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Full Length Research Paper

Determination of microbiological characteristics of Turkish Karin Kaymagi cheeses packaged in different materials

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The aim of this study is to transport to dairy plants the making technique of Karin Kaymagi cheese and to make them hygienic cheese. Also, the effects of different packaging materials (artificial case, barrel and tripe) on microorganism counts in the cheese samples were determined. In this research, four different Karin Kaymagi cheese samples were prepared from white cheese, civil cheese, whey cheese, pasteurized cream and concentrated yoghurt mixes. These mixes were put in three different packaging materials (artificial case, barrel and tripe) and ripened at 12°C for 2, 15, 30 and 60 days. The means of total aerobic mesophilic (TAMB), lactic acid (LAB), coliforms, proteolytic, lipolytic, psychrotrophic, spore forming bacteria and yeast-moulds in the cheese samples were determined as 7.08, 6.11, 1.18, 5.13, 4.82, 5.30, 1.30 and 4.83 log cfu/g, respectively. As the LAB counts and the yeast-mould counts of samples increased, the coliform group bacteria counts decreased during ripening periods. The yeast-moulds counts of cheese samples packaged in barrel were lower than that of tripe and artificial case.

Key words: Karin Kaymagi cheese, microbiological characteristics, packaging materials.

INTRODUCTION

Cheese is a product containing protein, calcium and phosphor at high levels. In Turkey, about 50 different kinds of cheese are produced. But, only Beyaz, Tulum and Kashar cheese are produced in all regions of Turkey (Anonymous, 2000). Other cheese kinds are traditionally made in only some regions. Karin Kaymagi cheese, one of the types of cheese, is widely produced in Sarikamis, Oltu and Kars regions of Turkey. Beyaz cheese pieces, civil cheese, cream, concentrated yoghurt and whey cheese can be used at Karin Kaymagi cheese production. Ripened Karin Kaymagi cheese is consumed by most people in Turkey. The making technique of this cheese can be transported to dairy plants. Thus, cheeses with standard quality and composition can be produced.

In traditional Karin Kaymagi cheese making, Beyaz cheese or civil cheese is mixed with cream (butter), whey cheese and yoghurt. Then, mix is salted at 2 - 3% ratio. Mix is filled to cleaned artificial case (abomasum) unless hole and pressed for 3 days. Cheeses are ripened at 5 - 10°C for 60 - 90 days. Because the making and ripening technique of the Karin Kaymagi cheese is parallel to tulum cheese, in this study, our aim was that the properties of this cheese be compared with tulum cheese. Although there are a few studies on Karin Kaymagi cheese (Cakmakci et al., 1995), a lot of researches were made on tulum cheese (Digrak et al., 1994; Keles and Atasever, 1996; Guven and Konar, 1995). The aim of this study is to transport to dairy plants, the making technique of Karin Kaymagi cheese.

MATERIALS AND METHODS

Materials

In this research, cow milk was used for Karin Kaymagi cheese samples production. One part of the milk was defatted and non fat milk was processed to civil cheese. At civil cheese making, defatted milk was acitiated to 20°SH. Then, milk was heated to 32°C and

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Table 1. Some microbiological properties of samples used for Karin Kaymagi cheese making (log cfu / g).

Microbial counts	Raw milk	Concentrated yoghurt	Beyaz cheese	Pasteurised cream	Civil cheese
TAMB	7.85	6.90	7.75	6.00	7.34
Psychrotrophs	-	3.41	4.53	2.95	3.94
LAB	-	5.00	5.45	4.48	5.49
Coliform	4.78	<1	1.70	<1	<1
Lipolytics	-	2.78	4,60	3.70	2.00
Proteoliytics	-	4.04	5.23	-	4.90
Spore forming bacteria	-	<1	<1	<1	1.48
Yeast - Mould	-	4.20	4.43	<1	4.54

- : not analysed.

added to rennet 1 ml for 100 L milk. The temperature of milk was increased to 55°C. Then, the civil cheese particles were collected with a stainless steel stick. The cream was pasteurized at 75°C for 30 min. The second part of milk was standardized to 3% butterfat and processed to Beyaz cheese curd. The whey obtained from Beyaz cheese production was processed to whey cheese. Third part of milk was standardized to 3% butterfat and processed to yoghurt. Then, yoghurt was drained in cloth for concentrated yoghurt making. The Beyaz cheese and yoghurt production were made with standard production techniques (Demirci and Simsek, 1997).

