samples were between <1.00 log cfu/g and 5.26 log cfu/g (Table 2). The highest mould count was found at control samples salted in scalding water, salted as dry and sorbated samples contained the lowest counts. The mould counts of control samples increased as ripening periods increased. Özdemir and Demirci (2006) found that the potassium sorbate treatment to Kashar cheese was decreased the yeast and mould counts of samples. These results of Özdemir and Demirci (2006) have similarities with our yeast and molds counts of samples.

The results of acidity, pH, WSN contents, ripening index values, TCA-SN and PTS-SN values of Kashar cheese samples are given in Figure 1, 2, 3, 4 and 5. The lowest acidity value (0.72%) was found at raw B samples, the highest value (1.04%) was found at A samples ripened for 30 days and C samples ripened for 90 days. From Duncan's test result, as a samples had the highest acidity (0.95%), D samples had the lowest acidity (0.78%). At the first of ripening periods, the awerage acidity of samples were 0.75%, the acidity of samples ripened for 90 days was found as 0.93%. The acidity of cheese is according to lactic acid bacteria counts, lactose amount and ripening state factors (Say, 2008). Researches (Arıtaşı, 1990; Koçak et al., 1996; Sert et al., 2007) found that as the ripening periods increased, the acidity of Kashar cheese samples increased. Özdemir and Demirci (2006) found that the potassium sorbate addition of cheese

was effected the acidity value of cheese samples. We found that the acidity of the samples preserved with potassium sorbate were lower than control samples. The results of Özdemir and Demirci (2006) weren't parallel with our results.

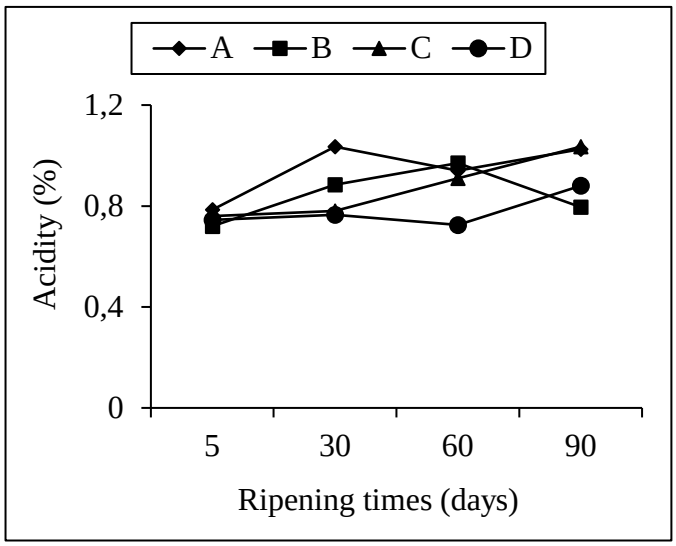

Figure 1. The changes in acidity values of Kashar cheese during ripening: A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

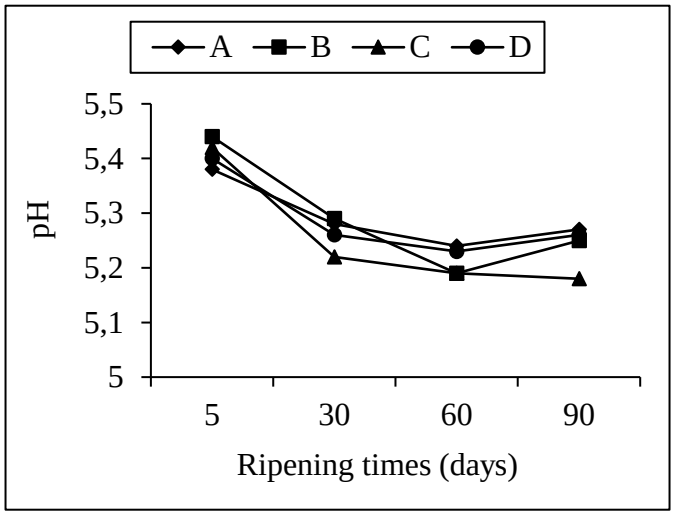

Figure 2. The changes in pH values of Kashar cheeses during ripening: A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

