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Comparison of the head and neck position of elite dressage horses during top-level competitions in 1992 versus 2008

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ABSTRACT

Among veterinary surgeons, interest has recently increased in the role of the horse's neck as a causative factor in complex locomotor disturbances. Specifically, controversy surrounds the trend for the head to be carried behind the vertical (BHV) in contravention of Fédération Equestre Internationale (FEI) rules. The aim of this study was to determine whether the head angulation of elite dressage horses has changed over the last 25 years, and whether head angulation correlates with the competition score awarded. Head angle was measured from videos recorded during the Grand Prix test at the 1992 Olympic Games and the 2008 World Cup Final, during collected canter (CC), collected trot (CT), passage (Pa), and piaffe (Pi).

Head angulations were BHV in CC and CT in both 1992 and 2008. The likelihood of being BHV during Pa or Pi was significantly greater in 2008 than in 1992 ($P < 0.05$). Higher scores correlated significantly with head positions that were further BHV during Pi in 2008 ($P < 0.05$). Head angulations were orientated BHV in all paces in 2008, whereas in 1992 this was only the case for CT and CC. These findings support the hypothesis that, in recent years, FEI dressage judges have not penalised horses for a head position BHV. The findings also support the need for further studies of the effects of head and neck position on the health of horses.

Introduction

Veterinary interest has recently increased about the role of the horse's neck as a potential causative factor in complex locomotor disturbances (Wijnberg et al., 2004). Controversy surrounds the head and neck position (HNP) of dressage horses during training and in high-level competition, as well as the traditional subjective scoring system used to judge dressage competitions. Nevertheless, dressage, in which a panel of judges subjectively assesses horse and rider, has been an Olympic sport since 1912 and remains one of the most popular equestrian sports (van Weeren, 2008).

The Fédération Equestre Internationale (FEI) has the regulatory responsibility for dressage. The FEI Handbook (FEI, 2011) provides rules for judges that clarify the process of and criteria for assigning scores in an attempt to keep the judging of performance as objective as possible. Article 101, which describes the object and general principles of the test, states that: '*The head should remain in a steady position, as a rule* ***slightly in front of the vertical****, with a supple poll as the highest point of the neck, and no resistance should be offered to the Athlete*' (FEI, 2011; Fig. 1). The position of the head is factored into the judge's score for every movement and into the collective marks awarded for general impression at the end of the test (Riexinger, 2003). A persistent faulty position can have a significant effect on the final score.

There are many methods of training dressage horses with different rationales (van Weeren, 2013). Currently, some highly successful trainers work their horses with the neck in a hyperflexed position, with the nose close to the chest and the front of the face far behind the vertical (BHV; Janssen, 2006). Other trainers believe that working the horse in this position is detrimental to the horse's health and well-being (Heuschmann, 2007). In response to this controversy, the FEI issued the following statement: '*There must be an understanding that hyperflexion as a training aid must be used correctly, as the technique can be an abuse when attempted by an inexperienced, unskilled rider or trainer*' (FEI, 2006).

Recently, the physiological consequences of different HNPs (Wijnberg et al., 2010; Sleutjens et al., 2012) and the effects of HNP on spinal and limb kinematics (Weishaupt et al., 2006; Rhodin et al.,

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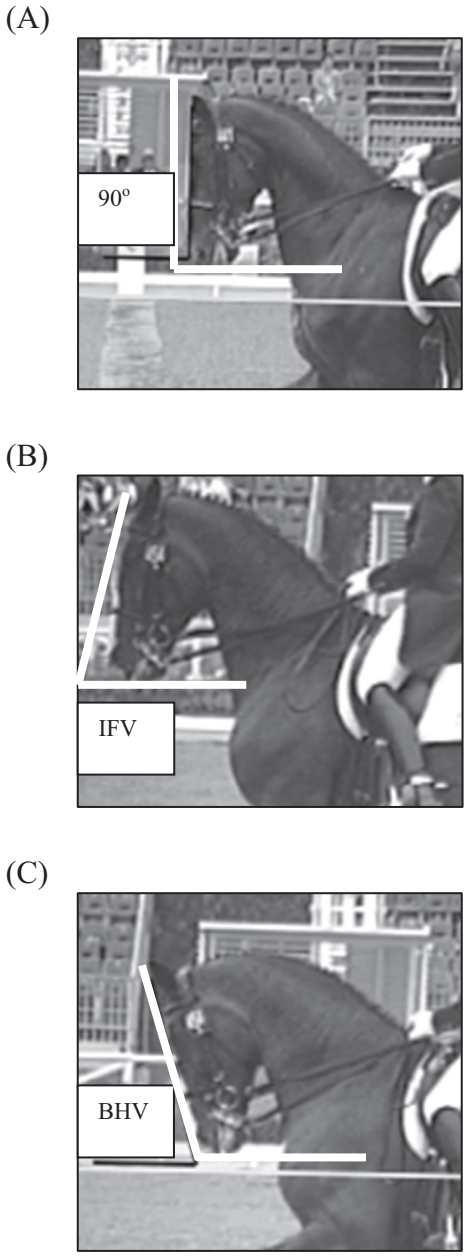

Fig. 1. Positions of the head: (A) on the vertical (90°); (B) in front of the vertical (>90°; IFV), and (C) behind the vertical (<90°; BHV).