Preparation of Karin Kaymagi cheese samples

The procedures for making the various Karin Kaymagi cheese samples were as follows:

Cheese 1 (M1)

Beyaz cheese fragments (80%), whey cheese (10%) and pasteurised cream (10%) were mixed. Then mixture was filled into packaging materials (tripe, barrel and artificial case).

Cheese 2 (M2)

Beyaz cheese fragments (80%), concentrated yoghurt (10%) and cream (10%) were mixed and filled into packaging materials.

Cheese 3 (M3)

Civil cheese pieces (80%), whey cheese (10%) and pasteurised cream (10%) were mixed. Then mixtures were filled into packaging materials.

Cheese 4 (M4)

Civil cheese pieces (80%), concentrated yoghurt (10%) and cream (10%) were mixed and filled into packaging materials.

All cheese samples were ripened at 12°C (relative humidity 85%) for 2, 15, 30 and 60 days.

Microbiological analysis methods

Eleven gram of samples (milk, yoghurt, civil cheese, whey cheese, cream, white cheese and Karin Kaymagi cheese) were homogenized in 99 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 (Diliello, 1982). Analyses were carried out using the following procedures:

1. Total aerobic mesophilic bacteria were enumerated on plate count agar (Oxoid) following the pour-plate method and with aerobic incubation at 30 ± 1°C for 48 h (Diliello, 1982).
2. Coliform counts were determined by the Violet Red Bile Agar (Oxoid) with plate incubation at 35 ± 2°C for 48 h (Diliello, 1982).
3. LAB counts were determined by MRS-agar (Oxoid) following the pour-plate method and incubated at 30°C for 48 h (Diliello, 1982).
4. Yeasts and moulds were enumerated on Potato Dextrose Agar (PDA) (Oxoid) following the pour-plate method and incubated at 25°C for 5 - 7 days (Koburger and Marth, 1984).
5. Spore forming bacteria counts were enumerated on Nutrient Agar (Oxoid). The 10% dilution of the cheese samples were heated 80°C for 10 min. Then samples were inoculated to agar and incubated at 37°C for 72 h (Baumgart et al., 1986).
6. Psycrotrophs were determined on Plant Count Agar (PCA) (Oxoid) incubated at 7°C for 10 days (Diliello, 1982).
7. Proteolytic bacteria counts were determined by Caseinate Agar (Oxoid) and incubated at 30°C for 72 h (Speck, 1976).
8. Lipolytic bacteria were counted by Sulfate Agar (Oxoid) and incubated at 25°C for 3 days (Diliello, 1982).

Statistical analysis

All statistical analysis was performed on a computer running SAS for windows. Analysis of variance was performed using the routine Proc ANOVA. Significant treatment was separated using Duncan's multiple range test (Duzgunes et al., 1987).

RESULTS AND DISCUSSION

Some microbiological properties of milk, concentrated yoghurt, whey cheese, civil cheese and Beyaz cheese fragments used in Karin Kaymagi cheese samples were given in Table 1. The microbiological analysis results of Karin Kaymagi cheese samples were given in Table 2. As seen in Table 2, the average total aerobic mesophilic (TAMB) count of samples was found as 7.08 log cfu/g. The differences of cheese mixtures, packaging material and ripening periods were significant ($p < 0.01$).

Table 2. Some microbiological analysis results (log cfu/g) of Karin Kaymagi cheese samples.

