

## **Selected performance parameters of Polish half-blooded mares**

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The study covered 89 Polish warm-blooded half-bred mares (51 representing Polish Noble Half-Breds, 23 Wielkopolski and 15 Małopolski horses) which went through a 60-day training (terminated with a performance test) at the Biały Bór training centre. Assessed was motion and jump parameters of individual mares (recorded with a digital video camera) and the heart rate (HR) index – based on ongoing telemetric registration – at rest and during performance test. Heart rate indices were also used to formulate a custom “effort reaction index” (WRW) employed further on in the study. A fairly pronounced inter-breed variation was identified in the mares, mainly in the case of the WRW index. This indicates the usefulness of the proposed index for the breeding selection of performance traits of horses. The index finely differentiated variation between the horses, unidentifiable in the analysis of the heart rate values alone.

**KEY WORDS:** sport horses / training / warmblood mares

At present, a vast majority of organisational breeding initiatives in horses are clearly focused on making a most effective use of sires (predominantly stallions that stand out within particular breeds and types). This stems, among others, from the widely held opinion about a comprehensively decisive role of stallions in shaping the phenotypic qualities of future horse generations. The above breeding practice is, however, not sufficiently well-justified by genetic and populational studies [Winter *et al.* 2004]. The practice is presumably based on the definitely higher stallion capacity

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(as compared to mares) to produce numerous offspring within the entire useful reproductive and breeding period. The above breeding practice also seems to stem from specific organisation and financial problems of particular breeding associations. It is not, however, validated by long-standing horse breeding traditions. Since antiquity, the traditions quite clearly promoted the view of higher mare (rather than stallion) influence on the quality of the progeny (within particular “horse families”). What is more, this view held by mediaeval horse breeders in the Arabian Peninsula even led to a substantial depreciation of stallions, considered *malum necessarium* in horse reproduction [Pruski *et al.* 2006].

This belief is also confirmed by contemporary genetic studies [Harrison and Turrion-Gomez 2006] of mitochondrial heritability. They clearly show that the zygote contains several thousand mitochondria originating from the egg cell and only a few ones that stem from the spermatozoon. The DNA contained in the predominantly maternal mitochondria forms the genetic basis for the development of a number of psychophysical traits of the progeny, including performance characteristics. This unambiguously emphasises the influence of the maternal organism on the quality of the offspring. Moreover, it has been determined [Winter *et al.* 2004] that possible “errors” in mitochondrial DNA structure cause serious neurological conditions to appear in horses: e.g. blindness and deafness.

The reproductive importance of mares is currently largely appreciated by horse breeding associations existing in countries that play the leading role in the production of horses capable of high sport performance. This is reflected in e.g. the organisation of intramural and field tests in Germany [www.hanowerian.com 2012; www.oldenburghorse 2012] and Netherlands [www.kwpn.org 2012], among other countries. The above-mentioned *status quo* chiefly stems from transformations in horse breeding and farming occasioned by the discontinuance of the mass production of horses for utilitarian purposes (farm, military, “ceremonial” and other types of horses) for the sake of specialised breeding and production of saddle horses, based on rational and modern implementation of the particular stages in breeding aimed at the improvement of specific breeds and types. For the purposes of such breeding, an appropriately high performance value of the mares and of their offspring (chiefly with regard to jumping ability) – as well as the qualification of their dams or their complete offspring for a sports horse programme (e.g. the one for the Hanoverian breed) or being listed for the World Breeding Championship of Sport Horses) – are the grounds for the “advancement” of young mares, connected with their entry in stud books of a higher breeding rank. Moreover, e.g. the Trakehner Breeders Association (info@trakehnerverband.de) makes use of a three-tier qualification system for the assessment of the usefulness of their mares (LStb: A – based on the individual performance capacity of a specific mare, evidenced at a training centre; B – on the basis of the mare’s own sporting achievements; C – based on the sporting achievements of her offspring). The Oldenburger Breeders’ Association, in turn, additionally distinguishes particularly valuable dams from the main stud book with the following titles: “Association Prize”,

“State Prize” or “Elite Prize” (the highest title). The mare classification system employed in the Dutch breeding practice for warm-blooded horses (KWPN) is very interesting. Young mares with adequate physique and appropriate motoric capacity are ranked as “ster”, whereas those whose offspring have scored outstanding achievements are ranked as “p.rest”.

