



# An investigation into the relationship between asymmetrical loading of the stirrups by the rider and hind-limb kinematics of the horse during rising trot.

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## INTRODUCTION

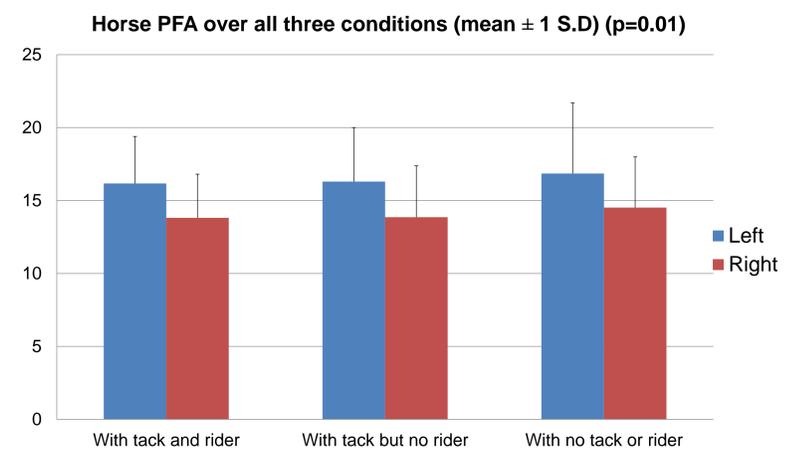
- Asymmetric load upon the horse's back has been identified as a possible cause of back pain and lameness (Gomez Alvarez et al 2008).
- Measurement of force contact points, such as the stirrups, have limited research. So far a strain gauge has been used between the iron and the leather in one stirrup.
- Knowledge of the effect of interactive forces between horse and rider on equine movement patterns may provide further understanding of the horse-saddle-rider interaction.
- The objective of this study is to measure rider asymmetry in stirrup loading during rising trot, and to identify concurrent effects on horse hind-limb kinematics.

## METHODOLOGY

- A controlled, randomised study using 20 sound horses with single horse/rider combinations capable of achieving satisfactory (6/10) in a Prelim dressage test; thus able to achieve a balanced working trot in unison.
- Rider stirrup force (SF) was assessed at rising trot on a riding simulator using riders' own saddles, with custom stirrups incorporating a force sensor.
- Skin markers were applied to the dorsolateral hoof of both hind-limbs of the horse.
- 2D video analysis recorded and assessed the peak flight arc (PFA) during three trials of trot step cycles in each direction for each of the conditions:
  - Ridden (R)
  - Unridden with tack (UT)
  - Unridden without tack (U)
- PFA was assessed using Kinovea software.
- Symmetry indices (SI) were calculated from means. Statistical analysis included, Kolmogorov-Smirnov test, Pearson's correlation coefficient and two-factor ANOVA.

## RESULTS cont'd

- Most horses (85% (R), 90% (UT) and 75% (U)) achieved a consistently greater left hind-limb PFA.



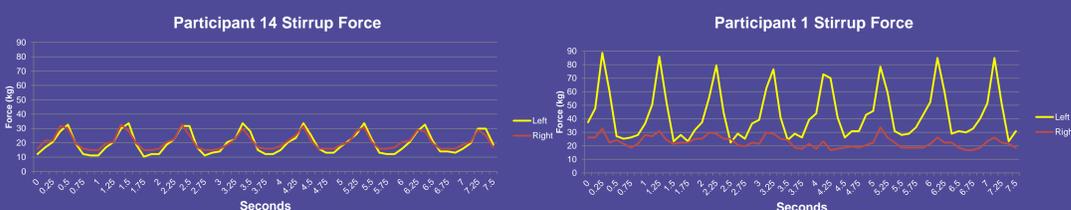
- There was a positive correlation between horse PFA SI and rider SF SI ( $r=0.5$ ;  $p<0.05$ )

## DISCUSSION & CONCLUSIONS

- Horses with an increased asymmetry in hindlimb PFA correlated with a greater rider SF asymmetry.
- As PFA does not change when ridden or unridden, it may be suggested that the horse has some influence on the rider rather than the other way around.
- Furthermore, the consistently greater left PFA could be highlighting the occurrence of lateral dominance in horses.
- Additional research is recommended to investigate these mechanisms of asymmetry.

## RESULTS

- There were no significant differences between left and right mean, minimum or maximum SF.



- There were significant differences in PFA between left and right hind-limbs for all three conditions ( $p=0.01$ ), but there was no significant difference between conditions.

## APPLICATION

Providing further evidence and understanding of horse-saddle-rider interaction.

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