Original Article

Correlation of Thigh Length with Adult Human Stature

Ahmad Raza Khan[1], Noman Butt[2], Mohsin Munawar[3], Rabia Nasir[3], Noreen Kashif[3] and Aatiqa Abass[4]

ABSTRACT

Objective: To find correlation of thigh length with adult human stature.
Study Design: Cross sectional correlational study
Place and Duration of Study: This study was conducted at the Department of Forensic Medicine and Toxicology, King Edward Medical University, Lahore from 24 May 2024 to 24 August 2024.
Methods: Sixty medical students (30 males and 30 females) were enrolled, with informed consent obtained after explaining the study's purpose. Biodata, including name, age, gender, and city, was collected. Stature, inter anterior superior iliac spinal distance, and thigh length were measured per Krogman's procedures, with the measurement team trained to minimize observer bias.
Results: The mean age of participants was 20.48 years (SD 1.19), with 30 males and 30 females. Those under 20 years comprised 45% (n=27), while those over 20 made up 55% (n=33). The mean thigh length was 46.18 cm (SD 2.02) and mean stature was 169.48 cm (SD 8.35). The overall correlation between thigh length and stature was 0.203 (p=0.12). In males, it was -0.106 (p=0.579) and in females, 0.099 (p=0.60). For participants under 20, the correlation was 0.167 (p=0.40), while for those over 20, it was 0.252 (p=0.158).
Conclusions: This study evaluated thigh length as a predictor of adult stature, finding a weak to moderate correlation that varied by gender and age. Although it shows some potential, correlation is not strong enough to recommend it as a standalone measurement.
Key Words: Anthropometric measurement, Stature, Thigh length

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INTRODUCTION

Human identification has always been a key factor in establishing individuality of a person either in civil or criminal cases. This process of identification has multiple approaches towards addressing this issue which include physical parameters, ABO blood grouping, HLA markers, DNA analysis and Y-STR analysis etc. Among all these parameters is an anthropometric study which includes quantification of human size and shape along with its proportions. This analysis is used not only for clinical evaluation of a person assessing his health and ergonomics but also for forensic purposes to prove and settle an identity dispute in medicolegal cases.[1]

[1.] Medical Officer / Senior Demonstrator[2] / Demonstrator[3] / Assistant Professor[4], Forensic Medicine and Toxicology, King Edward Medical University Lahore.

Correspondence: Dr. Ahmad Raza Khan. Department of Forensic Medicine and Toxicology, King Edward Medical College, Lahore.
Contact No: 03214102116
Email: arkizback@gmail.com

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Anthropometry can further be subdivided in multiple measurements of the body parts and the present study shall focus on long bones with specificity to measurement of the thigh i.e. femur bone. Multiple measurements of long bones is incorporated in mathematical statistics using regression analysis eventually reflecting a correlation among long bone like femur with overall height.[2] Although this physical analysis is an old school technique as compared to recent advancements to manifest identity yet as with all evolution of scientific scans, human stature estimation has also significantly metamorphosed to advanced technological approach for better anatomical comprehension.[3] This scientific approach has progressed due to improved regression model approach with more accurate results enabling stature evaluation even from partial bone fragments. Anthropometrists have delved deeper into physical measurements like Inter Anterior Superior Iliac Spinal Distance (IASISD) and Thigh Length (TL); TL measures the distance from the ASIS to the femur's medial condyle, while IASISD measures the distance between ASIS points.[4] On a comparative note IASISD is usually used in clinical scenarios for guidance in surgery whereas thigh length is a true leg length parameter which can give an accurate stature estimate in absolute least time consumption. This TL technique not only can be used as an evaluative tool in the living subjects but also has an archeological approach assisting identity

establishment as femur has the most significant correlative factor for height calculation.[5,6] In human population thigh length is dependable measure of human stature due to its steady proportional association with height reckoning around 26-27% of entire height across multiple populations.[7] This is a dependable method with accuracy in stature calculation in living subjects due to prominent anatomical landmarks indicative for precise measurements with least observer error which prompt application in regression analytical models. This technique is even most reliable in such calculative purposes to evaluate stature from skeletal remains either complete or partial.[8] Finally emphasizing on objectivity of this study it is elaborated that such a technique is extremely resourceful due to its accuracy, non-invasive approach with limited resources and technology in a third world country like Pakistan in assessing stature measurements in not only living subjects but also in post mortem examinations along with the fragmentary, mutilated remains procured by the police from either mass disasters or on exhumation to establish identification for various medicolegal purposes.[9]