The above-mentioned performance testing systems for young mares are generally optional, though some breeder organisations (e.g. Polish Horse Breeders Association ([www.pzhk.pl](http://www.pzhk.pl)) intend to lend them an obligatory character in the near future.

Considering the above, the present work was aimed at providing information about the levels of selected performance parameters of young half-bred mares through the application of the following procedures:

- assessment of selected motoric capacity, jumping ability and heart rate parameters of the mares,
- identification of possible differences between the breeds of the analysed mares in reference to the assessed motoric and physiological parameters,
- identification of particular motoric and physiological parameters that may increase the objectivity of the performance testing system currently in use for young half-bred mares.

### **Material and methods**

Eighty nine local warm-blooded half-bred mares were analysed (including 51 Polish Noble Half-Breds (pksp) – hereinafter referred to as Noble Half-Breds, 23 Wielkopolski (wlkp) and 15 Małopolski (m) mares). They were subjected to a 60-day training regimen and underwent performance tests at the training centre in Biały Bór, according to a uniform regimen included in the breeding programmes for the particular breeds ([www.pzhk.pl](http://www.pzhk.pl) 2012). The analyses were carried out on the day of the official performance tests. The procedure included filming the gallop (at approx. 20 metres in front of the obstacle) and 5 free jumps (*i.e.* without the rider) of each mare throughout the regular set of obstacles. The crucial last element in the discussed set was the oxer – 100 cm high and 100 cm broad – the height of which was increased by 5 cm after each successful jump. Recorded jumps served for further analyses.

The gallop and free jumps of the mares were filmed with a Sony digital *video* camera (DCE-TR 8 000 E) fixed on a stand. The digital analysis of the images (introduced into the database through a *fire-wire* peripheral) depicting the gallop and jumps of each mare was performed using *Studio 9* software (to distinguish particular motion phases). The following motoric capacity and jumping ability parameters were measured using MultiScanBase (MSB) software:

- a) rate of movement (in m/min) over the entire trial length and when performing successive jumps;
- b) length (cm) of the galloping step (jump or foulée) along a distance of 20 m before the obstacle set;

- c) length (cm) of the last foulée before the obstacle set (including the last, i.e. principal, obstacle (oxer) – the one at which appropriate measurements were taken);
- d) length (cm) of the rear-leg spring before the jump itself (as the distance from the edge of the front wall of the rear-leg hoof set the closest to the oxe to the middle of the obstacle);
- e) length (in cm) of the proper jump (i.e. flight over the obstacle, defined as the distance between the spring and landing points) – i.e. from the edge of the front wall of the rear leg hoof set the closest to the obstacle following the spring before the obstacle to the tip of the front leg hoof also set the closest to the obstacle after the jump;
- f.) landing distance (in cm), (the distance from the middle of the oxe to the tip of the front leg hoof set the closest to the obstacle after negotiating it).

The above tools were also used to determine the so-called croup positioning angle by measuring (in degrees, in the front-leg take-off phase, with the rear legs maximally “pulled up” under the trunk) the angle between the ground and the tangent to the rear edge of the rear cannon of the leg that was the closest to the centre of the oxe and lent the decisive momentum to the body in the take-off phase.

The analysis also covered the heart function parameters of the mares. They were measured using the *Polar S 810* telemeter – by means of continuous electronic registration (with the values subsequently transferred to a computer database). The results were analysed with adjusted Polar ProTrainer 5 software and included:

- a) resting heart rate (HR) recorded about 15 min. prior to the official performance tests;
- b) jumping heart rate (HR) recorded during the entire performance test, differentiating separate phases during the 5 successive jumps (defined as the “jumping pulse”) and during 5 seconds after the completion of each jump (the “post-jump heart rate”).

