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Body indices of the Karakachan horse breed

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Abstract

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Based on the 404 body measurements of 52 horses from the autochthonous Bulgarian breed Karakachan horse are calculated the main body indices. The indices are with the following average values: for body extension – 108.0±0.8%, chest index – 59.07±0.99%, massiveness – 121.0 ±1.0%, compactness – 112.2±1.0%, leg length – 54.17±0.43%, body ratio – 100.7±0.4% and for bone development – 13.56±0.11%. The populated area has no reliable influence on the body proportions of the horses from the Karakachan breed, but the sex is a reliable source of variation ($P < 0.01$) only on the bone development index as the bones of the stallions are better developed. The body of the horses from the Karakachan breed is prolonged and with slightly downhill built. The chest is bulky as its girth is larger than the height at the withers and the length of the body, which makes the animals look massive enough and compact.

Keywords: body indices; exterior; Karakachan horse; autochthonous breeds

Introduction

The Karakachan horse is a local, primitive (autochthonous) breed of Bulgarian origin. (Karaivanov & Barzev, 1994). The breed was created by national selection, under very specifi c conditions. The breed is poorly studied, as in a long period of time, the only published scientific researches on the economic and biological characteristics of the breed were the works of Al. Petrov (1939a, b; 1940; 1941), made in the 40s of the last century. Nowadays, the data for the Karakachan horse has been quoted by Barzev et al. (2005), in the breeding programme of the breed (Sabeva, 2009), and in almanacs and other popular sources, as a new original data are cited by Popova et al. (2018).

Exterior takes central place for the characteristics of the breed. For the horses, the exterior is decisive because it is related to their basic economic quality – performance. Exterior measurements, basic element of the characteristics of horses, are used for the objective characteristics of the exterior, and they are in integrated part of the breeding programmes for the breeds (Sabeva, 2009, 2012, 2015; Sabeva & Kaschiev, 2010; Asenov, 2011; Barzev et al., 2011; Hinkovski et al., 2011).

When evaluating the exterior Purzyc et al. (2007), Komosa & Purzyc (2009), Komosa et al. (2013), Ivanovic et al. (2016), Popova (2017) and others. give great importance to the calculation of the body indices, which give a better and clearer view of the proportions of the body by the percentage ratio between the individual body measurements. Usually for horses are calculated from 3 (Sabeva & Kaschiev, 2010; Lukanova, 2016) – 4 (Sabeva, 2015) to 24 (Komosa et al., 2013) and more indices, characterizing size and width of the head, the depth and width of the body, the development of the thorax, the croup, bones and etc. That way, Komosa et al. (2013) are trying, based on the biometric characteristics by comparing of 24 body indices in 3 different groups of breeds – primitive, transitory and cultural, to define the main indices, by which to differentiate the breeds most precisely according to the level of selection.

The study of the exterior, together with the other biological qualities, the ecological and economic characteristics, is

of great importance in preserving the genetic resources of autochthonous, sparse breeds, which Karakachan horse belongs to. This provokes our interest in body indices studies of contemporary representatives of horses from this breed as well as in the influence of some factors on it.

Materials and Methods

The study includes 52 horses (10 males и 42 females) from the Karakachan horse breed with complete growth, bred in the villages of Levka, Tazha, Karlievo, Plana, Vlahi and the towns of Karlovo and Kalofer. Some of the exterior measurements, on the basis of which the indices were calculated, were taken in June 2014 and June 2016, and the rest of the data was taken from the registers of the Association for Breeding Indigenous Breeds in Bulgaria (ABIB)

There were analyzed 404 body measurements, which are included in the calculation of 7 body indices, by formulas presented in Table 1.

Table 1. Main body indices in horses (by Barzev, 2009)

№	Indices	Formulas
1	body extension	(body length*100)/withers height
2	massivness	(chest girth*100)/ withers height
3	body ratio	(croup height*100)/ withers height
4	leg length	(withers height – depth of chest)*100/ withers height
5	bone development	(cannon girth*100)/ withers height
6	chest index	(the width of the chest *100)/the depth of the chest
7	compactness	(chest girth*100)/ Diagonal length of body

When processing the data and establishment of the influence of some factors on the studied trait we used multifactor dispersion analysis as the linear model had the following statistical type:

$$Yijk = \mu + SZi + SXj + SSij + eijk,$$

where: *Yijk* – observation vector; μ – overall average constant; *SZi*, *SXj* are fixed effects corresponding to the populated area ($i = 7$) and the sex of the horse ($j = 2$); *SSij* is random effect of interaction sex*populated area; *eijk* – residual variance.

