Correlation of two different scaling approaches of motion asymmetry variables to expert visual assessment of lameness in horses

F. Serra Bragança, E. Hernlund, M. Rhodin, L. Roepstorff, J. Stenius, J. Martinsson, Q. Pleyers, E. Persson- Sjodin, A. Hardeman, C. Roepstorff

Background and Objectives

Objective motion asymmetry measurements of head and pelvis are valuable for orthopaedic diagnostics and screening. However, comparing horses requires scaling variables to horse size. With non-optical sensors, this has typically been achieved by normalizing variables to the vertical range of motion (vROM) using the symmetrical component (H2) of the displacement signal. A drawback is that horses with low vROM relative to body size may produce asymmetry measurements disproportionately elevated compared to visually perceived lameness. This study compared veterinary visual assessment against two objective scaling methods: vROM-based and video frame-based anatomical scaling.

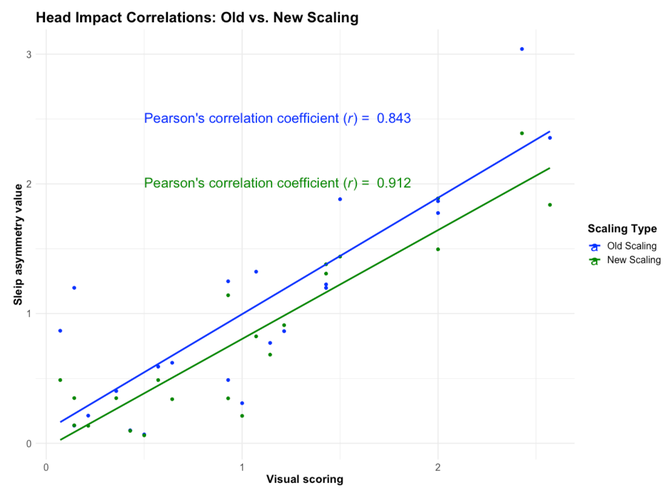
Materials and Methods

Smartphone videos of 22 horses were independently assessed by seven experienced clinicians who rated head and pelvis movement asymmetry on a 0-5 scale (0=symmetrical, 5=non-weight bearing lameness) in 0.5 increments. Asymmetry measures were computed using vROM scaling with H2 as reference, and anatomical scaling based on horse size (in pixels). Pearson's correlation assessed relationship strength, while Intraclass Correlation Coefficient (ICC) evaluated agreement between scales. Separate analyses were conducted for both scaling methods, asymmetry components (impact and push-off), and anatomical locations (head and pelvis). Inter-observer agreement was assessed using ICC.

Results

Correlation/agreement between measured asymmetry and visual scoring (vROM, anatomical scaling) were: head impact (r=0.84, 0.91; ICC=0.85, 0.92), head push-off (r=0.41, 0.57; ICC=0.42, 0.59), pelvis impact (r=0.88, 0.90; ICC=0.88, 0.91), and pelvis push-off (r=0.79, 0.85; ICC=0.80, 0.86). Inter-observer lameness degree agreement was higher for pelvis (0.79) than head (0.69).

Figure 1



One grade on the visual scale corresponds to appox. **0.75** on the anatomically based "Sleip scale".

The **head push-off** variable shows **the weakest correlation and agreement to visual scores** for any scale.

Table 1

	vROM (r, ICC)	Anatomical scaling (r, ICC)
Head impact	0.84 (0.85)	0.91 (0.92)
Head push-off	0.41 (0.42)	0.57 (0.59)
Pelvis impact	0.88 (0.88)	0.90 (0.91)
Pelvis push-off	0.79 (0.80)	0.85 (0.86)

Correlation (r) and agreement (ICC) between measured asymmetry and visual scoring for two scaling methods:

1. vROM; normalized to the vertical range of motion using the symmetrical component (H2) of the displacement signal.
2. anatomical scaling; video frame-based scaling based on horse size (in pixels).

Conclusion

Anatomical size-scaling better aligned with veterinary visual assessment than vROM based scaling and likely improves between-horse comparisons.

An increase of **0.75** on the anatomical objective scale **corresponded to** an increase of **1 grade** on the visual 0-5 scale, with a linear relationship.