Original Research

A Cross-sectional Study of Stature by Foot Length

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Abstract

Background: Forensic podiatry is the application of sound and researched podiatric knowledge and experience in forensic investigations, to show the association of an individual with a scene of crime, or to answer any other legal question concerned with the foot or footwear that requires knowledge of the functioning foot[1,2]. Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and adipose tissue. The most common methods used in anthropometry are height, weight, body mass index (BMI), body circumferences and skinfold thickness. As forensic doctors, we tend to come across cases with skeletal remains which tends to be the clinching evidence in court of law where in the estimation of stature of the deceased plays an important role.

Methods: This crossectional study was conducted by the department of forensic medicine at Travancore medical college, Kollam from July 2019 to Dec 2019. A total of 60 subjects were included in the study. The study design comprised of thoroughly scrutinized measurements of the footprint length and stature taken by using standard anthropometric instruments.

Results: The present study observed a significant correlation of stature with right and left foot length($P<0.01$). The results show that there is no statistically significant difference in right and left foot length in male students ($P>0.05$). Either right or left foot length may be used to predict the stature by regression formula.

Key Words: Forensic podiatry, Footprint, Anthropometry

Introduction:

Forensic podiatry is the application of sound and researched podiatric knowledge and experience in forensic investigations, to show the association of an individual with a scene of crime, or to answer any other legal question concerned with the foot or footwear that requires knowledge of the functioning foot[1,2]. Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and adipose tissue. The most common methods used in anthropometry are height, weight, body mass index (BMI), body circumferences and skinfold thickness. As forensic medicine doctors, we tend to come across cases with skeletal remains which tends to be the clinching evidence in court of law where in the estimation of stature of the deceased plays an important role. Cases like mass disasters where only a portion or a part of body may persist which helps in determination of stature of a person. Footprints are also of immense value in establishing the identity of the criminals in crime scene. Foot length is the distance from the most prominent part of the heel backward to the most distal part of the longest toe (2nd or 1st). The footprint is also an important identifying factor to recognize new born babies in hospitals.

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There is always a correlation that exists between living stature and long bone length and it holds good for foot length too. Hence estimation of stature from footprint length becomes important and it is necessary to develop the method to determine stature from the footprint length as it varies by geography, climate, genetics, nutrition and diet, race, religion, and socioeconomic state of local population.

Materials & Methods:

This cross sectional observational study was conducted by the department of forensic medicine at Travancore medical college, Kollam from July 2019 to Dec 2019.60 male students of second year M.B.B.S were enrolled into the study after obtaining Informed consent. The study design comprised of thoroughly scrutinized measurements of the footprint length and stature taken by using standard anthropometric instruments. The data was collected, analysed and subjected to statistical analysis.

Statistical analysis: The data was analysed using SPSS software version 16. Descriptive statistics like mean and percentages were used to interpret the results. Simple linear regression formulae were derived to know the correlation of the stature with the length of feet. The reliability of estimation of stature from the lengths of feet was determined with the help of standard error of estimation (SEE).

Results and Observations:

A total of 60 male students were included in this study. Out of 60 subjects enrolled into the study, maximum cases 24 have their right side footprint length of measurement between 24.1 – 25 cm and their standard deviation is 5.4 as noted above. 5 subjects have their right-side footprint length of measurement between 22 – 23 cm and their standard deviation is 5.2 as above.4 subjects have their right-side footprint length of measurement between 27.1 – 28 cm and their standard deviation is 7.3 as above. There is a standard variation in the footprint length of the individuals while walking and stepping up their foot and also the height of the subjects varies as they walk and step up their foot (Table 1).

Table 1: Right Foot Length (RFPL) and Height (Ht) In Male Students

RFPL	No of Students	Min Ht	Max Ht	S.D
22 – 23	5	156.3	169.4	5.2
23.1 – 24	10	162.4	175.5	4.6
24.1 – 25	24	158	178.2	5.4
25.1– 26	13	164	182.3	5.6
26.1– 27	4	178	184	4.5
27.1 – 28	4	182	194	7.3

Table 2: Left Foot Length (LFPL) and Height (Ht) In Male Students

LFPL	No of students	Min Ht	Max Ht	S.D
22 – 23	4	167.5	171.4	4.8
23.1 –24	7	1623.3	175.3	4.7
24.1 –25	25	152.4	183.5	5.6
25.1– 26	14	165.2	178.6	5.1
26.1– 27	9	170.4	183.2	4.8
27.1 –28	1	185	192	3.2

The stature can be estimated by the regression equation.

Ht = 87.24+ 3.46(RFPL)

Ht =89.24 + 3.21(LFPL)

Table 3: Correlation between Right Foot Length, Left Foot Length and Stature in Male Students

Variable	N	Mean ± Sd	Range	Cor. Coeff. R- Value	Reg. Coeff. B Value	Reg. Equation
RFPL	60	24.4±1.25	22.5–28	+ 0.534	3.46	Ht = 87.24+ 3.46 (RFPL)
Actual Ht	60	171.7 ±6.21	156-194			
LFPL	60	24.9±1.36	22.1–27.6	+0.614	3.21	Ht =89.24 + 3.21 (LFPL)
Actual Ht	60	171.7 ±6.21	156-194			

From analysis, it was revealed that there was a significant positive correlation between right foot length with stature (r=+0.534) and left foot length with stature (r=+0.614). The difference in correlation coefficient is statistically significant (P<0.01).

Discussion:

Pearson was the first to set regression equation to estimate stature from long bone measurements and he concluded that these formulae are population specific and should not be applied to individuals of different populations[3].Analysis of footprints helps in estimation of an individual's stature because of existence of strong positive correlation between one's stature and foot size, the footprints are also considered as indicators of skeletal and body structure of a person. Vardhan H et al[4] in their study on the measurement of foot length and body height of 184 medical students which included both sexes of 19 to 25 years of age found regression equation as Y= 88.39+3.27for right foot length and for left foot as Y=92.81+3.10 for left foot length. Agnihotri AK et al[5] in their study of measurements of foot length and stature from 250 medical students aged 18-30 years concluded that multiple linear regression model was highly significant (P<0.001). Karaddi S. et al[6] in their study of stature from foot length revealed a significant correlation of stature with right and left foot length has been observed (P<0.01). Devesh VO et al[7] in their study of stature observed a correlation coefficient (r) of 0.698 for males was obtained between stature and left foot length which was in accordance with our study.Krishan K et al[8] in their study of 246 subjects in the age group from 17 to 20 years observed that the highest correlation coefficient existed between stature and foot length and also concluded that the foot length provides highest reliability and accuracy in estimating stature.Kanchanet al[9] in their study of relationship between stature and foot dimensions among 200 subjects devised linear and multiple regression equations for estimating stature using foot dimensions which was highly significant and was consistent with our study.

Patrick S. et al[10] in their study of anthropometric dimensions of hand and foot as predictors of stature revealed a significant correlation and derived the mean estimated value of stature using linear and multiple regression which was highly significant. SoochanJee et al[11] in their study of stature prediction from foot anthropometry in south korean population revealed a significant correlation between stature and foot length and prediction accuracy was highest in the linear regression equation.

Conclusion:

From this study, we can conclude that stature is one of the important feature of identification in an individual. Though the stature and the relationship with their body parameters differ from region, culture and nutrition, the relationship between foot length and stature is reliable. Anthropometry as such has gained wide interest in the recent years especially in the field of forensic medicine where in identification of a person in criminal cases and as well as in mass disasters becomes easy. Significant and positive correlation coefficient has been shown to exist between stature and measurements of foot.

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