METHODS

This cross-sectional correlational study was conducted at King Edward Medical University Lahore including students ranging from 1st year to final year MBBS, over three months after ethical approval from institutional review board vide letter number.56 /RC/KEMU dated 06th May 2024. A sample size of 60 cases was calculated with a 95% confidence level and a 5% margin of error, using non-probability consecutive sampling. Following approval from Ethical Committee, participants with inclusion criteria were enrolled, and written informed consent was obtained from participants. A detailed history and complete physical examination were conducted for all participants. For thigh length measurement, a measuring tape or anthropometer was used to measure from the greater trochanter, a bony prominence on the hip, to the lateral condyle of the femur, ensuring the thigh was fully extended and the knee was in a neutral position. This measurement was recorded to the nearest centimeter. Stature was measured using a stadiometer; participants stood erect with their backs against the device and heads positioned in the Frankfort plane. The measuring arm was lowered until it made contact with the participant's head, and the height was recorded to the nearest centimeter. A predesigned questionnaire was used to collect demographic information, including age, gender, and ethnicity/race, from each participant. The overall aim of the study was to assess the effectiveness of thigh length as a predictor of adult human stature, contributing valuable data for further research in this area.

Ethical Declaration: Ethical review board proceedings were conducted in Mayo Hospital Lahore under the Chairmanship of Prof. Muhammad Imran, Secretary Institutional Review Board, Chairman Department of Medicine, King Edward Medical University/Mayo Hospital, Lahore and project was approved vide letter no.**56 /RC/KEMU dated 06th May 2024.**

Inclusion Criteria: Study included individuals aged 18 to 24 years, with both males and females eligible for enrollment.

Exclusion Criteria: It included individuals younger than 18 or older than 25 years, those with stunted or enhanced bone growth, and those with a history of skeletal injury.

Data Analysis: Data was entered and analyzed through SPSS 26. Mean and standard deviation was calculated for quantitative variables like age, thigh length, and stature. Frequency and percentage were calculated for gender. Correlation analysis, such as Pearson correlation coefficient, was performed to examine the associations between thigh length and stature. Effect modifiers such as age and gender were controlled through post stratification and p-value <0.05 was considered significant.

RESULTS

The mean age of all patients was 20.48 years with a SD of 1.19 years. The mean thigh length was 46.18 cm with a standard deviation of 2.02 cm. The mean stature was 169.48 cm with a standard deviation of 8.35 cm as shown in Table-I.

The study involved 60 participants, evenly split between genders with 30 males and 30 females, each representing 50% of the total population. Participants were categorized into two age groups: 27 individuals (45%) were under 20 years old, while 33 individuals (55%) were over 20 years old as shown in Table-2.

The overall correlation between stature and thigh length in the study population (n=60) yielded correlation coefficient of 0.203 with a *p*-value of 0.12 as shown in Table-3.

Table No. I: Mean and standard deviation of Age, Thigh length and Stature (n=60)

Variable	n	Mean	SD
Age (Years)	60	20.48	1.91
Thigh Length(cm)	60	46.18	2.02
Stature (cm)	60	169.48	8.35

The correlation of stature with thigh length, when analyzed separately for males and females (n=60), showed differing results. For males (n=30), the correlation had an R value of -0.106 with a *p*-value of 0.579, indicating a weak negative and non-significant relationship. For females (n=30), the R value was 0.099 with a *p*-value of 0.60. The correlation of stature with thigh length, when analyzed according to age groups

(n=60), showed varying results. In participants aged <20 years (n=30), the correlation coefficient of 0.167 with a *p*-value of 0.40. For participants aged >20 years (n=30), the correlation showed an R value of 0.252 with a *p*-value of 0.158 as shown in Table-4.

