

Determination of some chemical and microbiological characteristics of Kaymak*

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RESUMEN

Determinación de algunas características químicas y microbiológicas del Kaymak

Kaymak es una clase de crema concentrada, que se fabrica tradicionalmente de la leche del búfalo o de la vaca en Turquía. Se consume generalmente con la miel en el desayuno y en algunos postres turcos tradicionales. El objetivo de este estudio fue determinar algunas características químicas y microbiológicas del kaymak. Las muestras fueron obtenidas de diversas instalaciones lecheras productoras de kaymak de leche de vaca y de mercados locales situados en İzmir. Se analizó el contenido en sólidos totales y grasas, acidez, pH y valores de peróxido, además del conteo de tan bien como cuentas de las bacterias coliformes, *E. coli*, levadura y mohos, y estafilococos. Las características químicas de las muestras fueron generalmente aceptables para el Turkish Food Codex. Sin embargo, las características microbiológicas de algunas muestras fueron muy malas. La industria del kaymak debe ser extremadamente cuidadosa durante la fabricación y el almacenaje del producto.

PALABRAS-CLAVE: Características químicas - Características microbiológicas - Kaymak

SUMMARY

Determination of some chemical and microbiological characteristics of Kaymak

Kaymak is a kind of concentrated cream, which is traditionally manufactured from buffalo or cow's milk in Turkey. It is generally consumed with honey at breakfast and some traditional Turkish desserts. The aim of this study was to determine some chemical and microbiological properties of kaymak. The samples were obtained from different dairy plants producing kaymak from cow's milk and local markets located in İzmir. They were examined for total solids and fat contents, acidity, pH and peroxide values, as well as counts of coliform bacteria, *E. coli*, yeast and moulds, and Staphylococci.

Chemical characteristics of the samples were generally favorable for Turkish Food Codex. However, microbiological properties of some samples were very poor. Careful considerations should be given by the kaymak industry during manufacturing and storage of the product.

KEY-WORDS: Chemical characteristics - Kaymak - Microbiological characteristics.

1. INTRODUCTION

Kaymak is traditionally produced from water buffalo or cow's milk in Turkey. It is the main component of some Turkish desserts such as kadayif and baklava. Consumers because of its high fat content (9.3%) and white color prefer Kaymak manufactured from water buffalo milk. As buffalo milk is not always available, it has become necessary to use cow's milk mixed with cream in the manufacturing of kaymak, which makes the production of kaymak possible in all seasons. In this study, all kaymak samples were manufactured from cow's milk.

Milk fat plays an important role in physical properties, flavour and nutritional values of milk and other dairy products. Moreover, milk fat is a good energy source and contains medium chain fatty acids, essential unsaturated fatty acids as linoleic and arachidonic acids and fat-soluble vitamins (A, D, E and K). Because of these properties, it has great importance in nutrition physiology (Fox, 1995; Metin, 1998).

Kaymak is different from other well-known milk fat based products such as butter, ghee, sanma, meshho, samin and samuli in terms of composition and shelf life. Firstly, kaymak contains higher amount of moisture and lower milk fat. In addition, no fermentation process is used for the manufacturing of kaymak. These differences affect the shelf life of kaymak. Kaymak should be consumed within one week because it is a non fermented product, whereas the shelf life of the other mentioned products was reported as 6-8 months (Sserunjogi *et al.*, 1998). The possibility of microbial contamination of the product makes it necessary to consume the product in a short time.

There is no international study on the properties of commercial kaymak samples except CLA content of kaymak (Akalın *et al.* 2005) although some studies have been published on the characteristics of different milk fat based products (Kaya, 2000; Hayaloglu and Konar, 2001; Sagdiç *et al.* 2004). Therefore, the aim of this study was to determine some chemical properties such as total solids, fat, acidity, pH and peroxide value as well as microbiological characteristics such as coliform bacteria, *E. coli*, staphylococci and yeast and

moulds in commercial kaymak samples produced in İzmir, Turkey.