Cheeses	Packaging materials	Ripening periods (days)	TAMB	LAB	Yeast and moulds	Coliforms	Proteolytics	Lipolytics	Psychrotroph	Spore forming bacteria
M1	Artificial case	2(Raw)	5.78	5.23	3.60	1.39	4.14	4.20	4.32	<1
		15	7.15	3.97	5.14	<1	4.50	4.36	5.73	<1
		30	6.04	6.54	5.36	1.17	5.95	4.60	5.70	1.74
		60	7.04	6.53	5.50	<1	5.64	5.20	5.49	2.04
	Barrel	2(Raw)	6.45	5.53	4.47	1.39	4.04	4.39	5.11	1.47
		15	5.60	6.45	4.30	1.17	4.69	4.65	5.64	1.54
		30	6.41	6.82	5.53	<1	5.88	4.60	5.85	<1
		60	6.34	5.30	5.70	<1	5.64	5.56	5.00	1.95
	Tripe	2(Raw)	6.63	4.86	3.54	1.30	4.90	4.23	5.04	<1
		15	7.88	5.41	4.74	<1	4.71	4.63	5.51	1.17
		30	6.72	6.34	5.20	<1	5.93	4.39	5.07	1.30
		60	8.18	6.23	5.34	1.30	5.64	5.27	4.60	1.65
M2	Artificial Case	2(Raw)	7.61	5.38	3.65	1.30	4.17	4.38	4.84	<1
		15	5.70	6.26	4.87	<1	4.72	4.57	4.84	<1
		30	6.77	6.38	5.25	<1	5.87	5.77	5.49	1.69
		60	5.85	6.34	5.67	<1	5.72	5.66	5.75	1.69
	Barrel	2(Raw)	7.41	5.45	3.60	1.65	4.11	4.56	4.77	<1
		15	6.48	6.63	4.92	1	4.85	4.71	5.74	1.47
		30	6.52	6.76	5.07	<1	5.88	4.39	5.92	<1
		60	6.26	6.76	5.72	<1	5.70	5.81	5.89	2.36
	Tripe	2(Raw)	7.68	4.61	4.54	1.30	4.43	4.55	4.69	<1
		15	6.00	5.30	5.07	<1	5.07	4.69	5.00	1.30
		30	7.64	5.95	5.69	1.39	5.93	5.04	5.65	1.77
		60	6.30	5.15	5.81	<1	5.63	5.56	5.17	1.77

Table 1. Contd.

		2(Raw)	7.51	5.57	3.39	1.47	4.04	4.14	4.50	1.17
	Artificial	15	5.81	6.23	5.11	<1	5.85	4.45	5.34	<1
	Case	30	7.46	6.88	5.74	<1	5.90	5.25	5.55	1.54
		60	7.38	6.53	5.17	1.30	5.77	5.50	5.70	1.17
M3		2(Raw)	7.40	5.54	3.47	1.30	4.38	4.74	6.00	<1
		15	6.88	6.53	5.77	1.39	4.98	4.92	5.69	1.39
	Barrel	30	7.18	6.08	5.17	<1	5.96	5.14	5.57	1.69
		60	6.70	4.81	5.38	1.17	5.68	5.46	5.46	1.81
		2(Raw)	7.46	5.54	3.54	1.17	4.14	4.17	5.11	<1
		15	6.81	6.61	5.17	<1	4.97	4.54	5.36	<1
	Tripe	30	7.51	6.61	5.78	<1	5.90	5.74	5.38	1.00
		60	6.48	6.53	4.84	<1	5.95	5.11	5.62	1.84
		2(Raw)	6.70	4.51	3.54	1.30	4.07	4.74	5.00	<1
	Artificial	15	6.00	6.25	5.07	<1	4.41	5.20	6.32	1.30
	Case	30	7.77	7.44	5.71	<1	5.94	5.68	5.74	<1
		60	8.00	6.56	5.92	<1	5.79	5.23	5.65	1.47
M4										
		2(Raw)	6.88	4.36	3.54	<1	3.81	4.04	4.89	<1
	Barrel	15	7.04	5.34	4.77	1.17	4.27	4.25	5.20	1.65
		30	6.57	6.54	5.34	1.30	5.97	5.34	5.30	1.17
		60	7.43	5.99	4.60	<1	5.96	5.46	5.88	2.04
		2(Raw)	7.04	4.41	4.95	<1	3.92	5.07	4.76	2.11
		15	7.08	7.14	5.25	1.39	4.41	4.41	5.20	<1
	Tripe	30	7.71	7.38	4.30	<1	5.93	4.84	6.00	1.30
		60	6.30	5.83	5.56	<1	6.96	5.69	5.94	1.84
	Average		7.08	6.11	4.96	1.18	5.13	4.82	5.30	1.30

Generally, the TAMB counts of samples packaged in tripe were higher than that of barrel and artificial ase. This state can be sourced from perfect water drainage as other packaging materials. The TAMB counts of samples ripened for 30 days increased but that for 60 days decreased. The TAMB counts of traditional Karin Kaymagi cheese samples analysed by Cakmakci et al. (1995) were higher than that of these research results. The average LAB counts of samples were found as 6.11 log cfu/g. The differences of ripening periods were significant ($p < 0.01$). This count was very low

from that of traditional Karin Kaymagi cheese samples (Cakmakci et al., 1995) and Van herby cheese samples (Kurt and Akyuz, 1984). These differences can be as a result of different making and ripening techniques of the cheeses. Generally, as cheese samples were ripened for 30, 60 and 90 days, the LAB counts increased too.

