VOLUME - 10, ISSUE - 09, SEPTEMBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anatomy

HUMERUS LENGTH ESTIMATION FROM ITS SEGMENTS

Dr. Santosh Kumar* Department Of Anatomy, Shahid Nirmal Mahto Medical College, Dhanbad, Jharkhand, India 826005. *Corresponding Author

Dr. Makardhwaj Prasad Department Of Anatomy, Shahid Nirmal Mahto Medical College, Dhanbad, Jharkhand, India 826005

ABSTRACT

An attempt was made, using a regression equation, to estimate the length of the humerus in Dhanbad, Jharkhand, based on measurements of the proximal and distal segments.

When a piece of bone is found, it may assist anatomists, orthopedists, radiologists, archaeologists, anthropologists, and forensic investigators in estimating the height and identify of a person. The measurements of the proximal and distal portions of the humerus were determined in the present research, and the length of the humerus was calculated.

KEYWORDS : Proximal and distal segments of humerus, Length, Regression equation, Dhanbad population

INTRODUCTION:

The physical stature of a person is one of the most significant characteristics that distinguishes them from others. The physical appearance of a person is one of the most significant factors in determining their identity. The estimate of stature may be done by using a variety of various body components. The estimate of height from the length of long bones is thus feasible and must be done in a population-specific manner[14].

Fragments of long bones are often preserved in archaeological and forensic practise since they are the only accessible source for establishing identification; thus, the estimate of height becomes the most essential task in such circumstances. For Anatomist , the use of osteometry is very essential for a variety of reasons. In order to identify unknown corpses, it is necessary to be familiar with the morphometric parameters of the humerus segment[5].

Additionally, since the whole set of long bones is unavailable in many circumstances, certain techniques have been developed to maximise the use of long bone pieces such as the ulna and tibia (Mysorekaretal., 1984) and humerus (Wright & Vasquez). Thus, by determining the length of the humerus's various segments based on their articular surfaces and muscle attachments (Muoz et al., 2001), the overall length of the humerus can be calculated.

MATERIAL AND METHODS:

This research examined 30 adult dryhumeribones from the Dhanbad population (right side 15; left side 15) of both sexes at the Department of Anatomy, S. N. M. M. C. Dhanbad. The humerus's maximal length was determined using an osteometric board.

A vernier calliper was used to determine the vertical diameter and transverse diameter of the superior articular surface of the proximal segment, the transverse diameter of the inferior articular surface, and the biepicondylar width of the distal segment in given fig.

EXCLUSION CRITERIA: The research excluded participants with broken, diseased, or damaged bones.

INCLUSION CRITERIA: Dried humerus are taken. The following measurements were made:

1) The vertical diameter of the superior articular surface was measured as the maximum distance between two points on the head of the humerus, in the plane of the tip of greater tuberosity.

2) The transverse diameter of the superior articular surface was measured as the maximum width between two points on the head of the humerus.

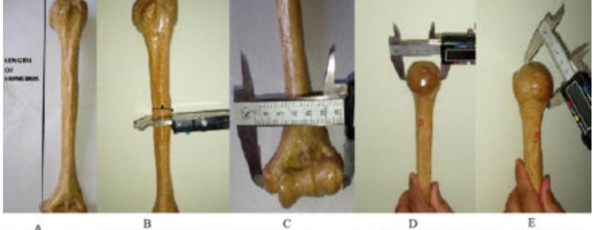
3) The transverse diameter of the inferior articular surface was measured as the maximum combined width of the trochlea and the capitulum at the anterior surface.

4) The biepicondylar width was measured as the maximum distance between the medial and the lateral epicondyles.

5) The maximum length of the humerus was measured as the straight distance between the highest point on the head of the humerus and the deepest point on the trochlea.

All of the measurements were in centimetres, unless otherwise stated. The lowest and maximum values, as well as the mean and standard deviation, were determined based on these data. The SPSS 12.0 statistical analysis software was used for the statistical analysis.

The measures of the proximal and distal portions of the humerus are shown in Figures :-



A Maximum Length of Humerus B Maximum Diameter of Shaft of Humerus C Biepicondylar width D Maximum Transverse Diameter of Head E Maximum Verticle Diameter of Head

RESULTS:

It was decided to do a statistical study on 30 dry adults from the city of Dhanbad. The descriptive statistics, linear regressions, and regression equations were completed, and the results are presented in a table.

