

LINEAR BODY MEASUREMENTS OF CIKA CATTLE IN COMPARISON TO PINZGAUER CATTLE

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ABSTRACT

Changes of body measurements and body proportions in endangered Slovenian autochthonous Cika cattle were studied. Forty six years after the last study of Cika cattle body measurements, more than three quarters of the total cow's population of Cika cattle were measured. Because of great variability of phenotypic traits in Cika cattle population, animals were divided into three groups: Cika cattle type, semi-Cika type and Pinzgauer type. Animals of semi-Cika type were larger than Cika cattle type and animals of Pinzgauer type were larger than semi-Cika type. It was observed, that proportions between linear measurements in all three groups were not different between groups and not different from the "old" Cika cattle type. It could mean that inseminations with Pinzgauer bulls in the past have not had such strong influence on Cika cattle population as assumed. In order to find the animals of Pinzgauer type with an objective method, cluster analysis was performed. In the group with the largest animals, some tendencies towards body proportions of Pinzgauer type were found, but the body proportions were still more similar to proportions of Cika cattle than to proportions of Pinzgauer cattle today and forty six years ago, respectively.

Key words: cattle / breeds / Cika cattle / Pinzgauer / body measurements / Slovenia

TELESNE MERE CIKASTEGA GOVEDA V PRIMERJAVI S PINZGAVSKIM GOVEDOM

IZVLEČEK

Študija proučuje telesne mere in njihova razmerja pri ogroženi slovenski avtohtoni pasmi cikasto govedo. Izmerjenih je bilo več kot tri četrtine celotne populacije krav, rezultate meritev pa smo primerjali z rezultati raziskave telesnih mer, ki je bila opravljena pri cikastemu govedu pred šestinštiridesetimi leti. Zaradi velike neizenačenosti lastnosti zunanosti, so bile živali razdeljene v tri skupine: cikasti tip, delni-cikasti tip in pinzgavski tip. Živali delnega cikastega tipa so bile večje od živali cikastega tipa, živali pinzgavskega tipa pa večje od živali delnega cikastega tipa. Razmerja med posameznimi linearnimi meritvami so bila pri vseh treh skupinah enaka. Prav tako so bila razmerja enaka v primerjavi s »starim« tipom cikastega goveda. Za iskanje živali v pinzgavskem tipu smo uporabili objektivno metodo – klustersko analizo z delitivijo v tri in v štiri skupine. V skupini z največjimi živalmi smo opazili nekatere tendence sprememb razmerij telesnih mer, ki so značilne za pinzgavsko pasmo govedi. Celostno pa so bila razmerja v tej skupini bolj podobna razmerjem, ki smo jih ugotovili pri cikastemu tipu kot razmerjem, ki smo jih ugotovili pri današnjemu oz. pinzgavskemu govedu izpred šestinštirideset let.

Ključne besede: govedo / pasme / cikasta pasma / pinzgavska pasma / telesne mere / Slovenija

INTRODUCTION

The Cika cattle is the only autochthonous breed of cattle in Slovenia. The breed originates from old reddish, small cattle, which was known in the nineteenth century. In that time, the breed was widely used in north-western part of Slovenia (Čepon *et al.*, 1999). It was known as good dairy cattle according to its body mass. Animals were mostly grazed on alpine pasture. Because of poor pasture conditions on the high mountains and inclined terrain farmers wanted to have such small animals with relatively good milkiness.

Pinzgauer breed from the neighboring Austrian province – Slovenia was at that time also part of Austria - , was known to be larger and more productive at that time, therefore the process of importing Pinzgauer bulls started (Pirc, 1908, cit. by Urbas 1958) in order to improve the Cika cattle. Crossbreeding process influenced coat color and frame size. Cika cattle became multi colored (red coat with white stripe on the back and on the belly and white tail; some animals also with white stripe on thigh and shank in the form of belt) and larger (more calving difficulties were observed) but milk yield was not increased. Unlike Cika cattle, Pinzgauer breed was characterized by much greater frame size and body weights which were the main reasons that Pinzgauer breed was not suitable for pasture breeding on steep areas (Čepon *et al.*, 1999). It is no wonder, that Cika cattle breeders rejected additional crossbreeding with Pinzgauer bulls. The breed was never called Pinzgauer but with Slovenian word "cika" or "cikasto govedo" – Cika cattle. The word "cika" means the characteristic colour pattern of Pinzgauer and also the Slovenian autochthonous Cika cattle breed – reddish with white stripes on the back and belly of the animal.