The results of acidity, pH, WSN contents, ripening index values, TCA-SN and PTS-SN values of Kashar cheese samples are given in Figure 1, 2, 3, 4 and 5. The lowest acidity value (0.72%) was found at raw B samples, the highest value (1.04%) was found at A samples ripened for 30 days and C samples ripened for 90 days. From Duncan's test result, as a samples had the highest acidity (0.95%), D samples had the lowest acidity (0.78%). At the first of ripening periods, the awerage acidity of samples were 0.75%, the acidity of samples ripened for 90 days was found as 0.93%. The acidity of cheese is according to lactic acid bacteria counts, lactose amount and ripening state factors (Say, 2008). Researches (Arıtaşı, 1990; Koçak et al., 1996; Sert et al., 2007) found that as the ripening periods increased, the acidity of Kashar cheese samples increased. Özdemir and Demirci (2006) found that the potassium sorbate addition of cheese was effected the acidity value of cheese samples. We found that the acidity of the samples preserved with potassium sorbate were lower than control samples. The results of Özdemir and Demirci (2006) weren't parallel with our results.

The ripening index of cheese is according to dfferent factors as waste renning amoung, packaging material, and salt and water ratio of cheese and storage stages. The ripening degree of cheese samples changed at between 4.13% and 14.37%. At Duncan test results, it was found that D sample had the highest ripening degree. Usually, ripening index of the samples added potassium sorbate had higher than that of unsorbatted samples.We can say that the sorbate addition to Kashar cheese was wasn't show no adverse effect on ripening of Kashar cheese. As the ripening periods increased, the ripening degree increased too. The results was parallel with Say (2008).

The soluble nitrogen in TCA is consist of peptides with short chain and amino acids (Fox, 1989). It was found that the lowest and highest soluble nitrogen in TCA ratio were found 0.18% and 0.29%, respectively. The TCA-SN ratio of D samples were higher than that of other samples. The TCA soluble protein ratio in cheese samplesis according to starter culture and waste rennet amount (Mc Sweeney and Fox, 1997). As the ripening periods increased, TCA-SN ratio increased too. Similar results were found by Yılmaz and Dağdemir (2012) too.Yaşar (2007) and Say (2008) found the similar reseults with ours. Lau et al. (1991) found that the TCA-SN ratio of Cheddar cheese samples increased as the ripening times increased.

