Estimation of Stature among Tribal Males from the Measurements of Foot Breadth in Udaipur District of Rajasthan

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Abstract

Background: Estimation of stature has a very significant role to play in forensic anthropometry for personal identification. *Objective:* To discover out the correlation among proportions of feet with stature in tribals of Udaipur district in Rajasthan (India). *Material and Methods:* The present study was conducted on a total number of 481 male tribals of Udaipur district by using standard anthropometric techniques. *Results:* There was a correlation between height and foot breadth in Tribals of Udaipur and found correlation coefficient (r) as 0.0240 for right foot and for left foot it was 0.0238. *Conclusion:* Linear regression equations were deduced in males out of which lowest standard error of estimate was experienced in combined foot breadth of males.

Keywords: Stature; Foot Breadth; Regression Equations.

Introduction

Anthropometry is an important tool of physical anthropology for obtaining different measurements like stature on the living as well as dead (skeleton and skeletal remains) of man using scientific method. Physical anthropologists mainly deal with study of human origin and evolution of human beings. They also deal with study of different races in various parts of the world. Stature estimation has a very important role to play in forensic anthropometry for personal identification. Even anatomists and anthropologists apart from forensic experts have shown keen interest in estimating the height of an individual/stature by measuring different parts of body like hand length, foot length. Previous researchers have established a very well defined relationship between height of individual and different parts of body like head, trunk and lengths of upper and lower limb.Important differences /variations between various ethnic groups have been studied in detail by comparing relationship between body segments and this has also been shown to be related to life style and locomotion.

Prediction of dimensions of body segments is useful in many areas of modern science for example in growth and decay the relationship between body segments is used in assessing normal growth as well as in people suffering from specific syndromes. The relationship between proportions and various body segments especially of long bones of limb (femur) have been most widely studied. The biological profile of an individual like inherent traits such as age, sex, ethnicity and stature can be determined with the help of anthropometry. For example, it has been proved that stature can be estimated from a shoe left at the scene of a crime. Similarly the stature of a victim can be estimated when a part of body, such as a long bone, or hand, is all that remains (Santosh K. 2014) [1]. Forensic anthropology is a branch of physical anthropology which interacts with other disciplines pertaining to the understanding of crime and its investigations .The biological profile of an individual is an inherent traits such as age, sex, ethnicity and stature can be determined with the help of anthropometry (A.I. Numan, 2013) [2].

Materials & Method

Source of Data

Sample will be drawn from the tribal community in Udaipur district. The study has been conducted

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on 481 tribals males. Bhil, Meena, Damors, Sahariyas, Gaduliya lohars, Garsias were the tribals of the Udaipur.

Instruments Used

- Sliding calipers will be used for the measurements of feet.
- Measuring tape will be used for vertical height measurement.

Inclusion Criteria

Healthy males of age group 20-30 years.

Exclusion Criteria

- Males having physical deformity affecting stature, hands and feet will be excluded from the study.
- Age 18 to 32 years.

Statistical Analysis

The data obtained will be subjected to statistical analysis to derive the mean, standard deviation, correlation coefficient, regression coefficient. For testing the level of significance t test will be applied.

Stature

It is the vertical distance between the highest point on vertex and the floor. The subject will be made to stand barefoot in an errect posture against a wall with the foot close together, buttocks and occiput touching the wall and hands hanging down on the sides. Measuring tape was kept fixed on wall and height is recorded.

Foot breadth

It is the distance between the most prominent point on medial aspect of head of first metacarpal and most prominent point on lateral aspect of head of fifth metatarsal.

Observations

The following observations were tabulated after statistical analysis:

The age of the study population ranged between eighteen and thirty two years for males. Table 1.shows the distribution of age in the study population.The mean age of males was 24.688 years.

Table-II Shows descriptive statistics for height and weight various parameters studied in males. The average stature of males was 1613.457±72.096 mm and ranged between 1426 to 1800 mm.

Table 3 shows Foot Breadth measured approximately 89 mm & ranged between approximately 70 to 104 mm in males.

To assess the statistical differences between the observations of right and left Foot Breadth in males, paired sample t test was performed and thus null hypothesis was rejected. The Foot Breadth in males was highly significant of right and left sides .There is a high correlation between right & left side Foot Breadth of males as observed in Table 4.

Table 1: Table showing distribution of age among study population in males

	Males
Number	481
Mean	24.688
Median	24.000
Std. Deviation	4.319
Range	14.000
Minimum	18.000
Maximum	32.000

Table 2: Descriptive Statistics of Height & Weight Studied in Males

Column	Size	Mean	Std. Dev	Std. Error	Range	Max	Min	Median
Height	481	1613.457	72.096	3.287	374	1800	1426	1621
Weight	481	56.89	11.495	0.524	46.07	88.13	42.06	53.29

Table 3: Descriptive Statistics of Right & Left Foot Breadth Studied in Males

Column	Size	Mean	Std. Dev	Std. Error	Range	Max	Min	Median
Male RFB	481	88.637	6.524	0.297	33.620	103.62	70	89.510
Male LFB	481	88.902	6.492	0.296	33.250	103.74	70.49	89.65

