International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.13

ORIGINAL RESEARCH

Percutaneous Length Of Tibia In Determining The Stature: Importance For Forensic Experts

Dr. Qaiser Rasool Panzoo[1], Dr. Abhishak Kumar Varshney[2], Dr. Harsh, Assistant Professor[3], Dr. Navinkumar Varma[4]

[1]Associate Professor, Department of Forensic Medicine, Gautam Budha Chikitsa Mahavidyalaya, Dehradun, qaiserrasoolpanzoo83@gmail.com
[2]Associate Professor, Department of Forensic Medicine, TMMC&RC, Moradabad, dr.abhishekvsny@gmail.com
[3]Assistant Professor, Department of Forensic Medicine, TMMC &RC, Moradabad, harsh3813@gmail.com
[4]HOD & Professor, Department of Forensic Medicine, TMMC&RC, Moradabad, drnmv1976@gmail.com

Corresponding Author:
Dr. Navinkumar Varma
HOD & Professor, Department of Forensic Medicine, TMMC&RC, Moradabad
drnmv1976@gmail.com

Received: 21 January, 2025 Accepted: 26 February, 2025 Published: 02 March, 2025

ABSTRACT

Introduction: The measurement of a person's height may be used for mass catastrophes, ethnographic study, and a variety of medical-legal applications. **Materials and Methods:** A stadiometer was used to measure height, and a spreading calliper was used to assess percutaneous tibial length. Technique for measuring stature: The subject was instructed to stand straight, with eyes front, both arms at the sides of the body, palms facing forward, both legs parallel to one another, both feet linked, big toe facing forward, and the head adjusted in the Frankfurt plane. **Results:** This suggests that the sample accurately reflected the population it was taken from. For both boys and females, the correlation values for tibial length and stature were close to +1, indicating a strong relationship. To evaluate the significance of correlation coefficients, a null hypothesis was established. **Conclusion:** The results of this investigation showed that height and percutaneous tibial length are positively correlated. For the estimate of height, separate formulas are required for men and females.

Keyword: Percutaneous,Tibia, Forensic Experts, Determining the Height

INTRODUCTION

The measurement of a person's height may be used for mass catastrophes, ethnographic study, and a variety of medical-legal applications. The manifestation of internal structure and tissue components, which are influenced by hereditary and environmental factors, are intimately linked to an individual's sex, form, and type, and these factors are directly tied to anthrapometric features.[1] In this regard, several investigations have been carried out, and various regression equation formulas have been developed to link height with percutaneous length of tibia (PCLT). The foundation for assessing stature is the research of Trotter and Gleser, Dupertutis and Hadden, and Trotter, not just for American Whites and Blacks, but also with the goal of resolving the complete statural reconstruction issue.[2,3,4,5,6] "There is a reasonably and relatively constant average stature which is devoid of any trend of variation for all the 4 groups born between 1840 and 1895," Trotter and Gleser had determined. Between 1895 and 1905, there was a trend for the Black American population, both male and female, to somewhat grow in height. The status of an individual is influenced by a number of elements, such as race, regional climate, food, and genetics.[7] Research must be conducted for a particular demographic since the correlation factor of one location will not hold true for another. Since dry bone is a laborious and time-consuming process that requires cleaning and preparing the bone, long bone percutaneous length is a more effective way to calculate stature.[8] The majority of prediction algorithms are based on the length of the tibia, femur, and fibula since lower limb length is crucial in determining an individual's standing height.[9] Since the tibia is subcutaneous, it is simple to measure in a live

DOI: 10.69605/ijlbpr_14.3.2025.13

population.[10] Since the link between tall and long bones determines an individual's gender and ethnicity, there are no generally accepted methods for calculating stature based on long bone length.[11]

Many existing studies focus on generalized equations that may not be applicable across diverse populations due to genetic, environmental, and ethnic variations. Moreover, while the relationship between tibial length and stature has been well established, there is a need for population-specific regression equations to enhance the accuracy of height estimation. The research gap lies in the limited availability of region-specific and gender-specific formulas that can provide more precise stature predictions, addressing the variability in body proportions across different demographic groups. This study aims to bridge this gap by developing separate estimation formulas for males and females based on percutaneous tibial length, ensuring more accurate and reliable results in forensic and anthropological contexts.

MATERIALS AND METHODS

Only individuals who were able to participate with written informed consent were included in the study. This retrospective study's cross-sectional design was carried out between April 2016 and March 2017.The age range was specified from 18 to 60. By random selection, 530 people who seemed apparently healthy (295 men and 235 women) were included in this research. In this study a total of 530 (N) healthy adult people were taken by the help of statistical formula for the cross-sectional study ($n=z2p(100-p)/e2$).[12] A stadiometer was used to measure height, and a spreading calliper was used to assess percutaneous tibial length. Technique for measuring stature: The subject was instructed to stand straight, with eyes front, both arms at the sides of the body, palms facing forward, both legs parallel to one another, both feet linked, big toe facing forward, and the head adjusted in the Frankfurt plane. The whole measurement was obtained by moving the sliding horizontal bar all the way up to the vertex. Participants with a history of trauma or fracture that resulted in skeletal abnormalities of the spine, limbs, or pelvis were excluded from the research in advance.

