

Estimation of Height in Rajasthani Males and Female by Measurement of Percutaneous Tibial Length of Left Side

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ABSTRACT

Introduction: Estimation of stature is an important step in identification of an individual, which often is required in medico-legal practice. A close relationship between stature and dimensions of various body segments is of value in medico-legal investigation as well as in anthropological studies. Estimation of stature by measurement of various bones is of immense value in identification of an individual. This study estimates the height of stature and left tibial length males and female in southern Rajasthan by

Methodology: Measurements were taken in centimeters. Institutional ethical clearance was obtained before conducting the study. Sample size was 200 males and 200 female between the age group of 18 to 24 years. Spreading calipers was used to measure left tibial length in sitting position. The bony prominences used for this were medial malleolus of tibia and medial epicondyle of left lower limb. Height of an individual was measured in a standing position with both feet close contact with each other with trunk in upright position. The head was adjusted in Frankfurt plane. The height was measured by stadiometer. Measurements were taken in centimeters.

Result: There was high correlation between tibial length and height. Regression equations for estimation of stature were calculated. The mean PCTL for male was found to be 32.14 ± 3.234 cm which was significantly ($p < 0.0001$) greater than female which was 29.023 ± 2.254 cm. The observed height was 154.5 ± 7.227 cm and 145.3 ± 4.654 cm for male and female respectively. The regression formula derived for male was $y_0 = 102.852 + 1.35x$ (PCTL) ± 6.365 and for female was $y_0 = 98.67 + 1.32x$ (PCTL) ± 3.52 .

Conclusion: The present regression equations could be employed for more accurate estimation of the height of an average population with significance in anthropometry and forensic medicine.

Keywords: Percutaneous tibial length (PCTL), regression formula, stature, anthropometry, medial condyle, forensic medicine.

1. INTRODUCTION

Estimation of stature is key step in identification of an individual, which often is requisite in medico-legal practice. It provides a valuable indicator for unknown individual in a population. Through the remains of human skeletal or body parts stature of an individual can be estimated.

Many scientific studies confirm that the measurement of standing height is an essential element in assessing nutritional status and evaluating basic energy requirements (Arif et al., 2018). It also a significant factor in assessing children's growth, adjusting the measures of physical capacity, predicting drug dosages and setting standards of physiological variables, such as muscle strength, metabolic rate, lung volume, and glomerular filtration (Gardasevic, Rasidagic, Krivokapic, Corluka, & Bjelica, 2017).

The lower limb length is the greatest contributor to the standing height, hence the most predictive equation are based on length of lower limb, the femur, Tibia and fibula (Kaore A et al., 2012). The tibia is ideal in this application as it resists erosion and keeps its anatomical shape for long even after burial. Tibia accounts for 22% of the total body length. Bone and stature of an individual are influenced by numerous factors as age, gender, race, geographical climate, nutrition and genetic factors (Kumar P et al., 2014). Hence, the correlation factors of one region will not hold good for the other, as this necessitates the researches to be done on a regional basis.

2. MATERIAL AND METHOD

Selection criteria:

Random samples of students were taken, 200 Male and 200 female, in the age group between 18-24 years of Pacific Medical College and Hospital, Udaipur (Rajasthan). This age group was selected because multiplication factor (M.F.) remains more or less constant in this age group. The following parameters were noted- Gender, Height in cms (crown heel length), Per-Cutaneous Tibial Length (PCTL) of left side in cms.

Exclusion criteria:

Subjects who had a history of major trauma or fracture of the leg, Achondroplasia or any other congenital or hereditary bony disease was excluded from the study.

