Biotechnology in Animal Husbandry 27 (4), p 1469- 1475 , 2011 ISSN 1450-9156
Publisher: Institute for Animal Husbandry, Belgrade-Zemun UDC 636.39
DOI: 10.2298/BAH1104469K

THE INFLUENCE OF NUMBER OF LACTATION ON MILK YIELD PARAMETERS IN GERMAN FAWN GOATS

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Original scientific paper

Abstract: Goat breeding is one of the least developed agricultural sectors in Serbia. This is reflected in the fact that the total number of goats in Serbia is less than 200,000, as well as the fact that no goat milk production has been recorded by the statistics. Over the last decade, there has been great interest of breeders for intensive breeding of highly productive goats, which resulted in imports of breeding goats. In the same period, several herds of the Alpine breed and German fawn goats were formed, while their production results in the growing conditions in our country have not been fully studied yet. During the first three lactations in the period 2003-2009, the following parameters of milk yield were studied: length of lactation, milk yield in one lactation, percentage and the milk fat yield, and percentage and the total protein yield. The average lactation period was 247 days for the first, 260.6 days for the second and 266.8 days for the third lactation. The average of milk yielded was constantly increasing from the first (594.51 kg) towards the third lactation (761.96 kg), showing statistically highly significant differences (P<0,001). What was also observed is that the order of lactation has not significantly affected the percentage of proteins in milk, whereas the total protein yield in lactations was influenced by the order of lactation due to the differences in average milk yield in lactations.

Key words: German fawn goat, lactation, milk fat, protein, days of lactation, amount of milk

Introduction

The milk yield and composition of goat milk depends on the breed of goats, but is also heavily influenced by physiological and environmental factors. Thus, highly

productive breeds of goats in intensive production can produce up to 1,500 kg of milk in a single lactation, while in the same conditions some other goat breeds can produce a hundred of litres *(Krajinović, 2006)*. The most significant physiological factors are the following:

- Colostral period and stage of lactation. *Anifantakis and Kandarakis (1980)* state that the percentage of fat and protein is high in colostrum and in milk in the first phase of lactation, while it is significantly lower in the middle of lactation, to be increased again in the last stage of lactation while the quantity of produced milk is significantly reduced. The percentage of lactose remains within a rather narrow range during the whole period of lactation, whereas the concentration of minerals increases with the duration of lactation *(Mioč, 1991)*.
- Gravidity dramatically reduces milk yield according to *Salama et al. (2005)*, and without kidding, lactation can be prolonged for 2 to 4 years.
- Age of goats, i.e. number of lactation. It was found that milk production was the lowest in the first lactation, gradually increasing until the fourth, and sometimes until the sixth lactation, after which it declines.
- Litter size, i.e. the number of born kids is correlated with the amount of produced milk. Thus, goats with more kids per litter produce more milk than goats with single-born kids. This phenomenon is accounted for by mechanical stimuli on the udders of goats with more kids and by the impact of genetics. As stated by *Mioč and Pavić (2002)*, the impact of the litter size on milk yield is independent from the order of lactation, body weight of goats and the kidding season. According to the research conducted by a number of authors *(Subires et al., 1988; Crepaldi et al., 2000; Mioč, 1989)*, goats with more kids have longer lactation, and produce more milk and milk fat.
- Kidding season significantly affects the milk yield. Thus, *Crepaldi et al. (2000)* point out that goats kidded in the winter period (the interval from January to February) have higher milk production compared with the goats kidded in the spring (the interval from March to April) or in the summer (the interval from May to July).

Goat milk is considered to be the most complete and the most balanced food. Due to its exceptional quality, high nutritive value, easy digestibility and low allergenic potential, goat milk is recommended in the diets of children, adults and convalescents *(Ribeiro and Ribeiro, 2001)*. Nutritive and health aspects of goat milk are important for numerous medicinal problems of people allergic to cow's milk proteins. As stated by *Businco and Ballanti (1993)*, allergies to cow's milk are prevalent in human population, and this problem was diagnosed in 2.5% of children aged up to three year.

Due to the above stated facts, over the last decade farmers in Vojvodina have become interested in goat breeding, especially raising noble, highly yielding breeds. As there was the lack of such goats in our country, goats have been imported on several occasions; these were Alpine, Saanen and German fawn goats.