2. EXPERIMENTAL

2.1. Materials

Kaymak samples were obtained from five different dairy plants producing kaymak from cow's milk in İzmir, Turkey. Kaymak has a special manufacturing process as a traditional product. (This process was carried out in Akgül dairy products plant Çiğli, İzmir, Turkey). Firstly, raw milk (100 L) containing 4 % fat was heated at 90 °C for 8-10 min. 13 kg of cream (70 % fat) heated at 85 °C were added and the mixture was stirred for 5 min and heated up to 87 °C. The mixture was poured into stainless steel pans of 6 L and kept at 75-80 °C for about 2 hours until the foam disappeared. Then, the mixture was cooled to 20-25 °C and stored at 4 °C for 8-12 hours in order to ripening. Finally, the kaymak layer formed at the upper part was cut and separated from the skim milk layer. It was shaped into small rolls and packaged in plastic cups. The samples and four other commercial kaymak samples were brought to the laboratory under cold conditions and stored in a refrigerator until analysis. Kaymak samples were manufactured twice in each plant. Therefore, ten samples were obtained for the analysis. All analysis were made in duplicate and completed within 2 d.

2.2. Methods

2.2.1. Chemical Analysis

Total solids: Total solids content was determined by drying samples at 105 °C for 3-4 hours (AOAC, 1990).

Titrateable acidity: It was determined in 10 g kaymak diluted with 10 ml of distilled water by titrating with 0.1 N NaOH and was expressed as % lactic acid.

pH: It was determined by using a pH meter combined with a glass electrode (Model SS-3, Beckman, Fullerton, CA, USA)

Fat content: Fat contents were measured according to Gerber butyrometric method (AOAC, 1990).

Peroxide value: Peroxide values of samples were measured according to AOAC (1990).

2.2.2. Microbiological Analysis

10 gram of each kaymak sample was homogenized with 90 ml of 0.15% (w/v) sterilized peptone water (Oxoid, Hampshire, UK) and mixed until uniform. Subsequent serial dilutions were prepared in sterile 9 ml 0.15% (w/v) peptone water and desired microorganisms were numbered. Plates containing twenty-five to 250 colonies were

numbered and recorded as colony forming units (CFU) per gram of sample.

Numbering of Coliform Bacteria: The counts of coliform bacteria were taken on Violet Red Bile Agar (VRB) (Merck, Darmstad, Germany) after incubating the plates aerobically at 37 °C for 24 h (Wehr and Frank, 2004).

Determination of *E. coli* : First gas formation was observed in the samples on Brilliant Green Bile Broth (BGBB) after incubating at 37 °C for 24 h. Samples which formed gas in Durham tubes were inoculated to nutrient broth and incubated aerobically at 37 °C for 24 h. Then, indole and methyl red tests were applied to determine the presence of *E. coli* (Wehr and Frank, 2004).

Enumeration of Yeasts and Moulds: Yeasts and moulds were numbered using Potato Dextrose Agar (PDA) (Merck, Darmstad, Germany) which was acidified with tartaric acid (10 % w/v). One ml tartaric acid was used per 100 ml PDA and tartaric acid was added to PDA just before pouring. The inoculated plates were incubated aerobically at 25 °C for 5-7 d (Wehr and Frank, 2004).

Enumeration of total Staphylococci: Total staphylococci were counted on MSA (Mannitol Salt Agar) after incubating the plates aerobically at 37 °C for 24 h (Wehr and Frank, 2004).

2.2.3. Statistical Analysis

The data were analyzed using SPSS. The Significance of the differences between means was evaluated by Duncan's Multiple Range Test considering $p < 0.01$ as significant.

3. RESULTS AND DISCUSSION

In Table 1, total solids, fat, pH, acidity and peroxide values of kaymak samples are presented. As is shown, important differences were found in total solids, fat, pH and acidity values among kaymak samples. No peroxide value was obtained in any sample. These properties especially depend on the quality of the raw milk and cream along with processing conditions. Similar findings on total solids, fat and acidity ratios and pH values in kaymak were also observed by Çon *et al.* (2000), Öksüz *et al.* (2000). Seçkin *et al.* (2005) also found 60% and 65% fat content in commercial kaymak samples.

