EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 4
Issue: 3
268-271
Year: 2017

# ESTIMATION OF STATURE FROM ULNAR LENGTH IN MAHARASHTRIAN POPULATION

**Sanju Acharya[1], Dr. Kishwor Bhandari[2*], Manish Acharya[3] and Dr. Kamil Khan[4]**

[1]Tutor, Department of Physiology. Hind Institute of Medical Sciences, Uttar Pradesh, India.
[2,4]Assistant Professor, Department of Anatomy. Hind Institute of Medical Sciences, Uttar Pradesh, India.
[3]UG Student, Gandaki Medical College, Nepal.

***Author for Correspondence : Sanju Acharya**
Tutor, Department of Physiology, Hind Institute of Medical Sciences, Uttar Pradesh, India.

**Article Received on 12/01/2017** **Article Revised on 01/02/2017** **Article Accepted on 21/02/2017**

## ABSTRACT
Stature is one of the parameter of identification for establishing individuality of the person. There is a definite relation between the height of the person and other parts of the body. So in this study, an attempt has been made to find the relation between ulnar length and the height of the person. A total of 150 undergraduate medical students including both males and females were studied. The obtained data were analyzed by Pearson's correlation to examine the relationship between the length of ulna and stature according to gender. A positive correlation of stature with ulnar length was found in both genders which was statistically significant. The finding of this study may be useful for anthropological and forensic sciences.

**KEYWORDS:** Stature, Ulna, Anthropology.

## INTRODUCTION
Estimation of stature is a key feature of personal identification, which is of immense significance to the anthropologists and medico-legal experts. Stature is the height of the person in upright posture. It is an important measure to physical identity. Stature provides insight into various features of a population including nutrition, health and genetics; geographical location, environment and climatic condition. Stature is considered as one of the parameters for personal identification and one of the 'big fours' of forensic anthropology. The stature of an individual is an inherent characteristic; its estimation is considered to be an important assessment in the identification of unknown human remains.

With increasing number of cases of mass disasters involving explosion, plane crash and suicide bombs the bodies of victims are severely dismembered. On such occasions just a fragment of body part may be presented to the forensic and medico-legal experts to comment on the stature of the individual to help establish the personal identity, e.g. hand.[1-11] Anthropometric techniques commonly used by anthropologists and adopted by medical scientists have been employed to estimate stature for over a hundred years.[12] Many studies have been conducted in different ethnic groups to estimate stature from hand and foot dimensions.[13-16] There are numerous means to establish stature and their significance lies in the simplicity of measurement, applicability and accuracy in prediction.[17]

The present study was conducted to find the correlation between the stature and ulnar length.

## MATERIALS AND METHODS
- Source of the data

The ulnar length and the stature of 150 healthy medical students (75 males and 75 females) were selected for the study. The study was conducted in the department of Physiology of MGM medical college, Navi Mumbai. The students were selected randomly having age group of 18-24 years. All the measurements were taken between 9:30 am to 12:30 pm. The stature and length of ulna were measured. To ensure the accurate results, all the measurements were taken by one person to avoid interpersonal errors.

- Landmarks and techniques involved in taking anthropometric measurements

### Height
Respondent's height was measured from the vertex of the head to the bottom of the feet by using a fixed stadiometer to the nearest 0.1 cm. The vertex is the highest point on the head. Height was measured without shoes in the standing position with the shoulders in relaxed position and arms hanging freely.

