

RESEARCH ARTICLE

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Evaluation of physical and chemical characteristics of milk and white cheese produced in the southern region of AlbaniaMARSELA ÇOMO^{1*}, ROZANA TROJA², MAJLINDA TERPO¹¹Department of Chemistry, University “Eqrem Cabej”, Gjirokastra, Albania²Department of Industrial Chemistry, Faculty of Natural Sciences, University of Tirana, Albania

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Abstract

The physical and chemical characteristics of milk, especially fat and protein content, are considered as very important parameters for the Albanian white cheese yield. White cheese is a white brined cheese traditionally made from sheep milk or from a mixture of sheep and goat milk. It has a slightly granulometric texture with small or no holes. Sheep and goat milk were taken from the southern region of Albania. Samples were analyzed during a two years period (2012-2013), from January to July of each year. In the mean time all the chemical parameters of cheese produced were analyzed. Sheep's milk was evaluated as follows: Beginning lactation: Fat= 7.68%, Protein = 5.97%, SNF = 11.57% Midpoint lactation: Fat = 6.71%, Protein = 5.81%, SNF = 11.41% Late lactation: Fat = 7.18%, Protein: 5.82%, SNF = 11.07% The increase of the fat and protein content of sheep milk leads to the increase of white cheese yield. The mixture of sheep and goat milk has lower values of fat, protein and solid non fat compared to pure sheep milk. Different mixtures of sheep/goat milk are used in white cheese production. The increase of the quantity of goat milk in the mixture decreases cheese yield. As a conclusion cheese yield depends not only on the lactation period but also from different ratios of sheep/goat milk mixture.

Keywords: milk characteristics, lactation, white cheese yield**Introduction**

The composition of sheep milk is influenced by a large number of factors; breed, nutrition, health of the animals, environment and the number and stage of lactation [6]. Goat and sheep milk are widely used in white cheese production. Their characteristics are more appropriate for white cheese production than cow milk. The gross composition of goat and sheep milk is similar but sheep milk has more fat, proteins, lactose compared to goat milk.

Cheese yield is defined as the amount of cheese, expressed in kilograms obtained from 100 kg of milk [1]. It is a very important parameter: the higher the recovered percentage of solids, the greater is the amount of cheese obtained and therefore gain in economic term. In cheese technology, it is very important to obtain the maximum possible recovery of substances from milk.

White cheese is produced using only whole sheep's milk, or a blend of sheep's and goat's milk (with a maximum of 30% goat's milk). The milk may be pasteurised or not, in general the shepherds produce white cheese with raw milk but in factories producers use pasteurised milk. Gjirokastra is a well-known town for the white brined cheese production.

The purpose of this article is to study the influence of physical and chemical constituents of sheep and goat milk variation during lactation on white cheese production yield.

Materials and methods*Sample collection*

The samples of milk (goat, sheep) were analyzed in the laboratory of dairy factory Gjirofarm which is located in the southern part of Albania. The results include data averaged weekly during two years of work for the period January-July of each year.

Since the parameters of milk do not change every day it has been decided to consider the data of one day per week (average) and after that the average of four weeks (monthly average).

Average values of each parameter have resulted after analysing 40 samples per week during January, 55 samples during February, 190 samples during March, 400 samples during April, 450 samples during May, 350 samples during June, 250 samples during July.

The milk was collected mainly in the towns of Gjirokastra, Tepelena, Vlora and their suburbs. Initially, during the months of January and February,

sheep milk was being collected only in Gjirokastra, while during the month of March was being collected also in the areas of Tepelena and Vlora. Goat milk was collected on April.

Tepelena and Vlora samples were gathered in the collection point of Tepelena where the milk was analyzed for the acceptance analyses, cooled for 2-3 hours (till to 2 °C) and transported in factory.

The two basic analysis of milk control and acceptance are the antibiotic test (β -lactam, tetracycline, sulfonamide) and pH control.

After the milk has been accepted every sample is analysed for its parameters: protein, lactose, fat, SNF, freezing point and acidity. Samples were collected in 80 ml capacity milk bottle.