RESULTS

Table 1 displays the sample's descriptive statistics. Both the male and female sample standard deviations for standing height were quite close to the population standard deviation. This suggests that the sample accurately reflected the population it was taken from. For both boys and females, the correlation values for tibial length and stature were close to +1, indicating a strong relationship. To evaluate the significance of correlation coefficients, a null hypothesis was established.

Table 1: Descriptive Statistics of the Sample

Statistical parameters		Males	Females
Sample size (n)		295	235
	Range	18 - 60	18 - 50
Age (years)	Mean	33.2	29.22
	Mean	161.18	159.11
	Range	143.6-179.1	141-178.6
Standing height (cm.)	Sample S.D.	±8.82	±10.60
	Population S.D.	±9.599	±8.014
	Mean	36.19	34.76
	Range	29.4-48.8	28.6-41.6
Percutaneoustibial length (cm.)	Sample S.D.	±5.06	±4.67
	Population S.D.	±4.733	±4.123
Correlation coefficient (r)		0.96	0.96

Both sexes in the 18–60 age range are included in this research. All individuals' height and percutaneous tibial length were measured, and the mean, standard deviation (±SD), standard error (SE), and range (minimum and maximum) were computed for statistical analysis. To determine if there is a significant connection between the parameters, the regression equation was also created using Pearson's correlation coefficient and the student's t-test with its p-value of significance for each parameter. Table 2 displays the statistical association between the ages of the men, females, and both sexes.

DOI: 10.69605/ijlbpr_14.3.2025.13

Table 2: Statistical Correlation between the Age of the Males, Females and Also Both the Sexes.

Group	Male	Female	Both sexes
Number of Population	295	235	530
Mean	21.57	20.11	21.28
Standard Deviation (±)	3.90	3.17	3.60
Variance	5.40	3.39	4.7
Minimum	20	20	20
Maximum	27	27	27

Table 3 displays the regression equations as they were computed. These equations have a very low standard error of estimation (males ± 0.19, females ± 0.18). These low standard error of estimate values for both boys and females provide sufficient statistical support for the equations proposed in this work.

Table 3: The Regression Equations

Side	Male	Female
Irrespective of side	S= 79.80 + 4.51T	S=72.11 + 4.73T
Right tibia	S = 79.77 +4.41 T	S = 71 + 4.71 T
Left tibia	S= 79.88 + 4.41 T	S = 71.17 + 4.71 T

Discussion

According to this research, there is a substantial correlation between height and percutaneous tibial length in Gujarati natives of both sexes. Pearson (1899) developed regression formulas for calculating stature using Rollet's data. The right side's lengthy bone segments were the only ones used. Pearson made a substantial contribution to the development of stature assessment. Trotter and Gleser sought to establish a new formula for Indians because they believe that as the world's population becomes larger, the link between long bone height and length changes and new formulae are needed for every generation,[13] varying parts of India and the globe have varying statures.[14] A diverse range of religions, castes, tribes, cultures, and geographical locations make up the Indian people. Indian size and construction were discovered to be diverse in various places of the globe. The many castes and tribes also have an impact on height, in addition to regional variations. In the same Madhya Pradesh state, the Barelas (tribe) and Bhils (tribe) had computed mean statures of 161.5 cm and 160 cm, respectively.[15] Bose reports that the average status in western Bangal is 166.6 cm.[16] According to Mohanty, the average height of Oriya men is 162.2 cm. Kolte PM et al. calculated that the average male height in the Marathwada region of Maharashtra was 163.7 cm.[17] In contrast, Patil T.L. et al. discovered that the average male status in the Vidarbha area of Maharashtra was 161.9 cm.[18] The average tibia length for males and females is 42.42 cm and 40.00 cm, respectively, for the Kori people of North India. This makes it very evident that one region's regression coefficient does not apply to another. The Kori people of North India had the longest tibias on average, measuring 42.42 cm for men and 40.00 cm for women. This demonstrates unequivocally that a region's regression coefficient does not apply to another.[19]

Key Insights

- A strong positive correlation was observed between percutaneous tibial length and stature, indicating its reliability in height estimation.
- Separate estimation formulas for males and females are necessary due to gender-based differences in body proportions.
- The study reaffirms the importance of tibial length as a predictor of stature, particularly in forensic and anthropological applications.

