

The effect of sire's breed on three body measurements and body conformation score in Polish Halfbred Horse at the beginnings and on the present-day of the breed

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The exchange of breeding material between countries caused by the needs of horse users is very intensive. The need for obtaining the sport horse was the reason to create a new Polish breed based on crossbreeding with foreign breeds. The aim of this study was to compare the effect of different sires' breeds on three body measurements and body conformation score of Polish sport horse breed – SP. The past (I Studbook) and present (performance tests results) were analysed with the analysis of variance.

The effect of the sires' breed estimated on all data was significant for all body measurements and body conformation score. The basic body measurements of horses sired by Hanoverian, KWPN and Holstein stallions were found greater than for the progeny of Polish sires.

Horses sired by foreign stallions as evaluated by selectioners showed body measurements and body conformation score to be higher than in those sired by Polish stallions.

KEY WORDS: body conformation score / body measurements / crossbreeding /
Polish Halfbred Horse / stallions

In the last decade the warmblood Polish Halfbred Horse (*szlachetna półkrew* – SP¹) has become very popular in Poland. In the years 1990-2000 the total number of SP stallions increased three times while that of mares almost eight times. SP was created as a strictly sport horse based on different horse breeds without clear pedigree structure and

¹In all Polish studbooks as well as in official breeding documents and records the abbreviations of names of horse breeds are always printed with small letters (e.g. sp., wlkp, etc.) In this article, to follow the international rules, capitals are used.

regulations. The need for developing such sport breed was connected with increasing number of horses of foreign origin which did not fulfill pedigree requirements for pure Polish warmblood horses. The other two Polish warmblood horse breeds are Małopolski Horse (M) and Wielkopolski Horse (WLKP). The Małopolski Horse was created through the centuries on the basis of Polish native horses of Arab type sharing Shagya Arabs, Anglo-Arabs and Thoroughbred blood. WLKP Horse is much more of a German type, coming from old Hanoverian and West-Pomeranian stock. Purebred Trakhenian horses are also registered in a separate part of the WLKP Studbook.

In the early seventies equestrian sport reached special popularity, and many French Anglo-Arab and Hanoverian horses were used to improve Polish horses. In the eighties the sport crossbreds were included into a second part of the Studbook and in 1997 the first Studbook for a new crossbred sport horse (SP) was initiated.

Due to the development of AI an international exchange of horse breeding material between European countries has become an every-day practice, the widely available information about stallions being of special importance. In Poland however, due to the fact that artificial inseminations in horses do not exceed 10% of a total number of matings, the exchange of breeding material is not so intensive. On the other hand, over the last 50 years many stallions have been imported. Estimation of the effect of stallions of different breeds imported to Poland in the past on development of three body measurements and body conformation score in the present SP horse was the aim of this report.

Material and methods

The past: SP horses born in the years 1965-1992

The data recorded in the first Polish Halfbred Horse (SP) Studbook were used for the analysis of the effect of the sire's breed on body measurements and body conformation score in SPs born within the years 1965-1992.

Height at withers, chest circumference, circumference of the cannon bone and body conformation score (points) were analysed with the GLM procedure of the SAS programme in the total of 498 horses from the first SP Studbook. The following model was used:

$$y_{ijkl} = \mu + S_i + P_j + O_k + e_{ijkl}$$

where:

y_{ijkl} – trait mean;

μ – population mean;

S_i – fixed effect of sire's breed;

P_j – fixed effect of the year-of-birth group;

O_k – fixed effect of the owner (breeder);

e_{ijkl} – residual.

Horses were divided into seven groups, according to their sires breed: 167 were offspring by Polish, 238 by Hanoverian (coming from earlier East and West Germany), 12 by KWPN, 11 by Selle Francaise, 16 by Holstein, 14 by sires of other German breeds, and 40 by Thoroughbred sires. Due to the specific attitude of Polish breeders to Hanoverian and Holstein horses, the two breeds were considered separately from other German breeds.

