Validation of the MSR145W Data Logger for Gait Determination in Horses (*Equus caballus*)

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Observing locomotor activity and resting behaviour is used to determine time budgets that may give some indication for the assessment of horses' welfare in different housing systems. Direct observation requires much manpower, and thus, a common method is the use of pedometers, which count and store single step events of a certain time interval. One disadvantage of these devices is the loss of information due to pooling of data, which also disallows the distinction of individual gaits. For gait determination, we tested a versatile skilled accelerometer, aiming to define activity value ranges for each gait, i.e. stand, walk, trot, gallop. The data logger (MSR145W, MSR Electronics GmbH, Switzerland) includes integrated temperature, humidity, pressure, light and three-axis acceleration (x-, y-, z-axis) sensors. The waterproof MSR145W (approx. 60x20x15 mm, 25 grams) has a memory capacity of 2 million values (expandable with optional microSD card) and a lithium polymer battery (260 or 900 mAh) for measurements over several days. Data is transferred to the PC via USB cable using MSR Software (Version 5.06).

For the validation, 19 horses of different breed and height at withers (125 - 169 cm) were ridden or longed in walk, trot and gallop and stood still for 5 minutes each in total. The logger was attached to the left front leg above the fetlock. Data was measured using the y-axis acceleration sensor, recording at a sampling rate of 10 Hz and a maximum sensitivity of ±10 g. Tests were conducted at different training arenas with variable floor surfaces.

The absolute activity values of every horse were averaged per second for each gait. A linear mixed-effects model was used to evaluate influences on gait determination according to activity values. Explanatory variables included gait, breed class (pony ≤ 148 cm / horse > 148 cm) and their interaction as fixed effects and the individual horse as random effect. Statistical assumptions were checked using graphical analysis of residuals. Results show only a significant influence of the gait ($F_{3,36}$ = 566.7, $p < 0.0001$). Therefore, a clear limitation of activity value ranges and the distinction between gaits was possible.

The validation reveals a clear suitability of the MSR145W data logger for gait determination in horses. Due to the loggers' battery and memory features, it furthermore seems well-suited for measurements of locomotor activity over longer time periods.

Key words
horse, activity, acceleration, gait determination

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