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MILK YIELD AND PHYSICO-CHEMICAL COMPOSITION OF MILK OF ROMANOV SHEEP BREED RAISED IN THE FOOT-HILL AREAS OF BULGARIA

Genoveva GEORGIEVA, Tsvetomira BANCHEVA, Svetoslava STOYCHEVA

Research Institute of Mountain Stockbreeding and Agriculture, 281 Vasil Levski Street, 5600, Troyan, Agricultural Academy, Bulgaria

Corresponding author email: genoveva-georgieva@abv.bg

Abstract

Romanov sheep breed was distributed in Europe more than 50 years ago. It is attracting more and more interest in Bulgaria because of its high fertility, but data on its milk productivity are scarce. The present study aims to determine the milk yield and physico-chemical composition of milk from Romanov sheep as it is the first of its kind in Bulgaria. 137 milk samples obtained from the 30th to the 120th day of lactation of 43 purebred Romanov ewes were analyzed. The average daily milk yield was 0.510 l, reaching 0.720 l as it gradually decreased during lactation. The milk yield for the studied period was 45.7 ± 3.52 l. The percentage content of milk fat increased with advancing lactation, as lactose showed insignificant changes. The protein indicator increased at the beginning, then it slowly decreased.

Key words*: milk yield, physicochemical composition, Romanov.*

INTRODUCTION

During the first weeks of life of newborn lambs, the main source of food is the mother's milk. They depend on the milk productivity of the mother, which is one of the main factors for the growth, development, health, and viability of the young organism (Lobkov et al., 2012).

In the first month of their life, the habituation to coarse fodder and the development of the proventriculus begins, and the most intensive growth of the animals is also reported (Ziangirova, 2020).

According to Radzik-Rant et al. (2017), sheep's milk contains biologically active compounds (enzymes, hormones, and vitamins) along with essential nutrients (proteins, fats, lactose, and total solids) that ensure the development of lambs and can influence the meat qualities. Breed, ewe age, feeding, and lactation period also influence milk composition (Atti et al., 2006; De La Fuente et al., 2009; Rozbicka-Wieczorek et al., 2015).

Tsochev et al. (2018) reported that milk yield in sheep is a heritable trait with high variation, both between breeds and between individuals within a breed, with a breed effect demonstrated on lactation and milk quality (Skoufos et al., 2017; Thomas & Haenlein, 2017; Moatsou & Sakkas, 2019).

According to Rozbicka-Wieczorek et al. (2015), the content of the main components in milk is determined by genetic and environmental factors. The milk of the dairy sheep breeds has a lower fat and protein content than the milk of breeds of other trends. Insignificant differences in milk composition were found in different meat-producing breeds (Peniche et al., 2015).

Establishing the quality of the milk and the higher milk yield of the ewes is a prerequisite for a higher increase in the rearing of lambs for meat production. There is a positive correlation between lamb growth and the amount of milk secreted by dams in early lactation (Wohlt et al., 1981).

Sheep's milk contains more total solids, protein, fat, and calcium. It follows that the calories in sheep's milk are almost twice as much as in cow's and goat's milk (Lesnovska, 2014).

Lobkov et al. (2012) found that under favorable feeding conditions high milk yield is ensured for the Romanov ewes, therefore they can raise two, often three lambs without giving them milk replacer.

According to Tekel et al. (2020), the Romanov breed has a high milk yield, which is sufficient not only to feed a large number of offspring, but also for the production of dairy products (Kostylev et al., 2015), but the data that

confirm it are limited. In Bulgaria, the milk of the Romanov sheep breed was studied by Tsochev (1983), and he reported data only on the milk yield of the first and second lactation and the content of milk fat and protein substances. The limited amount of information on milk yield and quality of milk from the Romanov breed necessitated the present study, which aims to determine the milk yield and physico-chemical composition of Romanov sheep and is the first of its kind in the contemporary conditions of Bulgaria.

MATERIALS AND METHODS

The study was conducted with 43 pure-bred Romanov ewes raised in the Scientific-Experimental Base at the Research Institute of Mountain Stockbreeding and Agriculture (RIMSA) of Troyan. The sheep are of different ages and stages of lactation. 15 ewes were in the first and second lactation, 15 ewes in the third lactation, and 13 ewes between the fifth and eighth lactation.

