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# ANALYSIS OF CONFORMATION TRAITS OF THE SLOVENIAN COLD-BLOODED HORSE

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## SUMMARY

*Slovenian Cold-Blooded horse is an autochthonous horse breed in Slovenia, traditionally reared in the North-Eastern and Northern parts of Slovenia. Today the breed is widespread all over the country. Breeding program for the Slovenian Cold-Blooded horse was accepted 2005 when the Association of Slovenian Cold-Blooded Horse Breeders was established, too. The aim of the study was to analyse conformation and gaits traits of the Slovenian Cold-Blooded horse. Likewise, we tried to evaluate fixed effect, affecting the included traits. Data were collected during the classifications of Slovenian Cold-Blooded horse performed from 1996 to 2011. In this study, 1920 horses were included, 52 of which were stallions and 1868 mares. The scoring system included 8 measured and 10 scored traits. Data were analysed by GLM procedure of statistical package SAS/STAT considering sex, age at scoring and birth year as fixed effects. Stallions of Slovenian Cold-Blooded horses were on the average  $152.4 \pm 0.56$  cm high at withers (stick), while mares were  $151.22 \pm 0.11$  cm. Body length (stallions  $163.95 \pm 1.48$  cm; mares  $164.28 \pm 0.17$  cm) was on the average larger than the height at wither thus indicating the rectangular body frame.*

**Key-words:** Slovenian Cold-Blooded horse, conformation trait, body measurements, gaits

## INTRODUCTION

Slovenian Cold-Blooded horse is an autochthonous horse breed in Slovenia traditionally reared in the North-Eastern and Northern parts of Slovenia. Today the breed is widespread also throughout Slovenia. In the year 2014, the estimated population size was around 3000 Slovenian Cold-Blooded horses of all categories (Veterinary faculty, Institute for breeding and equine health). The breed was formed in the past based on local populations of cold-blooded horses like was Posavinja horse, Bohinj horse, Kobarid horse, Međimurje horse, Alpine horse and many others. Most of them are extinct today or were merged in the population of Slovenian Cold-blooded horse. Local mares were improved with cold-blooded stallions of the Belgian horse as well as Noric horse. Breeding program (Rus, 2010) was accepted in the 2005 for the first time, when the Breeders Association of Slovenian Cold-Blooded Horse was established, too. The Slovenian Cold-blooded horse is a medium body framed horse with a large head and convex nose profile, with a moderately long neck. The body is large, deep, wide and compact. The croup is low

and often split up. The horse's legs are strong and have good gaits (Rus, 2010). The aim of the study was to analyse conformation traits in the Slovenian Cold-Blooded horse and to evaluate fixed effects affecting those traits.

## MATERIAL AND METHODS

Data were collected during the Slovenian Cold-Blooded horse classifications, taken after the horses achieved breeding maturity around 30 months of age. Classification was performed for males and females prior to records in the Slovenian Cold-Blooded horse Stud book by only one classifier. The scoring system included 8 measured and 10 subjectively scored (1 to 10 point scale) traits.

This study includes only data of Slovenian Cold-Blooded horses, aged 30 to 60 months in the scoring day. Data of younger and older horses as well as outliers were excluded from further analyses. Data of conforma-

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tion traits used in this study belong to 1920 horses of Slovenian Cold-Blooded horse population, where 52 stallions and 1868 mares were born during the period 1999-2007. Likewise, four body indexes were computed from measured traits as follows, cannon bone circumference/height at wither (ICBC), chest width/height at wither (ICW), chest depth/height at wither (ICD) and croup width/height at wither (ICrW).

