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COMMENTARIES

A Nonnatural Head–Neck Position (*Rollkur*) During Training Results in Less Acute Stress in Elite, Trained, Dressage Horses

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This study measured parameters of stress in recreational, trained horses (REC; $n = 7$) and elite (International Grand Prix level) trained, dressage horses (DRES; $n = 5$). The training of the DRES horses uses an unnatural head–neck position (*Rollkur*), whereas in the REC horses such training techniques are not common. The study measured stress by using heart rate variability analysis for 30 min postfeeding in the morning and 30 min postexercise after a morning training session. The study found no significant difference at rest between the REC and DRES horses. During the posttraining measurements, however, the DRES horses showed, among others, a less sympathetic and increased parasympathetic dominance. These results suggest that DRES horses tend to have less acute stress than do REC horses postexercise. The findings of this study suggest maintaining the health and well-being of DRES horses despite nonnatural, biomechanical positions.

Equine training methods are regularly criticized because of unnatural positions the horse has to maintain during training. Most research regarding the effects of training, however, has focused on anatomical, biomechanical, and kinematical aspects of training (Gómez, Rhodin, Roepstorff, Weishaupt, & van Weeren, in

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press; Rhodin, Johnston, Holm, Wennerstrand, & Drevemo, 2005; Weiler, 2001). Recently, a training system in which the positioning of head and neck in a deep and round position (*Rollkur)* was introduced in dressage training and was immediately criticized for its possible detrimental effects (Figure 1) on the mental state of the horse (FEI, 2005). Although some evidence emerges from the scientific community regarding the positive kinematical aspects of this training method (Gómez et al., in press), evidence regarding the effects of the aforementioned training method on stress and well-being is lacking. In addition, most research on horses has been done in nonelite, trained horses in laboratory situations. Here, for the first time, we present scientific evidence regarding the effects of a training technique on pain and stress parameters in elite, Olympic level, dressage (DRES) horses in comparison with recreational, trained (REC) horses.

NONHUMAN ANIMALS, MATERIALS, AND METHODS

Animals and Training Regimen

Seven noncompetition-trained REC horses, all warmbloods, and 5 international-competing DRES horses, all warmbloods, were used in this study. The animals included in the study were: six geldings and one mare aged from 7 to 23

FIGURE 1 Typical head and neck position according to the *Rollkur* training method.

years ($M \pm SD = 11.57 \pm 5.19$) for the REC group and four geldings and one stallion aged from 9 to 22 years ($M \pm SD = 15.20 \pm 5.45$) for the DRES group. All horses (REC and DRES) were privately owned and stabled. On nonriding days, the group REC horses were allowed free paddock time. DRES horses were allowed free paddock time once every day for 45 min. The horses were housed in single, straw-bedded boxes of 3.5 × 3.5 square meters for the REC horses and 3.5 × 3.75 square meters for the DRES horses. Ceiling height was at least 3 meters and all horses had access to daylight by means of windows to the open air. The feeding consisted of hay and concentrates three times daily and water was provided ad libitum. The measurements were performed on each horse in the horse's own stable. REC horses were trained according to a basic training regimen (5 days/week, 45 ± 6 min/day) consisting of basic dressage riding, whereas the DRES horses were trained daily (6 days/week, 75 ± 17 min/day). All horses were trained with the same rider and the same equipment during the last 6 weeks prior to the study. The *Rollkur* position was used with the DRES horses for an average of 24 ± 6 min during a training session, whereas this training method was never used for the REC horses.

Heart Rate Variability Analysis

Beat-to-beat heart rate was collected during a 10-min timeframe prior to a training session in the morning between 7:00 and 9:00 a.m. and 30 min after the horses finished their meals. Posttraining data were collected between 30 and 45 min after the horses were washed with hand-warm water and groomed after the training session.

For beat-to-beat heart rate analysis, two electrodes were placed directly on wet skin on the left lateral thorax wall and fixed thoroughly with an elastic stable girth. The electrodes (Polar Electro Oy, Kempele, Finland) were connected to the storage device (Con2trol, Badhoeverdorp, The Netherlands), which was fixed onto the girth. The interval between the R peaks was stored in a computer. Mean RR interval, the root mean square of successive R–R intervals (RMSSD), and frequency domain results (LF [low frequency], HF [high frequency], and LF/HF ratio) were calculated with special HRV (heart rate variability) software (HRV analysis software, Biomedical Signal Analysis Group, Dept. of Applied Physics, University of Kuopio, Finland).

Statistical Analysis

Statistical analyses were carried out in SPSS 12.0.1 for Windows. Descriptive statistics (*M, SD*) were computed for each parameter. Differences between the

groups were tested using a *t* test (for RR, RMSSD, LF, and HF) or the Wilcoxon Rank Sum test (for LF/HF). If not indicated otherwise, significance level was set at $p < .05$.

RESULTS

No statistically significant differences could be found in mean RR interval, RMSSD, LF, HF, and the LF/HF ratio between DRES and REC horses (Table 1).

