

Estimation of Height from Percutaneous Tibial Length among Student Population in Two Medical Colleges in North India

Vijay Kumar¹, Somshekhar Sharma², Jaswinder Singh³, Rajesh Chandra Sharma⁴

¹Associate Professor, Dept of Forensic Medicine and Toxicology, SRMS-IMS, Bareilly.

²Assistant Professor, Dept of Forensic Medicine and Toxicology, VIMS, Gajraula.

³Professor and Head, Dept of Forensic Medicine and Toxicology, SRMS-IMS, Bareilly.

⁴Professor, Dept of Physiology, ACPM Medical College, Dhule.

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Corresponding author: Dr. Vijay Kumar

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Abstract:

Introduction: The origins of anthropometry are very ancient. As long ago as old Egypt and Greece. The word 'Anthropometry' was first used in the seventeenth century by a German physician J. Sigismund Elshwltz (1623-88).

Materials and Methods: This present study was conducted on 300 Medical male students of MBBS phase 2 and phase 3 studying in Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly and Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh. The age of the students ranged from 20-23 years who belonged to Uttar Pradesh and Delhi NCR region. The length of the tibia is defined as the direct distance between the medial most superficial point on upper border of medial condyle and tip of the medial malleolus. The study subject was asked to sit with knee placed in the semi flexed position and the foot partly inverted to relax the soft tissues and facilitate bony landmarks prominent. Then, the bony landmarks are measured with the help of spreading callipers. Further, the measurement is confirmed by using measuring tape. Height was measured by measuring crown to heel standing erect posture with anthropometer. Measurements of length of right and left tibia were taken separately for calculation. Statistical analysis was done using SPSS software.

Observations and Results: Linear regression formula was derived for estimation of height from percutaneous length of right and left tibia. $Y_1=94.5+1.8X_1$ $Y_2=88.55+1.95X_2$ Where, Y_1 and Y_2 are estimated heights from length of right and left tibia. X_1 and X_2 represent the length of right and left tibia respectively.

Conclusion: Regression formula obtained can be used for the estimation of height from the tibia bone in selected population.

Keyword: Tibia, Stature, Forensic, Anthropology

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Introduction

The origins of anthropometry are very ancient. As long ago as old Egypt and Greece. The word 'Anthropometry' was

first used in the seventeenth century by a German physician J. Sigismund Elshwltz (1623-88). [1]

Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are closely linked with each other and manifestation of internal structure and tissue components which in turn are influenced by environmental and genetic factors. [2]

Identification of individual by estimation of stature has valuable impact in various medico-legal investigations and can be applied during mass calamities. Lower limb length plays important role in estimation of standing height of an individual hence most predictive formulas are based on length of tibia, femur and fibula [3]. Tibia being located subcutaneously easily approachable to measure in living population [4].

Materials and Methods

This study was conducted on 300 Medical male students of Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly and

Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh. The age of the students ranged from 20-23 years who belonged to North Indian region. The length of the tibia is defined as the direct distance between the medial most superficial point on upper border of medial condyle and tip of the medial malleolus. The study subject was asked to sit with knee placed in the semi flexed position and the foot partly inverted to relax the soft tissues and facilitate bony landmarks prominent. Then, the bony landmarks are measured with the help of spreading callipers. Further, the measurement is confirmed by using measuring tape. Height was measured by measuring crown to heel standing erect posture with anthropometer. Measurements of length of right and left tibia were taken separately for calculation. Statistical analysis was done using SPSS software.

Observations and Results:

Table: 1 Descriptive statistics of study population

Descriptive Statistics					
	Range	Minimum	Maximum	Mean	Std. Deviation
Age	5	19	24	20.52	1.007
Height	24	150	174	161.93	6.582
Rt Tibia	11	31	42	37.43	2.741
Lt Tibia	14	31	44	37.50	2.816

Table 1 shows length of tibia and height of the subjects. The mean length of the Right tibia was 37.43cm with standard deviation of 2.741 and of left tibia was 37.50cm with standard deviation 2.816. The mean height of subjects was 161.93cm with standard deviation of 6.582. Table 2 shows Pearson correlation coefficient (r) for Right tibia as 0.750 and left tibia as 0.837 which indicates a strong positive correlation between stature and length of tibia.

