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UDDER MEASUREMENTS AT "ALBA DE BANAT" AND "CARPATINA" GOATS BREEDS

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Abstract

Considering that the form and size of the goat's udder can influence its productive capacity, a series of measurements of certain dimensions of the udder at Romanian breeds Alba de Banat and Carpatina were performed, as follows: large perimeter of the udder, small perimeter of the udder, prior depth of the udder, back deepness of udder, length of udder, length and thickness of nipples. The primary data obtained was statistically processed using statistical functions available in Microsoft Excel and the main statistical parameters were determined: arithmetic mean, standard error of mean and variability coefficient. The udder measurements indicated that, in both breeds, the udder suffers transformations along lactations; thus, with regard to the large perimeter, as well as the small perimeter of the udder, the largest dimension is reached at the 3rd lactation, after which it begins to decrease. These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the quantity of the milk. The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish. The length of the udder is higher at Carpatina by 20.3% than Alba de Banat, suggesting a longer form, but nipples at Alba de Banat are longer (by 9%) and thicker (by 22.7%) compared to Carpatina, so it is better suited to the mechanical milking.

Key words**:** *goats, milk, udder, dimensions, measurements*

INTRODUCTION

The opportunity of these researches is that in the specialty literature on the Romanian goat breeds there are quite a few references regarding the sizes of the udder. The form and development degree of the udder can influence its productive capacity. The sizes of the udder increase in the same time with milk production, to the top of the lactation curve, after that begin to decrease. The results of other researches in this direction have shown that these dimensions are influenced by breed and are positively correlated with the milk production, also depending on the lactation curve [2].

The udder and its characteristics are influenced by several factors such as genotype, growing and management systems applied. The breed is an important factor that determines the production of milk, and in this sense there are different levels of amelioration [9]. Research conducted in Nigeria on local breeds demonstrated that the age of the goat, the lactation phase and the weight of the goats are important factors that have great influence on the udder size [1]. Lactation number influence on milk production, where the evolution is ascending with a maximum at the 3rd lactation, after which, beginning with the 4th lactation, the production starts to decrease, is also confirmed by the research of other authors [4].

MATERIALS AND METHODS

Research has been carried out in the goats' farm belonging to S.C. AGROFAM HOLDING S.R.L., located in Călăraşi County, on the biological material represented by the lactating goats of Alba de Banat and Carpatina breeds.

There were performed 7 types of udder measurements, on different lactations, for 120 goats, of which 60 goats of Alba de Banat breed and 60 goats of Carpatina breed, using the ribbon, as follows [3]:

- The udder's large perimeter - determined as circumference of udder in zone of its grip on abdomen;

- The udder's small perimeter - determined as a circumference of udder in the zone of the nipples grip on udder;
- The anterior depth of udder - size between the zones of udder grip on abdomen, in the anterior part of udder, to the area where nipples are attached to udder;
- The posterior depth of udder - dimension between the zone of udder grip on abdomen, in the back part of udder, by the point of nipples attachment to the udder;
- The udder's length - dimension between anterior part of udder's grip on abdomen, by posterior part of udder's grip on abdomen;
- The nipples length - determined from their gripping area on abdomen, to their top;
- Nipple thickness - measured as their circumference.

We should mention that the timing of the measurements was 3 hours before the second milking of the day.

The primary data obtained was statistically processed using the statistical functions available in Microsoft Excel program and the main statistical parameters were determined: arithmetic mean, standard error of mean and coefficient of variability, following the relations:

Arithmetic mean [5]: $\overline{X} = \frac{\sum_{i=1}^{n} Xi}{n}$

Standard error of mean: $s_{\bar{x}} = \pm \frac{s}{\sqrt{n}}$

Coefficient of variability: $V\ \% = \frac{s}{\overline{X}} \times 100$

The test of differences statistical significance between averages was carried out with the help of ANOVA Single Factor, within the Excel program.

The measurements provided clues about the form and sizes of the udder as well as mechanical milking suitability, being an originality aspect of the research in the domain of goat rising in our country.

