THE RELATIONSHIP BETWEEN BONE CONDITION AND DNA PRESERVATION

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To investigate the relationship between gross bone condition and DNA preservation, the skeletal remains of thirty-nine adult individuals from 19th century Euro-American coffin burials from central Indiana were examined. It was hypothesized that bones in better condition would produce greater amounts of extractable skeletal DNA. A long bone from each individual was scored using a series of bone condition scales defined by the author. Five variables (delamination, epiphyseal loss, fracturing, root etching, and staining) were used to create a summary scale ranging from 0 (good preservation) to 23 (bad preservation). The thirty-nine long bones were also seriated from best-preserved (0) to worst-preserved (39). Cortical thickness was measured at the point where each bone sample had been taken, near the midshaft.

The individual condition variables, total bone condition score, seriated rank, and cortical thickness were then compared to the quantity of human DNA obtained from a one gram sample taken from each bone. The DNA was purified via decalcification, solubilization, organic extraction, desalting, and concentration by lyophilization. A 59 ul aliquot of the extracted DNA was denatured and adhered to a nylon membrane via slot blotting. The DNA from each sample (immobilized on the nylon membrane) was then quantified using a primate-specific DNA probe (Alu element) and chemiluminescent detection techniques.

The bone condition scores and DNA quantity for each sample were compared using Pearson correlation. The results of this study indicate that there is a statistically significant relationship between the amount of extractable DNA in a sample and the gross condition of the bone. The better-preserved the bone, the greater the amount of extractable skeletal DNA from the sample. Of the five condition variables tested, fracturing had the greatest influence on DNA yield, significantly decreasing the quantity of extracted DNA. The cortical thickness of each sample showed a statistically significant relationship with bone condition, indicating that bones with thicker cortices were better-preserved. However, analysis of covariance indicated that the morphological sex of the individual did not significantly affect the amount of extractable DNA from each sample. Therefore, it is concluded that a sample taken from a well-preserved bone with little fracturing would most likely produce the greatest DNA yield. This study contradicts previous research that found no relationship between gross bone condition and DNA preservation. The more comprehensive bone condition scale used here most likely allowed for a more sensitive test of the hypothesis compared to previous research.

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