In the year 1958 (Urbas, 1958), the population of Cika cattle was studied and compared with contemporary Pinzgauer cattle. In comparison to Pinzgauer, animals were lower in withers (on average 116 cm in Cika cattle and 130 to 132 cm in Pinzgauer) (Urbas, 1958, Müller 1958, cit by Urbas, 1958). Animals of Cika cattle were in comparison to Pinzgauer extremely slim; average chest girth in Cika cattle was only 163 cm comparing to 200 cm in Pinzgauer breed. In Pinzgauer chest girth was 150.8% in Salzburg and 157.2% in Carinthia of withers height, but in Cika cattle chest girth was only 141.1% of withers height. In the year 1992, the wither height of Cika cattle cows was estimated between 135 and 140 cm and depth on chest on 55% of wither height (between 74 and 77 cm) (Holz *et al.*, 1992). All other measurements, which measure strength of the body, were in Pinzgauer breed proportionally much larger than in Cika cattle.

Soon after 1950, induced also by political activity, in some cases against the will of farmers, artificial insemination of cows became widely spread. Influenced by the policy in Europe the livestock production experts of that period decided to abolish the autochthonous breeds. These breeds were substituted by or remelt with Simmental and to some extent with Slovenian Brown breed today, the Cika cattle, with a total currently population of only 300 cows, is in danger of extinction. The breed is included in the program for conservation of Slovenian autochthonous breeds which is running at Biotechnical Faculty, Zootechnical Department. Around five years ago Pinzgauer bulls were still used for insemination of Cika cattle cows, included in the selection program. Using this practice, a lot of autochthonous traits of Cika cattle were lost and some researchers assumed that the animals of real Cika cattle type were extinct (Jeretina, 1998, 2004). Fortunately, the most conservative breeders living in some remote, often economically unfavourable areas still kept this locally adapted breed. Estimated total population size of Cika cattle breed is between 800 and 900 animals (Čepon, 2005) Most of the animals came from the herds, which are not under selection and control program and pedigree data are incomplete.

MATERIAL AND METHODS

Almost all cows of Cika cattle breeding in Slovenia were measured. Seven linear measurements were taken as defined in Slovenia (Osterc *et al.*, 1984).

- wither height (WH),
- chest girth (CH),
- rump width (RW),
- depth of chest (DC),
- width of chest (WC),
- height of rump (HR),
- length of body (LB).

According to emphasize of autochthonous traits animals were classified in three groups:

- Cika type ,
- semi Cika type,
- Pinzgauer type.

For evaluation of data statistical model was used:

$$Y_{ijk} = \mu + B_i + T_j + b(x_{ij} - \bar{x}) + e_{ijk} \quad [1]$$

where Y_{ijk} is an observed dependent variable, μ is an average value of model, B_i is an effect of breeder, T_j is an effect of animal type (Cika, semi - Cika, Pinzgauer), b is regression coefficient of age on observed dependent variable and e_{ijk} is the rest for k -th animal of i -th breeder and j -th type. Evaluations were done with SAS/STAT procedure of SAS 8.02.

At measuring cows were classified into three groups: Cika type, semi-Cika type and Pinzgauer type. This subjective classification was checked by cluster analysis (procedure SAS/FASTCLUST version 8.02). Following cluster analysis the animals were classified into three and into four groups on the basis of three variables: withers height, chest girth and width of chest. Thereafter the comparison between subjective and objective classification within the type was made.

RESULTS AND DISCUSSION

In Table 1, some body measurements of Cika and Pinzgauer cattle made in 1958 and some body measurements of Cika cattle made in 2004 are presented. In the year 1958, the Cika cattle animals were much lower in wither than Pinzgauer (116 cm in comparison to 130–132 cm). In the next forty years, the average withers height in Cika cattle was increased to nearly 130 cm (12%). In the same time, the chest girth increased for ten percent (164–180 cm), the depth of chest for 12% (59–66 cm) and width of chest for 32% (32–43 cm). The Pinzgauer cattle were in the year 1958 larger than Cika cattle in 1958 and 2004.