During the study period, the animals were kept in a goat shed and fed according to norms for lactating ewes. The daily ration included bulk feed of good quality meadow hay, oat straw, and concentrated feed containing corn, wheat, sunflower meal, and vitamin-mineral premix. Animals had continuous access to water. During the first ten days after parturition, the lambs together with their mothers were raised in individual boxes, then they were gathered in a group box, and between the 20th and 30th day, the lambs were separated from their mothers.

The 90-day milk yield of the ewes was determined by individual hand milking at each milking check. The lambs were separated from their mothers 12 hours before the control milking, and the amount of milk produced by each ewe was measured. To determine the milk yield for the entire control day, the milk yield was doubled. The duration of the control period averaged 30 ± 3 days. Milk yield for a control period is the product of the amount of milk determined on the control day and the number of days in the control period. The 90-day milk yield is the sum of the amount of milk from the individual control periods.

To determine the quality of milk, individual samples were placed in containers with a capacity of 50 ml. Immediately after receiving, the milk samples were examined in the Analytical Laboratory of RIMSA to determine the main physicochemical parameters such as milk fat content (%), protein (%), lactose (%), solid-not-fat (%) and total solids (%) with milk analyzer "Laktoskan LW". The statistical processing of the data was conducted using the statistical package Data Analysis, Excel 2021, Microsoft.

RESULTS AND DISCUSSIONS

Milk yield is influenced by several genetic and non-genetic factors, such as feeding, animal movement, lamb presence, and udder stimulation during lactation (Kostylev et al., 2015), as well as animal temperament (Stoycheva et al., 2014).

The average daily milk yield for the 90-day study period was 0.510 l. For the researched herd, the peak of the average daily milk yield was between the 40th and 50th day with 0.720 l. A significant gradual decrease in the average daily milk yield was reported as the days of lactation of the ewes progressed ($P<0.05$) (Figure 1).

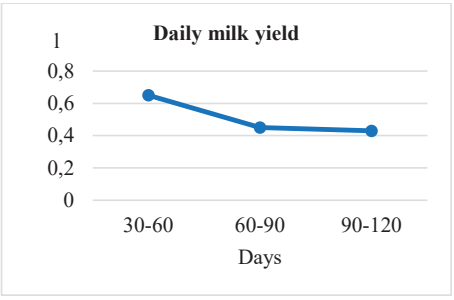

Figure 1. Dynamics of average daily milk yield for 90 days

The average daily milk yield in the present study was 0.184 l more than that reported by Boylan and Sakul (1988) for Romanov ewes with a daily milk yield of 0.326 l. In contrast to the present results, Kostylev et al. (2015) reported a higher milk yield, which reached 1550 g on the 10th day. After that, it gradually decreased and by the end of lactation, the daily amount of milk reached 100-150 g, and the milk yield was determined by weighing the lambs. The dynamics of changes in the amount

of average daily milk yield reported by Boylan & Sakul (1988) and Kostylev et al. (2015) are consistent with our results.

The results of the present study do not correspond with those obtained by Magomedov (1976), who found an average daily milk yield of 1.661 to 1.758 l.

In contrast to our results, Magomedov (1976) and Kostylev et al. (2015) reported the milk yield of sheep by weighing the lambs before and after suckling.

During the studied 90-day period, the average amount of milk was 45.7±3.52 l.

Kutlucaa et al. (2011) reported that in F1 crossings Morkaraman x Romanov, the milk yield was 74.2 kg, and in F1 crossings Awassi x Romanov it was 104.3 kg.

The ewes with one lamb (Figure 2) had a 38.7% lower milk yield than the ewes that gave birth to twins (Figure 3). The ewes with triplets (Figure 4) had a 24.6% lower milk yield than the ewes that gave birth to twins (Figure 5).

Figure 2. Romanov ewe with a single lamb (own source)

Figure 3. Romanov ewe with twins (own source)

Figure 4. Romanov ewe with triplets (own source)

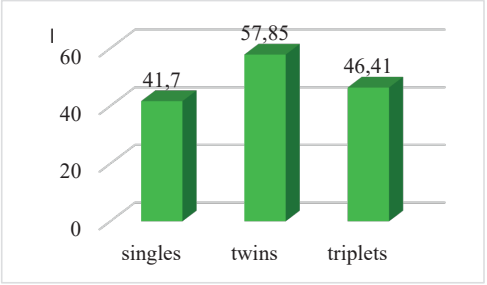

Figure 5. Milk yield of ewes according to type of parturition

Magomedov (1976) cited by Tsochev (1983) found 157.8 l for the first and 190 l for the second lactation of ewes with a delicate constitution, and for animals with a rough constitution, respectively, 149.8 and 167.2 l, which does not correspond to our study.