**Ulnar length**

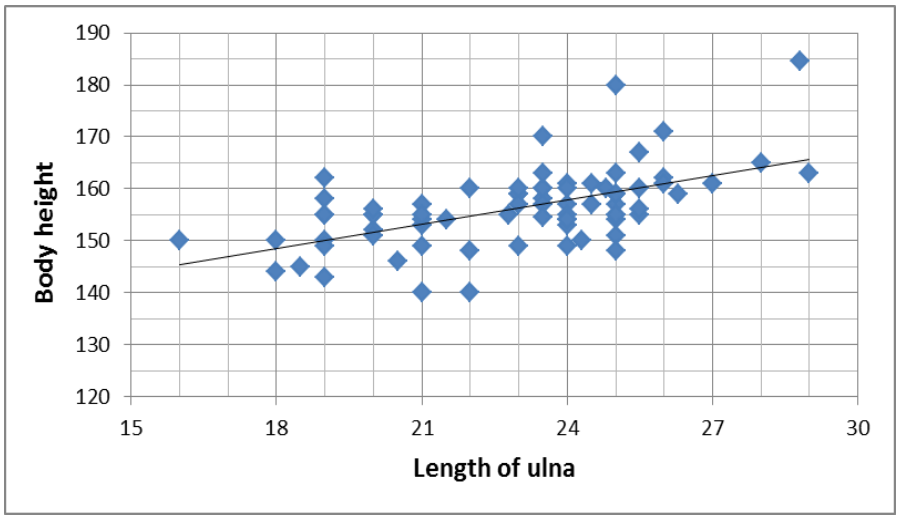
The ulnar length was taken from the tip of the elbow joint to the head of the ulna using a standard measuring tape in an arm flexed position.

After collection of data, the data were subjected to statistical analysis for calculation of mean, standard deviation, Pearson's r coefficient, regression coefficient and t-test for correlation coefficient applied to test the statistical significance.

## OBSERVATION AND RESULTS

**Table 1: Correlation statistics of height with length of ulna in females.**

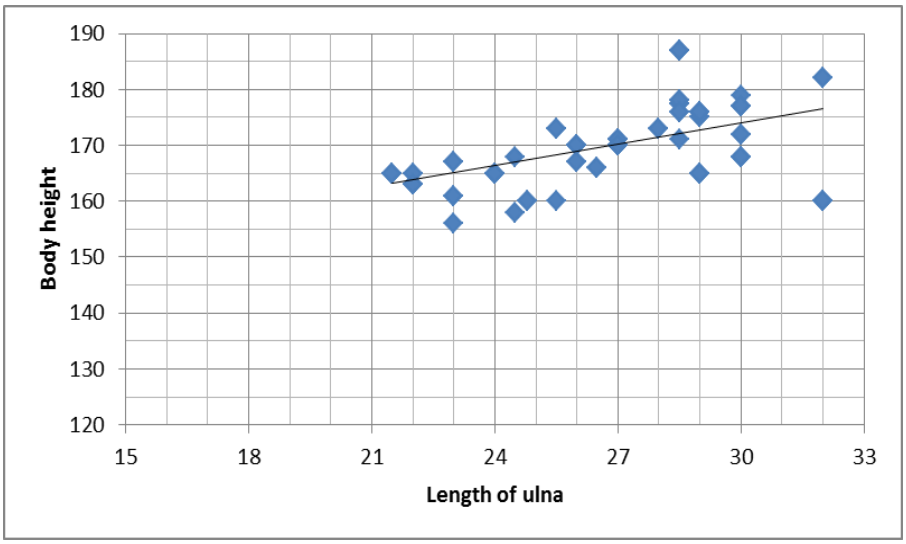
| S.N. | Variable | Mean | Standard Deviation | Pearson's r coefficient | $r^2$ | P-value |
|---|---|---|---|---|---|---|
| 1. | Length of ulna (cm) | 22.98 | 2.72 | 0.57 | 0.32 | <0.001 |
| 2. | Body height (cm) | 156.30 | 7.47 | | | |




**Scatter Graph 1: Correlation between length of ulna and body height in females.**

**Table 2: Correlation statistics of height with length of ulna in males.**

| S.N. | Variable | Mean | Standard Deviation | Pearson's r coefficient | $r^2$ | P-value |
|---|---|---|---|---|---|---|
| 1. | Length of ulna (cm) | 26.96 | 2.91 | 0.50 | 0.25 | <0.001 |
| 2. | Body height (cm) | 170.21 | 7.37 | | | |




**Scatter Graph 2: Correlation between length of ulna and body height in males.**

**Table 3: Regression analysis for prediction of height from the length of ulna in males and females.**

| S.N. | Simple Linear Regression Formula | Males | Females |
|---|---|---|---|
| 1. | Y= a+bX | 135.64 + 1.28X | 120.22 + 1.56X |

Where, Y= Height, X= Length of Ulna, a= Intercept/constant, b= Regression Coefficient

Graphical representation in scatter graph 1 and 2 show that length of ulna is plotted on the x-axis and the height of the body on y-axis. Both the scatter graphs clearly show the linear relationship between x and y axis. So, there is a positive correlation between x and y. The relationship between the ulnar length and body height is positive for every unit increase in the ulnar length. The significant correlation was further interpreted by linear regression. 32% variation observed in height in females was due to the increase in the length of the ulna ($r^2$=0.32) and 25% variation observed in height in males was due to the increase in the length of the ulna ($r^2$=0.25).

