



Walking and trotting through a water track affects limb sagittal angles and stride timing in horses

Nikae C.R. te Moller, Tijn J. Spoormakers, Meike A.C. van Donk, Filipe M. Serra Bragança

Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, Yalelaan 112-114, 3584 CM Utrecht, The Netherlands

Introduction

- Rehabilitation after musculoskeletal injury has become an essential part of veterinary care. Various forms of exercise in water have been described as an effective medium to improve function while preventing further injuries [1].
- The aim of this study was to evaluate limb kinematics (stride timing and sagittal angles) during water track exercise at walk and trot and compare this with overground locomotion.
- **We hypothesized that 1) horses show increased stride duration and pro- and retraction of the limbs in water and 2) water exercise affects limb kinematics on land.**

Conclusion

There is a combined effect of water and gait on stride duration and limb sagittal angles, where hindlimb pro- and retraction yielded the most noticeable change. The speed reduction in water at walk was small but should be considered as a confounding factor. One Water track session did not change overground locomotion. These results can help practitioners to meet individual rehabilitation requirements.

Material and Methods

Eleven Warmblood horses, equipped with IMU sensors (EquiMoves®; one the cannon bone on each leg; figure 1B) were measured overground (OG1), while going through a water track (85m long; water height 33cm), and once more overground (OG2). Linear mixed models were used to compare different conditions ($p < 0.05$).

