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Research

Assessing ridden horse behavior: Professional judgment and physiological measures

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ABSTRACT

The assessment of ridden horse behavior by 12 equestrian professionals (riding instructors n = 4, riders n = 4, veterinarians n = 4) was compared with observed behavior and physiological measures (salivary cortisol and eye temperature). Horses (n = 10) were ridden at walk, trot, and canter in a predefined test of approximately 2-3 minutes. Video footage of the ridden test (RT) was analyzed using Observer XT 10 and duration of behavioral states/events recorded. Saliva was collected in the stable, after the warm-up (WU) and at 0, 5, 15, 30, and 60 minutes after the RT. The saliva was analyzed for cortisol (enzyme-linked immunosorbent assay) and the difference between minimum and maximum concentration (ng/mL) and associated sample times recorded. Eye temperature was measured using an infrared thermal camera (MobIR M8), static images (stable, after WU, after RT), and video footage (WU and RT) with maximum eye temperatures derived from set intervals. Mean maximum eye temperatures during ridden work were calculated. Video footage of the RT was observed by the 12 equestrian professionals who each scored the horses on 7 performance parameters derived from the Fédération Equestre Internationale rules for dressage events and the training scale of the German National Equestrian Federation (relaxation, energy, compliance, suppleness, confidence, motivation, and happiness). These scores were compared with behavioral and physiological measures and correlations investigated (Spearman's rank order correlation). Higher percentage durations of high head carriage (ranging from 0 to 50.75% of RT) and the nose carried at an angle in front of the vertical (0%-74.29% of RT) correlated with overall less favorable assessment by the equestrian professionals ($P < 0.05$) and only the instructors associated neutral head carriage (32.76%-91.92% of RT) and vertical nasal angle (0.97%-68.90% of RT) as a positive sign ($P = 0.03$ and $P = 0.04$, respectively). Increases in salivary cortisol positively correlated with the duration of low head carriage ($P < 0.05$), suggesting that this way of going increased the demands placed on the horse. Increased eye temperature positively correlated with duration of nose carried behind the vertical when ridden ($P = 0.02$) and negatively correlated with duration of nose carried in front of the vertical ($P = 0.01$). Some discrepancy between physiological evidence and professional assessment of ridden horse behavior was evident as were differences between groups of professionals. Further evaluation of the association between behavioral signs and physiological measures is now required to ensure that the assessment of ridden horse performance is based on valid and consistent measures.

Introduction

Ridden horse assessment is generally based on subjective judgment of observed behavior. In addition to physical soundness, veterinarians and other equestrian professionals need to be able to identify signs of mental distress in ridden horses (Ödberg, 1987), which can contribute to poor performance, health, and behavioral problems. Within international equestrian sport, there is much debate surrounding the stress associated with training methods, in particular in relation to head and neck position (van Breda, 2006; von Borstel et al., 2009; McGreevy et al., 2010). In response, the Fédération Equestre Internationale (FEI, 2009) published guidelines advocating harmonious education of the horse resulting in overt behavior indicative of "submission" and the development of the horse into a "happy athlete." The guidelines state that the nasal plane should at all times be positioned in front of the vertical (FEI, 2009). However, there is evidence that overflexion of the neck (and

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the consequent positioning of the nasal plane behind the vertical) is still considered by some as a positive sign in the ridden horse (McGreevy et al., 2010). For example, during official stallion performance tests, higher scores for ride ability were awarded to horses that were ridden with their nose line predominantly behind the vertical than to those ridden with their nose line at the vertical (König von Borstel et al., 2011). Behavioral events such as grinding the teeth and agitation of the tail are considered signs of nervousness, tension, or resistance on the part of the horse (FEI, 2009). In their judgment of ridden horse behavior, equestrian professionals will rely on overt behavioral signs, but the relative importance attributed to specific signs is unlikely to be consistent across professional disciplines. To determine whether the interpretation of behavioral signs used in such judgments is justifiable, more objective evidence is required.