It was found that the yeast and mould counts of sample were between 3.39 and 5.93 log cfu/g. The differences of packaging material and ripening periods were significant ($p < 0.01$). The yeast and mould counts of samples packaged in barrel were lower than that of others. During ripening of cheese samples, the counts increased. Average yeast and mould counts found at Karin Kaymagi cheese by Cakmakci et al. (1995) and at Cerkez cheese samples by Uysal et al. (1998) was higher than that of the research results. Generally, the cheeses making and ripening at different states contain different yeast and mould counts.

The average psychrotroph bacteria count of samples was found as 5.30 log cfu/g. The differences in packaging material and ripening periods were significant ($p < 0.01$).The psychrotroph bacteria count of samples ripened for 30 days was the highest. The count also decreased for the cheese samples ripened for 60 and 90 days. These results were paralleled with results of Kashar cheese samples by Ozdemir and Demirci (2006). The psychrotroph bacteria count of samples packaged in tripe was higher than that of other packaging materials. This can be sourced from very uniform water drainage of tripe than barrel and artificial case. The average spore forming bacteria count of samples was 1.30 log cfu/g. The spore forming bacteria count of 11 samples were <1 log cfu/g. There was no important different among cheese samples ($p < 0.05$). But, the spore forming bacteria counts of samples ripened for 60 days were higher than that of 2, 15 and 30 days. The spore forming bacteria counts of Lavas cheese samples (Celik et al., 2001) which is a traditional cheese made in Turkey was lower than that of the research results. This can be sourced from different making and ripening conditions of different cheeses.

Coliform group bacteria in foods are accepted as hygiene index. The coliform group bacteria counts of Karin Kaymagi cheese samples changed around <1 and 1.65 log cfu/g. Turkish standards (TS-591) permit the maximum 2 log cfu/g coliform counts in Beyaz cheese (Anonymous, 1989). All of samples were legal as Turkish standards. The differences between ripening periods were significant ($p < 0.01$). As cheese samples were ripened for 15, 30 and 60 days, the coliform counts decreased. The average coliform count of Tulum cheese (Keles and Atasever, 1996) was higher than that of Karin Kaymagi cheese samples. In this research, because the cheese and cream used at Karin Kaymagi cheese making were pasteurised, the coliform counts were lower than 2 log cfu/g. The Karin Kaymagi cheese samples produced as traditional (Cakmakci et al., 1995) were higher than that of the research results. The cheese samples made from raw materials can contain coliform counts at high level.

Proteolytic bacteria break up the proteins and form water soluble peptides and amino acids. The average proteolytic bacteria count of cheese samples was found as 5.13 log cfu/g. The differences between cheese mixtures and ripening periods were significant ($p < 0.01$). During ripening for 30 days, the proteolytic bacteria count was the highest. But, fresh (2 days) cheese samples had the lowest count. The proteolytic bacteria counts of traditional Karin Kaymagi cheese samples (Cakmakci et al., 1995) were similar to this research results. Generally, cheeses ripened at different states contained different proteolytic bacteria counts. The average lipolytic bacteria counts of cheese samples were found as 4.82 log cfu/g. There were no important differences among the ripening periods, packaging materials and cheese mixes ($p < 0.01$). M1 and M4 mixtures contain more lipolytic bacteria than others. As cheese samples were ripened for 15, 30 and 60 days, lipolytic bacteria count increased too. The average lipolytic bacteria count found in this research was lower than that of Karin Kaymagi cheese samples produced as traditional (Cakmakci et al., 1995).

Conclusion

Karin Kaymagi cheese is a traditional dairy product produced only in Turkey. In addition, this product has been produced by primitive methods. The aim of this study is to transport to dairy plants, the making technique of Karin Kaymagi cheese and to make the cheese hygienic. Also, the effects of different packaging materials on microorganism counts of the cheese samples were researched. The results clearly demonstrated that Karin Kaymagi cheese and other traditional dairy products can be produced in factory condition. In this study, it was found that coliform counts of 27 samples were <1 log cfu/g. If Karin Kaymagı cheese was made in hygienic conditions, the cheese would not have a risk to human health. There was no important effect on microorganism counts of the different packaging materials.

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