The statistical processing was done with the program SPSS 19.

Results and Discussion

Our studies show that the body of the horses from the Karakachan breed is relatively elongated. The length of the body is greater than the height at the withers, therefore the average index for body extension is 107.96±0.82 % with individual variation of 3.56 %. For the individual animals the index ranges from 101.50% to 120.47% and in individual farms from 104.0% to 111.2% on average (Fig. 1). The index is lower for horses in the village of Plana, village of Vlahi and town of Karlovo, and is highest for horses from village of Levka, as the region of breeding is not a reliable source of variation of the index for body extension.

The extention of the body, in the Karakachan horses studied by us, is the closest to that of the horses from the primitive breed of Konnik Polski – 106.00% (Komosa et al., 2013). The Karakachan horse is more extended than the cul-

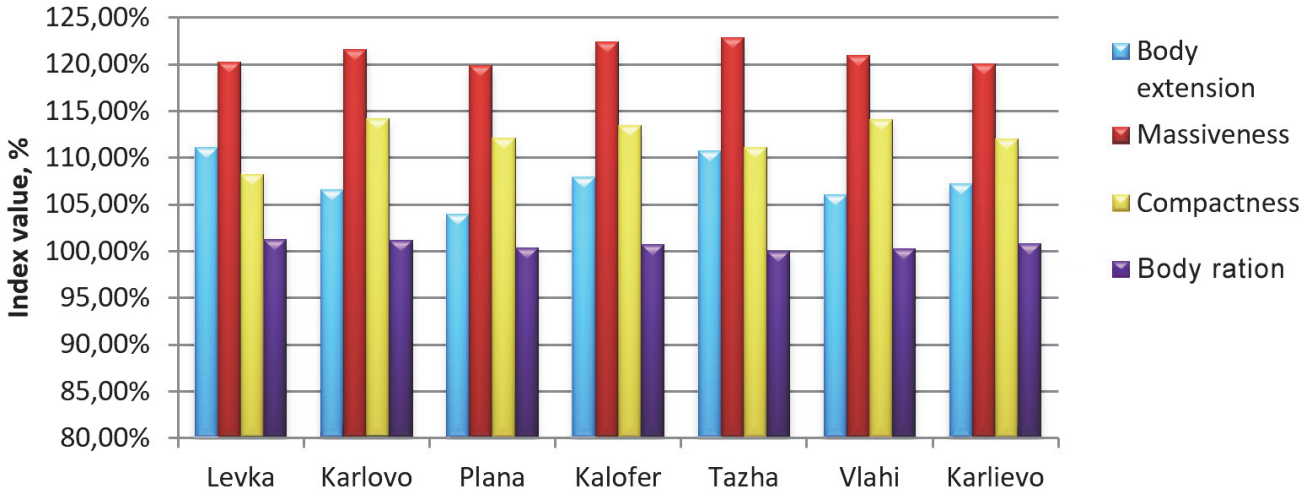

Fig. 1. Indices of body extension, massiveness, compactness and body ration of horses from the Karakachan breed

tural breeds such as Gidran (101.4% for stallions and 99.2% for mares) (Ivankovic et al., 2016), the Arabian breed – 98.8% (Balakshin, 1978), the East Bulgarian horse – 98.63% (Sabeva & Kaschiev, 2010), the trotter horses in Bulgaria – 99.8-102.5% (Lukanova, 2016), as well as from some primitive breeds such as the Hutsul (102.8 % for stallions, 105.0% for mares and 102.9% for geldings) (Purzyc et al., 2007), Azerbaijan horse (100,7%), Dagestani horse (102.6%), Lokai (100.6%), Kazakhstan horse (105.3%) (Balakshin, 1978).