Interestingly, data obtained 30 min posttraining showed a significant difference between the DRES and REC horses for RR ($p < .05$; 1457 ± 264 vs. 1123 ± 123, for DRES vs. REC, respectively); for RMSSD ($p < .05$; 83.95 ± 31.87 vs. 47.98 ± 69, for DRES vs. REC, respectively); and for LF, HF, and LF/HF ratio ($p < .05$; 98.83 ± 12.1 vs. 115.21 ± 19.1, 43.80 ± 11.76 vs. 23.09, and 11.07 ± 6.4 vs. 20.71 ± 2.56, for DRES vs. REC, respectively).

DISCUSSION

In this study, we compared DRES horses with REC horses not being trained for competition. The results of this study indicate that the DRES horses do not have more stress or pain in comparison with REC horses. Moreover, the DRES horses tended to have *less* stress based on heart rate variability time and frequency domain results postexercise.

TABLE 1
Heart Rate Variability Parameters of Elite Dressage Horses and Recreational Horses

	At Rest		*Postexercise*	
	Elite Dressage Horses[a]	*Recreational Horses*[b]	*Elite Dressage Horses*[a]	*Recreational Horses*[b]
RR mean (msec)	1717 ± 230	1472 ± 353	1457 ± 264	1123 ± 123[c,d]
RMSSD (msec)	118.64 ± 59.22	71.89 ± 20.68	83.95 ± 31.87	47.98 ± 69[c]
LF (nu)	87.86 ± 9.48	88.90 ±7.53	98.83 ± 12.1	115.21 ± 19.1[c]
HF (nu)	12.14 ± 10.56	11.10 ± 8.78	23.09± 9.1	43.80 ±11.76[c,d]
LF/HF	1.8 ± 0.7	2.8 ± 0.6	11.07 ± 6.4	20.71 ± 2.56[c,d]

Note. All values are *M* ± *SD*.

[a]$n = 5$. [b] $n = 7$. [c]Statistically significant different ($p < .05$) between recreational postexercise and elite dressage horse postexercise. [d]Statistically different between rest and postexercise in the same group of horses.

To date, there is a public belief that DRES horses experience more stress than REC horses. Even more, it is suggested that horses trained according to the deep and round (*Rollkur*) method experience more stress and pain than do horses trained according to other training methods. The results of this study suggest that DRES horses level do not, at first sight, experience more stress than REC horses; they experience less stress as measured 30 min postexercise.

Our findings are in line with the findings of Gómez et al. (in press), who reported an increased back motility in horses exercised on a treadmill according to the *Rollkur* position, but are contradictory to the results of Weiler (1998), who reported a possible increased number of head and neck problems (insertion desmopathy) in DRES horses. A major drawback of both studies is the use of REC horses trained in a laboratory set-up. Gómez et al. exercised the horses on a motor-driven treadmill, whereas Weiler used postmortem tissue. The results of this study are, to the best of our knowledge, the first that describe in a nonlaboratory or clinical situation the effects of training on stress and welfare of horses.

Heart rate variability measures are now a well-accepted technique for measuring stress or comfort in horses (Kato, Ohmura, Hiraga, Wad, Kuwahara, & Tsubone, 2003; Rietmann, Stauffacher, Bernasconi, Auer, & Weishaupt. 2004). Our results, however, must be interpreted with care because no behavioral measurements have been taken into account as Rietmann et al. (2004) suggested. Our findings of a higher mean RR interval in parallel with a lower LF/HF ratio 30 min postexercise are indicative for a less stressful experience for DRES horses in comparison with the data obtained from REC horses. Although an explanation for these findings is not easy to provide, the results indicate that intense exercise with an extensive period of *Rollkur* training more closely fits the nature of the horse than does the recreational riding. A possible confounding factor in this study could be the increased exercise and paddock time of the DRES horses. This makes a comparison between the REC and DRES horses less reliable but indicates that more exercise time in training, combined with more paddock time, reduces the overall stress as measured by HRV. Furthermore, one has to keep in mind that DRES horses are looked after more frequently than REC horses. Furthermore, it is feasible that a significant influence of breed plays an important role in the observed differences. In cows, Hagen, Langbein, Schmied, Lexer, and Waiblinger (2005) reported a difference in heart rate variability measures between two different breeds.

Although these preliminary data provide no evidence for a detrimental effect of the *Rollkur* training method on stress and/or pain in these horses, the number of horses in this study warrants more research. Finally, it has to be taken into account that heart rate variability has, to the best of our knowledge, not yet been proven as an established measure for chronic pain (Dobromylskyj et al., 2000). In addition, future studies in elite equine athletes should involve endocrine and behavioral indicators of pain.

In conclusion, this study showed that DRES horses trained according to the *Rollkur* method suffered no more stress than did REC horses not trained for competition. The outcome lends credibility to the background of the *Rollkur* as a training method and may serve as an argument in the discussion about the ethical acceptability of some training methods common in modern sports practice.

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