UDK 636.127

Izvorni znanstveni članak
Original scientific paper

EXTERIOR FEATURES OF GIDRAN HORSE IN CROATIA

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Summary

The objective of this study was to investigate morphometric measures from numerically small population of Gidran horses in Croatia. Thus body measurements were taken from a total of 31 individuals. The dactylo-thoracic index indicated that these animals are intermediary (not suitable for speed nor for traction) what was confirmed with the higher conformation index. The analysis of other conformation indices indicated that, in general, these horses are medilines, compact, with good developed chest. No significant differences between male and female Gidran horses considering body measurements exist what confirm conformation homogeneity as result of well managed breeding strategy. Compared to Hungarian Gidran population, Gidrans from Croatia show great similarity even though they have had lower values for body measurements.

Key words: Gidran horse, origin of breed, conformation, exterior measures, body indices

Introduction

In the area of today's Croatia for centuries, in continuity or discontinuity, are grown numerous breeds of domestic animals, including horses. Some breeds are bred for centuries (*autochthonous breeds*), some are arrived during migration and conquest (*Arabian horses during the Ottoman conquest*), some were accepted and integrated into the tradition of the area (*Lipizzaner who arrived during the Napoleonic conquests*) and some breeds are still introducing (*allochthones*) in accordance with the needs of modern farming. In the horse breeding and cavalry, directions of breeds forming are result of the needs of recreational and professional riders, and to a lesser extent, the needs of agriculture or other sectors of the economy. Unfortunately, some breeds, such as the horse from the Island Krk are permanently disappeared along with their habitat, and for some we are still not sure whether they are completely lost. Today from a total of 904 horse breeds, 87 of them are extinct, 202 breeds are in some level of vulnerability, while only 137 are not in the risk of disappearance (FAO, 2015). This report indicates that 53% horse breeds have unknown status of their biological endanger level. Although, in the present time are preferred combination crossing that create new genotypes of desirable working features, we should be aware of the need to preserve the traditional breeds in order to preserve their genetic structure which could serve as the basis for creating useful types of horses. However, breeds are also part of the cultural heritage that has been for centuries incorporated in the life of rural areas and, as such, inseparable part of particularly important in the sustainable are development.

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For centuries horse breeds have been carefully selected, raised and bred in accordance with the human needs, and to a large extent conditioned by political, economic and agroecological environment in which they were developed. In geopolitically volatile periods such as the former border area between the Habsburg monarchy and the Ottoman Empire attention was given to breed horses with good working and riding predispositions on which safety and survival of the local population depended. The economic state of the area also influenced on horse shaping. For example in the coastal and islands area in Croatia for centuries have been bred small and modest, so called, karst horses, while in the northern part of Croatia due to rapid development of trade during the second half of the XIX century encouraged the formation of heavier Murinsulaner horse which was recognized and respected in the former Austro-Hungarian monarchy.

In Croatia there are three autochthonous breeds Croatian Posavina horse, Croatian coldblood and Murinsulaner horse while Lipizzaner as traditional breeds are included in the conservation program. However, today's Croatian territory through its geopolitical history was heritage to breeds like Gidran, Nonius and others used primarily in the cavalry, but due to geopolitical turmoil were marginalized. For example, in Croatia and wider area, at that time well known uniformed cavalry Hussar troops were very effective in countering with the occasional marauding invasions of Ottoman troops. Hussar cavalry troops from the border areas of Krajina (Croatian, Banska, Slavonian and Slavonian-Syrmian Krajina) rode the horses which were proclaimed firstly from the Habsburg monarchy, then the Austrian Empire and then the Austro-Hungarian monarchy until its collapse.

Jónás et al. (2006) in the monography have precisely documented formation of Gidran breed from the very beginnings (Figure 1). History of Gidran is related to the stud farms in today's Hungary, which back then, have a mission to take care of horses of the Austro-Hungarian monarchy. During the second half of the nineteenth and early twentieth centuries Gidran breed was spread and used in the area of today's Croatia also. Founder of Gidran breed was the *Gidran Senior* Arab stallion foaled in 1809 in the desert inhabited by tribes *Hagdi Hamdania* which were bought by a horse expert baron Fechtig in 1816 and brought in Trieste. The stallion *Gidran Senior* in 1818 is moved to a military stud Bábolna in Hungary and serves as sire where he, along with numerous offspring, gave six quality male offsprings of which the most important was *Gidran II* (*Gidran Senior* × *Spanish mare Arogante*). *Gidran II* as sire was taken to military stud farm Mezőhegyes (Hungary) where he was mate with different types of mares (*Holstein, Mecklenburg, Hungarian, Romanian, Moldovan and Arabian mares*).

