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SOME PHYSICOCHEMICAL AND MICROBIOLOGICAL PROPERTIES OF TRADITIONAL HELETE CHEESE

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Absract

Helete cheese is a type of cheese produced by boiling the curd and is called finger cheese and squeeze cheese in the Southeastern Anatolia Region. Helete cheese is produced from full-fat raw goat's milk and is usually consumed after ripening. In this study, cheese samples were obtained from 12 different cheese producers traditionally produced in the Helete, Kahramanmaraş in August and September. Some chemical and microbiological properties and mineral content of Helete cheese were investigated. Dry matter, fat, protein, ash, pH, acidity, total mesophilic-aerobic bacteria, total mold, yeast, *Staphylococcus aureus*, total coliform and *Escherichia coli* and calcium, magnesium, zinc, phosphorus and potassium content were investigated in cheese samples. At the end of the research, it was determined that Helete cheese was in accordance with the standards specified in the Turkish Food Codex and Helete cheese was classified as semi-hard and full fat cheese.

Key Words: Helete cheese, traditional food, microbiological properties

1. Introduction

Cheese has always been a sought-after food and emerged with two simultaneous developments. The first is that during the Neolithic period, as people practiced intensive agriculture, the soil became infertile and sheep and goats were more engaged in farming and milk production increased. The second was the discovery of pottery and people started to store milk (Kindstedt, 2012). In addition, during this period, the milk that was not consumed was stored in tulum made from freshly slaughtered sheep tripe and the story of cheese began with the milk slaughtered here (Kamber, 2006). Cheese has gained an important place in the history and economy of humanity with its durable and rich nutritional content and has enabled the spread of civilization to the west. After Asia and Europe, it started to be made in the British Isles and America (Tekinşen and Tekinşen, 2005).

In our country, cheese production has not been fully mechanized except for large enterprises. For this reason, people's personal experience and skills are at the forefront and the chemical compositions of our cheeses vary in a very wide range. The reasons for this are the lack of certain standardization in production and the lack of widespread use of pasteurized milk and starter culture (Hayaloğlu, 2008). It has been determined that 15% of the total milk produced is used in modern enterprises, 40% in dairy farms and the remaining amount is used in the production of different dairy products in family enterprises, hygienic conditions are not taken into consideration in the production of local cheese, traditional methods are used and therefore a standard product could not be obtained (Tekinşen and Tekinşen, 2005).

More than 200 different types of cheese are produced in different regions of Turkey and this number can increase even more with the addition of local production culture (Demirgül and Sağdıç, 2018). Maraş (Sıkma) cheese and similar local cheeses are traditionally produced in some provinces in the Eastern Mediterranean and Southeastern Anatolia. The production steps and chemical composition of this cheese, called Parmak (Sıkma) cheese produced in Kahramanmaraş, are similar to some other cheeses. These include Nabulsi and braided-weave in Arab countries, Kasseri and kalkaval in Balkan countries, halloumi in Cyprus, some Italian cheeses and Armavir cheese produced in the Western Caucasus. It is similar to hand cheese, which is made from low-fat / low-fat milk, usually with churning, and is known under different names in different countries (Tekinşen, 2000). In addition, Antep cheese is similar to local cheeses such as Adıyaman, Hatay, Malatya and Mersin boiled cheese, Urfa cheese and Diyarbakır braided cheese, especially in terms of the boiling stage of the curd and production technique (Tekinsen, 2001; Ardıç, 2003).

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These cheeses which are traditionally produced in our country by boiling the curd in water and are also reported as melting (boiled) cheese by some researchers. It is thought that the consumption of these cheeses produced especially in Eastern Mediterranean and Southeastern Anatolia has a high rate (Tekinşen, 2000). Sheep and goat milk is generally used in the production of Maraş cheese and it is generally consumed after ripening. Maraş (squeezing) cheese has a distinctive and salty taste and is homogeneous, elastic, firm, does not crumble when cut and has a good white color (Tekinşen and Tekinşen, 2005).

Helete cheese is a type of cheese produced by boiling the curd and is called finger cheese and squeeze cheese in the Southeastern Anatolia Region. Helete cheese is produced from full-fat raw goat's milk and is usually consumed after ripening. It is made in March-September. Helete is a town surrounded by mountains and high plateaus and people here are generally engaged in animal husbandry. Most of them are goat breeders and Helete cheese is made with the milk produced.

