

## Estimation of height from percutaneous tibial length among South Indian population

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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, Dental and Parmedical male students of Vinayaka Missions University, Salem, Tamil Nadu. The age of the students ranged from 20-23 years who belonged to South 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 malleous. 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.

$$Y1=94.5+1.8X1$$

$$Y2=88.55+1.95X2$$

Where, y1 and y2 are estimated heights from length of right and left tibia.

X1 and X2 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 south Indian population.

**Keyword:** Tibia, Stature, Forensic, Anthropology

### 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).<sup>[1]</sup>

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.<sup>[2]</sup>

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<sup>[3]</sup>. Tibia being located subcutaneously easily approachable to measure in living population<sup>[4]</sup>.

### Materials and Methods

This study was conducted on 300 Medical, Dental and Parmedical male students of Vinayaka Missions University, Salem, Tamil Nadu. The age of the students

ranged from 20-23 years who belonged to South 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 malleous. 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

| 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 |
|----------|----|----|----|-------|-------|

| Correlations |                     |          |          |
|--------------|---------------------|----------|----------|
|              |                     | Rt Tibia | Lt Tibia |
| Height       | Pearson Correlation | .750**   | .837**   |
|              | P Value             | .001     | .001     |
|              | N                   | 300      | 300      |

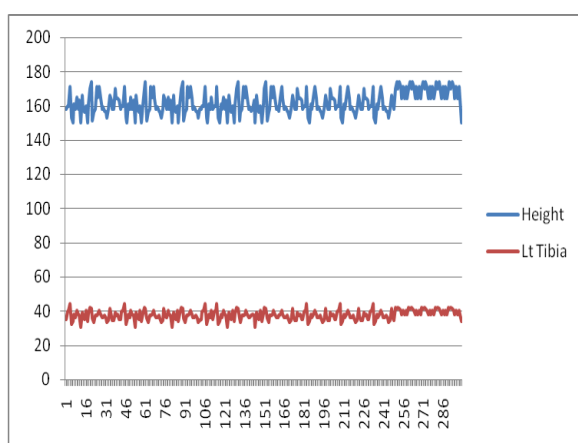
Correlation of Height with Right Tibia

Height= 94.5+1.8\* Right Tibia

R Square= .563

P value .001

### Correlation of Height with Left Tibia



Height= 88.55+1.95\*left Tibia

R square= .701

P value=.001

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.

$$Y1=94.5+1.8X1$$

$$Y2=88.55+1.95X2$$

Where y1 and y2 represent estimated heights from length of right and left tibia.

X1 and X2 represent the length of right and left tibia respectively.

### 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 south Indian 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.<sup>[5]</sup> who estimated mean stature of Barelas (tribe) as 161.5 cm and that of the Bhils (tribe 160 cm, in Madhya Pradesh. Similarly Bose<sup>[6]</sup> reported average stature for Bengalis (East) as 166.6 cm, M.P. Patel et al.<sup>[7]</sup> 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.<sup>[8]</sup> estimated an average stature of 163.7 cm for male amongst the people of Marathwada region, whereas Patil T.L. et al.<sup>[9]</sup> 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<sup>[10]</sup>.

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<sup>[11]</sup>.

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 south Indian population.

### References

1. Indera P Singh, M.K; Bhasin A manual of biological anthropology;1<sup>st</sup> Ed; Kamalaraj Enterprises;2004;p9.
2. Krishan K. Anthropometry in Forensic Medicine and forensic Science- 'Forensic Anthropometry'. The Internet Journal of Forensic Science 2007. Vol.2 no 1.
3. Mohanty NK; Prediction of height from percutaneous tibial length amongst Oriya population. Forensic Sci Int.,1998;98(3):137-141.

4. Miltred T, Gleser GC; Estimation of stature from long bones of American white and negroes. *Amj phy Anthrop.*1952;10(4):436-514.
5. Bhargava L, Kher GA; A comparative Anthropometric study of Bhils and Barelals of Central India. *J Anat Soc India*, 1961;10:31-33.
6. Bose A; Anthropometry of the Kayasthas of Bengal with special reference to Vangaj Kayasthas. *J Anat Soc India*, 1963;12:20-25.
7. Patel MP, Joshi NB, Dongre AV; Regression equation of height on tibial length. *Indian J Med Res.*, 1964;52:541-534.
8. Kolte PM, Bansal PC; Determination of regression formulae for reconstruction of stature from long bones of upper limbs in Maharashtra's of Marathwada region. *J Anat Soc India*, 1974;23:6-11.
9. Patil TL, Gawhale RS, Muzumdar RD; Reconstruction of stature from long bone of both upper and lower limb. *J Anat Soc India*, 1983;32(3):111-118.
10. Rani M, Tyagi AK, Verma SK., Kohli A; Estimation of stature from percutaneous measurements of legs (1999-2000). *Journal of Forensic Medicine and Toxicology.* 2004;21(1):12-14.
11. Bhavana S, Surinder Nath. Estimation of stature on the basis of measurements of the lower limb. *Anthropologist special volume.*2007;3;219-222.