

EVALUATION OF MILK PRODUCTION OF GOATS POPULATIONS FROM NORTH-EASTERN ROMANIA

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Abstract

The purpose of this paper is to make an assessment on the main parameters that characterize the quality and quantity of milk production and correlations between them. To achieve this goal, we studied a total of 497 adult goats belonging to three populations in north-eastern Romania, coverage of the population belonging to native goats. Working methods used are specific to this kind of research, using the A4 method, apparatus Ecomilk and Milko-Skane, Pearson correlation and Fisher test. The results of this study highlight the fact that the amount of milk recorded goats studied had an average of 184.01 kg, no significant differences between the populations studied ($P > 0.05$). Physical and sensory analysis indicated that goat milk is presented as a yellowish-white liquid with a characteristic taste and smell, an average density of 1.034, pH 6.45 and freezing point at -0.58°C . Data on gross chemical composition of goat milk shows an average concentration of fat and lactose little more than 4% and an average of 3.07% protein, no statistically significant differences has been found between the populations studied. The close correlations with the quantity of milk are assigned characters: the amount of lactose (+0.996), protein (+0.957) and amount of fat (+0.927). Local goats populations is characterized by a relatively low milk production in comparison with specialized breeds.

Key words: goat, milk, quality, correlations.

INTRODUCTION

The importance of goats has been supported and documented in recent years at several international conferences [2; 6]. More than any other farm animal in the rural areas of the globe, goat is the main supplier of milk and meat for processing or self-consumption. Requirements for these products is growing, due primarily to increase of the world population. The second aspect, in terms of increased demand for goat milk, is increasing consumer's interest in products made from goat's milk, especially cheese and yoghurt. The third aspect of increased demand for goat milk derived from diseases of people with allergies to cow's milk or other gastrointestinal diseases. Demand is increasing and due to wider coverage of these issues and opportunities in a natural way of treating these diseases. Currently, there are many efforts to increase production of milk and goat meat, mainly because of their ability

to exploit agricultural land which cannot be used for other activities [10].

This paper makes analysis on some features specific to goats raised in Romania, especially from north-east of the country. The main factors studied are both quantitative milk production, as well as key components that determine its quality. Making this work is fully consistent with the tendency of the last time in terms of goat rearing in our country. From this point of view, it should be noted that in many areas of the country, including Moldova, goat rearing enjoys attention from small farmers, given that the number of goats is increasing.

MATERIAL AND METHODS

The biological material studied is represented by a number of 497 adult goats of three populations in north-eastern Romania (the counties of Iasi, Neamt and Bacau), goats belonging native goats.

Control of milk production was done by standard method A4, and was performed in all goats in lactation, from the 40th day after kidding. In this case, there were 12 controls (morning and evening) throughout lactation, with an interval of 30 days between inspections. At each control was taken on the average 40 samples from each farm, which served to determine the main chemical components (fat, protein, lactose). Milk samples were collected from each individual after a previous homogenization, without taking into account the last jets of milk. Determination of physical properties and chemical composition of raw goat milk was done within 24 hours of collection, using Ecomilk and Milko-Skane devices, both based on Spectrophotometer.

To test the statistical significance of differences between values studied, and correlations between the main characters of milk production, we used ANOVA Single Factor and Pearson correlation algorithms, both included in the software package MsExcel.

RESULTS AND DISCUSSION

1. Milk production. Research has shown that in the lactation period considered (from May to October), monthly milk production was on average 35 kg/goat in early lactation (May, June and July) and late lactation registering less than half of this amount. The fact that among the studied goats met some goats with high milk production, indicating high milk potential that have goats in this region. But, quite high values of coefficient of variability (between 25% and 46% depending on the population and months of lactation), indicating a strong heterogeneity of this trait. The cause of this situation is primarily unsupported selection for milk production, but the high variability may be the result of applying various techniques of feeding and keeping. Data on quantitative milk production from goats belonging to the populations evaluated in Iasi, Bacau and Neamt are presented in Table 1.

Table 1. The amount of milk from goats in north-eastern Romania

Control Month	Iași		Bacău		Neamț	
	kg	% of total	kg	% of total	kg	% of total
May	34.45	20.17	37.29	19.35	37.43	19.86
June	38.70	22.65	39.00	20.23	40.20	21.33
July	34.09	19.96	38.35	19.89	38.97	20.68
August	25.41	14.88	33.45	17.35	29.95	15.89
September	23.50	13.76	25.84	13.41	23.94	12.70
October	14.65	8.58	18.82	9.76	16.99	9.01
Total	170.80 ^{aa}	100.0	192.75 ^a	100.0	188.48 ^a	100.0

^{aa} – differences statistically insignificant ($P > 0,05$)

Analyzing the data presented in Table 1, it appears that the total quantity of milk has similar values in the three populations studied, ranging from 170.8 kg (the goats in Iasi) and 192.75 kg (goats in Bacau). It also can find that in this period, milk production has the same value, the largest amount occurring in control in June (about 20% of total lactation), and the lowest value being recorded at control in October (about 9% of total).