The key year for consolidation of Gidran breed is 1855 when the director of the stud Lt. Lobkowitz switched over to grouping stud farms based on genealogy and the yellow stud farm called number IV mainly with gidran origin and typical chestnut coat colour towards the full

consolidation of the breed (Jónás et al., 2006). The Ministry of Defence of the Austro-Hungarian monarchy officially recognized in 1885 Gidran breed as a separate genetic entity. The original Gidran breed is traced back to 16 family founders, though more families had died out since and only six exists nowadays, and three founder lines. Line "A" was founded by Gidran XXXI who were used for breeding purpose from 1867-1875, line "B" by Gidran XXXIII used for breeding purpose from 1872-1884, and line "C" by Gidran XXI used for breeding purpose from 1869-1879. During and after the World War I a breeding of Gidrans is disturbed because one part of population is killed, and also, large number of horses (186) was relocated to Romania. The World War II caused additional damage in already declining number of Gidran horses because large numbers of mares were dislocated (94 in Bayerland, 4 in Czech Republic) and in 1948 only 28 mares found their ways back Mezőhegyes (Jónás et al., 2006). This declining continued and in 1975 the breed was consisted of only 3 stallions and 17 mares. But end of XX and beginning of XXI century brings a certain reversal in breeding of Gidran horses, the population number starts to increase, primarily encouraged by participating in equestrian sports and recreation and the needs to preserve the specific combination of genes.

Figure 1 – Stallion (12 years old) and mare (6 years old) of Gidran breed in Croatia (photo taken in June 2016)

Breeding of Gidran horses was always present in Croatia especially in the northern areas where they were used as warhorses by hussar military cavalry troops established in Bjelovar as far back as 1756. In 1880's due to its excellent abilities and great possibility of utilisation in almost every stallion stables in northern part of Croatia there was Gidran horses among Thoroughbreds, Lipizzan, Nonius horses and others (NN, 1885). Therefore, through history there are strong indications that Gidran breed on Croatian territory has the character of a traditional breed. Reintroduction of this

breed mainly at the Bjelovarsko-Bilogorska County starts at the end of nineteen and at the beginning of twentieth century. Today's population of Gidran in Croatia is very modest, the highest number of animals is in Hungary (≈ 320 animals), Romania (≈ 50 heads) and Bulgaria (≈ 30 heads). Under the national EAAP and FAO classifications we conclude that Gidran breed are in the category of highly endangered (FAO, 2015). In Croatia, Gidran population counts for 66 animals with all age and sex categories of which are 13 stallions (Figure 1) and 37 mares (CAA, 2016). The majority of population (≈ 70%) is located in Bjelovar-Bilogora County where this breed closely related to the historical heritage of hussar troops, so called *The historical Bjelovar border troops – Hussars 1756* (Figure 2). Croatian association of breeders of Gidran horses (HUGK) and Croatian Agricultural Agency take care about conducting the breeding program for Gidran horse adopted in 2011 and meeting those commitments.

Figure 2 – The historical Bjelovar border troops – Hussars 1756 in Bjelovar at cultural manifestation Terezijana in May 2016

For insight into the current state of Gidran population in Croatia and their protection, the aim of this study was to evaluate the phenotypic characteristics of Gidran breed in Croatia, which is one of the criteria for selection indicated by breeding program. In addition, their comparison with the Hungarian populations of Gidran and Nonius which took part in Gidrans history by crossing we will get insight about their relationship.

