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HERITABILITY OF TRACK CONDITION AFFINITY IN THE AUSTRALIAN THOROUGHBRED RACING POPULATION

B.D. Velie, N.A. Hamilton and C. M. Wade

University of Sydney, Faculty of Veterinary Science, Camperdown, Sydney, NSW, Australia 2006

SUMMARY

Performance records were obtained for 31,441 Thoroughbreds racing in Australia. Three traits, best race track condition, best average finish position track condition, and best earnings per start track condition, were calculated for each horse. Heritability of each trait was estimated using an animal model incorporating sex as a fixed effect and trainer as a random effect. Heritabilities of best race track condition, best average finish position track condition, and best earnings per start track condition were 0.03 ± 0.007, 0.04 ± 0.008, and 0.03 ± 0.007, respectively.

INTRODUCTION

The ability of a race horse to consistently perform under varied environmental conditions undoubtedly plays a significant role in the success it will have on the racecourse. This is arguably most on display when the skies open and it starts to rain. The ability of certain horses to perform well in wet conditions has given rise to labels such as “mudder” and “swimmer” with some horses branded as “mudders” and “swimmers” based solely on their breeding. Although multiple studies have demonstrated significant relationships between racing success and track surface (Silveira & Ferreira 2008; Cheetham *et al.* 2010), few studies have investigated the idea that the ability of a horse to perform well under wet conditions is heritable. In this study we explore this notion in the Australian Thoroughbred racing population and provide estimates of heritability for 3 traits associated with a horse’s performance under specific track conditions.

MATERIALS AND METHODS

Population. Performance records were made available by Racing Information Services Australia (RISA) for all Thoroughbreds entered in a race or official barrier trial in Australia from 1 August 2000 until 22 February 2011. The data were filtered to include only horses that had raced on the turf and that were under the supervision of a single trainer or training partnership during the entire time frame of the study. The filtered sample included a total of 31,441 horses representing offspring from 2,269 sires and 22,716 dams. The sample consisted of 1,743 (5.5%) intact males, 14,244 (45.3%) females, 15,444 (49.1%) geldings, 8 (<0.1%) cryptorchids and 2 (<0.1%) horses where the sex was not listed in the raw data provided by RISA.

Best Race Track Condition. Horse races in Australia are classed according to the previous performance of the horse and consist of ‘restricted’ and ‘open’ classes. Restricted races place conditions on horses eligible to race and can be restricted by age, sex, and/or number of previous wins (maidens, class 1 to 6 in increasing order of performance). Open class races have fewer restrictions based on previous performance (although they may be limited by sex and age) and are thus of a higher class than restricted races. The highest class of horse races are black type races, consisting of Listed, Group 3, Group 2 and Group 1 races (in increasing order of difficulty and prestige). Turf tracks in Australia are rated based on 5 categories (fast, good, dead, slow, heavy) and on a scale of 1 to 10 (Table 1).

Table 1: Australian turf track ratings

Category	Scale	Description
Fast	1	A dry hard track
Good	2	A firm track
Good	3	Ideal track with some give
Dead	4	Track with give, better side of dead
Dead	5	Significant amount of give, worse side of dead
Slow	6	A mildly rain effected track, better side of slow
Slow	7	Rain affected, worse side of slow
Heavy	8	Soft track, just into heavy range
Heavy	9	Very soft, genuine heavy
Heavy	10	Very soft, wet and muddy, heaviest category

Best race track condition (BRTC) was recorded as the category rating of the track in which a horse won its highest class of race in Australia. For horses with multiple wins at the same class of racing over a variety of track ratings, the category rating of the track for the race with the largest amount of prize money was chosen.

Best Average Finish Position Track Condition. The average position in which a horse finished under each category track rating was calculated for each horse. Best average finish position track condition (BAFPTC) was recorded as the category rating of the track in which a horse had its best average finish position.

Best Earnings Per Start Track Condition. Earnings per start under each category track rating were calculated for each horse. Best earnings per start track condition (BEPSTC) was recorded as the category rating of the track in which a horse had the highest earnings per start.

Heritability. Analyses were carried out using a single trait animal model in ASReml-R (R Development Core Team 2011). Sex and colour were included as fixed effects while trainer and horse were included as random effects. Cryptorchids and horses with no documented sex were excluded from the analysis (n = 10). Only fixed effects and covariates with a Wald-test $P<0.05$ were retained in the final model.

