



A154 Assessing Fluctuating Asymmetry in the Crania and Lower Limb Bones of Two Modern Populations

Shelby Garza, MA*, Texas State University, San Marcos, TX 78666; Emilie Wiedenmeyer, BA, Texas State University, San Marcos, TX 78666-3511; Kari Helgeson, MA, Allen, TX 75002; Kate Spradley, PhD, Texas State University, San Marcos, TX 78666

Learning Overview: After attending this presentation, attendees will have a greater understanding of how environmental stress can affect the levels of Fluctuating Asymmetry (FA) in both the cranium and the lower limb bones.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by adding to the ongoing research being conducted involving variables affecting FA and will lead to a better understanding of human variation.

FA, the main focus of this research, occurs when small deviations from perfect symmetry present themselves under conditions of developmental stress. Understanding how environmental stress can affect FA is important in a forensic setting. Individuals that have been exposed to environmental stress during growth and development have the potential to show greater levels of FA in the skeleton. This could reflect the environment of a missing person's childhood, potentially aiding in identification.

Inadequate nutrition, Socioeconomic Status (SES), and climatic changes have been shown to be linked to environmental stressors, which can disrupt developmental homeostasis.^{1,2} Skeletal asymmetry in the cranium and long bones can be an indicator of environmental stress that occurred during growth and development.³ The purpose of this study is to examine a migrant population and a donated skeletal collection to analyze varying degrees of FA between the cranium and lower limb bones from both men and women with different SES. Few studies have compared the prevalence of FA in the cranium and lower limbs of individuals with documented SES.

For this study, a total of 50 individuals were examined with paired long bone and cranial measurements to assess the level of FA. Twenty-seven of the individuals were from the Texas State University Donated Skeletal Collection (TXSTDSC) and 23 were from Operation Identification (OpID), which was representative of the migrant population in this study. This study had three categories of SES: low, middle, and high. The TXSTDSC was separated into one of the three groups using self-reported SES. The OpID population was assumed to be from a low SES because unauthorized immigrants often have significantly lower SES when compared to non-immigrant residents of the United States.⁴ Postcranial measurements were collected on all lower limb bones and 3D landmarks were collected from the cranium using a Microscribe® digitizer and 3Skull.⁵

Postcranial measurements were converted to absolute asymmetry percentages and a Mann-Whitney test was used to compare FA between sexes, while a Kruskal-Wallis test was used to compare SES. The results showed that only FA in the fibula was significant when both sex and SES were compared. For the cranium, landmarks were paired and aligned using a Procrustes fit, followed by a Procrustes Analysis of Variance (ANOVA) in MorphoJ to measure left-right asymmetry. The results of the one-way ANOVA showed that there was a significant difference between groups in both the comparison of SES and sex, showing that OpID had lower FA scores than all the TXSTDSC individuals, with a significant difference between OpID and the upper SES TXSTDSC. The results also showed that females had a significantly higher FA scores than males in the cranium.

This research demonstrates that there is a significant difference in FA scores between a donated skeletal collection and a migrant population and between sexes, but not between SES. The present study also suggests that FA is more commonly seen in the cranium when compared to lower limb bones. FA levels represented in this study reflect differences in SES between migrants and high SES TXSTDSC, but not between migrants and the other SES groups in the TXSTDSC. There was also a lack of significant difference between individuals with different SES in the TXSTDSC, possibly suggesting that these individuals experienced similar patterns of environmental stress during childhood, regardless of their self-reported SES. Out of the three long bones examined, only the fibula shows signs of FA. This may suggest a prevalence of FA in non-weight bearing bones, rather than bones that often respond to biomechanical factors.

Reference(s):

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Fluctuating Asymmetry, Craniometrics, Human Variation