The influence of horse gender on eventing competition performance

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Abstract
The study undertook comparative analysis of horse gender and eventing performance. Limited previous research has investigated the impact horse gender may have on performance. However, many competitors have a preference for one gender over another (normally geldings). The study sampled five levels of the sport (intro, pre-novice, novice, intermediate and advanced) and investigated dependent variable penalty scores within the dressage, show jumping and cross-country phases; additionally, final penalty score, rank in competition and lifetime score were analysed. Results indicated the effect of gender to be limited. Issues relating to sample size, data structure and scoring mechanisms are discussed further.

Keywords: eventing; gender; performance

Introduction
Currently, our understanding of differences in equine competition performance relating to horses’ gender is limited. Differences in performance have been observed within racehorse and trotter populations1–3. The relationship, however, is not simplistic. If these observed differences are considered to be significant and occurring in a systematic manner, their implications need careful thought. Particular consideration would need to be given to their effect on potential selection decisions whether they are being made in a sporting or breeding context.

Physical and psychological differences between the genders need to be analysed in order to understand not only which gender may be superior but also why. Limited literature has been published on the physiological differences between genders in horses, yet sexual dimorphism occurs in horses. Males tend to be taller and heavier than females and horsemen often feel that stallions are more muscular than geldings, although body composition is rarely measured in horses. Physiological differences in muscle fibre proportions between sexes would suggest that mares have less power and stamina with lower proportions of type IIA muscle fibres, and therefore fatigue more quickly than stallions4. However, no such differences have yet been reported between mares and geldings4.

Harkins et al.5 found gender differences in the performance of Thoroughbred racehorses; males showed no significant difference in performance between solo training gallops and competitive runs, but females ran significantly more slow during competitive runs. However, no physiological or psychological reasoning for these results was given other than impaired run times during competition in females may be stress induced. Associations between gender and performance relating to heart rates during sub-maximal exercise in Thoroughbred racehorses have been suggested5–7. A significant difference was found in the heart rates between male and female horses when cantering a 500 m circular track at submaximal levels, which suggests that the aerobic capacity of males may be higher than females6.

There have been few reports on the analysis of competition performance between mares, geldings and stallions at different levels of competition and between disciplines. Whitaker et al.8 investigated scoring patterns in eventing competition at six pre-novice events. The results showed very little variation in final penalty scores (0.8 penalties) between mares and geldings. However, a significant variation between mares and stallions (with stallions scoring on average...
jumping events; Whitaker et al.9 studied show jumping competition and suggested that stallions were reaching a higher percentage of clear jumping rounds than both mares and geldings and that mares refused jumps more frequently than geldings and stallions. Whitaker et al.10 indicated that within the progeny groups of elite eventing sires, male performance was superior when measured by points won over the animal's whole competitive career. These pieces of research would suggest that mares generally and stallions specifically have a superior performance than mares. However, Whitaker et al.9 only looked at one level of competition, while Marsalek et al.'s9 work was focused on international show jumping events; Whitaker et al.10 reviewed only progeny of elite stallions and only lifetime performance.

This study aimed to investigate the effect of horse gender on competition performance within eventing. The stated hypothesis, horses' gender has no significant effect on eventing competition performance, was tested. A sample of all levels of affiliated national level competition run within the UK is used as the studied population. Performance measures used include phased and final competition scores as well as final rank in competition.

**Materials and methods**

Eventing (also known as horse trials) is an equestrian event that combines three disciplines: dressage, show jumping and cross-country into one competition11. The penalty scores from each of the three phases are combined to produce an overall total penalty score (cumulative basis). The competitor with the overall lowest penalty score is ranked first in competition. The five main levels of affiliated national level competitions are intro (Intro), pre-novice (PN), novice (N), intermediate (Int) and advanced (Adv), with competitions becoming progressively more difficult and complex. Details of the nature and structure of British Eventing disciplines have been described previously8. A total of 185 events were run in 2006 in the United Kingdom.

The dataset comprised 1156 horses (1.7% of all competition entries) and the data were analysed by the level of competition. Competition performance records were described as dependant variables; gender (mare, gelding and stallion) was defined as the independent variable. Dependent variables used included dressage penalty scores (D), show jumping penalty scores (SJ), show jumping time penalty scores (SJT), cross-country jumping penalty scores (XCJ), cross-country time penalty scores (XCT) and final penalty score. Final rank in competition and lifetime points score were collected as additional dependent variables. Lifetime point scores are only awarded to those horses competing at the novice, intermediate and advanced levels. They are based on the level of competition, final rank in competition and the number of total competitors within competition. All data were collated from the British Eventing web-sourced database11 and details of horse gender were collated from event programmes. Data were found to be skewed at all levels for SJJ, SJT, XCJ, XCT and total penalty scores; therefore, all data were transformed using the Bartlett’s (log x + 1)12 approach. This reduced the skewness of the data to a suitable level before appropriated parametric statistical analysis was undertaken.