Horses from the first SP Studbook were born in the years 1965-1992, and were subdivided into three year-of-birth groups: 41 horses born before the year 1974, 198 born in the years 1975-1984 and 259 born after 1985. Because of change in the political situation in Europe in the eighties and its effect on horse breeding in Poland, the owners of horses were included in the model as their effect was proved to be statistically significant in preliminary analyses. In the investigated group 143 horses were owned by private persons (29%) and 355 were the National Studs' property.

The present-day: SP stallions performance-tested in the years 2001-2003 data

Over the years the performance tests rules for warmblood stallions in Poland were modified and changed many times. From the multipurpose driving and riding type the Polish warmblood horse was modified to a riding type. In 1997 the multipurpose 11-months test for National Stud's stallions was changed to a 100-days test, introduced on the basis of German experience. In this study the quality of foreign sires bought by Polish breeders over the last years was investigated of a group of 151 SP stallions, tested in the years 2001-2003 with the Polish stallion's performance test.

The body conformation score (points) and three body measurements (listed before) were analysed by the GLM procedure of the SAS programme with the following model:

$$y_{ijkl} = \mu + S_i + O_j + Y_k + e_{ijkl}$$

where:

- y_{ijkl} – trait mean;
- μ – population mean;
- S_i – fixed effect of stallion's breed;
- O_j – fixed effect of the owner;
- Y_k – fixed effect of the year of testing;
- e_{ijkl} – residual.

Stallions were divided into eight groups according to their sires breed: 43 were offspring by Polish, 22 by Hanoverian, 43 by KWPN, 14 by Holstein, 12 by sires of other German breeds, and three by Thoroughbred sires. Moreover, within Polish sires two Małopolski, 10 Wielkopolski and 31 SP sires were distinguished, according to the share of foreign blood being involved in creation of SP breed.

Within the period investigated, 77 stallions were tested in the year 2001, 34 in 2002

and 40 in 2003. Out of the total of 151 stallions, 118 (78%) were the private property and the remaining were possessed by National Studs.

Results and discussion

The sire's breed effect on body dimensions and body conformation score as estimated on the basis of the past and present records was found to be significant for almost all relations considered (Tab. 1-6). The least squares means for body measurements and body conformation traits as related to the breed of the sire and based on the Studbook records (years 1965-1992) are presented in Table 1. The body measurements of horses sired by Hanoverian, KWPN, or Holstein stallions were greater than those of the progeny of Polish sires. The highest value for the height at withers was observed in the progeny of Holstein sires while the smallest in the progeny of Polish SP and "other German" sires. The chest circumference of the progeny of Polish sires differed significantly mostly from that found in horses by Holstein sires. The analysis of the body conformation score showed that the progeny by Polish sires differed from the Hanoverian and Holstein sires progeny. Horses sired by Hanoverian and Holstein stallions were evaluated by selectioners as more proper and with better appearance.

The means for body measurements and body conformation score of the present-day Polish stallions tested during 2001-2003 performance tests were not markedly

Table 1. Least squares means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses sired by stallions of different breeds, as estimated from 1965-1992 Studbook records

Sire's breed		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (point)
Studbook SP	LSM	141.9 ^{a,c}	193.3 ^a	21.1 ^{a,b}	78.3 ^{a,b}
	SE	0.34	0.47	0.08	0.17
Hanoverian	LSM	144.3 ^{a,d}	194.5 ^b	21.4 ^b	79.2 ^a
	SE	0.44	0.82	0.10	0.20
KWPN	LSM	144.8 ^b	194.0 ^b	21.1	78.2 ^b
	SE	1.32	2.44	0.28	0.41
Selle Français	LSM	143.9 ^d	189.2 ^{b,c}	20.6 ^{a,b}	78.6
	SE	1.31	2.42	0.28	0.40
Other German	LSM	141.1 ^c	188.6 ^d	20.9	78.9
	SE	2.18	4.03	0.47	1.01
Thoroughbred	LSM	143.4 ^d	193.7 ^a	21.1 ^c	78.6
	SE	0.70	1.29	0.15	0.32
Holstein	LSM	144.6 ^{c,d}	197.0 ^{b,c}	21.7 ^{a,b,c}	79.8 ^a
	SE	1.13	2.08	0.24	0.52

^{a-d} Within columns means bearing the same superscript differ significantly at: small letters - P<0.05; capital - P<0.01.

affected by their sires' breed (Tab. 2). The greatest differences were revealed between the offspring of KWPN and SP sires. The lack of differences was observed between the progeny of Hanoverian and SP sires. That may be caused by the number of sires used for formation of the breed of interest. Through the past twenty years many Hanoverian stallions were engaged in establishing of SP, while nowadays the KWPN stallions seem to be the most popular.