The highest levels of both total solids and fat contents were obtained in kaymak sample 3. Fat contents were in the range of 63.00% and 73.75% (Table 1). According to Turkish Food Codex (2003), kaymak should have a min of 60% fat and the fat contents of our samples were higher than this limit.

Acidity was higher in samples 1 and 5 than those found in the others. Similarly, pH values were lower in samples 1 and 5. There is no limitation for acidity of kaymak in the Turkish Food Codex (2003). According to the Turkish Standart Institute (1975), the lactic acid percent should not be higher than

0.225% in sweet creams, which is the raw material for kaymak.

The microbiological characteristics of the kaymak samples are summarized in Table 2. Counts of coliform bacteria, total staphylococci and yeast and moulds were between 0-3.38, 0-6.86 and 3.88-7.53 log cfu/g, respectively. *E. coli* was detected only in one sample. Differences between the log counts of coliform, staphylococcus and yeast and moulds of the kaymak samples were statistically significant ($p < 0.01$). The results are in agreement with those reported on commercial kaymak samples obtained from different regions of Turkey by Yılsay and Bayazit (2002) and Çon et al. (2000).

Coliforms and staphylococci were not detected in samples 2 and 4. Similarly, the count of yeast and moulds was also lower in samples 2 and 4. Sample 3, contained the highest count of coliform, had *E. coli*. This finding was also observed by Yılsay and Bayazit (2002).

All samples were above the limits established by Turkish Food Codex (2003) for yeasts and moulds. According to Turkish Food Codex (2003), counts of

yeast and mould should be ≤ 3 log cfu per gram of kaymak. Samples 1, 3 and 5 contained higher counts of total coliform and staphylococcus than the mentioned limits. In terms of *E. coli*, all samples were in compliance to the Turkish Food Codex, except sample 3.

On the whole, the results indicated that the chemical properties of commercial kaymak samples are acceptable according to Turkish Food Codex (2003). However, the microbial load of most the samples indicates a poor hygienic quality of kaymak, probably due to contamination during the manufacturing process and / or further handling procedures.

In order to improve the safety of the products good manufacturing practices (GMP) including the application of HACCP will have to be introduced to kaymak producing plants. Products similar to kaymak are produced in other parts of the world where the manufacturing process and product quality may vary considerably. As majorities of these traditional products have not been sufficiently studied, more research should be conducted.

Table 1
Total solids, fat, pH and acidity values in kaymak samples*

Sample No	Total Solids (%)	Fat (%)	pH	Acidity**	Peroxide value
1	68.43±0.04 ^c	64.00±0.71 ^c	6.21±0.14 ^c	0.13±0.03 ^b	ND
2	74.00±0.99 ^b	68.00±0.71 ^b	6.90±0.00 ^b	0.09±0.01 ^c	ND
3	77.55±0.21 ^a	73.75±0.35 ^a	6.88±0.04 ^b	0.10±0.01 ^{bc}	ND
4	67.80±0.42 ^c	64.50±0.70 ^c	7.20±0.04 ^a	0.08±0.01 ^c	ND
5	68.30±0.99 ^c	63.00±0.28 ^c	6.20±0.21 ^c	0.20±0.02 ^a	ND

^{a-d}Means in the same column with different letters show significant differences ($p < 0.01$)

*Values are expressed as mean ± Standard deviation

**Acidity are expressed as lactic acid (%)

ND: non determined

Table 2
Counts of Coliform, Staphylococcus and Yeast and mould in kaymak samples*

Sample No	Coliform (log cfu/g)	Staphylococcus (log cfu/g)	Yeast and mould (log cfu/g)	<i>E. coli</i>
1	2.38±0.23 ^b	6.86±0.04 ^a	7.53±0.01 ^a	–
2	ND	ND	5.59±0.07 ^d	–
3	3.38±0.02 ^a	4.72±0.00 ^b	7.15±0.03 ^b	+
4	ND	ND	3.88±0.02 ^e	–
5	1.48±0.20 ^c	4.48±0.03 ^c	6.12±0.06 ^c	–

^{a-e}Means in the same column with different letters show significant differences ($p < 0.01$)

*Values are expressed as mean ± Standard deviation

ND: non determined

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