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Effect of different head and neck positions on behaviour, heart rate variability and cortisol levels in lunged Royal Dutch Sport horses

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ABSTRACT

Different head-and-neck positions (HNPs) are discussed in relation to potential welfare issues. To evaluate the effect on welfare, seven Royal Dutch Sport horses were studied in five predetermined HNPs: (1) unrestrained (HNP1); (2) neck raised, bridge of nose around the vertical (HNP2); (3) neck lowered and considerably flexed, bridge of nose pointing towards the chest (HNP4); (4) neck raised and extended, bridge of nose in front of the vertical (HNP5), and (5) neck lowered and flexed, bridge of nose pointing towards the carpus (HNP7). A standardised exercise test (SET) of 34 min consisted of trot, canter and walk. Behaviour was recorded with a pre-defined ethogram and R-R intervals measured using telemetry. Cortisol concentrations were taken at the start, 5 and 30 min after the SET. Behaviour around the SET was scored separately.

Conflict behaviours increased significantly during HNP2 when compared with HNP1, HNP4 and HNP7 during the SET, and there was significant negative anticipation before HNP2 and HNP7. The heart rate variability (HRV) frequency domain for HNP2 showed a significantly increased low frequency peak (LFpeak) compared with other HNPs, and there was a decrease in very low frequency (VLF%) compared with HNP1. HNP4 showed a significant increase in LF% and decrease in VLF% compared with HNP1. Saliva cortisol concentrations were significantly increased in HNP2 at 5 and 30 min after exercise. Increased conflict behaviour was mostly observed in HNP2, but there was a raised HRV suggesting a sympathetic shift in HNP2 and HNP4, and increased cortisol concentrations during HNP2 indicated a stress response.
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Introduction

Over the last few years, the welfare of sport horses has gained increased attention from the general public. Public awareness is not only limited to the use of a hyperflexed head-and-neck position (HNP) in dressage horses, but concerns about 'performance enhancing' measures used in the show horse industry have also been raised (McLean and McGreevy, 2010). In 2010, the Fédération Equestre Internationale (FEI), the world authority for equestrian sports, defined 'Low, Deep and Round (LDR)' as a HNP which is not 'aggressively obtained' and was considered to be acceptable as a training method, in contrast to the 'aggressively obtained' hyperflexion, also known as 'rollkur' (FEI, 2010). Several studies have concentrated on the biomechanical effects of different HNPs (Rhodin et al., 2009; Waldern et al., 2009)

In recent years, it has been implied that certain training techniques, especially those using a hyperflexed HNP, may cause unnecessary discomfort and possibly pain to horses (McLean and McGreevy, 2010). However, studies using base level trained horses have not demonstrated increased stress during exercise in a hyperflexed HNP using blood cortisol concentrations and heart rate measures (Sloet van Oldruitenborgh-Oosterbaan et al., 2006) or saliva cortisol concentrations combined with heart rate variability (HRV) analysis (Becker-Birck et al., 2012). One study compared high-level dressage horses with recreational horses and implied there was a decreased level of stress in high-level trained horses in a hyperflexed position based on HRV measurements after exercise (Van Breda, 2006). Von Borstel et al. (2009) suggested that the hyperflexed

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position may be uncomfortable to horses unaccustomed to this position based on behaviour alone.

In many species, HRV has been shown to be an indicator of acute and chronic stress and is often used for research on autonomic nervous system function during welfare and behavioural studies (Von Borell et al., 2007) in horses with (Bachmann et al., 2003; Rietmann et al., 2004b; Schmidt et al., 2010a) and without a rider (König Von Borstel et al., 2011). HRV in horses varies significantly between basal conditions and psychological stress (Visser et al., 2002; Bachmann et al., 2003; Rietmann et al., 2004b) and the low frequency (LF) component is known to correlate with both mental stress in Warmblood horses (Rietmann et al., 2004b) and a rise in adrenaline (Rietmann et al., 2004a). A decrease in HRV has been linked to increased cortisol concentrations during road transport (Schmidt et al., 2010b, 2010c, 2010d), whereas an increase in LF power, with a decrease in the high frequency (HF) component, has been linked to stress during road transport (Ohmura et al., 2006).

Currently, several so-called 'conflict behaviours', such as tail lashing and mouth opening, are considered to be indicators of acute discomfort and are used in many stress-related studies (Christensen et al., 2010; McLean and McGreevy, 2010; Williams and Warren-Smith, 2010), but definite scientific evidence for the indicative value of most of these behaviours is lacking.

Cortisol concentration is known to be altered by minor perturbations in the horse's environment and is one of the most common and accessible hormones to measure the stress response in plasma, serum or saliva (Irvine and Alexander, 1994; Möstl and Palme, 2002). Cortisol concentrations in combination with physical and behavioural parameters could be even more useful in determining whether certain performances are associated with acute and/or chronic stress.

The combination of behavioural assessments, HRV analysis and cortisol concentrations in plasma and saliva could therefore reflect the welfare status of a horse and were used in the present study to test whether different HNPs have a different effect on the welfare status of the equine athlete.

Materials and methods

This study was approved by the Committee on Animal Welfare of Utrecht (University DEC: 2008III07068).

