BRIEF COMMUNICATION: The prevalence of limb deformities in New Zealand Standardbred foals and their influence on racing success – A preliminary investigation

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Keywords: horse; limb deformity; Standardbred; growth; angular; flexural.

INTRODUCTION

Within the New Zealand racing industry, breeders and purchasers of racehorses seek foals with good conformation as racing and breeding prospects. There is a perceived association between correct conformation and the duration and success of racing careers (Weller *et al.*, 2006a). However, to date there has been limited data on the effect of limb deformities on any parameters of racing success (Morley & Townsend, 1997, Anderson *et al.*, 2004).

Horse racing in New Zealand is a billion dollar industry and the success of the sale of horses as yearlings is vital to the continuing success of New Zealand horses in the international market. With reductions in the annual foal crop of the Thoroughbred and Standardbred it is increasingly important to minimise wastage within the breeding and rearing environment to ensure there is sufficient high quality product available for sale and racing. The first stage in minimising wastage is the quantification of the impact variables on the likelihood of a successful outcome, in this case a racehorse capable of competing for a number of racing seasons.

In Thoroughbreds and Quarter Horses Anderson *et al.* (2004) were able to identify an association of variations in foal conformation with injury during race training by physically scoring foals. However, in the Standardbred, previous studies have focused on the relationship between radiographic abnormalities and racing success. There have been no New Zealand studies to date that have investigated the physical scoring of foals and subsequent racing success in Thoroughbreds or Standardbreds. Although physical scoring may not be as objective as radiographs, it provides some insight into the overall conformation and conformational changes that occur as the foal ages. Anecdotal evidence suggests that foals that have a non-straight conformation of the limbs do not appear to race with the same level of success as foals that have a straight conformation of the limbs (Weller *et al.*, 2006b, van Weeren & Crevier-Denoix, 2006). The primary objective of this study was to investigate the prevalence of angular and flexural limb deformities in New Zealand Standardbred foals and the association of these deformities with racing success.

MATERIALS AND METHODS

Data Collection

Limb deformity data were routinely recorded on two commercial Standardbred stud farms in New Zealand. The clinical inspection of foals, within one day after birth, was carried out on both farms by an experienced equine clinician and/or the foaling attendant. The conformation of the front and hind legs were scored using qualitative scales encompassing: Normal, Varus (Medial deviation), Valgus (Lateral deviation), Flexural deformity (Contracted tendons) and Crooked conformation of the hind limbs.

Foals presenting with a flexural deformity were, if required, routinely given 10 ml of Oxytetracycline (Engemycin®, Intervet/Schering-Plough, Upper Hutt, New Zealand) intravenously. This was repeated one to two times, depending on the response of the limbs. If a foal had severe varus or valgus deviation and the veterinarian deemed it necessary to treat the conformational change, a periosteal strip was performed. Other conservative treatments such as foal confinement and corrective farriery were also used but not recorded in this study. The efficacy of these treatments was not examined in this preliminary study of the prevalence, rather than treatment, of limb deformities. Angular and flexural limb deformities were combined for all statistical analyses and renamed "Limb deformities" (LD), due to the low prevalence of angular deformities.

The data used in this study covered the 2004-05 and 2005-06 breeding seasons and the racing seasons up to 2008-09 when the foals were at the completion of their four (2004-05 foal crop) and three (2005-06 foal crop) year old seasons. Foals that died before 1 September 2007 were excluded from the data to assess racing performance, but were included in the prevalence of angular and flexural limb deformities. Foals that were not born on the

farm were also excluded from the dataset because no data were available about the conformation of these foals.

Performance indices

Performance data were obtained from the online databases of Harness Racing New Zealand (www.hrnz.co.nz) and the Australian Harness Racing Council (www.harness.org.au). From the online databases the following performance indices were used to evaluate racing career and performance; qualifying to race, age of qualifying to race, total number of career starts, total career prize money, total career prize money per start, if exported or not. It was not possible to obtain racing information for the 11 horses exported to the USA. Their data were excluded from the analysis of racing success.

