

## **An attempt at objectivization the halfbred stallion' performance test in Poland. II. 100-day test**

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**The aim of this study was to investigate the usefulness of results and possibility of objectivization of stallion's 100-day performance tests. No correlation between performance test results and number of covered mares was found. An objectivization attempt was made on the basis of physiological blood analyses after the stamina trial (5 min gallop) and on the basis of some measurements of free jumping parametres by means of video image analysis (VIA). Additionally, an analysis of relations between different performance test trials was made. The correlations between evaluation of jumping traits in the performance test were at medium level and were from 0.47 to 0.73. The correlations between results of jumping skills from the test and measurements from VIA were weak and ranged from -0.1 to 0.3.**

**Results of blood analyses reached values within a normal range. Only heart rate values seemed to be too high relative to the effort of this test. This provides some possibility to improve the objectivity of the performance test for young stallions.**

**KEY WORDS:** horse / performance testing / stallions

The aim of this study was to define the usefulness of results of the 100-day test and to determine the possibility of its objectivization. Another aim of the study was to compare these results with the corresponding results for the 8-month test presented earlier by Lewczuk *et al.* [2004].

## **Material and methods**

### **Total results of performance test and number of covered mares**

The usefulness of performance test results was proved by the correlations between the number of mares covered by stallions and performance test results of the stallions from a 100-day performance test (100-dPT). The results of 99 stallions tested in the years 1997-1998 which covered the mares in the National Studs in the years 1998-2000 were taken into account. The phenotypic correlations found by the Manova procedure in the SAS programme were adjusted by a model which included the effects of the number of standing seasons, number of stallions at the same station, number of stations at which the stallion stood over one reproductive season.

### **Performance test results and free jumping parametres**

Measurements of jumping parametres of 21 young stallions filmed during their performance test in 2001 were made. Results of performance tests of these stallions were collected.

Jumping skill in 100-dPT consists of traits evaluated during:

- the trail evaluated by jugdes (“free jumping”, “jumping under the rider”);
- all the training period by trainers (“free jumping”, “jumping under the rider”).

Horses filmed during their free jumping performed three to five jumps over four heights of a double bar obstacle standing as a main part of a combination for the young stallions performance test. The obstacle was of four different heights – 90, 100, 110 and 120 cm, and 70 cm wide. The digital camera operated 25 frames per second. The data were analysed by a non-automatic programme for video image analysis [Lewczuk 1999]. For every 156 jumps the following parametres were measured:

- take off distance;
- lifting the legs over the obstacle (for front and hind legs);
- height of some specific points that characterize the silhouette (bascule) of the horse over the obstacle (the highest position of the head, withers and croup above the obstacle);
- position of the head during the highest point of the air-borne phase of the jump;
- landing distance.

Two different correlations were calculated. Correlations between marks for jumping traits were Pearson’s correlations calculated by using the Corr procedure from SAS Programme. Correlations between measurements of jumping parametres and marks for jumping traits were obtained with an adjustment for the influence of the height of the obstacle and the successive number of the jump. The data were analysed by means of the Manova procedure from the SAS Programme.

### **Results of performance test and heart rate and blood indicators**

During a 100-day performance test horses are subjected to a stamina trial which consists of a gallop with the rider for 5 minutes at a speed of 350 m/min and at the end

of this gallop - 30 seconds at a speed of 400 m/min. The heart rate Polar monitor was used to measure working capacity of the circulatory system. Blood samples were taken in the third minute after effort from the jugular vein.

The levels of hematocrite, ESR, lactic acid, total protein, K and Na were investigated. A centrifugal microhematocrite machine was used to analyse hematocrite (Ht), Westergren's standers were used for ESR analysis. Total protein was designated in the blood serum by the Alpha Diagnostic tests. The levels of Na, K and chlorides were determined in blood serum by the Medica's ionic analyzers. Lactic acid was measured in the total blood by the Accusport tests (Boehring). For all physiological and biochemical results an analysis of variance (SAS, GLM) was made with the fixed effects of breed, breeder and rider.

## **Results and discussion**

### **Total results of performance test and number of mares covered**

The correlations between the stallions' performance tests and the number of mares covered were not significant and reached 0.12. This result is comparable with the corresponding correlation for the 8-month test [Lewczuk *et al.* 2004] and for ealier studies [Pikuła 1986, Geringer and Dobrowolski 1997].

### **Results of jumping traits of 100-dPT and measured free jumping parametres**

The results of the jumping marks in the performance test are shown in Table 1. The marks given by judges in the 100-dPT fell in a narrower range of scale and had higher coefficients of variation than the corresponding results of the 8-mPT [Lewczuk *et al.* 2004]. The variabilities of this test seemed to be comparable with results obtained in other countries [Bruns 2001, Koenen and Aldridge 2001].

