Environmental factors affecting racing time of trotter horses in Serbia

Štrbac, Lj., Trivunović, S., Baban, M.

Poljoprivreda/Agriculture

ISSN: 1848-8080 (Online)
ISSN: 1330-7142 (Print)

http://dx.doi.org/10.18047/poljo.21.1.sup.42

Poljoprivredni fakultet u Osijeku, Poljoprivredni institut Osijek

Faculty of Agriculture in Osijek, Agricultural Institute Osijek

ISSN 1330-7142
UDK: 636.12(497.11)
DOI: 10.18047/poljo.21.1.sup.42

ENVIRONMENTAL FACTORS AFFECTING RACING TIME OF TROTTER HORSES IN SERBIA

Štrbac, Lj.(1), Trivunović, S.(1), Baban, M.(2)

Original scientific paper

SUMMARY

Speed, the most important trait in trotter horses, forms the basis for examining their racing ability, and is calculated according to the time it takes to run a certain distance. The phenotypic manifestation of a horse's speed is controlled by numerous genes and larger or smaller impacts of environmental factors. To improve trotter horse selection to be more successful and faster in genetic progress it is very important to determine the impacts of such gene-related and environmental factors. The aim of this study was to investigate the effect of year and month of birth, sex, year and season of race, age, racetrack, distance and type of start on trotter horse racing times. Data from the Association for Trotting Sport of Serbia (UKSS) for the registered horses and races in the period from 1998 to 2010 were used. The database is comprised of data for 1263 horses over a total of 14398 races. After calculating descriptive statistics of racing times, the effect of fixed factors using the general linear model (GLM) was examined. The average racing time achieved was 84.21s, and ranged from 73.8 to 132.2s. All of the tested factors had a statistically significant effect on the observed racing times. Thus, each of these factors should be included in future models for genetic prediction of the suitability of animals use as parents of further generations of racing trotters. This should increase the rate of genetic progress and competitiveness of the animals at both national and international levels.

Key-words: trotter, time in race, environmental factors, genetic improvement

INTRODUCTION

Trotting races are the test of the speed, endurance and regularity of trot of trotter horses. Speed, though, is the most important trait in trotters and forms the basis for examining their racing ability. Speed is calculated on the basis of the measured time it takes to run a certain distance. The main goal in breeding trotters is to produce good (successful, durable, healthy) race horses, able to start young in their sports (racing) careers, because once proven in sport, they are generally made available for reproduction. Trotter breeding values are determined by time records achieved in races, from which speed is indicated as well as the number of race starts, being an indicator of horse endurance. These traits are quantitative, meaning that their phenotypic manifestation is controlled by numerous genes and is more or less affected by the environment. It is, therefore, very important to ensure optimal environmental conditions, and conditions in which the genotype of the animals can achieve maximum expression. In addition, when defining a model for genetic estimation, it is important to consider all the environmental factors that can affect the final result of the animals in the race (Ojala et al., 1987).

The results of trotting horse races are influenced by many environmental factors. Čačić and Šimundža (2012) based on the research of numerous authors reported the following factors which can be used for the analysis of accumulated (annual) race results: age, age at first start, month and year of birth. The authors note that the inclusion of individual race records in a model allows the definition of additional factors such as the racetrack, distances, type of start and condition of the track. In order to produce a more reliable model though, the effects of the environment should be included for

(1) M.Sc. Ljuba Štrbac (ljuba.strbac@stocarstvo.edu.rs), Assoc. Prof. Snežana Trivunović - University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, (2) Prof. Dr. Mirjana Baban - Josip Juraj Strossmayer Univesity of Osijek, Faculty of Agriculture, Kralja Petra Svačića 1d, 31000 Osijek, Croatia

individual results or the results of each race. Specific environmental conditions for each recorded race result can be directly introduced into a statistical model, and it is not necessary to pre-adjust data for this purpose (Rohe et al., 2001; Bugislaus et al, 2006; Langlois and Blouin, 2007). According to Štrbac and Trivunović (2013), sex, racetrack, season, age and distance have a statistically significant effect ($P<0.01$) on horse racing time. Similar results have been shown by Rohe et al. (2001) and Bugislaus et al. (2006). The aim of this study was to investigate the influence of the year and month of birth, sex, year and season of the race, age, racetrack, distance and method of start on racing times of trotters.

