

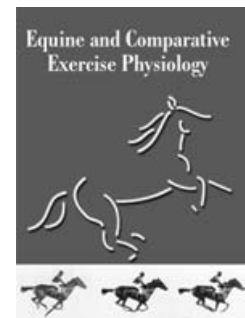
Warm-up in dressage competitions: association with level, competition type and final score

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Research Paper

Abstract

Warm-up of 267 competitors at British Dressage affiliated competitions was observed, including competitors at novice (N) ($n = 104$), medium (M) ($n = 65$), Prix St Georges (PSG) ($n = 60$) and Grand Prix (GP) ($n = 38$) levels. Competitions were classified as local ($n = 103$), regional ($n = 57$) and national championship ($n = 107$) events. Overall, the mean warm-up duration for competitors at dressage competitions was 29 min 53 s. Total warm-up duration was 25 min 23 s $\pm$ 10 min 2 s (mean $\pm$ SD) at N level; 31 min 32 s $\pm$ 11 min 32 s at M level; 32 min 53 s $\pm$ 11 min 19 s at PSG and 34 min 34 s $\pm$ 10 min 10 s at GP. Mean proportion of walk, trot and canter at each level was N: walk = 39.26%, trot = 40.31%, canter = 20.43%; M: walk = 43.77%, trot = 32.54%, canter = 23.69%; PSG: walk = 38.53%, trot = 31.03%, canter = 30.43% and GP: walk = 38.79%, trot = 33.26%, canter = 27.95%. There was no effect of rider experience, but level and type of competition affected the proportion of time spent in different paces and total time of warm-up, which was increased at higher levels and championships. Increased warm-up time and specific warm-up design were positively associated with final score at novice and Prix St Georges levels.

Keywords: dressage; exercise; equine

Introduction

Warm-up prior to competition is considered an important component of preparation to enhance performance and potentially reduce injury risk^{1–6}. Both physiological and psychological benefits have been ascribed to warm-up^{7,8}. However, there is limited knowledge of how riders or the horse–rider combination can optimize warm-up to augment performance and minimize injury. In order to improve warm-up strategies, investigation is required into the current types of warm-up strategies and how they may affect performance.

Although there has been some investigation into the effect of warm-up on horses in preparation for racing^{9–13}, there have been few studies into warm-up for other equestrian sports. Dressage is a sport with increasing popularity in the UK. In a previous report from Germany, it was found that dressage horses worked on average for 60 min on a competition day¹⁴, but there are no reports of the duration and type of warm-up taking place at current competitions in the UK. It has been suggested by riders and trainers that type of warm-up at a dressage competition

can affect performance¹⁵; however, this has not previously been investigated.

This study aimed to provide baseline data on the duration and breakdown by pace of warm-up at dressage competitions in the UK summer season, to investigate whether these were affected by the level of competition, type of competition and rider experience, and to investigate whether there is an association between warm-up and final score. It was hypothesized that warm-up at higher levels of competition would be longer than at lower levels; that at championships would be longer than at local level and that increasing warm-up duration would be associated with a better result in competition.

Materials and methods

Warm-up of competitors at British Dressage (BD) affiliated dressage competitions was observed. Competitors were divided by level and type of competition. Level was classified based on the BD competition

scale, and included novice (N), medium (M), Prix St Georges (PSG) and Grand Prix (GP) levels. Competition type was classified as local, regional and national championship events. Competitions met the inclusion criteria if they took place in 2005, were located in the BD eastern region, except for the national championship, and both warm-up and competition tests were performed on surfaces other than grass.

All competitors taking part in competitions at the selected level were included, but data for any horse that had already performed a test on the day were excluded from the study. Total duration of warm-up and time spent in each pace was timed using one stop-watch per pace by three observers. For each competitor, the final percentage score gained for the test was recorded. For N and M levels, the section entered (open or restricted) was recorded.

Intra-observer repeatability was assessed using seven horse-rider combinations. These were timed at a competition, and then timing was repeated on four occasions using video recording of the competition warm-up. Inter-observer repeatability was assessed using six horse-rider combinations that were each timed independently by the three observers. The coefficient of variation (CV) was calculated for total warm-up duration, walk, trot and canter duration for both intra- and inter-observer comparison.

Normal distribution of data was confirmed using Shapiro-Wilk *W* test of normality. Warm-up total duration, absolute time and proportion of time spent in each pace were compared between competitive level (N, M, PSG or GP), local, regional and national competitions and open and restricted riders using analysis of variance and multiple comparisons of the means. At each level, linear regression and Spearman rank correlation were used to test the association between warm-up total time or time spent in each pace and final score. To evaluate the effect of rider experience, warm-up total time and time spent in each pace were compared between open and restricted riders. All data were analysed using a statistical software package (Analyse-It, version 1.71) with a significance level of 0.05.

