

Exploration of a Subadult Sex Estimation Method Using Pelvic Metrics

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SUMMARY

To test the utility of pelvic metrics (interlandmark distances) for sex estimation of subadult individuals, 10 standard interlandmark distances (ILDs) were measured from computed-tomography (CT) scans of 356 individuals from the contemporary US subset within the Subadult Virtual Anthropology Database (SVAD). Linear discriminant function analyses were performed using the ILDs and ILIS (triradiate cartilage) fusion scores as predictors. Total correct sex classifications for the models ranged from 90.00% to 93.42%. This research has demonstrated that individuals as young as 10 years of age can be correctly classified by sex using pelvic metrics.

Keywords: interlandmark distances; discriminant function analysis

Introduction

Biological sex estimation represents a main component of the biological profile estimated by forensic anthropologists. Adult sex estimation methods using morphological and metric analyses of the pelvis consistently yield high classification accuracies. Subadult sex estimation methods have been less successful due to a lack of large skeletal samples representing all of ontogeny. However, approaches can be re-evaluated now that larger samples are available through virtual anthropology. Specifically, pelvic metrics have not been fully explored regarding their utility in sex estimation of subadults.

Objectives

The goal of this research is to explore the utility of pelvic ILDs, collected from partially and fully fused subadult innominates, in sex estimation of individuals between the ages of 7 and 20 years.

Methods

Thirty-four pelvic landmarks were placed on 356 left innominates from which 10 standard ILDs

(LANGLEY e colab., 2016) were calculated using the X, Y, and Z coordinates. Cross-validation and linear discriminant function analyses (LDA) were performed to model the relationships between pelvic metrics, a maturity indicator, and known biological sex.

Results and Discussion Correct sex classification of females ranged from 93.33% to 96.67%; male classification ranged from 88.0% to 93.33% correct; total correct sex classifications ranged from 90.0% to 93.42% (Table 1). Accuracies are remarkably comparable to adult sex estimation methods and are stronger than morphological subadult sex methods currently published that use the pelvis.

Table 1. Correct sex classifications produced by the LDA models using pelvic metrics and ILIS fusion.

Classification accuracies of LDA models				
LDA Model	Sample	% Correct F	% Correct M	% Correct Total
10-ILDs	Train	94.62	90.67	92.18
	Test	93.33	88.00	90.00
10-ILDs and ILIS	Train	93.55	93.33	93.42
	Test	96.67	90.00	92.50

Conclusion

Large samples enabled exploration of metric data using robust statistics to expose the utility of pelvic ILDs for subadult sex estimation, given an ongoing or completely fused innominate. These results are transformative to the field, as we can now confidently estimate sex, with a high level of accuracy, on younger individuals than previously assumed.

Bibliographic references (ABNT standard)

LANGLEY, Natalie R e colab. Data collection procedures for forensic skeletal material 2.0. University of Tennessee and Lincoln Memorial University, 2016.

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