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Breed differences in behaviour-related characteristics of stallions evaluated in performance tests

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Present study was aimed at testing the possible breed differences in behaviour-related traits evaluated in performance tests of stallions. The results as regards the traits labelled "character", "temperament", "trainability" and "rideability" were examined. The results of 326 three-years old stallions submitted to the 100-days training at two training stations in the period 2004-2007 were used. Breeds tested were Polish Halfbred Horse (PH), Małopolska (M), Wielkopolska (W) and horses of foreign origin (F). Horses of F breeds scored highest on all behavioural characteristics. The M horses scored the lowest on "character", differing significantly from other breeds. PH and W horses did not differ in regards to this trait. There were no differences in "temperament" between the breeds, except for the F horses. "Trainability" was rated the lowest in M horses, increasing successively in W, PH and F horses. The "rideability" within PH, M and W horses was similar but was significantly lower than in F breeds. Expectations of raters as per horses' mental characteristics were met best by the F horses; the M horses met them at the lowest level. It may be concluded that F horses are best fit to fulfil the breeding objectives in terms of their behavioural characteristics. It should be noted that the breeding objective seems to favour behavioural characteristics enabling horses to perform well in sport rather than in leisure. It should be also emphasized that the method of evaluation of behaviour-related traits of stallions in performance tests may not be valid enough to detect real differences between individuals and breeds.

KEY WORDS: stallion / performance tests / behaviour

Nowadays the traditional farm use of horses changes more to that of leisure and companionship. The human-horse relationship and its significance is now being a

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subject of numerous studies [Hausberger *et al.* 2008]. Unquestionably, peculiarity of horse's nature and behaviour is a source of human fascination which in turn is a predominant motivation for riding and maintaining contact with this animal. It has been documented that users and owners enumerate "pleasure" related to owning and riding a horse as the main reason for buying it [Mills and McNicholas 2005; Heydemann and Grosbois 2006ab]. This attitude results in turning on the "horse industry", an important branch of the economy [Łojek 2006; Kamieniak *et al*. 2008]. The significance of the "horse industry" is illustrated by the fact that it contributes more to the gross domestic product in the USA than either the film or tobacco industries [Mills and McNicholas 2005].

The most popular riding horses come from warmblood breeds. These horses serve many purposes – from leisure and therapeutic riding to elite sport competition. Warmblood horses are bred according to the policies of relevant breeding organisations whose objectives involve several selection criteria. Mainly, these selection criteria are conformation and quality of gaits, jumping and dressage predispositions, cooperation with rider during riding (rideability), sport performance and more or less precisely defined mental characteristics, such as "character" or "temperament" [Koenen *et al.* 2004]. In many countries the selection of stallions involves performance tests comprising evaluation of traits accordingly to the selection criteria [Thorén Hellsten *et al*. 2006]. Most of the breeding organisations have uniform sport-oriented breeding policies which they apply to their active populations, although others aim at breeding horses that are suitable for both competition and leisure activity [Koenen *et al*. 2004]. It is important to mention that the majority of riders who contribute to the development of the "horse industry" are leisure riders [Mills and McNicholas 2005; Górecka *et al*. 2008; Hennessy and Quinn 2008; Hennessy *et al*. 2008]. As pointed out by many authors [Koenen *et al.* 2004; Christensen 2007; Górecka *et al.* 2008, Hennessy and Quinn 2008; Hennessy *et al*. 2008, Wolframm and Micklewright 2008ab] equine behavioural characteristics related to the attitude towards humans, ease of handling and safety of use are of high importance to this group. Thus, singling out a breed best suitable for leisure use would be beneficial for safety and satisfaction of amateur riders. Although breed related differences in horse behaviour ("personality") have been found by Lloyd *et al.* [2008] no warmblood breeds were included in that research.

In Poland, the most popular warmblood horses are of Wielkopolska, Małopolska, and Polish Halfbred Horse breeds. Foreign warmblood breeds, mainly German and Dutch, are imported and used in sport and breeding. Breeding programs for the Polish breeds define expectations of behaviour predominantly as: calm and gentle character, equable temperament, high level of trust and responsiveness to the rider, willingness to work, courage and consideration when jumping (Tab. 1).