The above physiological parameters were also used to calculate the assumed effort reaction index (WRW) – proposed by Kaproń [1999] and applied to assess e.g. the training progress [Kaproń *et al.* 2003 and 2004] with the following formula:

$$WRW = \frac{X_w}{X_{sp}} \times X_w$$

where:

$WRW$  – effort reaction index,  $X_w$  – mean jumping heart rate;

$X_{sp}$  – mean resting heart rate.

The results were analysed using ANOVA – according to the smallest squares, allowing for the breed factor and the successive jump factor – using an appropriate SAS procedure.

## Results and discussion

The data in Table 1 show that the galloping rate of the mares prior to the jump was not considerably diverse (only *ca* 3-6 m/min) or statistically significant as related to the breed. However, a certain measure of statistically significant differences between the mean speed values of the horses were observed during the negotiation of the obligatory obstacle set.

**Table 1.** Least squares means (LSM) and standard errors (SE) for motion parameters in the mares

Factor		Mean motion parameters							
		average length of galloping step (cm)		average length of last galloping step before take-off (cm)		croup positioning angle (°)		motion rate (m/min)	
		LSM	SE	LSM	SE	LSM	SE	LSM	SE
Breed	pksp (n=51)	383 <sup>A</sup>	2.05	293 <sup>A</sup>	2.34	43	0.56	355	2.57
	wlkp (n=23)	388 <sup>B</sup>	3.05	295 <sup>B</sup>	3.64	45	0.86	361	3.83
	m (n=15)	378 <sup>C</sup>	3.78	287 <sup>C</sup>	4.32	44	1.02	358	4.74
Successive jump	1 (n=89)	385 <sup>D</sup>	3.66	290 <sup>D</sup>	4.40	45	1.07	367 <sup>IJ</sup>	4.93
	2 (n=89)	380 <sup>E</sup>	2.98	292 <sup>E</sup>	4.36	44	1.02	364 <sup>KL</sup>	4.93
	3 (n=89)	383 <sup>F</sup>	3.13	291 <sup>F</sup>	4.39	43	1.02	366 <sup>MN</sup>	4.93
	4 (n=89)	383 <sup>G</sup>	3.42	291 <sup>G</sup>	4.44	44	1.04	347 <sup>IKM</sup>	4.93
	5 (n=89)	383 <sup>H</sup>	3.51	295 <sup>H</sup>	5.16	44	1.23	346 <sup>JLN</sup>	4.93

pksp – Polish Noble Half-Breds mares; wlkp – Wielkopolski mares; m – Małopolski mares.

<sup>AB</sup> Mean marked with the same superscripts differ significantly at  $P \leq 0.01$ :

- length of galloping step/length of last galloping step before take-off – rowwise;
- motion rate – columnwise.

As regards the comprehensive juxtaposition of the jumps, in turn, (*i.e.* without considering the breed factor) the average differences in motion rate of the mares at the first three jumps only slightly oscillated within *ca* 1-2 m/min, these differences being (obviously) insignificant. In continuation, however, the rate was found to be fairly variable as an evident deceleration was identified at jump 4 and 5 (by *ca* 20 m/min). This decrease proved highly significant as compared to jumps: 1, 2 and 3 with 4 and 5, whereas the motion rate between the latter jumps (*i.e.* 4 and 5) almost did not differ at all, either.

The analysis of the mean length of the galloping steps at 20 metres before the obstacle revealed that the steps were almost by 100 cm longer than the last steps right before negotiating the obstacles (Tab. 1). This correlation proved highly significant – both within the particular mare breeds and for the successive jumps of the mares. This type of difference was not, however, identified in the case of the croup positioning angle which (on the mean) differed by only *ca* 1-2 degrees, both in reference to the breed and the successive jumps.

