A92 An Analysis of Sexual Dimorphism Using Geometric Morphometrics (GM) of the Femur and Tibia: The Use of GM in Assessing Sex of Fragmented Remains

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After attending this presentation, attendees will have a better understanding of the usability of GM to accurately assess sex of unidentified remains. Attendees will also be educated on which areas of two skeletal elements — the femur and tibia — preliminarily indicate they are more indicative of sex-dependent size and shape variation when compared to others.

This presentation will impact the forensic science community by providing a method for assessing sex of fragmented remains when other methods are not possible, which has the potential to provide the researcher with critical forensic information that may not otherwise be attainable.

Biological anthropologists have recently been utilizing GM to investigate sexual dimorphism among modern *Homo sapiens*. To analyze sexual dimorphism of the femur and tibia using GM, landmark data were registered using a MicroScribe® on 250 individuals of known sex and age at death from the William M. Bass Donated Skeletal Collection. The sample was limited to individuals of "White" ancestry in order to eliminate population bias. A combination of landmarks and semi-landmarks were collected on the proximal and distal epiphyses of each bone, which captured the overall size and shape variation present in the sample. Classification rates for males (ages 19 years to 96 years) and females (ages 29 years to 97 years) for the proximal femur were 80.8% and 78.4%, respectively; for the distal femur, 92.6% and 89.6%, respectively; for the proximal tibia, 80.8% and 83.2%, respectively; and for the distal tibia, 81.6% and 80.8%, respectively.

This study indicates the knee joint is the most dimorphic, followed by the ankle, then the hip. The results are similar to other studies that indicate the knee is more sexually dimorphic, though here it was found the distal femur was more dimorphic when compared to the proximal tibia. This preliminary research indicates that in comparison to standard measurements, GM may provide a more reliable method for sex estimation when used on the knee. Further research applications excluded landmarks to determine the usability of the method if fragmented remains are present due to taphonomic processes, such as the case may be in forensic circumstances. When landmarks were excluded simulating taphonomic damage, the distal femur still presented the highest classification rates, averaging more than 81% for males and females, followed by the distal tibia, averaging more than 73% for males and females, followed by the proximal tibia, averaging more than 71% for males and females, and the epiphysis with the lowest classification rate after landmark removal was the proximal femur, averaging more than 63% for males and females.

This application revealed which areas of the femur and tibia are more indicative of sex-dependent size and shape variation when this method was applied to a modern "White" population. These areas are controversial in that they are not areas previously associated with sexual dimorphism. Knowledge of these areas will change how future research analyzing sexual dimorphism of the skeletal elements of the leg is conducted.

Sexual Dimorphism, Geometric Morphometrics, Forensic Anthropology

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