SPECIFICS AND QUALITY OF DOMESTIC COOKED CHEESES FROM UNA-SANA CANTON

ORIGINAL SCIENTIFIC PAPER

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ABSTRACT:
Una-Sana Canton with geographical and climatic characteristics abounds in different types of cheese produced from cow's milk. In this paper presents the production process and the results of chemical and sensory analysis of three types of domestic cow's cheeses, where acetic acid and whey were used for milk coagulation, and the heating temperature of milk ranged from 90°C to 95°C. For the third type of cheese, the milk coagulated using its own microflora, and the heating temperature ranged from 50°C to 55°C. Cheeses produced by coagulation of milk using their own microflora and whey could be classified as semi-soft cheeses, and cheese obtained by coagulation of milk with acetic acid in the group of semi-hard cheeses. Sensory analysis of the cheeses showed that the cheese produced by coagulation of milk with acetic acid had the highest total score of 94.10 points; then followed the cheese obtained coagulation of milk by its own microflora with 84.16 points, and the lowest number of points 81.92 had the cheese produced by coagulation of milk using whey.

KEYWORDS: domestic cooked cheeses, Una-Sana Canton, chemical and sensory properties

INTRODUCTION

Production of cheese is one of oldest way of milk storing which has take place to present days. It is assumed that cheese as foodstuff was arised as 7000. to 6000. B.C. by spontaneous conversion of milk constituents, primarily casein and milk fat [1, 2]. According to Rulebook on dairy products and starter cultures in Article 29 [3], cheese is defined as fresh product or product with different of degree of maturity, and it is produced by separating of whey after milk coagulation (cow's, shep's, goat's, buffalo milk an/or their mixtures), from skimmed or partially skimed milk, or by combination of the above listed raw materials. In the production of cheese is allowed the use of starter cultures, rennet and as so as appropriate coagulation enzymes. Cheese is very popular food product because of its richness in nutritional components like proteins, vitamins (riboflavin, thiamin, cyanocobalamin), minerals (calcium, phosphorus), and short-chain fatty acids [4]. Mechanical, rheological and cooking properties of heated and unheated cheese depend on the structure of cheese [5]. The main structual component of cheese casein, is present in the form of a three-dimensional network, where fat globules, water, minerals, bacteria and dissolved solutes such as lactose, lactic acid, soluble salts and peptides are presents in the cheese matrix [6].

In some countries and some areas of these countries are developed different ways of cheese production, and different climat zones and kind of milk cattles influence on the exsistence of different types of cheeses. One of classification of cheeses is according to way of coagulation of milk [7] so there are: sour cheeses (made by the lactic acid fermentation), sweet cheeses (produced by the action of enzyme additions), fresh soft cheeses, semi-hard and hard cheeses, mixed cheeses (produced whit acid and rennet). According to the water content in the non-fat dry matter of the cheese and to the consistency, pursuant to the above listed Rulebook [3], cheeses are produced and placed on the market as: extra hard, hard, semi-hard, soft cheese and fresh cheese.

Cheese produced by heat treatment of milk, so-called cooked cheese is a representative of traditional cheese making and has a marginal importance. Cooked cheese can be produced from whey (albumin cheese), from milk and from fresh cheese [8]. In the production of cooked cow's cheese for coagulation is most commonly used 9% acetic acid which is added in quantity of 2-3% in the heat milk on 98°C-99°C. Except acetic acid, whey and buttermilk also be used for acidification. After coagulation of proteins, the mass is calmed down and in this moment the heating of the milk begins at the temperature 88°C -98°C in duration of 10-20 minutes. The cheese curd put into the molds and then pressed [1]. Cheese can be consumed immediately after production or after prolonged storage [9]. Cooked cheeses are less sour

than cheeses produced by fermentation with lactic acid [10].