RESULTS AND DISCUSSIONS

Analyzing the data in Table 1, illustrated in Figure 1, it is noted that with regard to the large perimeter of the udder and the small perimeter of the udder, the largest dimension is reached at the 3rd lactation [8].

Practically, the evolution of these two dimensions indicates that the udder undergoes transformations along lactations, so that after the third lactation begins to diminish.

The prior depth of udder increases permanently by the fourth lactation (by 33.3%), and regarding the back depth of udder, it has a continuous dimensional evolution until the third lactation, after which it begins to decrease.

The length of the udder reaches the maximum size at the 4th lactation (30.20 cm), 57.3% higher than the first lactation.

Table 1. Udder's sizes at Alba de Banat, on lactations (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$			
	First lactation	Second lactation	Third lactation	Fourth lactation
Large perimeter of the udder	41.60± 1.86	43.40± 1.03	49.20± 3.06	47.60± 0.68
Small perimeter of the udder	37.40± 1.08	41.60± 2.42	47.20± 0.86	44.40± 0.40
Prior depth of the udder	6.00± 0.32	6.20± 0.37	7.20± 0.58	8.00± 0.45
Back depth of the udder	12.00± 1.14	15.80± 1.46	18.20± 1.36	17.80± 0.58
Length of the udder	19.20± 0.97	27.60± 1.86	29.60± 1.54	30.20± 1.07
Length of the nipples	8.00± 0.32	8.00± 0.63	10.20± 0.74	7.60± 0.25
Nipples thickness	14.80± 0.58	17.40± 1.03	18.80± 0.66	11.60± 1.03

Source: Own calculation.

These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the amount of milk that for this breed, reached a maximum of 2.3 kg / day during the studied period.

The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish.
Thus, the nipple length of the 3rd lactation (L3) is 27.5% higher than the first lactation (L1), and their thickness is 27% higher at L3 than L1.

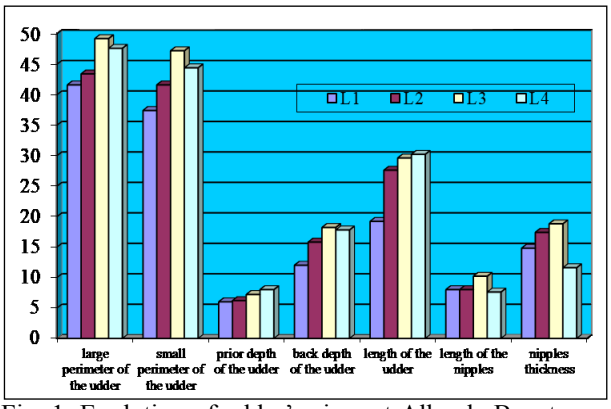

Fig. 1. Evolution of udder's sizes at Alba de Banat, on lactations
Source: Author's calculation.

The test of differences statistical significance between lactations regarding udder's dimensions at Alba de Banat using ANOVA Single Factor shows there are significant differences (P <0.05) between lactations for the large udder perimeter, the udder's prior depth, and the nipples length.
Distinctly significant differences (P <0.01) there are between lactations regarding small perimeter of udder and udder's back depth.
Very significant differences between lactations (P <0.001) there are at Alba de Banat in terms of length of udder and thickness of nipples.

Table 2. The mean of udder's sizes at Alba de Banat (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$	V%
Large perimeter of the udder	45.45 ± 1.12	11.00
Small perimeter of the udder	42.65 ± 1,05	11.03
Prior depth of the udder	6.85 ± 0.27	17.89
Back depth of the udder	15.95 ± 0.78	21.95
Length of the udder	26.65 ± 1.20	20.13
Length of the nipples	8.45 ± 0.34	17.79
Nipples thickness	15.65 ± 0.74	21.17

Source: Own calculation.

The mean, standard error of the mean and coefficient of variability of these sizes parameters of udder at Alba de Banat are shown in Table 2.
The average dimensions of the udder at Alba de Banat breed suggest a globular form of it, with a good abdominal grip, with well-developed nipples, suitable for both manual and especially mechanical milking.

