

## Covariation bone biomechanics and enthesal changes in reindeer long bones – implication of activity?

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Our aim was to study the relationship between bone formation related enthesal changes (abbreviated EC) in humerus (deltoid, infraspinatus, lateral digital extensor, ulnaris lateral, and superficial and deep digital flexor) and in radioulna (anconeus, flexor profundus, biceps brachii, and flexor profundus digiti) and mid-shaft cross-sectional robusticity indicators (CA and J) of humerus and radioulna in reindeer in order to evaluate their etiology. Oulu Zoological Museum contains samples of free-ranging and corralled reindeer. We focused on humerus and radioulna as feeding behaviour (digging for lichen versus being fed) is known to affect EC scores of these bones. Bone robusticity measures CA and J were divided into three categories of EC for each enthesis, and statistically significant differences between these categories were tested with one-way analysis of variance. We found that CA and J values increased from one EC category to next. Differences were mostly statistically significant regardless whether origins versus insertions, or fibrous versus fibrocartilaginous enthesis were observed. This relationship was not confined within a bone element: EC scores of radioulna were related with humeral bone properties, and vice versa. However, CA and J values correlated with body size, and in case of EC there was an increase in body size between EC categories. Thus, bone robusticity and EC relationship might be an indicator of body size effects. These results provide relevant new insights in the methodological aspect of physical activity reconstructions as our results indicate ordinal nature of bone formation EC scores, and that EC are related to skeletal robusticity.

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