Influence of sports-specific shoeing methods on loading and movement of the limbs in tölting Icelandic horse

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Key words
Gait analysis, gait manipulation, hoof health, Icelandic horse, orthopaedics, shoeing.

Aim of the study
The aims of the study were (1) to describe the motion pattern and loading of the limbs in the Icelandic horse with a correct standard shoeing in different gaits, particularly at the tölt; as well as (2) to quantify the mechanical consequences of shoeing manipulation (high hooves, long toes) and additional weights by means of kinetic and kinematic gait analysis.

Material and methods
Force and time parameters were measured with an instrumented treadmill at walk (1.4 m/s) and at two speeds at tölt and trot (3.3 m/s; 3.9 m/s). Simultaneous kinematic data was obtained by capturing reflective markers overlying bony landmarks on the fore- and hindlimbs and the head. Thirteen sound adult Icelandic horses were first measured with high, long front hooves shod with commonly used steel horseshoes, pads and packing material (S_H). Gait analysis was repeated one week later after trimming the hooves according to standard shoeing principles (S_N). Cycles of each record were averaged and left and right limb data pooled. Differences were tested using a paired t-test (walk) or a RM ANOVA (tölt, trot). Level of significance was set at $P<0.05$.

Results and significance
High hooves and long toes reduced stride frequency in all three gaits. The footfall rhythm at the tölt became less laterally bound and the suspension phase was longer at the trot. Regularity of the gaits was not influenced by the shoeing condition. In the S_H condition, the forelimbs showed higher protraction arcs, but no wider protraction angles. Compared to S_N, the longer stride duration observed in the S_H condition led at the fast tölt and trot to an increase in limb impulses and peak vertical forces in the forelimbs and prolonged breakover duration in fore- and hindlimbs in all three gaits.
Although changes in certain temporal variables and in the movement pattern are beneficial for gait performance, adverse effects on gait mechanics such as higher limb forces as well as prolonged breakover durations compromise the soundness of the hoof and the locomotor system.

Publications, posters and presentations
Waldern, N.M.; Wiestner, T.; Ramseier, L.C.; Amport, C.; Weishaupt, M.A. (2012) Shoeing effects on limb movement and ground reaction forces in Icelandic horses at walk, tölt and trot. Vet J, in press.

Weishaupt, M.A.; Waldern, N.M.; Amport, C.; Ramseier, L.C.; Wiestner, T. (2012) Effects of shoeing on intra- and interlimb coordination and movement consistency in Icelandic horses at walk, tölt and trot. Vet J, in press.

Waldern, N.M.; Weishaupt, M.A. Normalbeschlag & Einfluss des Beschlags auf das Gangbild und die Belastung der Gliedmassen beim Islandpferd. Oral presentation at a seminar of the IPV CH (Islandpferdeverband Schweiz), Zurich, 4th February 2012.

Waldern, N.M.; Ramseier, L.C.; Weishaupt, M.A. Das Islandpferd im Fokus der Forschung. Oral presentation at the BEA, Bern, 2nd May 2012.

Weishaupt, M.A.; Waldern, N.M.; Ramseier, L.C.; Wiestner, T. Effects of shoeing in Icelandic horses part I: Intra- and interlimb coordination and movement consistency at walk, tölt and trot. Oral presentation at the 7th International Conference of Equine Locomotion, Strömsholm, 25th-28th June 2012.

Waldern, N.M.; Wiestner, T.; Ramseier, L.C.; Weishaupt, M.A. Effects of shoeing in Icelandic horses part II: Limb movement and ground reaction forces at walk, tölt and trot as well as gait comparison tölt vs. trot. Oral presentation at the 7th International Conference of Equine Locomotion, Strömsholm, 25th-28th June 2012.

Weishaupt, M.A.; Wiestner, T.; Waldern, N.M. The effect of shoeing on the movement and forces of the limbs. Oral presentation at the 12th Congress on Equine Medicine and Surgery, Geneva, 11th-13th December 2012.

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