The average amount of milk goats in this specific region may be regarded as a relatively good compared with populations of goats from other regions of the country, but very small compared to yields recorded for the specialized breeds [14].

Comparing yields of milk valued at three populations were not significant differences from a statistical point of view, which shows that goat populations in the region studied,

were not subject to any selection or breeding activities.

2. Evaluation of milk quality. Goat milk has a high content of lacto-albumin and lacto globulin and advanced dispersion of fat globules, which increases its digestibility. The chemical composition of milk is an important indicator because it directly affects the quality of products derived from milk processing.

Sensory and physical analysis of milk from goats included in the study showed that this looks like a yellowish-white fluid with specific taste and odor, an average density of approximately 1034, pH average of 6.45, the mean freezing point being -0.58 °C, similar to the data presented in the literature [7; 8].

Fat is one of the most important components of milk if we refer to how they

affect the price of milk, the nutritional component, or physical and sensory characteristics which it prints in dairy products. Of all fats, triacylglycerol are the largest group (about 98%), including a large number of esterified fatty acids, which are fat with complex structures. Besides these, in goat milk fat, are also found other fats with simple structure (diacyl-glycerol, monoacyl-glycerol, cholesterol esters), complex lipids (phospholipids) and fat soluble compounds (sterol esters of cholesterol, hydrocarbons) [5; 9]. Milk fat is in the form of globules, characteristic for sheep and goats being that most of them were smaller than 3.5μ (in goat, 65% less than 3μ) [8]. Content and monthly variation of total milk fat in goat populations studied is shown in Table 2.

Table 2. Fat content of milk from goats in north-eastern Romania

Control Month	Iași		Bacău		Neamț	
	%	kg	%	kg	%	kg
May	3.35	1.154	3.53	1.316	3.62	1.355
June	3.56	1.378	3.80	1.482	4.06	1.632
July	3.83	1.306	4.25	1.630	4.10	1.598
August	4.48	1.138	4.24	1.418	4.53	1.357
September	4.76	1.119	4.64	1.199	4.87	1.166
October	6.33	0.922	5.22	0.982	6.00	1.019
Average	4.11 ^{aa}	7.02 ^a	4.16 ^a	8.02 ^a	4.31 ^a	8.12 ^a

^{aa} – differences statistically insignificant ($P > 0,05$)

From the data presented, it appears that fat percentage showed a reverse trend compared to the amount of milk. Thus, during the onset of lactation, when the quantity of milk was higher, percentage of fat had average values of about 3.5%, which is registered to control carried out in May, rising gradually towards the end of lactation up to 5.85% average recorded in control in October. As for quantity production of milk in terms of milk fat content recorded throughout the control period, there were no statistically significant differences among the three populations studied. In respect of the percentage of milk fat, they are similar to those presented in the literature. However, the total quantity of milk fat was much lower

compared to specialized breeds, the quantity of milk in this case having a decisive influence on this factor. The amount of milk fat has a different dynamic compared to the percentage of fat, the maximum being recorded in July for the population of Bacău (average 1.63 kg fat per individual) and the minimum value was registered in October for the population in Iași (by an average of 0.922 kg fat per individual).

Milk protein varies greatly from one species to another, being influential by race, stage of lactation, feeding, climate, by season and health status of the udder. Sheep and goat's milk contains nitrogen between 0.7 - 1.0% and 0.4 - 0.8% respectively, distributed in different fractions, which importance

varies according to milk processing technology, or culinary preferences of consumers. The sheep milk, over 95% of the total nitrogen is bound to proteins, and 5% is non-protein origin. In comparison, goat milk contains a larger amount of non-protein nitrogen and lower proportion of nitrogen bound to casein. In this case goat milk is less

efficient in the production of cheese and a weak structure and texture of yogurt, while sheep milk has very high power coagulation [4]. Similarly the percentage of fat, the protein had an upward trend, thus confirming the positive correlation, which is established between the quantity of milk and protein level (Table 3).

Table 3. The protein content of milk in Romanian native goats

Control Month	Iași		Bacău		Neamț	
	%	kg	%	kg	%	kg
May	2.99	1.030	3.22	1.201	3.00	1.123
June	2.97	1.149	3.31	1.291	3.12	1.254
July	3.05	1.040	3.42	1.312	3.18	1.239
August	3.17	0.805	3.47	1.161	3.28	0.982
September	3.96	0.931	3.61	0.933	4.03	0.965
October	4.36	0.639	4.26	0.802	4.26	0.724
Average	3.26 ^a	5.57 ^a	3.48 ^a	6.71 ^a	3.34 ^a	6.30 ^a

^{aa} – differences statistically insignificant ($P > 0,05$)

The data presented in Table 3, we can see that in June when the average quantity of milk was higher protein content of milk has been an average of 3.07% and the amount of protein/individual was 1.23 kg. Similar to fat, the last month of lactation protein percentage was maximum (average 4.29%), and the amount of protein recorded minimum values (average 0.722 kg/head). Overall lactation, the average percentage of protein was 3.36% and the average amount of protein/individual was 6.19 kg, between the three populations studied were not significant differences from a statistical viewpoint.

