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Physico-Chemical and Microbiological Properties of a Traditional Turkey Cheese Tomas/Serto (Dorak)

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Abstract: Turkey is a country producing various kinds of cheese. Tomas cheese is a kind of cheese that is still traditionally produced, and it is not widely-known. In this study, the characteristic properties of Tomas cheese, a local product that is extensively consumed in the city of Tunceli and its environs, have been examined. For this purpose, samples from cheese varieties currently on sale in the cities of Tunceli and Elazığ have been taken, and some of their physico-chemical and microbiological properties have been determined. The results of physico-chemical analysis showed that the average moisture rate of the samples was 53.24%, average ash rate 4.24%, average dry matter 46.76%, average acidity rate in terms of lactic acid 1.08%, average salt rate 2.93%, average fat rate 17.66%, average fat-free dry matter rate 25.56% and average pH value 4.67. The microbiological analysis data showed that the average values for the total aerobic mesophyll bacteria (TAMB) was 7 $\log_{10}$ kob/g, 2.3 $\log_{10}$ kob/g for coliform, 4.6 $\log_{10}$ kob/g for yeast, 5.5 $\log_{10}$ kob/g for mold, 6.8 $\log_{10}$ kob/g for *Lactococcus* spp., and 6.1 $\log_{10}$ kob/g for *Lactobacillus* spp.. The results show the high variation among samples, proving that there has not been a standard production procedure. It has been established that the hygienic condition of the product changes according to the production process, and the probability for cross contamination is high. A large number of studies need to be carried out for this kind of traditional food items, due to lack of enough literature data in this paper.

Key words: Tomas/Serto (Dorak) cheese, traditional food, physico-chemical and microbiological properties.

1. Introduction

Cheese, which is an animal food, is a dairy product rich in proteins, fat, minerals and vitamins along with its rich calcium and phosphorus contents, and it has a very high nutritional value. The fact that it is easy to digest and its proteins contain all the basic aminoacids increases its importance in terms of nutrition and health [1]. Due to its importance, many varieties of cheese with different tastes and aromas are produced in Turkey and the world. Local varieties of cheese in many parts of Turkey are widely produced in usually family-run businesses and primitive dairy farms using traditional methods [2].

Tomas cheese is a local product that has a very important place in the city of Tunceli and its environs. It is also called “Serto” or “Dorak” in Tunceli. It is mostly made of sheep or goat milk, and its production usually starts in the months of May-June and continues until the months of September-October [3].

In accordance with the traditional production process, yoghurt is made from pasteurized milk first, and then the yoghurt is turned into ayran by adding water. Butter is produced by subjecting ayran to churning process. The remaining fat-free ayran is heated to boiling temperature to make çökelek (skim-milk cheese). After the heating process, ayran is curdled and fat-free çökelek is obtained. Then, çökelek is cooled, drained and filled into skin bags. Enough amounts of whole-fat milk, milk cream and yoghurt are added into the skin bag, and the mixture is mixed thoroughly at least once a week. This procedure is repeated for at least 3-4 months. Then, cheese is filled into skin bags and is left to mature in a cool place. Tomas cheese acquires its distinctive taste and aroma as a result of the physical, chemical and microbiological changes that occur during this

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maturing process [3]. In short, while the fat in yoghurt, which is used to make the cheese, is removed in the beginning, and fat is gradually increased during the maturing process of the cheese.

Researches show that, unlike other cheese varieties, Tomas cheese of Tunceli is made by fattening the cheese with yoghurt and milk cream. It also differs from the cheese made in other cities in terms of its ingredients and taste, because of both the milk used and the production technique. A standard production method specified for Tomas cheese does not exist in Turkey. Therefore, products of standard quality can not be produced. The fact that a control mechanism does not exist because it is produced in small family-run businesses, causes a low quality and reliability in cheese [4]. While a number of researches have been made on other cheese varieties, there are very few researches on Tomas cheese which is the subject of this research. Therefore, it is essential to increase the number of researches on Tomas cheese and make it possible for the production of healthy products of a standard quality. Thus, this study aimed to collect samples of Tomas/Serto (Dorak) cheese currently in the market in the cities of Tunceli and Elazığ and determine some of their physico-chemical and microbiological properties.

2. Materials and Methods

Samples of Tomas/Serto (Dorak) cheese were collected from the market in the cities of Tunceli and Elazığ, then put in sterilized glass jars and some physico-chemical and microbiological analyses have been conducted. Each analysis has been conducted by taking two samples. Samples have been preserved in refrigerator conditions (4 °C).

2.1 Microbiological Analyses

A 10 g cheese sample and a 90 mL sterile 1/4 ringer solution (Merck) were put into a stomacher bag and homogenized for 2 min in the blender under aseptic conditions. From this 10^{-1} dilution, dilutions of 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} and 10^{-8} were prepared in the tubes that contained 9 mL 1/4 ringer solution [5].