The breeding programs are run by the Polish Horse Breeders Association (PHBA). Accordingly to the breeding programs, stallions of Małopolska, Wielkopolska and Polish Halfbred Horse breeds (http://www.pzhk.pl/art.php?id=pr_hodow.htm), as well as stallions whose progeny are eligible for entry into the Polish studbooks, are

Table 1. Breeding objectives and selection criteria of Polish warmblood horses, according to breeding programmes of Małopolska, Wielkopolska and Polish Halfbred Horse breeds

Breed	Breeding objective	Selection criteria
Wielkopolska	Refined, all-purpose horse, suitable for riding and driving sports as well as for leisure	- results in the sport - health and stamina - equable temperament, gentle character - rideability enabling all-purpose use - gaits and conformation
Małopolska	Horse suitable for different riding activities, characterized by good longevity, health and fertility	- work suitability - gentle character, lively temperament - appearance, conformation and gaits
Polish Halfbred Horse	Sport horse of high performance	Dressage horses: - excellent conformation and beauty, efficient and impressive gaits - trainability, willingness to cooperate, obedience, trust for the - rider, immediate responsiveness for rider's demands - calm and gentle character, equable temperament Jumping horses: - functional conformation - jumping ability - calm and gentle character, equable temperament, consideration and courage when approaching obstacles, trust for the rider - perfect style and energy of jumping Eventing horses: - functional conformation, exceptional resilience - power, stamina and sport predispositions - all-purpose use suitability - calm and gentle character, equable temperament, exceptional courage and willingness for jumping, obedience, trust for the rider

tested at training stations or are evaluated based on their results in sport. All breeding programs for the Polish warmblood horses include the same testing procedures during the 100-days training at a training station. Final evaluation of the stallions involves the assessment of traits related to the "utility behaviour" of the stallion, i.e. "temperament", "character", "trainability" assessed by the trainer, and "rideability" assessed by independent (test) riders.

Methods of evaluating horse temperament/personality are currently under debate [Visser *et al.* 2003, Lansade 2005, Burger *et al*. 2008]. Considering the importance of horse behaviour to sport and leisure riders we aimed the present study at testing possible breed related differences in behavioural characteristics of stallions evaluated in performance tests. Such a comparison could provide the evidence for behavioural distinctiveness of the studied breeds. Then, the results would be informative for the users of warmblood horses as per the breed behavioural profile. Additionally, the present work is an attempt to establish if the currently used methods of assessment of behaviour-related characteristics of stallions are helpful for selecting horses from the breeds which would better meet the behavioural requirements of leisure or top sport performance.

Material and methods

The horses were 326 three-years old stallions, submitted to the 100-days training at two training stations (194 in one station and 132 in the other) from 2004 to 2007. The breeds tested were the Polish Halfbred Horse (PH), Małopolska (M) and Wielkopolska (W). Stallions of foreign breeds, whose offspring is to be admitted into the Polish warmblood studbooks were gathered in one group (F). The M stallions were tested at a single station (A) whereas the other breeds were tested in both stations (A, B). The distribution of stallions across the breeds, stations, and years is presented in the Table 2. After the training the stallions were subjected to the performance test.

Table 2. Distribution of stallions across breeds, training stations, and years of evaluation

	Training station	2004 (n)	2005 (n)	2006 (n)	2007 (n)	2008 (n)	Total
Polish Halfbred Horse	A	17	18	13	11	0	59
	B	19	20	19	9	14	81
Małopolska Breed	A	29	28	15	20	19	111
Wielkopolska Breed	A	4	8	5	6	0	23
	B	5	7	3	4	0	19
Foreign breeds*	A	6	8	3	3	0	20
	B	12	10	12	12	15	61

*Foreign breed include: KWPN (n=15), Holsteiner (n=14), Oldenburger (n=14), Hanoverian (n=8), Westfalian Warmblood (n=5), Zangersheide (n=5) and other breeds (n=5).