Descriptive statistics and measures of dispersion defined by the independent variables were returned for all dependent variables at the various levels of competition. Differences between gender, mean rank in competition and mean penalty scores in D, SJ, SJT, XCJ XCT and total penalty score were assessed using independent t-tests13 for all levels of competition. Stallions were found competing within the pre-novice, novice and intermediate levels of competition. However, the small numbers made comparative analysis impossible; for the pre-novice and intermediate levels, only one and two stallions were present, respectively. Within the novice level, six stallions were present; however, a Fmax test13 indicated inequality of variances (P > 0.05) when stallions were included within the analysis. Comparative analyses to establish whether significant differences were present for final rank in competition (by level) were undertaken via a Mann–Whitney U-test13.

All horses that failed to complete a competition were excluded from the data analysis. Such horses present incomplete performance records and make analysis much more complicated. Non-completion of competition is a complex and multi-factorial issue. However, evidence from other studies (in eventing)8 would suggest that such non-completers can be described as missing at random. Therefore, the exclusion from the analysis is an acceptable approach.

**Results**

**Data structure**

Of the 1156 horses, 170 completed intro level, 306 completed pre-novice level, 372 completed novice level, 215 completed intermediate level and 91 completed advanced level. The percentage of mares performing is seen to fall as level of competition rises, 31.2% at intro level to 9.9% at advanced level (Fig. 1). The number of animals with no gender reported is observed to be comparatively consistent throughout the levels (minimum 4.3% advanced level, maximum 6.5% novice level). Within the sample studied stallions are only observed to compete at the pre-novice, novice and intermediate levels and the numbers are small (n = 1 to 6).
Phase and final penalty score

Table 1 returns mean final penalty scores for each phase of competition as well as overall final penalty score by gender and level.

Intro

No significant differences were observed within any phases of competition or for final penalty score. Geldings did, however, have a final penalty score of 3.4 points lower than mares. A relationship that could be described as towards a trend ($P = 0.071$) was reported for SJT; this amounted to mares scoring 0.1 penalties lower than geldings.

Pre-novice

No significant differences were observed within the phases of competition D, SJT, XCJ and XCT and final penalty score. Geldings did, however, have a final penalty score of 3.4 points lower than mares. Mares scored 0.4 penalties lower than geldings for SJT ($t = -2.053$, $df = 231$, $P < 0.05$); unequal variances assumed ($F = 6.263$, $P < 0.05$) with geldings scoring 0.9 penalties lower; XCT ($t = 1.947$, $df = 340$, $P = 0.052$) with geldings scoring 2.2 penalties lower; final penalty score ($t = 1.743$, $df = 340$, $P = 0.082$), with geldings scoring 4.6 penalties lower.

Intermediate

No significant differences were observed within D, SJT, XCJ and XCT phases of competition or for final penalty score. Mares did, however, have a final penalty score of 3.4 points lower than geldings. Trends were, however, observed for D ($t = 1.729$, $df = 203$, $P = 0.085$), with geldings scoring 1.8 penalties lower. A difference ($t = -2.550$, $df = 203$, $P < 0.05$) was reported within the SJJ phase of competition, mares scoring 2.0 penalties lower than geldings.

