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# Influence of lactation number and parity on milk yield of Saanen goat's breed

[*Influência do número de lactação e paridade na produção de leite da raça de cabras Saanen*]

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## ABSTRACT

The aim of this research was to determine the influence of lactation number and parity on milk yield of Saanen goat's breed. It has been concluded that milk yield was higher for goats that had given birth to twins and three kids than for goats that had given birth to a single kid (P<0.05). The longevity has a great positive impact on production, given that goats in the fifth lactation produced more milk than goats in first or second lactation (P<0.05), while goats in the sixth lactation still produced more milk than goats in first lactation (P<0.05). During the period from 2014- 2019, the research was conducted on a farm of multiparous Saanen goats in Vojvodina (northern part of Serbia). In the observed period, the farm had between 350 and 400 goats per milking, and the research included a total of 1,628 concluded lactations, within which the first lactations were the most 484, then the second 381. According to the number of lactations, goats were grouped into classes from one to seven and from one to three for parity. By comparing each individual lactation, it was determined that in first lactation goats produced significantly lower milk than goats in the rest lactations(P<0.05), except the seventh. Research has shown that lactation number has a significant influence on milk yield (P=0.00). Increasing the fertility of goats significantly affects the production capacity of dairy goats, since does with a larger number of kids in the litter had a significantly higher milk production (P<0.05). Due to the larger number of kids in the litter, milk production also increases. Likewise, it is assumed that the increase in milk yield of goats with two and three kids is a consequence of a larger placenta, i.e. stronger lactogenic activity during pregnancy.

Keywords: saanen goat, lactation number, parity, milk yield

## RESUMO

*O objetivo desta pesquisa foi determinar a influência do número de lactações e da paridade na produção de leite da raça de cabras Saanen. Concluiu-se que a produção de leite era maior para caprinos que haviam dado à luz gêmeos e três cordeiros do que para caprinos que haviam dado à luz um único cordeiro (P<0,05). A longevidade tem um grande impacto positivo na produção, dado que as cabras na quinta lactação produziram mais leite do que as cabras na primeira ou segunda lactação (P<0,05), enquanto as cabras na sexta lactação ainda produziram mais leite do que as cabras na primeira lactação (P<0,05). Durante o período de 2014- 2019, a pesquisa foi realizada numa fazenda de cabras Saanen multipares em Voivodina (parte norte da Sérvia). No período observado, a fazenda tinha entre 350 e 400 cabras por ordenha, e a pesquisa incluiu um total de 1.628 lactações concluídas, dentro das quais as primeiras lactações foram as mais 484, depois as segundas 381. De acordo com o número de lactações, as cabras foram agrupadas em classes de um a sete e de um a três para paridade. Comparando cada lactação individual, determinou-se que na primeira lactação as cabras produziram leite significativamente menor do que as cabras nas demais lactações (P<0,05), exceto a sétima. Pesquisas mostraram que o número de lactações tem uma influência significativa na produção de leite (P=0,00). O aumento da fertilidade das cabras afeta significativamente a capacidade de produção de caprinos*

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*leiteiros, já que com um número maior de cabritos na ninhada a produção de leite foi significativamente maior (P<0,05). Devido ao maior número de cabritos na ninhada, a produção de leite também aumenta. Da mesma forma, assume-se que o aumento na produção de leite de cabras com dois e três cabritos é uma consequência de uma placenta maior, ou seja, de uma atividade lactogênica mais forte durante a gestação.*

*Palavras-chave: cabra Saanen, número de lactação, paridade, produção de leite*

## INTRODUCTION

Goat production in the world has been continuously growing (Giuseppe *et al*., 2018). The highest growth is recorded in less industrialized countries, while in Europe the number of goats is declining. This practically means that there is a continuous growth of extensive or grazing goat breeding, while intensive farm goat breeding is decreasing. Europe as a continent is recognized as a region of the world with developed intensive milk production of goats (Pulina *et al*., 2018). Besides milk yield, some characteristics of Saanen goats that could be improved are kid birth weight and milk quality that could be improved are kid birth weight and milk quality (Irawati *et al.*, 2019). The length of the lactation period, the daily and total amount of milk yield, and the composition of milk from goats are influenced by genetic factors (breed with its physiological characteristics) and numerous paragenetic factors, some of them are imposed and therefore cannot be significantly influenced by the breeder (climate and lactation length…), and others are affected by short-term changes (diet, milking) or long-term changes (selection) (Goetscha *et al*., 2011; Krajinović and Pihler, 2015). The goats have a certain ability to adapt to rearing conditions, which is more pronounced in smaller than in larger groups. Any change can affect both of traits, milk yield and milk composition (Faye and Konuspayeva, 2012).