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Table 4: Paired Samples t-Test & Pearson Correlation showing statistical difference between Right and Left Foot Breadth in Males

Paired Samples	t	DF	Sig.(2-tailed)	Pearson Correlation
Male Right Foot Breadth-Male Left Foot Breadth	17.181	480	.000**	.999**

** Statistically Highly Significant at the Level (0.01 & 0.05)

Table 5: Correlation between the Stature and Right & Left Foot Breadth Parameters studied in Males

| Parameters	Male Right Foot Breadth	Male Left Foot Breadth
Pearson Correlation	0.024	0.023
Sig.(2-tailed)	0.599	0.603

Table 6: Correlation between the Stature and combined Foot Breadth studied in Males

| Parameters	Male Foot Breadth
Pearson Correlation	0.0239
Sig.(2-tailed)	0.601

To assess the statistical differences between the observations of right and left Foot breadth in males, Pearson Correlation was performed. There is a low correlation between foot breadth of males of right and left sides with the stature as observed in Table 5.

There was a low correlation between foot breadths of males with the stature.

Graph 1 Shows Regression Formula. Value of constant is 1589.91, Regression coefficient is 0.265 and standard error is 72.151. There was positive but low correlation between height and Right Foot Breadth in males.
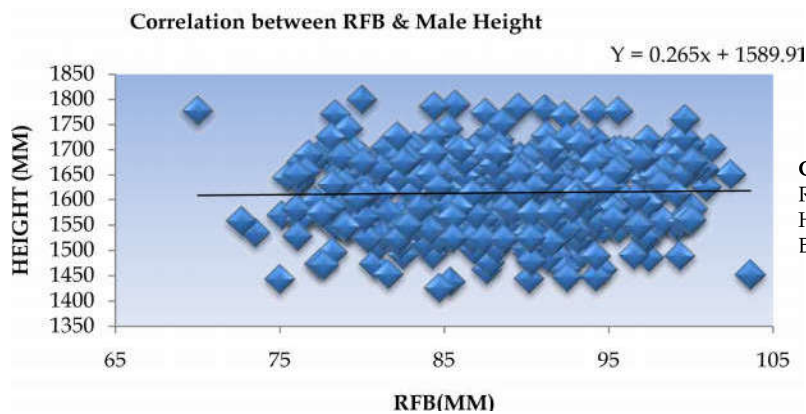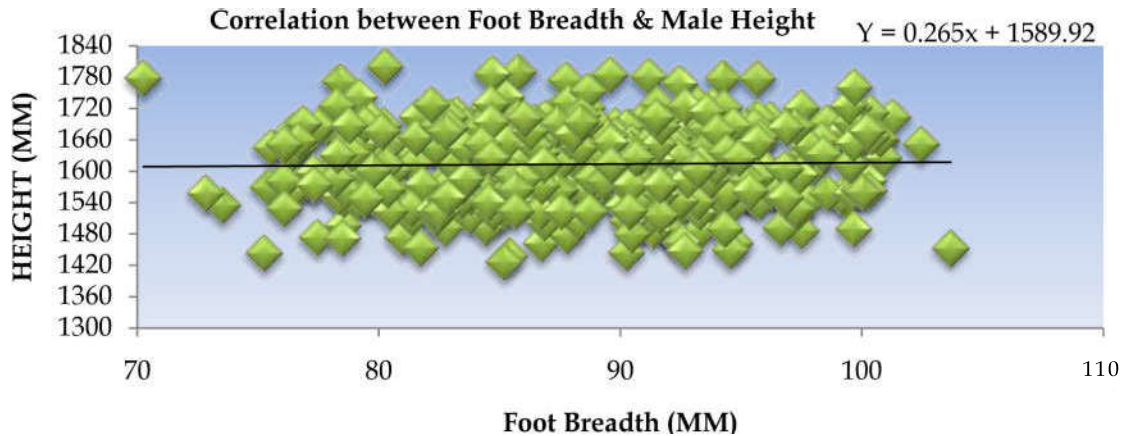

Graph 1: Showing Correlation between Right Foot Breadth and Height in Male Height = 1589.910+ 0.265 × Right Foot Breadth ± 72.151
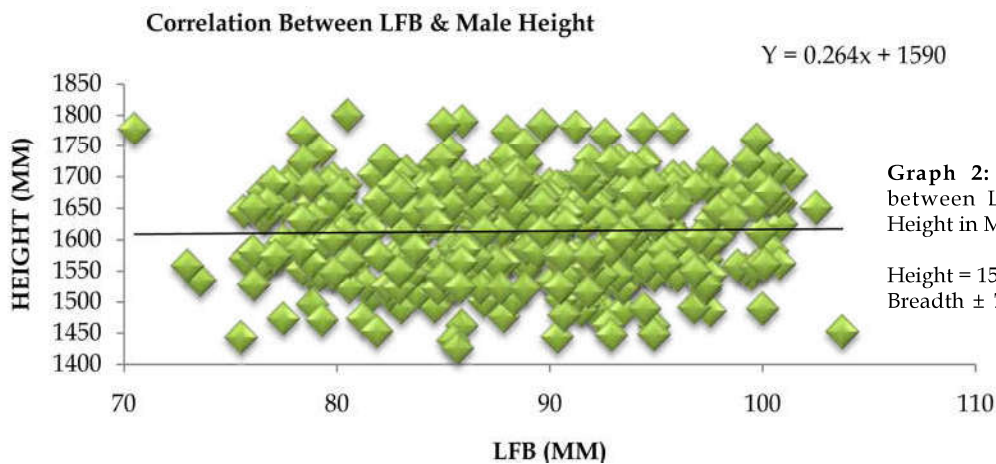
Graph 2: Showing Correlation between Left Foot Breadth and Height in Male

