

Stature Estimation from Tibial Length in Maharashtra

Avantika Bamne¹, Rajveer Singh Chourasia²

Abstract

Introduction: Estimation of stature has been found to have important role in anthropometry and forensic medicine. Stature is a very valuable measure of race. It is another unit character of greater value than skin color because there are extreme variations in human height. In present study an attempt has made to evaluate the anthropometric relationship between stature with that of lengths of tibia. **Objectives:** To evaluate the length of tibia in Indore population and to derive regression equation. **Materials & Methods:** This study has been carried out in the Department of Anatomy, medical institute. Out of 180 healthy individuals; 90 males and 90 females of individuals in Maharashtra, with age ranging from 19 to 24 years. **Results:** There is positive correlation between length and stature of tibia. **Conclusion:** It is observed and concluded that stature of an individual can be estimated with the help of anthropometric measurement of tibia.

Keywords: Maharashtra; Stature; Tibia.

Introduction

In the field of Anthropometry and Forensic medicine; estimation of stature has received a utmost significant importance. Anthropometric characteristics have direct relationship with sex, shape and form of an individual & these factors are intimately linked with each other [1].

Johan Friedrich Blumenbach [2] (1752-1840) laid down the foundation of Science of anthropology. To correlate the stature of a person with measurement of various body parts great extensive work has been done in India & abroad. All studies have concluded that there is a linear relationship between measurements & stature.

However they have been conducted in different races, hence their data & statistical formulae cannot be generalized. In this work an attempt is made to use length of ulna and tibia for calculating stature of a person [3].

Factor responsible for the height of the person is mainly the length of lower limb bones. In viewing the above point in mind, the present work was planned to calculate the height of the body from the length of percutaneous tibia. The measurement was done between the two anatomical land marks: Palpable portion of medial condyle and medial malleolus of tibia. Later on the regression analysis was done and regression formula was derived separately for both sexes to calculate the body height by using length of percutaneous tibia [4].

In 1997, N.K. Mohanty studied 1000 adult in Oriya individuals, that includes 500 males & 500 females and derived regression formula using percutaneous tibial Length (PCTL) [4]. In 2009, Bhavna and Surinder Nath have done the study to compute Multiplication factors and regression equations for estimation of stature among male of Delhi. The study constitutes 503 males. And they were measured for length of femur, tibia, fibula, foot length & breadth [5].

The recent study conducted by Agnihotri and his

Author's Affiliation: ¹Assistant Professor, Department of Anatomy Index Medical College, Hospital & Research Centre, Indore, Madhya Pradesh 452001, India. ²Assistant Professor, Department of Anatomy, Hind Institute of Medical Sciences, Safedabad, Barabanki Road, Lucknow, Uttar Pradesh 225003, India.

Corresponding Author: Rajveer Singh Chourasia, Assistant Professor, Department of Anatomy, Hind Institute of Medical Sciences, Safedabad, Barabanki Road, Lucknow, Uttar Pradesh 225003, India.

E-mail: researchguide86@gmail.com

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group [6]. In his study of estimation of stature from percutaneous length of tibia in Indo-Mauritian population suggested that percutaneous length of tibia can be efficiently used for estimation of stature. They remarked that tibial length show linear relationship with stature.

Present study includes measuring the length of tibia and height of individual and is also helpful in forensic medicine if tibia specimen of medico legal case is found we can estimate probable stature of that person. This study will be helpful in artificial limb centers in calculating appropriate length of prosthesis.

The study will be helpful in corrective surgeries for leprosy patients, amputation of limb surgeries for accidental injuries. The derived formulae can help to calculate height in case of patients suffering from spine disorders like kyphoscoliosis. The data collected can be useful in further anthropological studies also.

Materials & Methods

This study has been carried out in the department of Anatomy, Krishna Institutes of Medical Sciences University, Karad, Maharashtra. Out of 180 healthy individuals included in the study 90 were males and 90 were females of Maharashtrian population, with age ranging from 19 to 24 years. Vernier caliper [7] (60 centimeter length with accuracy of 0.01 cm) and standard flexible steel tape [8] was used to measure height of the subject.

Anthropometric measurements taken include right tibial length, left tibial length Stature. Independently for each individual as well as stature of each subject was also recorded. Tibia lies medial to fibula & is exceeded in length only by femur. Its shaft is triangular in section & has expanded ends proximally i.e. condyles and a strong medial malleolus projects distally from smaller distal end.

The anterior border is sharp & curves medially towards the medial malleolus & it is subcutaneous [9].

The individuals were asked to sit with left knee placed in the semi flexed position and partly everted to relax the soft tissues, so that the bony landmarks are more prominent. With the help of caliper the length of the bony marks of tibia are measured.