Intercept and regression coefficient of Rt.

tibia was 94.5 and 1.8 and regression coefficient for left tibia was 88.55 and 1.95. Linear regression formula was derived from all the above parameters.

$$Y_1 = 94.5 + 1.8X_1 \quad Y_2 = 88.55 + 1.95X_2$$

Where y_1 and y_2 represent estimated heights from length of right and left tibia.

X_1 and X_2 represent the length of right and left tibia respectively.

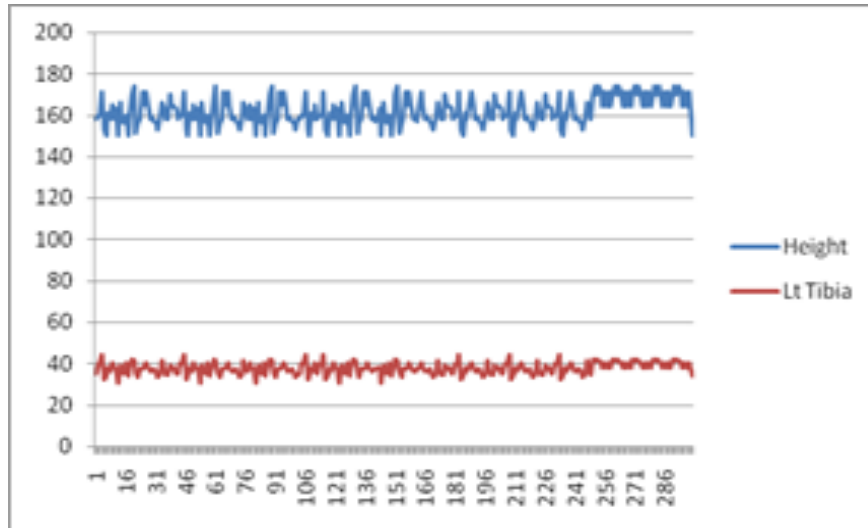


Figure 01 Correlation of Height with Left Tibia

Height= $88.55 + 1.95 * \text{left Tibia}$ R square= .701
P value=.001

Discussion

The establishment of stature becomes important in cases where bodies are found in highly decomposed and mutilated state or only fragments of skeletal remains are obtained. Present study was conducted on living male subjects to correlate the percutaneous tibial length with body height. A simple linear regression equation was derived which can be used for the estimation of height.

In India population is subdivided into various castes and tribes and they reside in various states. The stature not only differs from region to region but also varies based on different castes and tribes as studied by Bhargava Indra and Kher G.A [5] who estimated mean stature of Barelas (tribe) as 161.5 cm and that of the Bhils (tribe 160 cm, in Madhya Pradesh. Similarly Bose [6] reported average stature for Bengalis (East) as

166.6 cm, M.P. Patel et al. [7] calculated stature as 173.4 cm in Gujarati people and Mohanty reported the stature for male Oriya population as 162.2 cm. It is also seen that the stature of a person differs not only state wise but also in the different regions of the same state. Kolte

P.M. and Bansal P.C. [8] estimated an average stature of 163.7 cm for male amongst the people of Marathwada region, whereas Patil T.L. et al [9] calculated the average stature as 161.9 cm for males of Vidarbha region, in Maharashtra. Mukta Rani et al. estimated the stature of Delhi population (Central North India) between 18- 22 years age group. A significant positive correlation of percutaneous tibial length (PCTL) with body height in males of this region was established. Their estimated average stature was 169.5 cm [10].

Bhavna and Surinder Nath in their study on male Shia Muslims of Delhi, found that among the long bones of the lower limb, tibial length exhibits the highest value of correlation ($r=0.718$) with stature followed by fibular and femur length. Their estimated stature was 167.69 cm for males [11].

In the present study the mean length of the Right tibia was 37.43cm with standard deviation of 2.741 and of left tibia was 37.50cm with standard deviation 2.816. The mean height of subjects was 161.93cm with standard deviation of 6.582 which correlates with the previous studies conducted by different authors. Pearson correlation coefficient(r) for Right tibia as

0.750 and left tibia as 0.837 which indicates a strong positive correlation between stature and length of tibia.

Conclusion

Regression formula derived can be used for the estimation of height from the tibia bone in Selected North Indian population. The formulae derived can be used in cases of mutilated and skeletal remains to adjudge the stature thus providing a valuable insight towards identification. The study is limited. By the sample size of 300 individuals as also the fact that only males were included. The lacunae of the present study can be overcome by a wider study population selection as well as inclusion of both genders.

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