BRIEF COMMUNICATION: Preliminary examination of sport horse competition data for genetic evaluation

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INTRODUCTION

A sport horse can be defined as a horse which participates in one of the three equestrian disciplines represented at Olympic level. These disciplines are dressage, eventing and show jumping. There are approximately 5,000 horses registered for equestrian sport in New Zealand (Rogers & Firth, 2005).

Despite the relatively small size of the New Zealand equestrian sport population, the New Zealand industry has been successful in International sport with the production of predominantly show jumpers and event horses for the export market (Rogers, 1993; Rogers & Firth, 2005). However, in contrast to the European equestrian sport communities, the New Zealand industry lacks a formal integration of the breeding and sport sectors (Huizinga & Vandermeij, 1989; Koenen *et al*., 2003). This lack of integration means that performance data is not readily available to the breeding sector and conversely the pedigree data is sometimes incompletely recorded by the sporting sector.

Many of the measures of performance recorded for equestrian sport are often not suitable for estimation of genetic merit without transformation. The solution to this is varied amongst the major sport horse breeding nations depending on the data recorded by the competition sector. In Germany and France, data utilised for genetic analysis are logarithmic annual earnings and logarithmic annual earnings per start respectively. In Sweden and The Netherlands, data available is a point based system with logarithmic accumulated lifetime upgrading points and logarithmic lifetime points used respectively (Huizinga & Vandermeij, 1989; Langlois & Blouin, 1997; Langlois & Blouin, 1998; Olsson *et al*., 2008). Within New Zealand the competition data recorded by Equestrian Sport New Zealand has been examined for the estimation of career length, but has not yet been examined for the genetic evaluation of performance. The objective of this paper is to provide the preliminary examination of the competition data recorded and its suitability for genetic analysis.

MATERIALS AND METHODS

Dataset

Official performance records for the 2008/09 season for the disciplines of eventing, dressage and show jumping were obtained from Equestrian Sport New Zealand, the body responsible for administering equestrian sport within New Zealand. Data were provided as an electronic extract of each horse's performance, total points and prize money won in 2008/09 season and another extract of rider and horse details which contained a unique registration number, horse's name, sire name and breed code. Within MicroSoft Excel (Microsoft Corporation, Redmond, Washington, USA), data were manipulated, cleaned and uploaded to a customised MS access database. Data linking horse performance with sire and riders records were extracted for analysis.

Performance measures

The criteria to quantify performance differed between the disciplines. For show jumping only placings were recorded, whereas for eventing and dressage each horse had individual start records. The performance data suitable for analysis was number of starts and total points awarded for dressage and eventing, and total annual prize money for show jumping. Within dressage, points are awarded according to the horses final percentage score for each event being 1, 3, 5 and 7 points irrespective of grade of competition. Points awarded in eventing use an ascending scale, with increasing points awarded with higher grades, such that a win earns 6, 9 or 12 points for Novice, Intermediate or Advanced grade. Prize money won in show jumping is positively associated with height of jumps and difficulty of competition, and is usually allocated with each placing generally receiving 60% of the prize money given to the placing above it.

To examine the effect of rider level on performance records riders were categorised into Professional, being riders of three or more horses in the season, and Amateur, being the rider of up to two horses registered for sport in a given season (Rogers & Firth, 2005).

TABLE 1: Description of the data set for the equestrian disciplines of dressage, eventing and show jumping during the 2008/09 competition season. IQR = Interquartile range; NA = Not applicable.

Parameter	Sport		
	Dressage	Eventing	Show jumping
Number of horses registered	1,125	960	1,821
Total number of riders	860	583	950
Number of Professional riders	51	115	60
Total number of starts during season	5,138	4,133	NA
Horses with no sire listed (%)	12.5%	17.6%	19.5%
Number of sires represented	557	476	250
Sires contributing only 1 progeny record	414	321	501
Percentage of horses without points (dressage and eventing) or placings (show jumping) recorded	2%	79%	75.5%
Percentage of horses without prize money recorded	53.9%	85.1%	76.1%
Median (IQR) points (dressage and eventing) and prize money (show jumping)	102 (32 – 266)	0 (0 – 0)	78 (25 – 280)
Median (IQR) transformed points (dressage and eventing) and prize money (show jumping)	2.02 (1.56 – 2.44)	0 (0 – 0)	4.38 (3.27 – 5.69)

Statistical analysis

Descriptive analysis was performed using SAS v9.1.3 (SAS Institute Inc., Cary, North Carolina, USA) and PASW Statistics 18. The raw data and the transformation of the raw data plus 1, were examined for normality using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Data used for transformation were for all animals with performance records for the 2008/09 season. Hence, all horses registered for the season in dressage and eventing, and all horses which were placed during the season in show jumping, were included in the analysis. Show jumping horses with no records were not included. For all analyses significance was set at a P value of <0.05.

RESULTS

During the 2008/09 season there were 1,125, 960 and 1,821 horses registered for the equestrian disciplines of dressage, eventing and show jumping respectively. Sire was not recorded for 12.5%, 17.6% and 19.5% of the registered horses within each discipline. There were 51, 115 and 60 riders with three or more horses registered for dressage, eventing and show jumping (Table 1).