Material and methods

The survey was conducted in the area of Bjelovar-Bilogorska County during summer 2016 year. A total of 31 breeding animals (nine stallions and 22 mares) older than three year were measured by a single person on the left side of the body. Measurements were taken during daily light, in open space, and horses were stood on firm ground in natural position in the presence of the owner according to Komosa and Purzye (2009). Lydtin stick was used to measure: height at withers (WH^S), height of back (BH), height of rump (RH), diagonal length of the body (BL), depth of chest (CD), width of chest (CW) and length of rump (RL). My measuring tape following measures was taken: high at withers (WH^T), chest circumference (CC) and cannon bone circumference (CbC). From body measurements biometric indices were calculated to evaluate the proportions of the individuals and to define its type as presented in Table 1.

Table 1 – Calculation model of body indices (Cabral et al., 2004; Druml et al., 2008; McManus et al., 2008)

Quadratic index	$(WH^S/BL) \times 100$	Conformation index	$(CC^2/WH^S) \times 100$
Body index	$(BL/CC) \times 100$	Caliber index	$(CC/WH^S) \times (CbC/WH^S) \times 1000$
Overbulit index	$(RH/WH^S) \times 100$	Dactylo-thoracic	$(CbC/CC) \times 100$
Format index	$(BL/WH^S) \times 100$	Tare index 1	$((CC/100)^2 \times 56) / CH \times 100$
Depth chest index	$(CD/WH^S) \times 100$	Tare index 2	$((CC/100)^2 \times 95) / CH \times 100$
Width chest index	$(CW/CD) \times 100$	Live weight index	$(CC^3 \times 80)$

Statistical analysis was carried out using the SAS software package (SAS, 2008). Two-dimensional representation of the three body measures are prepared wit R package (R Core Team, 2013). These three measures were chosen because they are the most commonly used and used in estimation of morphology by different horse breeding organizations in Croatia.

Results and discussion

The mean values of the various body measurements for mares and stallions are presented in Table 2. As expected, the wither high of stallions was greater than those in mares and the difference was 2.8 cm (measured with the stick) and 1.7 cm (measured by tape). Our results are within the range of 160 to 173 cm for high at withers as stated Bokor (2011). Compared to Hungarian

Gidran mares (162.5) and Nonius mares (164.7) Croatian Gidran mares have smaller withers high (161.9) but higher than Thoroughbred (160.9; Bene et al. (2014). The stallions are higher in the back (+1.4) and rump (+1.1), but in as many as three traits the mares have greater variables: circumference and width of the chest, and length of the rump (Table 2). Stallions and mares of Gidran in Croatia have similar measures for two morphological traits, i.e. length of the body and chest depth with differences between them less than 0.1 and 0.8 cm (Table 2).

