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TECHNOLOGICAL PROPERTIES OF WHITE BRINED CHEESE PRODUCED FROM ORGANIC CERTIFIED GOAT MILK

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Abstract: *The research has been conducted on organic goat milk, certified by EU equivalent regulations Reg. 834/2007 and on two types of white brined cheese using two types of lyophilized starter cultures. A combined mesophilic and thermofilic starter culture (Lactococcuslactisssp.lactis, Lactococcuslactis ssp. cremoris, Streptococcus termophilusi Lactobacillus bulgaricus) was used for the first type of cheese and a thermofilic starter culture for the second type of cheese. The results showed that the use of starter cultures in cheese production did not affect negatively the cheese components. Sensory panel showed that the highest average sensory evaluation points were recorded in cheeses made with mesophilic and thermofilic starter culture, whereas other starter culture combinations had been affected less in regard to taste or appearance.*

Keywords: *organic, goat milk, white brined cheese, starter culture, acidity, sensory analysis*

1. Introduction

Over the last years the production of organic food has reached an expansion in the world, thus changing the consumers' habits and the number of those who decide to buy organic products is increasing, including the dairy products. Compared to the conventional production, the organic one complies with the legal standards and regulations for control of each phase of the production process, which contribute to the production of safe products of animal origin.

The organic system of production is made according to determined standards which do not allow the use of antibiotics, coccidiostats, medicinal apparatus, growth stimulators, genetic modifications, hormones and other chemical substances in the whole production process [10].

For dairy products, cow milk is used most of the time, but there is always a reason to change our eating habits. Goat milk is considered one of the healthiest food, its chemical composition being similar to human milk and has specific taste and smell, thus being unacceptable for the consumers [1,2].

It is believed that goat was the first animal humans used for the production of milk. The ancient Greeks and Romans drank goat milk, because they believed it was very healthy [2]. Since ancient times goat milk has been used all over the world not only as a food, but also in the treatment of many diseases such as: bronchitis, allergies, by providing better immunity, treating and strengthening of the lungs. B

vitamins of the goat milk are beneficial for the nervous system, it has higher concentration of calcium, being important in building strong bones and keeping normal blood pressure [1].

The nutritional content of goat milk ranks it as the most balanced dairy product used in the production of cheese. There are 400 varieties of goat cheese and due to their specific taste and nutritional value, they have higher price on the market. The characteristic smell of goat milk is given by the higher quantity of capric, caprylic and caproic acids. [3]. The characteristics and quality of the cheese depends mostly on the quality of the milk, i.e. its physical-chemical composition. The most variable component of goat milk is the fat content which depends mostly on the stadium of lactation (2-8%). The content of milk fat at the beginning of the lactation is 3.34%, in the middle of lactation 2.73% and at the end 4.58% [4].

The proteins from goat milk are more digestible than those of cow milk and the absorption of amino acids is more efficient [5]. Goat milk protein content is 3 to 4.5%. Goat milk has less lactose ranging from 4.3 to 4.8% compared to cow milk, giving it advantage among the lactose intolerant human population [6].

2. Matherials and methods

The analysis of the chemical composition of goat milk was made in the study, where the content of the milk fat, also proteins, lactose and dry matter were dewtermined by infrared analyzing machine Milcoscan in accordance with the IDF 141C:2000 standard.The total solid, fat, raw protein, ash were also determined according to AOAC (2009) and pH was determined by pH meter Metler –Toledo. The sensory evaluation of the two types of goat cheese is made by method of points, a quantitative descriptive method for sensory analysis [7,8]. The samples of the two types of cheese were coded with letter A and B. For each of the cheese characteristics profile: cross-section, consistency, colour, smell and taste, a coefficient of importance was determined. The sensory characteristics of the goat cheese are valued with marks from 1 to 5 multiplied by the coefficient of importance, and their collection is expressed in (%) from the maximal possible quality. The balanced middle value, i.e. the balanced general value of the quality of the goat cheese is made by dividing the maximal possible quality with the summation of the importance coefficient (Σ=20) [7].

The technology of goat cheese production:

One hundred (100) liters of goat milk collected from the same lot is used for the production of the two types of cheese.

- The pasteurization of goat milk for the two types of cheese is made at 72^0C for 15/sec.
- Cooling of milk to temperature of 35^0C for inoculation of starter cultures
- Inoculation of starter culture FRC-75 which consists of combination of mesophilic and thermophilic milk-acidic bacteria (*Lactococcus lactisssp.lactis, Lactococcus lactis ssp.cremoris, Streptococcus termophilus*, and *Lactobacillus bulgaricus*) and maturing of the milk for 30 minutes.
- Addition of solid $CaCl_2$ previously dissolved in water in the amount of 10 gr/100 liters of milk.
- Curding of milk on temperature of 34^0C with rennetenzyme (CHR-HANSEN) in quantity which will provide the curding of the milk in 60 minutes.
- The curd was then cut into small cubes (2x2x2 cm). After draining, salt at 2% (w/v) was mixed with the curds.
- The curd was poured into small clean wooden moulds lined with cheese cloth and pressed for 5 hours.