MATERIAL AND METHODS

As working material, data from the Association for Trotting Sport of Serbia (UKSS), for registered horses and races in the period from 1998 to 2010 was used. The database is comprised of data for 1263 horses over a total of 14398 races. For consideration of average racing time and variability of racing time, descriptive statistics was performed. For this purpose, standard statistical parameters were calculated: mean, standard error of the mean, minimum, maximum, standard deviation and coefficient of variation. The general linear model (GLM) was used to determine the influence of the year and month of birth, sex, year and season of the race, age, racetrack, distance and method of start on racing times of trotters according to the following two models:

$$Y_{ijklmnoprs} = \mu + Yb_i + Mb_j + S_k + Yr_l + Se_m + A_n + Rt_o + D_p + St_r + e_{ijklmnoprs} \quad (1)$$

$$Y_{ijklmnop} = \mu + YbMb_i + P_j + YrSe_k + A_l + Rt_m + D_n + St_o + e_{ijklmnop} \quad (2)$$

Where:

Y – observed trait

μ – general mean

Yb – year of birth (n=13)

Mb – month of birth (n=11)

YbMb – interaction between year and month of birth (n=114)

S – sex (n=3)

Yr – year of race (n=12)

Se – seasons of race (n=3)

YrSe – interaction between year and month of race (n=14)

A – age (n=11)

Rt – racetrack (n=50)

D – distances (n=3)

St – type of start (n=3)

e – random error

In both models, the factors were defined as fixed effects, and notably, model 2 included interactions between year and month of birth and year and season of racing.

Statistical analysis was performed using software Statistics 12.

RESULTS AND DISCUSSION

The average phenotypic value and variability of racing time of trotter horses in Serbia is shown in Table 1. The average racing time achieved was 84.2 s, and ranged from 73.8 to 132.2 s. According to the European Trotting Statistics, the average time achieved on European racetracks ranged from 77.5 to 71.7 s during the period 1985-2009.

Table 1. Phenotypic parameters of racing time

Trait	N	$\bar{x}$	$S_{\bar{x}}$	Min	Max	SD	CV
Time in race, s/km	14398	84.2	0.038	73.8	132.2	4.6	5.5

$\bar{x}$ – average; $S_{\bar{x}}$ – standard error; Min – minimum; Max – maximum; SD – standard deviation; CV – coefficient of variation

Based on the results in Table 1, we can conclude that, on the average, our horses achieve racing times significantly slower than those of horses from other European countries. This may be due to the fact that selection in Serbia is currently carried out solely on the basis of phenotypic parameters, while genetic evaluation as selection criteria has not yet been implemented. Also, population size, management and quality of race tracks are not on at an adequate level for top results in trotting sports.

Racing time is a simple phenotypic measure that is collected routinely for all horses participating in a trotting race (Ricard et al. 2000). Although its inclusion as a criterion for selection is not always necessary, it is recommended, bearing in mind that it shows the ability of the animals to quickly trot (Thiruvenkadan et al., 2009). In addition, Rohe et al. (2001) suggested that this is the most important trait for selection of sports performance because it has the highest heritability of all traits that have been studied and has a high genetic correlation with a horse's ability to achieve a place in the races.

In Tables 2 and 3, the effects of environmental factors on the racing times achieved are shown.

Table 2. Impact of environmental factors on trotter horse racing time (model 1)

Factors	d.f.	F – value	R^2
Year of birth	12	15.6**	0.505
Month of birth	10	13.9**	
Sex	2	78.2**	
Year of race	13	17.4**	
Season of race	2	28.4**	
Age	10	59.7**	
Racetrack	49	86.7**	
Distances	2	189.1**	
Method of starts	3	492.1**	

** $p<0.01$; d.f. – degree of freedom; R^2 – coefficient of determination

Table 3. Impact of environmental factors on trotter horse racing time (model 2)

Factors	d.f.	F – value	R^2
Year and month of birth	113	8.5**	0.528
Sex	2	76.9**	
Year and season of race	13	8.7**	
Age	10	60.2**	
Racetrack	49	82.4**	
Distances	2	197.5**	
Method of starts	3	474.1**	

** $p<0.01$; d.f. – degree of freedom; R^2 – coefficient of determination

All of the examined factors had a statistically significant effect on trotter horse racing times. Thus, each of these factors should be included in models for genetic evaluation of the animals. Year of the race and birth year of the animals have an impact on horses' sports performance, due to improvement of the training over time, and possible changes in the quality of conditions at racetracks (Thiruvenkadan et al., 2009). The effect of month of birth was also noted by Saastamoinen and Ojala (1991), especially at an early age, which may indicate that there are significant differences in physical growth between animals born at the beginning and end of the year. The influence of sex on horses' racing times has also been proven in other studies (Ojala and Hellman, 1987; Štrbac and Trivunović, 2013). In most cases, males performed better in races than females. Ojala and Hellman (1986) reported that males were superior to females and that stallions were faster on the average by 1.05 to 2.29 seconds. Štrbac and Trivunović (2013) reported that stallions achieved the best racing times, followed by mares, and that geldings produced the worst results. The influence of age in trotter horse races was established by Ojala and Van Vleck (1981). Saastamoinen and Ojala (1991) pointed out that starting trotters at an early age enables profitable production through earlier and more accurate selection. The effect of year-season-racetrack is also included in some models as an indirect measure of the conditions on the track at the time of racing (Ojala et al., 1987a). Racing time largely depends on the race itself - the distance. Čačić and Šimundža (2012) pointed out that the best racing time is achieved over shorter distances (1900m or less). Type of starts also affects the racing time (Ojala et al., 1987; Thiruvenkadan et al., 2009; Thuneberg-Selonen et al., 1999), and Čačić and Šimundža (2012) suggest that much better time occur in races with flying starts.