In this study, some chemical, microbiological properties and mineral content of Helete cheese were investigated. The production flow chart of Helete cheese is shown in Figure 1 (Hoplamaz, 2019).

Figure 1. Helete cheese production flow chart

Raw Goat Milk (approx. 35°C)
Straining into Copper Boilers
Rennet Supplement (0.010% diluted about ten times with cold water)
Clot Cutting
Placing in Cloth Bags
Printing Application (Approx. 10 hours) (printing at 1:5 weight of the amount of milk used in production)
Interrupting Telemetry
Boiling the curd with whey (80-90°C, 5 minutes)
Shaping by Hand Squeezing
Cooling and Salting (1% rate)
Brining (Next Day)

2. Materials and Methods

2.1. Material

Cheese samples were obtained from 12 different cheese producers traditionally produced in the Helete, Kahramanmaraş in August and September. The samples were randomly selected from different batches, packaged and labeled to represent the whole batch and brought to the laboratory in insulated containers and kept at refrigerator temperature (+4°C) until analysis.

2.2. Method

The analyses of the study were carried out at Kahramanmaraş Sütçü İmam University, Faculty of Engineering-Architecture-Food Engineering laboratories. Dry matter (Anonymous, 2006), fat (TS EN ISO 5534, Anonymous, 2015b), protein (Anonymous, 2014a), acidity (Anonymous, 2013), pH (Anonymous, 2013), ash (Anonymous, 2006), and Total Aerobic Mesophilic Bacteria (TAMB) count (Anonymous, 2014b), total yeast and mold (Anonymous, 2014c), total coliform and *E. coli* (Anonymous, 2010, Anonymous 2015c), *S. aureus* (Anonymous, 2023). Mineral matter analyses were determined by ICP-OES (Inductively Coupled Plasma-Optic Emission Spectroscopy) in the laboratories of the University-Industry-Public Cooperation Development Center (ÜSKİM) using the method specified in (NMKL 186) and the results were given in mg/kg (Anonymous, 2007).

2.3. Statistical Analysis

Analyses were carried out at least three parallel and IBM SPSS Statistic 23 package program was used for statistical evaluation of the data. The data were subjected to one-way analysis of variance (ANOVA) and significant differences were determined by Duncan multiple comparisons.

3. Results and Discussion

3.1. Chemical Analysis Results

The results of chemical analysis of Helete cheeses are given in Table 1.

There was a significant difference between the average dry matter content of the samples ($p<0.05$). The findings obtained were higher than the values stated by Yalçın et al. (2007), Yener (2012), Kıvcı (2018), Ceylan et al. (2019).

Table 1. Chemical analysis results of Helete cheeses

Sample	Dry matter %	Fat %	Protein %	Ash %	pH	Acidity %
1	63.94±3.39^{bc}	32.50±1.06^{abc}	24.33±1.17^{c}	13.73±1.17b	5.92±0.57^{a}	0.44±0.06^{a}
2	64.60±2.40^{bc}	39.02±0.74^{d}	23.86±1.36^{bc}	9.03±0.04a	5.38±0.42^{a}	0.49±0.10^{ab}
3	55.15±3.18^{ab}	32.70±1.70^{abc}	21.58±0.85^{abc}	10.66±0.48^{ab}	5.50±0.42^{a}	0.46±0.04^{a}
4	67.50±1.41^{c}	35.10±1.27 ^{cd}	28.80±0.71^{d}	12.13±0.47^{ab}	5.72±0.59^{a}	0.54±0.06^{ab}
5	56.30±1.41^{ab}	35.15±0.57^{cd}	20.02±1.03^{a}	11.93±1.46^{ab}	5.85±0.21^{a}	0.60±0.03^{ab}
6	58.37±2.35^{ab}	33.60±1.56^{abc}	23.10±0.42^{abc}	11.66±0.93^{ab}	5.39±0.34^{a}	0.48±0.06^{ab}
7	57.95±4.10^{abc}	34.50±0.71^{bc}	20.54±0.69^{abc}	10.28±0.40^{ab}	5.14±0.08^{a}	0.52±0.03^{ab}
8	52.20±1.84^{a}	30.25±0.71^{a}	20.81±1.12^{abc}	11.63±0.82^{ab}	5.87±0.10^{a}	0.56±0.06^{ab}
9	51.90±2.69^{a}	30.75±1.06^{ab}	20.54±0.79^{abc}	10.60±0.85^{ab}	6.08±0.11^{a}	0.58±0.07^{ab}
10	54.30±2.83^{ab}	31.50±0.71^{abc}	20.67±0.91^{abc}	12.60±0.85^{ab}	6.00±0.14^{a}	1.08±0.11^{c}
11	56.20±2.83^{ab}	32.04±0.41^{abc}	22.90±1.41^{abc}	11.40±0.57^{ab}	5.78±0.99^{a}	0.72±0.03^{ab}
12	58.10±1.47a^{bc}	32.00±0.35^{abc}	20.39±0.55^{ab}	11.90±1.98^{ab}	5.70±0.28^{a}	0.60±0.03^{ab}

