



Estimation of Body Stature Using Fore Arm Bone (ULNA) – A Cross Sectional Study

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Abstract

Background- Stature is natural heights of a person in an upright position. Estimation of body stature has a chief importance in the field of anthropometry and forensic science research. In this connection, I have made an effort to derive regression equation formula to estimate stature from length of ulnar bone in south Indian medical student population.

Methods- This study was done on 120 medical college students of Telangana area of south india, with age between 18 to 21 years. Every student height and length of right and left ulna was recorded. The measurements were always taken at a fixed time between 9-10 a.m to eliminate diurnal disparity. Percutaneous ulna length will be measured in centimeters with the help of spreading calipers, by measuring the distance between the tip of olecranon process and tip of styloid process of ulna with fixed elbow and palm faced over opposite shoulder. The data was analysed statistically SPSS software version-20 for calculation.

Results – The correlation coefficients for right and left ulnae in males are 0.735 and 0.737 whereas in females 0.672 and 0.674 correspondingly. The difference in mean length of ulna in males and females was statistically significant ($P < 0.001$).

Conclusion- The ulna length will help improved reliability in estimation of an individual stature in medico legal aspects and anthropometry evaluations.

Key Words - Ulnar length, Body Stature, Anthropometry, Medico legal aspects

INTRODUCTION

Stature is natural heights of a person in an upright position. Identification of an individual from mutilated, decomposed due to natural disasters is vital for medico legal and humanitarian grounds.

⁽¹⁾ Several factors are taken into concern for establishing the identity in these cases. Stature is

considered as one of the important parameters for personal identification and stature reconstruction plays a vital role in identification of individuals. There is an established relationship between stature and dimensions of various body parts which allows forensic experts to estimate stature.

⁽²⁾ The ulnar length is one such parameter shown

to be a reliable in predicting stature of an individual. ⁽³⁾ The length of one of the forearm bones ulna gives more accuracy in devising regression of persons height ⁽⁴⁻⁵⁾ rather than the length of the lower limb bones like tibia. ⁽⁶⁾ To this purpose we have analysed the anthropometric-relationship association between length of ulna and stature and to derive regression formula from it.

METHODS

The present study comprised of a total 120 Medical college students of Medi Citi Institute of Medical Sciences, Medchal Mandal, Ranga Reddy District, during the period of August 2008 to August 2009. Their age ranged between 18 to 21 years. Ethics committee has approved the study protocol and obtained informed consent from the study participants. Students with significant systemic diseases, history of old fractures, orthopaedic malformation which could have affected the bony growth were excluded from study. All the students; height and length of right and left ulna were recorded separately. The measurements were taken at a fixed time of a day

between 9-10 a.m to eliminate diurnal discrepancy. Percutaneous ulna length will be measured in centimeters with the help of spreading calipers, by measuring the distance between the tip of olecranon process and tip of styloid process of ulna with fixed elbow and palm faced over opposite shoulder. Measurements of length of right and left ulna were taken separately for calculation. The data was analysed statistically SPSS software version-20 for calculation of Mean, SD, Standard error, Correlation coefficient, Regression coefficient, value of constant and 't' test for correlation coefficient.

RESULTS

Table 1 shows that in male subjects, mean height is 167.93 ± 6.73 cm, and mean length of right ulna is 26.84 ± 1.45 cm, with range of 23.60 – 29.40 and mean length of left ulna is 26.75 ± 1.44 cm with range of 23.50 – 29 cm and in the females, mean height is 155 ± 4.96 cm, and mean length of right ulna is 24.67 ± 1.22 cm with range of 23.60 - 29.20 cm and mean length of left ulna is 24.60 ± 1.23 cm with range of 21.50 - 27 cm.

Table 1: Range of all parameters in male and female subjects

Parameters	Mean \pm SD		Range (min – max)	
	Male	Female	Male	Female
Height	167.93 ± 6.73	155.94 ± 4.96	159 – 186	144 – 166
Length of right ulna	26.84 ± 1.45	24.67 ± 1.22	23.60 – 30.40	21.60 – 27.20
Length of left ulna	26.75 ± 1.44	24.60 ± 1.23	23.50 – 30.00	21.50 – 28.00

Table 2 shows that there is no significant sidewise variation in ulnar length of males and females.

Table 2: comparison of length of right and left ulna

Gender	Length of right ulna (cm)	Length of left ulna (cm)	p-value	t-value
Male	26.84	26.75	>0.05	0.56
Female	24.67	24.60	>0.05	0.62
t-value	12.93	12.77		
p-value	<0.001	<0.001		

Table 3 shows that the correlation coefficients for right and left ulnae are 0.835 and 0.837 respectively, in case of male subjects, and those for right and left ulnae of women are 0.772 and 0.774 respectively.

Table 3: Correlation of height with length of ulna in male and female subjects

subjects	Correlation coefficient (r)		Coefficient of determination (r ²)		p-value
	right	left	right	Left	
Male	0.735	0.737	0.596	0.7	<0.0001
female	0.672	0.674	0.495	0.598	<0.0001

As per the regression equation for height with ulna length in males and females:

The equation is as follows: Height(Y) = a (constant or intercept) + b (slope) × ulnar length.

In male students, 60.57 and 59.91 are intercept (constant or a) and 3.81 and 3.89 are regression coefficient (b) for right and left ulnae, respectively. In women students, 75.78 and 76.54 are intercept (constant or a) and 2.122 and 2.101 are regression coefficient (b) for right and left ulnae, respectively.

DISCUSSION

The estimation of stature is of utmost importance whenever bodies are found in mutilated state or when skeletal remains are available. Present study was done to evaluate the stature from percutaneous length of ulna on living subjects in a medical student population belongs to south india.

Sarojini Devi et al ⁽⁷⁾ found correlation coefficient (r=0.619 for male and 0.584 for female) and formulated regression formula for estimation of stature by using upper arm length among Manipur tribes. Trotter et al Muñoz et al ⁽⁸⁻⁹⁾ have offered regression equations based on long bones. However it is well known that formulae that apply to one population do not always give accurate results for other population and each group needs a separate formula. In our study mean value of right ulnar length is 27.84 cm and that of left ulnar length is 27.75 in males. Our findings correlate with Bamne et al ⁽¹⁰⁾ findings. They studied 200 subjects (100 men, 100 women) and concluded that anthropometric measurement of ulna can estimate stature of a person with great accuracy. Our findings also correlated with Duyar et al ⁽¹¹⁾ studied 254 healthy male subjects and derived new ulna-based height estimation formula. His study was based on the need for population-specific stature estimation in Turkish population.

Our findings also correlate with those of Mondal et al ⁽¹²⁾ who studied 300 male subjects in of west bengal state. My study also supported by Manirul Islam et al ⁽¹³⁾ study, done on 200 young and healthy male college students of Tripura state.

CONCLUSION

From the present study, it has been concluded that the mean height and length of ulna is more in males than in females. The difference in mean length of ulna in males and females was found to be statistically significant (P <0.001). There is positive correlation between stature and length of ulna. Simple linear regression equation so far derived can be used for estimation of height in Telangana region of south India. This fact will be of sensible exercise in all medico legal examinations and anthropometry procedures.

CONFLICT OF INTEREST: NONE

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