RESULTS

Descriptive statistics, stratified by sex, of BRTC, BAFPTC, and BEPSTC are shown in Tables 2, 3, and 4. Analysis of BRTC, BAFPTC, and BEPSTC yielded heritability estimates of 0.03 ± 0.007, 0.04 ± 0.008, and 0.03 ± 0.007, respectively. Sex and trainer were significant ($P < 0.01$) for all traits and were retained in the final models. Colour was not significant ($P = 0.06 - 0.40$) for any trait and was therefore dropped from the final models.

Table 2: Descriptive statistics, stratified by sex, of best race track condition for a sample of Thoroughbreds racing in Australia between 2000 and 2010

Best race track condition	Sex				
	Intact males	Females	Geldings	Cryptorchids	Not listed
Fast	67	565	663	0	0
Good	1016	8147	8912	5	1
Dead	370	2839	2869	1	0
Slow	183	1557	1682	2	0
Heavy	107	1136	1318	0	1
Total	1743	14244	15444	8	2

Table 3: Descriptive statistics, stratified by sex, of best average finish position track condition for a sample of Thoroughbreds racing in Australia between 2000 and 2010

Best average finish position track condition	Sex				
	Intact males	Females	Geldings	Cryptorchids	Not listed
Fast	102	819	1118	0	0
Good	555	4313	4496	2	1
Dead	443	3507	3441	3	0
Slow	394	3145	3514	2	0
Heavy	249	2460	2875	1	1
Total	1743	14244	15444	8	2

Table 4: Descriptive statistics, stratified by sex, of best earnings per start track condition for a sample of Thoroughbreds racing in Australia between 2000 and 2010

Best earnings per start track condition	Sex				
	Intact males	Females	Geldings	Cryptorchids	Not listed
Fast	95	685	923	0	0
Good	764	6047	6356	4	1
Dead	458	3453	3607	1	0
Slow	254	2361	2499	3	0
Heavy	172	1698	2059	0	1
Total	1743	14244	15444	8	2

DISCUSSION

On a wet track, mud and dirt are often kicked back into the faces of the horses that sit back in the field, potentially resulting in a dry track preference for horses that are put off by flying debris. While this debris may unfavourably affect these horses, it is just as likely to play a favourable role for horses that are unfazed by the flying mud, and is just one example of why a horse may finish in a higher position on a wet track compared to a dry track. In the current study BRTC, BAFPTC, and BEPSTC were used to assess each horse for its "preferred" track condition and to estimate the heritability of this preference. Heritabilities for BRTC (0.03 ± 0.007), BAFPTC (0.04 ± 0.008) and BEPSTC (0.03 ± 0.007) were estimated to be very low; however, it is interesting to note that a similar trait used to evaluate a horse's ideal race distance, has been shown to be significantly heritable ($h^2 = 0.61$-0.98) (Williamson and Beilharz 1996; Velie *et al*. [Under Review]). Because BRTC assumes that winning a race of lower class is always better than placing in a race of higher class, it was thought that the true "preference" of a horse may not be accurately assessed using BRTC. With this in mind, BAFPTC and BEPSTC were also analysed as these traits were able to account for a superior finish position without a horse having won the race. Unfortunately, although arguably a better assessment of a horse's track "preference", both BAFPTC and BEPSTC yielded heritability estimates less than 0.05, providing evidence to refute the racing of progeny under similar track conditions to that of their parents based solely on the track condition "preference" of the parents.

Multiple theories have been put forward as to why certain horses are able to perform well on wet tracks and others show a distinct "dislike" for wet track conditions. There is no doubt that the genetic composition of a horse's dam and sire significantly contributes to how well it performs on the racetrack (Ekiz *et al*. 2005; Ekiz and Kocak 2007; Bakhtiari and Kashan 2009; Binns *et al*. 2010; Hill *et al*. 2010). Our results suggest that the sire and dam contributions reflect attributes of

the horse that are separate from its affinity for a specific track condition (Cust *et al.* 2012). Regardless, additional research exploring the genetic contribution to a horse's "preferred" track condition would undoubtedly provide more insight into the reasons behind common observations that horses express an affinity for particular track conditions.

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