



## DETERMINATION OF MICROBIOLOGICAL QUALITY OF WHITE CHEESES MARKETED IN AFYONKARAHISAR

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### ABSTRACT

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Cheese is a dairy product with a high nutritional value, a unique flavor, aroma, a long shelf life, and a very different variety. Cheese may be contaminated with harmful microorganisms which may pose a risk to public health during the raw material procurement and production stages. This study investigated the microbiological quality of 60 white cheese samples, marketed in Afyonkarahisar province. The mean levels of total mesophilic aerobic bacteria, *Enterobacteriaceae*, coliform, *Escherichia coli*, coagulase-positive staphylococci, and yeast-mold were determined as  $2,1 \times 10^5$ ,  $1,4 \times 10^4$ ,  $2,1 \times 10^3$ ,  $4,5 \times 10^2$ ,  $4,1 \times 10^2$  and  $3,8 \times 10^3$  CFU/g, respectively. Also, *Escherichia coli* was found in 10% (6/60) of the samples between the level of  $10^2$ - $10^5$ . Consequently, the microbiological quality was found to be insufficient in some of the samples examined. Therefore, it is recommended to take necessary hygienic measures in raw material supply. In addition, necessary precautions should be taken in all stages of cheese production and attention should be paid to the personnel and equipment hygiene.

**Contribution/Originality:** This study investigated the microbiological quality of 60 white cheese samples, marketed in Afyonkarahisar province.

### 1. INTRODUCTION

Animal-origin food products play an important role regarding the balanced and adequate nutrition of people (Kirdar, 2001). Milk and milk products are among the important foods of animal origin. Cheeses are important in nutrition since their structure comprises proteins, fats, vitamins and minerals (Fox & Mcsweeney, 2004). Approximately, 4000 types of cheese are available in the world, over 110 types of which can be found in our country (Kamber & Terzi, 2007). White cheese assumes the first place between the produced and consumed cheese assortment in our country. According to Turkish Food Codex, white cheese 'with proper processing technique and using rennet enzyme coagulation of milk and the curd which is made from coagulated milk, could be produced in fresh and mature form in the production stage, which shows variety-specific characteristics (Turkish Food Codex, 2015). On the other hand, milk and dairy products are also important sources of foodborne infections and intoxications, in addition to their positive properties, cheese obtained from raw milk may pose a great risk to public health (Mead et al., 1999). Bacterial contamination of raw milk can be caused by different sources such as air, dairy

equipment, animal feeds, soil, and feces (Coorevits et al., 2008). In addition, the use of raw milk with low microbiological quality for the production of cheese, the lack of effective pasteurization, the production of milk products in inappropriate conditions and its open sale can pose significant risks to public health (Akkaya, ALIŞARLI, Recep, & Telli, 2007; Yücel & Anıl, 2011). Furthermore, microorganisms can cause changes in the structure of cheese and may lead to food poisoning as a result of its consumption (Kaynar, 2011). In this study, certain microbiological parameters were investigated in 60 white cheese samples that are sold in the district markets of the Afyonkarahisar province.

## 2. MATERIAL AND METHOD

### 2.1. Material

In this study, the 60 white cheese samples were used as a material that was bought from the district markets of Afyonkarahisar province.

### 2.2. Method

The 10 grams of cheese samples were added to 90 ml sterile peptone water and these cheese samples were homogenized for analysis. Then, serial dilutions were prepared from 1:10 diluted sample and sowing was done from the medium.

In the samples, total aerobic mesophilic bacteria count (ISO., 2003) the count of *Enterobacteriaceae* (ISO, 1993) the coliform count (ISO.. 1991) *E. coli* count (ISO... 2001) coagulase-positive staphylococcus (ISO... 1999) and yeast/mold count (ISO.... 2008) were applied.

## 3. RESULTS AND DISCUSSION

In this study, the microbiological analysis findings of cheese samples are given in Table 1.

Table-1. Result of microbiological analysis of white cheese.

