
A8 Estimation of Stature From Footprints 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 footprints, which will help them study cases pertaining to footprint evidence usually encountered at crime scenes and conduct further research in this area.

This presentation will impact the forensic science community by presenting standards and methodology for stature estimation from various footprint length measurements, which will be helpful in studying footprint evidence encountered at crime scenes.

Forensic podiatry is an up and coming branch of forensic science which deals with the collection, interpretation, and examination of the pedal evidence recovered at crime scenes. The evidence may be in the form of complete and/or partial bare footprints, shoe prints, or a series of footprints that can provide clues to the identity the perpetrator/criminal. The footprint evidence may help to provide identification by the study of individualistic characteristics and features present in the footprints and by providing clues regarding the biological profile of the criminal. The parameters of the biological profile such as stature and sex can be estimated from the size of the footprints. The present study provides correlation of stature with various lengths of the footprint and derives linear and multiple regression models for estimation of stature from these lengths. The sample for the present study is based upon 700 adult participants (500 males, 200 females) with ages ranging from 18 years to 30 years old. The standing footprints were taken from each participant using an inking method. Five footprint length measurements were taken from each subject using the length of the footprint from the anterior-most point of each toe pad to the posterior-most part of the heel impression (i.e., T1, T2, T3, T4, and T5, respectively), according to standard procedures and landmarks. Sex differences in stature and footprint measurements were calculated using a Student's t-test. Pearson's correlation coefficients were calculated between stature and various length measurements of the footprint. Stature was estimated from various length measurements of the footprint using linear and multiple regression analysis.

Mean stature of the study group was 170.30cm and 157.98cm in males and females, respectively. Footprint length at the first toe (T1) was found to be the longest on the left side in males and females. Sex differences in the length measurements of the footprints were statistically significant between males and females for the right and left feet ($p < 0.001$). Statistically significant correlation coefficients ($p \leq 0.001$) were found for correlation between stature and various footprint length measurements in males, females, and in the pooled sample, except for footprint length of the fourth toe (T4) in females. Thus, stature was found to be positively and strongly correlated to various footprint length measurements in both the sexes. In males, the correlation value (r) ranged from 0.653 and 0.693, while in females it was from 0.558 and 0.665. The correlation coefficient in the pooled sample ranged from 0.672 and 0.698. Thus, the pooled sample showed relatively higher values of correlation coefficients than males and females separately. The linear and multiple regression models were derived for estimation of stature from footprint length measurements in males, females, and the pooled group. Multiple regression models showed a marginally better result, but with a similar trend of accuracy as shown in the males, females, and pooled group in the linear regression analysis. When estimating stature from linear regression models involving all footprint length measurements, the Standard Error of Estimate (SEE) for females (left=3.4cm, right=3.5cm) was lower than that of males (left=4.8cm, right=4.9cm). Observations indicated that female footprints gave a better estimate of stature than did male footprints. Accuracy of stature estimation was marginally better on the left side compared to the right side.

Forensic Podiatry, Stature Estimation, Footprint Length