In contrast to our results Kostylev et al. (2015) reported that a ewe with one lamb gave 97 kg of milk, when two litters were lambed, the amount of milk for lactation was 155.4 kg, and when triplets were born it was 161 kg.

According to Kostylev et al. (2015), milk production is affected by the age of the mother, as young animals in the first and second lactation produce less milk than adults. The milk yield of the ewes increases until the 5th or 6th lactation, after which it gradually decreases. Assan (2020) reported that milk yield was higher in multiparous beef breeds.

In the present study, the daily milk yield in the 3rd lactation of ewes was 0.120 l more than the 1st and 2nd lactation of ewes (Figure 6).

The milk yield of the sheep in the 1st and 2nd lactation was 39.25 l for 90 days. The milk productivity of the sheep in the 3rd

lactation was 50.62 l or 29% more than the previous group.

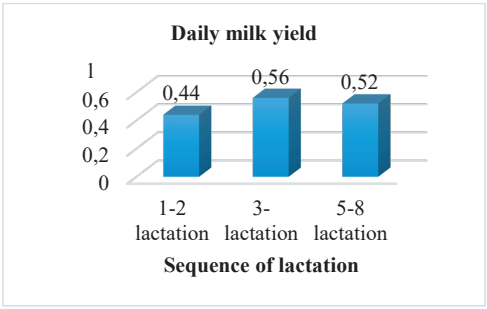

Figure 6. Daily milk yield according to the sequence of lactations

Since the Romanov breed is precocious (Gatsiev, 2015), during the first lactations the animals have not completed their growth and development, therefore large amounts of energy are used for their growth instead of milk production (Bancheva et al., 2023). In the group of ewes between the 5th and 8th lactation, the amount of milk was 46.48 l, which was 8.9% less than the ewes in the 3rd lactation (Figure 7).

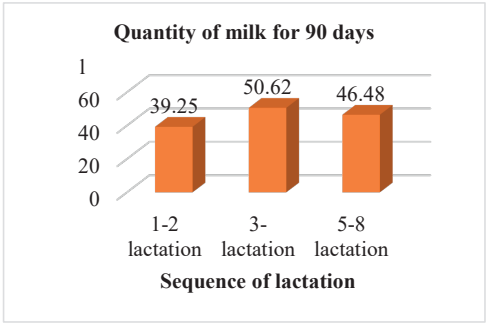

Figure 7. 90-day milk yield according to the sequence of lactations

In animals that have completed their growth, the maximum number of offspring in one parturition is observed and the highest milk yield is established (Ziangirova, 2020).

Tsochev (1983) found that animals in the 1st lactation had a milk yield of 87.6 l, as it was 107.3 l in the second lactation for 100 days, and the amount of daily milk was the highest in the first month.

Smirnova (1954) cited by Arsenyev et al. (2011) reported that for 100-day lactation, the milk productivity of Romanov sheep with one lamb was 97.2 kg, with two lambs was 120 kg, with three lambs was 153 kg and with four lambs was 169.1 kg, which is not confirmed in our results.

Erokhin et al. (2005) found that according to age, body weight, constitution, and the size of the mammary papillae, the largest daily amount of milk was obtained by the mothers of the 5th or 6th lactation with 956 g, after which the milk yield decreased.

Lobkov et al. (2012) reported that ewes in the 3rd lactation released 142 kg of milk, 151.9 kg in the 4th, 170.8 kg in the 5th, 169 kg in the 6th, and 149 kg in the 7th and 8th lactations. The study mentioned above shows clearly that sheep in the 5th lactation gave the largest amount of milk.

In the Romanov herd examined in the present study, the ewes in the 3rd lactation had the highest milk yield, but they occupied the largest share of the herd. Sheep between the 5th and 8th lactation were collected in a group where the recorded amount of milk was lower since the group also included ewes in the 7th and 8th lactation.

In contrast, Smirnov (1953) quoted by Tsochev et al. (2018) found the highest milk yield in the 2nd lactation, respectively in the 1st lactation the milk yield was 111.48 l, 157.71 l in the 2nd, and 111.37 l in the third.