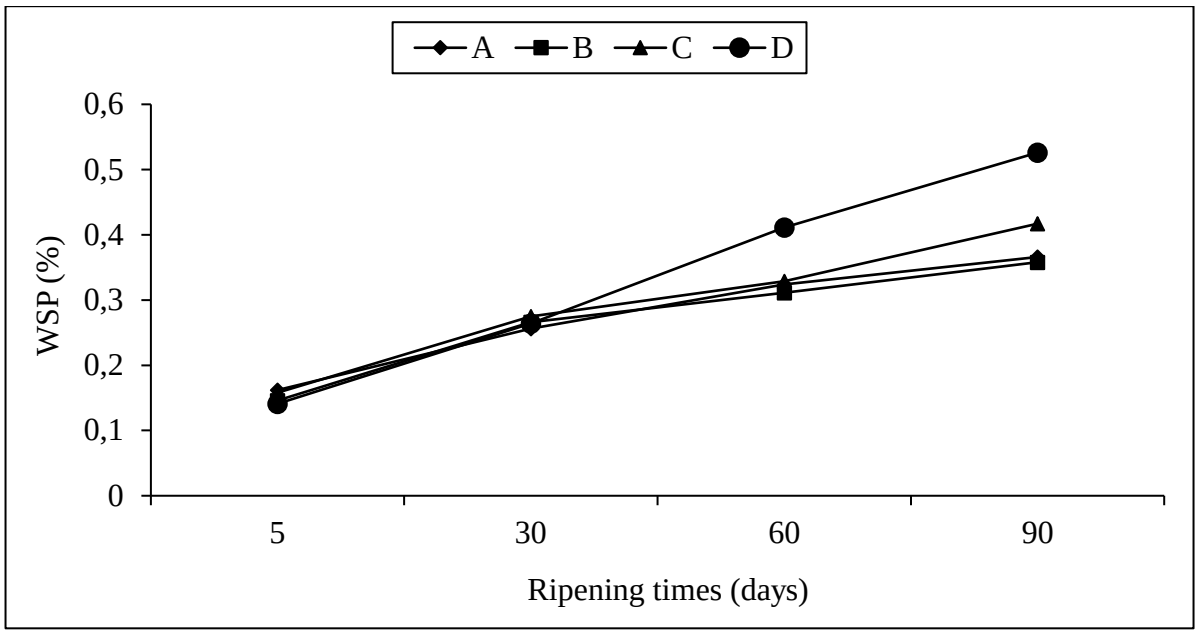

Figure 3. The changes in WSN contents of Kashar cheeses during ripening A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

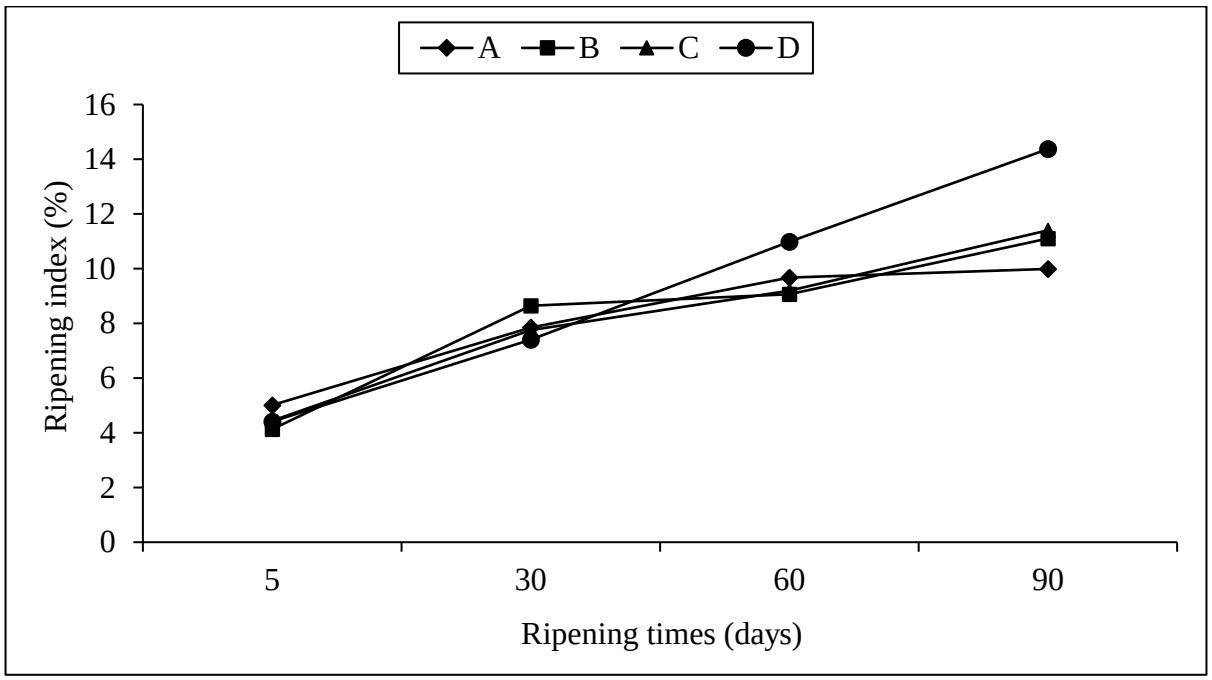

Figure 4. The changes in ripening index values of Kashar cheeses during ripening A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

