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Morphometric Measurements of Upper and Lower End of Dry Human Humerus

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ABSTRACT

Background: The morphometric characteristics of the humerus are crucial in Forensic, Anatomy and Archaeology. These measurements can help forensic experts to estimate the age, sex and identity of an individual from skeletal remains. The goal of the current study was to examine various morphometric analyses of the humerus segment.

Materials and methods: From January 2021 to December 2021, this descriptive type of study was carried out in the Anatomy Department at Sylhet MAG Osmani Medical College. For the study's purpose, 200 healthy adult right humeri were gathered. Samples that met the inclusion and exclusion criteria were used for data collection. the Vertical Diameter of the Head (VDH) the Transverse Diameter of the Head (TDH) the Maximum Transverse Diameter of the head (MTD) Epicondylar Breadth (EB) Condylar Breadth (CB) Breadth of the Capitulum (BC). All the variables were checked carefully. Data were analyzed and processed in windows 10 and SPSS version 23. Data were expressed as mean±SD.

Results: The mean vertical diameter of the head of humerus was 42.28±3.43 mm, mean maximum diameter of the head of the humerus was 39.84±3.45 mm and mean transverse diameter was 39.42±6.29mm. In the lower end, the mean epicondylar breadth was 56.09±6.24 mm and mean condylar breadth was 40.42±3.35 mm.

Conclusion: For anatomists, understanding of the morphometric measurements of humerus segments is crucial. It takes forensic specialists and archaeologists to identify a skeleton's identity. Additionally, it supports the surgeons during various humerus implantation operations.

KEY WORDS

Condyle; Descriptive study; Greater tubercle; Humerus; Morphometry.

INTRODUCTION

"Morphometry" refers to the quantitative assessment of form, encompassing both size and shape. The human brachium (Arm) is defined by the humerus, the biggest bone in the upper extremity.[1] It articulates distally with the radius and ulna at the elbow joint and proximally with the glenoid cavity of scapula via the Glenohumeral (GH) joint. The head of the humerus, which connects to the glenoid cavity of the scapula in a ball and socket joint. Anatomical neck, located directly distal to the head, separates the humeral head from the greater and lesser tubercles.[2] The anatomical neck of the humerus, which separates the head of the humerus from the greater and lesser tubercles, is located immediately below the head of the humerus. The remaining epiphyseal plate forms the anatomical neck of the humerus. Proximally, a groove known as an intertubercular groove separates the two tubercles vertically. The surgical neck of the humerus follows the tubercles and is a location that frequently sustains fractures.[3] The medial and lateral epicondyles of the humerus are formed by a broadening of the bone at its distal end. The condyle, which is made up of the trochlea, capitulum, olecranon, coronoid and radial fossae, marks the distal end of the humerus.[4]

From an anatomical perspective, the humerus enables various upper limb movements. According to Celbis et al. the remnants of upper limb bones such the humerus, radius and ulna can be used to estimate life stature in the absence of lower limb bones.

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When estimating stature and bone length from the skeleton, anthropometric measures are quite helpful.[5] Estimating stature from human skeletal remains is a crucial step in determining the general body size variations and health of the target populations.[6] It also plays a crucial role in the identification of missing people during medicolegal investigations. Forensic experts and anatomists both appreciate knowing the measurements of humerus segments since it aids the investigator in determining the identity of the skeleton.[7] In order to obtain accurate anthropological information for morphometric analysis, it is crucial to employ well-preserved human skeleton bones.[8] In addition to the pelvic and cranial bone structures, radius, ulna, sternum, femur, tibia, talus and calcaneus bones are also employed in anthropological research. Bone abnormalities may be caused by chemical and mechanical influences, it is now common practice to determine sex of a dead by using strong bones like the humerus.[9] Thereby, humerus has been employed by researchers in forensic and anthropological studies extensively.[10] The morphometry of humerus are variable between different individuals with different races.[11] Anatomy, forensic medicine, anthropology, radiology, orthopedic surgery, reconstructive surgery, and sports science all benefit greatly from understanding the humerus' anatomical structure. There are differences in morphology of humerus between sexes, ethnic groupings, and geographical areas. By evaluating this information from dry bones, the data will facilitates improved diagnosis and treatment planning. Moreover, the accuracy of forensic reconstructions will be enhanced by the findings. Therefore, present study aimed to evaluate the morphometric measurements of upper and lower end of dry human humerus.

