CHEMICAL COMPOSITION OF MILK AT CARPATHIAN GOATS UNDER SEMI-INTENSIVE FARMING CONDITIONS

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Abstract

The studies were performed on milk samples collected from 178 Carpathian females belonging to a farm from southeastern Romania. The females were grazed daily, benefiting from natural pasture, specific to the Dobrogea area. Before each milking, 100 g of special granules for goat's milk were administered. After weaning (April), the goats were milked twice a day for 5 months. Milk production control was carried out monthly, after the weaning of the kids, for three consecutive months, starting with May. For this, the amount of milk milked in the morning and in the evening was weighed individually. The computation of the total individual production was calculated by applying the Fleischmann formula in the case of milking the goat after a period of lactation, when the first milking is done after the flat-rate date of the end of lactation. For primiparous, the total individual milk production was between 124.35 kg and 199.76 kg with an average of 164.93 kg/head/day. At multiparous, the average total individual milk production was 168.32Kg. Biochemical parameters (fat, protein, lactose) were analyzed by ultrasonic method in a standardized analyzer for goat's milk. At primiparous, the fat concentration reaches a maximum of 3.12 g% in July, and at multiparous 3.36g% in June. The protein concentration had values between 2.87g and 3.08g% at primiparous and between 2.90g% and 3.22g% at multiparous. The results of our analyzes recorded a maximum of 4.36% for lactose in June for primiparous and 4.58g% for multiparous. The percentage of mineral substances varies between 0.65 g% and 0.67 g% at primiparous and between 0.64 and 0.65 g% at multiparous.

Key words: goat, milk, nutrition, fat, protein

INTRODUCTION

The increasing demand for food of animal origin requires at the same time increased quantities of good quality feed but also achieving a cost price that would make this activity as efficient as possible. In addition to annual and perennial forage crops, a particularly important source is grasslands. Meadows, both permanent and cultivated, provide a large part of the volume fodder needed to feed these animals. In Romania, although we benefit from a relatively large area of meadows, their share in the feed balance is quite low. It is estimated that the contribution of grasslands, seen as a green mass, is quite low, the explanation being given by the small yields obtained, due to a multitude of factors that acted and eventually led to their degradation [11].

There are researches that indicate that certain feeds, especially leguminous vegetable, can significantly influence the composition of fatty acids and lipids in ruminant milk. The presence of lipids in goat's milk, beneficial to human health, can be attributed to the selective dietary behavior of goats and to the interaction between the components of the diet and the digestive system [10]. A French study showed that the rations in which grazing has a high weight, compared to hay-based rations, were associated with increased levels of xanthophile, retinol and α-tocopherol in Rocamadour cheese, and a high proportion of concentrates in the diet resulted in lower levels of xanthophile and α-tocopherol [7].

In conclusion, grazing has a major beneficial effect by lowering the level of saturated fatty acids and increasing the level of fatty acids, considered to have a favorable effect on human health (C9-18:1, C18:3n-3, C9t11-CLA) compared to the winter diet,

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especially that based on corn concentrates and silo [4].

The needed quantity of fodder for goats is closely correlated with their milk production and maintenance status as well as with the quality of fodder. The consumption level of a goat is very variable, depending on the plant's age and its presentation, hence the dry matter content, cellulose and protein on one hand and the way the supplement is presented on the other hand. Due to its specific biological characteristics, this animal often requires a change of diet and therefore it is necessary to permanently diversify its way of presentation in order to ensure palatability and, in fact, to increase the ingestion capacity. Carpathian breed is a rustic goat breed, well adapted to the climatic conditions specific to our country, with a very good capacity to exploit nutrients with low nutritional value. A particular situation is the Dobrogea area characterized by a dry climate with strong winds that causes a typical poor steppe vegetation.

