The effect of standardised exercise tests on equine kinematics varies between disciplines

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Kinematic methods are widely used to quantify locomotion and exercise but reference values are missing. In this study, variation in kinematic parameters was evaluated between horses competing in different disciplines before and after standard exercise tests (SET). Elite sport horses (6 dressage, 10 showjumping, 9 eventing, 5 eventing ponies, 9 endurance, 14 young Friesian stallions) equipped with EquiMoves® inertial sensors (poll, withers, sacrum, limbs) were measured during two trials (in-hand trot before/after discipline-specific SET) on a hard or soft surface (both if available). During the discipline-specific SET, plasma lactate (LA) was measured after each exercise bout. Exercise intensity (EI) was defined as high if peak-LA >4 mmol/l and low otherwise. Vertical displacement differences (MaxDiff, MinDiff) and range of motion (ROM) of the upper body, limbs protraction ROM (ROMprot), stance and stride durations were extracted. Data were analysed using linear mixed-effects models, including Discipline, Trial, Discipline-Trial interaction, Surface, and EI as fixed effects. Akaike's Information criterion was used for model reduction. Both Surface and Discipline-Trial interaction affected all parameters except MinDiff- and MaxDiff-Withers. Pre-SET Friesians and showjumpers showed higher front limb ROMprot than dressage. Post-SET, all disciplines showed less ROMprot than dressage. MaxDiff-Head, -Withers and -Sacrum, MinDiff-Withers and stride duration were also significantly affected by EI. Horses with high EI showed higher MaxDiff-Withers change (estimate:8.96 mm, 95%-CI 2.47,15.45) than with low EI. Results showed that SETs and EI affect kinematic parameters differently across disciplines. Thus, developing and understanding kinematic reference values for fit-to-compete horses is of high importance.

Gait differentiation of Mangalarga Marchador horses using principal component analysis (PCA)

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There is a lack of studies evaluating the peculiar aspects of Mangalarga Marchador (MM) breed gaits, marcha batida (MB) and marcha picada (MP). So far, gait classification is mainly performed by inspection. We hypothesised that a PCA might differentiate both gaits. Kinematic variables were measured of 29 MB and 19 MP horses. Eighteen Optitrack® Prime 17w cameras (240 Hz) were used to acquire the three-dimensional data of three retro-reflective markers fixed to the hooves, and four complete stride cycles per horse were selected from a 26-m course. Two PCAs were performed, and data were normalised by Z-score transformation. The first PCA used stride temporal variables: stride frequency (FS, Hz), stride length (m), stride thoracic or pelvic supports (STS or SPS, %), diagonal advanced placement at support (DAPS, % stride), diagonal advanced placement at lift-off (DPLO, % stride). The second PCA used limb support variables normalised to % of stride time: thoracic triple support, pelvic triple support, diagonal support (DS), lateral support, bipedal pelvic support (BPS), monopedal thoracic support, monopedal pelvic support and suspension. For the PCAs, two principal components (PC1 and PC2) explained about 72.5% and 51.1% of total variability. DAPS and DPLO resulted in the most useful variables for PC1, while FS and SPS were valid to define PC2. The second PCA showed DS and BPS as useful variables to explain gait patterns, mainly for MP gait. PCA proved to be an effective technique to explore the crucial parameters for gait differentiation in MM horses.