As regards the mean jump parameters (Tab. 2), no significant differences were identified between the breed-specific means in the case of the spring length prior to the jump itself, although the Noble Half-Breds (pksp) and Wielkopolski (wlkp) mares exhibited a fairly clear-cut advantage (of *ca* 10 cm) over the Małopolski (m) mares.

**Table 2.** Least squares means (LSM) and standard errors (SE) for flight parameters in mares

Factor		Mean jump parameters					
		spring length (cm)		flight length (cm)		motion rate (m/min)	
		LSM	SE	LSM	SE	LSM	SE
Breed	pksp (n=51)	180 <sup>E</sup>	0.72	423 <sup>A</sup>	0.83	243 <sup>CE</sup>	0.93
	wlqp (n=23)	179 <sup>F</sup>	1.03	424 <sup>B</sup>	1.04	246 <sup>DF</sup>	1.04
	m (n=15)	171 <sup>G</sup>	1.03	403 <sup>AB</sup>	1.45	221 <sup>CDG</sup>	1.65
Successive jump	1 (n=89)	184 <sup>H</sup>	1.23	393 <sup>MO</sup>	1.34	209 <sup>HI</sup>	1.16
	2 (n=89)	171 <sup>I</sup>	1.23	410 <sup>N</sup>	1.34	239 <sup>I</sup>	1.16
	3 (n=89)	171 <sup>J</sup>	1.23	421 <sup>M</sup>	1.34	250 <sup>J</sup>	1.16
	4 (n=89)	175 <sup>K</sup>	1.23	424 <sup>N</sup>	1.34	249 <sup>K</sup>	1.16
	5 (n=89)	181 <sup>L</sup>	1.23	436 <sup>O</sup>	1.34	254 <sup>L</sup>	1.16

pksp – Polish Noble Half-Breds mares; wlqp – Wielkopolski mares; m – Małopolski mares.

<sup>AB</sup> Means marked with the same superscripts differ significantly columnwise at  $P \leq 0.01$ .

Differences between the mare breeds turned out to be highly significant for the mean length of the flight over the obstacle and in the case of the landing distance, since the advantage of the Noble Half-Breds and Wielkopolski mares over the Małopolski mares rose to *ca* 20 cm.

Moreover, highly significant differences were identified in the case of all the mare breeds between the spring length means (prior to the jump) and the landing distance (after the jump). The spring length proved even *ca* 60-70cm (Noble-Half-Breds and Wielkopolski mares) shorter than the landing distance in all cases. This type of difference was, however, slightly less pronounced in the case of the Małopolski mares (*ca* 50 cm).

Variation analysis of the parameters in the successive jumps of the mares revealed the mean spring length to be the largest in jump 1 (*ca* 184 cm) and almost as large in jump 5 (*ca* 181 cm). An identical value of the spring length was, in turn, recorded for the jump 2 and 3 (*ca* 171cm), with a slight increase in jump 4 (up to *ca* 175 cm). This revealed evident highly significant differences in some comparisons. A similar pattern was observed in the case of the landing distance means, with the lowest value identified in jump 1 (*ca* 209 cm) and the highest in jump 5 (*ca* 254 cm). Specifically, means for last three jumps did not significantly differ between one another but were significantly higher than the means for jump 1 and 2.

In the case of the flight length, a highly significant advantage of the Noble Half-Bred mares was observed over the Wielkopolski and Małopolski mares. Additionally, an almost linear increase was identified between the mean values (from 393 cm in jump 1 to 436 cm in jump 5, with the smallest and insignificant flight length increase – *ca* 3 cm – between jump 3 and 4), which caused highly significant differences to appear.

As regards the breed-specific heart rate parameters (Tab. 3), an almost negligible range of variation was found in the case of the resting heart rate. The same was also observed in the case of the jumping heart rate registered during the jump and immediately after the jump. Nevertheless, highly significant differences were identified among the particular mare breeds (which seems quite obvious) between the jumping and the post-jumping heart rate means.