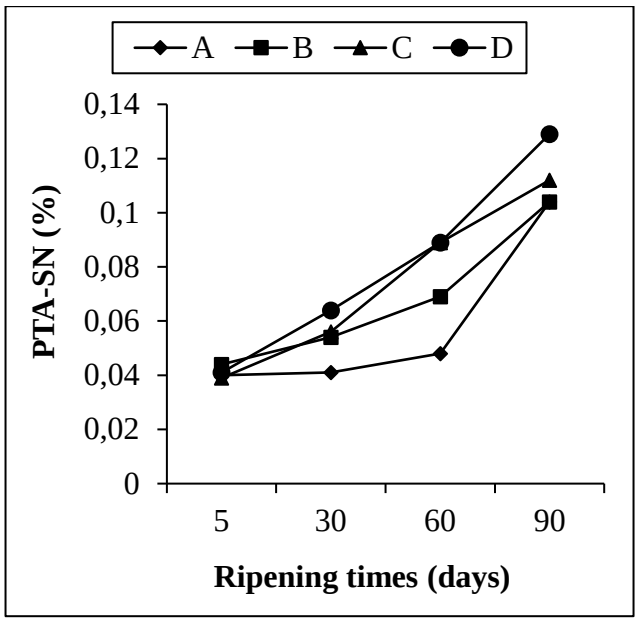

Figure 5. The changes in TCA-SN values of Kashar cheeses during ripening A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

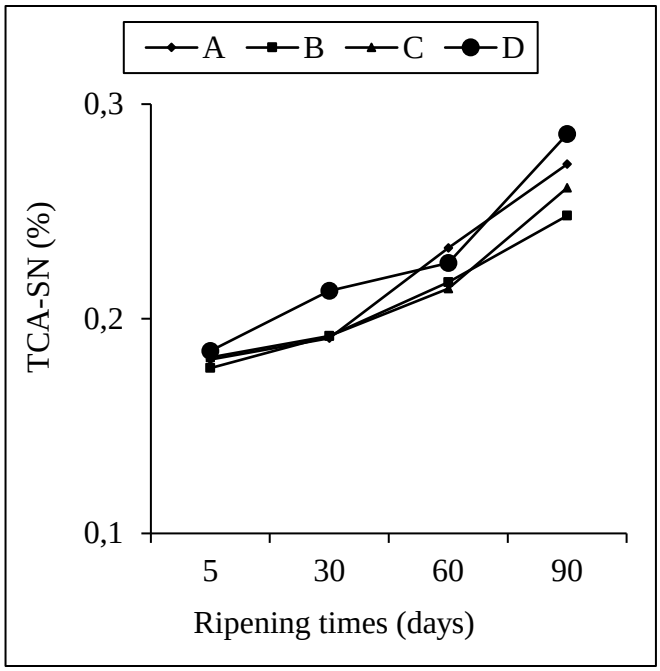

Figure 6. The changes in PTA-SN values of Kashar cheeses during ripening A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

The PTA soluble nitrogens are consist of peptides with very low weight and amino acids (Fox, 1989). The PTA-SN ratios of Kashar cheese samples were ranged in between 0.04% and 0.13%. As the highest PTA-SN ratio was found at D sample (0.08%), the lowest ratio was found at a sample. As the ripening times of cheeses increased, the PTA-SN ratio increased too. Çürük (2006) found that the TCA and TCA-SN ratio increased during ripening periods as similar results with ours.

The sensory analyses results of Kashar cheese samples were given Table 4.