Analysis of the 1965-1992 Studbook records showed that over that period a trend appeared of increasing the frame of the horse (Tab. 3). However, this tendency is not

Table 2. Least squares means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses sired by stallions of different breeds as estimated from 2001-2003 results of performance testing

Sire's breed		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (point)
Hanoverian	LSM	167.1	190.8 ^a	22.2 ^a	79.2
	SE	0.45	1.01	0.14	0.23
KWPN	LSM	166.0 ^{ab}	189.0 ^{ab}	21.7 ^{ab}	79.4 ^a
	SE	0.47	0.70	0.12	0.17
Other German	LSM	168.1 ^a	194.8 ^a	22.4 ^{ab}	79.9 ^b
	SE	0.95	1.50	0.24	0.33
Thoroughbred	LSM	164.9 ^c	190.5	21.4 ^c	79.7
	SE	1.77	2.73	0.44	0.44
Holstein	LSM	166.4 ^b	189.8 ^a	21.6 ^{ab}	79.7
	SE	0.82	1.24	0.21	0.30
Makopki	LSM	167.3	194.8	22.1	78.8
	SE	2.15	3.31	0.54	0.77
Wisłopotki	LSM	167.4	195.2 ^b	21.9	79.1
	SE	1.02	1.57	0.25	0.34
Polish Halfbred	LSM	168.5B ^{cd}	193.1 ^c	22.1 ^a	79.1 ^a
	SE	0.57	0.87	0.14	0.24

^{ab} Within columns means bearing the same superscript differ significantly at small letters - P<0.05; capital - P<0.01.

very popular now in the warmblood European breeds. Significant differences identified in a group of present-day stallions should not be treated as a definite trend because of the relatively small number of observations (Tab. 4).

Interesting results were obtained while analysing the effect of ownership on the horses' body measurements and body conformation in the two periods considered. When analysis involved the period 1965-1992 significant differences were identified between the horses owned by private and state's owners (Tab. 5). That was not observed in the 2001-2003 tested stallions representing the present-day situation (Tab. 6). Through the years private breeders were thought to keep smaller horses with worse body conformation. Investigated population showed that in the SP breed this tendency

Table 3. Least squares means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses as estimated from 1965-1992 Studbook records (sizes of different breeds are pooled)

Year-of-birth group		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (points)
1965-1975	LSM	143.2 ^a	193.3	20.9 ^{a*}	78.1 ^a
	SE	4.35	7.41	0.18	1.59
1976-1985	LSM	143.5 ^a	194.4	21.5 ^{a*}	78.9 ^a
	SE	5.54	7.34	0.12	2.56
1986-1992	LSM	144.1 ^{a*}	195.2	21.7 ^{a*}	79.1 ^{a*}
	SE	4.69	8.78	0.10	1.87

^{a*} Within columns means bearing the same superscript differ significantly at small letters - P<0.05; capitals - P<0.01.

Table 4. Least squares means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses as estimated from 2001-2003 results of performance testing ((sizes of different breeds are pooled)

Year-of-birth group		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (points)
2001	LSM	144.0 ^a	190.8 ^a	21.7 ^a	79.2 ^a
	SE	0.51	0.8	0.12	0.18
2002	LSM	144.5	191.4 ^a	21.9	79.2 ^a
	SE	0.64	0.98	0.12	0.22
2003	LSM	148.4 ^{a*}	194.4 ^{a*}	22.1 ^a	79.9 ^{a*}
	SE	0.69	1.04	0.17	0.24

^{a*} Within columns means bearing the same superscript differ significantly at small letters - P<0.05; capitals - P<0.01.