Table 2 – Body measurements of 31 individuals of Gidran horse in Croatia

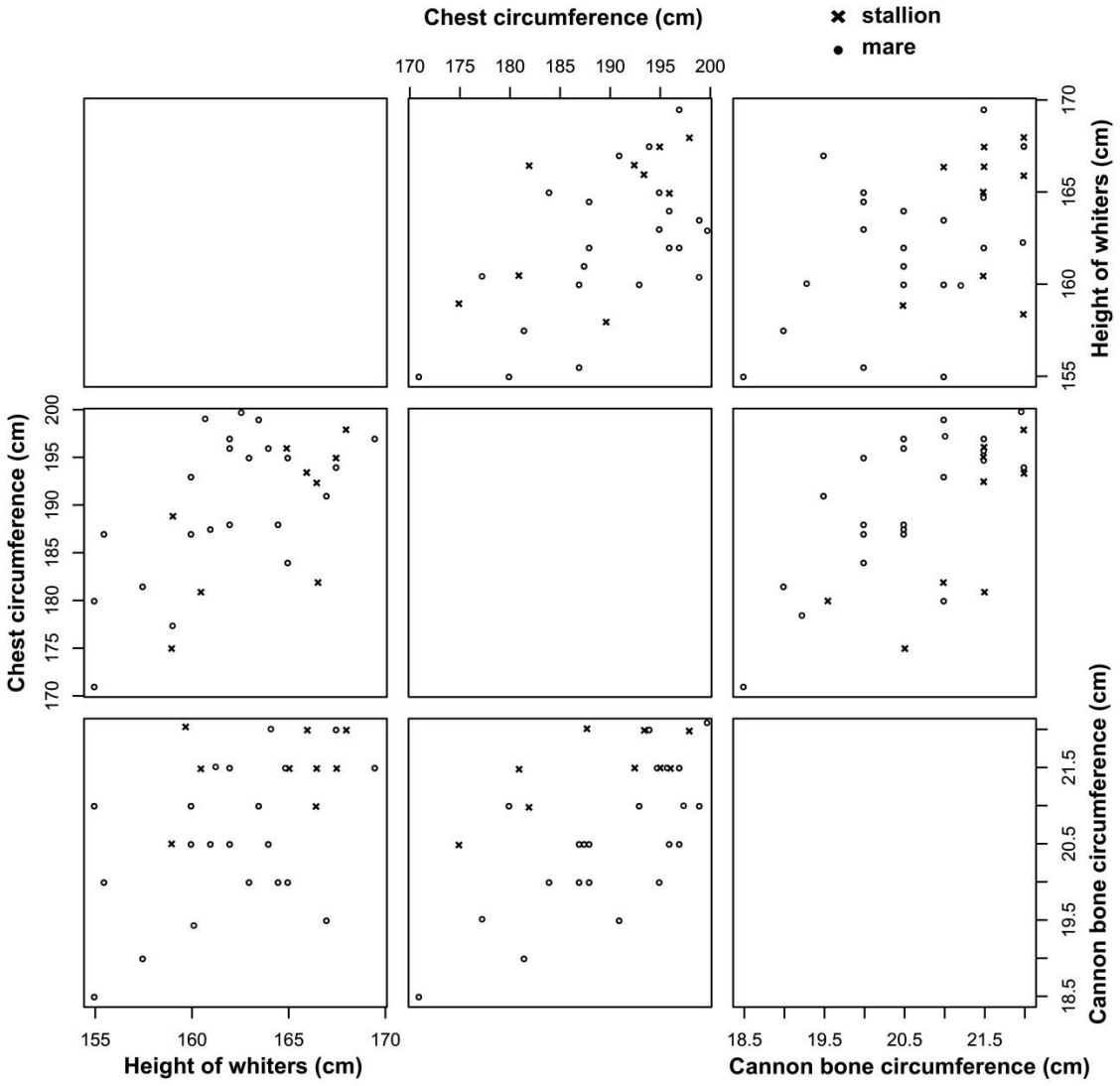
Body measurements	n	$\bar{X}$	s.d.	s_e	Min	Max	Variance
Height of withers (stick)	9 stallions	164.1	± 3.855	*1.285*	158.0	168.0	10.78
Height of withers (tape)		172.6	± 3.678	*1.301*	167.0	176.0	12.91
Height of back		152.4	± 2.279	*0.759*	149.0	156.0	5.64
Height of rump		159.2	± 3.821	*1.291*	151.5	165.5	16.22
Length of body		166.2	± 6.819	*2.277*	155.0	175.0	51.01
Chest circumference		189.1	± 7.964	*2.565*	175.0	198.0	71.86
Cannon bone circumference		21.5	± 0.499	*0.167*	20.5	22.0	0.55
Depth of chest		74.8	± 3.528	*1.176*	69.0	82.0	9.84
Width of chest		40.4	± 2.934	*0.978*	36.0	44.0	8.23
Length of rump		48.8	± 3.640	*1.136*	45.0	55.5	12.16
Height of withers (stick)	22 mares	161.9	± 3.889	*0.829*	155.0	169.5	14.46
Height of withers (tape)		170.9	± 4.573	*1.049*	162.5	181.0	18.72
Height of back		151.0	± 4.345	*0.926*	142.0	159.0	17.23
Height of rump		158.1	± 4.391	*0.936*	151.0	165.0	19.25
Length of body		166.1	± 5.241	*1.117*	153.0	179.0	21.32
Chest circumference		190.3	± 7.855	*1.674*	171.0	202.0	48.16
Cannon bone circumference		20.5	± 0.919	*0.196*	18.5	22.0	0.75
Ddepth of chest		74.0	± 2.769	*0.590*	67.5	78.0	7.12
Width of chest		42.1	± 2.244	*0.527*	36.0	48.5	6.32
Length of rump		51.8	± 3.910	*0.833*	46.0	60.5	14.54

n – number of individuals; $\bar{X}$ – average value; s.d. – standard deviation; s_e – standard error; Min – minimum; Max – maximum

All investigated differences of morphological traits between mares and stallions in this study were not statistically significant ($P<0.5$). For example, representing the three most important body measures (withers high, circumference of the chest and cannon bone) in the Graph 1, there was no indication of separation between stallions and mares taking into account these measurements. This suggests that the homogeneity and uniformity in population of Croatian Gidran reflects good

conducting of breeding program and well managed current methods of selection within the population.

