Morphologic characterization and body measurement of Hungarian goats

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Abstract
The objective of this study was to phenotypicaly (morphologically) characterize and compare the local goat breeds (Hungarian Milking White /HMW/, Hungarian Milking Brown /HMB/, Hungarian Milking Multicolour /HMM/) and the adult offspring of the imported breeds, bred in Hungary, like Alpine and Saanen. This survey is the first step of the comparison of breeds, and can be the base of development of Hungarian goat selection indices. The farms were chosen from the register of the Hungarian Goat Breeders' Association, concerning each breed. In the case of native breeds, most of the farms are keeping all of these breeds. The 1,157 measured female goats, in 24 farms were with age varying between 1 and 8 years. The following measurements were taken: body weight, wither height, body length, thorax depth, thorax width, pelvic width, hip width, head length, ear length and width, and distance between eyes.
In the survey, there were 18% Alpine of the measured goats, 30% Saanen, 13% HMW, 16% HMB and 23% HMM.
The collected data was analysed by SPSS for Windows 10.0 software. According to the results received no significant differences (in $P<0,05$) were observed in each body measures, between the HMW and Saanen, or HMB and Alpine does, even in considering the age and the herd effect. The HMM breed has several kinds of breeds of its background including brown and white goats, but its measurements do not differ in morphology from the other 4 breeds.

Introduction

The goat industry is the smallest big domestic animals sectors in Hungary; the estimated size is about 60-70 thousand does, which are kept by a little bit more than 7,000 holders.
At present not more than 20 thousand does are registrated of 8 different breeds, including 4 imported ones (Saanen, Alpine, Anglo-Nubian and also Boer for meat).
The native goat population is very heterogeneous in characteristics and also in production. Thanks to the work of Hungarian Goat Breeders' Association this population started to be distinguish by the colour of hair, called Hungarian Milking White (HMW), Milking Brown (HMB) and –Milking Multicolour (HMM). The aim of the present study is to describe the native goats bred in Hungary, to compare them with Alpine and Saanen in order to highlight morphological differences and similarities.

Materials and Methods

Twenty-four (24) farms were chosen from the register of the Hungarian Goat Breeders' Association, concerning each breed. The age of the 1,157 measured female goats were varying between 1 and 8 years. Eleven morphological variables were measured in these animals as follows: body weight, wither height, body length, thorax depth, thorax width, pelvic width, hip width, head length, ear length and width, and distance between eyes. The length and width data were measured by stick, pelvic and hip by bows and the head was measured by tape. From this population 493 purebred adult goats were randomly selected for the statistical analysis. The collected data were analysed by SPSS for Windows 10.0 software.
The authors have used multivariate analysis of variance (*LSD test*) for compare the breeds on levels $P\leq0,05$ (*), $P\leq0,01$ (**) and $P\leq0,001$ (***).

Results

By the mean of data, Saanen does have the biggest body measures, except head length and wither height, wherein Alpine breed is the biggest (Table 1). In every body measures Hungarian Milking Multicolour breed have the lowest mean.
The comparison of counted mean and estimated measures by SPSS is shown in Table 2.

Table 1. The body measurements data of adult milking does in Hungary (mean±std.deviation)

Breed	n	Body weight	Wither height	Body length	Thorax depth	Thorax width
		kg	mm			
Alpine	85	54.08±5.84	679.2±42.1	743.3±39.3	325.4±24.5	198.1±27.9
Saanen	79	64.51±14.08	674.3±38.5	742.8±47.8	330.0±23.2	214.6±34.1
Hungarian Milking White (HMW)	90	51.29±5.38	664.4±40.6	714.2±38.1	315.8±17.1	184.7±18.7
Hungarian Milking Brown (HMB)	125	51.13±6.25	657.8±44.2	713.5±37.9	315.8±20.8	190.9±25.4
Hungarian Milking Multicolour (HMM)	114	49.83±6.11	655.6±36.4	705.8±41.0	314.8±24.1	182.3±22.3

Breed	n	Pelvic width	Hip width	Head length	Ear length	Ear width	Distance between eyes
		mm					
Alpine	85	172.1±10.7	185.9±9.8	177.1±12.2	142.7±12.6	73.5±7.5	129.8±11.0
Saanen	79	184.9±22.9	195.9±20.3	175.4±12.0	143.0±14.9	75.3±6.0	134.6±9.6
Hungarian Milking White (HMW)	90	164.9±11.8	180.6±11.4	173.7±13.1	141.4±12.0 *	70.9±5.2 *	129.7±11.2
Hungarian Milking Brown (HMB)	125	164.9±12.7	179.8±11.8	173.8±10.4	140.0±12.1 **	72.1±5.8 **	130.5±10.1
Hungarian Milking Multicolour (HMM)	114	161.8±11.5	176.0±12.4	173.6±9.8	140.9±11.8 ***	72.1±6.7 ***	128.8±10.3

* 4 does have short ears, n=86
** 4 does have short ears, n=121
*** 8 does have short ears, n=106

