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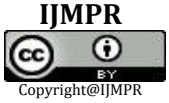

Estimation of Stature from Per Cutaneous Length of Tibia in Students in a Rural Government Medical College and Hospital in Maharashtrian Population

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ABSTRACT

Introduction: Establishment of identity of unknown human remains is a challenging task in medico-legal cases, especially when the remains are partial, mutilated or dismembered. Such situations usually arise in cases of natural disasters, rail, aircraft accidents, wars, terrorist explosions. Hand, foot, Ulna and Tibia length can be used to determine the stature of the person whenever mutilates, bones or part of bone comes for post-mortem examination. The tibia is ideal in this application as it resists erosion and keeps its anatomical shape for long even after burial.
Objective: To find out the relationship between personal stature and length of tibia.
Methods: Cross sectional study was conducted during October 2021-November 2021 in Department of FMT in a Rural Medical College Maharashtra. Study Population included 100 medical students.
Result: Regression equations were formulated with R2 (coefficient of determination) of 0.5796 for males on right side & 0.5709 on left side and 0.5748 and 0.563 for females on right and left tibia respectively. The calculated height was compared with the observed height of the students using t test. The test revealed that there was no significant difference between observed and calculated height of both male and female students, $p>0.05$.
Conclusion: Tibial length is a reliable parameter in reconstructing the stature of an individual.

Key Words: *Stature, percutaneous length of tibia, regression formula*

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INTRODUCTION

Establishment of identity of unknown human remains is a challenging task in medico-legal cases, especially when the remains are partial, mutilated or dismembered. Such situations usually arise in cases of natural disasters, rail and aircraft accidents, wars and terrorist explosions. Many times, only parts of human body, such as limbs, are available for identification. Being an individual characteristic, stature is one of the important parameters for personal identification. Estimation of stature, therefore, plays an important role in medico-legal cases in the identification of unknown bodies, parts of bodies or even skeletal remains. There exists a strong relationship between stature and dimensions of different body parts, particularly bone lengths, which form the basis for stature estimation [1]. Key factors for identification are Age, Sex and Stature. Many factors should be taken in to consideration while fixing stature with help of bone. Use of anatomical measurement of body is very ancient. The word 'Anthrapometry' was first used by a German physician J. Sigismund Elshwltz [2].

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 [3]. Hand length, foot length, Ulna length and Tibia length can be used to determine the stature of the person whenever mutilates, bones or part of bone comes for post-mortem examination.

Percutaneous length of long bone is more convenient method for estimation of stature than dry bone as it is a tedious and time consuming process which involves cleaning and preparation of bones [4]. 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 [5].

Tibia being located subcutaneously easily approachable to measure in living population [6]. The tibia is ideal in this application as it resists erosion and keeps its anatomical shape for long even after burial [7]. Tibia accounts for 22% of the total body length [8].

Present study was conducted to analyse the anthropometric relationship between tibial length and personal stature and to derive regression formulas to estimate stature for study population.

Objectives:

To find out the relationship between personal stature and length of tibia

MATERIAL & METHODS

Cross sectional study was conducted in Department of Forensic Medicine in Medical College and Hospital Maharashtra. After obtaining clearance from institutional ethical committee, data was collected from 100 students aged between 22-25 years. Height of the individuals were measured from vertex to heel in the Frankfurt's plane. For tibial length, measurements were taken with a spreading calliper from the medial most point on upper border of medial condyle of tibia to the tip of medial malleolus. Study was done during October 2021 to November 2021. Students with physical debilities, skeletal defects and past history of diseases affecting bones and joints and subjects who are on any form of hormonal medications were excluded from the study. All the subjects were briefed about the purpose of study and informed and written consent was obtained. Data thus acquired was analysed in a scientific way using appropriate statistical tests and SPSS16software.

