

## STUDY OF MILK AND CHEESE QUALITY OF SHEEP AND GOATS

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### Abstract

*It was studied chemical composition of whole milk from sheep, goats and mixes in different proportions, i.e. 50:50% and 25:75% sheep-goats and 75:25% sheep-goats, in a total of 5 batches. From those lots was prepared cheese, being determined its chemical composition and sensory qualities. It was confirmed that the milk of sheep after all the indices have been investigated is higher than that of goats: fat – by 79.3%, total protein – by 22.9%. It was established that in the batches of prepared cheese, the amount of dry matter weight has a tendency to decrease as the quota of sheep milk decreases in the mix. The amount of dry matter in sheep milk cheese was 44.5%, while in the 75:25% batch – 41.8%. In the goats milk cheese this index amounted to 41.5%. The amount of salt in cheese samples varied in limits from 4.55% (in 50:50% sheep-goats cheese) up to 5.25%. Sensory testing demonstrated that cheese made from mixtures of milk after the average score is higher than the experimental cheese prepared from pure sheep and goats milks.*

**Key words:** sheep, goats, milk, cheese, dry matter

### INTRODUCTION

Milk from times is recognized as a valuable and indispensable food. The ancient philosophers called the milk righteous "source of health, juice of life", and doctors recommended it to treat a number of diseases: tuberculosis, anemia, podagra, etc. Milk is a product that is easy to assimilate and is recommended primarily for sick, children, and elders. Goat milk is well known for curative qualities, including antimicrobial effect, stimulating of immune system because of the content of selenium, as a source of calcium, etc. Milk represents the most complete food, being the most easily assimilated by the organism, and contributes to body's health maintaining, its normal growth and development, increases the resistance to various diseases, infections and toxic substances. Milk is widely used in alimentation because it contains all nutrient substances necessary for normal body growth

and development. In the first days of life of a newborn, milk is the only source of food. Milk contains proteins which are represented by casein, lactoalbumin and lactoglobulin; carbohydrates, which are represented by lactose; and lipids represented by glycerides, sterids and phosphatides. Also milk contains mineral salts, in particular calcium, phosphorus and others, which are easily assimilated by the organism; vitamins, both water-soluble (B1, B2, B12, C, PP), as well as fat-soluble (A, D, E, K); a number of enzymes.

Milk can be used integral or as raw material for different dairy products – yoghurt, farmer-cheese, cheese, etc. The Euromonitor study presented by Cristina Mărăscu [4] indicates that the consumption of industrial milk by Romanians for a year is 12.6 kg per person, while the Eastern European average is 33.5 kg/year, and average consumption in Western Europe is 67.5 kg/year per person. And what concerns to yoghurt and buttermilk, Romanians consume 8.1 kg/year, in the Eastern Europe the average being of 12.1 kg/year per person, and that of the Western Europe is 19 kg/year. According to statistics in Republic of

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Moldova in 2013 per person were consumed 166 kg/year milk (including butter) [5].

The quality of dairy products is an index quite important but which is influenced by a number of factors starting with the race membership, period of collection of milk, season of collection, zoo-hygienic conditions of maintenance of animals, nutrition of animals, abidance to rules of processes, the ferment, and others. On the quality of milk and dairy products depends the realization price and, at the same time, the economic income of a business in sheep breeding.

In our country, at the vast majority of sheep farms are bred and exploited besides sheep – goats too. It is obvious that the milk is collected together and subsequently is prepared cheese. Proceeding from this, it was decided to study the chemical composition of milk and cheese separately for each species and in mixture with different shares of milk (sheep and goats).

## MATERIAL AND METHOD

Scientific investigations were carried out by the collaborators of the PSIBZVM in common with the collaborators of the Chair “Technology of Food Products” of the Faculty of Technology and Management in Food Industry of the Technical University of Moldova (TUM). The chemical analysis of milk from sheep, goats and mixture was performed in the laboratory of the institute (PSIBZVM), while the chemical analysis of the cheese – in the “Etalon” laboratory of TUM.

As a research object it served the integral milk of sheep and goat and the mixture of these species in different shares before the preparation of cheese, and the cheese itself. For this purpose, were collected samples of sheep and goat milk – in total 40 liters, 20 liters of each species. From the collected milk were composed 5 lots (samples) for the preparation of classical salt brining cheese.

The works were carried out in laboratory conditions, according to the presented scheme (tab. 1).

