H5 Sexual Dimorphism in the Distal Humerus

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This presentation provides the results of a metric analysis of six measurements on the distal humerus to determine their accuracy in discriminating the sex of the individual. The results indicate the most accurate measurements to be the articular width and biepicondylar width.

This presentation will impact the forensic community and/or humanity by showing that the distal left humerus can provide an alternative to sex identification in a forensic setting when other elements are missing. Occupational stress or habitual stress on the elbow may be the influential variable affecting the accuracy of some of the measurements for sex identification. This can be seen in the disparity of the articular width versus the biepicondylar width measurement results. Further refinement in measuring techniques of the distal humerus may provide better quantification of the sexual dimorphism in this bone.

Fragmentary remains in a forensic setting often do not include the most obvious elements used to measure or make morphological assessment of the sex for the individual. With the exclusion of elements such as the cranium, pelvis, or femora, sex identification becomes increasingly difficult to undertake. This becomes even more difficult when only isolated bones or partial remains are found. To assist in the determination of sex from fragmentary remains, this study focuses on measurements of the distal humerus to evaluate the differences present in this morphology by statistical means. The object of this study is to identify metric differentiation between males and females in a modern population for use in determining sex from the distal humerus.

This study evaluated 268 adult left humerii from 141 males and 127 females from the Robert J. Terry Anatomical Collection. Humerii exhibiting abnormalities, severe arthritic wear, and fragmentation were excluded from this study. Elements were randomly chosen to avoid any selection biasing. However, equal numbers of Blacks and Whites and males and females were obtained from the collection to provide balanced sample sets for statistical comparison. Morgue records of the individuals in the Terry Collection were utilized to obtain reported cause of death, age, sex, and race.

Discriminant analysis was applied to assess the metric variables' ability to accurately assign sex using SYSTAT 10.2 software. Variables were analyzed independently and their accuracy determined. The two variables with highest ability to attribute sex were then combined to test for their ability as a combined set. All six measurements were also analyzed as one combined set with the races pooled, the only discretionary variable being between males and females, since race cannot be identified in fragmentary remains.

From the results of the statistical analysis, the combined six variable set provided a total correct sex attribution rate of 94%, with a 97% accuracy rating in the females (120 females correctly classified, 4 females misclassified) and the male sample producing a 91% accuracy rate (128 males accurately classified, 13 males misclassified). The two most valuable independent variables for sex attribution were articular width, with a total accuracy of 93% (97% correct for females and 89% for males) and biepicondylar width, correctly identifying sex at 85% correct (86% for females and 85% for males). These two measurements combined had a total accuracy rating of 93%, correctly classifying 120 females and misclassifying 4 females (97%) and 127 males were classified correctly with 14 males misclassified (90%).

Either articular width or biepicondylar width can be used independently as a defining measurement to accurately attribute sex to an individual. The combination of the two measurements provides a high degree of accuracy in determining sex. Articular width is the most reliable single measurement to correctly sex individuals. These few measurements can prove valuable when uncovering partial remains and can consequently give possible evidence to determine the identity of the individual.

The results of this investigation have shown that the distal left humerus can provide an alternative to sex identification in a forensic setting where other elements, such as the pelvis and cranium, are missing. Occupational stress or habitual stress on the elbow may be the influential variable affecting the accuracy of some of the measurements for sex identification. This can be seen in the disparity of the articular width versus the biepicondylar width measurement results. Further refinement in measuring techniques of the distal humerus may provide better quantification of the sexual dimorphism in this bone. Additional studies should also be conducted to substantiate this study's results.

Humerus, Forensic Anthropology, Sexual Dimorphism