Horses

Seven healthy, clinically sound, base-level trained Royal Dutch Sport horses (5 mares, 2 geldings; mean age 10 ± 4 years; mean height at withers 161.2 ± 1.4 cm; mean weight 531 ± 47.3 kg) with no disease history participated in the study. Radiographic and ultrasound examinations of their cervical spinal column showed no clinically significant abnormalities. All horses were accustomed to the HNPs during a training period of at least 3 weeks (Wijnberg et al., 2010; Sleutjens et al., 2012) according to the experimental design that enabled acceptance of the training method inducing the HNP without force.

Head and neck positions

Five standard predetermined HNPs were used, as described earlier in detail (Elgersma et al., 2010) (Fig. 1). These were: (1) HNP1 (free, unrestrained); (2) HNP2 (neck raised; bridge of the nose around the vertical); (3) HNP4 (neck lowered and considerably flexed; nose pointing toward the chest); (4) HNP5 (neck raised and considerably extended; bridge of the nose in front of the vertical), and (5) HNP7 (neck lowered and flexed; nose pointing towards the carpus).

The HNPs used in the present study were identical to those used in an earlier experiment (Gómez-Alvarez et al., 2006; Weishaupt et al., 2006; Rhodin et al., 2009; Waldern et al., 2009) with the exception of HNP7, which was newly defined for the current investigation following preparatory fieldwork that revealed that equestrian connections had two interpretations (positions HNP4 and HNP7) for the hyperflexed

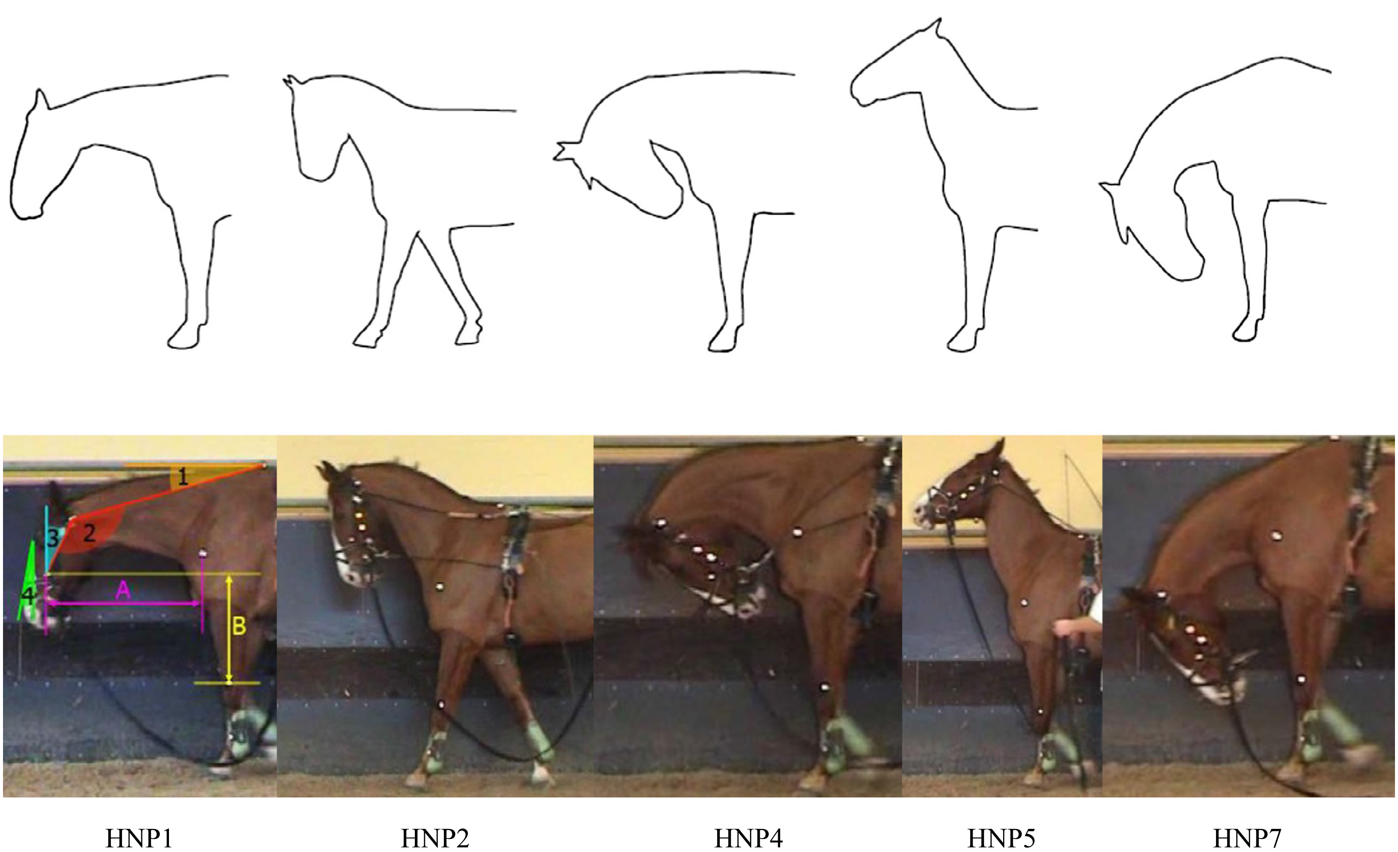

Fig. 1. Various head-and-neck positions used. For details see text and Elgersma et al. (2010).

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