

Quantitative Ultrasound- and Dual X-Ray Absorptiometry- Measurements of the Third Metacarpal Bone in Horses An In Vivo - Ex Vivo Study

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The purpose of the study was to examine the relationship between in vivo and ex vivo quantitative ultrasound (QUS) measurements with and without soft tissue and ex vivo dual-X-ray absorptiometry (DXA) at different aspects and levels of the third metacarpal bone (MC III) in horses. Both MC III of 8 clinically normal horses were divided in 9 sites (lateral, medial, dorsal aspect; proximal, mid, distal level). Speed of sound (SOS) measurements were performed with a QUS multisite device (Sunlight Ltd., Rehovot, Israel) and a DXA device (Hologic Inc., Bedford, USA) was used to evaluate cortical bone mineral density (BMD) at each site. Ex vivo data on MC III were analysed with a mixed model to test the hypothesis of no difference between aspect and level in QUS and DXA while adjusting for fixed member and for random horse effects. Pearson correlation coefficients between SOS and BMD obtained on MC III with soft tissue were calculated for each member and site. A mixed model was used to determine whether there is a difference between in vivo and ex vivo SOS data while adjusting for fixed aspect, level and member and random horse effects. Highly significant ($p < 0.001$) differences were obtained between aspects for ex vivo SOS and DXA measurements. Differences ($p < 0.001$) were obtained between measurement levels for DXA data.

| Aspect | LSM (SOS) m/s (Std Err=51.30) | LSM (BMD) g/cm ² (Std Err= 0.02) |
|---------|----------------------------------|--|
| Lateral | 4202.45 | 1.95 |
| Dorsal | 3982.71 | 2.61 |
| Medial | 4086.81 | 1.97 |

The table shows least squares means (LSM) and standard errors (Std Err) for QUS and DXA measurements performed at different aspects. The correlation coefficient between SOS and DXA over all 9 sites and both MC III was negative ($r = -0.28$; $p < 0.001$). In vivo and ex vivo SOS data were different ($p < 0.01$), but not ex vivo data with and without soft tissue ($p > 0.05$). The study suggests that, in horses, SOS results can not be explained only by BMD, but could reflect additional properties of bone, such as elasticity, architecture or bone strength. Our results indicate that soft tissue does not influence ex vivo SOS measurement results.

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