Physiological and Behavioural Validation of Stress in Horses: The Implications for Equine Welfare and Training

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Word count: 982

Introduction

Equine welfare is influenced primarily through feeding, housing, training techniques and human interaction. Physiological and behavioural assessments of stress provide important insights to animal welfare, whereby equine welfare is considered high when stress is minimal (McGreevy & McLean, 2010). These assessments can also be used to predict horse responses to challenging situations (Munsters *et al*., 2013), which has positive safety implications for both horse and trainer or rider. Different training techniques, exposure to challenging objects and horse-rider interactions evoke varied physiological and behavioural responses in horses. Thus, assessment of stress through behavioural and physiological means can be used to maximise both training success and welfare.

Discussion

It is commonly accepted that heart rate can be measured to assess stress and, when measured telemetrically, does not influence the stress response (Young *et al*., 2012). Kedziersky *et al*. (2012) used heart rate to assess horse emotional response to two types of training methods. Two groups of naïve, purebred Arabian colts and fillies (each group n=16) were compared: one group was subjected to traditional training methods and the other to sympathetic training. Traditional training relies primarily on negative reinforcement, while sympathetic training relies on gentle visual and auditory cues to encourage horse behaviour (Visser *et al*., 2009).

Each horse was trained by only one trainer throughout the study, and was fitted with an elastic belt around the chest with a transmitter to measure heart rate. Heart rate was recorded prior to, during and following set activities, most importantly bridling, saddling and mounting. The results of this study strongly support the benefits of sympathetic training methods both in terms of training success and improved welfare. Heart rate was significantly lower in those horses trained sympathetically, and the time required to successfully achieve the set activities was also significantly shorter. Thus, emotional state in response to training methods can be correlated to training success, and performance and learning ability are significantly greater in horses when they are calm (Christensen *et al*., 2006). This physiological validation of horse response to training corresponds to previous studies (Visser *et al*., 2009).

Kedziersky *et al*.'s (2012) conclusions were limited by their having only used heart rate to assess stress. In a study conducted by Munsters *et al*. (2012), the degree of assessment was taken to a further level. In addition to heart rate, heart rate variability and behaviour scores were also included in the assesments. This study aimed to evaluate the effect of horse-rider interactions on stress in response to a series of obstacles. Dutch Warmblood horses (n=16) were individually ridden through a route that included three challenging objects. This was repeated three times with three different randomly selected riders. Heart rate monitors recorded heart rate and heart rate variability throughout each test, and all horses were video recorded to assess their behaviour. Horse behaviour was evaluated using a behaviour scoring system adapted by Visser *et al*. (2010). The results of this study support the physiological validation of the behaviour of horses in response to stressful stimuli, whereby heart rate was higher when horse behaviour score was high (expressed by fearful or anxious behaviour). Assessing behaviour in this way can be applied to the selection of riders or trainers, where heart rate and behaviour score decreased significantly when horses were paired with "matching", or preferred, riders. Optimal communication between horse and rider to overcome an obstacle characterises a "match". Thus, assessing behaviour can be utilised to select the most compatible horse-rider pairs to optimise animal performance and reduce overall stress.

In order for these assessments to have widespread positive impact on equine welfare and training, evaluation of stress response must be relatively easy, reliable, affordable and non-invasive. Young *et al*. (2012) aimed to re-evaluate previously derived behaviour scores to create a reliable,

physiologically validated measure of stress through visual interpretation of behaviour. Previous behaviour scores, such as that used by Munsters *et al*. (2012), were established by exposing horses to purposely stressful stimuli and assessing their behavioural response.

Young *et al*. (2012) provided a more comprehensive measure of stress by measuring two physiological variables; heart rate and salivary cortisol concentrations, and then validated these measures against behavioural patterns analysed by a panel of 13 equestrian professionals. Horses (n=32) of various breeds, ages and genders were exposed to one of four different basic husbandry or training procedures. Behaviour and heart rate were recorded as in Munsters *et al*. (2012), and salivary cortisol was collected prior to, immediately after and at 10-minute intervals for 40 minutes following the procedure. The physiological results of this study correspond with recent assessments of equine stress (Lewinski *et al*., 2013). Heart rate increased significantly during the procedures, and salivary cortisol concentration was significantly elevated during and following all procedures. These results correlated with the developed behaviour scores, whereby horses with a high score showed notably unsettled or anxious behaviour. Thus, this study was able to develop a descriptive, reliable and straightforward behaviour scale that can be used across a range of situations to rapidly assess stress and welfare in domestic horses.

Conclusion

Physiological validation of behaviour is important to assess animal welfare in relation to stress responses. By developing a complete and reliable behaviour-scoring system, horse stress can be evaluated in relation to husbandry procedures, training, and human interactions (Young *et al*., 2012). Thus, by controlling such circumstances to minimise stress, equine welfare can be maximised. Movement from traditional training methods to sympathetic training in naïve horses may be justified by this assessment. Additionally, selection of trainers or riders to minimise stress can be determined by assessing horse behaviour in order to maximise training success and improve welfare. Further research on the effect of the source of stress, either through husbandry or training, may further substantiate the impact of different levels or types of stress on learning and memory (Christensen *et al*., 2012), to be applied to maximise equine training success and welfare in domestic horses.

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