Data analysis

Data on both farms were used to score the prevalence of angular and flexural limb deformities at birth. Data on Farm A were also used to determine if there was a difference in prevalence between fillies and colts and to examine the association of limb deformities and racing performance.

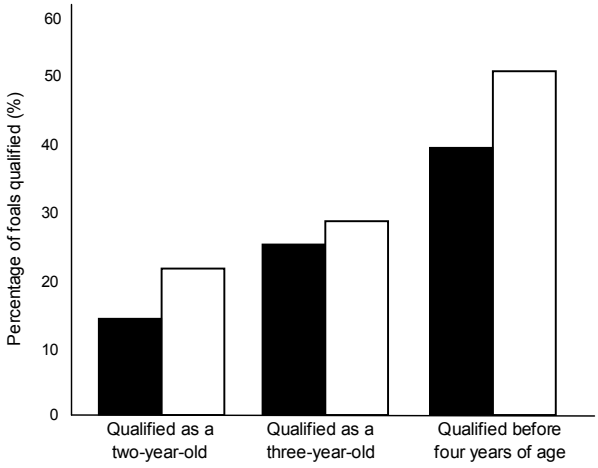
Binary logistic regression was used to examine the effect of foal sex, and sire on the prevalence of LD. Non normally distributed racing performance data was examined using a Mann-Whitney test. All data were analysed using SPSS V17 (SPSS Inc, Chicago, Illinois, USA) with a significance level of $P < 0.05$.

RESULTS

Prevalence

Data were collected on 1,379 foals of which 261 horses were recorded as having an angular or flexural limb deformity at birth. The mean prevalence of LD at birth per year was 19 ± 2 %, although variation between seasons and farms exists, the differences were not significant (Table 1). There was no significant difference detected between prevalence of LD in colts or fillies ($P > 0.1$) nor was there a significant influence of sire on LD ($P = 0.275$).

FIGURE 1: Percentage of foals qualified with (■) and without (□) a limb deformity, from the 2004-05 and 2005-06 foal crops on two commercial New Zealand Standardbred stud farms.



Racing success

Only 19.8% of the foals in this dataset qualified as a two-year-old, 28.8% qualified as a three-year-old and almost half of the foal crop had qualified by four years of age (48.7%). A small proportion of foals qualified after the age of four (12.6%).

There was no significant difference detected in total prize money won, total starts and, total of prize money per start, between horses with or without LD. There was a strong trend that foals without LD were 1.5 (95% CI (1 to 2.4)) ($P = 0.058$) times more likely to qualify before the age of four than those with LD (Figure 1).

A total of 90 horses from the 2004-05 and 2005-06 breeding seasons were exported before 1 August 2007. All of the horses exported to the USA had qualified in New Zealand, emphasising the importance of qualifying at a young age. No horses with LD were exported to the USA and only 13.9% exported to Australia had LD scores as foals.

DISCUSSION

The fact that only 19.8% of the horses in this dataset qualified for racing before the age of two is of concern from an individual and industry

TABLE 1: Prevalence of total limb deformities at birth in 1,379 foals on two commercial Standardbred farms in New Zealand.

Description	Farm 1		Farm 2		Mean ± standard error
	2004-05	2005-06	2004-05	2005-06	
Total number of foals	351	429	266	333	
Number of foals with no limb deformity	280	341	235	262	279 ± 22
Number of foals with a limb deformity	71	88	31	71	65 ± 12
Proportion of foals with a limb deformity (%)	20	21	12	21	19 ± 2

perspective. There is a growing body of evidence to suggest that exercise early in life is associated with greater orthopaedic health and longer racing careers (Barneveld & van Weeren, 1999; Rogers *et al.*, 2008a; Rogers *et al.*, 2008b). For racing administrators it is important that horses start racing as two-year-olds to ensure there is sufficient racing product to maximise betting returns.