Table 3. Some chemical analysis results of Kashar cheese samples

Samples	Ripening Times (days)	Acidity (%)	pH	Total Nitrogen (%)	Water Soluble Nitrogen (%)	Ripening Index (%)	TCA-TN (%)	PTA-TN (%)
A	5	0.785±0.007	5.40±0.000	3.23±0.099	0.162±0.000	5.01±0.141	0.181±0.000	0.040±0.002
	30	1.035±0.035	5.26±0.000	3.26±0.028	0.256±0.007	7.85±0.163	0.191±0.000	0.041±0.001
	60	0.940±0.057	5.23±0.007	3.36±0.007	0.324±0.020	9.67±0.615	0.233±0.004	0.048±0.001
	90	1.025±0.021	5.26±0.000	3.66±0.085	0.366±0.026	9.99±0.481	0.272±0.005	0.104±0.001
B	5	0.720±0.000	5.42±0.007	3.55±0.021	0.146±0.001	4.13±0.071	0.177±0.001	0.044±0.001
	30	0.885±0.050	5.22±0.000	3.08±0.078	0.266±0.000	8.64±0.184	0.192±0.000	0.054±0.000
	60	0.970±0.000	5.19±0.007	3.44±0.078	0.311±0.010	9.06±0.502	0.217±0.004	0.069±0.001
	90	0.795±0.050	5.18±0.007	3.23±0.064	0.358±0.001	11.10±0.184	0.248±0.001	0.104±0.001
C	5	0.760±0.000	5.44±0.007	3.56±0.064	0.158±0.002	4.44±0.007	0.182±0.002	0.039±0.002
	30	0.780±0.014	5.29±0.000	3.54±0.007	0.275±0.022	7.76±0.587	0.192±0.001	0.056±0.000
	60	0.910±0.014	5.19±0.007	3.58±0.028	0.329±0.016	9.19±0.502	0.214±0.000	0.089±0.001
	90	1.035±0.035	5.25±0.007	3.66±0.071	0.417±0.017	11.40±0.240	0.261±0.003	0.112±0.003
D	5	0.745±0.007	5.38±0.021	3.19±0.028	0.141±0.000	4.41±0.042	0.185±0.006	0.041±0.005
	30	0.765±0.007	5.28±0.000	3.56±0.014	0.264±0.002	7.40±0.085	0.213±0.010	0.064±0.000
	60	0.725±0.064	5.24±0.000	3.75±0.014	0.411±0.025	10.98±0.728	0.226±0.005	0.089±0.001
	90	0.880±0.028	5.27±0.000	3.66±0.000	0.526±0.011	14.37±0.304	0.286±0.005	0.129±0.002

*Values are means of 2 replicates ±SD

Abbreviations are: A, scalded; B, scalded and potassium sorbated; C, dry salted; D, dry salted and potassium sorbated.

Table 4. The sensory analyses results of Kashar cheese samples

Samples	Ripening Times (days)	Colour and Appearance	Texture	Taste	Odour	General acceptability	Bitterness
A	5	0.785±0.07	5.40±0.000	3.23±0.099	0.162±0.000	5.01±0.141	0.181±0.000
	30	1.035±0.035	5.26±0.000	3.26±0.028	0.256±0.007	7.85±0.163	0.191±0.000
	60	0.940±0.057	5.23±0.007	3.36±0.007	0.324±0.020	9.67±0.615	0.233±0.004
	90	1.025±0.021	5.26±0.000	3.66±0.085	0.366±0.026	9.99±0.481	0.272±0.005
B	5	0.720±0.000	5.42±0.007	3.55±0.021	0.146±0.001	4.13±0.071	0.177±0.001
	30	0.885±0.050	5.22±0.000	3.08±0.078	0.266±0.000	8.64±0.184	0.192±0.000
	60	0.970±0.000	5.19±0.007	3.44±0.078	0.311±0.010	9.06±0.502	0.217±0.004
	90	0.795±0.050	5.18±0.007	3.23±0.064	0.358±0.001	1.10±0.184	0.248±0.001
C	5	0.760±0.000	5.44±0.007	3.56±0.064	0.158±0.002	4.44±0.007	0.182±0.002
	30	0.780±0.014	5.29±0.000	3.54±0.007	0.275±0.022	7.76±0.587	0.192±0.001
	60	0.910±0.014	5.19±0.007	3.58±0.028	0.329±0.016	9.19±0.502	0.214±0.000
	90	1.035±0.035	5.25±0.007	3.66±0.071	0.417±0.017	11.40±0.240	0.261±0.003
D	5	0.745±0.007	5.38±0.021	3.19±0.028	0.141±0.000	4.41±0.042	0.185±0.006
	30	0.765±0.007	5.28±0.000	3.56±0.014	0.264±0.002	7.40±0.085	0.213±0.010
	60	0.725±0.064	5.24±0.000	3.75±0.014	0.411±0.025	10.98±0.728	0.226±0.005
	90	0.880±0.028	5.27±0.000	3.66±0.000	0.526±0.011	14.37±0.304	0.286±0.005