**Table 1.** Means and their standard deviations (SD) for scores of evaluation of stallion's jumping traits in the 100-day test (in points)

Trait	Mean	SD	Min/max	Scoring scale
Jumping under the rider (judges' mark)	6.7	0.5	5.7-7.3	0-10
Free jumping (judges's mark)	7.2	0.5	6.1-8.1	0-10
Jumping under the rider (trainer's mark)	3.4	0.4	2.7-4.2	0-10
Free jumping (trainer's mark)	7.5	0.5	6.0-8.2	0-10

Jumping parametres ascertained for the 100-dPT differed from the results received for the 8-mPT. Mean values are shown in Table 2. The landing distance in the 100-dPT was much shorter than that measured in the 8-mPT. The reasons for this difference may be explained by other training advantages.

**Table 2.** Means and their standard deviations (SD) for parameters of free jumping of stallions in the 100-day performance test referring to fence height

Fence height		Length of jump		Bascule (points)			Height of legs over the obstacle			
		taking off (cm)	landing (cm)	head (cm)	withers (cm)	croup (cm)	front left (cm)	front right (cm)	hind left (cm)	hind right (cm)
90 cm	mean	238.6	143.6	125.7	123.3	115.4	23.0	25.5	23.3	24.4
	SD	53.1	48.6	27.7	25.3	23.3	11.0	10.8	9.7	10.4
100 cm	mean	251.8	145.4	123.5	117.2	109.9	19.0	22.8	18.4	20.4
	SD	32.1	41.3	13.6	9.9	10.2	8.2	6.2	8.2	9.4
110 cm	mean	255.5	158.7	112.1	111.5	103.7	14.3	14.7	16.8	19.2
	SD	41.2	55.4	15.3	10.8	11.7	7.5	8.1	8.3	10.4
120 cm	mean	280.4	169.6	100.8	108.7	99.3	11.7	11.8	18.6	20.7
	SD	41.8	59.7	15.9	14.5	14.8	7.5	8.4	14.5	16.1

**Table 3.** Means and their standard deviations (SD) for heart rate and post-effort blood indicators in stallions in the 100-day performance test

Parametre	Mean	SD	Minimum	Maximum
HR in rest (beats/min)	101.8	10.4	91.0	123.0
HR maximum (beats/min)	175.5	26.1	139.0	214.0
HR mean (beats/min)	147.3	17.9	105.9	180.9
SD for HR (beats/min)	16.0	6.5	6.9	31.1
Lactic acid (mmol/l)	1.7	0.4	0.0	2.0
ESR15 (mm)	2.5	3.2	0.0	10.0
ESR30 (mm)	15.2	11.8	1.0	40.0
OB45 (mm)	31.4	17.2	5.0	60.0
ESR60 (mm)	45.7	20.8	10.0	80.0
Hematocrite (%)	48.0	4.5	42.0	61.0
total protein (g/l)	66.2	3.9	59.0	73.0
P (mmol/l)	1.3	0.1	1.0	1.5
K (mmol/l)	4.4	0.3	3.7	4.9
Na (mmol/l)	135.0	2.7	125.0	140.0
Cl (mmol/l)	103.9	1.0	103.0	107.0

Another difference was observed in the position of bascule points. The highest bascule point was the head, not the withers, as it was in the 8-mPT. The position of the legs over the obstacle seems to be higher for the first height of obstacle than in the 8-mPT. All these changes seemed to be the effect of longer training for the 8-mPT.

The variation of parameters was wider for distances of length of the jump in the 8-mPT; for other parameters was quite similar.

The correlations between jumping marks given by judges were much higher in the 100-dPT than in 8-mPT (Tab. 4) and reached from 0.49 to 0.73.

Partial correlations between marks for the test and parameters are shown in Table 5. They were consistently low, but on the same level and in the same direction as

**Table 4.** Phenotypic correlations between marks for jumping traits of stallions in the 100-day test

Correlated traits	Correlation coefficient
Jumping under the rider (trainer) – jumping under the rider (judges)	0.60
Free jumping (trainer) – free jumping (judges)	0.60
Jumping under the rider (trainer) - free jumping (trainer)	0.72
Jumping under the rider (judges) – free jumping (judges)	0.73
Free jumping (trainer) – jumping under the rider (judges)	0.49
Jumping under the rider (judges) – free jumping (judges)	0.68