Performance test comprised evaluation of conformation and gaits, free-jumping, work under the rider (gaits and jumps), stamina, character, temperament, trainability, and rideability. The horses must pass successive elements of the test, according to a defined schedule established by PHBA and were rated on a 10-point scale (where 1 is "very bad" and 10 is "excellent") by the PHBA jury and by test riders. The trainer provides assessments based on his/her observations of the horse during 100-days training. The definitions of the "character" and "temperament", according to the Breeding Programs, are as follows: character – "*the set of mental traits, typical to the individual horse, displayed in its conscious activity. The character is expressed in the attitude toward other horses and humans. The individual horse may be gentle or violent, easy or difficult when handled, franc or insincere, friendly or vicious. Lack of ambition and competitiveness is a significant defect in the sport horse*" and temperament – "*the predispositions of the horse displayed in its psycho-nervous reactions to the environmental stimuli. These reactions are characterised by different intensity, latency and rate. Accordingly to individual courses of arousal and inhibition processes, different types of temperament can be distinguished. From the user's point of view it is suggested that the horse has equable (balanced) temperament*" (http://www.pzhk.pl/art.php?id=pr_hodow.htm). "Trainability" is not defined in the breeding programs and the assumption of the authors is that it concerns the progress

in the development of horse's abilities in jumping and dressage, along with learning capacity.

Independent test riders evaluated horse's "rideability", i.e. its willingness to perform the task, sensitivity to the aids, concentration and cooperation with the rider during the test ride.

The results of the assessments of horses on "temperament", "character", "trainability" and "rideability" were submitted to the analysis of variance. The examined factor was "breed" and the data were corrected for the "year and training station" joint factor.

Results and discussion

Behaviour-related traits of stallions, evaluated by trainers were in majority rated higher than the expected mean (5.0, Tab. 3); the minimum score was lower than the expected mean only for "character" of the PH horses. This result indicates that the "character", "temperament" and "trainability" of stallions met the expectations of trainers of how the good material to train and handle should perform. However, in the test riders' assessment of "rideability" the evaluation was more diversified, with the means being closer to 5.0 and the range covering almost the whole scale of rating (from 1.5 to 9.5).

Table 3. Descriptive statistics of behaviour-related traits of stallions

Trait / Breed*	Character	Temperament	Trainability	Rideability
	Mean / *sd* (range)			
PH	7.8 / *0.8* (4.0-9.5)	8.6 / *1.0* (6.0-10.0)	7.2 / *0.8* (6.0-9.5)	6.0 / *1.8* (4.0-9.5)
M	7.8 / *0.7* (5.0-9.0)	7.8 / *0.7* (6.0-9.0)	6.7 / *0.9* (4.0-9.0)	5.8 / *1.9* (2.0-9.5)
W	8.4 / *0.9* (6.0-10.0)	7.6 / *0.7* (5.0-9.0)	6.8 / *0.7* (5.0-9.5)	5.9 / *1.6* (1.5-9.3)
F	9.0 / *0.7* (6.5-10.0)	8.1 / *0.6* (6.5-9.5)	7.7 / *0.7* (6.0-9.5)	6.8 / *1.7* (2.5-9.5)

*PH – Polish Halfbred Horse, M – Małopolska Breed, W – Wielkopolska Breed, F – Foreign breeds.

The results showed significant effect of the breed upon all examined traits (Tab. 4). Horses of F breeds scored highest on all behavioural characteristics. The M horses scored the lowest on "character", differing significantly from other breeds. The PH and W horses did not differ in regards to this trait. There were no differences in "temperament" between the breeds, except for the F horses. The trainers' evaluation of "trainability" was the lowest for the M horses, increasing successively in the W, PH and F horses. The "rideability" of the PH, M and W horses was rated similarly

Table 4. Least-squares means (LSM) and standard errors (*se*) of behaviour-related traits of stallions across breeds

Breed*	Character LSM / *se*	Temperament LSM / *se*	Trainability LSM / *se*	Rideability LSM / *se*
PH	8.6^{AC} / *0.1*	7.8^{A} / *0.1*	7.2^{Aa} / *0.1*	6.1^{A} / *0.1*
M	8.2^{B} / *0.1*	7.7^{A} / *0.1*	6.8^{B} / *0.1*	5.8^{A} / *0.2*
W	8.4^{C} / *0.1*	7.6^{A} / *0.1*	6.8^{ABb} / *0.1*	5.9^{A} / *0.3*
F	8.9^{D} / *0.1*	8.2^{B} / *0.1*	7.7^{C} / *0.1*	6.8^{B} / *0.2*