Cooked cheese made from fresh cheese is produced of raw cow's milk that leave to sour spontaneously for 2 to 3 days, whereby the separated cream on the surface is skimmed, and the remaining milk is gently heated for 2 to 3 hours and coagulation. The created coagulum is cut into equal parts to separate the whey, and then put into gauze where it is drained [8]. Cooked cheese from whey is produced with acidification of whey (pH 4.5) and heating at 90°C to 95°C, whereby come to floculation of whey proteins and milk proteins. The most famous cheese from whey is Itallian Ricotta [9].

On the Una - Sana Canton there are casein cheeses made from cow's, shep's and goat's, milk, and consider to way of milk coagulation there are: fresh cheeses made with coagulation of milk using their own microflora and heating on the temperature to 55°C, then the cheeses made with coagulation of milk using acetic acid or whey and heat to the temperature of boiling [11].

Domestic cow's cheese produced by heat treatment of milk is very represented in Bosnia and Herzegovina and has a characteristics of tradicional speciality due to its long-term way of production and traditional composition. Food would have to be traditionally produced and marketed for at least 25 years in order to receive the traditional speciality label [12].

The main goal of this paper was to describe the production process and the results of chemical and sensory analysis of three types of domestic cooked cheeses from Una-Sana Canton. In the cheese production, for milk coagulation, acetic acid and whey were used with the heating temperature from 90°C to 95°C. Where milk was coagulated using its own microflora, the heating temperature ranged from 50°C to 55°C.

MATERIALS AND METHODS

In this experiment, three types of cow's milk cheese were made with the following labels: (A1), (A2) and (A3). Five liters of fresh milk were used to make each of these cheeses. For the cheese marked as (A1), 80% acetic acid was used to curd the milk; into the milk was added a teaspoon of salt (cca. 10 g), then the milk was heated at the temperature about 95°C, and a spoon of acetic acid was added (cca. 15 ml) in the milk. After addition of acid, the visible curd appeared in the cheese bowl. The curd is transferred to a strainer to separate the whey, and after squeezing, the curd is transferred to a wooden mold to acquire a round shape. For the cheese marked as (A3), the production process was the same, only whey (cca.2 l) was used for the milk coagulation.

Figure 1. shows the production process of the cheeses marked as (A1) and (A3).

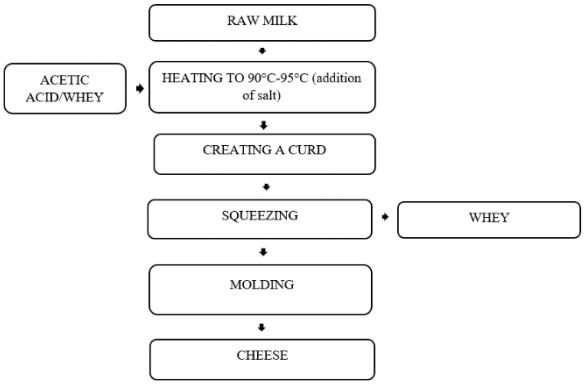

Figure 1. Production process of the cheeses marked as (A1) and (A3)

For the cheese marked as (A2), the milk was coagulated using its own microflora where the heating temperature ranged from 50°C to 55°C. Figure 2. shows the production process of the cheese marked as (A2).

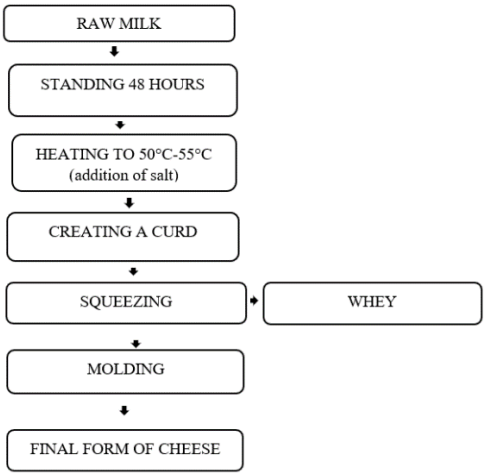

Figure 2. Production process of cheese marked as (A2)

Chemical and sensory analyzes were performed in the Laboratory for Control and Quality of the Biotechnical Faculty in Bihać. Of chemical analyses were done the following: water content, degree of acidity [13], and the content of sodium-chloride [14].