RESULT

Of the total 100 undergraduate students, 56 were males (56%) and 44 were females (44%). Mean and standard deviation of observed height for males and females were 168.95±5.86cm and 158.11±6.01cm respectively. The length of right tibia in males varied from 35 cm to 47.5cm with mean and standard deviation of 41.23±2.60 cm; whereas, that of left tibia ranged from 35 cm to 47.5cm with mean and standard deviation of 41.25±2.62 cm. On the other hand, the length of right tibia in females fluctuated between 31.4 cm and 44 cm with mean and standard deviation of 38.39±2.69 cm; whereas, that of left tibia ranged from 31.4 cm to 44 cm with mean and standard deviation of 38.38±2.69 cm. Mean values of length of both right and left tibia and height being higher in males than in females and observed difference was statistically significant.

Table No 1: Stature and length of tibia in males & females

Measurements		**Male (56)**		**Female (44)**		**P value**
		Range	Mean± SD	Range	Mean± SD	
Observed height		152-183	168.95±5.86	148-171	158.11±6.01	0.001
Tibial Length	Right	35-47.5	41.23±2.60	31.4-44	38.39±2.69	0.001
	Left	35-47.5	41.25±2.62	31.4-44	38.38±2.69	0.001

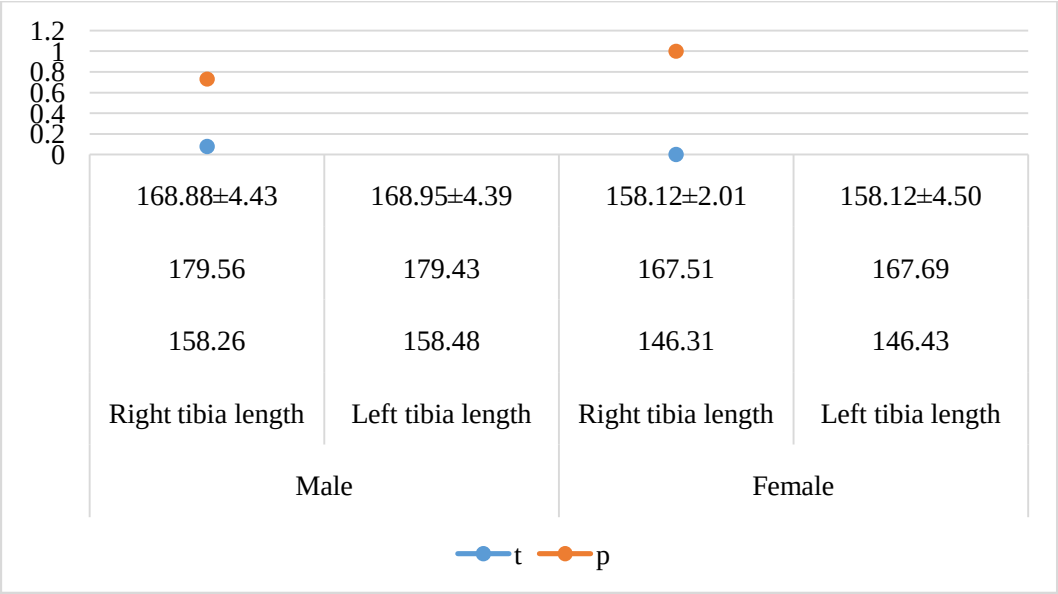
Table 2: Regressing equations for the estimation of stature from tibia length in males and females

Gender	**Side**	**Correlation coefficient (r)**	**r2 (coefficient of determination)**	**Regression equation**	**P value**
Male	Right	0.7613	0.5796	1.7037x + 98.693	1.173
	Left	0.7555	0.5709	1.676x + 99.816	-0.514
Female	Right	0.7581	0.5748	1.6965x + 93.039	1.493
	Left	0.7503	0.563	1.6726x + 93.913	-1.031

Simple linear regression was calculated to predict height (calculated height) based on tibial length measurements. The significant regression equations were formulated with R2 (coefficient of determination) of 0.5796 for males on right side & 0.5709 on left side and 0.5748 and 0.563 for females on right and left tibia respectively.