- Cutting of the cheese in moulds with dimensions of 11 x 8 cm.
- Addition of brine (16% NaCl) 12ºC for 12 hours)
- The packaging of the cheese in plastic cans which are filled in 10% brine.
- The ripening of cheese is 30 days on 18^0C.
- Lagering of cheese until sale (2-4 ^{0}C).

Cheese A: Starter culture with the combination of mesophilic and thermophilic milk-acid bacteria is used (*Lactococcus lactisssp.lactis, Lactococcus lactis ssp.cremoris, Streptococcus termophilus* and *Lactobacillus bulgaricus*) and maturing of milk for 30 minutes.

Cheese B: Inoculation of cultivated thermophilic culture (*Str.thermophilus* and *Lactobacillus delbruecki*, sub. *Bulgaricus*).

3. Results and discussion

The mean data of organic goat milk samples for the physical-chemical composition and pH are presented in (Table 1).

Table 1.
Physical-chemical composition of organic goat milk

Parametres	Value (%)
Milk fat	5.14
Proteins	3.28
Dry no- fat matter	8.28
Lactose	4.34
Minerals	0.65
pH value	6.61

From the results of Table 1 we can determine that the content of milk fat in the goat milk used to make the two types of cheese is of 5.14%, proteins of 8.28%, lactose is of 4.34%, minerals of 0.65%, and DNM of 8.28%.pH value of the goat milk is in the range of the standard milk of 6.61%. Considering the fact that the research was conducted in autumn, the goat milk is higher in dry matter, so it has a higher content of milk fat and proteins. These findings were in agreement with those reported by other authors [4,6].

3.1 Determining the dynamics of pH value of cheese

Goat cheese has characteristic pH value which indicates the degree of conversion of lactose into milk sugar. The pH value of the curd and the two types of cheese (A and B) during ripening are shown in Table 2.

Table 2.
pH value of goat cheese (Types A and B)

pHvalue	A	B
Coagulum	6.15	6.04
After cutting	5.07	4.72
After saltING	4.91	4.60
15th of rippening	4.50	4.48
30^{ty} day of rippening	3.85	3.90

From the results it can be seen that pH value of the cheese A coagulum is of 6.15 and it is higher as compared to the pH value of cheese B coagulum with 6.04. After the cheese is cut and salted a significantly lower pH value of cheese B compared to cheese A was determined, showing greater activity of cultivated thermophilic starter culture compared to the combined starter culture. After thirty (30) days, at the end of the ripening process, a continuous decrease of the pH value is registered in both types of cheese (Figure 1).

The differences in pH values in the two types of cheeses are due to the different starter cultures used in the production technology.

During the ripening of cheese, complex biochemical processes take place and they change the structure of the cheese components which determine the sensory evaluation, giving characteristic taste, smell and texture.

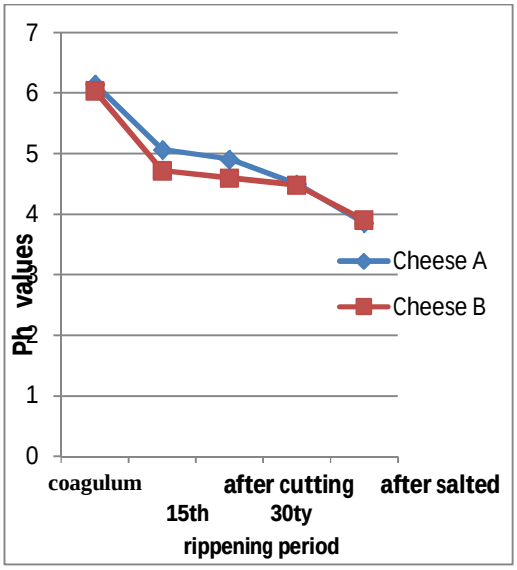

Fig.1. Dynamics of pH over the ripening period

3.2.Chemical composition of goat cheese

During rippening, the three main milk components (lactose, proteins and fat) take part with different percentage. The modifications start by transforming the lactose into milk acid which is more common in the first days of ripening. The biggest changes during the rippening of goat cheese are in the proteins and less in the milk fat.

The average values of the chemical composition of the two types of goat cheese A and B produced by certified organic goat milk are presented in (Table 3).