When analysing the heart rate during the successive jumps (Tab. 3) without allowing for the breed factor, in turn, an almost linear increase in the mean jumping heart rate values (from *ca* 172 in jump 1 to *ca* 178 in jump 5) was observed. However, this did not prove significant. A similar trend was observed in the case of the post-jump heart rate which rose from *ca* 163 (in jump 1) to *ca* 169 (in jump 5), however, not significant, either.

Definitely more pronounced differences were observed between the WRW means calculated for the phase of the flight over the obstacle (jumping WRW), since the Małopolski mares exhibited a significantly lower (by *ca* 15-20 units, *i.e.* more advantageous) and highly significant mean value of the effort reaction index in comparison to the Noble Half-Breds and Wielkopolski mares. Similar results were not, however, obtained in the case of the post-jump WRW, since the highest mean was achieved by the Wielkopolski mares (*ca* 806) which highly significantly dominated over the Małopolski mares (by *ca* 25) and the Noble Half-Breds (by *ca* 10 units).

As regards the WRW index calculated for the successive jumps of the mares (in a collective juxtaposition – without allowing for the breed aspect), an almost linear increase in the mean values was observed in the case of the jump phase (WRW ranging from 839 units in jump 1 to 903 in jump 5), which proved highly significant (apart from jump 3 and 4). In the case of the post-jump WRW, in turn, the mean value

Table 3. Least squares means (LSM) and standard errors (SE) for heart function in mares

Factor	Mean heart function parameters														
	resting heart rate			jumping heart rate			post-jump heart rate			jumping WRW <sup>1</sup>			post-jump WRW		
	LSM	SE		LSM	SE		LSM	SE		LSM	SE		LSM	SE	
Breed															
pksp (n=51)	35	0.24	175 <sup>A</sup>	0.74	166 <sup>A</sup>	0.68	875 <sup>I</sup>	7.99	789	789	10.01				
wilkp (n=23)	36	0.36	176 <sup>B</sup>	1.10	168 <sup>B</sup>	1.01	879 <sup>J</sup>	11.90	806	806	10.44				
m (n=15)	36	0.45	175 <sup>C</sup>	1.36	166 <sup>C</sup>	1.26	862 <sup>J</sup>	14.73	779	779	12.93				
Successive jump															
1 (n=89)	-	-	172 <sup>D</sup>	1.42	163 <sup>D</sup>	1.31	839 <sup>MNKL</sup>	15.32	755 <sup>RSTU</sup>	755	13.44				
2 (n=89)	-	-	174 <sup>E</sup>	1.42	166 <sup>E</sup>	1.31	859 <sup>KO</sup>	15.32	785 <sup>RW</sup>	785	13.44				
3 (n=89)	-	-	175 <sup>F</sup>	1.42	167 <sup>F</sup>	1.31	873 <sup>LOP</sup>	15.32	794 <sup>S</sup>	794	13.44				
4 (n=89)	-	-	177 <sup>G</sup>	1.42	169 <sup>G</sup>	1.31	885 <sup>M</sup>	15.32	808 <sup>T</sup>	808	13.44				
5 (n=89)	-	-	178 <sup>H</sup>	1.42	169 <sup>H</sup>	1.31	903 <sup>NP</sup>	15.32	815 <sup>UW</sup>	815	13.44				

pksp – Polish Noble Half-Breds mares; wilkp – Wielkopolski mares; m – Małopolski mares; WRW – effort reaction index.  
<sup>A,B</sup> Means marked with the same superscripts differ significantly at P≤0.01;  
<sup>I</sup> – jumping heart rate/post jump heart rate – rowwise;  
<sup>J</sup> – jumping WRW/post-jump WRW – columnwise.

variation of the index ranged from 755 (after jump 1) to 815 (after jump 5). However, no significant differences were identified between jump 2 and 3 and between jump 4 and 5.

As with the heart rate (HR), a complete set of statistical differences between means was also obtained for the WRW index in two perspectives: 1 – within each mare breed, with the WRW levels always significantly higher during than after the jumps, 2 – within the five successive jumps, with the mean WRW levels recorded during the jumps always significantly higher than the WRW recorded after the jumps.