Lactose or milk sugar offers sweet taste of fresh milk, being the most important carbohydrate in milk. Other carbohydrates that may be found in milk but in small concentrations are represented by oligosaccharides, glycol-peptides, glycol-protein's and sugar nucleotides, whose function has been less studied. It is synthesized from glucose in the mammary gland, using α -lactalbumin [12] and is found in varying concentrations in the milk of all mammals except seals. Lactose is a valuable component of milk because it promotes

absorption of calcium, magnesium and phosphorus at the intestinal level and the use of vitamin D [12]. Lactose is paramount in maintaining the osmotic balance between blood flow and alveolar cells in mammary gland during the synthesis of milk, and during milk secretion in mammary alveoli and galactophore ducts of the udder [13].

Research shows that, unlike other ingredients, lactose keep a constant evolution throughout lactation, not influenced by the dynamics of milk production. Compared with the other two components of milk (fat and protein), the percentage of lactose shows a slightly upward dynamic from May to September, based on an average of 4.19% recorded in May, up from 4.34% in September, followed in October to register a slight decline up to the value of 4.21%. From a quantitative study goat milk lactose reaches the highest value in June with an average of 1.66 kg/capita, the lowest value being recorded in October when it decreases, reaching 0.71 kg lactose/individual. In the total lactation, the percentage and the average amount of lactose were 4.19% and 7.71 kg of lactose/individual respectively (Table 4).

Table 4. The lactose content of milk from goats in north-eastern Romania

Control Month	Iași		Bacău		Neamț	
	%	kg	%	kg	%	kg
May	4.34	1.495	4.18	1.559	4.04	1.512
June	4.22	1.633	4.29	1.673	4.13	1.660
July	4.04	1.377	4.25	1.630	4.13	1.609
August	3.94	1.001	4.26	1.425	4.17	1.249
September	4.49	1.055	4.28	1.106	4.24	1.015
October	4.11	0.602	4.27	0.804	4.26	0.724
Average	4.19 ^{ab}	7.16 ^a	4.25 ^b	8.19 ^a	4.12 ^a	7.77 ^a

^{aa} – differences statistically insignificant ($P > 0,05$)

^{ab} – statistically significant differences ($P < 0,05$)

Regarding the amount of lactose recorded in the three populations, throughout lactation, no significant statistical differences were recorded. However, in respect of the percentage of lactose, significant differences ($P < 0,05$) were recorded only between populations of Iasi and Bacau, differences between the other values were statistically insignificant.

3. Correlation. One of the main issues in the study of heredity of quantitative characters is knowing the degree of interdependence between two characters, the size of it, and its meaning. This interdependence is highlighted by the correlation coefficients. This coefficient can take any value between -1 and

+1. Positive sign indicates the trend of variation in the same way of the two characters, while the negative sign indicates the trend of variation in different directions. The correlation value approaches 1 (or -1), the more closely the link between the two characters. From this point of view, there may be correlations between different characters very close ($> 0,5$), strong correlations ($0,2 < 0,5$) and weak correlations ($< 0,2$). The values of correlation coefficients of the main characters that define quantitative and qualitative milk production in populations of goats in the north-east of Romania are presented in Table 5.

Table 5. The correlation coefficients between characteristics that define the production of goat milk in populations studied

Character	% fat	% protein	% lactose	kg fat	kg protein	kg lactose
kg milk	- 0.934	- 0.929	- 0.371	+ 0.927	+ 0.957	+ 0.996
% fat	-	+ 0.936	+ 0.432	- 0.764	- 0.882	- 0.927
% protein	-	-	+ 0.508	- 0.823	- 0.832	- 0.909
% lactose	-	-	-	- 0.254	- 0.227	- 0.305
kg fat	-	-	-	-	+ 0.940	+ 0.923
kg protein	-	-	-	-	-	+ 0.982

As shown in Table 5, very strong positive correlations with milk production are the characters: the amount of lactose (+0.996), protein (+0.957) and amount of fat (+0.927), data similar to those presented in the literature [1; 3; 11]. Also, very strong

positive correlation can be observed between fat percentage and milk protein percentage (+0.934) between the amount of fat and amount of protein and lactose (+0.940 and +0.982 respectively).

The strong negative correlation (coefficients with values very close to -1) are between milk production and fat percentage and milk protein percentage, with values of -0.934 and -0.929 respectively, and those between the quantity of lactose and fat and protein percentage (-0.927 and -0.909), much closer correlation than those reported by other authors [1, 11].

Lower values of correlation coefficients are between the percentage of lactose in milk and all the other characters that contribute to the definition of milk production.

CONCLUSIONS

Following the official control of milk production, it was found that the three goat populations studied have a similar milk production, both quantitatively and qualitatively, confirming that they belong to the same population (Carpatina).

It also points out that, between the amount of milk and the characters that define its quality, there is a very close interdependence (over 90% of genes being common), whether varies in the same direction or opposite directions.

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