Data were analysed by GLM procedure of statistical package SAS/STAT (SAS User's Guide, 2001) considering sex, age at scoring and birth year as fixed effects (Model 1). The horses were divided into two groups by the age at scoring day, from 30 to 42 months (N=1444), and from 43 to 60 months of age (N=476).

$$y_{ijk} = \mu + S_i + A_j + B_k + e_{ijk} \quad \text{Model 1}$$

where:

$y_{ijk}$ —conformation trait;  $S_i$ —sex;  $i=1, 2$ ;  $A_j$ —age at scoring day;  $j=1, 2$ ;  $B_k$ —birth year;  $k=1, \dots, 11$ ;  $e_{ijk}$ —residual

## RESULTS AND DISCUSSION

Significant differences between stallions and mares of the Slovenian Cold-Blooded horse were recorded at three measured, four scored and two body indexes (Table 1). Stallions were higher in wither (stick measured) ( $152.40 \pm 0.56$  cm), had larger cannon bone circumference ( $24.72 \pm 0.17$  cm) and shorter chest girth ( $191.8 \pm 1.34$  cm) than mares ( $151.22 \pm 0.11$  cm,  $22.62 \pm 0.03$  cm,  $196.43 \pm 0.26$  cm), respectively. The average values for the measured traits especially height at wither measured by stick ( $152.40 \pm 0.56$  cm) has shown that the Slovenian Cold-Blooded horse is a draft horse with smaller body frame compared to the well-known Noric draft horse (156–162 cm) (Druml, 2006). On the other side, stallions and mares of the Slovenian Cold-Blooded horse were higher at wither compared to stallions ( $142.8 \pm 0.56$  cm) and mares ( $142.0 \pm 0.24$  cm) of the Slovenian population of Posavje horse (Simčič et al., 2012). Dario et al. (2006) found lower chest girth ( $187.89 \pm 0.67$  cm) in Murgese stallions as well as Simčič et al. (2012) in Posavje stallions ( $188.2 \pm 1.57$  cm) compared to Slovenian Cold-Blooded horse.

However, height at wither measured by stick were not in accordance with a breeding goal of the Slovenian Cold-Blooded horse, which assumed 155 cm (148-160 cm) for stallions and 150 cm (146-158 cm) for mares (Rus, 2005).

The average value for each scored trait means also the average value of the population, regarding to breeding goals in the breeding program (Rus, 2010). The explanation what exactly each point meant is very subjective, while 1 means that the trait was the worst expressed, and 10 that the trait was the most expressed (Simčič et al., 2012).

Significant differences between stallions and mares existed also in the scored traits. Stallions expressed breed type significantly better ( $7.49 \pm 0.09$ ) than mares ( $7.29 \pm 0.02$ ). Also head, neck and rear legs were significantly better scored in stallions ( $7.43 \pm 0.09$ ,  $7.52 \pm 0.11$ ,  $6.59 \pm 0.09$ ) compared to mares ( $7.06 \pm 0.02$ ,  $7.28 \pm 0.02$ ,  $6.29 \pm 0.02$ ). No significant differences were found out between stallions and mares in gaits correctness as well as in gaits efficiency. The differences between sex were significant in the two (ICBC, ICrW) of four body indexes. ICBC and ICrW were higher in stallions ( $16.26 \pm 0.10\%$  and  $37.54 \pm 0.59\%$ ) compared to the mares ( $14.96 \pm 0.02\%$  and  $39.04 \pm 0.05\%$ ). The scored traits had higher scores at stallions with the exception of gaits efficiency and correctness where a more intensive selection is seen in stallions compared to mares.

Body indexes showed interdependence among the measured traits, compliance of the body and coherence with the breed standards (Ivanković, 2004). On the base of body index (chest depth/height at wither) we could determine which group, oriental (hot-blooded) (45.0-46.5%), half-blooded (warm-blooded) (46.5-48.5%), or cold-blooded (>50.0%), a horse or a population belong to (Brinzej, 1980 cit. by Ivanković, 2004). Consequently, the Slovenian Cold-Blooded horse belongs to half-blooded (warm-blooded) group with the index chest depth/height at wither of stallions  $47.22 \pm 0.66\%$  and mares  $47.75 \pm 0.06\%$ . The Slovenian population of Posavian horse were also arranged in the same half-blooded group, where the index chest depth/height at wither of stallions were  $47.5 \pm 0.41\%$  and of mares  $47.5 \pm 0.13\%$  (Simčič et al., 2012).