2.1.1 Total Aerobic Mesophyll Bacteria (TAMB)

The number of TAMB was determined in plate count agar (PCA) medium with pour plate technique. The planted petris were incubated at 30 ± 0.1 °C for 48 h [6].

2.1.2 Enumeration of Yeast and Mold

Planting was done in dichloran rose-bengal chloramphenicol (DRBC) agar with surface spreading method and incubated at 25 ± 1 °C for 5 d in an aerob medium [7]. The bright and slightly disperse colonies that are round, oval or lemon-shaped were assumed to be yeast, and those that formed micella in various forms were considered to be mould [8].

2.1.3 Enumeration of Coliforms

It was performed in violet red bile (VRB) agar using the pour plate method, and after 24 ± 2 h of incubation at 32 ± 1 °C, dark red colonies with a diameter of 0.5 mm were assumed to be coliform group [9].

2.1.4 Enumeration of *Lactococcus* spp.

It was performed by using M17 agar, and was determined by incubating it in an anaerob medium at 30 °C for 48 h [10, 11].

2.1.5 Enumeration of *Lactobacillus* spp.

It was determined in De Man Rogosa and Sharpe (MRS) agar at 35 ± 1 °C by incubating it in an anaerob medium [12].

2.2 Chemical Analysis

2.2.1 Determination of Dry Matter

Certain amount of cheese was dried at a temperature of 105 °C in a drying stove until its weight was unchanged. The percentage of dry matter was calculated gravimetrically from the difference in weight [13].

2.2.2 Humidity Rate

The humidity rate was calculated by subtracting the amount of dry matter.

2.2.3 Fat-Free Dry Matter Rate

It was determined by subtracting the fat rate from dry matter rate.

2.2.4 Titratable Acidity

It was performed according to alkali titration method, and the results were expressed in terms of lactic acid percentage [14].

2.2.5 pH

The 10 g of grated cheese and 10 mL of pure water were mixed and homogenized, and then the pH values of the homogenized mixture were determined with a digital pH meter.

2.2.6 Fat Amount

It was determined with Gerber method by using Van-Gulik butyrometer [15].

2.2.7 Salt Rate

Salt rates were determined with Mohrtitration method according to the result of titration of the prepared sample with calibrated 0.1 N $AgNO_3$ [16].

2.2.8 Ash Rate

It was determined with gravimetric method according to the description by Yöney [17]. A certain amount of cheese is dried in porcelain containers, and after it was burned in an ash stove at a temperature of 550 °C, the percentage of ash amount was calculated.

3. Results and Discussion

In this study, physico-chemical and microbiological analyses were conducted in order to identify some of characteristic properties of Tomas cheese collected from the cities of Elazığ and Tunceli, where it is consumed most in Turkey (Tables 1 and 2). Since it is a local product, there is the limited number of researches on Tomas or (Serto or Dorak) cheese as review of literature in doing this paper. Also, there are still not any standards regarding Tomas cheese. Therefore, standards for tulum cheese (TS 3001) issued by Turkish Standards Institute (TSE) were used in assessing and interpreting the results of the analyses obtained in the present research due to the similarity of Tomas cheese to tulum cheese [18].

3.1 Microbiological Results

TAMB value in Serto cheese varied between 6.0-7.7 $\log_{10}$ kob/g with the average 7 $\log_{10}$ kob/g. The number of TAMB plays an important role as an indicator in determining the microbiological quality of food [19]. As seen in Table 1, the number of the total microorganisms detected in the samples is quite high. In Ref. [20], the lowest numerical value of the total living bacteria in Thomas cheese was found to be 12×10^5/g and the highest 237×10^6/g.

In the present research, the lowest total number of yeast and mould was 3 $\log_{10}$ kob/g and the highest 6.2 $\log_{10}$ kob/g. The average values were 4.6 $\log_{10}$ kob/g and 5.5 $\log_{10}$ kob/g for yeast and mould, respectively. The high numbers of yeast and mould in the research indicate that hygiene was not observed in the production of cheese. Also, the conditions of the environment, packing material and the way of cheese pressed into the packing material are also factors that influence the formation of mould in cheese [4]. Some mould types endanger human health by growing on the food item, where they inhabit and secreting mycotoxins. For these reasons, the total number of yeast and mould is an important criterion for food products [1].

The examined cheese samples contain various degrees of coliform bacteria (Table 1). Coliform microorganisms are indicators of bad sanitary conditions, insufficient or wrong pasteurization practices, repetition of contamination after cooking or pasteurization [21, 22].

The value of *Lactococcus* spp. microorganisms in Tomas cheese varied between 4.4-7.4 $\log_{10}$ kob/g with the average 6.8 $\log_{10}$ kob/g. While the value of *Lactobacillus* spp. microorganisms in the examined cheese samples varied between 4.0-6.7 $\log_{10}$ kob/g with the average 6.1 $\log_{10}$ kob/g.