In comparison to wither height, the animals of Cika cattle were lower as the animals of Pinzgauer breed. In year 1958 chest girth was 1.5 times longer by Pinzgauer and 1.4 times longer by Cika cattle as withers height. Forty six years latter chest girth of Cika cattle was still only 1.4 times larger than withers height. In proportion to withers height, Pinzgauer breed was also more robust on width and depth of chest. The same is true after forty six years. The import of Pinzgauer bulls had no effect on proportions between observed body measurements of average Cika cattle cow in the present population. Animals from the remains of this autochthonous breed increased in size, but proportions remained the same as fifty years ago.

In the Table 2, some average body measurements of Cika cattle cows, divided into three groups according to "type" are presented. Animals were divided into three types: Cika type,

semi-Cika type and Pinzgauer type. Animals of the Cika type were the smallest, animals of the Pinzgauer type were the largest and animals of semi-Cika type of Cika cattle were between the two types.

Table 1. Some body measurements and its ratios in cows of Cika cattle in the year 1958 (Urbas, 1958), Pinzgauer cattle of two origins – Salzburg and Carinthia (Müller, 1958, cit. by Urbas, 1958) and measurements of Cika cattle in the year 2004

Preglednica 1. Nekatere telesne mere krav (v cm) cikastega goveda (Urbas, 1958) iz leta 1958, pinzgauskega goveda dveh izvorov – Salzburg in Koroška (Müller, 1958, cit. po Urbas, 1958) v primerjavi z meritvami cikastega goveda v letu 2004

Trait lastnost	Cika cattle cikasto gov. (1958)	Pinzgauer (Salzburg) pinzg. gov. (Salzburg) (1958)	Pinzgauer (Carinthia) pinzg. gov. (Koroška) (1958)	Cika cattle cikasto gov. (2004)
WH (VV)	116.1	132.2	130.4	129.7
CG (OP)	163.9	199.3	200.5	180.2
WC (ŠP)	32.4	49.4	49.4	42.7
DC (GP)	59.2	74.0	71.4	66.4
CG/WH (OP/VV)	1.412	1.508	1.538	1.389
WC/WH (ŠP/VV)	0.279	0.374	0.379	0.328
DC/WH (GP/VV)	0.509	0.560	0.548	0.512

WH = wither height, CG = chest girth, WC = width of chest, DC = depth of chest, CG / WH = chest girth / wither height, WC / WH = width of chest / wither height, DC / WH = depth of chest / wither height

WH = višina vihra, CG = obseg prsi, WC = širina prsi, DC = globina prsi, CG / WH = obseg prsi / WC / WH = višina vihra, širina prsi / višina vihra, DC / WH = globina prsi / višina vihra

Table 2. Average body measurements of cows of Cika cattle (cm) and its ratios, divided into three types

Preglednica 2. Povprečne telesne mere treh tipov krav cikaste pasme (v cm) in njihova razmerja

	Cika type (R1) cikasti tip	semi-Cika type (R2) delni cikasti tip	Pinzgauer type (R3) pinzgavski tip	total skupaj
number/število	60	104	105	269
WH	123.6	128.2	134.8	129.7
CG	172.6	176.9	187.8	180.2
WC	39.7	41.4	45.7	42.7
CG / WH	1.397	1.380	1.393	1.389
WC / WH	0.321	0.323	0.339	0.329
DC / WH	0.511	0.511	0.512	0.512

WH = wither height, CG = chest girth, WC = width of chest, CG / WH = chest girth / wither height, WC / WH = width of chest / wither height, DC / WH = depth of chest / wither height

WH = višina vihra, CG = obseg prsi, WC = širina prsi, DC = globina prsi, CG / WH = obseg prsi / WC / WH = višina vihra, širina prsi / višina vihra, DC / WH = globina prsi / višina vihra

In the Table 3, results of analysis are shown. All the measurements in centimetres and as ratios – in proportion to wither height, were evaluated with the statistical model [1]. The model explained all dependent variables except the variable WC / WH (width of chest as proportion of wither height). By the model, the measurements were explained much better than ratios. Type and breeder statistically significantly explained all the measurements, but type of animal had no effect on any ratio between wither height and other variables and the LSM values are very similar to the available historical data of Cika cattle. This means, that subjective classification of

animals in three groups was done on the basis of animal size and not on the basis of proportions between different body sizes. On the other hand, all the proportions, except the proportion HR / WH and WC / WH, were statistically significantly influenced by the breeder – owner of the animal.