A significant difference was found between the average % fat ratios of the samples ($p<0.05$). Our findings were higher than the values reported in the studies of Tekinşen (2005), Yalçın et al. (2007), Yener (2012) and Kıvcı (2018). This difference is thought to be due to the season in which the milk is obtained and economic concerns. When the Turkish Food Codex Communiqué on Cheese was evaluated according to the milk fat content of the cheeses (45% or more fat content in dry matter), Helete cheese samples were found to comply with the definition of full fat cheeses (Anonymous, 2015a).

There was a significant difference between the average moisture content of the samples ($p<0.05$). When evaluated in terms of the maximum moisture value (45%) to be included in the Turkish Food Codex Communiqué on Cheese, 17% of the samples did not overlap (Anonymous, 2015a). Our findings were lower than those of Tekinsen (2005) and Sagun et al. (2001). The changes observed may be due to variability in cheese types, differences in processing techniques, ripening and storage conditions, sampling errors, environmental factors (environmental conditions during cheese production, humidity, temperature).

A significant difference was observed between the average protein content of the samples ($p<0.05$). The findings obtained were lower than the findings of Kıvcı (2018) and Yener (2012). It was found to be higher than the values stated in the study of Atasoy et al. (2003). Öner and Sarıdağ (2019) reported that the amount of protein in cheeses produced from goat milk varied between 7.95% and 16.3%. This suggests that these differences are due to the quality of the milk used.

There was a significant difference between the average ash content of the samples ($p<0.05$). Our findings were higher than the values reported by Yalçın et al. (2007), Yener (2012), Kıvcı (2018) and Aydın and Ardıç (2019). This difference may be due to the quality of the milk, the season in which the milk is obtained, the equipment used and economic concerns.

As a result of the analyses, no statistically significant difference was found between the average pH values of the samples ($p>0.05$). This finding indicates that the ripening process of the samples has not yet been completed. The results of the study were found to be compatible with the values reported in the studies of Yener (2012), Kıvcı (2018) and Aydın and Ardıç (2019). The pH value of Adıyaman cheese was determined as 6.57±0.44 (Ceylan et al., 2019). This value, which was higher than our study, is thought to be due to the difference in production.

A significant difference was found between the average acidity value of the samples ($p<0.05$). Our findings are above the findings of Aydın and Ardıç (2019) and similar to the findings of Yener (2012) and Kıvcı (2018). The acidity in cheeses increases the titration acidity with lactic, acetic, formic and butyric acid formed by the fermentation of lactose by microorganisms (Öner and Sarıdağ, 2019).

3.2. Microbiological Analysis Results

The results of microbiological analysis of Helete cheeses are given in Table 2.