Height = 1589.971+ 0.264 × Left Foot Breadth ± 72.151

Graph 3: Showing Correlation between Foot Breadth and Height in Males
HEIGHT = 1589.924 + 0.265 × Foot Breadth ± 72.151

Graph-2 Shows Regression Formula. Value of constant is 1589.971, Regression coefficient is 0.264 and standard error is 72.151.There was positive but low correlation between height and Left foot breadth in males.

Graph-3 shows Regression Formula. Value of constant is 1589.92, Regression coefficient is 0.265 and standard error is 72.151.There was positive but low correlation between height and foot breadth in males.

Discussion

In 2007 Bhavna and Nath S studied correlation between height and foot breadth in Male Muslims of Delhi and found correlation coefficient(r) as 0.383 in males. Lowest correlation was exhibited by foot breadth with highest error of estimate, should be used only in the absence of the other measurements of the lower limb.

In 2007 Krishan K and Sharma A studied correlation between height and Foot Breadth in Rajputs of Himachal 60 Jat Sikhs and found correlation coefficient (r) as 0.324 in males where as in females it was 0.323.

In 2010 Singh S, Hussain M and Rizvi SJ studied correlation between height and hand Foot Breadth in Volunteers of Aligarh and found correlation coefficient (r) as 0.31 in males where as in females it was 0.36.Coefficients was more positive in both the sexes combined as compared to those of male and female separately. Foot breadth and stature were better correlated in females as compared to that of males.

In 2011 Rani M et al. studied correlation between height and Foot Breadth in Students of Delhi and found correlation coefficient (r) as 0.345 for right foot and r for left side was 0.413 in males where as in females it was 0.345 for right side and 0.358 for left side in females. The correlation coefficients between stature and foot dimensions were found to be positive and statistically highly significant.

In 2012 Shende S, Tirpude B and More S studied correlation between height and Foot Breadth in Students of Maharashtra and found correlation coefficient (r) as 0.44 for right foot and r for left side was 0.41 in males where as in females it was 0.29 for right side and 0.32 for left side in females. Foot breadth showed minimum correlation with stature in females.

In 2013 Singh JP et al. studied correlation between height and foot breadth in female volunteers of New Delhi and found correlation coefficient (r) as 0.379.Correlation coefficients of foot breadth were lower as compared to foot length measurements in females.

In 2014 Dayananda R, Babu U and Kiran J studied correlation between height and foot breadth in Medical Students and found correlation coefficient (r) as 0.375. The correlation between stature and all the foot measurements was found to be positive and statistically significant (p value <0.001).

In 2015 DR R et al. studied correlation between height and foot breadth in Medical students of Puducherry and found correlation coefficient (r) as 0.431 for right side in males and r for left side was 0.394 where as in females it was 0.464 for right side and 0.473 for left side in females. The correlation coefficients were higher in females than the males.

In the present study I noted the correlation between height and foot breadth in Tribals of Udaipur and found correlation coefficient (r) as 0.0240 for right foot and for left foot it was 0.0238 and for combined

foot breadth r was 0.0239 in males.In the present study the stature shows low correlation between the stature and foot breadth in males.

All the human beings on this earth belong to the same species i.e. Homo sapiens. They are not exactly alike in all their measurable traits; even genetically differ in so many respects. All traits tend to undergo change in many degrees from birth to death. In these traits changes in skeletal development depends on geographical regions.

The study is also in accordance with the fact that there are ethnic as well as racial variations in the dimensions of hands, digits, phalanges and foot. Thus, emphasizing the need to have normal values and range for the dimensions of hand length, hand breadth, middle finger digit length, middle finger proximal, middle and distal phalangeal length, foot length, foot breadth of both the sides (right and left) for different population as well as supporting the statement "There are no mean values, t values, correlation values and regression equations that is linear and multiple regression of the hands and foot that are valid for all population."It is suggested to carry on further studies on the other body parameters (eg: - ankle breadth, wrist breadth, ratio of fingers to the body length, length of lower limb, arm length, forearm length) to allocate for full anthropometric data for tribals of Udaipur district.

Conclusion

In the present study following conclusions were derived these were:

1. In the males for right and left foot breadth a low correlation was shown.

2. From my study it was concluded that foot breadth in males can be used in stature estimation in tribal population of Udaipur district.

Conflicts of Interests

None

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