**Table 5.** Phenotypic correlations between marks for stallions' jumping traits from the 100-day test and their jumping parametres measured by video image analysis

mark	Correlated traits (free jumping)	Correlation coefficient
	jumping parameter measured (video image)	
Mark for the willingness to jump	take off distance	-0.3
Mark for the ease of the jump	take off distance	-0.1
Mark for the ease of the jump	landing distance	0.2
Mark for the ease of for the jump	height of front legs over the obstacle	0.1
Mark for the work of the front	height of front legs over the obstacle	0.2
Mark for the work of the front	height of withers and head over the obstacle	-0.15
Mark for the work of the croup	landing distance	0.3
Mark for the work of trunk	landing distance	0.2
Mark for the work of trunk	height of hind legs over the obstacle	-0.2

obtained earlier for the 8-mPT. It was difficult to compare the relationship between jumping marks and measured parametres in both the studied tests because not exactly the same marks were evaluated. Only those which remained the same may be discussed. The correlations between the willingness to jump and the take off distance for the 8-mPT and 100-dPT were 0.1 and -0.3, respectively. The correlation between the landing distance and willingness to jump in the 100-dPT and willingness to jump in 8-mPT was 0.3 and 0.2, respectively. All given correlations were significant.

#### **Heart rate and blood indicators**

The values of investigated parametres are shown in Table 3. They were in the range of reference values [Szarska 1999], but some of them were very suprising in comparison with values observed for the 8-mPT, which is much more intensive than the 100-dPT. It is noticeable that minimum, maximum, and mean heart rate values were much higher for the 100-day than for the 8-month test. This may be caused by two reasons – either the shorter test is much more stressful for the horses, or the preparation before the test was not sufficient for this short test. The latter possibility was not confirmed by normal level of lactic acid. The ESR values were higher for the shorter test. The results observed in this study were not affected by the investigated impact of rider or breeder.

As a general conclusion, marks given by judges in the 8-mPT were in a wider range, and coefficients of variation were higher. This may be caused by the fact that 8-months training gave an opportunity for a better evaluation of the horses' skills. Correlations between marks for different jumping skills were higher for the 100-dPT, which can also be caused by the same reason. The evaluation made by riders unfamiliar with horses seemed to be a different skill, like other jumping traits – the correlation between the riders' evaluation and jumping skills was at medium level.

Free jumping measured parameters obtained for the 8-month and 100-day performance tests showed some differences that may be caused by a different training period. Further investigation on the training methods may solve this problem. Video image analysis seems a useful method of evaluating the horse's jumping skills, but more precise variable should be found which would be independent of external influences. Most of comparable correlations between jumping parameters measured by video image analysis and the jumping skills evaluated by judges are equal or similar, but some, such as "work of the trunk – height of hind legs" have quite a different direction. This may be caused by different style of judging on both tests depending on different training advantages or some differences in the jumping combination. So the conclusion may be that on a different combination and on a different level of training the judges' preferences may also differ. In both cases jumping parameters were connected with the judges' evaluation, but no one of these parameters seems to be of crucial importance for the total assessment of jumping skill. Some other independent indices should be investigated.

The physiological tests made during the two performance tests show that on the basis of existing traits the effect of training can be recognized only in the 8-mPT. The 100-dPT does not entail sufficient effort to be of statistical significance. The other question is whether the effort of a 100-dPT is adequate for correct and precise performance testing. The usefulness of HR measurements in the 100-dPT is also emphasized by other authors [Kaproń *et al.* 1999]. Some HR indices were investigated [Strzelec 2000], but their connection with sport ability has not been proved, so far. Existing physiological tests such as V4 or V200 [Catherine *et al.* 1999, Courouce *et al.* 1999, Kobayashi *et al.* 1999, Lindner *et al.* 1998, Sloet *et al.* 1999] prepared for other breeds could be adapted for the training programme for investigated halfbred horses, but first of all the correlations between such test and breeding goals should be checked.

#### REFERENCES

1. BRUNS E., SCHOBER M., FREDRICKSON I., 2001 – A cross-country evaluation of testing methods and data availability/suitability. Proceedings of the 52nd Annual Meeting of the EAAP, Budapest, Hungary, Book of Abstract p. 347.
2. CATHERINE M., TYLER-MCGOWAN, LARRAINE GOLAND C., EVANS D.L., HODGSON D.R., ROSE R.J., 1999 – Haematological and biochemical responses to training and overtraining. Equine Exercise Physiology 5. *Equine Veterinary Journal* (Supplement) 30, 621-625.
3. COUROUCE A., GEFFROY O., BARREY E., AUVINET B., ROSE R.J., 1999 – Comparison of exercise tests in French trotters under training track, racetrack and treadmill conditions. Equine Exercise Physiology 5. *Equine Veterinary Journal* (Supplement) 30, 528-532.