The R^2 value (see Tables 2 and 3) was higher in model 2, which included interactions between year and month of birth and year and season of race. Overall, the R^2 values showed that about 50% of the variability in racing times was determined by the applied models. The values of R^2 would certainly be higher if the models had also included effects of sire and dam, as around 30% of the variability in racing times can be caused by genetic differences measurable through the horses' bloodlines.

CONCLUSION

This study has shown that trotter horses bred in Serbia currently achieve poorer results (slower racing times) compared to similar horses in other European countries. The selection of trotters in Serbia is based only on phenotypic parameters. Such selection is less efficient than selection using genetic analysis, as changes in the phenotype can occur as a result of interactions of genotype with environmental factors. To further progress the trotter horse selection process, it will be necessary to utilise genetic analysis that includes the impact of environmental factors. Results of this study show that the impact of the year and month of birth, sex, year and season of the race, age, racetrack, distance and method of start should all be included in models for genetic prediction of trotter horse ability. This system of genetic evaluation should result in genetic improvement increase, and increase in the competitiveness of Serbian-bred trotters at the national and international levels.

REFERENCES

1. Bugislaus, A.E., Roehe, R., Willms, F., Kalm, E. (2006): The use of a random regression model to account for change in racing speed of German trotters with increasing age. Journal of Animal Breeding and Genetics, 123: 239-246. doi: http://dx.doi.org/10.1111/j.1439-0388.2006.00596.x
2. Čačić, M.,Šimundža, S. (2012): Genetski i okolišni parametri u proceni trkaćih performansi kasača. Poljoprivreda/ Agriculture, 18 (2): 50-58.
3. European Trotting Statistics: http://www.uet-trot.eu/pdf/en/stat06.pdf
4. Langlois, B., Blouin, C. (2007): Annual, career or single race records for breeding value estimation in race horses. Livestock Science 107: 132-141. doi: http://dx.doi.org/10.1016/j.livsci.2006.09.017

5. Ojala, M.J., Van Vleck, L.D., (1981): Measures of race-track performance with regard to breeding evaluation of trotters. J. Anim. Sci., 53(3): 611–619. doi: http://dx.doi.org/10.2134/jas1981.533611x
6. Ojala, M., Hellman, T. (1987): Effect of year, sex, age and breed on annually summarized race records for Trotters in Finland. Acta Agric. Scand., 37: 463–468. doi: http://dx.doi.org/10.1080/00015128709436577
7. Ojala, M., Van Vleck, V.D., Quass, R.L. (1987a): Factors influencing best annual racing time in Finnish trotters. J. Anim. Sci., 64: 109–116. doi: http://dx.doi.org/10.2134/jas1987.641109x
8. Richard, A., Bruns, E., Cunningham, E.P. (2000): Genetics of performance traits. (Bowling A.T., Ruvinsky A.: The Genetics of the Horse), 411-439.
9. Rohe, R., Savas, T., Brka, M., Njillms, F., Kalm, E. (2001): Multiple-trait genetic analysis of racing performance of German trotters with disentanglement of genetic and driver effect. Arch. Tierz. 44: 579-587.
10. Saastamoinen, M.T., Ojala, M.J. (1991): Influence of birth-month on age at first start and racing performance in young trotters. Acta Agric. Scand., 41: 437–445. doi: http://dx.doi.org/10.1080/00015129109439926
11. StatSoft (2014): Statistica - version 12.
12. Štrbac, Lj., Trivunović, S. (2013): Effect of paragenetic factors on race time in a small population of trotters. Turkish Journal of Veterinary and Animal Science, 37: 701-705. doi: http://dx.doi.org/10.3906/vet-1212-18
13. Thiruvenkadan A.K., Kandasamya N., Panneerselvama S. (2009): Inheritance of racing performance of trotter horses: An overview. Livestock Production Science, 124: 163-181. doi: http://dx.doi.org/10.1016/j.livsci.2009.01.010
14. Thuneberg-Selonen, T., Pösö, J., Mäntysaari, E., Ojala, M. (1999): Use of individual race results in the estimation of genetic parameters of trotting performance for Finnhorse and Standardbred trotters. Agric. Food Sci. Finl., 8: 353–363.

(Received on 30 April 2015; accepted on 17 July 2015)