It must be pointed out at the outset that it was extremely difficult to compare (both directly and indirectly) the present results with the results of other authors due to the scarcity of original constructive scientific research papers in domestic and foreign hippological literature on the control and assessment of the performance of young half-bred mares (pre-qualified for breeding) published in renown scientific journals. Nevertheless, the importance of the discussed subject is increasingly more often stressed in hippological press, with a varying quality of the published observations. The *status quo* mentioned concerns, however, only young, warm-blooded half-bred mares – unemployed in high-performance equestrian sports and races in which the performance capacity of mares is evidently confronted with that of stallions and geldings.

In a general view of the problem of the control and assessment of contemporary half-bred horses, it has to be stated that there is interest in the issue on behalf of a considerable portion of the hippological community. However, most studies concentrate on the improvement of training and performance test systems for young half-bred stallions, potentially envisaged for the role of reproductive sires [Gelinder *et al.* 2001, Santamaria *et al.* 2004, Lewczuk 2008, Janczarek 2011].

At the opening of the discussion of the present results, two main aspects must be emphasised. The first one concerns the identified differences between the breeds of the analysed mares – relating to the performance parameters – which show that Małopolski mares are quite clearly (and sometimes highly significantly) inferior to Noble Half-Breds and Wielkopolski mares with regard to motoric capacity and jumping ability, but display higher physiological resistance to the conditions of standardised training. This would suggest a better predisposition of Małopolski horses for endurance disciplines (e.g. the three-day event – not analysed by the present authors but practically confirmed in sports applications). On the other hand, Noble Half-Breds and Wielkopolski horses are better predisposed for jumping competitions, which has also been repeatedly confirmed in practice in domestic high-performance events.

Another aspect revealed in this study is the specific usefulness of the proposed effort reaction index (WRW) for the assessment of the training progress of horses (especially significant for obtaining their optimum physical capacity – Malarecki 1981). The wide-spread use of the index in previous (not only those quoted – Kaproń *et al.* 2003, 2004) studies of breeding, race and sport horses showed on many occasions that possibly lowest values of the index are the most desirable in a physiological sense.



The use of the WRW index in the present study made it possible to reveal the statistical significance of the differences between the means of the analysed heart function parameters to an extent that would be impossible to identify by means of the – commonly applied – heart rate (HR) index compared with which the WRW index proved far more precise. For this reason, the discussed index also helped to reveal a considerably broader scope of individual variation between the horses, which is the preliminary requirement and basis for rationally conducted breeding work for the improvement of the animals.

In an attempt at an “indirect” comparison of the results obtained in the present study with the results of other studies, it must be stated that the heart function indices of the mares are similar to those identified for young half-bred stallions by Kaproń *et al.* [2004]. Moreover, the findings of Ruhlman *et al.* [2009] and Janczarek [2011] clearly show that the sex of the horses does not exert a determinant effect on their performance capacity, as earlier shown e.g. in racing Thoroughbreds [Janczarek 2003].

The breed factor exerted a fairly limited effect on the significant variation of the means of the analysed motoric and physiological parameters. Such effect was identified only in the case of the smaller over-the-obstacle flight length and a lower WRW level in the Małopolski mares, highly significantly inferior to both the Noble Half-Breds and the Wielkopolski mares (the latter not significantly differing between each other). Considering the fact that it is rather desirable that young horses have possibly highly distanced spring and landing points during their jumps over the obstacles [Powers 2005, Janczarek 2011] – though other authors have shown a fairly “unsteady” attitude to the discussed issue [Preuschoft *et al.* 1986, Lewczuk 2008] – the current *status quo* should, however, be considered as quite disadvantageous for Małopolski mares, presumably also limiting the possibilities for improvement in the jumping predisposition of the breed.