The mean length of ulna in females were 22.98 whereas in males were 26.96. There was a significant difference in the mean length of ulna and body height of males and females statistically. Increase in the length of ulna leads to increase in the height of the subject which is statistically significant (P <0.001) in both the sexes.

The regression analysis was carried out to find the strength of relationship of ulna length with body height. The relationship between ulna length and body height is positive for every unit increase in ulnar length.

## DISCUSSION

Anthropometry means the measurement of human beings, whether living or dead or on skeletal material. The human beings in the various parts of the world belong to the same Homo sapiens species. We can never find any two individuals similar to each other whether it might be their measurable traits. The genetically born twins also are different to each other in some respects. Since skeletal development gets influenced by various factors which leads to change in skeletal proportions between different geographical areas. Anthropometry is one of the techniques of expressing quantitatively the form of the human body.

Determination of human stature from the body parts is an important parameter in medicolegal and anthropological examination. Study on skeletal of an unknown individual remains is vital to identify of an unknown individual. Long bones are the best for the prediction of height. Measurement of length of the ulna provides an alternative way to predict the stature. Further, the ulna is mostly subcutaneous throughout its length in forearm and easily approachable for measurement in living subject. The subject with congenital and traumatic deformities were excluded from the study as these conditions may interfere the prediction of the actual height.

In this study, the mean personal height of the male subjects was 170.21 cm which was similar to the height of the Gujarati male medical students which was 168.10 cm.[18] In this study, the mean body height of males is higher than that of mean body height of females. This is in agreement with the result of Ebite et al., 2008 and llayperuma et al.,2008.[19,20] The mean ulnar length of the male subjects was 26.96 and in females was 22.98. Study done by Allbrook et al., 1961 and Athawale et al., 1963 also shown a significant correlation between stature and ulna bone length.[22,23] There are also other study on stature correlating with the length of foot,tibia, head. [21,22,24] From this study, it is found that the length of ulna can be used to predict the height of the person. Variety of factors like age, race, gender, geographical distributions and nutritional status affect growth and development of human and therefore, different nomograms are required for different populations.

## CONCLUSION

From this study, it is found that there exists a linear relationship between the ulnar length and height of the body. It can be useful in the medico legal cases in establishing the identity of an individual where only some remains of the body are found. The height of the body can be predicted from the length of the ulna. The length of ulna and height of the body is less in females than the males. There are lot of variations in estimating stature from ulna measurements among people of different region & race. Hence, there is a need to conduct more studies among people of different regions & ethnicity so that stature estimation becomes more reliable & identity of an individual is easily established.

## REFERENCE

1. Saxena S.K. “A study of correlations and estimation of stature from hand length, hand breadth and sole length”. Anthropol Anz, 1984 Dec; 42(4): 271-276.
2. Abdel-Malek A.K., Ahmed A.M., el-Sharkawi S.A., el-Hamid N.A. “Prediction of stature from hand measurements”. Forensic Science International, 1990 July; 46(3): 181-187.
3. Sultan G. Sanli, Emine D., Kizilkanat, Neslihan Boyan, Esin T. Ozsahin, M. Gulhal Bozkir, Roger Soames, Hamza Erol, Ozkan Oguz. “Stature estimation based on hand length and foot length”. Clinical Anatomy, 2005 Nov; 18(8): 589–596.
4. Özaslan A, Koç S, Özaslan I, Tugcu H. ”Estimation of stature from Upper Extremity”. Military Medicine, 2006 Apr; 171(4): 288-291.
5. Syeda Zamila Hasan Laila, Roxana Ferdousi, A.B.M. Nurunnobi, A.T.M. Shafiqul Islam,Syeda Zamila Hosen Holy, Farzana Yesmin. “Anthropometric Measurements of the hand length and their correlation with the Stature of Bengali adult Muslim females.” Bangladesh Journal of Anatomy, 2009 Jan; 7(1): 10-13.