The lactation length, as well as the physico-chemical composition of milk, are genetically determined by the breed. However, they are significantly affected by the stage of lactation, the nutrition of the ewes, the body and health condition of the ewe, and the environmental factors of the respective economic year (Nudda et al., 2014; Skoufos et al., 2017). The decrease in milk fat during lactation may be due to increased milk secretion and reduced fat mobilization from adipose tissue (Chilliard et al., 2003).

Changes in the physico-chemical composition of milk during lactation periods are presented in Table 1.

As lactation progresses, fat content increases reliably from the 90th to the 120th day ($P<0.05$). Protein and lactose indicators do not change significantly during lactation.

The solid-not-fat remains within narrow limits, and at the beginning of the study, it was 0.15%

more than the previous period. A reliable gradual decrease of the total solids index with advancing lactation of the ewes (P<0.05) is reported, which is associated with the decrease of milk secretion (Table 1).

Table 1. Main indicators of milk

	Milk fat, %	Protein, %	Lactose, %	SNF, %	Total solids, %
30-60 day	6.75±0.23^{b*}	5.03±0.04^{ns}	4.71±0.04^{ns}	10.57±0.09^{ns}	17.32±0.22^{b}
60-90 day	7.33±0.21^{ab}	4.95±0.03^{ns}	4.64±0.03^{ns}	10.41±0.06^{ns}	17.75±0.21^{ab}
90-120 day	7.87±0.21^{a}	4.96±0.04^{ns}	4.64±0.04^{ns}	10.42±0.08^{ns}	18.29±0.20^{a}
LSD 0.05	0.60	0.10	0.10	0.22	0.60

Note: *Means followed by the same letters are not significantly different; ns - No statistical proof.

When examining the 28th and 56th day of lactation of the Dorset, a meat and wool-producing sheep breed, Wohlt et al. (1981) found higher results on the 28th and 56th day than the mentioned above, respectively the milk fat content was 11.4 and 13.2%, the protein was 4.9% and 4.6%, lactose was 5.3 and 4.5% and total solids were 22.5 and 23.1%.

Our results are close to Skoufos et al. (2016), who studied three dairy breeds with milk fat between 6.1% and 8.5%, protein from 5.43% to 5.95%, lactose from 4.5 to 4.64 and total solids from 19.51 to 20.04%.

Boylan and Sakul (1988) indicated average values of milk fat content of 6.4%, protein was 6.1, lactose was 4.8, and total solids were 18.1% for the Romanov sheep breed. The average milk fat content in the present study is 0.92% higher, the protein is 1.12% lower, for the lactose indicator the difference is insignificant, and the percentage of total solids is 0.32% higher than our results.

Kostylev et al. (2015) studied a Romanov herd and recorded milk fat content and protein of 6.3, respectively; 5.23% at the beginning of lactation, 6.15; 5.13% in the middle and 7.35%; 6.20% at the end of lactation, for lactose at the beginning of lactation reported 5.15%, 4.7% in the middle and 4.5% at the end of lactation.

The total solids at the beginning were 17.9 ± 0.04, in the middle 17.1 ± 0.3 and 19.2 ± 0.4 % at the end of the lactation period. The milk fat content, in the present study, at the beginning of lactation was 0.44%, in the middle was 1.18%, and at the end of lactation was 0.52% more. The protein was 0.2% lower at the beginning, 0.18% lower in the middle and 1.24% lower at the end of lactation.

The lactose level was 0.44% lower at the beginning of lactation in our results, but in the middle and at the end of lactation the values were similar.

According to Tsochev (1983), a herd of Romanov sheep in the 1st lactation had an average milk fat content and protein of 7.85 and 5.6%, respectively, for the 2nd lactation the fat content was 7.78% and 5.4% protein, as the data correspond to our data.

In a study in Poland of a local breed of sheep, Rozbicka-Wieczorek et al. (2015) and later Radzik-Rant et al. (2017) confirmed the dynamics of physicochemical parameters found in the present study.

CONCLUSIONS

A significant gradual decrease in the average daily milk yield of ewes was reported as the days of lactation progressed (P<0.05).

Mother ewes in the 3rd lactation had a higher milk yield than ewes in the 1st and 2nd lactation.

In the course of lactation, milk fat content, and dry matter increased reliably, whereas the values of protein, lactose, and solid-not-fat did not change significantly.

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