GENETIC AND PHENOTYPIC PARAMETERS FOR EARLY CAREER PERFORMANCE AND AGE AT THE BEGINNING OF THE CAREER IN STANDARDBRED TROTTERS

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SUMMARY

Genetic and phenotypic parameters for early career performance traits and age at first qualifying start (AFQ), passed qualifying start (APQ), and age first race (AFR) were estimated for Finnish Standardbred trotters using REML with an animal model. A high genetic correlation was found to exist between the performance traits. The genetic correlation between age (AFQ, APQ, AFR) and performance traits was also high. The variation in number of starts, AFQ, APQ and AFR is attributable mainly to environmental factors, as indicated by their low h^2-estimates.

INTRODUCTION

Summarized race records of the progeny over certain age classes are commonly used in estimating breeding values for trotters. The main interest is focused on the results of young age classes, i.e. (2-) 3- to 5-year-old horses. Precocity has also been selected as a breeding goal in some countries. Age at the beginning of the career may reflect time needed to reach maturity, but also the health and soundness of the horse, which are importantant characteristics to be included in breeding programmes. Low age at the beginning of the career improves the economy of breeding and keeping horses by reducing the costs to horse owners. Furthermore, it enables an earlier and more accurate selection of breeding animals. Horses starting their career early have also been found superior to other individuals as race horses.

Accurate genetic and phenotypic parameters for measurements of racing performance are needed in planning efficient breeding plans. According to Hill and Meyer (1988) REML should be used generally in animal breeding applications. In many countries, animal model is applied, or is planned to be applied to predict breeding values of horses. However, many of parameters used in practice are based on estimates from methods based on analysis of variance or sire models.

The aim of this study was to estimate genetic and phenotypic parameters for selected performance traits of early career, and age at the beginning of the career, in Finnish Standardbred trotters, using REML with an animal model.

MATERIALS AND METHODS

The data consisted of annually summarized race records for 3- to 5-year-old Standardbred trotters born in Finland between 1981 and 1984. Furthermore, age at first and passed qualifying start (in an official qualifying start or start in a local race), and age at first start (in an official totalizator race),

were recorded for 2- to 5-year-old horses. The annual race records were summarized to provide early career performance results for 3- to 5-year-old horses. The performance traits considered were best time on volt-start, square root of number of starts and fourth root of earnings.

The data were edited to include only progeny of sires having at least five offspring with a record for the trait under consideration. After editing, the total number of raced horses with own racing records was 2753, being offspring of 105 stallions. When non-starters were included, the number of horses increased to 2923 horses. The number of horses that have taken part in a qualifying start was 2855.

Relatives (parents and grandparents) of horses without recorded traits were not taken into account. The total number of animals in the analyses was 7824. Most of the parents and grandparents in the pedigree were foreign imported horses.

The whole data set was used for estimating heritabilities by single-trait analysis. When variances and covariances for the traits were estimated by multiple-trait analysis, only horses for which all the traits under consideration had been recorded, were included in the data.

The data were analyzed the DMU-package for analysing multivariate mixed models (Jensen & Madsen, 1993). The variances and covariances were estimated using REML with an animal model. The DMU-package utilizes a derivate-free algorithm in maximizing the likelihood (Graser et al., 1987).

The model used, included sex (2 classes), month of birth (7 classes) and year of birth (4 classes) of the horse as fixed effects, and was the same for all traits and both analysis. The DMU calculated the standard errors of heritabilities and genetic correlations based on Taylor series approximation.

RESULTS AND DISCUSSION

The heritability (h^2) estimates of the early career performance traits (Table 1 and 2) are well in agreement with those reported previously by Saastamoinen and Ojala (1991) (Henderson III) and Pösö (1993) (REML AM). The results also agree with the values reported in Swedish studies (Arnason et al., 1982 and 1989) (Henderson III). Inclusion of non-starters in the data decreased the h^2 estimate of earnings by about 15 %, indicating the influence of preselection on the magnitude of h^2 values. Multiple-trait analysis, includind horses having all the traits under consideration, resulted in estimates of the same magnitude than the single-trait analysis, but the estimates where associated with smaller standard errors (Table 2). The variation in number of starts is attributable mainly to environmental factors, as indicated by its low h^2 estimates.

The performance traits were highly and favourable correlated, both genetically and phenotypically. The strongest genetic correlation (-0.98) was observed between best career time and earnings. The

correlations among career performance traits reported in literature are few, but the results of the present study agree with those of Pösö (1993), and regarding correlation between best time and earnings, with Arnason et al. (1982).

Table 1. Heritability estimates for the studied traits (single-trait analysis).

	Best time	(earnings)$^{1/4}$	(no. of starts)$^{1/2}$	AFQ	APQ	AFR
n=	2646	2753	2753	2855	2739	2723
	0.27±.05	0.39±.06	0.13±.04	0.09±.04	0.14±.05	0.11±.04
		0.33±.05	0.13±.04			

second row: non-starters included (n=2923)

Table 2. Genetic (above diagonal) and phenotypic (below diagonal) correlations and heritabilities (diagonal) for the performance traits in multiple-trait analysis (n=2646).

	Best time	(earnings)$^{1/4}$	(no. of starts)$^{1/2}$
Best time	**0.25±0.03**	-0.98±0.02	-0.81±0.06
(earnings)$^{1/4}$	-0.81	**0.36±0.01**	0.86±0.02
(no. of starts)$^{1/2}$	-0.71	0.81	**0.08±0.02**

In general, the heritabilities for traits AFQ, APQ and AFR were low, the highest being for APQ. The h^2 estimates from single-trait analysis agree with the values found in the literature (Saastamoinen, 1991; Saastamoinen & Ojala, 1991). The h^2 estimates from multiple-trait analysis were slightly higher and had smaller standard errors than those from the single-trait analysis. The variation in age at the beginning of the career was mainly due to environmental factors, such as intentions of owners and trainers, or injuries, but also to genetic differences in precocity, soundness and ability to response to training.

Genetic correlations between age and performance traits were high, except for the correlation between age at first qualifying start and best time, which was observed to be only moderately high

(Table 3). The corresponding phenotypic correlations were found to be moderately high, and of somewhat higher absolute values than those reported previously between AFR and performance traits (Saastamoinen & Ojala, 1991). The results indicate that horses beginning their career young are superior to other horses as race horses. Selection based on racing results of an early career is likely to result in younger age at qualifying and first start.

Table 3. Genetic (r_g) and phenotypic (r_p) correlations between the performance traits and precocity, and heritability estimates (h^2) for AFQ, APQ and AFR in two-trait analysis.

	AFQ	APQ	AFR
Best time r_g	0.43±0.17	0.71±0.10	0.68±0.10
r_p	0.33	0.47	0.49
h^2	0.11±0.04	0.15±0.05	0.15±0.04
(earnings)$^{1/4}$			
r_g	-0.64±0.12	-0.70±0.10	-0.75±0.09
r_p	-0.44	-0.49	-0.57
(no. of starts)$^{1/2}$			
r_g	-0.71±0.12	-0.72±0.10	-0.79±0.08
r_p	-0.48	-0.55	-0.58
h^2	0.14±0.04	0.16±0.04	0.16±0.04

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