As seen at Table 4, color scores of sorbated samples increased during ripening, but color scores of control samples decreased during ripening. Say (2008) found that color scores changed during ripening periods. The body scores of dry salted samples were lower than that of salted in scalding water. Panelists determined that Kashar cheese samples salted as dry were harder than that of salted in scalding water. Panelists saw that dry salted samples contained the holes in and out of cheese samples during panel. Çürük (2006) found that Kashar cheese samples added themelting salt were softer during ripening periods and and texture scores decreased too. The taste scores of Kashar cheese samples varied at between 6.42 and 7.57. The taste scores given by panelists to Kashar cheese samples decreased during 90 days of ripening. The taste scores of control samples salted in scalding water were lover than that of samples salted in scalding water and sorbated. Piacquadio et al. (2001) found that the taste scores of Mozzarella cheese samples decreased during 90 days of ripening too.The founds were paralelled with research founds of our. The odour scores of sorbated Kashar cheese samples were higher than that of no sorbated samples. However, the odour scores of dry salted samples were lower than that of scalding water. Çürük (2006) found that the odour scores of Kashar cheese samples decreased as ripening periods increased as parallel our results. The bitterness score of samples decreased during ripening periods. General acceptability of of Kashar cheese samples were between 6.56 and 7.62 scores (Table 4). Generally, panelists gave higher score to general acceptibility of samples salted in scalding water. In this research, it was found the potassium sorbate added to Kashar cheese had not any unfavorable effect on the sensory properties of cheese samples. But, Aworh and Egounlety (1985) found that the potassium sorbate added to West African soft cheese was effected as unfavorable the cheese flavor. Panelists preferred the raw and cheese samples ripened for 1 months more than the other ripened periods (60 and 90 days). This state can be sourced from the unfavorable aromatic matters as free fatty acids and casein break down products formed during ripening periods for 60 and 90 days.

Conclusion

The highest mould count of Kashar cheese samples was found at control samples salted in scalding water, salted as dry and sorbated samples contained the lowest counts. For this reason, Kashar cheese must be sorbated for unmoulding. In the all cheese samples, pH value decreased the 30 and 60 days of ripening, but increased the 90 days. The highest water soluble nitrogen and ripening degree was found in Kashar cheese samples salted as dry. However, the sorbate adding to Kashar was increased the ripening level of Kashar cheese. The TCA-SN and PTA-SN ratio increased in cheese samples wich dry salted according to salted in scalding water. It was determined that there was no adverse effect of sorbate on ripening of Kashar cheese samples. Generally, panelists preferred the Kashar cheese samples ripenned for 5^{th} days and 30^{th} days of ripening time.

Acknowledgments

The researchers are grateful to the Atatürk University Research Fund for Financial Support (Project No: 2011/158).

References

Akbulut, N., Gonc, S., Kınık, O., Uysal, H., Akalın, S., Kavas, G. (1996). Bazı Tuzlama Yöntemlerinin Beyaz Peynir Üretiminde Uygulanabilirliği ve Peynir Kalitesine Etkileri Üzerinde Bir Araştırma 1- Duyusal ve Mikrobiyolojik Özelliklere Etkileri. *Erzincan Üniversitesi Fen Bilimleri Dergisi*, 33(1), 9-15.

Altuğ, T. (1993). Duyusal test Teknikleri. E.U. Mühendislik Fakültesi Ders Kitapları, İzmir Yayın No: 28.

Anonymous (2013). Turkish Food Codex Regulations on Food Additives. Ankara, Turkey.

Arıtaşı, C. (1990). Çeşitli Kuru Meyvelerin İlavesi ile Üretilen Vakumla Ambalajlanmış Kaşar Peynirlerinin Özellikleri Üzerine Bir Araştırma. Ph.D. Thesis, Trakya University Edirne, Turkey.

Aworh, O.C., Egounlety, M. (1985). Preservation of West African soft cheese by chemical treatment. J*ournal of Dairy Research*, 52, 187-193.

Bodyfelt, F.W., Tobias, J., Trout, G. M. (1988). The Sensory Evaluation of Dairy Products. Van Nostrand Reinhold, New York. ISBN: 9780442226855

Çürük, M. (2006). Influence of Themelting Salts Used on the Some Characteristics and Ripening Properties of Kashar Like Cheese. PhD. Thesis, Department of Food Engineering Institute of Naturel and Applied Sciences University of Çukurova, Konya, Turkey.

