H1   Effect of Obesity on the Accuracy of Age-at- Death Indicators of the Pelvis

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After attending this presentation, attendees will learn how obesity, measured using the body mass index, affects the accuracy of skeletal age-at-death estimations based on the pubic symphysis and auricular surface.

This presentation will impact the forensic anthropology community by demonstrating that caution should be used when estimating age in obese individuals using the auricular surface, and that age-at-death estimations based on the pubic symphysis are preferred for obese individuals.

Age-progressive stages or macromorphological changes of the auricular surface of the ilium and symphyseal face of the pubic bone are commonly examined by forensic anthropologists to estimate adult age-at-death from skeletal remains. However, individual rates of progression through these stages can vary considerably depending on life history events such as diet, disease, physical activity, and body mass. Since the sacroiliac and pubic symphysis are weight-bearing joints, it is likely that the rate of progression through age-related stages is influenced by body mass, especially obesity. To date, no study has examined the effects of body mass on the progression of age-related morphological changes in the pubic symphysis or auricular surface. Since 1990, adult obesity rates have been dramatically increasing. As the number of obese individuals increase, so will the representation of obesity in forensic cases. Therefore, it is vital that forensic anthropologists know whether obesity affects the rate of progression through the different age stages in the pubic symphysis and auricular surface. This study investigates if obesity affects the age-related progression of morphology in the auricular surfaces and pubic symphyseal faces, and how these modifications affect the accuracy and precision of age-at-death estimates. In addition, sexual dimorphism in age-related changes was examined. It is hypothesized that obesity causes acceleration in degenerative age-related changes in these two anatomical regions, especially the auricular surface, and therefore, the inaccuracy of age-at-death estimations will be greater in obese individuals compared to those with a clinically normal body weight for stature.

The hip bones of 245 adults (23-90 years of age) of known age, sex, stature, and body weight from the William M. Bass Donated Collection were used in the study. Specimens with gross pathological anomalies of the pelvis or lower limb were not used. BMI was calculated for each individual by dividing recorded body weight in kilograms by stature in meters squared. Age-related stages were scored on the hip bones of 119 adults of clinically normal body mass (BMI between 19 and 25) and 126 obese (BMI $\geq$ 30) adults using the Suchey-Brooks method for the pubic symphysis and the Buckberry-Chamberlain method for the auricular surface. In some analyses the obese sample was subdivided into obese (BMI 30 to 39) and morbidly obese (BMI $\geq$ 40). In addition to the overall progression through the age-related stages, specific traits (transverse organization, surface texture, microporosity, macroporosity, and apical lipping) were scored for each auricular surface to reveal which of these features, if any, are affected by obesity. The accuracy of each method was calculated by subtracting the actual age from the mean and median age of the stage for the pubic symphysis and auricular surface, respectively. The correlation between actual age and the estimated age was calculated for both obese and normal body massed individuals using Pearson's correlation coefficient. Bias was calculated to determine the under- and over-aging results for the different age groups of each population, while inaccuracy is the average absolute error of age without reference to under- or under- age prediction.

As expected, the degree of bias and inaccuracy generally increases with age using both methods regardless of BMI. However, young adult obese individuals exhibit greater inaccuracy in age-at-death estimations using the auricular surface, but not the pubic symphysis compared to individuals with a normal BMI. This is probably due to the greater weight-bearing function of the sacroiliac joint and postural changes during locomotion in obese individuals. In addition, age was estimated with less precision in obese individuals compared to clinically normal weight individuals for both methods. Obese males show greater inaccuracy than obese females. There was also a greater tendency to over-age morbidly obese compared to obese individuals. Morbidly obese individuals also exhibited greater inaccuracy than either clinically normal or obese BMI individuals. The specific characteristics all follow the same general pattern of onset regardless of BMI.

This study helps to elucidate how obesity affects the rate of age-related skeletal change of the human pelvis. The results indicate that the pubic symphysis method is preferred when estimating age in obese individuals, especially males. However, the results also indicate that forensic anthropologists should use caution when assessing age-at-death from the skeletons of obese individuals using either auricular surface or pubic symphysis methods.

Obesity, Age-at-Death, Auricular Surface