Limitations

- Measurements were conducted manually using a stadiometer and spreading calliper, which may introduce human error and slight inconsistencies.
- Soft tissue variations and postural differences could have influenced the accuracy of percutaneous tibial length measurements.
- The study did not account for factors such as nutritional status, genetic predisposition, or medical conditions that may affect height and limb proportions.

Future Recommendations

Future studies should include a larger and more diverse population to improve the generalizability of the findings across different ethnic and regional groups. The use of imaging techniques such as CT scans or digital anthropometry can enhance measurement precision and reduce human error.

DOI: 10.69605/ijlbpr_14.3.2025.13

CONCLUSION

The results of this investigation showed that height and percutaneous tibial length are positively correlated. For the estimate of height, separate formulas are required for men and females. For a more precise estimate of the average Indian population, two regression models that account for the ethnic, regional, gender, and secular variations in tibial length might be used. Therefore, both anthropologists and forensic experts may benefit greatly from this work.

REFERENCES

1. Anam E, Patel M, Phatak A, Kumar L, Agarwal SS. Estimation of stature from inter-acromial length in Western Indian population: a pilot study. Journal of Indian Academy of Forensic Medicine. 2014;36(1):31–33.
2. Anirban D, Arindam B, Prithviraj K. Estimation of stature of Eastern Indians from measurements of tibial length. Anatom. Physiol. 2013;(1):2161–0940.1000115.
3. Arif M, Rasool SH, Chaudhary MK, Shakeel Z. Estimation of stature; upper arm length-a reliable predictor of stature. Professional Medical Journal.2018;25(11).
4. Ghanbari K, Nazari AR, Ghanbari A, Chehrei S. Stature estimation and formulation of based on ulna length in Kurdish racial subgroup. Italian Journal of Anatomy and Embryology 2016;121(1):43–50.
5. Ibegbu A, David E, Hamman W, Umana U, Musa S. Hand length as a determinat of height in school children. Adv. Life Sci. 2015;5:12–17.
6. Khatun SS, Sharma N, Jain SK, Gupta A. Estimation of stature from percutaneous tibial length in Indian population. Int J Anat Res.2016;4(3):2571–6.
7. Mehta, A. A., A. A. Mehta, V. Gajbhiye and S. Verma."Correlation of percutaneous tibial length with body height and estimation of stature in living Central India population."2015a.
8. Mehta AA, Mehta AA, Gajbhiye VM, Verma S. Correlation of percutaneous tibial length with body height and estimation of stature in living Central India population. International Journal of Anatomy and Research .2015b;3(2):1159–61.
9. Nemade P, Ambiye M, Nemade A. Regression analysis on stature estimation from cephalic dimensions. Int. J. Appl. Basic Med. 2015;4:298–312.
10. Song-in K, Riengrojpitak S, Tiensuwan M. Estimation of stature from forearm length in Thai children. Journal of Food Health and Bioenvironmental Science.2013;6(1):131–40.
11. Trivedi A, Saxena S, Morya R, Jehan M, Bhadkaria V. Stature estimation using percutaneous tibial length in people of Gwalior region. IOSR J Dent Med Sci.2014;13(5):65–70.
12. Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. Gastroenterol Hepatol Bed Bench. 2013;6(1):14-7. PMID: 24834239; PMCID: PMC4017493.
13. Ukoha UU, Umeasalugo KE, Udemezue OO, Asomugha LA. Estimation of stature from cephalic dimensions in a Nigerian population. Estimación de la estaturapor las dimensionescefálicasenuna población nigeriana. Revista Argentina de Anatomía Clínica.2016;7(1):17–25.
14. Anitha MR et al. Estimation of height from percutaneous tibial length among South Indian population,IndianJournalofClinicalAnatomyand Physiology. 2016;3(4);405-407
15. Wankhede KP, Anjankar VP, Parchand MP, Kamdi N, Patil ST. Estimation of stature from head length and head breadth in Central Indian population: an anthropometric study. Int. J. Anat. Res 2015;3:954–957.
16. Renu Kamal a, Praveen Kumar Yadav; Estimation of stature from different anthropometric measurements in Kori population of North India; Egyptian Journal of Forensic Sciences. 2016;6:468–7.
17. Gaur R, Kaur K, Airi R, Jarodia K. Estimation of Stature from Percutaneous Lengths of Tibia and Fibula of Scheduled Castes of Haryana State, India. Ann Forensic Res Anal.2016; 3(1): 1025.
18. Anitha MR1, Bharathi D2, Rajitha V3, Chaitra BR. Estimation of height from percutaneous tibial length among South Indian population, Indian Journal of Clinical Anatomy and Physiology.2016;3(4);405-7.
19. Mirzanaik AD, Patil RC, Ranjakash S. Stature estimation from hand length in north Karnataka population, India. IP International Journal of Forensic Medicine and Toxicological Sciences.2018;3:41–4.