Table 2. Microbiology analysis results (log cfu/g)

Sample	Total mesophilic aerobic bacteria	Total yeast and mold	*S. aureus*
1	6.51±0.22^{d}	3.69±0.16^{b}	3.46±0.37^{bc}
2	6,36±0,24^{d}	2,60±0,26^{a}	4,69±0,38^{ef}
3	4,60±0,26^{a}	3,60±0,44^{b}	3.11±0.12^{b}
4	5.30±0.10^{b}	4.47±0.10^{c}	3.69±0.25^{bcd}
5	5,07±0,08^{b}	4,84±0,07^{cd}	4,60±0,22^{ef}
6	6,36±0,14^{d}	4,47±0,09^{c}	3,11±0,12^{b}
7	5,84±0,09^{c}	5,00±0,10^{d}	3,23±0,12^{b}
8	6,38±0,10^{d}	4,84±0,05^{cd}	4,23±0,07^{de}
9	6,39±0,09^{d}	4,60±0,13^{cd}	5,20±0,26^{f}
10	6,38±0,07^{d}	4,90±0,10^{cd}	4,11±0,12^{cde}
11	6,30±0,05^{d}	4,84±0,09^{cd}	2,00±0,10^{a}
12	6,41±0,06^{d}	4,90±0,10^{cd}	4,95±0,40^{f}

A significant difference was found between the total number of mesophilic aerobic bacteria ($p<0.05$). The results obtained were found to be lower than the total number of aerobic mesophilic bacteria reported in the studies of Tekinşen (2005), Kamber (2005) and Aydın and Ardıç (2019). The total number of viable aerobic mesophilic bacteria is an indicator of the shelf life and hygiene quality of foods.

A significant difference was observed between total yeast and mold counts ($p<0.05$). Our findings were lower than the total yeast and mold counts reported by Tekinşen (2005), Kamber (2005) and Aydın and Ardıç (2019). The number of yeasts and molds is derived from the Turkish Food Codex Regulation on Microbiological Criteria (2011) and there is no legal limit. Since it is a sign of potential spoilage, it is important for the evaluation of microbial quality.

There was a significant difference between the *S. aureus* counts of the samples ($p<0.05$). Coagulase (+) *S. aureus* was observed in 8.3% of the samples. Tekinşen (2005) found a wide range of *S. aureus* counts in cheeses and Kamber (2005) found staphylococci in 20% of the samples. The number of *S. aureus* obtained in this study is similar to the values reported in other studies. Since it is known that the transmission of this bacterium to foods is mostly caused by personnel, it is estimated that hand contact occurs during the squeezing of cheeses.

Coliform bacteria and *E. coli* were not isolated from Helete cheeses. Tekinşen (2005) detected coliform bacteria in 16% of squeezed cheese samples, while *E. coli* was not detected. Kamber (2005) detected 4.35 log cfu/g of coliform bacteria in 20% of Çeçil cheeses, Kaynar et al. (2005) reported that fecal coliform bacteria and *E. coli* were not detected in 18 samples of 30 white cheeses.

3.3. Mineral Matter Analysis

There was a significant difference between the calcium amounts of cheese samples ($p<0.05$). It was observed that our findings were higher than the calcium content in the studies of Özlü et al. (2012) and Öksüztepe (2013).

A significant difference was observed between magnesium amounts ($p<0.05$). Our findings were lower than the magnesium levels in the studies of Özlü et al. (2012) and Öksüztepe (2013). The difference in these values is thought to be due to factors such as lactation stage, environmental conditions and feeding.

There was a significant difference between the zinc amounts of cheese samples ($p<0.05$). The findings obtained in this study were higher than the zinc levels reported by Özlü et al. (2012) and Öksüztepe (2013). There was a significant difference between the phosphorus amounts ($p<0.05$). It was found to be higher than the findings of Özlü et al. (2012) and Öksüztepe (2013). This difference is thought to vary depending on the processes applied during cheese production.

There was a significant difference between the potassium content of cheese samples ($p<0.05$). It was observed that our findings were similar to those of Özlü et al. (2012) and Öksüztepe (2013).

4. Conclusion and Recommendations

The chemical analysis findings of this study with Helete cheese samples showed diversity. This may be due to the non-standardization of raw materials and production procedures.

Our traditional cheeses are limited to the regions where they are produced in our country and are about to be forgotten. In this respect, it is very important to examine and register the general characteristics of our cheeses processed with traditional methods. It is important to transfer these types of cheeses to the industry without losing their natural qualities. It is extremely important to obtain better quality milk in terms of chemical and microbiological aspects and to supply products of the same quality and standardization with biochemical parameters. In this way, the region will be developed and traditional products will not be forgotten and recognized.

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