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KAPOSVÁR UNIVERSITY

FACULTY OF ANIMAL SCIENCE

Department of Large Animal Breeding and Production Technology

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EVALUATION OF BODY MORPHOLOGY AND PRODUCTION TRAITS OF GOAT BREEDS IN HUNGARY

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1. BACKGROUND AND OBJECTIVES OF THE RESEARCH

The primary aim in Hungarian goat breeding programmes was to stabilize and standardize the local breeds, and in order to improve the productivity some cross-breeding also took place, using imported intensive breeds (Alpine and Saanen).

In goat breeding the easiest and fastest way to describe the breeds is – beside using methods of molecular biology (QTL, microsatellites, mtDNA polimorphisms analysis) – the description of external markings, the measurement of body characteristics and production traits.

In several countries of the world the description of local (mostly native) goat breeds already took place in the past few decades, however, in Hungary there is little information available regarding the phenotypical markings, the body measurements and the correlation of these to the milk production of the breeds that make up 80% of our goat population. Body measurements of goats in Hungary were taken and published 50 years ago by BODÓ (1959) in his dissertation.

The description of external and milk production traits of the three goat breeds in breeding programme started by the Hungarian Goat Breeders' Association in 1999, is necessary and reasonable because of the growing importance of the preservation of biodiversity in the world. Through the crossbreeding for increasing of milk production, growing number of breeds are disappearing.

The objective of the examinations was to collect basic data necessary to the elaboration of performance test and the relationships among those. The objectives are justified by limited accuracy of performance test, because the data base for the Performance Test Codex is considerably incomplete.

The examination and description of external markings and milk production traits of Hungarian breeds are needed for determination of similarities and differencies between these and the imported ones.

In my experiments, I wanted to find the answer to the following questions:

1) What are the typical body mesurements of the Hungarian goat breeds?
2) What are the external characteristics of the Hungarian breeds?
3) What are the average milk production traits of the Hungarian breeds (*daily milk yield, milking period, milk quantity, fat content, protein content, lactose content and somatic cell count*)?
4) What kind of relationships could be determined among body measurements and milk production traits, as well as the external markings and milk production traits?

2. MATERIALS AND METHODS

The first in the series of examinations was to survey the body measurements (body weight, wither height, body length, thorax depth and width, pelvic width, hip width, head length, ear length and width and distance between eyes) of the does of the milking breeds kept in Hungary (Hungarian Milking White, n = 198; Hungarian Milking Brown, n=182; Hungarian Milking Multicolour, n=202; Alpine, n=146 and Saanen, n=216). In addition, the external characteristics of the three Hungarian breeds (Hungarian Milking White, n=977; Hungarian Milking Brown, n=1244; Hungarian Milking Multicolour, n=1190) were surveyed, such as coat colour, presence of stripes, hair length, presence of horns, size of ears, presence of tinkles and beard, and the udder shape. In monthly test milkings, beside measuring the milk yield, individual milk samples were also taken from the Hungarian goats (Hungarian Milking White, n=156; Hungarian Milking Brown, n=168; Hungarian Milking Multicolour, n=106). In laboratory examinations the fat, protein and lactose content of the milk and the somatic cell count were defined.

The SAS® (2004) software package was used for the statistic analysis. The least squares means ± standard error of mean of each basic fact were calculated in order to compare the different data numbers' treatements and demonstrate the differences.

To define the relation between body measurements, milk yield and milk components, as well as somatic cell count, Pearson-correlation analysis was used; to explore the correlation between body measurements controlled for body weight, partial correlation analysis was conducted. To compare the breeds, and to discover the effects of breed, age and farm, multivariate analysis of variance was applied. The measurements carrying the most information were found with factor analysis. To search the presence of external characteristics in a given breed, frequency distribution analysis was used, to compare the breeds with each other the Chi^2-method was applied. To determine the correlation between the external characteristics and milk yield, rank correlation was used.

3. RESULTS

My results showed that the goats in the Hungarian Milking White and the Saanen; and the Hungarian Milking Brown and Alpine breeds were significantly different in every examined **body measurements**.

Among the five breeds the Saanen does were the heaviest, the thorax and hip measurements were also the widest. The highest wither, longest body and deepest thorax measurements were found in the Alpine breed.

The average body weight, wither height, pelvic and hip width of Alpine and Saanen breeds were significantly different, however, the differences between body length and thorax depth in these two breeds were not statisticaly justified.

Among the three Hungarian breeds, the Hungarian Milking White had the lowest body weight, wither height, body length and thorax depth, while the Hungarian Milking Multicolour had the smallest thorax width, pelvic and hip width. All measured data were the highest in the Hungarian Milking Brown breed.

