

## THE QUALITY OF LATVIAN WARBLOOD BROODMARES AND THEIR PROGENY DEPENDING ON TYPE AND ORIGIN

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### Abstract

In breeding of Latvian Warmblood breed carriage type horses *Equus caballus* one of major breeding objectives is producing of typical purebred animals with minimal influence of modern warmblood breeds. The aim of the study was to analyze the quality of Latvian Warmblood horse breed carriage and sport type mares included in the register of Latvian Horse Breeding Association broodmares and differences between types in valuation and quality of progeny. The data included 135 records from Latvian Warmblood horse breed mares having valuation both of conformation and performance. The data from 79 sport type and 56 carriage type broodmares were collected. The majority of mares in population (31.9%) had proportion 0 – 24.9% of Latvian warmblood purebred ancestors. The proportion of Latvian Warmblood purebred ancestors in the group of carriage type mares was high – 72.2%, while sport type mares – only 23.4%, a difference between groups was significant ( $p < 0.01$ ). Sport type mares showed significantly ( $p < 0.05$ ) better results in conformation and performance quality whereas carriage type broodmares had significantly higher count of daughters registered in Stud book. Comparison of breed types showed that groups did not differ significantly by height of withers and quality of progeny. Lower quality of conformation and performance of carriage type had to be explained by pedigree data as the main criteria for acceptance, also with older age of broodmares. For future the main goal has to be censorious licensing of best carriage type stallions and using young broodmares with higher quality of gaits and conformation for breeding purpose.

**Key words:** Latvian Warmblood, carriage type, sport type, broodmares.

### Introduction

The main breeding objective for the Latvian Warmblood sport type horse *Equus caballus* is to produce horses suitable and competitive for show jumping or dressage, for carriage type horse – produce purebred horses with a steady temperament, suitable for tourism, hobby class riding, driving, reittherapy. Historically, Latvian Warmblood horses had been used for universal purpose, both riding and farm work. Due to the use of several warmblood breeds for improving jumping and gait characteristics, Latvian Warmblood horse became lighter. There was a small number of horses with high proportion of purebred Latvian Warmblood ancestors in their pedigree. Preservation of carriage type started in 2004 based on determination of preserving genetic resources of livestock. The horses accepted as appropriate for the breed's genetic resources must conform to several criteria. The most important criteria is an origin of horse. Currently, one of major breeding objectives in breeding of carriage type horses is producing of typical purebred animals with minimal influence of modern warmblood breeds. A steady temperament, an easiness of handling and a strong body conformation are desirable features for carriage type horses (Rozitis et al., 2008). Recently the count of carriage type horses has been increasing and also a demand for well trained purebred carriage type horses has been growing.

There are stallions of related breeds widely used to reach the breeding objective of breed's sport type. Breeding Programme of Latvian Warmblood Horse determines also criteria for quality of

broodmares appropriate to breeding objective and registering in Stud Book. Nevertheless, mares are used for breeding purpose based on the owners' preference and knowledge without external control. Especially selection of Latvian Warmblood sport type females are totally breeder dependant likewise in majority of warmblood breeds (Dubois et al., 2007). Certainly, the selection of stallion is important for the genetic progress in population although the mare contributes as much as the male to the individual foal (Viklund et al., 2011) The selection of females can contribute 1/4 of genetic response (Dubois et al., 2008). Currently, Latvian Horse Breeding Association with the help of a special prize and support payments, promotes breeders to include the best mares in stud herd.

The aim of the study was to analyze a quality of Latvian Warmblood horse breed carriage and sport type mares included in the register of Latvian Horse Breeding Association broodmares and differences between types in valuation and quality of progeny.

### Materials and Methods

Data from Latvian Horse Breeding Association broodmares regist of 2013 were analyzed. The data included 135 records from Latvian Warmblood horse breed mares having valuation both of the conformation and the performance. The data from 79 sport type and 56 carriage type broodmares were collected. Based on methodology of an assessment of the broodmares' quality each mare had records of:

a) age;

- b) proportion of Latvian Warmblood purebred ancestors in pedigree;
- c) height of withers;
- d) valuation of conformation;
- e) percentage from maximal conformation valuation;
- f) points for limb conformation faults;
- g) points for conformation;
- h) valuation of performance;
- i) percentage from maximal performance valuation;
- j) points of performance;
- k) points for participating in competitions or horse shows.

