A Study of Relation Of Stature And Percutaneous Ulnar Length

Dr. Swati D. Shah *,Dr. Mohammed Ziyauddin G. Saiyed **,Dr. Pratik R. Patel ***

* Assistant Professor, Department of Anatomy, ** Resident Doctor, Department of Forensic Medicine, *** Professor and Head, Department of Forensic Medicine, Smt. N.H.L. Municipal Medical College, Ellis bridge , Ahmedabad – 55. India.

Abstracts: Introduction: Stature of an individual is one of the most important characteristics of identification which is required in medico legal practice quite often. There is direct relationship between anthropometric characteristics and sex, shape and form of an individual. Stature estimation is usually based on measurement of long bones. Ulna is a very useful bone for this purpose. Material and Methods : In this paper, attempts are made for the estimation of the stature of native of Gujarat state at Smt NHL Municipal medical college, Ahmedabad using "Percutaneous ulnar length" in year 2010-2011. Four hundred and fifty (450) healthy adults (245 Males and 205 Females) aged between 17-30 years who are medical students, paramedical students and staff members of Smt. N.H.L. Municipal Medical College, Ahmedabad were studied and measurement of stature and percutaneous ulnar length was done for each of them. The ulnar length was measured from tip of olecrenon process to the distal margin of the head of ulna (palpable on the dorsum of the wrist) with forearm flexed and semi pronated and the hand in the neutral position. Observation and Results : We found that the difference in age of Males and Females was statistically not significant with $p>0.05$ but the difference in Mean stature between Males and Females and the difference in Mean Ulnar length between Males and Females was statistically highly significant ($p<0.001$).Simple linear regression equations are derived in the study for estimation of height of Males and Females based on length of Ulna.Conclusion : It was concluded that the estimation of Stature among the population can be carried out using measurements of Ulna and there is positive correlation between Stature and Length of Ulna in a particular population. [Shah S et al NJIRM 2012; 3(1) : 73-76]

Key Words: Anthropometry, Identification, Medico legal practice, Percutaneous ulnar length, Stature, Ulna

Author for correspondence: Dr. Swati D. Shah, Assistant Professor, Department of Anatomy, Smt. N.H.L. Municipal Medical College, Ellis bridge, Ahmedabad – 55, e-mail : drswati.shah@yahoo.com

Introduction: One of the primary characteristic for the identification of a person is the stature of the person. After the age of 21 – 25 years, the dimensions of the skeleton remain unchanged and the ratio in size of different parts to one another is also considerably variable in different individuals. In case of skeletonised, mutilated, decomposed and dismembered body parts, stature can be estimated on the basis of ratio of the different parts.

The long bones are especially impressive. Stature estimation from long bones have long been formulated and accuracy in that has improved day by day. The fact in minds of not only the Anatomists but also the artists, that trunk and limbs exhibit consistent ratios among themselves and relative to total height. Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of the human body and skeleton. It has a long tradition of use in forensic science and it is finding increased use in medical sciences especially in the discipline of Forensic Medicine.

Ulna is the medial bone of fore arm and represents the post axial bones. Ulna consists of upper and lower end with intervening shaft. Upper end consists of olecrenon and coronoid processes and two articular areas – trochlear and radial notches. The olecrenon process projects upwards and possesses beak like summit which is palpable externally in semi flexed elbow. Lower end is expanded and presents head of ulna and styloid process. Head of ulna is rounded and it is palpable percutaneously.[2]

Information about the mean variables of local population is required so that the estimation of the stature can be carried out by using them for the local use as there will be differences in these variables between one region and the other. So present study aimed at deriving the average of variables such as stature and ulnar length (in both

males and females) among the study population as well as to derive linear regression equation for estimation of Stature based on the measurement of Ulnar length as a tool for forensic and anthropometric studies.