Sensory evaluation of cheeses was performed by the Sensory assessment panel of 5 evaluators. With the grades from 1 to 5, the following properties were evaluated: Appearance, Color, Smell, Taste and Consistency. Each of these properties was multiplied by a coefficient of importance: 1 for Appearance, 2 for

Color, 3 for Smell, 10 for Taste, and 4 for Consistency [15].

The results of this study are presented as the mean values accompanied with their standard deviations. One factor analysis of variance (ANOVA) was performed using statistical software SPSS (VER.20). When the main impact was significant, averages were split by Tukey's test of the smallest significant deviations at 5% level.

RESULTS AND DISCUSSION

Table 1. shows the results of chemical analysis of cheese samples.

Table 1. Results of chemical analysis of cheese samples

Parameters	Sample A1	Sample A2	Sample A3
Water %	53.20 ± 0.30^{b}	66.15 ± 0.72^{a}	65.63 ± 0.44^{a}
Acidity °SH	11.12 ± 0.06^{a}	24.56 ± 1.03^{b}	10.65 ± 1.16^{a}
NaCl %	0.92 ± 0.09^{a}	0.77 ± 0.06^{b}	0.80 ± 0.07^{ab}

Data are expressed as mean ± standard deviation. Means with the same letter in the same row do not differ statistically at 5% ($p>0.05$).

The results of chemical analysis of samples show that the highest water content was found in the sample (A2) 66.15%, then followed the sample (A3) 65.63%, and the sample (A1) with a water content of 53.20%. As reported by Kirin [9], domestic cooked cheeses produced with milk coagulation using whey or acid and then heated at 95°C, had the average water content 51.04% and dry matter content 48.96%. The water content in cooked cheeses without the use of microorganisms was 48.86%; these cheeses can be consumed immediately after production [1]. Domestic semi-hard cheeses obtained by coagulation of milk using 80% acetic acid and heated to 95°C had a water content in range from 31.56% to 36.56% [16]. Considering the water content, (A2) and (A3) cheeses could be classified as semi-soft/ soft cheeses, while (A1) cheese could be classified as semi-hard cheese according to Tratnik [7]. The moisture content is very important for increasing the storage life of cheese [17].

Salt is added in cheese ranging from 0.5% to 6.0%, mainly for flavor and preservation [18]. The highest content of sodium chloride was recorded in the sample (A1) 0.92%, followed by the sample (A3) 0.80%, and the lowest content of sodium chloride had the sample (A2) 0.77 %. According to Kirin [9], the NaCl content in the samples of cooked cheese was 1.23%, and since it is a traditional way of making cheese, table salt is added according to one's own taste when making cheese.

Acidity has a strong influence on the texture, rheological, and cooking properties of cheese because of the its impact on the interactions of casein-casein, mineral-casein, and casein-water [6]. Strong casein-casein interactions increase the firmness of the cheese matrix, and as a consequence, cheese becomes more firm and elastic [19]. The highest acidity was in the sample (A2) 24.56°SH, which is a significantly value compared to the samples (A1) 11.12°SH and (A3) 10.65°SH. Cheese (A2) produced by coagulation of milk using its own microflora had the highest water content which could be the cause of higher acidity compared to the other two methods of production. As reported Sabljak at al. [20], the acidity of fresh cheese obtained by coagulation of milk using its own microflora varies from 4.44 to 4.68 pH on the first day of storage. Pračić et al. [16] recorded values of acidity from 25.83°SH to 36.86°SH in domestic semi-hard cheeses. Kirin [21] states that due to the non-uniformity of the chemical composition of cooked cheeses, it is necessary to adopt regulations on the range of parameters of the chemical composition of cheese.

Table 2. shows the results of sensory analysis of cheese samples.