^{ab}Values within columns with lower case superscripts differ at $P<0.05$.
^{AB}Values within columns with upper case superscripts differ at $P<0.01$.
*PH – Polish Halfbred Horse, M – Małopolska Breed, W – Wielkopolska Breed, F – Foreign breeds.

but it was significantly lower than in the F group. Expectations of raters as per horses' mental characteristics (related to learning and cooperating with the rider and handler were met best by the F horses; the M horses met them at the lowest level.

The lack of breed related differences in reactivity to moving novel objects between the M, W and PH horses was also reported in the study carried out on 341 Polish stallions [Budzyński *et al.* 1992]. The W and PH horses with the F ancestors showed better performance in the final tests, including both behavioural and riding ability assessments, as compared to the stallions without the F horses in their pedigree [Lewczuk 2004]. This confirms, to some extent, the superiority of the F horses in many characteristics evaluated in the performance tests.

"Character", "temperament", "trainability" and "rideability" have been found to be interrelated, as they loaded on the common factor, revealed by factor analysis (FA) including all traits evaluated in the performance tests [Górecka-Bruzda *et al.*, unpublished]. The FA results indicated the existence of a common background for the behavioural traits. Many authors agree that for numerous mental characteristics, the temperament is a "biological background", appearing early in the ontogeny [Bobylev 1960; Slater 1981; Strelau 2002]. In several approaches to temperament, ability to learn is acknowledged to be its component [Momozawa *et al.* 2003] and although consistent across situations [Goldsmith *et al*., 1987] the temperament undergoes changes during individual's life. In the studied case trainers considered "temperament" only as horses' responsiveness to external stimuli and innate excitability, accordingly to the definition given by the breeding programs [Breeding Programs of Małopolska, Wielkopolska, and Polish Halfbred Horse breeds (http://www.pzhk.pl/art.php?id=pr_hodow.htm)].

All behavioural characteristics are not (or not precisely enough) defined, although the supplementary definitions are given in the breeding programs. Unfortunately, clear interpretation of the results is impeded by the lack of accurately defined behavioural characteristics of the horse. Nevertheless, it can be speculated that although the PH, M and W horses did not differ in "temperament", they responded differently to the human contact during work and handling, clearly differing in learning abilities and the

willingness to perform tasks, as assessed by "trainability". As to the F horses their highly rated "temperament" and "trainability" resulted in matching high scores for "character" and "rideability". "Rideability" is perceived as horse's willingness to cooperate and responsiveness to rider's physical communication through seat, legs and hands (*i.e.* aids). In natural conditions, the horse is rarely touched with high frequency and force, thus it must learn to respond properly to rider's stimuli. Therefore, the "rideability" develops during the training process and involves both learning abilities and a component of the natural sensitivity, which is considered a dimension of temperament [Visser *et al.* 2001; Lansade *et al*. 2008]. In the current study, the "rideability" was the lowest rated trait and again, no significant differences appeared between the PH, M and W horses, similarly to the assessment of their "temperament". The lack of the differences between the PH, M and W horses indicates that, like "temperament", sensitivity to rider's aids is similar for these breeds. It might also be the case that breed-related differences in "trainability" are not sufficient to alter the level of "rideability" and that individual sensitivity prevails in the development of "rideability".