Results

Warm-up of 267 competitors met the inclusion and the exclusion criteria, including competitors at N

($n = 104$), M ($n = 65$), PSG ($n = 60$) and GP ($n = 38$) levels. Local competition warm-up was included for 103 competitors, 57 competitors at the regional championship and 107 competitors at the national championship.

Repeatability

Intra-observer repeatability for timing total warm-up duration (CV < 0.7%), walk (CV < 2%), trot (CV < 2%) and canter (CV < 5%) was considered acceptable for the study. Inter-observer repeatability for timing total warm-up duration (CV < 2%), walk (CV < 5%), trot (CV < 4%) and canter (CV < 4%) was also considered acceptable.

Overall warm-up duration

The mean warm-up time for all competitors at dressage competitions was 29 min 53 s.

Effect of competitive level

Total warm-up duration and proportion of time spent in walk, trot and canter for each competitive level are recorded in Table 1. Warm-up duration increased with increasing competitive level from N to GP. There was a significant difference between levels in total time overall ($P < 0.001$), at local ($P < 0.02$), regional ($P < 0.001$) and national ($P < 0.02$) competitions. Overall warm-up at N level was significantly shorter than at the other levels ($P < 0.001$), which was also observed at local, regional and national competitions. In addition, at local level GP warm-up was significantly longer than PSG ($P = 0.044$).

Within the warm-up, there were significant variations in the proportion of walk, trot and canter between different levels ($P < 0.001$). Overall, the proportion of walk at N level was significantly less than at M level ($P = 0.046$) and at M level, it was significantly greater than at PSG level ($P = 0.030$). N competitors spent a larger proportion of time in trot compared with all other levels ($P < 0.001$), which was also seen within local, regional and national competitions. N and M competitors spent a significantly lower proportion of the warm-up in canter than PSG ($P < 0.001$) and GP ($P = 0.034$) overall and at all competition types.

Effect of competition classification

Duration of warm-up and proportion of time in walk, trot and canter for local competitions, regional and

Table 1 Warm-up duration and proportion of walk, trot and canter for 267 competitors in dressage competitions at novice ($n = 104$), medium ($n = 65$), Prix St Georges ($n = 60$) and Grand Prix ($n = 38$) levels

Competitive level	Total warm-up duration (min:s)	Walk time (min:s)	Trot time (min:sec)	Canter time (min:s)	Proportion of walk (%)	Proportion of trot (%)	Proportion of canter (%)
Novice	25:23 $\pm$ 10:02	10:02	10:04	5:17	39.3	40.3	20.4
Medium	31:32 $\pm$ 11:32	13:59	10:08	7:25	43.8	32.5	23.7
Prix St George	32:53 $\pm$ 11:19	13:02	10:23	9:28	38.5	31.1	30.4
Grand Prix	34:34 $\pm$ 10:10	13:45	11:22	9:27	38.8	33.3	28.0

national championships are given in Table 2. There were significant differences between competition types for total time ($P < 0.001$). For N, M and PSG competitors, total warm-up duration at national level was significantly longer than at local level (N: $P < 0.001$, M: $P = 0.014$ and PSG: $P < 0.001$). GP warm-up time was not significantly different between competition types.

Within the breakdowns of the different paces, N competitors at local level warmed up for a shorter total time, but spent a higher percentage of it in walk than competitors warming up at regional competition ($P < 0.001$) and national competition ($P = 0.006$). N competitors spent a significantly larger proportion of the warm-up in trot at regional competitions than either local ($P = 0.014$) or national ($P = 0.033$), and significantly less time in canter at local competitions compared with the national championships ($P < 0.001$). PSG competitors spent significantly more time in canter at regional compared with national championships ($P = 0.042$).

Effect of rider experience

There was no significant difference between the warm-up of open and restricted competitors at N or M level.

Association between warm-up time and final score

At N (Fig. 1) and PSG (Fig. 2) levels, there was a significant positive association between final score and total warm-up time (N: $R^2 = 0.05$, $P = 0.022$; PSG: $R^2 = 0.08$, $P = 0.025$). At N level, there was a positive association between final score and walk percentage ($R^2 = 0.06$, $P = 0.013$), time spent in trot ($R^2 = 0.10$, $P = 0.001$), time spent in canter ($R^2 = 0.15$, $P < 0.001$) and canter percentage ($R^2 = 0.07$, $P = 0.008$).

