A63 Subadult Body Mass Estimation From Skeletal Remains: Validation for Femoral Cross-Section Methods in a Contemporary Taiwanese Population

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Learning Overview: After attending this presentation, attendees will have a better understanding of the validity of body mass estimation equations for subadult skeletons using femoral cross-section and whether it is suitable to apply such equations in different populations.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing population data from an underrepresented area of the world and will promote better understanding of how cultural and ecological contexts affect subadult body mass estimation.

Body mass estimation for subadult skeletons is sometimes required in forensic anthropological analysis and can provide important and useful information in subsequent legal investigations. Several methods are available for estimating subadult body mass from skeletons, either using external measurements or cross-sectional measures of the femur. Specifically, past studies suggested that the two methods using femoral cross-section:age-structured equations developed by Robbins et al. and a panel regression-based equation developed by Robbins Schug et al. may yield more accurate results compared to equations using external measurements of the femur.[1,2] However, these methods have not been tested in contemporary samples of Asian descent, and their validity in these populations is largely unknown.

This study tested both the age-structured equations and the panel regression-derived equation for body mass estimation in a contemporary Taiwanese population. Computed Tomography (CT) scans of individuals aged 0 to 16 years of both sexes were collected from the National Taiwan University Hospital (NTUH). Individuals with fractured femur or visible anomalies were excluded. Cross-sectional properties were measured at approximately 50% length. Estimated body mass was compared to documented body mass to evaluate the performance of the two methods.

The results indicate that both methods performed relatively similarly in a contemporary Taiwanese population. The accuracy (absolute mean differences) for age-structured equations is 13.99kg while the accuracy from the panel regression equation is 19.64kg. The bias (mean differences) for age-structured equations is -6.83kg, while the bias for panel regression equation is 19.15kg. These values far exceed those observed previously in populations of mostly European and African descent. In general, the age-structured method tends to overestimate body mass while the panel regression method tends to underestimate body mass in the Taiwanese population. Moreover, Root Mean Squared Error (RMSE) was calculated for different age categories to investigate whether age has an effect on the estimation. Results show that as age category increases, deviation of estimated body mass from true body mass increases for the panel regression-derived equation, while the reverse is true for age-structured equations. Suggestions are made in light of these findings and statistical procedures are developed for future references.

While hospital samples may not be the best representation of a population, this study highlights the need to test the validity of methods for body mass estimation for subadult skeletons in different populations, especially in underrepresented areas of the world.

Reference(s):

1. Robbins, Gwen, Paul W. Sciulli, and Samantha H. Blatt. Estimating Body Mass in Subadult Human Skeletons. *American Journal of Physical Anthropology* 143, no. 1 (2010): 146-50.
2. Schug, Gwen Robbins, Sat Gupta, Libby W. Cowgill, Paul W. Sciulli, and Samantha H. Blatt. Panel Regression Formulas for Estimating Stature and Body Mass from Immature Human Skeletons: A Statistical Approach without Reference to Specific Age Estimates. *Journal of Archaeological Science* 40, no. 7 (2013): 3076-86.

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