The aim of these researches was to assess the production capacity of Carpathian females exploited in the semi intensive system, on a farm in Constanta County

The experiments were carried out on 178 goats of the Carpathian breed, 12 female primiparous and 166 female multiparous, exploited in semi-intensive system on a farm in Constanta County. In the first 60-75 days after calving, the milk was almost entirely sucked by the kids, so the milked milk could not constitute a total production control. Starting April, the animals were put out to pasture and received alfalfa hay, corn and barley as a dietary supplement. They had free access (09:00-17:00) to a permanent pasture consisting of 30% legumes (*Trifolium repens, Trifolium pratense, Medicago falcata*) and 70% graminea (*Festuca vallesiaca, Lolium perenne, Bathriochloa ischaemum, Stipa capilata, Poa bulbosa, Agropyron repens, Avicular Poligonum, Taraxacum officinalis, Dactylis glomerata*).

After weaning (April), the goats were milked twice a day for 5 months. After the weaning of the kids, the control of milk production was carried out monthly, for three consecutive months, starting with May. For this, the amount of milk milked in the morning and in the evening was weighed individually. The computation of the total individual production was calculated by applying the Fleischmann formula in the case of milking the goat after a period of lactation, when the first milking is done after the flat-rate date of the end of lactation.

Also, individual milk samples were taken for qualitative analysis. Biochemical parameters (fat, protein, lactose) were analyzed by ultrasonic method in a standardized Funke Gerber Lactostar analyzer for goat's milk.

RESULTS AND DISCUSSIONS

For goats, the lactation stage is closely related to the breeding season. Being seasonal poliestric animals, goats have calving season placed between January and March, depending on the climatic conditions of the previous year when the mounting were made. Generally, lactation begins during the first months of the year when the animals are on stable and are fed with feed from stock. The amount of milk increases after they are released to pasture, then it decreases towards the end of lactation (autumn) [3]. Our results on the amount of milk in primiparous females are presented in Table 1.

Table 1 - Milk quantity (Kg) variation during lactation in primiparous Carpathian female (n=12)

Specification	Minim	Maximum	Average Kg milk / goat	Std. Deviation
Control 1 (kg milk/day)	1.27	2.89	1.82	0.47
Control 2 (kg milk/day)	0.55	1.68	1.09	0.31
Control 3 (kg milk/day)	1.08	2.16	1.63	0.35
Total Kg milk/ lactation	124.35	199.76	164.94	23.29

At the first check (May), the average milk production per primiparous female, ranges from 1.27 Kg to 2.89 Kg, with an average of 1.82 Kg. At the second check carried out in June, the individual milk production registered a significant decrease, the minimum being 0.55Kg and the maximum of 1.68 Kg milk, with an average of 1.09 Kg, lower quantities contrary to the data in the literature. From the third month of lactation, the milk production enters the plateau phase and should be maintained for about two to three months after which to decrease until goat's weaning. Due to the climatic conditions specific to the area and the advanced drought, the composition of the pasture did not provide qualitatively or quantitatively nutritional needs of the goats. The 100 g concentrated supplement given at milking was insufficient to compensate for the poor quality of the pasture and the energy consumption of longer-distance movements in search of food. As a result of this control, and in order not to compromise the lactogenic capacity of the primiparous goats, the decision to supplement the daily food ration by an additional 100 g /day was made. By administering this concentrated supplement in addition to grazing, for one month, an increase in dairy production is observed at the third official control. Thus, on July control day it was registered a minimum of 1.08 kg milk/day and a maximum of 2.16 kg/day, the average of the 12 goats being 1.63 kg. Goats were milked until September, all the while they benefited from the concentrate supplement, which was suppressed towards the end of the month, in October the goats being prepared to be weaned.

The estimation of individual total milk production was made by mathematical calculation (Fleischmann formula), which was between 124.35 kg and 199.76 kg with an average of 164.94 kg/head/lactation. From the data processing it was found that there are statistically significant differences ($p \leq 0.05$) between the average milk production at the first control and the second and between the average milk production at the second control and the third.

The second batch of goats under study consists of 166 multiparous females, aged 3 to 7 years, operated under the same maintenance and feeding conditions.