Sample	CFU/g	Total Aerobic Mesophilic Bacteria n(%)	<i>Enterobacteriaceae</i> n(%)	Coliform Bacteria n (%)	<i>E. coli</i> n(%)	Coagulase (+) Staphylococci n(%)	Yeast/Mould n(%)
White Cheese (n:60)	<10 <sup>2</sup>	-	38 (63,33)	41 (68,33)	54 (90,00)	52 (86,67)	35 (58,33)
	≥10 <sup>2</sup> -<10 <sup>3</sup>	5 (8,33)	1 (1,67)	5 (8,33)	1 (1,67)	6 (10,00)	8 (13,33)
	≥10 <sup>3</sup> -<10 <sup>4</sup>	30 (50,00)	11 (18,33)	10 (16,67)	4 (6,67)	(0,00)	12 (20,00)
	≥10 <sup>4</sup> -<10 <sup>5</sup>	17 (28,33)	8 (13,33)	4 (6,67)	1 (1,67)	2 (3,33)	4 (6,67)
	≥10 <sup>5</sup> -<10 <sup>6</sup>	6 (10,00)	2 (3,33)	-	-	-	1 (1,67)
	≥10 <sup>6</sup> -<10 <sup>7</sup>	2 (3,33)	-	-	-	-	-
Mean		2,1x10 <sup>5</sup>	1,4x10 <sup>4</sup>	2,1x10 <sup>3</sup>	4,5x10 <sup>2</sup>	4,1x10 <sup>2</sup>	3,8x10 <sup>3</sup>
Minimum		4,0X10 <sup>2</sup>	<10 <sup>2</sup>	<10 <sup>2</sup>	<10 <sup>2</sup>	<10 <sup>2</sup>	<10 <sup>2</sup>
Maximum		6,0X10 <sup>6</sup>	3,3x10 <sup>5</sup>	3,0X10 <sup>4</sup>	2,0X10 <sup>4</sup>	1,2X10 <sup>4</sup>	1,2X10 <sup>5</sup>

The total aerobic mesophilic bacteria count in white cheese samples were found between 4.0X10<sup>2</sup> and 6.0X10<sup>6</sup> CFU/g levels (mean: 2.1x10<sup>5</sup> CFU/g). Tekinşen and Elmali (2006) reported that the total aerobic mesophilic bacteria count in fresh civil cheese as 7.86 log CFU/g. Kursun, Güner, Kırdar, and Akcan (2008) have reported that for 100 white cheese samples which bought from Burdur province district markets, TAMB count was found to be between 1.0x10<sup>6</sup> - 4.6x10<sup>9</sup> CFU/g, but 70% of samples the TAMB count was determined between 10<sup>7</sup> and 10<sup>8</sup> CFU/g. Also in study of Onganer and Kirbağ (2009) the precipitate cheese samples (n: 30) TAMB, total number were detected 8.49 ± 0.79 log CFU/g; however, in the study of Oksüztepe, Padir, Dikici, and İlhak (2009) in kashar cheese samples (n: 50), the TAMB average counts were found to be 1.07x10<sup>7</sup> CFU/g. Our finding (4,0x10<sup>2</sup>-6,0x10<sup>6</sup> CFU/g) are low compared to the other researcher's results. The number of TAMB, which is an indicator of

hygienic contamination in food production, can be increased under the unhygienic production process and unsuitable storage conditions.

*Enterobacteriaceae* is a large family of gram-negative bacteria such as *Escherichia coli*, *Klebsiella*, *Salmonella*, *Shigella* and *Yersinia pestis*. These bacteria may cause bacteremia and endocarditis; and also these bacteria are the cause of the diseases like a respiratory tract, skin, soft tissues, urinary tract, joint, bone, eye and CNS infections (Posse, Dios, & Scully, 2017). In this study, the number of *Enterobacteriaceae* was between  $10^2$ - $10^6$  CFU/g in 34.99% samples (mean:  $1.4 \times 10^4$  CFU/g) and high ( $10^5$ - $10^6$  CFU/g) in two samples (2.33%). El Zubeir, Sanna, and Sanaa (2006) have determined the number of *Enterobacteriaceae* in 3 different regions as  $2 \times 10^4$ ,  $8 \times 10^4$  and  $1.3 \times 10^4$  CFU/g respectively in Sudan. Kara and Akkaya (2015) reported the *Enterobacteriaceae* number in tulum cheeses which they bought in Afyonkarahisar were detected high count 5.77 log CFU/g and an average count is 2.19 log CFU/g. Result of this study similar to El Zubeir et al. (2006) but the different than the study of Kara and Akkaya (2015). Also, differences can be caused by the production conditions of cheeses and different applications in technology.

