ASSESSING ECOCOGEOGRAPHIC VARIATION IN SUPERIOR ETHMOIDAL BREADTH AS A PROXY FOR INTERNAL AIRWAY DIMENSIONS

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Superior Ethmoidal Breadth (SEB = the maximum breadth between the left and right frontoethmoidal sutures) is widely employed as a proxy for internal nasal airway dimensions. SEB is also commonly argued to evince climatic adaption in modern humans, as populations living in cold-dry environments predictably exhibit narrower SEB dimensions than those inhabiting tropical environments. However, as SEB anatomically spans both the upper nasal airways (i.e., common and superior meatuses) and the ethmoid air cells, the accuracy of SEB as a proxy for airway dimensions remains questionable. Here, we assess the relationship between SEB and internal nasal cavity dimensions using measurements collected on CT scans from a mixed-sex sample of modern human crania (n=46) from West Africa, Europe, and the Arctic Circle. Our results indicate that the position of SEB is typically superior to the roof of the internal nasal cavity, and thus above the actual airways. However, linear regression demonstrates that SEB is highly correlated with bi-ethmoidal breadth taken at the appropriate level of the airways (r=0.94, p<0.0001). Kruskal-Wallis ANOVA results indicate, that in addition to significant differences in SEB (p=0.0007), regional differences also exist for common (p=0.018) and superior (p=0.046) meatus breadths, but not ethmoid air cell breadth (p=0.21). Moreover, our results indicate a positive scaling relationship between SEB and internal airway dimensions, such that West Africans with wider SEB values exhibit disproportionately wider common and superior meatuses compared to Europeans and Arctic Circle natives. Cumulatively, these results support use of SEB as proxy for upper nasal airway breadth.

Keywords: Upper Respiratory Tract, Nasal Anatomy, Human Variation, Osteology, Climatic Adaptation