Fig. 2. Goats of Carpatina breed
Source: Photo by author

At Carpatina breed, the same types of measurements were performed, on different lactations, and the results are found in Table 3 and Figure 3.
In this breed, there is also an evolution of the udder's sizes, from the beginning of the productive life to the end of it, or until the maximum lactation (L3).

Table 3. The udder's sizes at Carpatina, on lactations (cm) (n = 60)

Specification	$\overline{X} \pm s_{\bar{x}}$			
	L1	L 2	L 3	L 4
Large perimeter of the udder	35.40 ± 0.51	36.20 ± 2.52	44.80 ± 1.28	38.40 ± 0.93
Small perimeter of the udder	30.60 ± 0.51	40.40 ± 1.12	44.40 ± 1.21	40.40 ± 1.12
Prior depth of the udder	5.60 ± 0.40	9.60 ± 0.40	15.20 ± 1.24	11.40 ± 0.75
Back depth of the udder	12.00 +0.55	16.40 ± 0.40	18.80 ± 0.58	21.40 ± 1.40
Length of the udder	21.60 ± 1.44	29.20 ± 0.74	38.40 ± 0.75	39.00 ± 0.55
Length of the nipples	5.80 ± 0.49	8.40 ± 0.25	9.20 ± 0.37	7.60 ± 0.81
Nipples thickness	9.80 ± 0.37	12.60 ± 0.51	14.40 ± 1.03	14.20 ± 1.43

Source: Own calculation.

The perimeters of udder, the prior depth of udder, as well as parameters of nipples reach the maximum size at L3, then decrease, and posterior depth of udder and its length increase along the lactations.

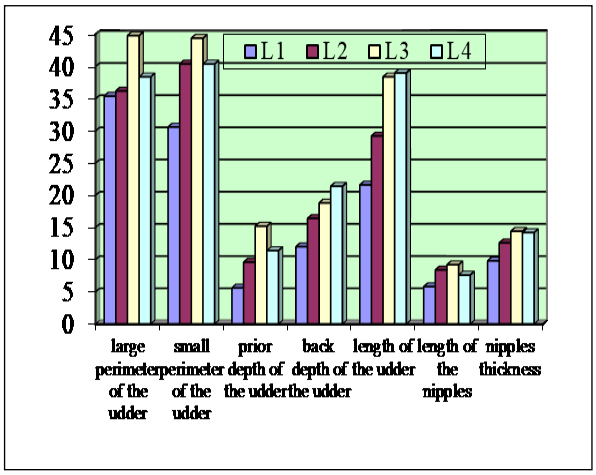

Fig. 3. The evolution of the udder dimensions at Carpatina breed, on lactations
Source: Own calculation.

It can be seen that at L3, the large udder perimeter increases by 26.6% compared to L1, and the small perimeter of the udder increases by 45.1% between L1 and L3. Also, the prior depth of udder is greatly increased, by 171% in the same period, and the back depth of udder increases by 78.3% at the end part of lactations compared to L1.
The length of the udder has also a spectacular evolution, which is 80.6% higher at L4 than L1, surpassing Alba de Banat breed, where the increase is 57.3%.
Also, the length and thickness of the nipples evolves until the 3rd lactation, when the maximum of the productions is reached.
The test of statistical significance of differences between lactations in terms of udder's sizes at Carpatina using ANOVA Single Factor shows that there are insignificant NS differences (P> 0.05) regarding the small perimeter of udder, the prior and posterior depths of udder and the length of udder.
There are also significant differences among lactations (P <0.05) in terms of nipple thickness and distinct significant differences (P <0.01) regarding the large perimeter of the udder and the length of the nipples.

Fig. 4. Goats of Carpatina breed
Source: Photo by author

In Table 4 there are presented the average dimensions of the udder at Carpatina, which show, among other things, that the small perimeter of the udder is actually slightly larger than the large perimeter and the length of the udder is higher than that of Alba de Banat with 5.4 cm.
Also, the depths of the udder are higher at Carpatina than Alba de Banat, all of these indicating a different form from Alba de Banat, where the udder is globular, at Carpatina being in the form of pear, flaccid and not so well gripped by abdomen like the other breed.