Table 5. Least squares means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses as estimated from 1965-1992 Studbook records

Owner's hip		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (points)
Private stallions	LSM	141.6 ^a	193.3 ^a	21.1 ^a	78.1 ^a
	SE	4.22	11.5	1.08	2.67
Studs' stallions	LSM	144.2 ^a	195.2 ^a	21.7 ^a	79.7 ^a
	SE	3.94	4.22	0.92	1.78

^{a*} Within columns means bearing the same superscript differ significantly at P<0.05.

Table 6. Least square means (LSM) and their standard errors (SE) for body measurement and body conformation score in Polish Halfbred horses as estimated from 2001-2003 results of performance testing

Owner's hip		Height at withers (cm)	Chest circumference (cm)	Cannon circumference (cm)	Body conformation score (point)
Private	LSM	144.9	192.4	21.8	79.0 ^a
stallions	SE	0.43	0.44	0.10	0.15
Stade'	LSM	147.1	191.9	22.1	79.8 ^a
stallions	SE	0.49	1.04	0.17	0.24

^{aa} Within columns means bearing the same superscripts differ significantly at P≤0.01.

is disappearing.

As far as the body conformation traits are concerned, Polish breeds seemed to be comparable with foreign breeds, but such similarity was not observed when analysing the results of performance tests [Lewczuk 2004]. Polish breeds did not differ from Thoroughbreds only. The results of Polish Halfbreds appeared better than of the other two Polish breeds. The number of SP horses tested through these years rose progressively from year to year. It seems that Polish stallions did not fulfill the requirements of Polish breeders. Also great is the number of foreign stallions tested in Poland. It should be noticed that the stallions that attended the performance test in Poland could be of different value. They were not expected to be the best of their breeds, because they were often bought as animals not selected for performance test in their own countries. The possibility of varying quality of stallions used by breeders of SP horses was also emphasized by Kaproń *et al.* [2000a] and Pikuła [2000].

The importance of body conformation is expressed in almost all breeding programmes [Koenen *et al.* 2004]. The relationships between conformation and performance results were studied in many populations and by many authors [Bruns *et al.* 1985, Koenen *et al.* 1995] and even if they were weak or negative, conformation features seemed to be the basic selection criterion. It may be caused by the fact, that for many horse breeders the horse still remains a hobby, and not only the object of sport-horse production [Die Moderne Sportpferdezucht 2000, EU Equus 2001].

The results concerning body conformation showed that the Polish type of warmblood horse changed from a multipurpose to a riding one. The breeding goal to improve riding and jumping ability of Polish warmblood horse is being achieved by the use of foreign horses. Better performance of foreign breeds or crossbreds with Polish horses was observed earlier by Łojek [1996], Łojek *et al.* [2000], Pietrzak *et al.* [2000] and Chrzanowski *et al.* 2000abc]. Many investigations with new suggestions for breeding programme were conducted [Kaproń *et al.* 2000abcd, Pikuła 2000]. Crossing with foreign breeds with expected higher genetic breeding value is widely used in many countries, and may produce relatively fast results not only in horse breeding. On the

other hand, the common opinion that “the best horse is a foreign horse” is opened to criticism.

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Wpływ rasy ojca na budowę Polskiego Konia Półkrwi (SP) oceniany na podstawie danych z I Księgi Stadnej i wyników prób dzielności

Streszczenie

Wymiana materiału hodowlanego między krajami, wynikająca z potrzeb użytkowników koni jest obecnie bardzo szeroka. Potrzeba wyhodowania konia sportowego była także przyczyną wytworzenia nowej polskiej rasy koni (SP) opartej na rasach zagranicznych. Aktualne dane biometryczne koni, jak i ocena ich pokroju oparta na danych z I Księgi Stadnej Polskiego Konia Szlachetnej Półkrwi oraz wynikach prób dzielności analizowano za pomocą analizy wariancji dla określenia wpływu rasy ojca na badane parametry. Podstawowe pomiary biometryczne koni będących potomstwem ogierów KWPN, hanowerskich i holsztyńskich okazały się większe niż potomstwa ogierów ras polskich. Konie pochodzące po ojcach zagranicznych uzyskały wyższą ocenę selekcjonerów.

