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TRENDS
IN LIVESTOCK
PRODUCTION

P R O C E E D I N G S

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BELGRADE - SERBIA

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VARIABILITY OF THE BODY DEVELOPMENT TRAITS OF SIMMENTAL COWS IN SERBIA

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Abstract: Assessment of cows' exterior is important because of the assessment of the capability of animals to guarantee, through their overall exterior appearance as well as the appearance of certain parts of the body, not only their good health but also long production life (longevity). The main goal of measuring of domestic animals is to determine the body dimensions, to compare animals of the same or different species, to understand the numerous physiological and biochemical processes that occur in the animal organism. Only by measuring, the accurate and reliable data on the general physical development of the animal and the harmony of its structure are obtained. In the present study, most of the physical measures were taken on total of 954 animals. The average height of the cow of the Simmental breed was 141.95 cm, the length of the pelvis was 51.44 cm, the width of the pelvis was 50.45 cm and the body depth was 78.84 cm. By analyzing the impact of the unified factor of the rearing system and origin, its very significant influence ($p < 0.001$) was determined on all four properties of body development.

Key words: Simmental breed, body development, rearing system, origin

Introduction

The Simmental breed of cattle is most common in the Republic of Serbia. At the beginning of 2013, preliminary results of the Agricultural census carried out in the Republic of Serbia in 2012 were announced. According to the results of the census, Serbia has a total of 908,990 cattle, of which about 450,000 cows and heifers. In the breed structure of cattle in Serbia, it is estimated that the Simmental breed makes about 85%, or about 360,000 cows and heifers (*Perišić et al., 2009 and Petrović et al., 2013*). Simmental cattle are reared increasingly in intensive

conditions of housing, care and nutrition, i.e., the number of farms in Serbia with more than 50 females is increasing (*Bogdanović et al., 2012*).

In some areas of Serbia, semi-intensive rearing in the herds of several cows is still present. The genetic improvement of this breed is mainly performed by breeding and selection in pure breed (*Petrović et al., 2009*). The improvement of the genetic basis of the Simmental cattle population in our conditions is mainly done through quality bulls (Germany, Austria, etc.) and in recent years, the number of genetically high quality heifers imported from the best European populations of this breed has not been negligible.

The experience of the breeders shows that health, resistance, constitution, fertility, length of exploitation and productive characteristics largely depend on the development of the body, its structure and the individual parts of the body (*Perišić et al., 2008*). Deficiencies in the type characteristics lead to poorer production, poor health status and premature culling of cows from the herd (*Pantelić et al., 2007*).

Romčević (1999) in his monograph "Simmental Cattle in Serbia" presents the morphometric measurements of bull dams of the Simmental breed for 1995 and 1996: the height to withers for both years was 136 cm, the chest circumference (girth) 199 and 202 cm, and the body weight 697 and 692 kg, respectively.

The Institute for the Application of Science in Agriculture (1999), in the report on the conducted livestock breeding measures in Serbia for 1999, provides information on the exterior measures of 610 selected bull dams of Simmental breed: height to withers 136 cm, chest depth 72 cm, body length 163 cm, chest circumference (girth) 197 cm and body weight 697 kg.

According to the Report on the implementation and results of the Breeding program in 2014, the Institute of Animal Husbandry (2015) the values of body measures taken on bull dams were as follows: 143 cm (137-150 cm) height to rump, 81 cm (71-92 cm) for body depth, 59 cm (43-77 cm) length of the pelvis, 55 cm (41-62 cm) width of the pelvis and 201 cm (188-218 cm) for chest circumference (girth). The average weight of bull dams was 689 kg (551-822 kg).

Examining the morphometric properties and the incidence of foot deformities in cows in tied system of rearing, *Stojanović (2012)* states the following data on the average body dimensions of Simmental cows in Kolubara district: height to withers 134.3 cm, height to rump 137.1 cm, body length 157.1 cm, chest width 47.8 cm, chest depth 86 cm, chest circumference (girth) 200.5 cm, pelvis width 47.5 cm and tibia circumference of 20.6 cm.

In the breeding programs of European countries for Simmental breed, different traits are given and different values for them. Thus, in Croatia, the breeding objective for height to withers is 138 cm to 148 cm, and the body weight of an adult cow 650 kg to 750 kg; in Germany: height to withers 136-142 cm, height to rump 138-145 cm, body weight 550-650 kg, etc.

Material and methods

Basic data on morphometric properties, as well as data on the origin of all examined cows, were collected in cooperation with the dairy farm "Lazar" Blace, which housed certain number of animals included in this research. For animals reared on individual farms, data on these characteristics were collected in cooperation with the breeding organizations, which carry out all activities in the implementation of the breeding program in the area of Toplica district.