For successful improvement it is necessary to apply adequate rearing system, primarily by improving nutrition and rearing conditions (Marković *et al*., 2020). The influence of the parity is still an insufficiently investigated paragenetic factor that affects the milk yield of goats. Higher milk yield of goats with a multi-pair litter is associated with a larger mammary complex, i.e. a larger number of alveoli in the udder than from goats with a single-born kid (Krajinović*et al*., 2011). Similarly, Upadhyay *et al*. (2014) concluded that the higher litter size means the higher udder and teat parameters value. They concluded that there were high phenotypic correlations between external measures defining udder size (circumference, depth, and width of the udder) and milk yield. McLaren *et al*. (2016) found that large volume udders, as well as deep and well attached udders are significantly and positively correlated with the quantity of produced goat milk.

In a study by Zygoyiannis (1994) on the topic: "The influence of the number and genotype of kids on the yield and milk composition of indigenous Greek goats", the author reports the following: four groups of 10 indigenous goats posterity suckling obtained in pure breed or obtained by crossing these goats with bucks of another breed, single or twin. Kids were used to examine the effect of suckling stimulus on milk yield and composition during the 12-week suckling period and during the first 20 weeks of milking. During the suckling period, the goats kidded the twins gave more milk than the goats kidded single-born kids. Goats with single-born kids had higher concentrations of fat, protein and lactose in milk than goats with twins. Ciappesoni *et al*. (2004) in their studies concluded that there is a significant positive correlation between litter size and milk yield while the percentage of protein in milk is inversely proportional.

Analysis of the influence of parity (i.e., single or twin) on lactation curve parameters, Salvador and Martínez (2007) attributed this effect to greater udder stimulation by multiple kidding; causing an increase in milk production, in addition to the hormonal effect during pregnancy (Pulina *et al*., 2007). Fatal (2008) in Syria reports that the increase in daily milk yield in goats that have had twins can be attributed to an improvement in the udder and an increase in its size during trimester period of pregnancy due to an increase in hormonal activity (placental lactogen) with an increase in placental size in goats that had twins compared to goats that had single-born kids. Semsemia (2010) found

variations in dry matter content in goats kidded three kids that was 0.14 ± 0.07% lower compared to goats given single-born kids.

Pihler *et al*. (2017) analyzing paragenetic factors that affect milk production of the Alpine breed of goats, found that goats with twin pregnancies produced an average of 44.5 kg more milk per lactation, than goats with one kid, while goats with three kids produced an average of 85.54 kg more milk. They hypothesize that goats with more embryos have higher lactogenic activity than goats with one embryo, which leads to better development of the mammary complex. Other studies (Zygoyiannis, 1994; Zygoyiannis and Katsaounis, 1986) have shown that goats with twins tend to yield significantly higher amounts of milk than do goats with a single kid.

## MATERIAL AND METHODS

The research was conducted on a farm of multiparous Saanen goats in Vojvodina (northern part of Serbia), in the period from 6 years (up 2014 to 2019). In the observed period, the farm had between 350 and 400 goats per milking, and the research included a total of 1,628 lactations. According to the number of lactations, goats were grouped into classes from one to seven, and from one to three according to the number of kids per litter. An intensive production system has been applied on the farm without heading out to pasture. Goats are arranged in group boxes of 40 to 50 heads each. Goats that were the subject of the research had a usual mating with bucks, without artificially stimulated estrus. Kids are separated from the mothers on the farm immediately after birth and suckled artificially, so that the effect of the increased stimulus of suckling the kids on the milk yield of the goats is avoided. The milking routine included goat milking which is performed twice daily in the morning and in the evening at average intervals of 12 hours. Milking is done with the DELAVAL automatic parlour which has the possibility of measuring the milked amount of milk for each milking place or for each milked doe. The milk control system was performed according to the ICAR A4 method. We are using the test day model in order to calculate the amount of milk produced during lactation period, respectively, on the day of testing, the total amount of produced milk is measured. The time period between two control (test day) is 28-34 days. Each lactation had a minimum 6 controls of the milk were performed. There were no changes in the feeding regime throughout the lactation period and the goats on the farm were in a closed system with balanced diet throughout the whole year.

