Proposed Title

A Metric Investigation of the Cranial Base and Vertebrae among Extant African Homininae: Discrimination across Posturo-locomotory Complexes

Abstract

Differences in cranial base angle, vertebral dimensions, and vertebral curvature exist among Homo, Pan, and Gorilla. Accordingly, these differences are also associated with each species' respective positional-locomotory complex. However, many distinctions are obfuscated by dimensional and behavioral overlap among the genera and their fossil relatives. To address these issues, cranial and vertebral features were examined among Homo, Gorilla, and Pan as representative hominines for their positional-locomotory complexes. Limited samples of Hylobates lar, Pongo pygmaeus, and Australopithecus afarensis (A.L. 288-1 and A.L. 333) were also analyzed for comparative purposes. Significant results ($p < 0.05$) for both the Kruskal-Wallis and Mann-Whitney tests indicated statistically significant differences among species for cranial base angle, vertebral dimensions with coronal and sagittal facet orientation, and positional-locomotory complex. A Multinomial Logistic Regression (MLR) model yielded a correct classification percentage with significant model fit ($p < 0.05$) of 86.4% for the cranial base, 82.8-97.0% for all subsequent vertebrae, and 80.3% for thoracic and lumbar curvature among species. Regarding the positional locomotory complexes, the results were also significant ($p < 0.05$) and yield a correct classification percentage of 82.2% among bipeds and the two modes of knuckle-walking practiced by Pan and Gorilla respectively. However, misclassifications between human and nonhuman primates for cranial base angle and vertebral curvature suggest that these variables are not viable for assessing either genera or positional-locomotory complexes. An MLR-based comparison of individual vertebrae for Hylobates lar, Pongo pygmaeus, and Australopithecus afarensis (A.L. 288-1 and A.L. 333) misclassified all species. In fact, A.L. 288-1 was misidentified as Homo while A.L. 333 was misclassified as Pan. Overall, the data suggest that both vertebral corpus dimensions and coronal and sagittal facet orientation differ significantly among hominine taxa as well as by positional-locomotory complex. Inferences from the data conclude that the complex integration among the cranium and vertebrae indicate an unknown variable is influencing the number of significant variables for each skeletal element as related to their respective taxa and positional-locomotory complex.