The prevalence of LD in this study was higher than in an earlier study carried out in Thoroughbreds (O'Donohue *et al.*, 1992). There have been no previous studies in Standardbreds reporting the influence of LD on racing success. In Thoroughbreds, Weller *et al.* (2006b) found that a valgus conformation of the metacarpophalangeal joint, had a detrimental effect on racing performance and was associated with an increased prevalence of injury. A possible explanation for this is the possible increased load on musculoskeletal structures.

Although there was no significant difference detected in total prize money won, total amount of starts and, total amount of prize money per start, this could be due to the heterogeneous nature of the racing data and the relatively small dataset available for this analysis. The trend for LD foals to qualify for racing later and the finding that only one of the foals exported had LD as a foal, indicates that LD at birth may have an influence on lifetime performance. This study is continuing, and the addition of future foal crops for analysis should provide a more precise measure of the association of LD and racing success. To confirm this requires a larger dataset and greater refinement of the evaluation system.

CONCLUSIONS

Angular and flexural limb deformities at birth may have a negative association with racing performance. The parameter most influenced by LD was the age of qualifying. There was a tendency that foals without LD were 1.5 times more likely to qualify before the age of four. The results obtained in this study emphasize the importance of further studies to obtain a greater understanding of the influence that angular and flexural LD have on racing performance, and further investigation should be carried out into causative factors for LD in horses.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the New Zealand Equine Research Foundation for the funding of this work. A special thanks also to the farm staff for their assistance with the data collection.

REFERENCES

Anderson, T.M.; Mcilwraith, C.W.; Douay, P. 2004: The role of conformation in musculoskeletal problems in the racing Thoroughbred. *Equine Veterinary Journal* **36:** 571-575.

Barneveld, A.; Van Weeren, P.R. 1999: Conclusions regarding the influence of exercise on the development of the equine musculoskeletal system with special reference to osteochondrosis. *Equine Veterinary Journal Supplement* **31:** 112-119.

Morley, P. S.; Townsend, H.G.G. 1997: A survey of reproductive performance in Thoroughbred mares and morbidity, mortality and athletic potential of their foals. *Equine Veterinary Journal* **29:** 290-297.

O'Donohue, D.D.; Smith, F.H; Strickland, K.L. 1992: The incidence of abnormal limb development in the Irish thoroughbred from birth to 18 months. *Equine Veterinary Journal* **24:** 305-309.

Rogers, C.W.; Firth, E.C.; Mcilwraith, C.W.; Barneveld, A.; Goodship, A.E.; Kawcak, C.E.; Smith, R.K.W.; Van Weeren, P.R. 2008a: Evaluation of a new strategy to modulate skeletal development in racehorses by imposing track-based exercise during growth: The effects on 2-and 3-year-old racing careers. *Equine Veterinary Journal* **40:** 119-127.

Rogers, C.W., Firth, E.C., Mcilwraitht, C.W., Barneveld, A., Goodship, A.E., Kawcak, C.E., Smith, R.K.W.; Van Weerew, P.R. 2008b: Evaluation of a new strategy to modulate skeletal development in Thoroughbred performance horses by imposing track-based exercise during growth. *Equine Veterinary Journal* **40:** 111-118.

Van Weeren, P.R.; Crevier-Denoix, N. 2006: Equine conformation: clues to performance and soundness? *Equine Veterinary Journal* **38:** 591-596.

Weller, R.; Pfau, T.; May, S.A.; Wilson, A.M. 2006a: Variation in conformation in a cohort of National Hunt racehorses. *Equine Veterinary Journal* **38:** 616-621.

Weller, R.; Pfau, T.; Verheyen, K.; May, S.A.; Wilson, A.M. 2006b: The effect of conformation on orthopaedic health and performance in a cohort of National Hunt racehorses: preliminary results. *Equine Veterinary Journal* **38:** 622-627.