Each mare also had records of her progeny. The quality of progeny was unified in total score that included points for:

- a) reproducing licensed stallions;
- b) reproducing broodmares registered in Stud book;
- c) high quality progeny;
- d) progeny participated in competitions or horse shows.

The Latvian horse breed broodmares were evaluated in accordance with Breeding Programme of Latvian Warmblood Horse. Conformation valuation included seven conformation criteria – type, top line of horse (head, neck, withers, shoulder, back, loins, croup), width of body, conformation of forelimbs, conformation of hind limbs, correctness of movement and temperament.

The performance valuation included four performance criteria evaluated in field-tests – quality of walk, trot, canter and free-jumping.

Some mares accepted as appropriate for the breed's genetic resources had valuation without scoring of jumping quality or without both scoring of jumping quality and canter quality. Each criteria should be valued in ten point scale and summed for valuation of conformation and valuation of performance.

The information about pedigree of broodmares and their conformation and performance valuation was found out from Stud Book and public horse database of Latvian Horse Breeding Association, available at: [www.lwhorse.lv](http://www.lwhorse.lv).

The method of points for limb conformation faults, conformation, participating in competition or horse shows, reproducing licensed stallions, reproducing broodmares included in Stud book and the progeny participated in competitions or horse shows were used for investigation. The points for the listed traits were given according methodics for detecting quality of broodmares registered in Latvian Horse Breeding Association with aim to range them by quality.

For further analysis the mares were divided in four groups by proportion of Latvian Warmblood

purebred ancestors in their pedigree, expressed in percentage:

- a) 0 – 24.5%, n = 43;
- b) 25 – 49.5%, n = 32;
- c) 50 – 74.5%, n = 27;
- d) 75 – 100%, n = 33.

The mares also were divided in four groups of age – 5 – 9 years (n = 32), 10 – 14 years (n = 35), 15 – 19 years (n = 47) and 20 and more years old (n = 21).

The points for limb conformation faults were deducted if the mare had score 6 or lower for forelimbs, hind limbs or correctness of movement, 1 point for each trait. The points for the conformation were given according to total valuation of conformation (percentage from maximum – 90 – 100% – 4; 80 – 89% – 3; 70 – 79% – 2; 50 – 69% – 1 point) and points for faults of limbs and correctness of movement were deducted.

The points for performance were given according to total valuation (percentage of maximum) likewise in conformation scoring. For broodmares of carriage type having no valuation of canter or/and jumping quality, percentage was calculated from sum of 2 or 3 performance traits.

The points for participating in competition or horse shows were given: 4 points to the mares participated in competitions and 2 points – in horse shows. Additional 2 points were given to the mares, who won prizes in show jumping up to 130 cm or dressage up to Advanced class. The additional 4 points were given to the mares, who won prizes in show jumping over 130 cm or dressage over Advanced class.

The total score of quality of progeny consisted of four criteria. The points for producing licensed stallions and mares included in Stud book were given for every licensed son (4 points for each) and every daughter registered in Stud book (2 points for each). The count of progeny with sum of conformation and performance valuation over 80 or performance valuation over 28 points were pointed out for each mare; 1 point was given for every offspring of high quality. The points for participating in competition or horse shows were given to progeny in the same way as to broodmares. Additional 4 points were scheduled to carriage type progeny, who won prizes in driving.

The statistical analysis was performed using IBM SPSS Statistics 20. The comparison of both groups were carried out by Independent Samples T-test. The data in groups of proportion of Latvian Warmblood purebred ancestors were analyzed using nonparametric nominal data descriptive statistic method Crosstabs. The significance of the differences between the groups was assessed using Chi-square ( $p < 0.05$ ). Pearson correlation was calculated.

### Results and Discussion

The quality of Latvian Warmblood broodmares were showed in Table 1 and Table 2. The broodmares had different origin - the proportion of Latvian Warmblood ancestors in origin in all population varied from 0 to 100%.