Discussion

The results of this study support the hypotheses that competitors at higher competitive levels warm-up for longer than competitors at lower levels, and that warm-up at a championship was longer than at local level. At N and PSG levels, the results supported the hypothesis that increased warm-up time was associated with better performance, but this was not supported at other levels. There was no effect of rider experience at N or M level (where rider experience is classified).

Warm-up for dressage horses often begins as a generalized warm-up, in walk, trot and canter, and then becomes more specific, following a similar pattern to that seen in various human sports^{16,17}. This could provide a logical method for physiological warm-up of the body, followed by optimization of proprioceptive pathways and specific muscles, tendons, ligaments and

Table 2 Mean warm-up duration and time spent in walk, trot and canter for different types of competition: local ($n = 103$), regional ($n = 57$) and national championships ($n = 107$)

Type of competition	Total warm-up duration (min:s)	Walk time (min:s)	Trot time (min:s)	Canter time (min:s)	Proportion of walk (%)	Proportion of trot (%)	Proportion of canter (%)
Novice level							
Local	23:40 ± 8:37	10:53	08:59	03:46	44.96	38.39	16.64
Regional	19:52 ± 8:04	06:39	08:50	04:23	33.01	45.25	21.74
National	31:55 ± 9:53	11:27	12:29	07:59	36.11	39.09	24.80
Medium level							
Local	27:34 ± 10:11	12:57	8:46	5:50	45.65	32.24	22.10
Regional	29:37 ± 11:26	12:34	10:13	6:50	42.63	34.97	22.40
National	36:05 ± 11:28	15:55	11:07	9:04	43.20	30.92	25.88
Prix St Georges level							
Local	24:34 ± 8:35	9:45	7:32	7:16	38.66	29.01	32.34
Regional	33:27 ± 13:08	13:52	8:51	10:44	39.22	26.98	33.80
National	37:47 ± 9:18	14:46	12:38	10:23	38.43	33.56	28.01
Grand Prix level							
Local	31:38 ± 12:13	11:38	10:34	9:26	35.55	34.24	30.21
Regional	N/A	N/A	N/A	N/A	N/A	N/A	N/A
National	37:48 ± 6:04	16:05	12:14	9:28	42.38	32.17	25.45

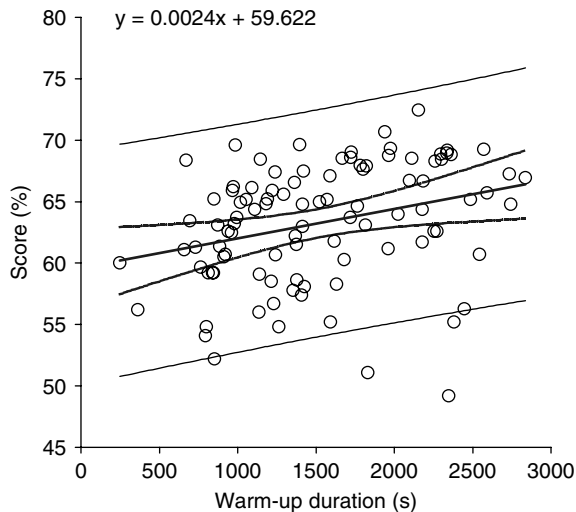


Fig. 1 Regression line plot of final score against warm-up duration for competitors at novice level. The fitted regression line, 95% confidence/prediction intervals and equation to predict score from warm-up time are shown

joints involved in the particular movements required in the competitive test. It is therefore possible that for a fit horse, increased opportunity to undertake a specific warm-up could enhance performance. However, although improved performance was associated with increased warm-up in this study, it will be important to establish whether there is a threshold past which fatigue leads to a reduction in performance. It has been shown that warm-up used in racehorses and trotters to improve VO_{2max} actually led to increased muscle fatigue¹³. At present, there is little information on how to evaluate the physiological requirements of dressage horses, but it is