Table No.2: Frequency of patients on the basis of gender and age (n=60)

Gender and Age Group	Frequency	Percentage
Male	30	50.0
Female	30	50.0
<20 years	27	45.0
>20 years	33	55.0

Table No.3: Correlation of stature with thigh length (n=60)

Variable	n	r	*p*-value
Over all Correlation	60	0.203	0.12

Table No.4: Correlation of stature with thigh length with respect to gender and age group (n=60)

Correlation	n	r	*p*-value
Male	30	-0.106	0.579
Female	30	0.099	0.60
<20 years	30	0.167	0.40
>20 years	30	0.252	0.158

DISCUSSION

Stature estimation is a crucial component in medico-legal investigations, particularly in the identification of unknown, fragmentary, or mutilated human remains.[10,11] Apart from other parameters of identification like age sex and ancestry accurately determining an individual's height can provide significant clues in forensic contexts, helping to establish identity and narrow down potential matches. This process becomes essential when dealing with incomplete or damaged skeletal remains where conventional identification methods may be insufficient.[12,13] In countries with limited resources, expertise in such simple procedures have paramount importance in identification of unknown fragmented, mutilated and skeletonized dead bodies. Other modern methods for objective identification require a detailed ante-mortem data and other sophisticated technology along with resources which in developing countries is limited. By applying anthropometric techniques and statistical models to the available skeletal elements, forensic experts can estimate the stature of the deceased, contributing valuable information to the investigative process.

In this study, correlation between thigh length and stature was determined utilized to explore the relationship. These statistical methods provide a robust framework for understanding how well IASISD can predict stature and the strength of their association. The correlation coefficient (r) obtained in this study was 0.927, indicating a very strong positive relationship.

In the present study overall correlation between stature and thigh length in study population was found to be 0.203, with a *p*-value of 0.12. This indicates a weak positive correlation that is not statistically significant, suggesting that while there is a slight association between thigh length and stature, it is not strong enough to be considered a reliable predictor of stature in this sample. The results suggest that while there is some degree of association between thigh length and stature, relationship is not strong enough to make thigh length a reliable predictor of stature on its own. This is consistent with findings from other studies which also report weak correlations between various anthropometric measurements and stature.[14,15] A study conducted by Arif Viqar et al. stated that a positive correlation was observed between the stature and the femur length and correlation was highly statistically significant. ($p<0.001$).

Another study finding aligns with other research where correlation between similar anthropometric measurements and stature has been shown to be both strong and significant, reinforcing reliability of these measurements for predicting stature.[16] These findings are well-supported by existing literature, which highlights the effectiveness of anthropometric measurements in predicting body dimensions.[17]

When analyzing the correlation between stature and thigh length separately by gender in the study population (n=60), the results varied significantly. For males (n=30), the correlation coefficient was -0.106 with a *p*-value of 0.579. This weak negative correlation suggests that, for males, thigh length has a negligible and statistically insignificant inverse relationship with stature. The high *p*-value indicates that this relationship is not statistically significant, and any observed association is likely due to chance.[18]

In contrast, for females (n=30), the correlation coefficient was 0.099 with a *p*-value of 0.60. This weak positive correlation implies that for females, thigh length shows a slight and statistically insignificant positive association with stature. Similar to results for males, high *p*-value signifies that observed correlation is not statistically significant; reinforcing that thigh length is not a strong predictor of stature in females either.

These gender-specific findings highlight that thigh length's predictive value for stature varies and is not robust across genders. Lack of significant correlation in both groups suggests that thigh length alone may not be a reliable measure for stature estimation. This is consistent with notion that anthropometric relationships can differ based on gender and other demographic factors, and underscores need for further research to

explore and validate more accurate predictors of stature in diverse populations. [19]

CONCLUSION

Statistical analysis of this study proved an insignificant correlation between thigh length and height of an individual especially of male gender. Weak correlative connection among the variable of thigh length with it as a predictive model of height estimation was established in this study as relationship varied by gender and age with an eventual conclusion that despite its potential, thigh length alone does not provide a highly accurate estimate of stature.[21]