Table 2 shows the average milk quantities measured at the three official controls in May, June and July. In multiparous females, at the first control of individual milk production the recorded quantity was between 0.54 and 4.22 kg/day, with an average of 1.65 kg milk/day. At the second control, was observed a decrease of dairy production between 0.53 and 3.36, with an average of 1.19 kg milk/day, based on the same poor nutrition. By adjusting the ration and supplementing concentrated feed by 200 g/head/day (total 400 g/head/day distributed in two equal supplements, before each milking) an increase in the average daily milk production to 1.70 kg is observed, with a minimum of 0.53 kg and a maximum of 2.87 kg milk. Although the minimum and maximum values of individual daily milk production are lower in the third month of control, the average per lot is higher (1.70 vs. 1.19) due to the higher number of females aged 3-5 years, respectively at the second up to fourth lactation corresponding to the maximum productive period in the life of lactating females. Similar results on the lactation curve in the Carpathian breed have been reported in other previous studies [1,2].

Table 2 - Milk quantity (Kg) variation during lactation in multiparous Carpathian goats (n=166)

Specification	Minim	Maximum	Average Kg milk/ goat	Std. Deviation
Control 1 (kg milk/day)	0.54	4.22	1.65	0.64
Control 2 (kg milk/day)	0.53	3.36	1.19	0.45
Control 3 (kg milk/day)	0.52	2.87	1.70	0.54
Total Kg milk/ lactation	73.52	287.59	168.33	41.11

After the onset of lactation, it is important to observe milk production and to make correlations with the productive level ensured in the sense of adjusting feed rations so that the goats and in particular the large-yielded primiparous female to receive in addition to pasture also a concentrate supplement of 200-400 g/head/day in relation to milk production [5]. On the other hand, during the summer, when the pasture becomes insufficient and of poorer quality, especially in dry summers it is necessary to ensure small quantities of quality hay and even supplementation with concentrated feed [6].

From the chemical composition point of view, the concentration of the different constituents is mainly conditioned by the individual and month of lactation, but also by breed, age, frequency and duration of the milking [8]. The results obtained by us are presented in Table 3, for milk from primiparous females and in Table 4 for milk from multiparous females.

Table 3 - Variation of composition (%) during lactation for Carpathian breed primiparous females (mean ± standard deviation)

Lactation stage	Fat (g%)	Protein (g%)	Lactose (g%)	Minerals (g%)
May	2.91±0.29	2.87±0.15	4.12±0.12	0.67±0.10
June	3.06±0.45	2.82±0.34	4.36±0.09	0.67±0.10
July	3.12±0.21	3.08±0.12	4.01±0.28	0.65±0.32

Table 4 - Variation of composition (%) during lactation for Carpathian breed multiparous females (mean ± standard deviation)

Lactation stage	Fat (g%)	Protein (g%)	Lactose (g%)	Minerals (g%)
May	2.95±0.12	2.90±0.15	4.37±0.24	0.65±0.26
June	3.36±0.54	3.22±0.20	4.58±0.28	0.66±0.15
July	3.07±0.33	3.18±0.22	4.51±0.30	0.64±0.38

From the data obtained it is observed that there are no significant differences between the concentration of biochemical parameters in primiparous and multiparous goats. The fat content of goat milk is one of the most important nutritional and dietary parameters. At primiparous, the fat concentration reaches a maximum of 3.12 g% in July, and at multiparous female 3.36g% in June. Regarding the protein concentration, our studies recorded values between 2.87 and 3.08g% at primiparous and between 2.90g% and 3.22g% at multiparous. Lactose is the main sugar in milk, being synthesized from glucose and galactose in the mammary gland. The results of the analyzes recorded a maximum of 4.36% for lactose in June for primiparous and 4.58g% for multiparous. In our study, the value of lactose concentration in the milk is similar to that recorded in other reports on the Carpathian breed, of 4.18% for goats raised in semi-intensive system, 4.23% for goats raised in extensive system [9] and 4.4 % [8]. The percentage of mineral substances varies between 0.65 g% and 0.67 g% in primiparous and between 0.64 and 0.65 g% in multiparous.

CONCLUSIONS

In primiparous goats, the average total individual milk production was 164.93Kg/head/lactation and 168.32 Kg/head/lactation at multiparous. From the data processing it was found that there are statistically significant differences ($p \leq 0.05$) between the average milk production at the first control and the second and between the average milk production at the second control and the third.

The analysis of the milk production evolution during the three months placed in the plateau area of the lactation curve demonstrates the role of nutrition in expressing the productive potential of goats and the need to adapt the feeding mode to the operating conditions and available nutritional resources.

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