Diliello, L.R. (1982). Methods in Food and Dairy Microbiology. AVI Publishing Co. Inc. Westport Connt. USA. ISBN: 0870554115

Famá, L., Flores, S.K., Gerschenson, L., Goyanes, S. (2006). Physical characterization of cassava starch biofilms with special reference to dynamic mechanical properties at low temperatures. *Carbohydrate Polymers*, 66(1), 8-15.

Fox, P.F. (1989). Proteolysis during cheese manufacture and ripening. *Journal of Dairy Science*, 72(6), 1379-1400.

Gül, O., Dervişoğlu, M. (2013). Investigation of sodium benzoate and potassium sorbate content and evaluation of microbiological parameters of fresh Kashar cheeses. *Korean Journal for Food Science of Animal Resources*, 33(4), 549-554.

Güler, Z. (2005). Quantification of free fatty acids and flavor characteristics of Kasar cheeses. J*ournal of Food Lipids*, 12, 209-221.

Güven, M., Karaca O.B. (2001). Proteolysis levels of White cheeses salted and ripened in brines prepared from various salts. *International Journal of Dairy Technology*, 54(1), 29-33.

Güven, M., Karaca, O.B., Kaçar, A., Hayaloğlu, A.A., Çürük, M. (2003). Kaşar peynirlerinin proteoliz düzeyleri üzerine farklı ambalaj materyali ve olgunlaşma süresinin etkileri. GAP III. Tarım Kongresi, Şanlıurfa.

Gilliand, S.E., Sandine, W.E., Vedamuthu, E.R. (1984). Acid Producing Microorganism, Compendium of Methods for the Microbiological Examination. 2nd edn, ed. Speck, M.L. Washington D.C.: 184-196, USA. ISBN: 9780875531175

Harrigan, W.F. (1998). Laboratory Methods in Food Microbiology. Academic Press, San Diego. ISBN: 9780123260437

Jarret, W.D., Aston, J.W., Dulley, J.R. (1982). A simple method for estimating free amino acids in Cheddar cheese. *Australian Journal of Dairy Technology*, 37, 55-58.

Johnson, M., Law, B. A. (2010). The Origins, Development and Basic Operations of Cheesemaking Technology, Part 2. Technology Of Cheesemaking, 2nd Edition, Ed. Law, B. A., Tamime, M.. Wiley-Blackwell, Singapore, 68-97. ISBN : 9781405182980

Koburger, J.A., Marth, E.H. (1984). Yeasts and molds. In Compendium of Methods for the Microbiological Examination of Foods 2nd edn, ed. Speck, M.L. Washington D.C.: American Public Health Association. ISBN: 9780875531175

Koçak, C., Ersen, N., Aydınoğlu, G., Uslu, K. (1998). Ankara piyasasında satılan Kaşar peynirlerinin proteoliz düzeyi üzerinde bir araştırma. *Gıda*, 23, 247-251.

Koçak, C., Bitlis, A., Gürsel, A., Avşar, Y.K. (1996). Effect of added fungal lipase on the ripening of Kashar cheese. *Milchwissenschaft*, 51(1), 13-17.

Kristo, E., Koutsoumanis, K.P., Biliaderis, C.G. (2008). Thermal, mechanical and water vapor barrier properties of sodium caseinate films containing antimicrobials and their inhibitory action on Listeria monocytogenes. *Food Hydrocolloids*, 22(3), 373-386.

Kurt, A., Çakmakçı, S., Çağlar, A. (2007). A Guide Book of Analysis Methods of Milk and Milk Products. Turkey: Ataturk University, Agriculture Faculty, Erzurum, Turkey.

Lau, K.Y., Barbano, D.M., Rasmusen, R.R. (1991). Influence of pasteurization of milk on protein breakdown in Cheddar cheese during aging. *Journal Dairy Science*, 74(3), 727-740.