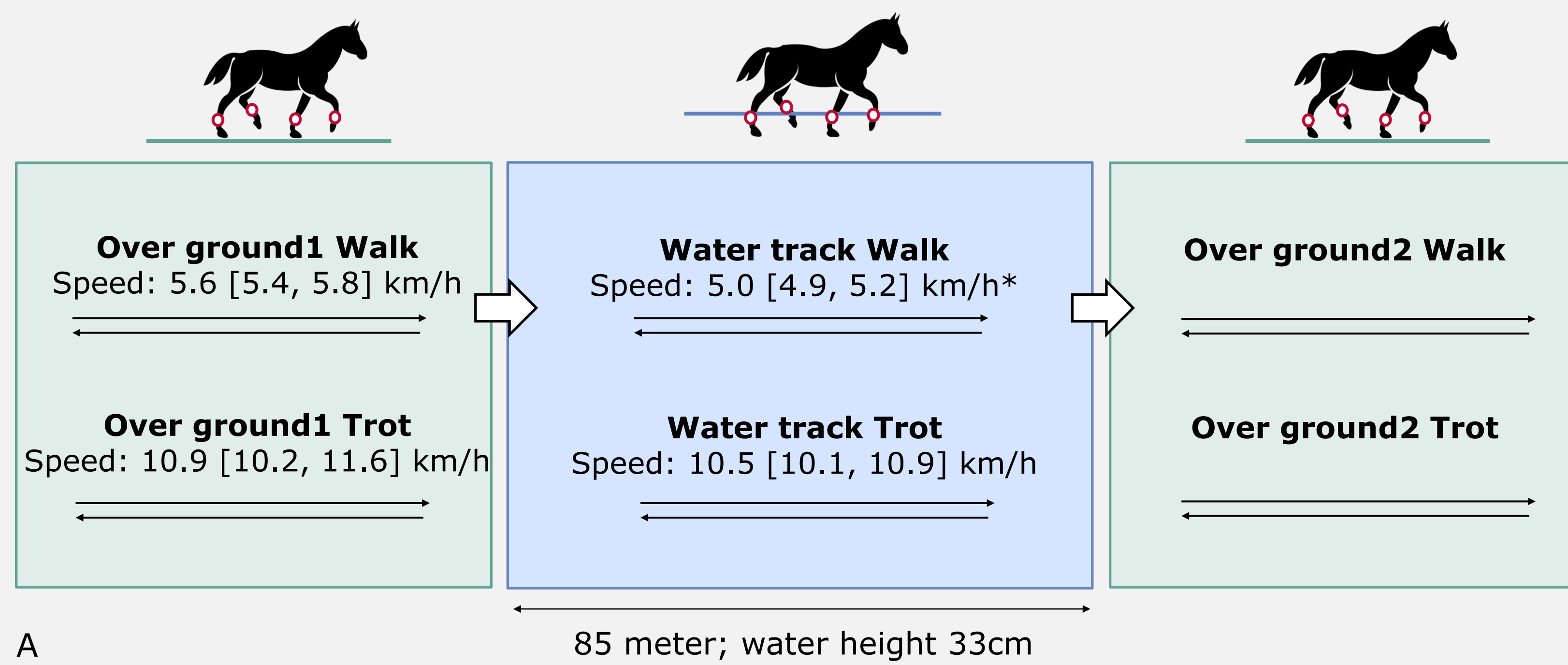


Figure 1

Experimental set-up with A) subsequent measurements overground (OG1), in the water track and overground (OG2) at walk and trot. B) Horse walking through water track. IMU sensors are indicated by red dots.

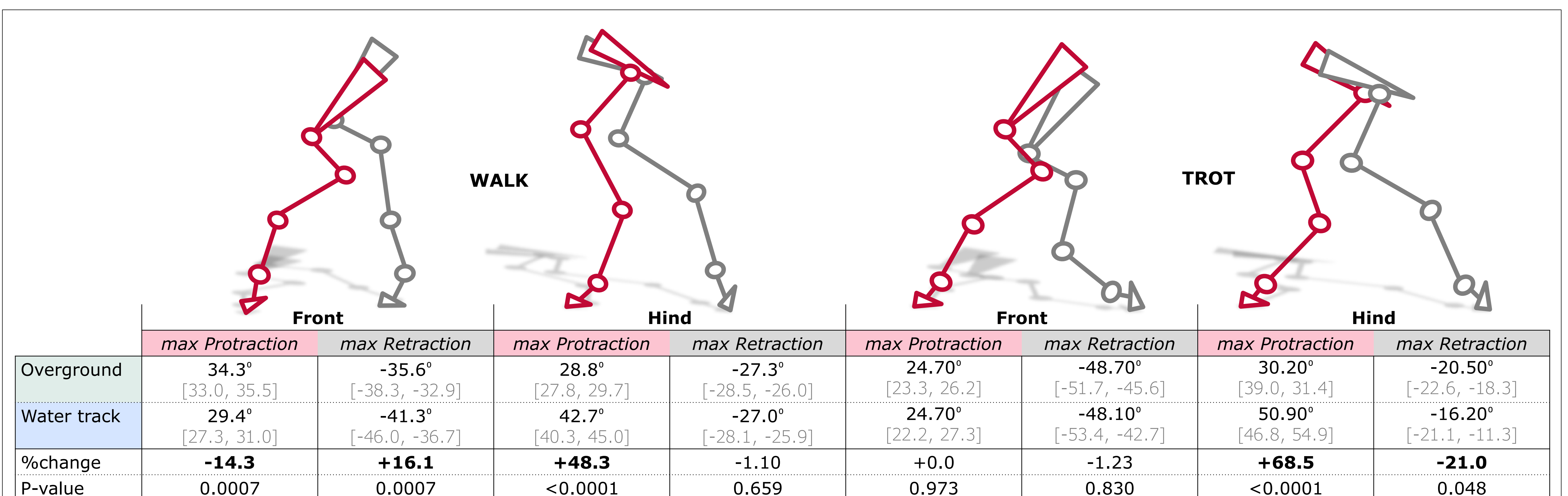


Table 1

Estimated mean [95%CI] pro- and retraction angles are presented for front and hind limbs at walk and trot. Changes that were significant are bolded.

Results

- No differences between Overground1 and Overground2 were found, indicating that there was **no immediate effect of water track exercise** on overground locomotion.
- Estimated mean speed measured with GNSS[5hz] was lower in the water track (5.0 km/h) compared with Overground1 at walk (5.6 km/h; $p=0.002$). At trot, speeds in water and overground were similar (10.5 vs 10.9 km/h; $p=0.18$; figure 1A).
- In the water track, **stride duration increased significantly** at walk and trot (respectively, +14.9% and +15.6%, $p < 0.0001$).
- At **walk**, **front limb protraction** decreased, while **front limb retraction** increased. **Hind limb protraction** increased.
- At **trot**, front limb sagittal angles did not change, but **hind limb protraction** increased, while **hind limb retraction** decreased (Table 1).