Since German fawn goats were not raised in our country before, there are no reliable data on production characteristics of this breed in our geographic and climatic conditions.

The aim of this paper is to supplement the research on milk yield traits of German fawn goats in geographic and climatic conditions of our country.

Materials and Methods

The research included German fawn goats from the reproductive herd of the goat farm "Select-milk" from Inđija, which is registered with the Department of Animal Husbandry, Faculty of Agriculture, Novi Sad, as a producer of high quality breeding livestock. During the period from 2003 to 2009, 269 first lactations, 178 second lactations and 97 third lactations of German fawn goats were analysed. The following milk yield parameters were studied: length of lactation, milk yield per lactation, the percentage and fat yield and the percentage and proteins yield.

The statistical parameters ($\bar{x}$, $S\bar{x}$, minimum, maximum) and t-test were calculated using the computer program Excel.

Results and Discussion

Lactation in goats starts with kidding, and finishes with drying of goats. In dairy goats, lactation can last virtually the whole year, i.e. from one until the following partus *(Krajinović, 2006)*. The total milk yield, milk fat and proteins depends on the duration of lactation, i.e. there is a positive correlation between the length of lactation and the total production of milk and milk fat *(Grossman et al., 1986)*.

Table 1. Duration of lactation of German fawn goats

	N	$\bar{x}$	$S\bar{x}$	Min - max
I lactation	269	246.95	1.40	120 - 292
II lactation	178	260.62	2.19	150 - 301
III lactation	97	266.77	3.39	150 - 309

On the basis of the results presented in Table 1, it can be observed that the average length of lactation, starting from the first lactation towards the third one, increased. The average length of the first lactation was almost 247 days, while the third lactation was almost 267 days. Statistical analysis determined that there is statistically highly significant difference ($P<0.01$) between the length of the first and the second lactation, and the first and the third lactation (at the level of $P < 0.01$), while there was no statistically significant difference between the second and

the third lactation. The obtained values of the lengths of lactation in German fawn goats are slightly higher than the values stated by *Ćinkulov et al., (2007)*. According to this author, the average length of lactation of German fawn goats is around 238 days. According to *Spatrh and Thume (2000)*, the average length of lactation for this breed is around 288 days.

The number of lactation markedly affects the milk yield. It was found that milk production is the lowest in the first lactation, to be gradually increased towards the fourth, and sometimes even to the sixed lactation, after which it declines *(Crepaldi et al., 2000)*.

Table 2. Milk yield (kg) at different lactations of German fawn goats

	N	$\bar{x}$	$S\bar{x}$	Min - max
I lactation	269	594.51	6.62	246 - 969
II lactation	178	678.93	12.30	272 - 1326
III lactation	97	761.96	19.47	252 – 1216

As expected, the average milk yield of the examined goats increased with every subsequent lactation. The average milk yield in the first lactation amounted to 594.51 kg, in the second lactation 678.93 kg, whereas the average milk yield in the third lactation of German fawn goat amounted to 761.96 kg. Statistical analysis showed that there are statistically highly significant differences ($P<0.01$) in the milk yield between all three observed pairs of lactations (between I and II, I and III, and II and III lactation). It can also be observed that there is statistically highly significant difference in the milk yield of the II and III lactation, while there was no statistically significant difference between the length of II and III lactation. What is also evident is that there is high variability of the milk yield within each lactation (even several times).

The most popular and widely used products from goat milk are cheeses. Production of cheese which will have consistent quality often includes many problems, the most significant of which is variable chemical composition of goat milk *(Morgan et al., 2001)*. One of the main parameters that influence the increase of cheese quantity and quality is its ability to coagulate and speed of coagulation. *Clark and Sherbon (2000)* found that goat milk with higher percentage of dry matter, protein and fat coagulates more quickly, forming firmer curd compared with milk with lower content of these components. Therefore, determining the parameters of milk yield traits is necessary in order to obtain information on the quality of milk for processing on one hand, and genetic potential of these parameters on the other hand.

Tables 3 and 4 present the average contents of milk fat and protein in different lactations of German fawn goats.