The body weight, body length, thorax depth and width of Hungarian Milking Brown were statisticaly different from Hungarian Milking White and Hungarian Milking Multicolour, while in the wither height there were not significant differences among the three breeds.

The Hungarian Milking White and Hungarian Milking Brown were significantly different from Hungarian Milking Multicolour, while the differences in average hip width between Hungarian Milking Brown and Hungarian Milking Multicolour were statisticaly justified.

Regarding the **colour of the coat**, there was an overlap in four colour combinations between the Hungarian Milking White and the Hungarian Milking Multicolour; and an overlap in twenty-four combinations between the Milking Brown and Multicolour breeds. More than 90% of the milking goats resembled in this characteristic to the Saanen goats used to improve the native breeds. Among the Hungarian Milking Brown 7.5% of the goats showed the typical Alpine colouring in Hungary (chamoisée - dark brown coat, black dorsal stripe and feet and nose). In the Hungarian Milking Multicolour breed the colour of the coat was very heterogeneous. 70% of the Hungarian Milking White and Brown breeds had short hair, similar to the imported, enhancing breeds. The does with long hair on back hindquarters, or half-long and long hair type were mostly found in the Hungarian Milking Multicolour breed. The population is very heterogeneous in **udder shape** as well, twenty-eigth kind of udder shape were drawn. In each of the three native breeds one third had medium-sized, normal, regularly shaped udder with small or medium fist sized teats.

The does of Hungarian Milking Multicolour started the lactation with the highest **daily yield**, while from the second part of the lactation, the Hungarian Milking White does had the highest average daily yield. In the course of lactation the Hungarian Milking Brown had the lowest daily yield. The Hungarian Milking White and the Hungarian Milking Multicolour does had the peak daily yield (1.6 litre) in the period of 81-110 days, while the Hungarian Milking Brown the peak daily yield (1.5 litre) was in the period of 111-140 days. At the beginning of the milking season the daily milk yield was between 1.4 and 1.5 litre, but in the second period the yield increased to 1.5 and 1.6 litre in all three breeds. The yield stayed at the same level in the Hungarian Milking White and the Hungarian Milking Multicolour breeds, and from the period of 171-200 days the yield decreased, to 1.0 litre at the end of lactation. The milk production of the Hungarian Milking Brown decreased after the peak yield to 0.9 litre.

The **fat content** of the milk increased from 3.2% to 5.0%, its fluctuation was the highest in Hungarian Milking Brown producing the highest fat content at the beginning and at the end of lactation.

The Hungarian Milking Multicolour does produced 3.4% milk fat until the 170th day, then it increased strongly. The tendencies were similar in other two breeds, however, the fat content increased from 3.3 to 3.5% in Hungarian Milking White, then it was stable until the 200th day, and increased strongly.

The **protein content** of the milk increased from 3.1 to 3.9%. In Hungarian Milking White the content increased persistently, however, in Hungarian Milking Brown and Hungarian Milking Multicolour the protein content decreased from the second period, and reincreased from the 111st day.

In the course of the lactation the differences among breeds changed, until the 140th day the protein yield was the highest in Hungarian Milking Multicolour does, but in the further period, in the Hungarian Milking Brown breeds.

During the milking period the **lactose content** of milk changed between 4.3 and 4.6%. The highest lactose content was measured in Hungarian Milking White, the lowest in Hungarian Milking Multicolour milk, which differences were significant in almost all, except 81-110 days periods. In the two last periods of lactation the lactose content of milk produced by Hungarian Milking White and Hungarian Milking Brown does were significantly different.

The **somatic cell count** increased continously during lactation, the values at the end were three times more than at the beginning. The highest increasing (4 times) was in the Hungarian Milking Brown breed. Until the 230th day, the somatic cell count were the highest in Hungarian Milking Brown, then the milk of Hungarian Milking White does had the highest quantity of somatic cell count.

4. CONCLUSIONS AND RECOMMENDATIONS

The one-year-old Hungarian does were heavier than the measured ones by BODÓ (1959), however, the two-years-old does had similar body weight. At age of three years the does kept in Hidashát (Hungary) the body weight measured by BODÓ (1959) were higher than the does measured for my study. The three-years-old does were smaller and shorter than the does measured fifty years ago.