Despite being prolonged, the body of horses from the Karakachan breed seems compact enough, as evidenced by the index of compactness. This index reflects the ratio of the chest to the body length and the horses studied by us have an average compactness index of 112.16% ± 1.04. The animals from Karlovo are with the highest value of the index 114.23 ± 2.96. Overall, the index variation is low and the coefficient of variation is within 3-4%. Higher than the Karakachan horses, is the compactness of the Hutsul breed, with an average index of 120.6% for stallions, 125.0% for mares and 121.7% for geldings (Purzyc et al., 2007). Significantly lower is the compactness of Gidran horses – 87.9% for stallions and 87.8% for mares (Ivanovic et al., 2016). Higher is the compactness of the primitive steppe horse breeds – Azerbaijan horse (115.8%), Dagestani horse (113.7%), Lokai (115.5%), Kazakhstan horse (116.2%) (Balakshin, 1978).

The established by us index for compactness of the body at the Karakachan horse is close to that established by Lukanova (2016) for the trotter horses belonging to the group of the light draft horses.

The index for massivness is 121.0% ± 1.0% on average with an individual variation of 3.79%. In individual animals the variation is from 103.05% to 131.50%. The most massive are the animals from the village of Tazha, with an average index of 122.85 ± 3.27% (with a chest girth of 161.50 cm and a height at the withers 131.50 cm (Popova et al., 2018)), and the smallest are the horses from the village Plana – average 119.89 ± 2.31%. For comparison, the Arabian horse index for massivness is 118.1% on average; for the stallions from the Don breed – 117.3% and for the mares – 118.1%; in Budyonny breed – 115.5% for the stallions and 117.1% for the mares (Balakshin, 2003), the East Bulgarian horse – 115.29% (Sabeva & Kaschiev, 2010). In the primitive Hutsul breed the stallion index for massivness is 123.9%, for the mares – 131.2% and for the geldings – 125.1% (Purzyc et al., 2007). More massive than the Karakachan horse are the Kazakh horses, with index of massivness for the foals – 123% and 122% for the mares, and the Jabe horse breed with an index of 124.8% for the mares and 125.6% for the stallions (Balakshin, 2003).

The breeds of the Karakachan breed are slightly downhill build. The average value of the body ratio index is 100.73 ± 0.37 with a variation of 1.66%. Overall, this index has the lowest variation among the indices we have studied. In the animals from the village of Tazha variation was practically not observed compared to the horses from Levka village wehere the variation was the highest – on average 1.99%. In our previous study (Popova et al., 2018) we found that the height at the croup was slightly higher than that at the withers in all studied from from us herds, except in the village of Tazha. Similar to the established by us minor downhill body conformation is observed and in the primitive horses from Hutsul breed – 100.6% for stallions, 100.7% for mares and 100.9% for geldings (Purzyc et al, 2008).

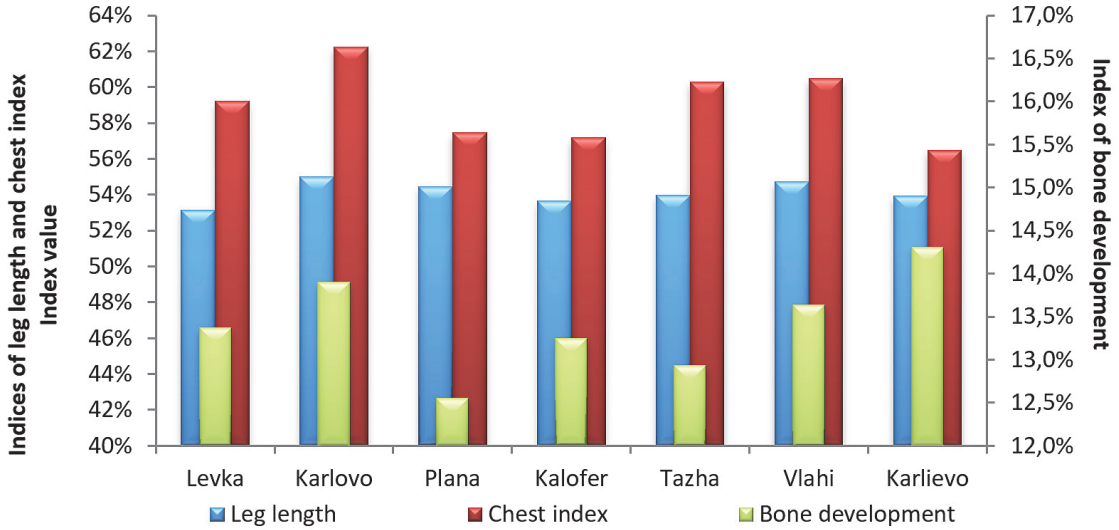

Fig. 2. Indices of leg length, chest index and bone development of horses from the Karakachan breed