Table 2. Results of sensory analysis of cheese samples

Sensory properties	Sample A1	Sample A2	Sample A3
Appearance	4.38 ± 0.30^{a}	4.02 ± 0.05^{b}	3.46 ± 0.26^{c}
Color	9.00 ± 0.14^{b}	8.04 ± 0.09^{a}	8.08 ± 0.11^{a}
Taste	47.40 ± 1.82^{b}	42.40 ± 0.96^{a}	41.60 ± 2.07^{a}
Smell	14.28 ± 0.55^{a}	12.78 ± 0.75^{a}	12.90 ± 0.77^{a}
Consistency	19.04 ± 0.73^{b}	17.12 ± 1.11^{a}	16.08 ± 1.25^{a}
Total	94.10 ± 1.47^{b}	84.16 ± 1.78^{a}	81.92 ± 3.62^{a}

Data are expressed as mean ± standard deviation. Means with the same letter in the same row do not differ statistically at 5% ($p>0.05$).

After food consumption, flavour compounds are released from the food matrix and mixed with saliva, which need to be transported to the flavour receptors in the mouth and nose [22]. Overall flavour is influenced by perceptual interactions between various sensory modalities such as aroma, taste and texture. According to Visschers at al. [23], intensity of aroma perceived by subjects decreased with increasing firmness of the food.

After Sensory panel assessment, sample (A1) had a total of 94.10 points, which is the highest total number of points, followed by sample (A2) with 84.16 points, and sample (A3) 81.92 points. According to the results of Sabljak at al. [20], cheeses sampled from different producers had an uneven consistency, softer structure, while Kirin [8] found that cooked cheeses generally had a homogeneous and pliable dough, without sticking to the blade of the knife, with a specific lactic-sweet-sour combination of flavors. Lukač Havranek [1] describes samples of fresh cheese to have a soft consistency, a characteristic pale yellow color, with a slightly sour smell and taste, but a very uneven chemical composition. In this experiment, sample (A1) had a good surface appearance, harder consistency, easier slicing ability, characteristic pale and yellow color, with moderate salty taste and pleasant aroma. The sample (A2), where its own microflora was used for milk coagulation had more pronounced cavities on the surface, a rather soft consistency, and desintegrated during slicing, which is a characteristic of cheeses produced in this way. Compared to the other two cheeses, the taste of milk was more intense in this sample, the acidity was more pronounced, as well as the salty taste. During heating of the cheese, the proportion of liquid fat increases, and according to Lopez at al. [24], at the temperature higher than 40°C, almost all fat in cheese is in a liquid state. Liquid fat acts as a plasticizer between casein strands, making cheese more soft and flexible [25]. Sample (A3) had a moist cheese surface, softer consistency, more intense taste of milk, moderate acidity and less salinity compared to the other two cheeses. Increasing the ratio of moisture to non-fat substances in cheese, weaknes the firmness in cheese and influences on the textural characteristics [5]. Content of fat, cheese yield, moisture, as well as coagulants plays an important role in cheese texture [26].

CONCLUSION

By the chemical analysis was determined statistically significant difference ($p < 0,05$) between samples for water and sodium chloride content, as well as acidity. These variations in chemical composition could be due to the different way of coagulation and the heating temperature of milk. Cheeses produced by milk coagulation using whey, and with the help of their own microflora had a higher water content compared to cheese obtained by coagulation of milk using 80% acetic acid. Uneven acidity was found between the samples, and the highest acidity was found in cheese produced by coagulation of milk using its own microflora.

The Sensory panel rated the cheese produced by coagulation of milk with 80% acetic acid as the best, and awarded the highest number of total points, followed by the cheese produced by coagulation of the using its own microflora. The lowest number of total points received cheese produced by coagulation of milk with whey.

Due to the growing competition in the food market, among which cheese occupies a significant place, traditional products are especially valued for their special quality, and in addition they are a reflection of the cultural heritage that is passed down from generation to generation. As there are a different approaches in the technology of domestic cooked cheese production, the results of chemical and sensory analysis in this paper could serve as a recommendation to producers to achieve even better results in the future and get products that could be placed on the market of Bosnia and Herzegovina, as well as wider.

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