Physical and chemical analysis

Milk analyses carried out in order to determine the necessary physical and chemical properties are: Acidity (in Soxhlet-Henkel method), pH with pH meter HANNA HI 9124, content of fat, protein, lactose, solid non fat (SNF), freezing point with milk analyzer Lactostar no.3510.

Cheese analyses include: pH, moisture with the thermo balance A&D MF-50 and fat by Gerber method.

Results and discussions

Physical, chemical properties of milk

The effect of the stage of lactation on the contents of all milk components under study is summerised in Table 1 and 2 for sheep milk and Table 3 and 4 for goat cheese. The beginning of the lactation period covered the first 60 days, the midpoint stage lasted from day 61 to day 180, and the final stage lasted from day 181 to day 240 [10].

In the beginning of lactation (January-February), sheep milk has high values of its parameters (fat, protein, lactose and SNF) in two years 2012 and 2013. This is related to the type of food consumed by the animal. Winter feeding regime consists of concentrates, straw and hay. These types of foods are rich in calories, fat, proteins etc. and as a consequence milk in this period will also be rich in fat and proteins. During the period of March-April-May (Mid-stage), sheep feed in lawns made of fresh herbage which are rich of water and as a result the milk will have lower values of fat, proteins, and SNF. As shown in Table 1 fat (from 7.48 to 6.8), protein (from 5.87 to 5.72), SNF (from 11.39 to 11.21) have lower values.

This is the phase when sheep /goat have high productivity of milk. During the end of lactation (June-July), especially during July, because of high atmospheric temperatures, grass is quite dry, hence milk parameters values are high see Table 2, fat (from 6.45 to 7.18), protein (from 5.84 to 5.92), while SNF has lower value from the normal and this is related with different adulterations like salt solution, cow milk to sheep milk, starch, sugar, water etc. Physiologically the sheep must be in an appropriate stage of lactation because at the very beginning and at the end of lactation the milk is of poor manufacturing quality, even though it has high fat and protein content [13]. These factors and their influence on milk quality for the processing of milk into dairy products, especially cheese, are described and critically examined.

During the first three months (beginning and mid of lactation) fat is higher than the limit given by the Albanian standards for white cheese production (< 6,4%). Values of fat exceeding 6,4% would make the cheese too soft and excess fat would be lost in the whey. Excess fat is skimmed and the cream is used for butter production. So during this period the only important parameter remains protein, as the fat remains constant.

Table 1. The physical and chemical analysis results of sheep's milk for year 2012

<i>Month</i>	<i>Fat (%)</i>	<i>Protein (%)</i>	<i>Lactose (%)</i>	<i>SNF (%)</i>	<i>p.H</i>	<i>Acidity(°SH)</i>
January	7,48	5,87	4,79	11,39	6.56	7.1
February	7,76	5,98	4,86	11,52	6.66	7.5
March	7,1	5,86	4,91	11,39	6.62	8
April	6,8	5,72	4,86	11,21	6.71	7.7
May	6,45	5,6	4,82	11,03	6.54	8.1
June	7,24	5,94	5,11	11,68	6.69	8.5
July	7,82	6,1	5,15	11,87	6.9	7.9

Table 2. The physical and chemical analysis results of sheep's milk for year 2013

Month	Fat (%)	Protein(%)	Lactose (%)	SNF (%)	p.H	Acidity(°SH)
Janar	7,56	5,94	4,97	11,62	6.65	8.1
February	7,8	6,01	4,81	11,52	6.72	7.3
March	7,15	6,04	4,89	11,62	6.78	7.7
April	6,45	5,84	5,02	11,56	6.53	8.2
May	6,49	5,78	4,89	11,41	6.65	7.7
June	7,2	5,83	4,69	11,27	6.59	8.4
July	7,18	5,92	4,54	11,30	6.87	8.6

Table 3. The physical and chemical analysis results of goat's milk for year 2012

Month	Fat (%)	Protein(%)	Lactose (%)	SNF (%)	p.H	Freez. Point (°C)
April	4.54	3.92	4.87	9.45	6.59	- 0.551
May	4.42	3.8	4.83	9.25	6.55	- 0.546
June	4.08	3.49	4.5	8.7	6.68	- 0.537