All the measurements were taken by the same observer and with the same instrument, to avoid any technical and/or inter-observer error and to maintain reproducibility. The measurements were taken three times and their mean value was considered for estimation of height. Standing Height (Stature) of the subject was measured in a standing position on a standard Stadiometer with both feet in close contact with each other with the trunk straight along the vertical board, and the head adjusted in Frankfurt plane. The measurement was taken in centimeters by bringing the horizontal sliding bar to the vertex. For measuring the tibial length (PCTL) subject was asked to stand and keep his/her foot on a stool to maintain the angle between the flexor surface of leg and that of the thigh at 90° . Then two points were marked by skin marking pencil. Distance between two points was measured with the help of Spreading Caliper to determine tibial length



Fig: A .Method of measurement of per-cutaneous tibial length by spreading caliper

Result: The stature and percutaneous tibial length of all the subjects were measured and the statistical analyses was done by calculating the mean, standard deviation ($\pm$ SD), standard error (SE), range (minimum and maximum). Using Pearson's correlation coefficient and student's t-test with its p-value of significance for each parameter to find out any significant correlation between the parameters and also the regression equation was also derived. There was high correlation between tibial length and height . Regression equations for estimation of stature were calculated. The mean PCTL for male was found to be 32.14 ± 3.234 cm which was significantly ($p < 0.0001$) greater than female which was 29.023 ± 2.254 cm. The observed height was 154.5 ± 7.227 cm and 145.3 ± 4.654 cm for male and female respectively. The regression formula derived for male was $y_0 = 102.852 + 1.35x$ (PCTL) ± 6.365 and for female was $y_0 = 98.67 + 1.32x$ (PCTL) ± 3.52 .

Table 1.1 Stature measurements by PCTL method and sex wise findings and regression value.

Sex	PCTL	Height	Regression	P-value
Male	32.14 ± 3.234 cm	154.5 ± 7.227 cm	$102.852 + 1.35x$ (PCTL) ± 6.365	$P < 0.0001$
female	29.023 ± 2.254 cm	145.3 ± 4.654 cm	$y_0 = 98.67 + 1.32x$ (PCTL) ± 3.52	$P < 0.0001$

3. DISCUSSION

We have conducted the study in India. We have selected 400 indusial (200 male and 200 female) between the age group of 18 – 24 year. Then the stature and PCTL were measured and the data was calculated. Our study was conducted among the age group of 18 – 22 years people and the similar age group was considered by Trivedi et al⁽⁵⁾, who studied the age group

between 18 – 21 year. Similar age group was also considered by Kumar P et al (3) and Agnihotri et al (7). In our finding the maximum number of subject was of the age group of 19 year in male and 18 year in female and after comparing the both the maximum number of subject was of the age group of 19 year, and the least number of subject was of the age group of 24 year. In our study the stature was measured for male and female separately. The study revealed a correlation between height and tibial length in both the genders. The stature measured for male was $154.5 \pm 7.227\text{cm}$ and that of female was $145.3 \pm 4.654\text{cm}$. Similar result was found Saini et al [9], Laxmi N. C. et al. [10].

Table 2.2: Showing the comparison of stature of the present study with the previous studies.

S.N.	Previous studies	Year	Male stature	Female stature
1.	Khatun SS et al	2016	$Y=67.08 + (2.75)$	$Y=58.11 + (2.88)$
2.	Anitha MR et al	2016	$Y=94.5+1.8X1$	$Y=88.55+1.95X2$
3.	Naha Saini et al	2013	$68.9514 + 2.5902$	$85.1460+ 1.9005$
4.	A.N. et al	2018	$y=109.885+1.58x$	$y=122.385+1.07x$
5.	Akhilesh trivedi. et. al	2014	$Y=105.971+1.53 \pm 7.452$	$y= 103.76+1.43 x \pm 4.69 .$
6.	Present Study.	2024	$154.5 \pm 7.227\text{cm}$	$145.3 \pm 4.654\text{cm}$

4. CONCLUSION

The present study reveals that a positive and definite correlation exists between the percutaneous tibial length and the stature as well as regression equation is also established in all the study findings. In the present study we have found moderate statistically significant correlation between height and PCTL and there is minimum standard error of estimation in stature. We conclude that the regression equations presented here can be used to estimate ante-mortem stature, with reasonable accuracy, of unknown mutilated or dismembered human lower limb remains from percutaneous lengths of tibia and fibula in medico-legal cases, particularly from Rajasthan state of India. Side of the limb has no effect on the accuracy of the estimate. The estimates are better if Multi unilinear equations of tibia and fibula together are used.

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