Nutrition of dairy goats directly affects the length of lactation, the amount of produced milk and its chemical properties. With regard to the chemical properties, the amount of milk fat is most affected by diet. Nutrition with larger quantities of bulky feeds has favourable effects on milk fat, while larger amounts of concentrate in meals result in increased milk yield, but also milk fat reduction. Variations are related not only to the total quantity of produced milk fat, but also to fatty acids composition. The quantity and quality of milk fat are directly dependent on the activity of stomach microorganisms and the amount of glucose in meals. Glucose with galactose in mammary complex forms lactose. Out of the total amount of glucose in body circulation, gland tissue of udders uses from 65% to 85% of it. The amount of lactose, proteins and minerals is less dependent on the diet *(Đorđević and Grubić, 2005)*.

Table 3. Milk fat content (kg and %) in milk of German fawn goats in different lactations

	N	$\bar{x}$		$S\bar{x}$		Min – max
		kg	%	kg	%	%
I lactation	269	18.37	3.11	0.23	0.017	2.30 – 4.44
II lactation	178	21.27	3.18	0.38	0.021	2.40 – 4.10
III lactation	97	24.22	3.24	0.59	0.029	2.65 – 4.06

Table 4. Protein content (kg and %) in milk of German fawn goats in different lactations

	N	$\bar{x}$		$S\bar{x}$		Min – max
		kg	%	kg	%	%
I lactation	269	18.12	3.06	0.20	0.013	2.80 – 3.79
II lactation	178	20.93	3.07	0.40	0.007	2.70 – 3.38
III lactation	97	23.40	3.07	0.57	0.008	2.88 – 3.30

Based on the results presented in Tables 3 and 4, it can be seen that the number of lactation affects milk fat content in milk of German fawn goats (in the first lactation it was 3.11%, while in the third lactation it amounted to 3.24%), whereas it has no significant effect on protein content in milk. Also, it can be noticed that milk fat content within every lactation is far more variable than protein content. By statistical analysis it was determined that there are statistically highly significant differences in milk fat content between I and III lactation ($P<0.01$), statistically significant differences between I and II lactation ($P=0.05$), while there are no statistically significant differences in milk fat content between II and III lactation. With regard to protein content, no statistically significant differences were determined between different lactations.

Conclusion

On the basis of the obtained results – the parameters of milk yield in the first three lactations of German fawn goats raised in the conditions of southern Vojvodina, the following conclusions can be reached:

- The number of lactation affects the length of lactation since the first lactation 246.95 days, the second lactation 260.62 days, and the third lactation 266.77 days.
- The number of lactation significantly ($P<0.01$) influences the milk yield during lactation, and in I lactation the milk yield was averagely 594.51 kg, to reach 761.96 kg in the third lactation.
- The number of lactation affects the content of milk fat in milk and it is statistically significantly higher ($P<0.01$) in goat milk in III lactation compared with I lactation, as well ($P<0.05$) as in II lactation compared with I lactation.
- No statistically significant differences were determined in average protein content in milk of the studied goats of different lactations.

Uticaj laktacije po redu na parametre mlečnosti nemačke šarene koze

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Rezime

Kozarstvo je jedna od najslabije razvijenih poljoprivrednih grana u Srbiji, što se ogleda kroz ukupan broj koza koji je manji od 200 000, kao i kroz činjenicu da statistika ne beleži proizvodnju kozjeg mleka. Tokom poslednje decenije zapaženo je veliko interesovanje odgajivača za gajenje visokoproduktivnih koza na intenzivan način, što je uslovilo uvoz priplodnih koza. U istom periodu je formirano nekoliko stada alpino rase i nemačke šarene koze, čiji proizvodni rezultati u uslovima gajenja u našoj zemlji nisu još uvek u potpunosti istraženi.

Tokom prve tri laktacije, u periodu od 2003. do 2009. godine, praćeni su parametri mlečnosti i to: trajanje laktacije, masa namuženog mleka po laktaciji, procenat i količina mlečne masti i procenat i količina proteina.

Prosečna dužina laktacije je iznosila: za prvu laktaciju 247 dana, za drugu laktaciju 260,6 dana, a za treću laktaciju 266,8 dana. Prosečna količina namuženog mleka se konstantno povećava od prve laktacije (594,51 kg) do treće laktacije (761,96 kg) i pokazuje statistički vrlo značajne razlike ($P<0,01$). Takođe je utvrđeno da redosled laktacije nije bitno uticao na procenat proteina u mleku, što se

ne može reći i za ukupne količine proteina u laktacijama obzirom na razlike u prosečnim mlečnostima laktacija.

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Received 30 June 2011; accepted for publication 15 August 2011