The correlations among body measurements were compared with oher native breeds from other country. The correlation between body weight and wither height in Alpine does was similar to the results published by KAFIDI et al. (2000), however, in Saanen does the correlation was stronger than his results. In the three Hungarian breeds the correlations among body measurements were similar to the results of VARGAS et al. (2007). The correlation coefficient of

the relationship between body weight and body length were between the results of SAMUEL FAJEMILEHIN and SALAKO (2008) and KHAN et al. (2006).
The correlation coefficients of body length and wither height of Hungarian Milking Brown and Alpine does were similar to HASSAN and CIROMA (1992) results, but in Hungarian Milking Multicolour and Saanen the correlation were not as strong as described by SAMUEL FAJEMILEHIN and SALAKO (2008).
The average **daily yield** (1.4 litre) of Hungarian Milking White does were higher than published by PINTÉR et al. (2004), but lower than the results of KUKOVICS (2005). In the Hungarian Milking Brown and Hungarian Milking Multicolour breeds PINTÉR et al. (2004), and KUKOVICS (2005) showed higher daily yield than 1.3 and 1.4 litres. The peak daily yields were reached later, but with higher yield than the ones published by ALEXANDRE et al. (1997).

According to my results the **fat content** of milk changed between 3.2 and 5.0%, like in the study of MIMOSI et al. (2007). MENA et al. (2007) also showed an important increase in fat content from April to December. ZANTAR et al. (2008), TERÉK (1999), OLIVEIRA et al. (2002), KUKOVICS et al. (2009) and KATANOS et al. (2005) published similar fat content to my results (3.7%) in all three Hungarian breeds.
The changes in **protein content** (from 3.1 to 3.9%) during lactation did agree with the results of MENA et al. (2007). The average lactational daily protein content (3.3%) was similar to CLAPS et al. (2007) in Red Syrian, MIMOSI et al. (2007) in Camosciata, BEDŐ et al. (1999) in Saanen breeds.
The changes in **lactose content** (between 4.3 and 4.6%) were in average 4.4-4.5% for the whole lactation like the data published by KATANOS et al. (2005), REYES et al. (1999), MOLNÁR és MOLNÁR (2000), and TERÉK (1999).
The increasing of **somatic cell count** during milking period was confirmed by other authors, however, in its rate the results were different. According to my results the somatic cell count increased from 867 thousands to 3.3 million,

which values were similar to the result published by SUNG et al. (1999) in Alpine, Saanen, Nubian and Toggenburg breeds.

The data at the end of the lactation were the triple or quadruple of the counts measured at the beginning, which tendencies are similar to the results of ROSATI et al. (2005) and KUKOVICS et al. (2009). My results at the beginning of lactation were between the results of FERNANDEZ (2002) and LIN and CHANG (1994), while at the end of lactation, the values were higher than published by ROSATI et al. (2005). During the whole milking period the somatic cell counts were between 1.7 and 1.9 millions, while the differences of ANIFANTAKIS et al. (1996) were wider.

According to the analysis of the body measurement, it could be concluded that in Hungarian breeds many does were mated too early, without attention to full growth, and those remained smaller and produced less milk.

In the case of Hungarian Milking Brown and Hungarian Milking Multicolour breeds, due to the high number and heterogenous coat colour, the hair length, and udder shape, as well as to promote to consolidate the breeds, it is proposed to select and multiply the three populations separately.

It could be proposed to start the milking period as soon as possible after the kidding, and finish or starting the dry season after 200 days, because of the decrease of milk yield even if the fat and protein content increases.

The results of the analysis of the three Hungarian breeds could be the base of a genetic experiment to find the genetic background of the differencies and/or similarities among the three breeds.

5. NEW SCIENTIFIC RESULTS

According to my experiments the following new scientific results were established:

1. The average body weight of does belonging to Hungarian breeds were between 46.3±0.6 and 48.9±0.7 kg, their wither height between 64.6±0.3 and 65.2±0.3 cm; body length between 69.2±0.3 and 70.5±0.3 cm; thorax depth between 30.5±0.2 and 31.2±0.,2 cm; thorax width between 18.1±0.2 and 18.7±0.2 cm; hip width between 15.9±0.1 and 16.3±0.1 cm; pelvic width between 17.4±0.1 and 17.8±0.1 cm.

2. The Hungarian breeds were characterized by the phenotypical features. The three Hungarian breeds are significantly different in the distribution of coat colour, presence of stripes, size of ears and udder shape.

3. During the milking period the milk fat content increased from 3.3±0.1% to 5.0±0.1%; the protein content from 3.1±0.1% to 3.9±0.1%; the lactose content remained balanced between 4.3±0.0 and 4.6±0.0%.

4. The milk production and milk qualities of the three Hungarian breeds were similar in daily milk production, in fat and protein content and in somatic cell count.

5. The milk production is in positive medium correlation with thorax measures in the Hungarian Milking Brown, with body length in the Hungarian Milking Multicolour, with body weight and thorax width in the Alpine breed.

6. According to the quantities examined, the Hungarian goat population separated in three breeds by coat colour seems to be grounded, thus the maintenance of three individual breeds is reasonable.

6. SCIENTIFIC PAPERS AND LECTURES ON THE SUBJECT OF THE DISSERTATION

Book chapters

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