The assessment of a horse for such a complex aspect as its suitability for the specific type of usage is very difficult and subjective. The definitions and scales used for rating horses may not reflect real differences in behaviour (do not meet validity criteria). This could be supported by the study of Budzyński *et al*. [1992] where the correlation between the results of startling test and the assessment of reactivity by stable personnel did not exceed 0.26. The subjectivity of judgment in performance tests has also been reported by Lewczuk [2008], as judges' evaluation of free jumping and biomechanical parameters of jumps assessed objectively by the video image analysis were only weakly correlated (r=-0.13 to r=0.27). High inter-rater reliabilities (up to 0.86) of ratings of horse personality based on owner and trainer supplied traits, were assessed by McGrogan *et al.* [2008], but on the other hand Anderson *et al.* [1999] showed that agreement between instructors evaluating the behaviour of therapeutic horses was relatively low (not more than 17% of horses' ratings by three instructors were correlated). The latter result could be explanative for high variability of test riders assessments stated in the current study. The cited results suggest that the assessment of different aspects of horse's "utility" traits is more related to raters' personal perceptions than to objective evaluations. Such a subjectivity is illustrated by a high range of heritability estimates (e.g. from h^2=0.06 to h^2=0.52 for "character") of behaviour-related traits evaluated in performance tests, assessed in other studies [Thorén Hellsten *et al.* 2006].

Horse's predisposition for a particular discipline or type of riding is only partially responsible for successful horse-rider cooperation in sport or leisure. It is difficult to assess what in the opinion of trainers and test riders an "excellent" or "bad" "temperament" or "character" actually means, since sport and leisure usage would require different behavioural qualities of the all-purpose horse that the breeding programs aim at producing. The best valued F horses derived from the breeds of top sport performers and it might have happened that the trainers and the test riders (in most cases

active competitors) promoted the behaviour of horses with high sport predispositions. This result is in agreement with general tendency observed in other warmblood horses [Koenen *et al.* 2004; Christensen 2007]. It may be concluded that F horses are best fit to fulfil the breeding objectives in terms of their behavioural characteristics. As to the M, W and PH horses, no distinctiveness of breeds in "temperament" and "rideability" could be confirmed. The differences in "character" and "trainability" of these breeds may result in higher or lower level of horses' response to the shaping the behaviour during training and daily contact with humans. Nonetheless, it should be noted that the breeding objective seems to favour behavioural characteristics enabling horses to perform well in sport rather than in leisure. It should be also emphasized that the methods of evaluation of behaviour-related traits in performance test may not be valid enough to detect real individual and breed differences in behaviour. In order to enhance their own profitability and reduce the number of unsuitable horses, the breeders are advised to introduce more accurate methods of behaviour assessment. Such promising methods are being gradually introduced in French and Swiss horse breeding [Burger *et al*. 2008, Lansade *et al*. 2008, Burger *et al.* 2008, Lansade *et al*. 2008].

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Zróżnicowanie rasowe cech związanych z zachowaniem ogierów ocenianych podczas prób dzielności

S t r e s z c z e n i e

Podjęte badanie miało na celu zbadanie różnic w cechach związanych z zachowaniem, ocenianych podczas prób dzielności ogierów zgodnie z programami hodowlanymi koni ras półkrwi. Przeanalizowano oceny „charakteru", „temperamentu", „przydatności do treningu" i „jezdności" 326-ściu trzyletnich ogierów półkrwi, poddanych treningowi 100-dniowemu w dwóch zakładach treningowych, w latach 2004-2007. Ocenianymi rasami były: polski koń szlachetnej półkrwi (PH), małopolska (M), wielkopolska (W) oraz ogiery ras zagranicznych (F). Najwyższe oceny we wszystkich badanych cechach uzyskały konie należące do grupy F. Konie M miały najniższe noty za „charakter", różniąc się istotnie od wszystkich badanych ras. Poza istotną przewagą koni F, nie stwierdzono różnic w „temperamencie" pomiędzy końmi pozostałych ras. Najniższa „przydatność do treningu" cechowała konie M, a w rosnącej kolejności uplasowały się ogiery W, PH i F. „Jezdność" koni w obrębie M, W i PH nie była zróżnicowana, natomiast była istotnie niższa niż u koni F. Wyniki badań wskazują, że oczekiwania oceniających co do zachowania najlepiej spełniają konie F, a konie M najsłabiej, co pozwala na wyciągnięcie wniosku, że pod względem cech zachowania konie F rokują najlepiej co do realizacji celów hodowlanych, jakim jest raczej koń wierzchowy o wyższej przydatności do sportu niż do rekreacji. Należy jednak podkreślić, że metody oceny zachowania, stosowane podczas prób dzielności, mogą nie spełniać wymogu trafności oceny faktycznych różnic międzyosobniczych i rasowych.