The total animals (n = 954) included in the study of morphometric traits were divided into four groups based on origin and rearing system, in the following way:

Group 1: animals of domestic origin reared by individual agricultural producers (n = 436);

Group 2: imported animals reared by individual agricultural producers (n = 68);

Group 3: domestic animals reared on farms (n = 282);

Group 4: imported animals reared on farms (n = 168).

The following traits of body development were taken after the first calving: height to rump, pelvis length, and body depth and pelvis width.

The analysis of the collected data consisted of determining the parameters of descriptive statistics (average, minimum, maximum, standard deviation, standard error of average and 95% confidence interval), while the analysis of variance, using the single factorial analysis model, examined the influence of the unified factor of the rearing system and the origin of the animals on their body development:

The model with a fixed unified influence of the rearing system and origin (NP):

$$Y_{ij} = \mu + NP_i + e_{ij}$$

- Y_{ij} : examined trait,
- μ : population average for a given trait,
- NP_i : a fixed unified influence of the rearing system and origin ($i = 1, 2, 3, 4$),
- E_{ij} : a random error

Subsequent to the analysis of the variance and determination of the basic parameters of descriptive statistics by the least significant difference test (LSD), the differences were determined by groups individually for all body development traits.

For statistical data processing and application of the specified model, the software SPSS Statistics for windows, Version 23.0 was used.

Results and Discussion

On the basis of the obtained results shown in Table 1, it can be concluded that the average height of the Simmental cows was 141.95 cm, the length of the pelvis was 51.44 cm, the pelvis width was 50.45 cm, and the body depth was 78.84 cm.

The highest height to rump was observed in imported cows reared on the farm (143.56 cm), and the lowest in domestic cows reared by individual agricultural producers (140.76 cm). The results obtained are lower than the results from the Report on the implementation of the Breeding program in Serbia, and higher than the results reported by *Stojanović (2012)*. The results presented agree with the breeding goal in Germany for the Simmental cows. The difference between the groups was statistically very significant ($p \leq 0.001$) in the comparison of groups 1 and 2, 1 and 3, 1 and 4, 2 and 4, statistically significant ($p \leq 0.05$) between groups 3 and 4, while between groups 2 and 3, 2 and 4, no statistically significant ($p > 0.05$) difference was found (Table 2).

The value for the length of the pelvis was the highest among the cows of domestic origin reared on the farm (53.72 cm), and the lowest among the imported cows from reared by individual producers (51.11 cm). Comparing the obtained values according to the Report on the implementation of the Breeding program in Serbia in 2014 of the *Institute for Animal Husbandry (2015)*, it can be concluded that the first heifers from the import reared by individual agricultural producers had the length of the pelvis as bull dams in Serbia, and other three groups, individually, had lower values for pelvic length. Statistically very significant ($p \leq 0.001$) difference between all observed groups was established by the LSD test, except for groups 1 and 3 where the presence of statistically significant ($p > 0.05$) difference in pelvic length (Table 2) was not established.

Table 1. Mean value and variability of body development traits by groups of first calving heifers

Trait	Group	No. of calvings	\bar{X}	SD	SE	95% confidence interval		Min.	Max.
						LB	UB		
Rump height (cm)	1	436	140.76	3.163	0.151	140.46	141.06	134	151
	2	68	142.72	3.570	0.433	141.86	143.58	136	152
	3	282	142.65	4.229	0.252	142.16	143.15	134	151
	4	168	143.56	3.562	0.275	143.02	144.10	135	155
Total		954	141.95	3.775	0.122	141.71	142.19	134	155
			F=31.554***			p=0.000			
Pelvis length (cm)	1	436	51.14	1.681	0.081	50.99	51.30	42	57
	2	68	53.72	2.072	0.251	53.22	54.22	46	57
	3	282	51.11	2.401	0.143	50.83	51.39	44	59
	4	168	51.83	2.094	0.162	51.51	52.15	46	57
Total		954	51.44	2.128	0.069	51.30	51.57	42	59
			F=36.579***			p=0.000			
Pelvis width (cm)	1	436	50.05	1.820	0.087	49.88	50.22	39	54
	2	68	52.69	2.160	0.262	52.17	53.21	45	56
	3	282	50.02	2.675	0.159	49.70	50.33	41	61
	4	168	51.30	2.490	0.192	50.92	51.68	43	58
Total		954	50.45	2.377	0.077	50.30	50.60	39	61
			F=38.568***			p=0.000			
Body depth (cm)	1	436	77.83	3.401	0.163	77.51	78.15	66	87
	2	68	83.72	3.709	0.450	82.82	84.62	75	90
	3	282	78.84	4.169	0.248	78.35	79.33	69	85
	4	168	79.51	2.624	0.202	79.11	79.91	75	90
Total		954	78.84	3.850	0.125	78.60	79.09	66	90
			F=56.552***			p=0.000			