Table 3: Calculated height using regression equations in males and females

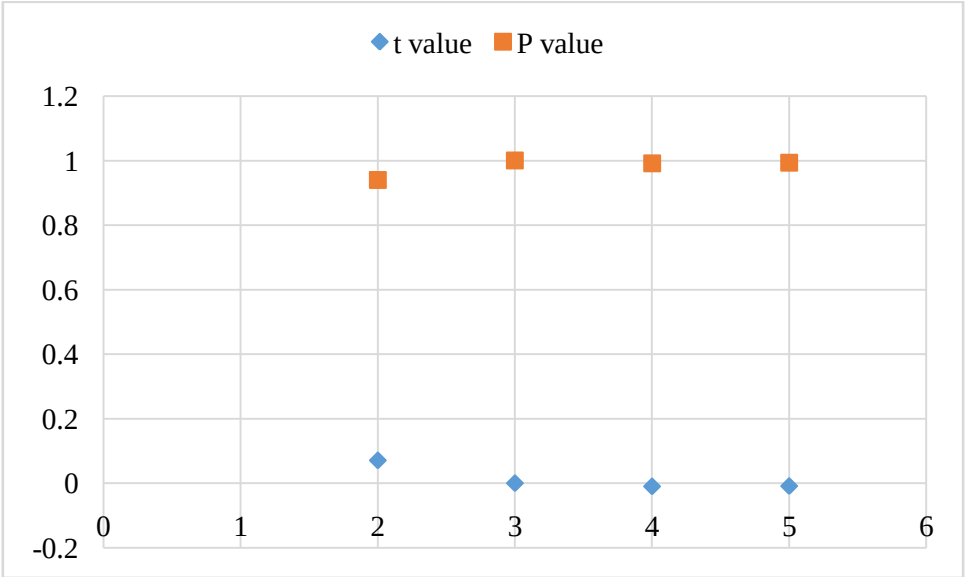
Gender	**Measurement**	**Minimum**	**Maximum**	**Mean±SD**	**t**	**P**
Male	Right tibia length	158.26	179.56	168.88±4.43	0.079	0.73
	Left tibia length	158.48	179.43	168.95±4.39		
Female	Right tibia length	146.31	167.51	158.12±2.01	0.00	1
	Left tibia length	146.43	167.69	158.12±4.50		



Height of each student was calculated by adopting these regression equations, as shown in Table 3. The mean and standard deviation of height (calculated height) computed using the regression equations derived from length of right and left tibia in males were 168.88±4.43 cm and 168.95±4.39 respectively, whereas, that in females were 158.12±2.011cm and 158.12±4.50 cm respectively. A paired t test revealed that there is no significant difference in the calculated height derived from regression equations using length of right and left tibia in both sexes, p>0.05.

Table 4: Comparison between the observed and calculated height of males and females

Gender	Measurements	Calculated Mean±SD	Observed Mean±SD	t value	P value
Male	Right tibia length	168.88±4.43	168.95±5.86	0.071	0.94
	Left tibia length	168.95±4.39		0.00	1.00
Female	Right tibia length	158.12±2.01	158.11±6.01	-0.01	0.991
	Left tibia length	158.12±4.50		-0.009	0.993



The calculated height was compared with the observed height of the students using t test. The test revealed that there was no significant difference between observed and calculated height of both male and female students, p>0.05.

Limitation: The present study was undertaken in undergraduate students of MBBS with relatively small sample size (comprising of 100 students). Other traits such as age, race and ethnicity were not considered. Hence, result of the study may not be generalized.

CONCLUSION

Tibial length is a reliable parameter in reconstructing the stature of an individual. These regression equations may be immensely useful to the forensic pathologist when stature is to be determined from fragmentary remains of body parts to identify a living or deceased.

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