Lower (*i.e.* physiologically advantageous and indicating higher endurance of the mares) WRW values, in turn, can suggest better “innate” predisposition of Małopolski horses for the so-called endurance (but not technique-oriented – e.g. show jumping) equestrian disciplines (e.g. the three-day event or long-distance runs and races). Nevertheless, these assumptions need to be confirmed in separate studies. The above-mentioned endurance factor also plays an exceptionally significant role – in obtaining an adequate level of training progress – in preparation for participation in high-performance endurance- and speed-oriented sport events [Malarecki 1981].

The variation in the mean values of the analysed parameters described above seems to reveal a growing effort of the analysed half-bred mares during the successive free jumps over the obstacles – as evidenced by the predominantly statistically highly significant increases of the WRW level, with a lack of similar statistical significance in the case of the also rising mean heart rate (HR). The deceleration of the motion rate by the mares during the discussed test, in turn, seems to testify to a “quietening of emotions” and indicates “discrimination” as to the degree of the expected difficulties,

which is notoriously often absent in horses at early stages of training [Janczarek and Kędzierski 2011]. It must be added that the analysed mares were characterised by clearly similar level of heart function indices to those identified earlier for young stallions of the same domestic half-blooded horse breeds during their free jumps over the obstacles [Kaproń *et al.* 2004].

Considering potential applications of the proposed physiological parameter for the evaluation of the heart function (abbreviated as WRW), it must be stated that it evidently helps to identify a much greater variation in horses (as compared to the variation detected with HR analyses only). Variation detection is the basic tool in rational breeding aimed at improving particular saddle horse populations (considering their highly advanced phenotype and origin standardisation) and has long been postulated by numerous hippologists [e.g. Rietman *et al.* 2004].

Summing up, it must be concluded that the role of performance tests of “ordinary” young reproductive half-bred mares – i.e. those that are not tested in races or in sports use but only within the scope of the so-called early jumping ability determination [Koenen and Aldrige 2002], with a significantly lower effort than required for high-performance tests [Art *et al.* 1990] – should gradually grow, chiefly in the light of constant attempts at breeding and producing sports horses of the highest possible performance. Chances for success in this type of horse breeding grow along with a prominent rise in the general performance level of particular breeds, which is rather impossible to obtain without adequate information on the level of performance predispositions inherited from their dams. In this respect, emphasis should be laid on compulsory performance tests for young half-bred mares and a gradual raising of the level of their performance requirements to approximate those that apply for local young half-bred stallions.

The data of the present study are (largely) preliminary, not to say “pilot” results. Nevertheless, they enable the formulation of the following conclusions.

The analysis of the motoric and jumping parameters of the analysed mares revealed that their breed significantly affected only the length of the proper jump – *i.e.* the flight over the main obstacle of the obligatory set – and the landing distance after the jump, in which respect the Małopolski mares were clearly inferior to the Noble Half-Breds and the Wielkopolski mares.

The analysis of the heart function parameters of the particular mare breeds did not reveal any significant differences in mean heart rate (HR) index. Such differences were, in turn, observed when using the proposed “training progress index” (WRW) which significantly affected variation between the analysed mare breeds (with Małopolski mares exhibiting better values than the other breeds). This provides a basis for a rationalisation of the rules of breeding management.

The successive jumps of the mares over the obligatory set of obstacles revealed a – variable in its degree and quite often statistically significant – increase of the mean levels of the length of the proper jump and landing distance, with a diminishing motion rate during the negotiation of the obstacles. In the case of the mean heart

function parameters (always rising in the successive jumps), the highest statistical significance of the differences was identified for the WRW index during the proper jump and the landing, with a complete lack of significance in the case of HR.

The trends observed in the mean WRW values during the free jumps over the obstacles (which significantly highlighted individual variation of the results) show that the index is potentially useful in physiological studies of the training progress of various horse breeds and types.

In order to prepare an appropriate basis for optimum and rational breeding of saddle horses in Poland it is necessary to considerably extend the qualitative and quantitative scope of performance tests for local half-bred mares by increasing the number of mares covered by the tests and raising the level of requirements.

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