Research Article

Estimation of height from the length of humerus in western region of Maharashtra

Meenakshi P. Borkar*

Department of Anatomy, L.T.M.M.C. & G.H., Mumbai, Maharashtra, India

*Correspondence:
Dr. Meenakshi P. Borkar,
E-mail: drmeenakshiukey@gmail.com

ABSTRACT

An attempt has been made to find out correlation and to drive a regression formula between the length of humerus and height of an individual, in western region of Maharashtra. The material consisted of 200 undergraduate and post-graduate medical students of age group 20 to 30 years from western region of Maharashtra. The length of humerus is measured by asking the subject to flex the elbow joint. The flexor surfaces of arm and forearm made an angle of 90 degree. The lateral epicondyle was felt and marked with skin marking pencil. Acromion point was traced by moving finger over clavicle's lateral end and was marked. The distance between two points was measured by spreading caliper, both side humerus length was taken. The measured length was subtracted by 2.0 mm as the acromion point is 2 to 5 mm above humeral head. Height of the subject was measured with standard height measuring instrument in anatomical position. The results obtained were analyzed and attempt was made to derive a formula between length of humerus and total height of an individual. The result shows that there is definite correlation between the two.

Keywords: Anthropometry, Spreading calliper, Humerus, Total height, Correlation

INTRODUCTION

Estimation of living height is an important part of the physical profile developed by forensic anthropologists from skeletonized or partly skeletonized remains. It conveys information regarding race, sex, age and height of a person. This information is of interest to the Anatomist in the academic field. It is also helpful in medico-legal work. The estimation of height has been done by various workers on various parameters, Pan N (1923), Nat B. S. (1931), Muller G (1935), Bretinger E (1937). Hrdlicka (1939). W. M. Krogman (1941) suggested taking more than one long bone for calculating the stature. Each worker has derived his own formula for calculating the stature from long bones, but no universally applicable formula has been derived, as the relationship between long bones to stature differs with sex, race and side of the body**.** Side is not as significant, instead age of subject is very important.

In the past work has been done to derive formula to calculate height of the individual from long bones, but rare work was done to estimate from humerus and no significant work was done on western region of Maharashtra.

Hence in the present study, an attempt has been made to find out height of an individual from length of humerus in western region of Maharashtra both in males and females separately.

Aim of study

Formulae derived for estimation of stature by the western workers are not suitable for Indian population as these formulae involve an error of 5-8%. So it was essential to evolve specific formulae for Indian population.

The present study is aimed to find out correlation and to derive a regression formulae between the length of humerus and height of an individual, in western region of Maharashtra. Correlation of height with the humerus of both sides and also the gender wise comparison.

METHODS

Equipments used are as follows

I) Anthropometer   II) Spreading caliper III) Skin marking pencil

The subjects consisted of 200 undergraduate and post-graduate medical students. The age group selected was between 20 to 30 years, from western region of Maharashtra. Medical students were selected due to easy availability. Measurements were taken at a fixed time, to avoid diurnal variations. Any obvious deformity or limb defects were not included in the present study. The height

of the subject was measured by standard height measuring instrument in anatomical position. The length of humerus was taken by asking the subject to flex the elbow joint. The flexor surfaces of arm and forearm made an angle of 90 degree. Lateral epicondyle was felt and marked with skin marking pencil. Acromion point was traced by moving finger over clavicle's lateral end and was marked and the distance between two points was measured by spreading caliper, both side humerus length was taken. The measured length was subtracted by 2.0 mm as the acromion point is 2 to 5 mm above humeral head.

RESULTS

Table 1 shows that the difference in height between male and female works out to be statistically significant. (p = 3.30 E-30). Difference in length of humerus of male and that of female is statistically significant. (P = 1.00 E-15) and (P = 1.50 E-16).

Table 1: Difference between height and length of humerus in male and female.