Material and Methods: Four hundred and fifty (450) healthy adults (245 Males and 205 Females) aged between 17-30 years who are medical students, paramedical students and staff members of Smt. N.H.L. Municipal Medical College, Ahmedabad were studied and measurement of stature and percutaneous ulnar length was done for each of them. Informed, written, witnessed consent in vernacular of each subject was taken.

Height (Stature) of the subject was measured in standing posture. The subject was instructed to stand barefooted on the board of a standard stadiometer with both feet in close contact with each other, trunk braced along the vertical board and head oriented in ear-eye plane by keeping the lateral palpebral commissure and tip of auricle of the pinna in a horizontal plane parallel to feet. The measurement was taken in centimeters by bringing the horizontal sliding bar to the vertex.

The Ulnar length was measured using calibrated meter rule from tip of olecrenon process to the distal margin of the head of ulna (palpable on the dorsum of the wrist) with forearm flexed and semi pronated and the hand in the neutral position. For uniformity, left ulna of all the subjects was measured.

Data so collected were entered in a master chart and were analyzed using SPSS statistical programme. Calculation of proportions, mean, standard deviation, median, standard error, range, correlation co efficient, t-value, regression co efficient were carried out and regression equations were derived for estimation of stature both in males and females using ulnar length as independent variable and stature as dependant variable.

Estimation of 95% of confidence interval for Stature (dependant variable) was also carried out for Ulnar length (independent variable) for both males and females based on values of standard error of it.

Result: Total 450 subjects were included in the study. Out of this 245 (54.8 %) were Males and 205 (45.2%) were Females with the Male : Female ratio of the population being 1.19 : 1 . The Range of Age for the study subjects was from 17-30 years and Mean Age was 19.21 years and Standard Deviation (SD) was 1.83.

However Mean Age of Males was 19.23 years with Standard Deviation (SD) of 1.837 whereas Mean Age of Females was 19.19 years with Standard Deviation (SD) of 1.834. This difference in age was statistically not significant with $p>0.05$.

Table 1 : Profile of Study Population

Characteristics	Males (n=245)		Females (n=205)	
Age groups (Years)	Number	Percentage	Number	Percentage
17-18	102	41.6	72	35
19-20	106	43.3	105	51.2
21-22	26	10.6	21	10.2
> 22	11	4.5	7	3.4

Stature in Males varied from 150.5 cm to 185 cm with Mean value of 170.90 cm and Standard deviation(SD) of 6.19 cm . Median of stature being 171.25 cm.

Stature in Females varied from 141.25 cm to 175.1 cm with Mean value of 156.46 cm and Standard deviation (SD) of 6.22 cm, Median of stature standing at 156.1 cm.

This difference in Mean stature between Males and Females was statistically highly significant ($p<0.001$)

Table 2 : Sex wise distribution of Stature

Stature (cm)	Males (n=245)	Females (n=205)
Mean	170.90	156.46
Standard deviation (SD)	6.19	6.22
Minimum	150.50	141.25
Maximum	185.00	175.10
Median	171.25	156.10

Table 3: Sex wise distribution of Ulnar length

Percutaneous Ulnar length (cm)	Males (n=245)	Females (n=205)
Mean	27.22	24.93
Standard deviation (SD)	1.40	1.36
Minimum	22.1	21.3
Maximum	31.0	29.0
Median	27.10	25.0

Percutaneous Ulnar length in Males varied between 22.1 to 31 cm with Mean value of 27.22 cm and Standard deviation of 1.40 cm. Median was 27.1 cm.

In females range of Percutaneous Ulnar length was from 21.3 to 29 cm with Mean value and Standard deviation of 24.93 cm and 1.36 cm respectively. Median was 25 cm.

This difference observed in Mean Ulnar length was statistically highly significant (p<0.001)

Figure 1.