Table 1  Mean-phased and final penalty scores for gender by competitive level

<table>
<thead>
<tr>
<th>Level</th>
<th>Gender</th>
<th>D</th>
<th>SJJ</th>
<th>SJT</th>
<th>XCJ</th>
<th>XCT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro</td>
<td>Mare</td>
<td>38.2 (0.87)</td>
<td>3.1 (0.50)</td>
<td>0.5 (0.28)</td>
<td>13.3 (3.09)</td>
<td>6.8 (1.15)</td>
<td>62.0 (4.16)</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>38.0 (0.50)</td>
<td>4.7 (0.48)</td>
<td>0.6 (0.26)</td>
<td>8.3 (1.47)</td>
<td>7.0 (0.99)</td>
<td>58.6 (2.41)</td>
</tr>
<tr>
<td>PN</td>
<td>Mare</td>
<td>38.3 (0.78)</td>
<td>5.0 (0.60)</td>
<td>0.2 (0.11)</td>
<td>11.8 (2.62)</td>
<td>4.7 (0.86)</td>
<td>60.1 (3.35)</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>37.8 (0.42)</td>
<td>4.3 (0.32)</td>
<td>0.6 (0.16)</td>
<td>8.7 (1.26)</td>
<td>5.4 (0.60)</td>
<td>56.7 (1.19)</td>
</tr>
<tr>
<td>N</td>
<td>Mare</td>
<td>36.6 (0.56)</td>
<td>4.7 (0.52)</td>
<td>0.7 (0.35)</td>
<td>5.0 (1.49)</td>
<td>14.0 (1.16)</td>
<td>61.0 (2.79)</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>35.8 (0.31)</td>
<td>3.8 (0.27)</td>
<td>0.2 (0.07)</td>
<td>4.9 (0.80)</td>
<td>11.8 (0.58)</td>
<td>56.4 (1.38)</td>
</tr>
<tr>
<td>Stallion</td>
<td>Mare</td>
<td>31.9 (2.64)</td>
<td>0.7 (0.67)</td>
<td>0</td>
<td>0</td>
<td>3.5 (1.91)</td>
<td>36.1 (3.77)</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>31.9 (2.64)</td>
<td>0.7 (0.67)</td>
<td>0</td>
<td>0</td>
<td>3.5 (1.91)</td>
<td>36.1 (3.77)</td>
</tr>
<tr>
<td>Int</td>
<td>Mare</td>
<td>38.9 (0.95)</td>
<td>4.0 (0.85)</td>
<td>0.9 (0.75)</td>
<td>7.1 (3.51)</td>
<td>17.4 (2.06)</td>
<td>68.2 (5.30)</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>37.1 (0.44)</td>
<td>6.0 (0.45)</td>
<td>0.8 (0.29)</td>
<td>8.3 (1.22)</td>
<td>19.3 (1.08)</td>
<td>71.6 (2.40)</td>
</tr>
<tr>
<td>Adv</td>
<td>Mare</td>
<td>37.7 (2.84)</td>
<td>6.2 (1.51)</td>
<td>0.1 (0.11)</td>
<td>2.2 (2.22)</td>
<td>19.2 (2.55)</td>
<td>63.7 (4.34)</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>38.1 (0.53)</td>
<td>5.5 (0.71)</td>
<td>1.4 (0.46)</td>
<td>6.7 (1.53)</td>
<td>22.5 (1.14)</td>
<td>73.1 (2.94)</td>
</tr>
</tbody>
</table>

Standard error stated within parentheses.
Advanced

No significant differences were observed within any phases of competition or for final penalty score. Mares did, however, have a mean final penalty score of 9.4 points lower than geldings.

Final rank in competition and lifetime points

Figure 2 shows comparison of median rank in competition by gender. No significant differences were observed. It can, however, be noted that at the intro and pre-novice levels mares are ranked slightly higher (worse), while at the higher levels intermediate and at the advanced level they are ranked slightly lower (better) than geldings. The analysis of mean lifetime points awarded (Fig. 3) showed no significant differences between mares and geldings when analysed by level (novice, intermediate or advanced). It is, however, noted that at advanced level geldings accrued on average more than twice the number of points than mares. Median points awarded for all three levels (novice, intermediate and advanced) were zero for all genders and levels. When the novice, intermediate and advanced levels were considered together as a whole, geldings’ mean points score was noted at 1.85 points, while mares’ score was noted at 1.28 points; $t = -2.239$, df = 321, $P < 0.05$; unequal variances assumed ($F = 5.454$, $P < 0.05$).

Stallions

Due to the very low number of stallions within the dataset, appropriate comparative statistical analysis was not possible. However, within the novice level of competition, six stallions competed, and it is interesting to note their performance. Overall, stallions were ranked much lower in competition, with a median rank of 1.5. Median rank for both mares and geldings was 15. Their median lifetime point’s accumulation was 5.5 compared with 0 for both mares and geldings. Within the dressage phase, stallions scored 4.7 and 3.9 penalties lower than mares and geldings, respectively, 4.0 and 3.1 lower for SJJ, 0.7 and 0.2 lower for SJT, 5.0 and 4.9 lower for XCJ, 10.5 and 8.3 lower for XCT, and 24.9 and 20.3 lower for final penalty score.

Discussion

This study shows that within the population studied there appears to be very little difference when comparing the performances measured by penalty score (phased and final), final rank in competition or lifetime points between mares and geldings. Previously, difference in performance has been observed between female and male horses1–3. It is, however, likely that the relationship between performance and equine gender is not necessarily easy to understand or one-dimensional. Differences between human male and female performances in sporting competition have been noted; statistically, the male performs better than the female (Patterson et al., 2005)14. However, the exact nature of this relationship is more difficult to quantify. It has been suggested that these gender differences may disappear when the fatigue/endurance of a sport increases (Coast et al., 2004)15.