Table 3. Analysis of variance after the model [1] for wither height (WH), height of rump (HR), length of body (LB), chest girth (CH), rump width (RW), depth of chest (DC), width of chest (WC) and for the ratios, where HR, LB, CH, RW, DC, WC are shown in proportion with the WH. The P-values and R^2 for model, P-values for effects type, breeder, age and LSM values for three types of animals are shown (type 1 – Cika cattle, type 2 – semi-Cika, type 3 – Pinzgauer)

Preglednica 3. Analiza variance po modelu [1] za višino vihra (WH), višino križa (HR), dolžino telesa (LB), obsega prsi (CH), širino križa (RW), globino prsi (DC), širino prsi (WC) ter razmerja, kjer so HR, LB, CH, RW, DC in WC prikazane kot razmerje z WH. Prikazane so vrednosti za p in R^2 za model ter vrednosti p za vplive tipa in starosti živali, rejca ter LSM vrednosti za tri tipe živali (tip 1 – cikasti tip 2 – delni cikasti, tip 3 – pinzgavski)

	Model P Model p	R^2 R^2	Type tip	Breeder rejec	Age starost	LSM type 1 LSM tip1	LSM type 2 LSM tip 2	LSM type 3 LSM tip3
WH	<0.0001	0.878	<0.0001	0.0141	0.1624	123.9 ^a	128.3 ^b	134.4 ^c
HR	<0.0001	0.881	<0.0001	0.0116	0.7032	126.8 ^a	131.7 ^b	137.1 ^c
LB	<0.0001	0.854	<0.0001	0.0027	<0.0001	124.4 ^a	129.0 ^b	133.9 ^c
CH	<0.0001	0.882	<0.0001	<0.0001	0.0002	174.0 ^a	178.2 ^b	187.8 ^c
RW	<0.0001	0.856	<0.0001	<0.0001	0.0007	45.7 ^a	47.6 ^b	50.7 ^c
DC	<0.0001	0.844	<0.0001	0.0003	<0.0001	63.7 ^a	65.6 ^b	69.6 ^c
WC	0.0001	0.774	0.0015	0.0266	0.3555	40.7 ^a	41.4 ^{ab}	46.0 ^c
HR / WH	0.0162	0.717	0.1346	0.0971	0.0056	1.023 ^a	1.026 ^a	1.020 ^a
LB / WH	0.0114	0.722	0.5267	0.0282	<0.0001	1.004 ^a	1.005 ^a	0.996 ^a
CH / WH	<0.0001	0.800	0.3612	<0.0001	0.0011	1.404 ^a	1.389 ^a	1.398 ^a
RW / WH	<0.0001	0.788	0.3125	0.0002	0.0017	0.368 ^a	0.371 ^a	0.378 ^a
DC / WH	0.0002	0.767	0.4702	0.0019	<0.0001	0.514 ^a	0.511 ^a	0.518 ^a
WC / WH	0.3186	0.651	0.2951	0.3803	0.8682	0.328 ^a	0.322 ^a	0.341 ^a

Results in tables 1, 2 and 3 suggested that Pinzgauer bulls insemination have not had such strong effect as we assumed. The size of animals can be changed because of development and forming breed through natural and artificial selection and some exchanges in management. Proportions between the different body sizes are good indicator of influence of the other breed or because of the change in the aim of selection. To find out whether some subgroups of animals are according to proportions between the body sizes more alike to Pinzgauer breed than to Cika cattle breed, another type of statistics, clustering method was used. Results are shown in Tables 4 and 5.

In the Table 4, animals were divided into three clusters according to three variables: wither height, chest girth and width of chest. From total 269 animals, 80 animals were collected in cluster 1, 118 in cluster 2 and 71 in cluster 3. From 80 animals in cluster 1, 36 animals were from subjective type 1, 36 from type 2 and 8 from type 3. In clusters 2 and 3, the animals were from all subjectively defined groups. In subjectively defined groups only rough measurements are increasing from Cika type to semi-Cika type and from semi-Cika type to Pinzgauer type.