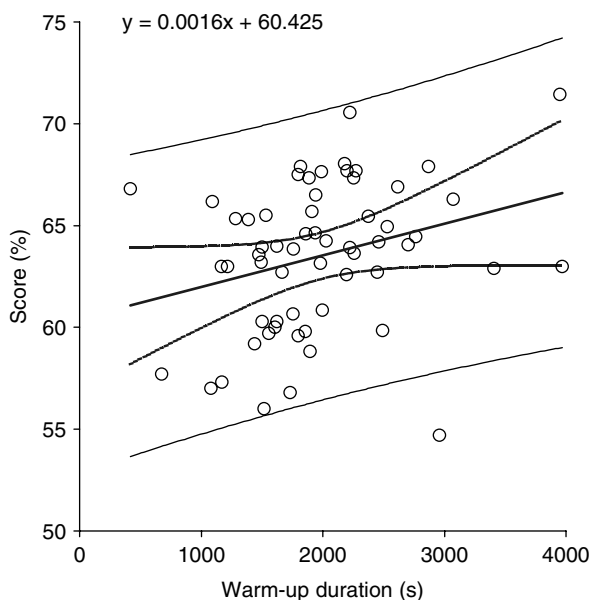


Fig. 2 Regression line plot of final score against warm-up duration for competitors at Prix St Georges level. The fitted regression line, 95% confidence/prediction intervals and equation to predict score from warm-up time are shown

likely that they are subject to fatigue of specific muscle groups rather than limited by cardiopulmonary capacity, so it could be postulated that generating muscular fatigue in the warm-up could reduce performance. The results of this study, however, indicate that the warm-up duration and type used by the competitors sampled were not associated with enough muscle fatigue to be limiting performance.

The mean warm-up for all competitors of *c.* 30 min is shorter than that reported in a previous report of dressage horses at L level (equivalent of elementary level in UK) and S level (equivalent of advanced level in UK) in Germany¹⁴ and is less than the German National Equestrian Federation recommended duration of 60 min¹⁵. This may reflect a difference in practices between countries. Further information on warm-up duration and pattern between different regions would be useful to ascertain how practices differ between regions, competitors and trainers and whether these differences could influence outcome.

The difference in warm-up duration and warm-up content between N and higher levels could relate to relative rider inexperience or to a difference in the movements required at this level compared with higher levels. The increased proportion of canter performed in warm-up for PSG and GP could relate to the requirement for more canter-based movements in tests at PSG and GP levels than at N and M levels.

The increased warm-up duration at national level could indicate increased competitor nerves at championships, or could be related to the competitors selected to compete. If warming up for longer is associated with enhanced performance, then it is possible that the competitors have reached national level partly because they warmup for longer and hence do better.

A positive association between warm-up duration and final score was observed at N and PSG levels, indicating that increased warm-up duration led to a better performance. As this was present at both a lower level of training and a more advanced level, it appears that it is not a phenomenon limited to any particular range of movements. It is certainly possible that inadequate warm-up could lead to reduced performance, based on the proposed physiological and psychological benefits of warm-up.^{7,16} This is also supported by the German National Equestrian Federation comments in its advanced dressage manual that horses are rarely warmed up for too long at a competition, although they are often not ridden-in for long enough.¹⁵ However, exceeding the optimum warm-up intensity and duration can result in fatigue and reduced performance.^{13,18} It is therefore important to investigate the warm-up threshold past which performance may reduce, and to determine this for both individual horses and for competitors at different levels. At N level, increased proportion and duration of canter were associated with better

performance. An increased proportion of canter was generally observed in warm-up at higher levels, so it appears that making the warm-up strategy more similar to that taking place at higher levels might improve performance.

There were limitations of this study. It was not possible to record times on all competitors, as a small number (less than 1%) did not have identification numbers visible. Not all venues were included, as grass surfaces were excluded from the study. Increased numbers could have improved the power of the analysis, particularly for the comparison between restricted and open-level riders. For a few horses, there was a short period between completing the warm-up and starting the test (usually related to unexpected delays in the competition), which could have influenced the effect of the warm-up. However, this was not a frequent occurrence and is unlikely to have influenced the overall findings. Although the proportion of time spent in each pace was recorded, the temporal distribution of each trot period within the warm-up was not recorded. The pattern of short or long periods of each pace and relative distribution of short and long periods of each pace may influence warm-up quality. In addition, it would be useful to understand the types of movements undertaken in a warm-up and how these relate to level and performance. Further study is therefore required to improve understanding of links between warm-up type and performance.

Conclusions

Competitors sampled in this study had a warm-up duration of c. 30 min, consisting of varying amounts of walk, trot and canter. Variations in warm-up duration and content were associated with competitive level, and type of competition, but not with rider experience. This is likely to provide adequate physiological warm-up of the body. However, it appears that increased warm-up duration at specific levels and increased proportion of canter at N level were associated with increased scores, which might indicate that increased opportunity for specific warm-up could lead to enhanced performance, although the threshold duration beyond which a positive response is seen is unknown.

Acknowledgement

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