In ridden work, physiological measures of mental stress are confounded by the effect of the physical demands of exercise (Marlin and Nankervis, 2002) as well as problems in distinguishing between excitement/arousal and fear/anxiety. Factors such as fitness and age need to be taken into consideration if hormonal stress responses are to be used as a means of interpreting behavioral signs. However, in low-level exercise scenarios, findings suggest that anxiety-provoking situations produce increases in salivary cortisol concentration (Schmidt et al., 2010). Training per se affects baseline plasma cortisol concentration in riding horses (Fazio et al., 2006) and subsequent cortisol response to ridden events is affected by previous training (Fazio et al., 2008). With due consideration to such factors, salivary cortisol response to low levels of established ridden work may provide evidence of the demand characteristics of some aspects of ridden horse behavior.

Circulatory changes are a more immediate physiological response to sympathetic activation (preparing the animal for flight or fight) and are associated with changes in surface temperature. These can be measured using infrared thermography and have been used as a noninvasive means of assessing stress responses in animals (Stewart et al., 2005). In particular, eye temperature has been shown to increase in some species in response to potentially distressing procedures (Cook et al., 2006; Stewart et al., 2007). In the horse, increases in eye temperature were found to correlate with increases in salivary cortisol during a potentially aversive procedure (clipping) (Yarnell et al., 2013) and higher eye temperatures were recorded when horses were lunged in a training aid (Pessoa) than when lunged without (Hall et al., 2011). Eye temperature offers a means of confirming (or not) the interpretation of behavioral signs in the ridden horse.

The aim of this study was to compare the judgment of ridden horse behavior made by equestrian professionals with evidence from both observed behavior and physiological measures. Associations between scoring and the duration of observed behavior and between behavior and physiological responses were investigated. The long-term aim is to identify behavioral signs in the ridden horse that are indicative of mental state.

Materials and methods

Horses

The study involved 10 riding horses (6 geldings, 4 mares) and 10 experienced riders (who rode the horse regularly). Horse heights ranged from 158 to 173 cm, their ages from 5-20 years (mean age 12.9 years), and they were thoroughbred and thoroughbred × warmblood cross in type. The current roles of the horses were either predominantly competitive (n = 6), leisure (n = 2), or riding school work (n = 2). All horses were in work at the time of the study (ridden 5 days/week) and were at levels of fitness befitting their current workload. This ranged from fit for regular hacking (walk, trot, and canter) to competition fit (British Eventing novice level). The trial was carried out in the United Kingdom during July and the horses were field kept (n = 4), or on a combined stable/field turnout regime, stabled during the day (n = 2) or stabled overnight (n = 4).

Experimental design

Each horse/rider combination completed a ridden trial consisting of a warm-up (WU) and ridden test (RT). Behavior was recorded from the video footage of the RT; this footage was also assessed by equestrian professionals (n = 12). Physiological measures were taken throughout the trial (salivary cortisol and eye temperature). Handling behavior was scored at sampling sessions before and after the RT to assess the impact of the ridden work on general behavior. See Table 1 for details of the sampling times for each measure. The study was conducted in accordance with the Nottingham Trent University's ethical review process.

Ridden trials

The ridden trials were all conducted at the horses' home yards and ridden work took place outside between 10.30 and 15.00 hours. The horse was prepared for ridden work (normal tack with no martingales, draw reins, or other schooling aids; 4 horses wore flash nosebands, the rest wore plain cavesson nosebands), led to the riding area, mounted, and warmed up (WU) for 10-20 minutes (including work in walk, trot, and canter on both reins). Each horse was ridden in a fenced arena on an all-weather surface in an area of

Table 1
Sampling times for each measure taken during the study

Measure	Before ridden work	WU	After WU/before RT	RT	After ridden work
Ridden behavior				% duration of behavior recorded from video	
Saliva sampling (cortisol)	Sampled before preparation for ridden work		Sampled after WU		Sampled 0, 5, 15, 30, and 60 minutes after RT
Eye temperature (static IRT)	Maximum eye temperature recorded		Maximum eye temperature recorded		Maximum eye temperature recorded (0, 5, 15, 30, and 60 minutes after RT)
Eye temperature (video IRT)		Maximum eye temperature recorded at 3 set points during WU		Maximum eye temperature recorded at 7 set points during RT	
Scoring by professionals				RT videos scored on 7 parameters	
Handling test	Behavior scored from video				Behavior scored from video (0 and 60 minutes after RT)

IRT, infrared thermography; RT, ridden test; WU, warm-up.