

# Do feeding and health management influence antler chemical composition and mechanical properties in Iberian deer?

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## ABSTRACT

Antler is a good model to study bone biology both because it is accessible and because it grows and falls every year. Previous studies have shown that chemical composition changes as the antler is grown, showing constraints in mineral availability and the physiological effort made to grow it. This study aimed at examining antler mechanical properties to assess whether they reflect physiological effort and whether they are associated to precise mineral bone composition rather than just ash content (which is considered the main factor affecting mechanical properties).

We examined Young's modulus of elasticity (E), strength, and bending work, as well as bone mineral composition along the antler shaft. Then we compared trends between antlers from two populations: captive, well-fed, health-managed deer (n=15), and free-ranging deer with lower food quality and no health treatment (n=10). Greater E, strength and work was found for better fed and health managed deer. In addition, antler chemical composition of both populations did differ in Na, Mg, K, Fe and Si, and marginally (p=0.06) in Zn, but not in ash or Ca content. Significant and clear divergent trends in mechanical properties supporting greater physiological exhaustion in free ranging deer were found for all mechanical variables. Detailed mixed models showed that, in addition to ash content, independent factors extracted from principal component analyses on composition affected E and strength, but not bending work. The results suggest that there is an association between bone chemical composition and its mechanical properties independently of ash content effects.