

CORRELATION OF PERCUTANEOUS TIBIAL LENGTH WITH BODY HEIGHT AND ESTIMATION OF STATURE IN LIVING CENTRAL INDIA POPULATION

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ABSTRACT

Identification of an individual by estimation of stature has got medico-legal importance. In present study an attempt will be made to estimate the stature from percutaneous length of tibia. Study subject consists of 40 adult males and 40 adult females between the age group of 18- 30 years, born in Central India. Simple regression formula was derived showing the correlation between percutaneous length of tibia and stature of an individual.

KEY WORDS: Stature, Tibia, Bone length, Regression equation.

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INTRODUCTION

Assessment of height from different bones by Anatomists and Forensic anthropologist is helpful for establishing the identity of an individual. Stature is defined as "height of body in standing position" [1]. Identification of an individual by estimation of stature has gross impact in various medico-legal cases and can be applied during mass disasters. Extensive work have been conducted on stature estimation from various body parts like hands, limbs, short bones, footprints etc [2]. Standing height is contributed maximally by lower limb length hence most predictive formulas are based on length of femur, tibia and fibula [3]. Tibia is easily approachable for percutaneous measurement and can be fairly used for stature

estimation. However, numerous factors such as diet, climate, hereditary, region etc. influence the morphological parameters of a population [4-5]. In view of the same generating formulae specific to a region and population is a need. In this work an attempt was made to use the surface bony length i.e. percutaneous length of tibia for calculating the stature of the individual by formulating regression formulae.

Aims and Objectives: To correlate percutaneous length of tibia with the body height and thus estimate stature by deriving regression formula.

MATERIALS AND METHODS

Standing height and percutaneous length of long bones of 80 apparently healthy individuals com-

prising of 40 adult males and 40 adult females of age range from 18 to 30 years were taken during February to May 2015 in PCMS & RC, Bhopal. Written informed consent was taken from all the subjects. Standing height of the individual will be measured by asking them to stand on the baseboard of a standard metric height measuring stand with head oriented in eye-to-eye plateau i.e the Frankfurt plane was horizontal. The measurement of height will be taken in centimeters by bringing the projecting horizontal sliding bar to the vertex. Percutaneous tibial length will be measured in centimeters (cm) with the help of spreading calipers, by measuring the distance between the medial most superficial point on upper border of medial condyle and tip of medial malleolus. The data will be then subjected statistical analysis using SPSS version 19 software.

RESULTS AND OBSERVATIONS

Table 1 shows the height of the subject and length of tibia. The mean height of the study subjects came out to be 163.46 cm with standard deviation (S.D.) of 9.70 cm and coefficient of variation 5.93 cm. Right tibia shows average length of 37.33 cm with 2.94 cm of S.D. Also, left tibia averagely measures about 37 cm with 2.88 cm of S.D. From the table II it is evident that correlation coefficient (r) of right and left tibia came out to be 0.886 and 0.864 which proves a strong positive correlation between stature and length of tibia. Intercept and regression coefficient of right tibia came out to be 54.47 cm and 2.92 cm whereas that of left tibia is 52.27 cm and 3.01 cm. With the standard error of estimate of 1.373 cm of right tibia and 1.384 cm of left tibia, a linear regression formula is derived from all the above parameters and is $Y_1 = 54.47 + 2.92X_1$ and

$$Y_2 = 52.27 + 3.01X_2.$$

Where, Y_1 and Y_2 are estimated heights from length of right and left tibia.

Table 1: Showing height and length of tibia.

S. No.	Variables (cms)	Average	Standard deviation	Summation	Summation of square	Summation of product XY	Co-efficient of variation
1	Height (y)	163.46	9.7	13077	2137566.4		5.93
2	Right tibia- X_1	37.33	2.94	2986	11467.38	488164.41	7.88
3	Left tibia - X_2	37	2.88	2940	108780	483849	7.78

X_1 and X_2 are length of right and left tibia respectively.

Table 2: Regression formula derivation for calculating stature from length of tibia.

Independent variable	Length of right tibia in cm (X_1)	Length of left tibia in cm (X_2)
Intercept (a)	54.47	52.27
Regression coefficient (b)	2.92	3.01
Correlation coefficient (r)	0.886	0.864
Coefficient of determination (r^2)	0.785	0.746
Standard error of estimate	1.373	1.384

Fig. 1: Scatter diagram showing correlation of length of Right tibia and stature.

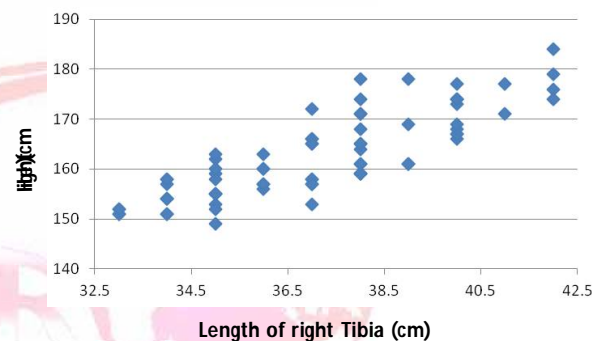
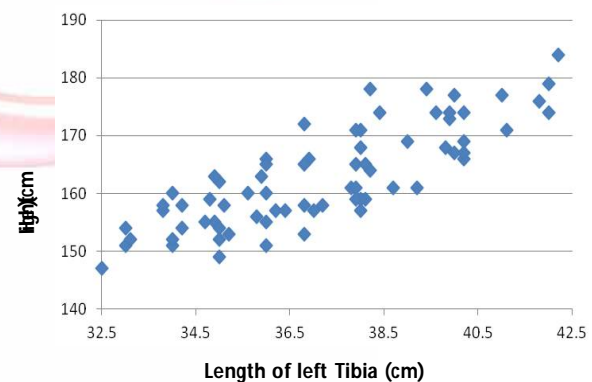


Fig. 2: Scatter diagram showing correlation of length of Left tibia and stature.



DISCUSSION

Stature determination from bones plays crucial role in various medico-legal cases by identifying missing persons in mass casualties.

As the fusion of epiphysis and diaphysis will take place by 18 years of age, present study was done

on 80 living subjects of age 18-30 years belonging to Central India.

In the present study no significant difference was observed in length of right and left tibia which coincides with the study of Surinder Nath et al [5], Agnihotri et al [6], Chavan et al [7]. The stature of an individual not only varies regionwise but also differs statewise. In Delhi, Mukta Rani [8] et al estimated 169.5 cm as average stature whereas in present study it was found to be 163.46 cm.

Gupta P. et al [9] found the 'r' value to be 0.75 of right and left tibia whereas in present it was 0.88 and 0.86 on right and left tibia. Both indicate positive correlation between length of tibia and estimated heights.

The regression formula derived from the present study is $Y_1 = 54.47 + 2.92 X_1$ and $Y_2 = 52.27 + 3.01 X_2$. Where, Y_1 and Y_2 are estimated heights from length of right and left tibia X_1 and X_2 are length of right and left tibia respectively. Bhavna and Surender Nath [10] in their study on male Shia Muslims in Delhi derived the following linear regression equation; Height in cm = $84.74 + 2.27x$ (PCTL) ± 3.67 . This exemplifies the fact that the regression equation derived will be population group/region specific [11].

CONCLUSION

Regression formula derived can be used for the estimation of stature from the tibia bone in Central India with fair accuracy.

Conflicts of Interests: None

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