Coliform bacteria cause changes in taste and aroma, especially in cheese they may cause premature swelling (Ellner, 2002). The coliform bacteria count was detected  $10^2$ - $10^5$  CFU/g in cheese samples (31.67%), and the average coliform count was found as  $2,1 \times 10^3$  CFU/g. In a study of Tekinşen and Elmali (2006) coliform bacteria counts were reported as 1.00-3.40 log CFU/g and average 2.75 log CFU/g in civil cheeses. Also, the Coliform bacteria count was detected  $10^3$  CFU/g in 14.3% samples. Oksüztepe et al. (2009) reported that average coliform bacteria count were detected  $5.2 \times 10^1$  CFU/g in 50 fresh cheddar cheese. Vural, Erkan, and Güran (2010) reported that coliform bacteria counts were detected average  $3.6 \times 10^4$  CFU/g in 105 pieces of knitted cheeses. Results of this study were found higher than Tekinşen and Elmali (2006); Oksüztepe et al. (2009)'s study, and were lower than in Vural et al. (2010). Coliform microorganisms are considered as the main indicator of hygiene in food and water analysis (Gökten & Tunçel, 2010). *E. coli* is an important indicator of fecal pollution regarding food and water hygiene (Percival & Williams, 2014). The *E. coli* count was detected as  $10^2$ - $10^5$  CFU/g in 6 (10.01%) cheese samples in our study. Kaynar., Kaynar, and Koçak (2005) detected the number of *E. coli* as (18/30)  $7.3 \times 10^1$ -  $2.4 \times 10^2$  kob/g in white cheese samples, Tekinşen and Elmali (2006) detected *E. coli* as (26/35) 1.75 log CFU/g in civil cheese samples, (Vural et al., 2010) detected *E. coli* counts as  $1.0 \times 10^1$ - $4.9 \times 10^4$  CFU/g in knitting cheese. In this study, the *E. coli* level was found higher than the above mentioned studies. The hygienic quality and production conditions of the raw material may effect this situation. *E. coli* can also be found in soft, semi-hard and fresh cheeses. Also, depending on cheese type, *E. coli* can survive for a long time even though there is a decreased number during the ripening period (Cağlar, Türkoğlu, Ceylan, & Dayısoylu, 1998).

The coagulase-positive Staphylococci were found  $10^2$ - $10^3$  CFU/g in 6 samples (10.00%) and  $10^4$ - $10^5$  CFU/g in 2(3.33%) samples. Kursun et al. (2008) reported that the micrococci and staphylococci counts were found  $10^3$ - $10^6$  CFU/g in all of the white cheese samples. Also, they reported that they found coagulase-positive staphylococci in 44% of these samples. Oksüztepe et al. (2009) found that the count of micrococcus and staphylococcus as  $1.4 \times 10^2$  CFU/g in cheddar cheeses. The results of the present study were found lower than the study results of Kursun et al. (2008) and higher than the study result of Oksüztepe et al. (2009). In addition, according to the microbiological criteria of the Turkish Food Codex, the coagulase-positive Staphylococci limit was reported as  $10^3$  CFU/g in cheeses (Turkish Food Codex., 2011). Only 2 (3.33%) samples have found higher than standard limits of Turkish Food Codex,

In the dairy products, the yeasts could develop in low water activity, high salt concentration, low pH value and low temperature (Jakobsen & Narvhus, 1996). The yeasts and molds can cause economic and sensory problems in some special cheese types (Torkar & Teger, 2008). In this study, 25 (41.67%) of cheese samples were found to be contaminated with yeast/mold at the level of  $10^2$ - $10^6$  CFU/g and yeast/ mold average counts were determined as  $3.8 \times 10^3$  CFU/g. However, the high level of yeast-mold contamination ( $10^5$ - $10^6$  CFU/g) was detected in one of the cheese samples (1.67%).

The yeast/ mold counts have been reported average  $3.75 \times 10^7$  CFU/g in cheese samples (Pekel & Korukluoglu, 2006),  $2.0 \times 10^6$  CFU/g in çivil cheese samples (Sengül, 2006) and  $5.82 \times 10^1$  CFU/g in cheddar cheese samples (Oksüztepe et al., 2009). The differences in the levels of yeast and mold can result from technological differences in the production process and storage conditions.

#### 4. CONCLUSION

Cheese has an important place among animal origin products due to its high nutritive properties. However, cheese can contain high rates of bacteria that possess a risk to public health due to unsuitable raw material, unhygienic production and storage conditions. Therefore, it is recommended to take necessary hygienic measures in raw material supply, production, storage and transportation stages in cheese production, to inform producers and consumers, to control the sale of open cheese and to perform periodic inspections.

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