6. Isurani Ilayperuma, Gananda Nanayakkara, Nadeeka Palahepitiya."Prediction of personal stature based on the hand length". Galle Medical Journal, 2009 Sep; 14(1): 15-18.
7. Rastogi P, Nagesh K.R., Yoganarasimha K. "Estimation of stature from hand dimensions of north and south Indians." Legal Medicine (Tokyo), 2008 Jul; 10(4): 185-189.
8. Kumar Amit, Srivastava A. K., Verma A.K. "Estimation of Stature by Percutaneous Measurements of Distal Half of Upper Limb (Forearm & Hand)". Journal of Indian Academy of Forensic Medicine, 2010; 32(4).
9. Kumar Sushil, Srivastava, A.K., Sahai, M.K.B. "Estimation of stature by anthropometric examination of forearm and hand". Journal of Indian Academy of Forensic Medicine, 2010 Mar; 32(1).
10. Chikhalkar B.G., Mangaonkar A.A., Nanandkar S.D., Peddawad R.G. "Estimation of Stature from Measurements of Long Bones, Hand and Foot Dimensions". Journal of Indian Academy of Forensic Medicine, 2010 Mar; 32(4).
11. V. Waghmare, R. Gaikwad & N. G. Herekar. "Estimation of the Stature from the Anthropometric Measurement of Hand Length". The Internet Journal of Biological Anthropology, 2011; 4(2).
12. Pearson K, Mathematical contributions to the theory of evolution. V. On the reconstruction of the stature of prehistoric races, Philos. Trans. R. Soc. Lond, 1899; 192: 169–244.
13. Ozaslan A, Koc S, Ozaslan I, Tugcu H. Estimation of stature from upper extremity. Mil Med, 2006; 171: 288–91.
14. Sanli SG, Kizilkanat ED, Boyan N, Ozsahin ET, Bozkir MG, Soames R, et al. Stature estimation based on hand length and foot length. Clin Anat, 2005; 18: 589–96.
15. Means LW, Walters RE. Sex handedness and asymmetry of hand and foot length. Neuropsychologia, 1982; 20: 715–9.
16. Malek AKA, Ahmed AFM, Aziz Sharkawi SAE, Abd Hamid NAEM EL. Prediction of stature from hand measurements. Forensic Sci Int, 1990; 46: 181–7.
17. Sherke A R and Tamgire D W. Correlations of stature with foot length in Andhra region. International Journal of Biomedical Research, 2013; 4-9.
18. Jadav HR, Shah GV. Determination of personal height from the length of head in Gujarat Region.
19. Journal Anatomical Society India, 2004; 53(1): 20-21.
20. Ebite LE, Ozoko TC, Eweka AO, Otuaga PO, Oni AO, Om'lnianohs FAE. Height:Ulna ratio: A method of stature estimation in a rural community in Edo state, Nigeria. The Internet Journal of Forensic Science, 2008; 3(1).
21. llayperuma I, Nanayakkara BG, Palahepitiya KN. A model for reconstruction of personal stature based on the measurements of foot length. Galle Med. J, 2008; 13: 6-9.
22. Qamra SR, Jit I, Deodhar SD. A model for reconstruction of height from foot measurements in an adult population of North West India. Indian JMed Res, 1980; 71: 77- 83.
23. Allbrook, D. "The estimation of stature in British and East African males based on the tibial and ulnar bone lengths", Journal of forensic Medicine, 1961; 8: 15-27.
24. Athawale MC. Anthropological study of height from length of forearm bones. A study of one hundred Maharashtrian male adults of ages between twenty five and thirty years. American Journal of Physical Anthropology, 1963; 21: 105-12.
25. Lal, C.S. and Lala J.K. "Estimation of height from tibial and ulnar lengths in North Bihar" Journal of Indian Medical Essentials, 1972; 58: 4.