1. Descriptive analysis: The mean values for the maximum humeral length (MHL) and the proximal and distal segments of the humeri on both sides are shown in [Table-1, 2, 3]. There was no statistical analysis performed since the right and left humeri did not belong to the same people.

2. Simple linear regression: The regression CoEfficient (COE) and significance (P value) for the proximal and distal portions of both humeri are shown individually in [Table-4]. The greatest outcomes were found with P1 rather than P2 on the right side's proximal section, whereas the best results were seen with D1 rather than D2 on the distal segment. The greatest outcomes were achieved with P2 rather than P1 on the proximal portion of the left humerus, and with D1 rather than D2 on the distal segment.

3. Simple linear regression equations: Regression formulas

have been widely recognised as critical for determining height from a variety of anthropometric variables [8, 9]. The following regression formula was used to determine the dimensions of the proximal and distal portions of the humerus in the current study:

Right humerus:

MHL=26.801+1.013×PS VD SAS
MHL=29.833+0.161×PS TD SAS
MHL=27.722+0.914×DS TD IAS
MHL=31.047+0.181×DS BECW

Left humerus:

MHL=32.508+0.238×PS VD SAS
MHL=25.963+2.228×PS TD SAS
MHL=30.213+0.571×DS TD IAS
MHL=32.78+0.254×DS BECW

Multiple linear regression:

Right humerus: In the proximal segment, the vertical diameter of the superior articular surface was found to be R=0.26, r2=.07, P<0.01, and the other three variables were excluded from this model (non predictors), indicating that, of the four variables examined, the vertical diameter of the superior articular surface in the proximal segment alone predicted a significant maximum humerus length.

Left humerus: R=0.13, r2=.017 for the vertical diameter of the superior articular surface in the proximal segment and the transverse diameter of the inferior articular surface. Both measurements indicated that the maximum humerus length changed significantly, with P<0.01 for the vertical diameter.

	Table 2- Right humerus					Table 3- Left humerus				
	N	Min(cm)	Max(cm)	Mean	Std. Deviation	N	Min(cm)	Max(cm)	Mean	Std. Deviation
PS-VD of SAS	15	2.2	4.0	3.43	0.500	15	1.9	3.8	3.22	0.519
PS-TD of SAS	15	2.2	3.2	2.78	0.285	15	2.2	3.2	2.59	0.265
DS-TD of IAS	15	2.2	3.4	2.80	0.340	15	2.0	3.5	2.67	0.426
DS-Biepicondylar width	15	3.5	4.9	4.24	0.390	15	3.0	4.8	4.10	0.632
Maximum Humeral length	15	26.2	32.9	30.28	1.92	15	28	34.9	31.74	1.864
Valid N	15					15				

Table 4- Right humerus				Table 5- Left humerus	
S.No	Variables	COE	P	COE	P
P1	PS-VD of SAS	0.26	<.001	0.06	<.001
P2	PS-TD of SAS	0.02	<.001	0.31	<.001
D1	DS-TD IAS	0.16	<.001	0.13	<.001
D2	DS - BECW	0.03	<.001	0.08	<.001

DISCUSSION:

Long bone length is critical in determining an individual's height. Stature is calculated using human skeletal remains in the archaeological method, which is a critical step in determining health, sexual dimorphism, and overall body size [14]. In the absence of more suitable long bones like as the femur or tibia, the humeral length may be used to determine live stature[10].

The humerus is the longest and biggest bone in the upper limb, therefore it is critical to determine the humeral length from the segmental measurements[9] before proceeding with the procedure. Using the proportionality between the measured distances between the fixed points of the bones and their overall length, Steele and Mckern[10] devised a technique for determining the length of the bones.

The mean value of the total humerus length is an essential piece of data in anatomical and anthropometric research since it indicates the distinctive characteristics of a population[6-8]. Estimating a person's height from their bones is essential in forensic anthropology since it aids in the identification of missing people[16].

In order to determine the connection between the length of the long bones and an individual's life height, as well as between the lengths of the measurements of the long bone pieces and their maximum lengths[15], regression analysis is a more suitable technique of investigation.