The mares of investigation group were large enough, reached average 166.97 cm in height of withers. The conformation and performance quality ranged widely. Low coefficient of variation in height of withers purported that population was uniform. It is also the result of criteria of Breeding Programme of Latvian Warmblood Horse, limiting height of withers for both type horses. Sport type horses only above 160 cm in withers can be included to breeding (licensing, registering in Stud book). The optimal height is determined as 162 cm for mares. There were strongly limited requirements for carriage type – small horses are undesirable, limitation also includes width of chest and cannon bone circumference. Only mares higher than 160 cm of withers can be accepted as appropriate for the breed’s genetic resources, with some exceptions. There was only 1 mare below 160 cm included in the register and also in the investigation due to high quality of traits. An information from Breeding Programme of Latvian Warmblood Horse suggests that average height of withers in all population is 164.8.

The difference between carriage type mares and sport type mares is shown in Table 2. According to the breeding objective to include mares to breed’s genetic resources based on the origin, proportion of Latvian Warmblood purebred ancestors in the group of carriage type mares was high – 72.2%, while sport type mares – only 23.4%, difference between groups was significant ( $p < 0.01$ ). A significant difference ( $p < 0.05$ ) between groups was found in age, all scores of conformation, included limb conformation faults, performance (expressed as percentage from maximum) and points for daughters registered in Stud book. Sport type mares showed better results in conformation and performance quality whereas carriage type broodmares had significantly higher

count of daughters registered in Stud book. It should be noted that valuation of conformation and performance in ten point scale and summing could have a low objectivity due to evaluation in different periods and various appraisers, and it also did not describe certain conformation and performance traits (Orbidane and Jonkus, 2013). Many traits in sport horse breeding are not easy to measure and have to be defined in a subjective way (Koenen et al., 2003). The objectivity could be increased with using evaluation of each trait, introducing of linear profiling using descriptions of trait expressions and regular training of appraisers in order to ensure the collection of suitable information for population analysis (Sanchez et al., 2012; Duensing et al., 2013). Certainly, evaluation of mares is essential, the increased proportion of tested broodmares gives opportunity for higher selection intensity of mares (Viklund et al., 2011).

The majority of mares (31.9%) had proportion 0 – 24.9% of Latvian Warmblood purebred ancestors. Respectively, mares with proportion 25 – 49.9% were 23.7%, with 50 – 74.5% were 20%, with 75 – 100% were 24.4%. The influence of foreign stallions increased in last 25 years. The similar trend was observed in Swedish Warmblood breed, where the proportion of mares covered by foreign stallions has increased dramatically in past decades, especially since early 1990s (Thoren Hellsten et al., 2008).

Relatively high percentage of broodmares with so large proportion of Latvian Warmblood purebred ancestors in their pedigree explicable with high interest in the preservation and breeding of breed’s genetic resources by breeding organizations. Corresponding to it, large numbers of mares accepted as appropriate for the breed’s genetic resources were included in registers of broodmares for evaluating and ranging.

Division in age groups showed that more than a third part of the broodmares were 15 – 19 years old (34.5%). The 5 – 9 years old young mares were 23.7%, 10 – 19 years old – 25.9% and older than 20 years – 15.6%. This proportion of age did not describe all population of mares; however, it suggests that there is a trend to use horses in breeding for too many years.

Table 1

Description of traits of Latvian Warmblood broodmares

Parameter	Minimum	Maximum	Average	Standart error	Coefficient of variation, %
Height of withers, cm	158	177	166.97	0.30	2.1
Proportion of Latvian Warmblood purebred ancestors, %	0	100	43.62	2.79	74.3
Valuation of conformation	42	70	52.37	0.37	8.2
Performance, % from maximum	35	90	71.71	0.70	11.3