The percentage of mares performing is observed to steadily drop as the level of competition rises: 31.2% Intro, 25.2% PN, 22.8% N, 18.6% Int and 9.9% Adv. This pattern is similar to that reported previously at various levels of the sport9,10. However, the commonly held assertion that geldings are better animals for competition in terms of performance is not supported. The study indicates that there are very few significant differences in performance between the two genders. Where differences are apparent, the level of these differences is comparatively marginal. When considering final rank in competition, it is interesting to note (although not found to be significant) that it is in fact mares that have the lower median rank at the highest level of competition.
Within the studied population, the small number of stallions competing \((n = 9)\) made comparative work impossible. At novice level of competition, the observed stallions consistently outperform both mares and geldings throughout all phases of competition and in overall final rank in competition. Stallions are expected to be the future sires of the next eventing generation; it may, therefore, be suspected that their performance may be superior. However, it is of concern that so few stallions are undergoing performance testing within a competition environment. It should also be considered that, because of the relatively small number of mares competing at intermediate and advanced levels, establishing comparative differences becomes difficult. It is noted that at intermediate level mares’ final penalty score was 3.32 points lower than geldings; while at advanced level, it was 8.26 points lower. Neither of these differences, however, proved to be significant. Further consideration needs to be given to the possibility that mares may retire earlier than geldings or have an interrupted performance career to undertake breeding duties. Within this study, it was not possible to integrate data to analyse this potential effect; however, further study of this would be worthy of consideration.

It is interesting to consider that the median lifetime points won by either gender at all levels of competition were zero. This effectively means that a large proportion of the population is recording no lifetime winnings from competition. The problems of non-linearity in scoring systems and the consequential hyper-geometric distributions have been described elsewhere\(^1\)\(^6–\)\(^1\)\(^8\). However, comparative assessment (using median scores) between mares and geldings using lifetime winnings is therefore impossible. The situation is confused further if arithmetic means are used at the novice and intermediate levels, when no meaningful difference is observed \((0.71 \text{ vs. } 1.14 \text{ at novice, } 2.4 \text{ vs. } 2.5 \text{ at intermediate})\). At advanced level, comparison of mean scores shows that geldings collect over twice as many points \((5.2)\) as mares \((2.2)\), this is despite the median lifetime points being zero for both groups. Due consideration needs to be given by the administrators of the sport to the current methodologies adopted for lifetime scoring.

When assessing and analysing performance data, a prudent approach is recommended. Particular regard has to be given to the potential influence of environmental factors and whether they are random or systematic fixed effects. Knowledge of such effects within equine competition is limited; however, previous authors\(^1\)\(^9–\)\(^2\)\(^2\) have highlighted that they are occurring. Within the data assessed, it is likely that rider effect may be exerting an influence. Jansseen et al.\(^2\)\(^3\) expressed the view that rider effect is likely to be a confounding factor. Skilled riders are more likely to select potentially better horses at a younger age. They also stated that, at the highest levels of competition, rider effect may be minimal. Furthermore, they concluded that, at the lower levels of competition, skilled riders are exerting a more influential effect on potential performances than less skilled riders. Significant difference has been observed within the dressage phase of competition at both the novice and pre-novice levels\(^2\)\(^4–\)\(^2\)\(^6\). Additional work has highlighted differences at advanced level within the cross-country phase\(^2\)\(^5\).

Consideration of gender in relation to behaviour is worthy of reflection. Reduction in desired level of performance has been demonstrated within equines as a direct result of behaviour. Various authors\(^2\)\(^6–\)\(^2\)\(^8\) have highlighted the differences in manifestation of sexual behaviour and how this might have a negative impact on performance. The need and methodologies that may be adopted to reduce these behaviours have been discussed and reviewed elsewhere\(^2\)\(^6–\)\(^2\)\(^8\). The use of training and management as a tool for controlling behaviour may be more effective in the male horse (stallion or gelding). Visuo-spatial ability in males is superior to that of females in most species, including horses\(^2\)\(^9\).

In conclusion, there appears to be very little difference in the performance of mares and geldings at all levels of eventing, despite a preconception that geldings are more suitable competition animals. It is recommended that future study involves a considerably larger studied population. The non-significant lower final penalty scores of mares at the higher levels are particularly worthy of consideration. Additional study of the effect of potential confounding factors, such as horses’ age or rider’s skill, need to be considered within any further work. It is impossible to undertake comparative analysis of stallions; however, where they do perform their performance is considerably better than both that of mares and geldings. The use of lifetime scores as a measure of performance results in a large proportion of horses being awarded no score. Reflection and consideration of scoring mechanisms are needed.

References