Within the horses registered for eventing 78% had no points, and 85.1% had no prize money recorded during the 2008/09 competition season. In dressage 2% of the horses had no points and 53.9% had no prize money recorded. In show jumping 75.5% of the horses had no placings and 76.1% had no prize money recorded. Amongst the recorded sites, 414, 321 and 501 sires had only one progeny recorded for dressage, eventing and show jumping respectively (Table 1).

Tests for normality identified that none of the raw performance data were normally distributed. Log_{10} transformation of the data plus 1, significantly improved the distribution of the performance data, though the large number of horses with no performance records continued to skew the distributions (Figure 1). Removal of horses with no performance records resulted in the transformed data being normally distributed ($P < 0.05$). There was no significant effect of rider level as being Professional or Amateur, on any measure of performance.

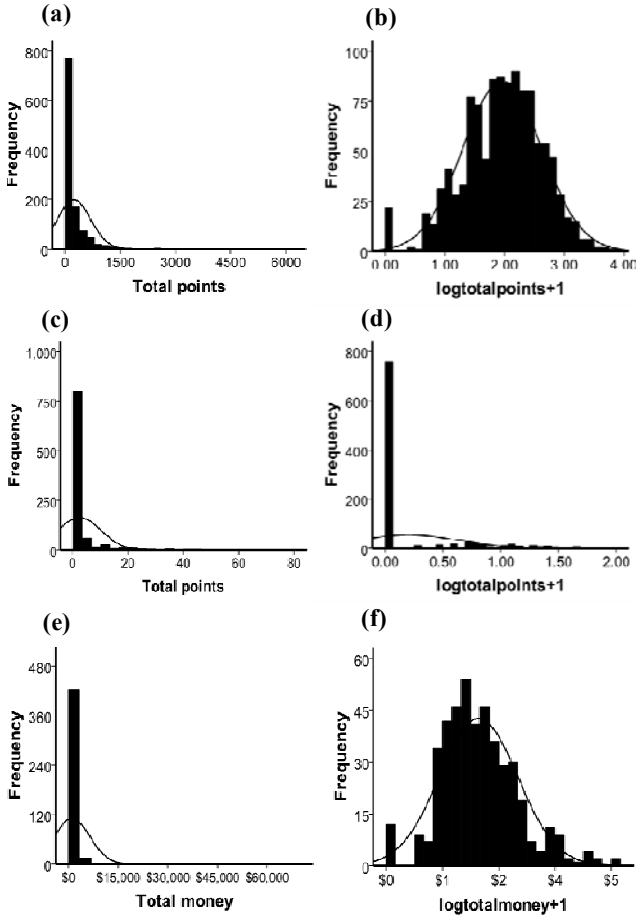
DISCUSSION

The size of the New Zealand sport horse industry is relatively small by international standards, and is relatively heterogeneous with a large number of sires having only a few progeny recorded for equestrian sport (Rogers & Firth, 2005). The sparseness of the relationship matrix could be improved with greater recording of pedigree information. In Germany, where many studbooks provide pedigree data, a standardised format for recording pedigree information is provided by the breeding section of the German national equestrian federation. If the data from the various studbooks breeding sport horses in New Zealand could be combined independently then there would be greater accuracy in the pedigree data and efficiency in combining pedigree and competition data.

A major problem with most sport horse competition data are that many of the horses fail to obtain a record of performance as placings are generally recorded only down to fifth place. Therefore, in any given competition only the top five horses receive a record. This problem is not unique to the New Zealand data and is a major problem with the use of competition data for genetic analysis (Tavernier, 1990).

Within the current New Zealand dataset, logarithmic transformation yielded data with a distribution that best reflects the biology of the traits

FIGURE 1: Histograms of (a), (c), (e) raw and (b), (d), (f) transformed (log_{10} data plus 1) data for the equestrian disciplines of (a), (b) dressage (points); (c), (d) eventing (points) and (e), (f) show jumping (prize money).



of interest. Logarithmic transformation of data is commonly used by most sport horse breeding nations to generate data suitable for genetic analysis (Huizinga & Vandermeij, 1989; Langlois & Blouin, 1997; Langlois & Blouin, 1998; Olsson *et al*., 2008). The difficulty with the current data set was the use of points for dressage and eventing and prize money for show jumping as measures of performance. It would be preferable to utilise a similar system across all disciplines, as is the situation in other sport horse breeding countries. Because of the difficulty in assessing the relative level of performance with a point based system where it is easier to obtain points at lower levels than higher levels, the best choice may be to utilise prize money recorded (Aldridge, 2000). The comparison of data for horses across years, or the use of a measure based on lifetime performance, may minimise this bias. However, before this could be initiated there would have to be an increased emphasis by the dressage and eventing disciplines in recording the prize money won. However, the logistical difficulties in enforcing compliance need to be thoroughly investigated.

In summary the data recorded by Equestrian Sport New Zealand after transformation appears suitable for genetic analysis. It is important to examine the industry structures in place within European sport horse breeding nations to identify mechanisms for greater accuracy and completeness of the relationship matrix.

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