Table 2

Comparison of carriage and sport type Latvian Warmblood broodmares

Parameter	Group	Average	Standart deviation	Standart error	p value
Age, years	carriage type	15.61	6.10	0.82	0.01**
	sport type	13.28	4.39	0.49	
Proportion of Latvian warmblood purebred ancestors, %	carriage type	72.21	20.36	2.72	0.00***
	sport type	23.35	22.59	2.54	
Heigh of withers, cm	carriage type	166.68	3.37	0.45	0.41
	sport type	167.18	3.52	0.40	
Valuation of conformation	carriage type	51.26	3.72	0.50	0.01**
	sport type	53.16	4.47	0.50	
Conformation, % from maximum	carriage type	73.05	5.26	0.70	0.01**
	sport type	75.90	6.40	0.72	
Points for limbs conformation faults	carriage type	0.80	1.10	0.15	0.04*
	sport type	0.46	0.84	0.10	
Points for conformation	carriage type	1.84	0.53	0.07	0.02*
	sport type	2.09	0.66	0.07	
Performance, % from maximum	carriage type	69.82	6.93	0.93	0.02*
	sport type	73.05	8.64	0.97	
Points for performance	carriage type	1.79	0.71	0.09	0.24
	sport type	1.94	0.74	0.08	
Points for competitions/horse shows	carriage type	1.13	2.37	0.32	0.32
	sport type	0.79	1.61	0.18	
Points for licensed stallions	carriage type	0.93	2.29	0.31	0.62
	sport type	0.76	1.70	0.19	
Points for mares registered in Stud book	carriage type	1.18	0.90	0.25	0.04*
	sport type	0.61	1.21	0.14	
Points for high quality progeny	carriage type	1.70	1.84	0.25	0.15
	sport type	2.18	1.96	0.22	
Points for competitions/horse shows (progeny)	carriage type	2.11	4.03	0.54	0.26
	sport type	1.47	2.54	0.29	
Total score of progeny	carriage type	5.91	7.36	0.98	0.42
	sport type	5.01	5.45	0.61	

\*Difference is significant at the 0.05 level.

\*\* Difference is significant at the 0.01 level.

\*\*\* Difference is significant at the 0.001 level

Other authors recommended to replace old broodmares by younger ones with higher genetic values for achieving a large annual genetic progress (Viklund et al., 2011).

Finding out proportion of age of mares in each type and each group of origin verified significant difference between groups ( $p < 0.01$ ). It could be explained by a fact that the structure of genetic resources was made from older carriage type mares, they also had higher

proportion of Latvian Warmblood purebred ancestors in pedigree. The percentage of proportion is shown in Table 3.

An occurrence of traits was found in each group of different proportion of Latvian Warmblood purebred ancestors in pedigree. Figure 1. shows the scattering of valuation of conformation in groups with different proportion of purebred ancestors in pedigree.

Table 3

**Frequencies of interaction between Latvian warmblood broodmares' age and groups of type and origin**

Age, years	Group, within frequencies calculated	Type		Proportion of Latvian Warmblood purebred ancestors in pedigree, %			
		Carriage	Sport	0 – 24.9	25 – 49.9	50 – 74.9	75 – 100%
5-9	age group	0.438	0.562	0.281	0.250	0.188	0.281
	type/origin	0.250	0.228	0.209	0.250	0.222	0.273
10-14	age group	0.257	0.743	0.543	0.200	0.114	0.143
	type/origin	0.161	0.329	0.442	0.219	0.148	0.152
15-19	age group	0.319	0.681	0.319	0.298	0.213	0.170
	type/origin	0.268	0.405	0.349	0.438	0.370	0.242
>20	age group	0.857	0.143	-	0.143	0.333	0.524
	type/origin	0.321	0.380	-	0.094	0.259	0.333