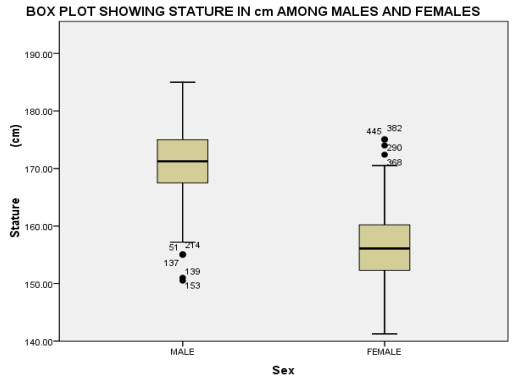
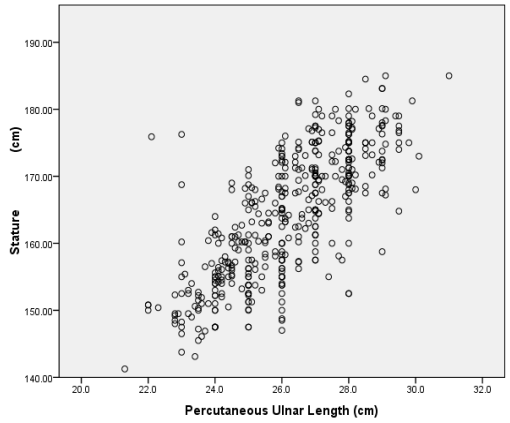


Figure 2. Scattered diagram of Ulnar length versus Stature



Scattered diagram of Ulnar length versus Stature showed a positive correlation as shown in above figure . t-test for correlation coefficient is applied to test statistical significance of correlation and for both two variables namely Ulnar length in males and Ulnar length in females. The values were calculated as statistically highly significant indicating very strong positive correlation between Stature and Ulnar length in males and females.

Table 4: Linear regression values of Stature versus Percutaneous Ulnar Length in Males and Females

Independent variable(Stature) (Y)	Ulnar length (cm)	
	Males (Xum)	Females (Xuf)
Intercept (a)	109.57	91.60
Regression coefficient (b)	2.25	2.60
Correlation coefficient (r)	0.510	0.57
Coefficient of determination (r^2)	0.257	0.327
Standard error of estimate	5.33	5.12
t- value	9.25	9.92
Significance (p value)	< 0.001	<0.001

Simple regression formula is Y = a + bX therefore, where Y is dependant variable that is Stature and X is independant variable that in our study is Ulnar length.

1. Estimated height of Males for Ulnar length

   Yum = 109.57 + 2.25 x Xum

2. Estimated height of Females for Ulnar length

   Yuf = 91.60 + 2.6 x Xuf

Standard error estimation was also done so as to find out 95% confidence limit for both variables as follows :

1. 95% confidence interval of Height of Males for Tibial length

   Yum = 109.57 + 2.25 x Xum + or – (1.96x5.33)

2. 95% confidence interval of Height of Females for Tibial length

   Yuf = 91.6 + 2.6 x Xuf + or – (1.96x5.12)

These are simple linear regression equations derived in the study for estimation of height of Males and Females based on length of Ulna.

Discussion: Anthropometric measurements are commonly used for assessment of height of the subjects for the purpose of their identification. Then data derived from entirely different population can not be used for height assessment for all types of population hence the baseline data shall be derived from local population so that they can be used for the height assessment amongst them.

In 1961, Allbrook attempted to develop standards for the estimation of stature from a British sample using percutaneous tibial and ulnar lengths.[1] Regression analysis can derive formula for Height assessment and can also give 95% confidence intervals for the estimations.

The similar techniques for determination of stature were used by several other authors.[5-10] Linear regression model as per sex category where length of ulna was used for estimation of height in present study.

While estimating baseline data of Stature and Ulnar length for Males and Females, it was observed that there is highly significant difference in all these variables between males and females ($p<0.000$) as estimated by independent t-test. Both variables had higher values among Males than Females. Based on this, not only stature but sex of the deceased can also be predicted using anthropometry of the available parts.

Conclusion: It was concluded that the estimation of Stature among the population can be carried out using measurements of Ulna and there is positive correlation between Stature and Length of Ulna in a particular population.

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