A50 Regression Analysis for Estimation of Stature From Foot Lengths in a North Indian Population

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After attending this presentation, attendees will understand the usefulness and methodology of stature estimation, especially from various length measurements of the foot, which will be helpful in conducting further research in this area and in studying forensic cases usually encountered in airplane crashes, intentional mutilation and dismemberment, explosions, or other mass disasters.

This presentation will impact the forensic science community by presenting standards for stature estimation from various length measurements of the feet when feet or parts thereof are presented for forensic examination.

Establishing identity is one of the primary goals of any medicolegal investigation, especially when human remains are brought in for examination. These remains may be in the form of dismembered and mutilated body parts or skeletal remains. The identification process involves the estimation of a biological profile of the decedent which includes estimation of age, sex, stature, and race or ethnicity. A biological profile derived in this manner is a circumstantial identification that narrows the comparative pool of potentially matching profiles and thus helps in medicolegal investigations. Estimation of stature is an essential parameter of identification that helps in establishing personal identity of the deceased. This complements other details on the age, ethnicity, and sex in the identification of skeletal remains and body parts. In this context, the present study was conducted in order to make regression models for estimation of stature from five specific foot lengths in a north Indian population. This study is based on a random sample of 700 adults (500 males, 200 females) ranging in age from 18 to 30 years old. In addition to stature, five separate foot length measurements were taken from each subject (length of the foot from each toe; i.e., T1, T2, T3, T4, and T5, respectively) according to standard procedures and landmarks. The data were statistically analyzed using Statistical Package for Social Sciences (SPSS), version 11.0, computer software. Sex differences in stature and foot measurements were analyzed using Student's t-test. Karl Pearson's correlation coefficients were calculated between stature and various length measurements of the foot. The stature was estimated from various length measurements of the foot using both linear and multiple regression analyses.

Mean stature of the sample was 170.3cm and 157.9cm in males and females, respectively. Length measurement at the first toe (T1) was found to be the longest in both the sexes on the right and left sides. Statistically significant sex differences were observed in the length measurements on the foot between males and females in right and left feet ($p<0.001$). Statistically significant correlation coefficients ($p\leq0.001$) were observed for correlation between stature and various foot length measurements in males, females, and the pooled sample. Thus, the stature was found to be positively and strongly correlated to various foot length measurements in both the sexes. In males, the correlation value (r) ranged between 0.628 and 0.641, while the range in females was between 0.539 and 0.657; however, the correlation coefficient in the pooled sample ranged between 0.746 and 0.776. Thus, the pooled sample showed relatively higher values of correlation coefficients than in males and females separately. The linear and multiple regression models were derived for estimation of stature from foot length measurements in males, females, and the pooled group. While estimating stature from linear regression models of all the right and left foot length measurements, the Standard Error of Estimate (SEE) in the case of females (3.5cm) was lower than that of males (5.3cm), indicating that female feet give a better estimate of stature than male feet. The pooled sample showed a similar SEE as that observed in males. Multiple regression models showed a marginally better, but similar, trend of accuracy as that shown in the males, females, and the pooled group in the linear regression analysis.

The study was conducted as a part of a major research project funded by University Grants Commission, New Delhi, vide grant no. F.No. 34-120/2008 (SR), dated January 2, 2009.

Personal Identification, Stature Estimation, Foot Length Measurements