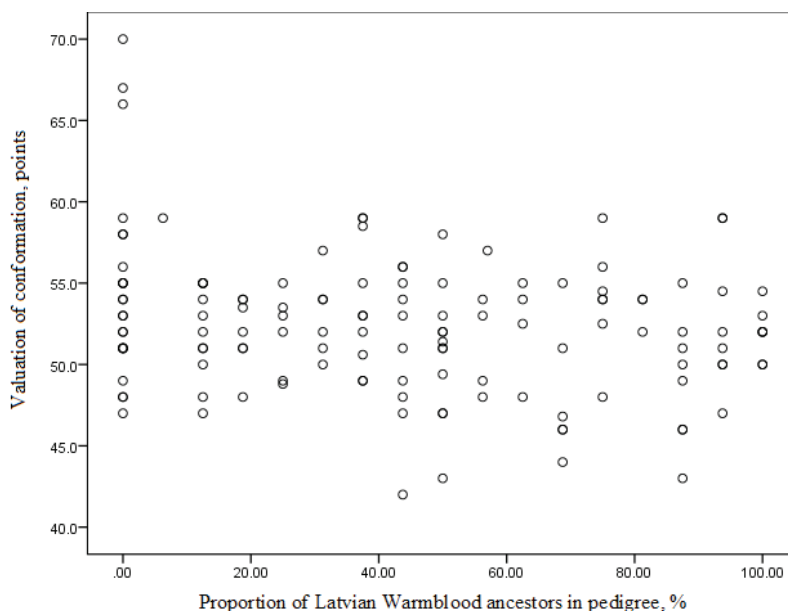


Figure 1. Valuation of conformation of Latvian Warmblood breed mares with different proportion of purebred ancestors.

Significant difference in groups of origin was detected to points for performance ( $p < 0.01$ ) and points for competitions and horse shows ( $p < 0.05$ ). The broodmares with larger proportion of Latvian Warmblood ancestors had exhibited in horse shows (in this case) more often than sport type mares. Certainly, high influence from other highly productive warmblood breeds also means higher quality of gaits and jump that results showed. The investigation of Swedish Warmblood showed that differences of jumping quality between stallions of different breeds have become smaller over time although foreign populations have considerably affected the show jumping performance in the past (Thoren Hellsten

et al., 2008). Currently, Breeding Programme of Latvian Warmblood Horse has not accepted the mares from related breeds as appropriate to the breeding programme and their offspring, born in Latvia, could not be registered as Latvian Warmblood as previously. Possibility the use of imported mares of related breeds for breeding purpose in the past, not only stallions, led to the situation that a mare with a lack of Latvian Warmblood breed presence in her pedigree and also her progeny in many generations were registered as purebred Latvian Warmblood.

Calculated fenotypic correlations showed connection between some traits (Table 4). Low and negative correlation was found between proportion



Table 4

**Correlations of traits of Latvian Warmblood broodmares**

Parameter	Proportion of Latvian Warmblood ancestors in pedigree, %	Valuation of conformation	Age, years	Performance % from maximum	Points for high quality progeny	Points for competitions and horse shows of progeny
Proportion of Latvian Warmblood ancestors in pedigree, %		-0.217*	0.188*	-0.261**	-0.358**	-0.088
Valuation of conformation			-0.019	0.257**	0.247**	0.017
Age, years				-0.268**	0.375**	0.381**
Performance, % from maximum					0.082	-0.056
Points for high quality progeny						0.496**
Points for competitions and horse shows of progeny						

\*Correlation is significant at the 0.05 level

\*\* Correlation is significant at the 0.01 level

of Latvian Warmblood ancestors in pedigree and points for high qualitative progeny, also negative ( $r_p = -0.261$ ) – with performance, expressed as a percentage from maximal valuation.

Connection between the age of mares and points for progeny are perspicuous due to larger number of offspring. Positive and close to moderate correlation also was calculated between high quality progeny and their participation in competitions and horse shows.

### Conclusions

Comparison of Latvian Warmblood carriage and sport type broodmares using horse breeding organisation's data showed that groups did not differ significantly by height of withers and quality of progeny while a significant difference among the types was found in age and valuation of conformation and performance. Significant difference ( $p < 0.05$ ) of types in points of limb conformation faults had to be explained with uncritical acceptance of mares as appropriate for the breed's genetic resources due to

remaining of small number of Latvian Warmblood purebred animals with low influence of other breeds in their origin. The mares of carriage type also were older, and recently there has been a high number of progeny from them gained by a realization of breeding programme. The main recommendation is a provident selection of high quality carriage type stallions for breeding purpose to reproduce young broodmares with higher quality of gaits and conformation for reproducing offspring more suitable for driving and youth sport. The analysis of data did not show a significant difference in quality of progeny between types, except in points for daughters registered in Stud book where carriage type mares had a better result.

There was insufficient evaluation data of broodmares, especially born before 2007, without the description of traits that is defined in the methodology of the recent breeding programme. The next step should be a reevaluation of broodmares to clarify trends of the population that is essential for achieving set breeding objectives.

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