Table 4. Number of animals divided into three clusters (TOTAL), number of animals per cluster and per type (R 1, R 2, R 3), and withers height (WH), chest girth (CG), width of chest (WC), chest girth / wither height (CG / WH), width of chest / wither height (WC / WH) and depth of chest / wither height (DC / WH) per cluster

Preglednica 4. Število živali, razdeljenih v tri klastre (TOTAL), število živali o klastru in po tipu (R 1, R 2, R 3) in višina vihra (WH), obseg prsi (CG), širina prsi (WC), obseg prsi / višina vihra (CG / WH), širina prsi / višina vihra (WC / WH) in globina prsi / višina vihra (DC / WH) po klastru

	CLUSTER 1	CLUSTER 2	CLUSTER 3
R 1	36	22	2
R 2	36	58	10
R 3	8	38	59
TOTAL	80	118	71
WH	124.4	129.5	136.1
CG	166.9	180.7	194.4
WC	37.6	42.7	48.3
CG / WH	1.342	1.395	1.428
WC / WH	0.302	0.330	0.355
DC / WH	0.501	0.512	0.524

Table 5. Number of animals divided into four clusters (TOTAL), number of animals per cluster and per type (R 1, R 2, R 3), and wither height (WH), chest girth (CG), width of chest (WC), chest girth / wither height (CG / WH), width of chest / wither height (WC / WH) and depth of chest / wither height (DC / WH) per cluster

Preglednica 5. Število živali, razdeljenih v štiri klastre (TOTAL), število živali o klastru in po tipu (R 1, R 2, R 3) in višina vihra (WH), obseg prsi (CG), širina prsi (WC), obseg prsi / višina vihra (CG / WH), širina prsi / višina vihra (WC / WH) in globina prsi / višina vihra (DC / WH) po klastru

	CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4
R 1	31	25	4	0
R 2	32	52	18	2
R 3	5	30	38	32
TOTAL	68	107	60	34
WH	123.8	128.8	133.7	137.5
CG	165.8	178.7	189.2	198.0
WC	37.3	42.1	45.1	51.0
CG / WH	1.339	1.387	1.415	1.440
WC / WH	0.301	0.327	0.338	0.371
DC / WH	0.501	0.509	0.524	0.521

Between objectively defined groups (cluster analysis) not only size but also ratios between sizes are increasing from one to another cluster. But all the averages are still in proportions, known for Cika cattle from the literature, published forty six years ago. Because of such results, animals were divided according to the same variables in four groups. Results are presented in Table 5 where 269 observations were divided in four clusters. In cluster 1, with the lowest wither height, chest girth and width of chest, 68 animals were ranged. In cluster 2, 107 and in cluster 3, 60 and in cluster 4 34 animals were ranged. Except in cluster 4, where no animals of Cika type

(R1) were selected, animals of different types were selected in different clusters. The averages of rough measurements and ratios for four clusters are increasing from cluster 1 to cluster 4, but in all groups animals are slimmer in comparison with average Pinzgauer cows.

In the year 1958, when the last study of Cika cattle was done, cows of Cika cattle were smaller than the cows of Pinzgauer breed. Cika cattle breed was also slimmer in comparison to Pinzgauer cattle. It seems, that the Pinzgauer cattle was more combined type of cattle, while Cika cattle was very small dairy cattle, excellent adapted on poor conditions of alpine pasture on high mountain regions. In the last decades, Cika cattle grew in size and breeders believed that the type of animals was changed in conjunction with Pinzgauer breed. However, in reality animals remained in the same proportions. In this study, breeders and experts were not able to recognize real Pinzgauer type of animals in the measured population.

CONCLUSIONS

The last four and half decades, the Slovenian autochthonous breed of - Cika cattle was not subject of research work. According to the FAO classification the Cika cattle is currently found on the "critical" list, indicating that there is estimation of total cow population about 300. Mistakes in breeding policy have missed the opportunity to improve and preserve the breed. Today, only some remains of Cika cattle are still used by some breeders. In the middle of 19th century first bulls of Pinzgauer breed were imported in Slovenia and in the next hundred years some of them followed. Therefore breeders believe that today's animals are more in type of Pinzgauer than in Cika type. After year 2001 first bulls from Slovenian farms were selected and later the decision was made that insemination with foreign bulls is not permitted.

In the year 2004, more than three quarters of existent cows of the Cika cattle population were measured. Animals were subjectively classified into three groups (Cika type, semi-Cika type and Pinzgauer type) and objectively with help of cluster analysis in three and four groups. It was observed that the animals of semi-Cika type and Pinzgauer type are only larger than Cika cattle animals were forty six years ago, but the proportions between available single body sizes remained the same after so many years. All three or four groups seem to be more alike the original Cika cattle than the old or modern type of Pinzgauer cattle.

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