Table 1 Scheme of variants of combining sheep and goat milk

Specification	Experimental lots				
	1	2	3	4	5
	Milk of goats	Mixture Sheep: goats	Mixture Sheep: goats	Mixture Sheep: goats	Milk of sheep
Share, %	100	25 : 75	50 : 50	75 : 25	100
The quantity of milk, l	8	2 : 6	4 : 4	6 : 2	8

From each composed lot, after the homogenization were collected average samples of milk for the determination of the chemical composition. The determination of the chemical composition of milk was performed with the Lactoscan device. There were determined the basic indices: fat, protein, lactose, dry-skimmed matter, and density of milk. Later in milk samples were introduced the rennet to coagulate the milk and to obtain curd. The obtained curd from each lot was undergone to conservation after traditional method of preparing of salt brining cheese. During the preparation (maintaining) of cheese were collected samples for the determination of the percentage of fat, dry matter, and salt. The

percentage of fat was determined by the classical method after Gherber, dry matter with the help of Chizlov apparatus, and percentage of salt by titration with AgNO<sub>3</sub>.

The preparation process for milk coagulation, the coagulation of the milk and the curd processing were carried out in a vat with a capacity of 12 l. The vat was made of stainless steel with double walls, in order to allow the heating of the milk. The formation and auto pressing of the cheese was realized in forms made of plastic materials having a diameter of about 110 mm and a height of 70 mm. The obtaining of the cheeses was performed in identical conditions.

An important index of the coagulating process, which determines the consistency of

the cheese, is the end of coagulation. The given index was determined visually by performing a cut in a curd and raising the curd in the cut place. If the curd opens as a “book” and the eliminated whey is clear-greenish – the coagulation is completed. After the obtaining of curd, the yield of the cheese samples was determined. The yield of the production of cheese was determined from the following relationship:

$$\eta_c = 1.07 \times G_m + 2.6 \times P_m,$$

where  $\eta_c$  is the yield of cheese, %;

$G_m$  – the fat of milk, %;

$P_m$  – the protein of milk, %

Later, after the preparation of cheese, was performed a sensory appreciation of the assortments of cheese according to the scoring scale method after the aspect, color, aspect in section, smell and taste. Sensory quality assessment was performed on the

base of scoring scale (ISO 6658: 2005). The maximum score for each character was 5 points. For each sample was calculated the average total score.

Data obtained from the research were processed biometrically after Plohinschi [6].

## RESULTS AND DISCUSSIONS

In the laboratory conditions were performed investigations of those 5 milk samples after the chemical composition according to the scheme of research. The chemical analysis of milk samples demonstrated that the maximum fat index was registered for sheep milk with 7.01%, and the minimum index for the goat milk with 3.91%. As the share part of sheep milk in mixture decreased as decreased the fat in mixture, which ranged in limits from 6.14% till 4.76% (tab. 2).

Table 2 Results of chemical analysis of milk

Specification	Sheep milk, 100%, experim.	Sheep milk, literature	Goats milk, 100%	Goats milk, literature	Milk sheep: goats, 50:50%	Milk sheep: goats, 75:25%	Milk sheep: goats, 25:75%
Fat, %	7.01	6.9-10.7	3.91	4.4	5.41	6.14	4.76
DSM*, %	8.36	10.2-12.6	6.8	9.3	7.53	7.96	7.19
Protein, %	3.96	4.18-7.04	3.22	4.1	3.57	3.77	3.4
Lactose, %	3.75	4.0-5.2	3.06	4.4	3.38	3.58	3.23
Density, g/cm <sup>3</sup>	1.02722	1.031-1.034	1.02352	-	1.02522	1.02633	1.0244
Temperature, °C	21.8		19.7		21.9	23.3	22.2
Acidity, °C	17	17.5-25.0	15	15.0-19.0	-	-	-

\* dry-skimmed matter

It should be mentioned that all the chemical components of sheep milk exceeds the goat milk. Thus, the amount of fat in the milk of sheep exceeds with 79.3% the amount of fat in the milk of goats. The amount of protein in the milk of sheep exceeds with 22.9% the protein in the milk of goats.