Variable	Group		Unpaired T-test applied		
	Male	Female	T value	P value	Significant
	Mean ± SD	Mean ± SD			
Age (years)	25.16 ± 2.74	25.48 ± 2.73	-0.826	0.410	Not Significant
Height (cms)	173.8 ± 8.80	157.6 ± 7.98	13.611	3.30 E-30	Significant
Humerus (right side)	30.98 ± 2.43	28.27 ± 1.92	8.736	1.00 E-15	Significant
Humerus (left side)	30.92 ± 2.44	28.12 ± 1.93	9.039	1.50 E-16	Significant

Table 2 suggests that, correlation-coefficient (r) between height and length of right humerus is 0.849, while same for the left side is 0.852, in males.

Table 2: Correlation-coefficient (r) between height and length of humerus in male.

Parameters (Male)	Co-efficient
Age and height	-0.250 P = 0.012
Humerus (right side)	0.849 P = 7.70 E-29
Humerus (left side)	0.852 P = 2.70E-29

Similarly, Table 3 shows, in females also Correlation-coefficient (r) between height and length of right humerus is 0.793, while same for the left side is 0.801. Age has no correlation with height while height shows positive and significant correlation with humerus on right and left sides.

Table 3: Correlation-coefficient (r) between height and length of humerus in female.

Parameters (Female)	Co-efficient
Age and height	0.032 P = 0.750
Humerus (right side)	0.793 P = 7.70 E-23
Humerus (left side)	0.801 P = 1.40E-23

Regression equation

$$Y = a + bx$$

For males: $Y = a + bX_1$

Estimated values of regression co-efficient are found to be statistically significant at 5 per cent level of significance for right as well as for left humerus. Estimation of height from length of humerus of right and

left sides can be attempted by substituting values of right humeral length and left humeral length measured from the subjects. Similarly, for females it as follows:

For females: $Y = a + bX_2$

DISCUSSION

In the past, various workers has shown significant correlation between height and different parts of body, work was done mostly on lower extremity long bones. It was observed that quite less work was done on superior extremity bones. No data was available specially on derivation of height from length of humerus, on western region of Maharashtra .On the basis of various previous studies, the earlier correlation co-efficient worked out between height and foot-length is +0.69 (male) and +0.70 (female) and height and head length is +0.2048. In the present study the correlation co-efficient is between height and length of humerus in males is 0.849 and in females is 0.793, which is much more significant. From the above discussion it is now much clear that if either of the measurement (height of a person or total length of humerus) is known the other can be calculated and this can be used for medico-legal investigation and anthropometry.

REFERENCES

1. Badkur P, Nath S. Use of regression analysis in reconstruction of maximum bone length and living stature from fragmentary measures of the ulna. Forensic Sci Int. 1990 Mar;45(1-2):15-25.
2. Boldsen J. A statistical evaluation of the basis for predicting statur from lengths of long bones in European population. Am J Phys Anthropol. 1984 Nov;65(3):305-11.
3. Byers S, Akoshima K, Curran B. Determination of adult stature from metatarsal length. Am J Phys Anthropol. 1989 Jul;79(3):275-9.
4. C. S. Lai, J. K. Lala. Estimation of height from Tibial and Ulnar lengths in north Bihar. J Indian Med Assoc. 1972 Feb;58(4):120-1.
5. David Albrook. The Estimation of stature in British and East African males. J Forensic Med.1961 Jan-Mar;8:15-28.
6. D. P. Bhatnagar, S. P. Thapal and M. K. Batish. Identification of personal heights from the somatometry of the hand in Punjabi males. Forensic Sci Int. 1984;24:137-41.
7. Holland TD. Estimation of adult stature from fragmentary tibias. J Forensic Sci. 1992 Sep;37(5):1223-9.
8. Jadhav HR, Shah GV. Determination of personal height from the length of head in Gujarat region. J Anat Soc India. 2004;53(1):20-1.
9. M. C. Athawale. Estimation of height from lengths of forearm bones. A study of one hundred Maharashtrian male adults of ages between twenty-five and thirty years. Am J Phys Anthropol. 1963;21:105.
10. Krogman, W. M. Skeleton. In: Charis C. Thomas, eds. The Human Skeleton in Forensic Medicine. 1st ed. Spring Field, US: Manouvrier and vide supra; 1962: 179-180.