Table 1 The results of the microbiological analysis of Tomas (Serto or Dorak) cheese.

Bacteria	Numbers of microorganism (log_{10} kob/g)		
	Minimum	Maximum	Average
Total aerobic mesophilic bacteria (TAMB)	6.0	7.7	7.0
Yeast	4.2	6.2	4.6
Mold	3.0	5.0	5.5
Coliform	< 3.0	3.0	2.3
Lactococcus spp.	4.4	7.4	6.8
Lactobacillus spp.	4.0	6.7	6.1

Table 2 The results of the physico-chemical analysis of Tomas (Serto or Dorak) cheese.

Physico-chemical properties	Minimum	Maximum	Average
pH	3.84	5.05	4.67
Titratable acidity (% lactic acid)	0.86	1.30	1.08
Dry matter (%)	44.19	51.11	46.76
Moisture (%)	48.89	55.81	53.24
Non-fat dry matter (%)	20.12	42.16	25.56
Fat (%)	10.00	27.00	17.66
Salt rate (%)	2.11	3.51	2.93
Ash rate (%)	1.44	5.58	4.24

3.2 Physico-Chemical Properties

The dry matter rate of the collected samples in the present study showed a variation between 44.19% and 51.11%, and the average value was found to be 46.76% (Table 2). As the amount of dry matter increases in cheese, meaning the components other than water, i.e., nutritional components, its nutritional value increases, too [23]. The amount of dry matter may show variation depending on such factors as the way cheese made, its type, its degree of maturity, the quality of milk, etc..

It was stated that the rate of humidity must be 40% at most according to Tulum cheese standards (TS 3001). In the light of this, the required amount of dry matter should be 60%, but the amount of dry matter in the samples observed in this study was found to be below 60%. Therefore, samples did not comply with TS 3001 standards. Doğan and Tükel [19] showed that the rate of dry matter in Thomas cheese was found to be 35.54% at least, 62-33% at most and 47.49% on average.

The rate of humidity in Tomas cheese varied between 48.89% and 55.81% with the average 53.24% (Table 2). Doğan and Tükel [19] found the rate of humidity in Tomas cheese to be varying between 37.54% and 64.46% with 52.51% on average. The data in this study are similar to the results obtained by Doğan and Tükel [19]. These values always in a wide interval are the most important evidence showing lack of a standard production of these cheeses.

The fat rate in the examined samples showed a wide range of variation between 10% and 27%, and the average value was found to be 17.66% (Table 2). The cheeses were made from different milk sources and different processing methods, so the fat rates were different. Doğan and Tükel [19] determined that the fat rate in Tomas cheese varied between 5% and 35.50% and the average value was 18.13%.

Titration acidity (in terms of % lactic acid) in Tomas cheese varied between 0.86% and 1.3%, and the average value was 1.08% (Table 2). According to TS 3001, the Tulum cheese with lactic acid of 1.5% at most is evaluated as the first class and 2.5% as the second class. In the light of this, the values of lactic acid in the samples below 1.5% were determined to be the first class cheese.

The pH values in the examined samples varied between 3.84 and 5.05, and the average value was

4.67 (Table 2). It was observed by Doğan and Tükel [19] that the acidity in Tomas cheese varied between 64° and 184° in terms of Soxhlet-Henkel (°SH) and the average value was 102.5°.

The salt values in the examined samples varied between 2.11% and 3.51% and the average value was found to be 2.93% (Table 2). Salt content regulates the aroma, color and composition, enables the removal of excess water by adjusting the amount of humidity, regulates maturity by controlling the starter bacteria and the activities of some unwanted microorganisms, and increases the durability of the cheese [1, 19]. Doğan and Tükel [19] measured the salt rate in Tomas cheese of 1.87% at least, 4.68% at most and 3.05% on average.

The ash values were seen to vary between 1.44% and 5.58% and the average value was determined to be 4.24% (Table 2). Doğan and Tükel [19] found that ash rate varied between 2.08% and 5.00% and the average value was 3.42%.

4. Conclusions

Microflora values and physico-chemical values obtained in the present study and similar studies were observed to be quite different from each other. There is a wide gap between the maximum and minimum values. The difference observed in these results is thought to be lack of a standard production method for local products and that families employ different methods of production under different conditions. This, in turn, influences the quality and reliability of cheese negatively and causes economic losses. Therefore, production technologies of local products, such as Tomas (Serto or Dorak) cheese, must be modernized, proper packaging material must be chosen and care must be taken to prevent subsequent contamination and carry out production under hygienic conditions to obtain products of a standard quality. Control mechanism must be run effectively. Further scientific studies are needed in this area.

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