4. GERINGER H., DOBROWOLSKI M., 1997 – Zależności między ocenami ogierów rasy śląskiej a intensywnością ich użytkowania rozplodowego (Relationships between results of stallions' performance tests and their use in reproduction). In Polish. Summary in English. *Zeszyty Naukowe AR w Szczecinie* 177, 35, 245-249.
5. KAPROŃ M., JANCZAREK I., BOCIAN K., PLUTA M., KAPROŃ H., KAPROŃ B., 1999 – Ocena zmienności tętna ogierów półkrwi w trakcie testu 100 dniowego. (Evaluation of variation of heart rate of halfbred stallions during the 100-day test). Symposium Międzynarodowe „Aktualne kierunki hodowli i użytkowania koni w Europie”. Cracow 17-19 September (International Symposium on Current Trends in Horse Breeding and Utilization in Europe), 129-132.
6. KOBAYASHI M., KURIBARA K., AMADA A., 1999 – Application of V200 values for evaluation of training effects in the young Thoroughbred under field conditions. *Equine Exercise Physiology* 5. *Equine Veterinary Journal* (Supplement) 30, 159-162.
7. KOENEN E.P.C., ALDRIDGE L.I., 2001 – Breeding objectives for sport horses: a review. Proceedings of 52nd Annual Meeting of the EAAP, Budapest, Hungary, Book of Abstracts p. 346.
8. LEWCZUK D., 1999 – Komputerowa analiza obrazu jako metoda oceny użyteczności sportowej ogierów w Zakładach Treningowych. Praca doktorska IGiHZ PAN w Jastrzębcu (Video image analysis as a method of evaluation of stallions' sport performance in Training Centres). In Polish. PhD Thesis. Institute of Genetics and Animal Breeding, Jastrzębiec, Poland.
9. LEWCZUK D., SZARSKA E., PIETRZAK S., 2004 – An attempt at objectivization the halfbred stallions' performance test in Poland. I. Eight-month test. *Animal Science Papers and Reports* 22 (3), 287-296.
10. LINDNER A., HATZIPANAGIOTOU A., 1998 – Effect of age and performance parameters on CK, LDH and AST activities in plasma of standardbred horses during exercise. Proceedings of the 48th Meeting of the EAAP, Warsaw, Poland. Book of Abstract p. 320.
11. PIKUŁA R., 1986 – Wykorzystanie wyników prób dzielności prowadzonych z zakładach treningowych. Praca doktorska. AR w Krakowie (Usefulness of stallions' performance test results from Training Centers). In Polish. PhD Thesis. Agricultural University, Cracow.
12. SLOET M., VAN OLDRUITENBORGH-OOSTERBAAN, WENSING TH., BARNEVELD A., BRENKINK H.J., 1999 – Standardized exercise tests and blood biochemistry. Chapter VI Usability in the selection and training of breeding stallions.
13. SZARSKA E., 1999 – Badania laboratoryjne w treningu koni. (Laboratory tests in horse training) In Polish. Published by Agencja Reklamowa “Crex” S.C.
14. STRZELEC K., 2000 – Ocena poziomu wybranych wskaźników fizjologicznych w trakcie treningu i prób wyczynowych koni uczestniczących w Rajdach Długodystansowych. Praca doktorska AR w Lublinie (Evaluation of levels of some physiological indicators from the training and sport tests in horses taking part in Endurance). PhD Thesis. Agricultural University of Lublin. In Polish.

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## Próba obiektywizacji próby dzielności ogierów półkrwi w Polsce.

### II. Test 100-dniowy

#### Streszczenie

Celem pracy było zbadanie wykorzystania wyników prób dzielności oraz możliwości obiektywizacji oceny tych prób. Nie znaleziono korelacji między wynikami próby a liczbą pokrytych klaczy.

Przeprowadzono badania mające na celu określenie możliwości zobiiektywizowania tych prób na podstawie wysiłkowych testów fizjologicznych (po 5-minutowej próbie wytrzymałościowej), a także na podstawie pomiarów parametrów skoków luzem koni wykonanych za pomocą komputerowej analizy obrazu. Przeanalizowano zależności między badanymi parametrami a wynikami prób dzielności. Korelacje między skokowymi składowymi prób dzielności wynosiły od 0,47 do 0,73.

Korelacje między badanymi parametrami a wynikami prób były niższe i wynosiły od -0,1 do 0,3. Wartości wskaźników fizjologicznych krwi układały się w granicach norm. Jedynie wskaźniki pomiaru tętna wydają się być zbyt wysokie w stosunku do wykonywanego wysiłku. Wykonane badania pilotażowe wskazują na możliwości poprawy obiektywności ocen na próbach dzielności młodych koni.