The analysis included 1,628 concluded lactations, within which the first lactations were the most 484, then the second 381. The amount of milk produced in lactation, was performed using Fleischman's formula. The Fleischmann's formula, for calculating the amount of milk produced in lactation uses the values of the measured amount of milk, on the day of testing:

$$KMI = I_o x KM_1 + I_1 x ( KM_1 + KM_2 )/2 + I_2 x ( KM_2 + KM_3 )/2 + I_{n-1} x (KM_{n-1} + KM_n )/2 + I_n KM_n$$

**$I_o$** = interval from the beginning of milking (from the date of drying if the kids suckled or from the date of the last kidding if the kids suckled only colostrum) to the first control
$KM_1$, $KM_2$,.....$KM_n$ = the amount of milk in milligrams milked in 24 hours on the day of control
$I_1$, $I_2$,.....$I_n$ = the interval between the two monitored milk control
$I_n$= the interval between the last control and the end of milking (drying of goats)

To test effects of number of lactations, number of kids in litter and their interaction on lactation length, amount of milk produced in lactation and amount of milk produced in 240 days of lactation, factorial ANOVA was used, followed by Tukey HSD test to separate the means. Differences were considered significant when $P<0.05$. Analysis was performed in Statistica software package (ver. 13 StatSoft).

## RESULTS AND DISCUSSION

Lactation length, average amount of milk produced in lactation and average amount of milk produced in 240 days of lactation are shown in Table 1. 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, actually the longest average length of lactation was the third (305.89 days), while the shortest was seventh lactation 283.31 days. Regarding the amount of milk produced in lactation, as the most important factor of production in dairy goat breeding, it was determined that the goats in the fifth lactation, which was the most productive according to the rest lactations (average 809.62 kg of milk) had an average of 148.25 kg of milk higher production than goats in the first lactation, whose average production was 661.37 kg of milk. Similar results were obtained by Krajinović *et al*. (2011) where they state that the number of lactations significantly influences the milk yield during lactation and the milk yield at third lactation was higher than in first. If we look at the average amount of milk produced in 240 days of lactation, it is noticed that the same most productive does were the goats of the fifth lactation 649.06 kg of milk. On the investigated farm, the average lifespan of goats is less than 4 lactations (3.8 lactations), which leads us to the conclusion that a large number of goats do not even reach their maximum production before being weaned from the flock. The number of lactations markedly affects the milk yield (P=0.00). 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 1. Effect of number of lactation and number of kids in litter on lactation length (DL), amount of milk produced in lactation (AMPL) and amount of milk produced in 240 days of lactation (AMPL 240 days), means ± SE

| | DL (days) | AMPL (kg) | AMPL 240 days (kg) | N |
|---|---|---|---|---|
| Number of lactations | | | | |
| 1 | 291.07±1.34$^{c}$ | 661.37±7.34$^{d}$ | 545.82±5.49$^{c}$ | 484 |
| 2 | 287.13±1.55$^{c}$ | 725.69±9.17$^{c}$ | 607.04±6.89$^{b}$ | 381 |
| 3 | 305.89±1.43$^{a}$ | 787.14±11.35$^{ab}$ | 617.33±8.37$^{ab}$ | 263 |
| 4 | 298.12±1.45$^{b}$ | 733.23±12.59$^{c}$ | 588.78±9.18$^{b}$ | 220 |
| 5 | 299.86±2.47$^{ab}$ | 809.62±17.25$^{a}$ | 649.06±13.29$^{a}$ | 118 |
| 6 | 284.85±2.69$^{c}$ | 716.40±14.74$^{c}$ | 602.29±10.22$^{ab}$ | 103 |
| 7 | 283.31±2.29$^{c}$ | 728.69±18.49$^{bcd}$ | 618.04±14.92$^{ab}$ | 59 |
| Number of kids in litter | | | | |
| 1 | 288.48±1.37$^{b}$ | 680.56±7.66$^{c}$ | 567.17±5.84$^{c}$ | 498 |
| 2 | 294.88±0.87$^{a}$ | 731.28±5.73$^{b}$ | 594.67±4.20$^{b}$ | 953 |
| 3 | 299.60±1.80$^{a}$ | 798.06±14.30$^{a}$ | 639.59±10.89$^{a}$ | 177 |
| p-values | | | | |
| Number of lactations | 0.000 | 0.000 | 0.000 | |
| Number of kids in litter | 0.049 | 0.000 | 0.002 | |
| Number of lactation x Number of kids in litter | 0.441 | 0.358 | 0.388 | |