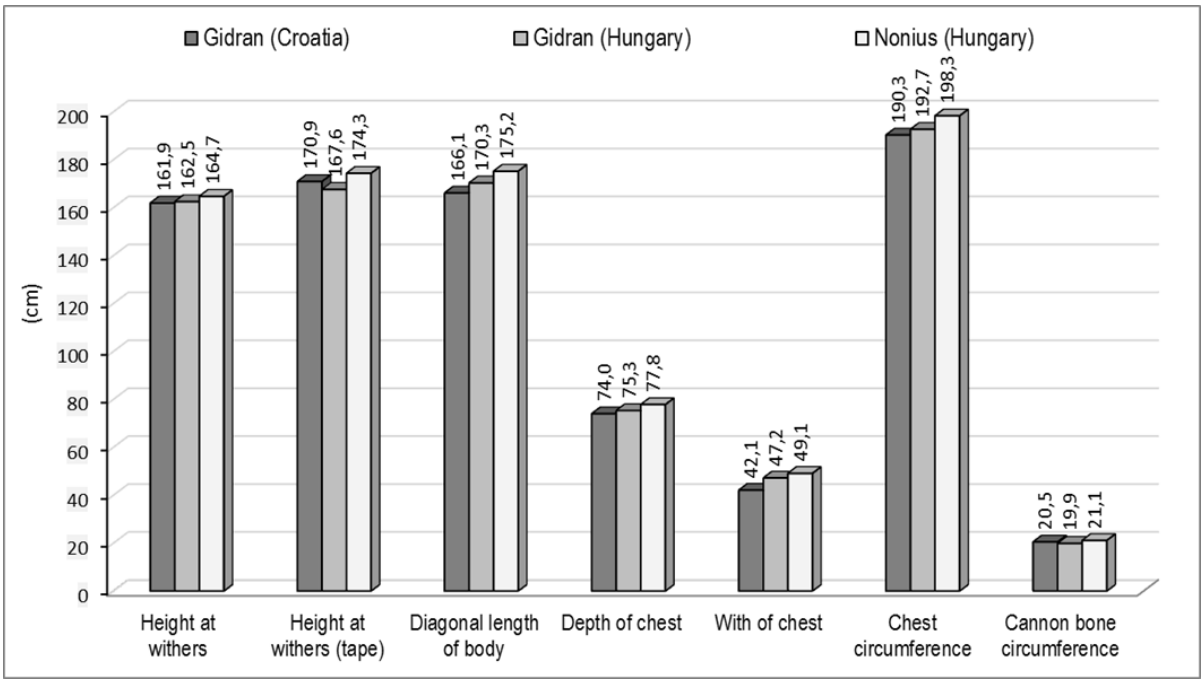
Graph 1 – Two-dimensional representation of three body measures of stallions (crosses) and mares (circles) in Croatian Gidran breed. Three body measures are w hither high measured by stick, circumference of the chest and cannon bone and its values are represented in cm.



Comparing the body measurements of Gidran mares (Bene et al., 2014) in Croatia with those from Hungarian, in general can be concluded that Hungarian population have higher values (Graph 2), although the differences were not large. Gidran mares in this study have negligible higher cannon circumference (20.5) compared to Hungarian Gidran mares (19.9) but smaller than Nonius mares (21.1 cm; Graph 2). The Croatian population of Gidran is considered to originate from Hungarian population therefore similarity of results are expected. Higher values for Gidran

mares population is Hungary are results of existence draught and farm horses in the past, followed by directed selection of the breed mainly toward using it for riding and by 1900's an elegant, though hussar horse with excellent abilities has been formed (Jónás et al., 2006).