Fat content in cheese A is 22.92%, and 23% in cheese B. The protein content in cheese A is of 14.09%, and of 13.98% in cheese B, respectively. The water content of cheese A is of 52.12% which is by 2.02% higher than that of cheese B.

From the data we can determine that the starter cultures used with different microbiological content influence the process of cheese rippening with repercussions on the quality of goat cheese.

Table 3.
Chemical composition of goat cheese (Types A and B)

Parameters (%)	A	B
Water	52.12	50.10
Dry matter	47.89	45.90
Fat	22.92	23.00
Proteins	14.09	13.98
NaCl	3.05	3.00

3.3 Sensory evaluation of goat cheese

The sensory characteristics of goat cheese: smell, taste, cross-section, consistency, colour, profile are important parameters which influence the quality of the product, including the consumers' product choice [9]. The mean sensory scores of white soft brined cheese samples are presented in Table 4.

Table 4.
Sensory evaluation of goat cheese (Types A and B)

Sensory characteristics	A	B
Profile	5.00	5.00
Cross-section	4.75	4.88
Consistency/texture	5.00	4.50
Colour	4.88	4.88
Smell	4.88	4.10
Taste	4.63	3.88
Average value	**4.85**	**4.56**

We can see from the sensory scores that the general suitability of cheese A has got an average grade of 4.85, while the general suitability of cheese B has got average grade of 4.56 (Fig. 2).

The profile of the two types of cheese is excellent and has got an average grade of 5 for both types.

The consistency i.e. the texture of cheese A is standard hard with grade 5, while

cheese B is harder and has got a grade of 4.5.

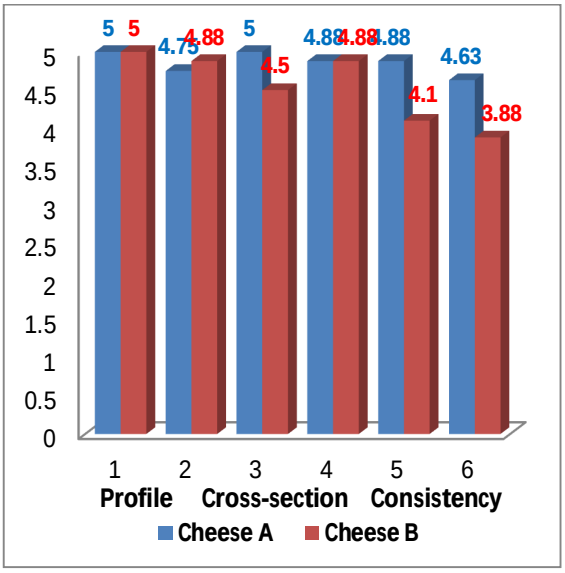

Fig. 2 Sensory scores of goat cheese samples

The cross-section of the two types of cheese was normal, with very few small holes, which are more common in cheese A. The cross-section of cheese A has got a grade of 4.75 and cheese B has 4.88.
The colour of the two types of cheese is significantly white with a grade of 4.88.
Cheese samples showed characteristic smell of white brined cheese. Higher amounts of caproic and caprylic acid in cheese seem to contribute to the development of piquant smell and taste. The taste of cheese A has got a grade of 4.63, while cheese B registered a slight deviationfrom the normal taste, getting a grade of 3.88.
From the results (Fig.2) we can determine that goat cheese A has better marks for the sensory characteristics as compared to cheese B, and we can conclude that the different starter cultures used for the production of the two types of cheese (A and B) influence the sensory evaluation of the cheese.

4.Conclusion

From the nutritional point of view goat milk is a more balanced product compared to cow milk, since it has all the necessary nutrients for a healthy body. The increased production of goat milk is the result of several attributes that makes it be by far a superior choice. Goat milk is less allergenic, naturally homogenized, easier to digest, lactose intolerant friendly, and biochemically and thermodynamically superior to cow milk.
The purpose of our research was to determine the differences of the two types of goat cheese made from milk from the same lot with the same physical and chemical composition, emphasizing that the variations in the physical and chemical parameters of the two types of goat cheese are not due to the physical or chemical composition of the goat milk. The differences of pH values of the two types of goat cheese are the result of the different starter cultures used in the process of cheese production.
According to the given scores for the sensory evaluation the total suitability of goat cheese A had best results with average of 4.85 compared to goat cheese B which had mark of 4.56. The taste, consistency and smell are better marked in cheese A as compared to cheese B.
The results from our research show that the starter cultures used in the production process of goat cheese influence the differentiation of milk component during the rippening of cheese; the biggest difference seen in the sensory characteristics of the goat cheese gives its specific quality.

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