The leg length index is dependent on the body depth – the lower the animal and the deeper the chest are, more short-legged it seems and higher is the value of the index. From the data presented in Fig. 2. it can be seen that the depth of the chest is more than 50% of the height at the withers. In some animals it reaches 60.31% (in Karlovo) and in individual animals it is below 50%. The avarage value of the leg length index in the measured animals was 54.17 ± 0.43 with variation of 3.49%. This shows that the horses of the Karakachan breed have a deep enough body. The animals from village of Levka have the lowest value of the index – an average of 53.16 ± 0.62. The individual variation is highest in the herd of Karlovo – 9.73%, and the most equal are the animals from the village of Carlievo – CV – 1.20%.

For the shape and bulk of the chest can be judged by the chest index witch is showing the ratio of the width in relation to depth of the chest. Normally, this index is higher in heavyweight breeds (Barsev, 2009). At the studied by us Karakachan horses, the index was highest in the horses from Karlovo with an average of 62.24 ± 2.82, and lowest in the horses from the village of Karlievo – 56.48 ± 3.26. The average chest index was 59.07 ± 0.99%, with individual variation in the separate herds ranging from 6.38% to 12.04%. In another study of ours (Popova et al., 2018) we found that chest width is the most variable indicator among all the studied body measurements as it is most influenced by the condition. Ivanovic et al. (2016) evaluated a chest index in horses of the Gidran breed and the obtained results were 54.1% for stallions and 56.9% for mares.

The Karakachan horse is with well-developed bones, as the index for bone development is 13.56 ± 0.11% on avarage, which is higher than that of the racing and some primitive horse breeds. For the Arabian horse, the index for bone development is 12.4%; for the stallions from the Don breed is 12.9% and for the mares – 12.3%; Budyonny breed – 12.6% for the stallions and 12.4% for the mares; for mares of the Azerbaijan, the Dagestani and Kazakh breeds is 12.9%; for the Deliboz and Hutsul breeds – 12.7 (Balakshin, 1978); for the Eastern Bulgarian horses is 12.62% (Sabeva & Kaschiev, 2010). The index for the bone development in Karakachan horses is higher than that of the trotter horses in Bulgaria – 12.23-13.23% (Lukanova, 2016).

The body proportions of the horses from the Karakachan breed are not influenced reliably by the region of breeding and sex (Table 2), as the only reliable difference ($P < 0.01$) is the development of the bones of the stallions and the mares. The bones of the stallions are better developed, as their index (14.29%) is about 1% higher than the index of the mares (13.44%). With the thinnest bones, a proof of a light constitution, are the mares of the village of Plana (12.55%), and the thickest ones belong to those in the town from Karlovo (13.95%). The stallions with the tiniest bones are the ones from the village of Levka (13.76%), and with the thickest bones are the stallions from the village of Karlievo (15.44%).

Table 2. Effect of the populated area, sex of the horse and sex of the horse in the populated area on the basic body measurements in horses from the Karakachan breed, F-criterion and degree of statistical significance

Indices	Populated area	Sex	Sex of the horse in the populated area
Df	6	1	3
Leg Length	0.669	0.362	0.870
Body extension	1.596	0.003	0.219
Body ratio	0.341	0.042	0.562
Massivness	0.395	0.494	0.415
Bone development	1.897	11.615**	1.977
Compactness	1.605	0.367	0.169
Chest index	0.383	2.763	1.893

***P < 0.001; **P < 0.01; *P < 0.05

Conclusion

The body of the horses from the Karakachan breed is prolonged (index for body extention – 108.0±0.8), and slightly downhill body conformation- (index for body ratio – 100.7±0.4%). The chest is bulky (chest index – 59.07±0.99%), as its girth is larger than the height at the withers and the length of the body, which makes the animals look massive enough (index for massivness – 121.0 ±1.0%), and compact (compactness – 112.2±1.0%). Animals are comparatively short-legged (leg length – 54.17±0.43%), with well-developed bones (index for bone development – 13.56±0.11%).

The populated area has no reliable influence on the body proportions of the horses from the Karakachan breed, but the sex is a reliable source of variation ($P < 0.01$) only on the bone development index as the bones of the stallions are better developed.

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