Table 4. The mean of the udder's sizes at Carpatina breed (cm) (n = 60)

Specification	$\bar{X} \pm s_{\bar{x}}$	V%
Large perimeter of the udder	38.65±1.07	12.40
Small perimeter of the udder	38.95±1.26	14.46
Prior depth of the udder	10.45±0.87	37.19
Back depth of the udder	17.15±0.88	22.96
Length of the udder	32.05±1.70	23.73
Length of the nipples	7.75±0.38	21.70
Nipples thickness	12.75±0.60	21.12

Source: Own calculation.

Following Figure 5, the udder's average sizes in the two breeds are compared. At Alba de Banat, the large perimeter of the udder is

17.6% higher than Carpatina, and the small perimeter of the udder is 9.5% higher.

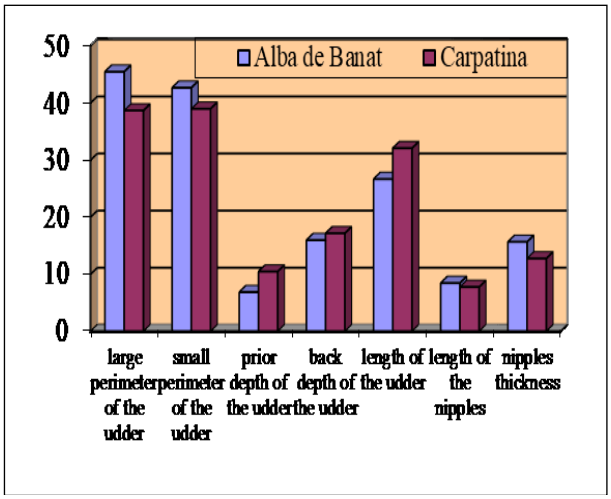

Fig. 5. The average sizes of udder at Alba de Banat and Carpatina
Source: Author's calculation.

The prior depth of the udder at Carpatina is 52.6% larger than Alba de Banat, and the back depth is higher by 7.5%.
Also, the length of the udder is higher at Carpatina than Alba de Banat by 20.3%, suggesting a longer shape, while the nipples at Alba de Banat are longer by 9% and thicker by 22.7 %, compared to Carpatina, thus, they are more suited to mechanical milking.
Statistical significance of differences among the two breed averages indicates that there are insignificant NS differences (P> 0.05) regarding the udder's large perimeter, the back depth of udder and length of nipples.
There are also significant differences (P <0.05) with respect to the small perimeter of the udder and the length of the udder, distinct significant differences (P <0.01) on the thickness of the nipples and very significant differences (P <0.001) regarding the anterior depth of the udder.

CONCLUSIONS

It is necessary to monitor all the categories of factors that determine milk production, in order to positively influence both the top of the lactation curve, the variations and the rate of decline [6].
Udder measurements indicated that, in both breeds, the udder suffers transformations along lactations; thus, with regard to the large perimeter, as well as the small perimeter of the udder, the largest dimension is reached at lactation 3, after that it starts to decrease.
At Alba de Banat, the prior depth of the udder and the udder's length grow continuously until the 4th lactation.
These dimensional evolutions indicate that the udder increases its capacity over the productive life of the animal in order to store the milk quantity produced.
The same transformation curve has the nipples in the sense that both their length and thickness are amplified until the 3rd lactation and then begin to diminish.
The average dimensions of the udder at Alba de Banat breed suggest a globular shape with a good abdominal attachment, with well-developed nipples, suitable for both manual and especially mechanical milking.
Average udder dimensions at Carpatina show that the small perimeter of the udder is slightly larger than the large perimeter, and the length of the udder is larger than Alba de Banat with 5.4 cm.
Also, the depths of the udder are larger at Carpatina than Alba de Banat, all of these indicating a different form from Alba de Banat, where the udder is globular, at Carpatina being in the form of pear, flame and not so well caught by the abdomen as the other breed.
The necessity to implement a strategy for the improvement of goats for dairy production is due to the increased interest of Romanian breeders for this species, as well as the opportunity for export of goat milk products to the European markets [9].
By launching an improvement program based on performance and growth technologies, the efficiency of exploitation of goats will increase [10].

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