Relationship between body condition and locomotion asymmetry in 109 riding school horses

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Excessive body fat may increase workload and has, both in horses and other species, been associated with a compromised locomotion pattern. Earlier studies suggest that ~30% of Swedish riding school horses are overweight and also that lameness is the most commonly occurring health problem. In this study, possible impact of body condition on horses' locomotion asymmetry were investigated in 109 owner sound horses (≥4≤20 years) from five riding schools in Sweden. Body condition (BCS) was assessed (scale 1-9, 0.5 precision) by the same person in all horses. Locomotion asymmetry was registered objectively with a 3-axis-inertial sensor system (Lameness Locator, Equinosis®) at trot by hand in a straight line on a soft arena surface (~100 m, minimum 25 strides). Vector sums of head (VS-front) and pelvic (VS-hind) minimum and maximum differences were calculated. Statistical analysis of VSs were performed in SAS 9.4 using Pearson's correlation analysis and a GLM including the fixed effect of riding school and BCS as a continuous variable. As several factors could be expected to interfere with the results, significance was set at $P<0.1$. BCS ranged from 4.5-7.5. BCS did not affect VS-front ($P>0.1$) but BCS showed an effect on VS-hind ($P=0.09$). BCS also showed a positive correlation to VS-hind (r=0.18, $P=0.06$). Although this was a field study, where a large number of environmental factors can be expected to affect the outcome, a relationship between BCS and hind limb locomotion asymmetry was indicated. Management-induced lameness in working horses is an animal welfare problem justifying further research.

Effects of 3D-printed horseshoes on kinematic hoof-parameters at trot on hard surface

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Proper and adequate shoeing is important to maintain and promote a functional foot. However, fitting a horseshoe can be challenging, especially in horses with hoof-related problems. The purpose of this study is to investigate the effects of tailor-made three-dimensional (3D)-printed horseshoes on equine hoof kinematic parameters in a controlled experimental setting, using a quantitative gait-analysis system. We hypothesised that 3D-printed horseshoes would cause less vibrations and impact on hard surface. Six rider-sound horses were shod with traditional steel shoes for two shoeing-cycles and one shoeing-cycle of 3D-printed horseshoes made of a thermoplastic elastomer, in a randomised order. Kinematic data was collected on a straight line at trot on hard surface, using hoof mounted inertial measurement units (IMU), including accelerometers (sampling frequency: 1000 Hz), one day after shoeing. A linear mixed effect model was used to determine the effect of shoeing-condition on the kinematic parameters extracted, with Horse as a random effect and Shoe type and Stride frequency as fixed effects. Among the extracted parameters, the ones significantly different were the lower Max acceleration values in the mediolateral (-145.25 m/s^2, p-value=0.049) and in dorsopalmar directions (-263.24 m/s^2, p-value=0.0001). The signals contained less energy in mediolateral and dorsopalmar directions (-4,673.63 $(m/s^2)^2$, $P=0.0107$ and –6,162.13$(m/s^2)^2$, $P=0.0149$, respectively). The Peak-Positive and Peak-Negative counts were larger in dorsopalmar direction (-1.58148, $P=0.01742$ and -1.56364, $P=0.01888$ respectively). No significant differences were found in proximodistal direction. These findings suggest that 3D-printed horseshoes decrease vibrations and have an impact absorbing effect on hard surface at trot.