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Ahmad Raza Khan, Noman Butt, Mohsin Munawar
Drafting or Revising Critically:	Rabia Nasir, Noreen Kashif, Aatiqa Abass
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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REFERENCES

1. MacKinnon G. Forensic anthropology current methods and practice. J Forensic Leg Med 2014; 27: 87–88.
2. Krishan K, Kanchan T, Sharma A. Multiplication factor versus regression analysis in stature estimation from hand and foot dimensions. J Forensic Leg Med 2012;19(4):211–214.
3. Thurzo A, Kosnáčová HS, Kurilová V, Kosmeľ S, Beňuš R, Moravanský N, et al. Use of advanced artificial intelligence in forensic medicine, forensic anthropology and clinical anatomy. Healthcare (Basel) 2021 [cited 2024 Oct 29]; 9(11): 1545.
4. Wang Q, Xu LY, Lei FZ, Lin JX, Song L, Li XY. Stature estimation from body dimensions in Han population of Southern China. J Forens Sci Med 2020; 6(4): 126-134.
5. Viqar A, Khanna M. Estimation of stature from femur length in north Indian male population. Ind J Forensic Comm Med 2020;5(3): 153–156.
6. Viqar A, Garg S, Tak RH, Devi S. Estimation of stature from percutaneous measurement of femur length in young females in north Indian population. Int J Med Toxicol Leg Med 2021;24(3and4): 30–33.
7. Imai N, Funayama K, Suzuki H, Tsuchiya K, Nozaki A, Minato I, et al. Stature estimation formulae based on bony pelvic dimensions and femoral length. Homo 2020;71(2): 111–119.
8. Hauser R, Smoliński J, Gos T. The estimation of stature on the basis of measurements of the femur. Forensic Sci Int 2005;147(2–3):185–190.
9. Babu GR, Johnson A. Medicolegal Investigation-Non-Invasive Procedures for the Criminal and Routine Human Identification: Prospective and Prolific Determinants for Profiling. Forensic Science Human Rights 2023;91. https://dx.doi.org/10.71000/cz022260
10. Verma R, Krishan K, Rani D, Kumar A, Sharma V. Stature estimation in forensic examinations using regression analysis: A likelihood ratio perspective. Forensic Sci Int Rep 2020;2(100069):100069.
11. Özaslan A, İşcan MY, Özaslan İ, Tuğcu H, Koç S. Estimation of stature from body parts. Forensic Sci Int 2003;132(1):40–45.
12. Bilge Y, Kedici PS, Alakoç YD, Ülküer KÜ, İlkyaz YY. The identification of a dismembered human body: a multidisciplinary approach. Forensic Sci Int 2003; 137(2–3):141–146.
13. Waghmare PB. Establishing identity and cause of death in mutilated and Un identifiable corpses: A challenging task for medico legal expert. J Forensic Biomech 2015; 06(01).
14. Pankaj Kumar PK, Shahnawaz K, Varma G. Study of estimation of stature by the length of femur. J Evol Med Dent Sci 2014;3(12):3166–3172.
15. Chawla H, Tyagi A, Dara S, Aravindan. Estimation of stature from lower limb measurements by regression analysis in north-west Indian population. Sci Med Sci 2022;1(46): 37–43.
16. Jones W, Pearson A, Glassbrook D, Slater G, Dodd-Reynolds C, Hind K. Precision of the GE lunar total body-less head scan for the measurement of three-compartment body composition in athletes. J Clin Densitom 2022; 25(4): 692–698.
17. Kamal R, Yadav PK. Estimation of stature from different anthropometric measurements in Kori population of North India. Egypt J Forensic Sci 2016; 6(4): 468–477.
18. Bragança S, Arezes P, Carvalho M, Ashdown SP, Castellucci I, Leão C. A comparison of manual anthropometric measurements with Kinect-based scanned measurements in terms of precision and reliability. Work 2018;59(3):325-339.
19. Wang M, Kane MB, Zhao D. Correlation-regression analysis for understanding dominant height projection accuracy. Forest Science 2023;69(1):e1-e10.