2009) have been studied. In addition, the constrictions present in the cervical vertebral canal at any time point throughout the extremes of movement have been assessed ex vivo (Elgersma et al., 2010; Sleutjens et al., 2010; Schmidburg et al., 2012). These constrictions may be responsible for the reduced in vivo nerve conduction velocity that is evident even when using the FEI-prescribed HNP (Wijnberg et al., 2010). It is thus of great importance to follow FEI rules when assessing HNP during performance in high-level competitions.

Measurements of head orientation in unridden horses have shown that the head is carried in front of the vertical (IFV) at walk, trot, and canter, and that the mean angle of the head from the vertical is significantly greater in unridden horses than in photographs of ridden horses used in advertisements for sale (McGreevy et al., 2010). Measurements based on lateral-view photographs in the FEI yearbook during the period 1979–2011 indicated that the angle of the front of the face varied between years and was furthest BHV in 2006 and 2010 (Randle and Venables, 2012). However, there are no reports to date on the head positions of dressage horses through complete strides of specific gaits during competition or on evaluations of the scores awarded to horses that compete with their head BHV.

In light of these deficiencies in the literature, we measured the head angulation of dressage horses during top-level international competitions to determine whether head orientation relative to the vertical had changed in the period from 1992 to 2008, and whether the mean angle of the head was related to the final score when competing.

Materials and methods

Subjects

The subjects were the top 15 finalists at each of the 1992 Olympic Games (OG 1992) and the 2008 World Cup Final (WC 2008). These events are considered to be of a similar level and the horses, all of which were Warmbloods bred in Europe, were of a high competitive standard. The OG 1992 horses had a mean age of 11 ± 2.5 years (mean ± standard deviation; range: 8–16 years), and comprised 11 geldings and four stallions. The WC 2008 horses had a mean age of 13.5 ± 2.6 years (range: 9–18 years), and comprised two mares, 11 geldings and two stallions.

Data collection

Sagittal plane video recordings were made during the Grand Prix Special (FEI, 1992) at the OG 1992 in Barcelona, Spain (Clayton, 1997) and during the Grand Prix B (FEI, 2003) at the WC 2008 in 's-Hertogenbosch, The Netherlands. A camcorder, placed 20 m behind the entrance, was orientated perpendicular to the short side of the rectangular (20 m × 60 m) dressage arena and was levelled horizontally. In 1992, a Super VHS camcorder (Panasonic AG 450) was used, operating at a sampling frequency of 60 Hz, and in 2008, a similar, standard camcorder was used (Canon D400) operating at 50 Hz.

Data analysis

The videos were analysed frame-by-frame using proprietary, commercially available software Dartfish (Dartfish v. 4.5.2.0, Dartfish TeamPro, 3650) to measure the angle of the dorsum of the nose relative to the horizontal. Measurement error was estimated at 0.5° by repeated analysis of the same footage. Two categories of angles were determined based on the corresponding angle at the poll: angles ≥90°, which indicated that the nose was vertical or rostral to the poll (on the vertical [90°; Fig 1a] or in front of the vertical [IFV: >90°; Fig. 1b], both categorised as 'not behind the vertical or 'NBHV'); and angles <90°, which indicated that the nose was caudal to the poll ('behind the vertical' [Fig. 1c], categorised as 'BHV'). Using the measured head angle as a basis, each frame was placed in one of the two categories (≥90° [NBHV] or <90° [BHV]).

Head angles were scored per frame throughout a complete stride of collected canter (CC), collected trot (CT), passage (Pa), and piaffe (Pi), starting and ending at the mid-stance phase of either the left or right forelimb. The stride used for measurement was taken at the same moment during the test for all riders. For example, the stride of CT at the WC 2008 was measured during the CT performed at the arena side marked K–A–F, which was movement number 2 during the Grand Prix test B. For Pi, the measurement started from the third stride, because of possible irregularities in the head position during the transition between Pa and Pi. The measurements were made when the horse was perpendicular to the camera. To correct for individual differences in the total number of frames, the number of frames (≥90° [NBHV] or <90° [BHV]) in each of the categories was normalised by dividing by the total number of frames for that horse per stride.

Statistics

To investigate differences in head position between the gaits and between the two competitions, the average percentage and standard deviation of the number of frames with a head angle ≥90° (NBHV) to the total number of frames were calculated for each gait per competition. A logistic regression analysis for grouped data (number of frames ≥90° of the total frames per horse and gait) was performed for both competitions with horse as a random effect to take the measurements of the four gaits for each horse into account. Gait, competition, and the interaction between the two were the explanatory variables. The statistical program R (R Development Core Team, 2014, package lme4), was used for the statistical analysis, operating at a significance level of $P < 0.05$.

To investigate the effect of head position on final score in the competition, Spearman's rank correlation coefficient was used to correlate the objectively measured angles with the subjectively judged overall scores. The overall scores were also