***- $p \leq 0.001$; ** - $p \leq 0.01$; * - $p \leq 0.05$; nz - $p > 0.05$

As well as the length, both the width of the pelvis was the highest among the cows of domestic origin reared on the farm (52.69 cm), and the lowest among the imported cows reared by the individual producers (50.02 cm). Based on the obtained results, it can be concluded that all four groups had significantly lower values than the values for the pelvis width of bull dams in Serbia, as stated in the Report on the implementation of the Breeding program in Serbia in 2014 by the *Institute for Animal Husbandry (2015)*, significantly higher than the values stated by *Stojanovic (2012)* for cows in the Kolubara district. A statistically significant ($p \leq 0.001$) difference between all observed groups was established by the LSD test,

except between groups 1 and 3 where the presence of statistically significant ($p > 0.05$) difference was not established, Table 2.

The greatest depth of the body was recorded for imported first calvers reared by individual producers (83.72 cm), and the lowest for domestic cows reared by individual producers (77.83 cm). If the obtained results are compared with the results stated in the Report and the results of the implementation of the breeding program in 2014 of the *Institute for Animal Husbandry (2015)*, only imported cows reared by individual agricultural producers have greater body depth than bull dams, while all four groups have much lower values for body depth than stated by *Stojanović (2012)*. The least significant difference test (LSD) established statistically very significant ($p \leq 0.001$) difference between all observed groups in regard to the trait of body depth, Table 2.

The statistically very significant impact ($p < 0.001$) on all observed properties was determined in the analysis of the influence of the unified factor (the rearing system, the origin) on the variability of the body development traits, which can be seen in Table 1.

Table 2. Differences of average for observed traits by groups of the first calving heifers (LSD test)

Rump height				Pelvis length			
group	2	3	4	group	2	3	4
1	-1.959***	-1.891***	-2.798***	1	-2.576***	0.031 ^{nz}	-0.683***
2		-0.068 ^{nz}	-0.839 ^{nz}	2		2.607***	1.893***
3			-0.907*	3			-0.714***
Pelvis width				Body depth			
group	2	3	4	group	2	3	4
1	-2.641***	0.033 ^{nz}	-1.247***	1	-5.893***	-1.012***	-1.678***
2		2.673***	1.394***	2		4.880***	4.215***
3			-1.280***	3			-0.666***

***- $p \leq 0.001$; ** - $p \leq 0.01$; * - $p \leq 0.05$; nz - $p > 0.05$

Conclusion

On the basis of the obtained results, it can be concluded that all the observed traits of body development were the most pronounced in imported cows reared by individual producers, with the exception of the height to rump which was the highest in the imported first calvers reared on the farm.

By analyzing the effect of the unified factor (rearing system x origin) on the variability of the body development properties, a statistically very significant influence ($p < 0.001$) was established for all observed traits.

The least significant difference test (LSD) established statistically very significant ($p \leq 0.001$) difference to absence of difference ($p > 0.05$) among all observed groups.

Assessment of cows' exterior is important because of the assessment of the capability of animals to guarantee, through their overall exterior appearance as well as the appearance of certain parts of the body, not only their good health but also long production life (longevity). The main goal of measuring of domestic animals is to determine the body dimensions, to compare animals of the same or different species, to understand the numerous physiological and biochemical processes that occur in the animal organism. Only by measuring, the accurate and reliable data on the general physical development of the animal and the harmony of its structure are obtained.

Varijabilnost osobina telesne razvijenosti krava simentalске rase u srbiji

Dragan Nikšić, Vlada Pantelić, Dušica Ostojić-Andrić, Predrag Perišić, Marina Lazarević, Nenad Mičić, Maja Petričević

Rezime

Procena eksterijera krava je važna zbog ocene sposobnosti grla da svojim ukupnim spoljašnjim izgledom kao i izgledom pojedinih delovima tela garantuju pored dobrog zdravlja i trajnu proizvodnju (dugovečnost). Osnovni cilj merenja domaćih životinja jeste utvrđivanje telesnih dimenzija, međusobno poređenje životinja iste ili različitih vrsta, razumevanje brojnih fizioloških i biohemijskih procesa koji se dešavaju u životinjskom organizmu. Jedino se merenjem dobijaju tačni i sigurni podaci o opštoj telesnoj razvijenosti grla i harmoničnosti njegove građe. U radu je većina telesnih mera utvrđena na ukupno 954 prvotelki. Prosečna visina krsta krava simentalске rase iznosila 141,95 cm, dužina karlice 51,44 cm, širina karlice 50,45 cm i dubina tela 78,84 cm. Analizom uticaja objedinjenog faktora načina držanja i porekla, utvrđen je njegov vrlo visoko značajan uticaj ($p < 0,001$) na sve četiri osobine telesne razvijenosti.

Ključne reči: simentalaska rasa, telesna razvijenost, način držanja, poreklo

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