After collection of data, it is subjected to statistical analysis, recorded and tabulated. After analyzing data of each and every subject. Students' t' test (unpaired t' test) [10] was applied to calculate the stature from tibial length and correlation between total body height and length of tibia was determined with the help of regression formula [11].

Observations and Results

The present study has been carried out in the department of Anatomy, Krishna Institutes of Medical Sciences University, Karad, Maharashtra. Out of 180 healthy individuals, there were 90 males and 90 females, with age ranging from 19 to 24 years.

Above table shows that mean stature of male subjects is 172.31 that of female subjects is 158.84 cm, Mean of length of right and left tibia in male subjects are 39.03 cm and 39.01 cm respectively and that of right and left tibia in female subjects are 35.57 and 35.47 cm respectively. The above table shows sidewise variation in tibial length of male and female subjects, which is not statistically significant Table shows regression equation for height with length of tibia in male and female.

Height = a (constant) + b (slope) X tibia length ± standard error.

Y = height / stature (cm). 74.39 & 76.25 are intercept (constant or a) and 2.50 & 2.46 are regression coefficient (b) for right tibia & left tibia respectively in males.

Table 1: Parameters (cm) in male and female subjects

Parameter (cm)	Stature	Right tibia	Left tibia
Mean	Male	172.31	39.03
	Female	158.84	35.57
Range	Male	188-158	44.31-35.24
	Female	174.5-145	41.24-30.19

Table 2: Comparison between length of right and left tibia

Subjects	Right tibia (cm)	Left tibia (cm)	P value	t value
Male	39.03	39.01	0.943	0.070
Female	35.57	35.47	0.737	0.336

Table 3: Correlation of stature between length of tibia

Subjects		Male	Female
Correlation Coefficient(r)	Right	0.783	0.768
	Left	0.782	0.801
Coefficient Of Determination(r ²)	Right	0.613	0.590
	Left	0.612	0.641
P Value		< 0.0001	0.641

Table 4: Regression equation for height with length of tibia in male and female

Parameter	Sex	Side	Regression Equation	Correlation Coefficient
Length of tibia	Male	Right	Y = 74.39 + 2.50 right tibial length	0.783
		Left	Y = 76.25 + 2.46 left tibial length	0.782
	Female	Right	Y = 73.75 + 2.39 right tibial length	0.768
		Left	Y = 72.06 + 2.44 left tibial length	0.801

73.75 & 72.06 are intercept (constant or a) and 2.39 & 2.44 are regression coefficient (b) for right tibia & left tibia respectively in females.

Discussion

In present study mean value of right tibial length is 39.03 cm & left tibial length is 39.01 cm in males. Our findings correlate with I. Can Pelin [10] study. He studied 110 male subjects from Turkish population. In this study, he presented a new method for estimation of stature from tibia length, Group-specific formula while present study slightly differ from Manisha R. Dayal [11], she studied 98 white males and 71 white females of South Africa.

Bhavna & S. Nath [5], did work on 503 shia Muslims of Delhi and they studied various percutaneous dimensions besides stature such as femur length, fibular length, tibial length, foot length and breadth. They concluded that tibial length provides best estimate of stature as it exhibits highest value of correlation (r = 0.765) & least value of standard error of estimate (SEE = +3.66).

In present study mean value of right tibial length is 35.57 cm & left tibial length is 35.47 cm in females. Our findings correlate with N. K. Mohanty [4], who studied 500 males and 500 females from Oriya population in Berhampur, Orissa and derived regression Equation using percutaneous tibial length.

Our study also correlate with Manisha R. Dayal [11], she studied 98 white males and 71 white females of South Africa. While present study slightly differ from Chavan S.K [3]. He studied 200 subjects (100 males & 100 females) in Maharashtra.

Conclusion

Database is prepared and tabulated. It is concluded that the lengths of tibia provide good reliability in estimation of stature in forensic examinations. In present study, It is observed that in males, the highest correlation is exhibited by right tibia length (r = 0.783) and lowest by left ulna length (r=0.733).

It is observed that in females, the highest correlation is exhibited by left tibia length (r = 0.801). Left tibia length in females depicts higher correlation coefficient than that of any other measurement. Thus tibia length is the best parameter for estimating stature for females. This is also supported by low SEE in case of tibia length in females. It is observed that in males, the highest correlation is exhibited by right tibia length, Thus tibia length is the best parameter for estimating stature for males. This is also supported by low SEE in case of tibia length in males.

Mean values of tibial length and stature in present study are comparable with the data of other workers. The data collected can be utilized for future anthropological studies.

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