**Table 1. Least square means (LSM), standard errors (SE) and p-values of included effects**

	Stallions			Mares			p-values		
	n	LSM	SE	n	LSM	SE	Sex	Age	Birth year
<b>Measured traits (cm)</b>									
Height at wither – stick (WH)	52	152.4	0.559	1868	151.22	0.108	*	**	***
Chest girth	50	191.8	1.339	1859	196.43	0.255	**	n.s.	***
Cannon bone circumference (CBC)	50	24.72	0.168	1822	22.62	0.032	***	*	***
Chest depth (CD)	10	72.07	1.125	1845	72.22	0.097	n.s.	n.s.	***
Croup height	13	154.09	1.591	1861	153.16	0.157	n.s.	n.s.	***
Chest width (CW)	10	49.31	1.369	1844	49.21	0.118	n.s.	n.s.	***
Croup width (CrW)	10	57.27	0.939	1843	59.03	0.081	n.s.	*	***
Body length	17	163.95	1.481	1835	164.28	0.167	n.s.	n.s.	***
<b>Scored traits (1-10)</b>									
Breed type	52	7.49	0.086	1841	7.29	0.017	*	*	***
Head	49	7.43	0.088	1777	7.06	0.017	***	n.s.	***
Neck	49	7.52	0.105	1777	7.28	0.02	*	n.s.	***
Front part	49	7.7	0.106	1776	7.52	0.021	n.s.	n.s.	***
Middle part	49	7.26	0.098	1775	7.12	0.019	n.s.	n.s.	***
Rear part	49	7.53	0.104	1775	7.37	0.02	n.s.	n.s.	0.004
Front legs	49	6.39	0.102	1773	6.43	0.02	n.s.	n.s.	***
Rear legs	49	6.59	0.091	1770	6.29	0.018	**	n.s.	***
Gaits correctness	34	6.41	0.109	1739	6.46	0.018	n.s.	n.s.	***
Gaits efficiency	34	6.91	0.101	1729	7.05	0.017	n.s.	n.s.	***
<b>Total score of scored traits</b>	35	70.15	0.975	1762	69.05	0.161	n.s.	n.s.	***
<b>Body indexes (%)</b>									
ICBC = (CBC/WH)*100	50	16.26	0.096	1821	14.96	0.019	***	n.s.	***
ICW = (CW/WH) *100	10	32.34	0.87	1844	32.53	0.075	n.s.	n.s.	***
ICD = (CD/WH) *100	10	47.22	0.663	1845	47.75	0.057	n.s.	*	***
ICrW = (CrW/WH) *100	10	37.54	0.591	1843	39.04	0.051	*	**	***

LSM–least square means, SE–standard errors, \*-p<0.05, \*\*-p<0.01, \*\*\*-p<0.001, n.s.-p>0.05

Differences in conformation traits between younger (30-42 months) and older (43-60 months) groups of horses were significant in height at wither, cannon bone circumference and croup width (Table 1). On the other side, differences in conformation traits among the birth years were significant for all the included traits. Within the effect of birth year, the sire effect could be expressed, because each sire did not have offspring in all the studied years (Table 1).

## CONCLUSION

Stallions of Slovenian Cold-Blooded horses had on the average  $152.4 \pm 0.56$  cm height at withers (stick), while mares had  $151.22 \pm 0.11$  cm. Body length (stallions  $163.95 \pm 1.48$  cm; mares  $164.28 \pm 0.17$  cm) was on the average larger than the height at wither thus indicating the rectangular body frame. However, in this study it was realised for the first time, in the case of Slovenian Cold-Blooded horses, that at least fixed

effects like sex, age and birth year need to be considered in the conformation traits evaluation since some traits were significantly affected by them. The total score of the scored traits is regarding to actual Breeding program scored immediately after the end of the scoring procedure. Such a scoring system does not allow to consider environmental effects, which in turns, could cause mistakes in the horse classification. To improve the classification of horses based on the conformation traits, estimation of breeding values need to be implemented. However, an analysis of conformation traits in Slovenian Cold-Blooded horse was the first step prior to the estimation of genetic variances of measured and scored traits, as well as body indexes which are basis for the evaluation of breeding values.

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