Graph 2 – Comparison of body measurements of Gidran mares from Croatia, Gidran and Nonius mares from Hungary (Bene et al., 2014; this research)



There were meaningful differences considering variance for some body traits, e.g. chest circumference (48.16 mares; 71.86 stallions) and body length (21.32 mares; 51.01 stallions; Table 2). One of the reasons could be lower reported heritability values between 0.26 to 0.35 for chest circumference (Druml et al., 2008; Zechner et al., 2011; Çilek, 2012). Chest circumference is correlated with breeding management (i.e. feeding, environmental and housing condition, care, training, etc.), therefore heritability is considered to have less influence thus variation of these traits will be bigger. Results presented in this study are based on a rather small number of individuals, namely the whole Gidran population in Croatia is consisted from 66 individuals of which only 50 is considered to be reproductive effective (CAA, 2016), the results should be therefore treated with the caution. Therefore, large variability for body length within investigated breed should be considered from this aspect.

When body measures were put in relations, physical indices were obtained which provide more detailed information about horse conformation which is represented in Table 3.

Table 3 – Body measure indices of 31 animals of Gidran population in Croatia

Index	Stallions (n = 9)	Mares (n = 22)
	$\bar{X}$ ± *s.d.*	$\bar{X}$ ± *s.d.*
Quadratic index (QI)	101.4 ± *2.63*	99.2 ± *2.50*
Body index (BI)	87.9 ± *2.27*	87.8 ± *2.28*
Overbuilt index (OI)	95.9 ± *1.76*	98.2 ± *2.42*
Format index (FI)	101.3 ± *2.97*	103.2 ± *2.28*
Depth chest index (DCI)	45.6 ± *1.65*	45.7 ± *1.40*
Width chest index (WCI)	54.1 ± *4.55*	56.9 ± *3.12*
Conformation index (CI)	2.2 ± *0.16*	2.2 ± *0.15*
Caliber index	151.1 ± *8.22*	149.1 ± *9.95*
Dactylo-thoracic index (DTI)	11.4 ± *0.33*	10.8 ± *0.34*
Tare index 1 (trot. gallop)	126.9 ± *9.96*	127.0 ± *9.09*
Tare index 2 (walk)	215.4 ± *16.91*	215.5 ± *15.41*
Live weight index (LWI) (kg)	541 ± *62.78*	546 ± *64.21*

n – number of individuals; $\bar{X}$ – average value; s.d. – standard deviation

The results obtained showed that the Gidran horses are well proportioned with almost equal withers high and body length, eumetric or medium horses (350≤LWI≤550 kg) with tendency to large (hypermetiric) horses. Body index of stallions and mares was almost identical, 87.9 vs. 87.8, and describes them as mediline animals not specifically convenient for speed or traction. This is in agreement with the breeding goal of Gidrans in the past, since selection was directed to form multipurpose – warhorse, durable, and muscle-bound with great ability of movements (Jónás et al., 2006). Thus, body index and quadratic index are useful parameters for assessment functionality and the balance of the horse. Compared to mares stallions have a slightly higher caliber (151.1 vs. 149.1) and dactylo-thoracic index (11.4 vs. 10.8) but the differences were not significant. Caliber index put Croatian Gidran population in multipurpose type of horses such as Gidran and Nonius population from Hungary (Bene et al., 2014). Horses with good predisposition to carry heavy loads have higher caliber index like Noriker (CI = 190) from Austria (Druml et al., 2008). Dactylo-thoracic index in this research classifies stallions and mares as eumetric or intermediate (10.5≤DTI≤11.5) animals what indicates a good development of thorax. Thorax should be well developed, wide and deep because it is associated with lung and heart capacity. This was confirmed

with the higher conformation index of 2.2 for both genders in this study. Bene et al. (2014) report higher values of conformation index of 2.3 for Gidran and Thoroughbred mares and 2.4 for Nonius mares. Working indices for stallions and mares in this study do not differ significantly, meaning that both can carry 127 kg weight at trot or gallop or 215 kg at walking pace. McManus et al. (2008) for Pantaneiro horse reported lower values of 105 kg and 180 kg.

Table 4 – Correlation coefficients of Gidran population in Croatia with significance level. Correlation higher than 0.50 are bolded.