Table 2. The counted and estimated body measures

[mm]		Wither height	Body lenght	Thorax depth	Thorax width	Pelvic width	Hip width
Alpine	***counted***	679.2	743.3	325.4	198.1	172.1	185.9
	estimated	687.7	736.7	327.9	199.8	169.9	183.3
Saanen	***counted***	674.3	742.8	330.0	214.6	184.9	195.9
	estimated	653.9	721.2	315.6	191.6	171.5	184.9
HMW	***counted***	664.4	714.2	315.8	184.7	164.9	180.6
	estimated	667.7	732.4	318.1	183.8	165.5	180.3
HMB	***counted***	657.8	713.5	315.8	190.9	164.9	179.8
	estimated	663.8	716.4	316.9	200.2	165.5	179.7
HMM	***counted***	655.6	705.8	314.8	182.3	161.8	176.0
	estimated	656.7	721.3	326.2	189.9	164.5	179.4

The authors have made hundred comparisons and found seventeen significant differences between breeds in body measures (Table 3 – 9). In most cases the significant level is P≤0.05 (*). The most important difference is in wither height measures (Table 3) between Alpine with Saanen does and Alpine with Hungarian Milking Multicolour does on level P≤0.001 (***). In body length (Table 4) only one significant difference was found between breeds, HMB and Alpine, where last breed's does are longer than other with 20.28 mm (Table 9). In case of thorax measures (*depth and width*) four-four differences were observed (Table 5 – 6).

Table 3. Analysis of variance of wither height measures

Breeds	A	S	HMW	HMB	HMM
A		***		**	***
S	0.001				
HMW					
HMB	0.008				
HMM	0.001				

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

Table 4. Analysis of variance of body length measures

Breeds	A	S	HMW	HMB	HMM
A				*	
S					
HMW					
HMB	0.016				
HMM					

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

Table 5. Analysis of variance of thorax depth measures

Breeds	A	S	HMW	HMB	HMM
A		**		*	
S	0.009				*
HMW					
HMB	0.011				*
HMM		0.018		0.020	

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

Table 6. Analysis of variance of thorax width measures

Breeds	A	S	HMW	HMB	HMM
A			**		*
S					
HMW	0.005			**	
HMB			0.002		*
HMM	0.050			0.020	

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

Table 7. Analyses of variance of pelvic width measures

Breeds	A	S	HMW	HMB	HMM
A					*
S				*	*
HMW					
HMB		0.021			
HMM	0.011	0.047			

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

Table 8. Analysis of variance of hip width measures

Hip	A	S	HMW	HMB	HMM
A					
S				*	*
HMW					
HMB		0.042			
HMM		0.038			

P≤0.05 (*), P≤0.01 (**), P≤0.001 (***)

According to the observed significant differences the authors have established (Table 9) that Alpine does are bigger/larger in every measurement than other breeds. In the case of wither height Alpine does have higher data than HMB, and does of this breed are also higher with 30.96 mm than HMM and 33.78 mm than Saanen does (Table 9).
Between two imported breeds Alpine have bigger wither height and thorax depth data than Saanen (Table 9). In case of thorax depth Alpine does have significantly higher data than of HMB too (*11.03 mm*).
The does of imported breeds have wider rump-bone (*pelvic and hip*) than local goats. The Saanen does have wider pelvic and hip than HMB (*5.99 and 5.25 mm*) and HMM (*6.92 and 5.59 mm*) (Table 9). Alpine does have surpassed also HMM does in pelvic width.
Between HMB and Alpine only wither height, body length and thorax depth data were statistically different. HMW isn't significant different ($P \leq 0.05$) from HMM and Saanen.
Between local breed HMM does have larger thorax than HMB (*9.29 mm*), and on thorax width HMW does have more narrow thorax than HMB (*16.42 mm*), but HMB does are wider (*10.33 mm*) than HMM (Table 9).

Table 9. Summarized data of observed significant differences between breeds

[mm]			Wither height	Body lenght	Thorax depth	Thorax width	Pelvic width	Hip width
HMW	<	HMB				16.42		
HMW		HMM						
HMW	<	Alpine				15.95		
HMW		Saanen						
HMB	<, >*	HMM			9.29	10.33*		
HMB	<	Alpine	23.87	20.28	11.03			
HMB	<	Saanen					5.99	5.25
HMM	<	Alpine	30.96			9.86	5.44	
HMM	>, <*	Saanen			10.59		6.92*	5.59*
Alpine	>	Saanen	33.78		12.33			

The comparisons of head-measures (*head length, ear length and width, distance between eyes*) aren't present in this study, because no significant differences were found between breeds in the case of these measures.

Conclusions

The authors found significant differences ($P \leq 0.05$) between HMB and Alpine in the case of wither height, body length, thorax depth, but no significant differences were observed in the body measurement, between the HMW and Saanen breeds, that can mean that Saanen breed is considerably used in development of HMW breed.
The Hungarian Milking Multicolour breed has several kinds of breeds of its background including brown and white goats, but only in thorax depth are differ from other local breeds.
The present work doesn't include the analyses' results of crossbred does, but its similarities/differences can be interesting in the future, when the development of Hungarian Goat Selection Indices program will start again.