The amount of dry matter in milk samples varied in limits from 6.8%, up to 8.36%. As well, the amount of protein in milk samples varies from 3.22% in goat milk, up to 3.96% in sheep milk. The amount of lactose varied in limits from 3.06%, up to 3.75%. In all the samples of milk the quantity of nutrients

tends to increase from that of goats till that of sheep. The maximum milk density was recorded in sheep milk as well, with 1.02722 g/cm<sup>3</sup>, while in the goat milk is only 1.02352 g/cm<sup>3</sup>. Comparing with literature data [2, 3], presented in the table, we can notice that, with the except of fat, in the sheep milk all the indices are lower, but this is explained by the fact that the milk was collected during early lactation (late May), while the indices of the bibliographic sources represent the average data for the all period of lactation.

Subsequently, from the milk samples were prepared five types of cheese, according

to scheme, which have been conserved in brine and kept at about 4°C [1].

After the physical-chemical analysis of cheese samples, it was determined that the maximum quantity of dry matter was detected in the sheep cheese as 44.5% (tab. 3). Then it is followed by that of the mixture

with goat: sheep share (25:75%) with 44.2%. The minimum indices of dry matter were recorded for goat cheese with 41.46%. As it can be seen from the data presented in the table, the amount of dry matter in sheep milk cheese samples decreased with decreasing of the share part of sheep milk.

Table 3 Physical-chemical indices of cheese

Samples of cheese	Quality indices				
	The content of DSM*, %	Water content, %	Fat content, %	Fat content in proportion to DSM	The salt content, %
Goats cheese	41.46	58.53	18.70	45	4.60
Goats sheep: cheese 75:25%	41.75	58.25	20.35	49	5.25
Goats sheep: cheese 50:50%	42.62	57.38	21.45	50	4.55
Goats sheep: cheese 25:75%	44.2	55.80	22.00	50	4.60
Sheep cheese	44.5	55.50	22.00	49	5.25
"Telemea" cheese from sheep milk [1]	-	maximum 55	-	minimum 47	2.0-2.5
"Feta" cheese from goat milk [1]	-	maximum 50	-	minimum 50	maximum 4

\* dry-skimmed matter.

The maximum amount of fat in sheep milk cheese, which constitutes 22%, was determined in samples of milk from sheep and from the mixture of milk of goats: sheep with the quota of 25:75% respectively. These lots are followed by the lot of sheep milk cheese from the goat: sheep milk mixture of 50:50%, with 21.45% of fat. The minimum fat index was registered in the cheese of goat milk with 18.7%. The content of fat reported to dry matter was framed in the limits of 49-50%, and only goat cheese constituted 45%.

The amount of salt in sheep milk cheese (curd) on the third day after the preparation varied in the limits from 4.55% to 5.25%. If we compare with the data from the specialty literature we observe that sheep milk cheese "Telemea" cheese from sheep milk contains only 2.0-2.5% of salt, while for the goat cheese "Feta" the maximum amount of allowed salt is 4%. It should be noted that, because the investigations were carried out under laboratory conditions and the obtained

amount of sheep milk cheese was small and the amount of brine exceeded the required volume that brought to an increased amount of salt in the samples.

After the determination of the amount of the final product (cheese) and the consumption of the raw material, the yield of product was determined for each lot. Research showed that the highest yield was recorded in cheese obtained from sheep milk with 17.8% (tab. 4), and to obtain 1000 kg of sheep milk cheese it is necessary 5618 kg of milk. With the decrease of the sheep milk share part in cheese samples it is observed a reduction of the yield of product from 16.4% to 13.9%. Goat cheese yield constituted 12.6%, and for obtaining of 1000 kg of product it is necessary 7937 kg of milk. It should be mentioned that the milk collection was effectuated during early lactation (May) when the forages used in animal feed are mainly juicy and prevails in rations that lead to the reduction of yield of cheese obtaining.

Table 4 Yield of sheep milk cheese samples

Samples of cheese	Production efficiency indices	
	The yield, %	Consumption kg/1000 kg
Goats cheese	12.6	7937
Goats: sheep cheese 75:25%	13.9	7194
Goats: sheep cheese 50:50%	15.1	6623
Goats: sheep- cheese 25:75%	16.4	6098
Sheep cheese	17.8	5618

On the third and fifth day after the production of cheese, its tasting was effectuated at the TUM and PSIBZVM. The final data of the sensory analysis of the prepared sheep milk cheese samples are shown in figures 1 and 2.

