

Title: Interspecific variation of calcaneal morphology in gorillas

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Abstract Text:

The foot plays a prominent role in weight-bearing suggesting it may reflect locomotor variation. Despite the immense amount of foot research, the calcaneus has been relatively understudied. Here we analyzed the entire calcaneal shape of *Gorilla gorilla gorilla* (n=41), *Gorilla beringei graueri* (n=17) and *Gorilla beringei beringei* (n=8) to understand how morphology relates to locomotor behavior.

Calcanei were surface scanned and external shape analyzed using a three-dimensional geometric morphometric sliding semilandmark analysis. Semilandmarks were slid to minimize the bending energy of the thin plate spline interpolation function relative to the updated Procrustes average. Generalized Procrustes Analysis was used to align landmark configurations and shape variation was summarized using a principal components analysis. Procrustes distances between species were calculated and resampling statistics were run to test for group differences.

All subspecies demonstrate statistically different morphologies ($p < 0.005$ for pairwise comparisons). *G. b. graueri* separates from other subspecies based on posterolateral morphology, with *G. b. graueri* demonstrating an elongated peroneal trochlea, and thus more bone superiorly than *G. g. gorilla*. Compared to *G. b. beringei*, *G. b. graueri* has less bone inferiorly near the tuberosity. Cuboid and posterior talar facet shapes correlate with arboreality. *G. b. beringei* (most terrestrial) has a flatter cuboid facet and a more transversely oriented/relatively smaller posterior talar facet than *G. g. gorilla* (most arboreal) and *G. b. graueri* represents an intermediate morphology. These differences demonstrate a relationship between calcaneal shape and locomotor behavior and suggest that *G. b. graueri* may load its foot differently from the other subspecies.

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