$^{a,b,c,d}$ Means within a continuous column with different superscript differ significantly at P<0.05.

As expected, the average milk yield of the examined goats increased with every subsequent lactation. Analysis of variance showed that there are statistically significant differences between

the observed lactations for the characteristics of lactation length (P=0.00), the average amount of milk produced in lactation(P=0.00) and the average amount of milk produced in 240 days of lactation(P=0.00). By comparing each individual lactation, it was determined that the milk production is lower in the first lactation compared to all other lactations(P<0.05), except seventh. Also, milk production is higher in the fifth lactation, compared to all others(P<0.05), except third.

As mentioned above, higher milk yield of goats with a multi-pair litter is associated with a larger mammary complex, i.e. a larger number of alveoli in the udder than in goats with a single-born kid (Krajinović *et al*., 2011). Table 1 gives the results of descriptive statistics for the characteristics of lactation length, the average amount of milk produced in lactation and the average amount of milk produced in 240 days of lactation, depending on the parity. The shortest lactation was in goats with single-born kid for 288.48 days, while the longest lactation was on average for goats with three kids in litter (299.60 days). Goats with three kids produced, on average, 798.06 kg of milk per lactation, which is 117.5 kg more milk than goats that had one kid and 66.78 kg more milk than goats that had two kids. Does that had a twin pregnancy produced an average of 731.28 kg of milk in the oncoming lactation, which is 50.72 kg more than goats whose pregnancy was single-fertile before the oncoming lactation. A similar ratio of differences is found in the trait produced milk quantity for 240 days of lactation, where they had the highest average milk yield for goats with three kids (639.59 kg), while goats with single-born kids had the lowest milk yield (567.17 kg). Fatal (2008) came to similar results, analyzing the influence of the type of kidding on the daily milk yield of autochthonous goat breeds. He states that the increase in daily milk yield in goats with multiple pregnancies was due to a better developed udder which is again the result of an increase in hormonal activity in the first trimester of pregnancy which is again a consequence of a larger placenta.

Analysis of variance shows the existence of statistically significant differences (P<0.05) of the observed milk yield parameters between goats with different parity in all observed traits. First parity goats had the lowest milk yield in regard to third parity goats which had the highest milk yield. Milk yield was higher for goats that had given birth to twins than for goats that had given birth to a single kid (P<0.05) but less for does that had given the three kids per litter.

According to our results, other studies (Zygoyiannis 1994; Zygoyiannis and Katsaounis, 1986; Peris *et al*., 1997) have shown that goats with twins and three kids tend to yield significantly higher amounts of milk than do goats with a single kid.

## CONCLUSIONS

From the previous study, by analyzing 1,628 concluded lactations of the Saanen goat breed, we can conclude that the longevity has a great positive impact on production, given that goats showed the highest milk yield in the third, fourth and especially fifth lactation, which proved to be the most productive. Increasing the fertility of goats significantly affects the production capacity of dairy goats, since goats with a larger number of kids in the litter had a significantly higher milk production. Due to the larger number of kids in the litter, the milk production also increases, so that goats with two kids had an average of 50.72 kg or 7.75% more milk per lactation than goats with one kid, that is, goats with three kids in the litter produced 117.5 kg or 17.26% more milk per lactation than goats with single-born kids. Considering that all kids from does were separated immediately after kidding, it is assumed that the increase in milk yield of goats with two and three kids is a consequence of a larger placenta, i.e. stronger lactogenic activity during pregnancy.

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