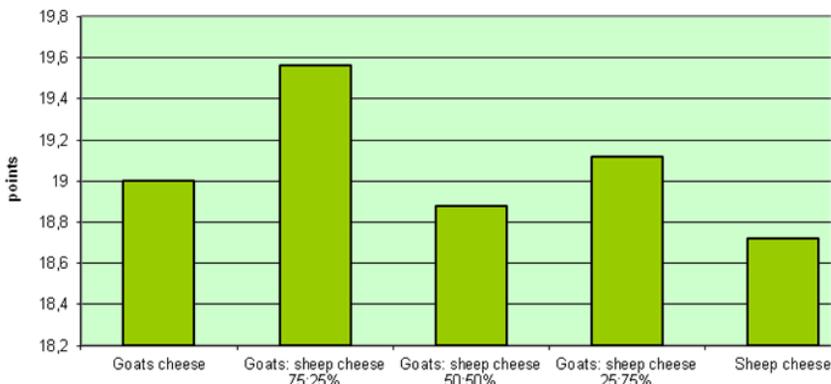


Figure 1 Variation of total average scores of the samples of cheese (tasting at TUM)



Figure 2 Variation of total average scores of the samples of cheese (tasting at PSIBZVM)

The results of appreciation of sheep milk cheese samples at TUM demonstrated that more required after total score preponderant was the sample of the mixture of milk of goats: sheep 75:25%, and it is followed by the reverse goats: sheep 25:75%, with a 19.56 and 19.12 points (Figure 1).

The sensory analysis at PSIBZVM showed that the maximum average of total score was obtained by the sample of cheese made from mixture of milk goats: sheep 50:50% with 18.51 points. This kind of assortment is followed by the sheep milk cheese made from milk of sheep with a total average score of 18.31. Practically, on the

same level with 18.28 and 18.27 points were placed the assortments of cheeses made from mixture of milk goats: sheep 75:25% and 25:75%.

All kinds of cheeses were appreciated as “very good” and can be characterized as

follows: the product has positive sensory attributes, specific, well defined, and does not present any noticeable defects.

Sensory indices of cheese samples were appreciated by the method of description and are presented in the table 5.

Table 5 Sensory indices of cheese samples

Sensory characteristics	Goat cheese	Cheese goat: sheep 75:25%	Cheese goat: sheep 50:50%	Cheese goat: sheep 25:75%	Sheep cheese
Appearance	Whole pieces with clean sides with traces of cedilla, uniform color over the entire surface				
Color	White uniform throughout the whole mass		White, up to yellowish-white, uniform throughout the mass		
Appearance in section	Uniform clean paste, with rare pressing meshes and very rare mesh from lactic fermentation				
Consistency	Fine buttery mass, uniform consistency, easily broken without breaking, consistency is accordingly hard				
Scent	Specific goat cheese sweet odor, sour		Pleasant specific sheep cheese, sour		
Taste	Pleasant goat cheese specific taste, sour, salty		Pleasant specific sheep cheese, sour, salty		

## CONCLUSIONS

Following these experiences it can be concluded that cheeses made from a mixture of milk of goats and sheep are more required and have higher taste qualities than those of pure milk of goats and sheep. The sheep milk cheese obtained from a mixture of sheep and goat milk after the exterior aspect, consistency and in section aspect are the same. Regarding to the color of cheese in samples of sheep cheese and mixture of up to 75%, the sheep milk manifests the color from the white to yellowish-white, that is influenced by the increased amount of fat, but not decreases its quality. Thus, we can conclude that the goats milk in the manufacture of cheese leads to its bleaching. Referring to the taste of cheese, it can be said that the mixture of 25% of sheep milk to goat milk practically doesn't influence the cheese taste. The addition of up to 75% of goats' milk to sheep milk does not influence the taste too, being specific the sheep cheese taste. Resulting from those mentioned above, it can be concluded that the growth and exploitation of goats on sheep farm is welcome and the goats milk in proportions of up to 75% does not influence the quality of sheep cheese, but improves its sensory qualities (by average score).

## REFERENCES

- [1] Costin G. M.: Science and Engineering of Manufacture of Cheese, Academic Publishing, Galati, 2003.
- [2] Guzun V.: Milk Industrialization, Tehnica-Info Publishing, Chisinau, 2001.
- [3] Guzun V.: Milk and Dairy Technology. Chisinau, 1996, p. 69-70.
- [4] Marascu C.: Milk and Dairy Products. Romanian Center for Trade and Foreign Investment, 2014.
- [5] www.statistica.md – Agriculture, Balances of Feeding Resources and Their Use (2006-2013).
- [6] Plohinski N. I.: Guidance on Biometrics for Zoo-technicians, Moscow, 1969.