Table 4. The physical and chemical analysis results of goat's milk for year 2013

Month	Fat (%)	Protein(%)	Lactose (%)	SNF (%)	p.H	Freez. Point (°C)
April	4.66	4.01	4.76	9.47	6.55	- 0.543
May	4.54	3.94	4.66	9.31	6.63	- 0.545
June	4.26	3.62	4.48	8.81	6.65	- 0.539

Table 5. Range of white cheese chemical parameters at different steps of maturation

24 Hours			48 Hours			First maturation		
pH	Moist.(%)	Fat (%)	pH	Moist.(%)	Fat (%)	pH	Moist.(%)	Fat (%)
5 - 4.64	61 - 55	25 - 20	4.8 - 4.6	59 - 53	25 - 22	4.4 - 4.3	53 - 50	32 - 24

White cheese chemical parameters and yield

After white cheese production, its quality control consists on this routine analysis:

pH, fat and moisture control after 24 hours, after 28 hours and after the first maturation (10-15 days) at 16 °C. Other components associated with cheese

production were also considered: monthly amount of milk, monthly quantity of cheese after the complete maturation (ready for sale). After the first maturation, cheese stays for 2 months in refrigerator 2°C (second phase of maturation) before getting prepared for packaging and sale. The chemical parameters changes of the final product are insignificant after the first maturation. The second maturation is more important for microbiologic than chemical aspects.

Table 6. Cheese yield related to percentage of sheep/goat milk mixture for year 2012

Month	Fat (%)	Protein(%)	Yield	% Sheep milk	% Goat milk
January	6.4	5.87	26.8	100	0
February	6.4	5.98	27.4	100	0
March	6.4	5.86	25.9	100	0
April	6.4	5.72	26.6	100	0
May	5.9	5.10	24.2	80.4	19.6
June	6.4	5.30	25.4	74.1	25.9
July	6.4	5.20	25.1	76.5	23.5

Table 7. Cheese yield related to percentage of sheep/goat milk mixture for year 2013

Month	Fat (%)	Protein(%)	Yield	% Sheep milk	% Goat milk
January	6.4	5.94	31.0	100	0
February	6.4	6.01	31.4	100	0
March	6.4	6.04	26.7	100	0
April	6.3	5.74	25.6	95.7	4.3
May	6.1	5.45	25.4	83.6	16.4
June	6.4	5.26	24.3	75.9	24.1
July	6.4	5.18	22.8	76.1	23.9

Decreasing of fat more than 6.4% affects only the softness of cheese, making it a bit more harder, influenced from goat milk too, a specific characteristic for white cheese preferred from locals and Albanian consumers too. These decrease has influence on cheese yield. As it is summarised in Table 6 and 7 yield from January till July decrease (respectively 26.8 to 25.1, table 6) despite milk parameters increase during mid-lactation (Table 1 and 2), quantity of milk that is added to sheep milk is of considerable value to decrease milk parameters of mixture and decrease cheese yield, too.

Despite this yield decrease, this mixture of sheep/goat milk is applied during white cheese production because the final product has special texture, taste and aroma, so desirable from the albanian consumer.

Conclusions

1. The results of the present study suggest that variations of lactation period affect milk constituents. Protein, fat, solid non fat during the beginning and the end of lactation have higher values than mid phase. Lactose content has its own deviations, but not significant one.

Beginning lactation: Fat= 7.68%, Protein = 5.97%, SNF = 11.57%

Midpoint lactation: Fat = 6.71%, Protein = 5.81%, SNF = 11.41%

Late lactation: Fat = 7.18%, Protein: 5.82%, SNF = 11.07%

pH during the end of lactation increase from 6.9 – 7.2, it means that this is the end of lactation and this milk should not be processed for cheese production. Acidity has different values, Tables 1 and 2 show that the temperature doesn't depend from the phase of lactation, it's more a parameter that vary from the hygienic conditions and the temperature in which the milk is kept from the milking moment till it's arrival in the dairy factory.

2. High fat, protein and total solids concentration in the milk are associated with high yields in white cheese. The optimal cheese yield is during February. Milk mixture of sheep and goat gives less cheese quantities but specific sensorial characteristics.

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