McSweeney, P.L.H., Fox, P.F. (1997). Chemical methods for the characterization of proteolysis in cheese during ripening. *Lait*, 77, 41-76.

Messer, J.W., Behney, H.M., Leudecke, L.O. (1985). Microbiological count methods. G.H. Richardson (Ed.), Standard Methods for the Examination of Dairy Products (15th Edn), A.P.H.A, Washington, D.C., USA. ISBN: 9780875531182

Özdemir, C., Demirci, M. (2006). Selected microbiological properties of Kashar cheese samples preserved with potassium sorbate. *International Journal of Food Properties*, 9, 515-521.

Payne, M.R., Morison, K.R. (1999). A multi-component approach to salt and water diffusion in cheese. *Interantional Dairy Journal*, 9, 887-894.

Piacquadio, P., De Stefano G., Sciancalepore, V. (2001). A no brine method for Mozzarella cheese making. *Milchwissenschaft,* 56(4), 204-206.

Polychroniadou, A., Michaelidou, A., Paschaloudis, N. (1999). Effect of time, temperature and extraction method on the trichloroacetic acid-soluble nitrogen of cheese. *International Dairy Journal,* 9, 559-568.

Say, D. (2008). Effects of salt concentratıon of scalding solution and storage period on properties of Kaşar cheese, Ph.D. Thesis, Çukurova University, Adana, Turkey.

Sert, D., Ayar, A., Akın, N. (2007). The effects of starter culture on chemical composition, microbiological and sensory characteristics of Turkish Kasar cheese during ripening. *International Journal of Dairy Technology*, 4(60), 245-252.

Tarakçı, Z., Küçüköner, E. (2006). Changes on physico-chemical, lipolysis and proteolysis of vacuum-packed Turkish Kashar cheese during ripening. *Journal Central Europen Agriculture*, 7(3), 459-464.

Tatini, R.S., Hoover, D.G., Lachica, R.V.F. (1984). Methods for the isolation and enumera-tion of Staphylococcus aureusin: M.L. Speck (Ed.), Compendium of Methods for the Microbiological Examination of Foods American Public Health Association, Inc, Washington. ISBN: 9780875531175

Tfouni, S.A.V., Toledo, M.C.F. (2002). Determination of benzoic and sorbic acids in Brazilian food. *Food Control*, 13, 117-123.

TSE (2006). Kashar Cheese Standard (TS 3272). Ankara, Turkey: Turkish Standard Institute.

Türe, H., Gällstedt, M., Hedenqvist, M. S. (2012). Antimicrobial compression-moulded wheat gluten films containing potassium sorbate. *Food Research International,* 45(1), 109-115.

Uzun, Y.S. (2006). A study on viability of *Lactobacillus acidophilus* LA-5 and *Bifidobacterium bifidum* BB-12 againts scalding and dry salting during Kaşar cheese making. M.Sc. Thesis,, Harran University, Şanlıurfa, Turkey.

Üçüncü, M. (1980). Peynircilikte sorbik asit ve kullanım olanakları. *Gıda,* 5(4), 79-87.

Üçüncü, M (2004). From A to Z Cheese Technology, Ege University Press, Izmir, Turkey, pp. 948-969. ISBN: 975-98951-2-9

Üçüncü, M. (2010). Süt ve Mamulleri Teknolojisi. Ege Üniversitesi Mühendislik Fakültesi Gıda Mühendisliği Bölümü, 571s, İzmir. ISBN: 978-975-98951-3-6

Yalman, M., Güneşer, O., Yüceer, Y.K. (2017). Evaluation of Some Physical, Chemical and Sensory Properties of Kasar Cheese and Its Processed and Analogue Types. *Tarım Bilimleri Dergisi,* 23(1), 63-75.

Yangılar, F., Oğuzhan Yıldız, P. (2016). Casein/natamycin edible films efficiency for controlling mould growth and on microbiological, chemical and sensory properties during the ripening of Kashar cheese. *Journal of the Science of Food and Agriculture,* 96(7), 2328-2336.

Yılmaz, F., Dağdemir, E. (2012). The effects of beeswax coating on quality of Kashar cheese during ripening. *International Journal of Food Science and Technology,* 47, 2582-2589.