International Journal of Anatomy and Research,
Int J Anat Res 2016, Vol 4(3):2590-92. ISSN 2321-4287
DOI: *http://dx.doi.org/10.16965/ijar.2016.282*

Original Research Article

ESTIMATION OF BODY STATURE USING FEMUR LENGTH IN SOUTH INDIAN POPULATION: A CROSS SECTIONAL STUDY

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ABSTRACT

Background: The identity of the dead and mutilated is an essential part of medico-legal and various social reasons. Stature can be estimated by either anatomical method or mathematical way. Skeletal height is estimated by use of bone length and regression formula. To this purpose, we estimated femur length by measuring inter-trochanteric crest to create regression equation in south Indian population.

Materials and Methods: The present study comprises of a total 100 ossified dried adult human femurs of both sexes were taken for morphometric measurements, from the collection of the bone bank of Medi Citi Institute of Medical Sciences Anatomy department for 12 months period between June 2008 to June 2009. Femur measurements were taken using Osteometric board and digital Vernier callipers. Inter-trochanteric crest at the upper level of the femur was measured by using sliding digital callipers. The measurements obtained were analysed using SPSS Statistical software for Windows version 13. Metric data were reported as the mean, median and standard deviation. P value of <0.05 was taken as significant.

Results: Total 100 dried human femurs were used in the study. The mean value of femoral length and the inter-trochanteric crests were 41.66 cm and 5.98 cm respectively. The Pearson's correlation coefficient was 0.64. The value of R-squared was 0.426. From the equation, the values were obtained for 100 randomly selected bones. These were compared with the observed length of those (n=100) and test of significance was done. The difference between the mean of estimated and observed values of the total length was by chance (p-value >0.05) indicating the validity of the regression equation.

Conclusion: This study showed the development of specific osteometric standards for stature determination from the femur of recent South Indian population with satisfactory accuracy. Hence this study concludes femur inter trochanteric crest length can be used as better alternative variable for estimating body stature length using regression formulae.

KEY WORDS: Body Stature, Femur Length, Regression Equation.

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Access this Article online

Quick Response code

DOI: 10.16965/ijar.2016.282

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 23 Jun 2016 Accepted: 15 Jul 2016
Peer Review: 23 Jun 2016 Published (O): 31 Jul 2016
Revised: None Published (P): 31 Jul 2016

INTRODUCTION

The identity of the dead and mutilated is an essential part of medico-legal and various social reasons [1]. Body stature is measured one of the key parameters for personal identification; stature reconstruction plays an essential role in the identification of individuals and establishes relationship between stature and dimensions of various body parts [2]. Methods of body stature estimation from long bones have

been given suitable weight by anatomists, forensic experts and anthropologists [3]. Stature will be estimated by either anatomical method or mathematical way. To compute the living body height of a person by using an anatomical method, rectification factors that recompense for soft tissue requires being added [4-6]. Total skeletal height is estimated by use of bone length and regression formula [7]. Regression formulae derived from major long bones are generally considered to be more accurate than those utilising other bones of hand and foot. Trotter et al. [8-10] studied series of regression equations based on measured cadaveric height and long bone length from the femur. Suman Babu.R [11-12] has also studied body stature using forearm bones like ulna and radius. To this purpose, we estimated femur length by measuring inter-trochanteric crest to create regression equation in south Indian population.

MATERIALS AND METHODS

The present study comprises of a total 100 entirely ossified, and dried adult human femurs of both sexes were taken for morphometric measurements, from the collection of the bone bank of Medi Citi Institute of Medical Sciences Anatomy department, Medchal Mandal, Ranga Reddy District, for 12 months between June 2008 to June 2009. Institutional Ethics Committee approved the study protocol. However, after a thorough examination of femur bones due to injury, deformity or damage were not considered for the study. Measurements were taken using Osteometric board and digital Vernier calliper with a precision of 0.1 cm [13]. Inter-trochanteric crest at the upper level of the femur was measured by using sliding digital calliper with the precision of 0.01cm. A single investigator performed all measurements for uniformity.

Each measurement was repeated three times and the mean value was recorded. The error was assessed for every anatomical parameter according to the standard method [14]. All the measurements were rounded to two decimal points. The upper limit length of the femur was measured by distance from the most superior point on the head of the femur to the most inferior point on the distal condyles, and inter-trochanteric crest was measured by marking the junction of the posterior surface of the neck with the shaft of the femur. Smooth roughened ridge which begins above at the postero-superior angle of the greater trochanter and ends at lesser trochanter.

Statistical Analysis: The measurements obtained were analysed using SPSS Statistical software for Windows version 13. Metric data were reported as the mean, median and standard deviation. P value of <0.05 was taken as significant. Pearson's correlation coefficient was used to examine the association between maximum femoral length to inter trochanteric crest.

RESULTS

The mean value of femoral length and the inter-trochanteric crests were 41.66 cm and 5.98 cm respectively. (Table 1) The correlation was made between the inter-trochanteric crest and the maximum femoral length. Regression equation with the inter-trochanteric crest as the independent variable and the maximum length of the femur as dependant variable was obtained using the total sample (n=100). The Pearson's correlation coefficient was 0.64. The following Regression equation was obtained: $y = 18.85 + 3.2x$, where $\bar{x}$ is the intertrochanteric crest (in cm.) and $\bar{y}$ is the maximum femoral length (in cm). The value of R-squared was 0.426. From the equation, the values were obtained for 100 randomly selected bones. These were compared with the observed length of those (n=100) and test of significance was done. It was seen that the results were consistent and accurate. The difference between the mean of estimated and observed values of the total length was by chance (p-value >0.05) indicating the validity of the regression equation.

Table 1: The mean value of femoral length and the inter-trochanteric crest.

	Maximum Femoral Length (cm)	Inter-trochanteric Crest Length (cm)
Mean ± SD	41.66 ±3.2	5.9 ±3.04
Median	42.64	5.8
Minimum	33.3	3.7
Maximum	46.2	7.1

DISCUSSION

The measurement of the length of long bones from the available fragments plays a vital role in the estimation of the stature of an individual. Collectively, the femur and the tibia are the most important components of height. Therefore, the best assessment of height is obtained from regression formulae derived from femoral lengths.

However, the statistical formula used in this method is appropriate when used only in specific population whence it was derived. Individual height is influenced by ethnicity, so it is recommended that regression formulae obtained in the certain population should not be applied in another. Regression formula obtained in a specific population can underestimate or overestimate stature if applied in another population. It is recommended that regression formulae obtained from other population-specific studies should be used for such purpose.

Similar studies were done on different population specimens have been done by Turkish Celbis & Agritmis et al. [15] However, Kate and Mazumdar also successfully estimated stature from a length of femur and humerus by regression method in Indian sample [16].

CONCLUSION

This study showed the development of specific osteometric standards for stature determination from the femur of recent South Indian population with satisfactory accuracy. Hence this study concludes femur inter trochanteric crest length can be used as better alternative variable for estimating body stature length using regression formulae.

Conflicts of Interests: None

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How to cite this article: Rameswarapu Suman Babu ESTIMATION OF BODY STATURE USING FEMUR LENGTH IN SOUTH INDIAN POPULATION: A CROSS SECTIONAL STUDY. Int J Anat Res 2016;4(3):2590-2592. **DOI:** 10.16965/ijar.2016.282