	WH^T	BH	RH	BL	CC	CbC	CD	CW	RL
WH^S	0.935**	**0.638****	**0.555****	**0.637****	**0.579****	0.459**	**0.608****	0.056	0.155
WH^T	-	**0.587****	**0.564****	**0.815****	**0.788****	**0.530****	**0.744****	0.262	0.294
BH		-	**0.835****	0.434*	0.225	0.118	0.419*	-0.012	0.273
RH			-	**0.545****	0.306	-0.001	0.326	0.161	**0.515****
BL				-	**0.784****	0.411*	**0.692****	0.463**	0.479**
CC					-	**0.597****	**0.835****	**0.671****	0.321
CbC						-	**0.570****	0.278	-0.061
CW							-	0.314	0.222
RL								-	0.407*

** P<0.01; *P<0.05; height at withers measured with stick (WH^S); high at withers (WH^T); height of back (BH); height of rump (RH); length of body (BL); chest circumference (CC); cannon bone circumference (CbC); depth of chest (CD); width of chest (CW); length of rump (RL)

The correlation coefficients between studied morphometric traits are given in Table 4. As expected, the highest correlation was between WH^S and WH^T measures. In this study three correlations have negligible negative values without significant meaning. The correlation coefficient ranged from 0.056 (CW/WH^S) to 0.835 (RH/BH and CD/CC). Strong association and significant correlation (P<0.05 and P<0.01) between variable pairs WH and [BH, RH, BL, CC, CbC, CD], CC and [BL, CD] and CD and CbC were evident. Conversely, the CW and RL dimensions show a weak to moderate association to other body measurements, except for 0.671 (CW/CC) and 0.515 (RL/RH). Compared to results from this research lower correlation values for majority of measurements reported Takaendengan et al. (2011) for Minahasa Horse and Bene et al. (2014) for combination of warmblood and coldblood breeds.

Conclusion

Morphological data from this research indicate that population of Gidran horse from Croatia is well proportioned and compact breed, with good thoracic development and classified as mediline, not especially convenient for speed or traction. These indices make Gidran as versatile horse, on one hand an excellent sports horse (e.g. eventing, show jumping, dressage, and endurance) and on other hand, outstanding attractive horse in cultural manifestation and recreation. Population of Gidran horses in Croatia have homogeneous phenotype indicating that conducting of breeding program and selection for these indices was successful. From genealogical aspect, population of Gidran horses in Croatia is similar to those in Hungary. In order to maintain specified standards for phenotype traits and to preserve sporting performance the implementation of the breeding program should be continued, planned mating must be carefully carried out, and if necessary, exchange of genetic material (live animals, semen) should involve breeders of Gidran from neighbouring countries, i.e. Hungary.

Acknowledgement

Hereby we would like to thank the Croatian breeders association of Gidran horses (HUGK) for their kindness and help in survey of body measurements. This research is part of the project "Reaffirmation programme of Gidran horse in Republic of Croatia" which is financed by the City of Bjelovar.

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ODLIKE EKSTERIJERA GIDRAN PASMINE KONJA U HRVATSKOJ

Sažetak

Cilj istraživanja je stjecanje uvida u morfometrijske mjere Gidran pasmine konja u Hrvatskoj koja je brojem skromna. Prikupljene su tjelesne mjere od ukupno 31 jedinke. Daktilo-torakalni indeks upućuje da Gidran populaciju u Hrvatskoj karakterizira srednji format tijela (koji nije pogodan ni za postizanje velikih brzina ni za vuču) što je potvrđeno vrijednošću konformacijskog indeksa. A naliza drugih tjelesnih indeksa pokazala je da su umjereno dugi, kompaktni, s dobro razvijenim prsnim košem. Ne postoji značajna razlika u tjelesnim mjerama između muških i ženskih grla što potvrđuje konformacijsku homogenost pasmine kao rezultat dobro vođene uzgojne strategije. Premda populacija Gidrana u Hrvatskoj ima nešto niže vrijednosti tjelesnih mjera u odnosu na uzgoj Gidrana u Mađarskoj, možemo zaključiti da ta dva uzgoja pokazuju veliku sličnost.

Ključne riječi: Gidran, povijest razvoja, konformacija, mjere vanjštine, tjelesni indeksi

Primljeno: 12.12.2016.