Because the data in the current research was sex aggregated, the accuracy in predicting the height would be improved if the sex information was available[9]. Nonetheless, Petersen[13] observed that the variations in femur length were not related to gender differences. The determination of the length of a long bone from its pieces is accomplished via the use of precise markers, which are essential. Because of their inability to define exact landmarks, the transverse diameter of diaphysis is often not suitable for calculating the length of the diaphysis. As a result, the only remaining location points are those on pieces of the proximal or distal diaphysis that have been measured. As a result, only the diameters of the proximal and distal portions of the humeri have been chosen for the sake of our current investigation.

In this research, we applied regression equations to determine the length of the humerus on both the right and left sides in Dhanbad population that has not been previously reported. When proximal measurements were taken, the vertical diameter of the superior articular surface alone demonstrated relevance in predicting the humerus's maximal length on the right side. On the left, however, there was a strong connection between the vertical diameter of the superior articular surface and the transverse diameter of the inferior articular surface.

CONCLUSION:

The result of our study concludes that the length of the humerus can be estimated from the measures of proximal and distal segments of humerus of both sides.

ACKNOWLEDGEMENTS:

It is our pleasure to express our gratitude to HOD & Professor, Dr. Makardhwaj Prasad for granting us access to the skeleton collection in the Department of Anatomy at the S. N. M. M. C. Dhanbad.

REFERENSCE:

1. 1.Chavan K.D, Datir SB et al. Correlation of foot length with height amongst Maharashtrian population of India. Journal of Indian Academy of Forensic Medicine.2009; 31(4):334-337.
2. Patel S M et al. Estimation of height from measurements of foot length in Gujarat region. J AnatSoc India.2007; 56(1): 25 27.
3. Sanli SG, Kizilkanat ED et al. Stature estimation based on hand length and foot length.Journal of Clinical Anatomy.2005 Nov; 18(8):589-96.
4. Rastogi P, Nagesh KR et al. Estimation of stature from hand dimensions of north and South Indians. Leg Med (Tokyo). 2008 July; 10(4):185-9[2].
5. Dan Utpal,Mukhopadhy P.P.,Ghosh.T.K.,Biswas.S,Estimation of stature from fragment of long bone(Tibia) In Indian Benagalee population, J.Anat.Soc.India-2009;58(2);169-172.
6. Ozaslan A, Üßcan MY, Zaslan Ü et al. Estimation of stature from body parts. Forensic Sci Int. 2003; 3501:1-6.
7. Mall G, Hubig M, Buttner A, Kuznik J, Penning R, Graw M. Sex determination and the estimation of stature from the long bones of the arm. Forensic Sci Int.

2001; 117(1-2): 23-30.
8. Wright LE, Vasquez MA. Estimation of the length of incomplete long bones: Forensic standards from Guatemala Am J PhysAnthropol. 2003; 120: 233-251.
9. Williams PL, Warwick R, Dyson M, Bannister LH (edn). The humerus. In: Grays anatomy, 37th edn. Churchill Livingstone. 1989, pp 406.
10. Steele DG, McKern TW. A method for the assessment of the maximum long bone length and living stature from fragmentary long bones. Am J PhysAnthropol 1969; 31: 215- 228.
11. Krishan K. Anthropometry In Forensic Medicine And Forensic ScienceForensic Anthropometry. International Journal of Forensic Science 2007; 2/1.
12. Scheuer L. Application of osteology to forensic medicine. Clinical Anatomy. 2002; 15: 297-312
13. Petersen HC. On the accuracy of estimating living stature from skeletal length in the grave and by linear regression. International Journal ofOsteoarchaeology. 2005; 15: 106-114.
14. Hoppa RD, Gruspier KL. Estimating the diaphyseal length from fragmentary subadult skeletal remains: implications for palaeodemographic reconstructions of a southern Ontario ossuary. American Journal of Physical Anthropology. 1996; 100/3: 341- 354.
15. Krogman WM, Iscan MY. The Human Skeleton in Forensic Medicine. Springfield: Charles C. Thomas, 1986.
16. Ross AH, Konigsberg LW. New formulae for estimating stature in the Balkans. Journal of Forensic Sciences. 2002; 47/1: 165-167.