MATERIALS AND METHODS

This study was descriptive and was carried out from January 2021 to December 2021 during a period of one year. Two hundred human right humeri that were dry and totally ossified and met the inclusion criteria were obtained from the Department of Anatomy at Sylhet MAG Osmani Medical College. The Ethical Committee of Sylhet MAG Osmani Medical College, Sylhet, granted approval for the study's protocol. Exclusion criteria included humeri that were fractured or deformed. Humeri with congenital abnormalities and broken bones with healed fractures were also excluded. Data were collected using a purposive sample technique, and they were recorded on a data sheet. For measuring the humerus, an osteometric board, a digital slide caliper and a flexible ribbon tape were employed. The study variables were the Vertical Diameter of the Head (VDH) the Transverse Diameter of the Head (TDH) the Maximum Transverse Diameter of the Head (MTD) Epicondylar Breadth (EB) Condylar Breadth (CB).

The straight distance between the highest and lowest points on the articular surfaces, calculated at a right angle to the transverse diameter, was used to determine the head's Vertical Diameter (VDH). The linear distance between the most anterior and most posterior places on the articular surface of the head is used to calculate the Transverse Diameter of the Head (TDH). The straight distance between the most lateral places on the articular surface of the head was used to measure the Maximum Transverse Diameter (MTD). The transverse distance between two epicondyles was considered as Epicondylar Breadth (EB). Condylar Breadth (CB) was measured between the midpoint of the medial margin of the trochlea and the midpoint of the lateral margin of the capitulum. SPSS (Statistical Package for the Social Sciences) version 23 were used for data analysis. Data were expressed as mean±SD.

Image 1 Measurement of Vertical Diameter of Head (VDH) of right sided humerus

Image 2 Measurement of Transverse Diameter (TDH) and Maximum Transverse Diameter of Head (MTD) of right sided humerus

Journal of Brahmanbaria Medical College
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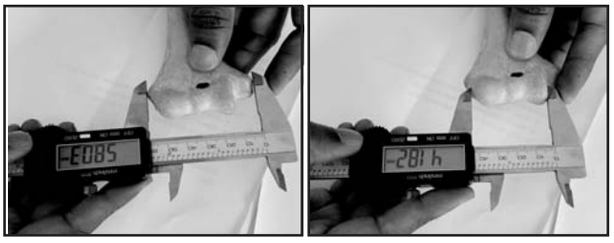

Image 3 Measurement of Epicondylar Breadth (EB) and Condylar Breadth (CB) of right sided humerus

RESULTS

Total 200 humerus were measured for the study purpose. The mean vertical diameter of the head of the 200 humerus were 42.28 ± 3.43 mm. The maximum diameter of the head of the humerus were 39.84 ± 3.45 and the transverse diameter of the head of the humerus were 39.42±6.29 (Table I).

The meanepicondylar breadth were 56.09±6.24 mm and condylar breadth were 40.42±3.35 mm (Table II).

Table I The measurements of different segments of head of the humerus (n=200)

Head of humerus	Number	Mean ± SD	Range
Vertical diameter of the head of the humerus (VDH)(mm)	200	42.28 ± 3.43	35.54-48.92
Maximum diameter of the head of the humerus (MTD)(mm)	200	39.84 ± 3.45	32-45.99
Transverse diameter of the head of the humerus (TDH)(mm)	200	39.42±6.29	32-71.73

Data was presented with mean±SD, mm-millimeter, n=total number of sample.

Table II The measurements of different segments of lower end of the humerus (n=200)

Lower end of humerus	Number	Mean±SD	Range
Epicondylar Breadth (EB)(mm)	200	56.09±6.24	39.02-68.50
Condylar Breadth (CB) (mm)	200	40.42±3.35	34.33-47.26

Data was presented with mean±SD, mm-millimeter, n=total number of sample.

DISCUSSION

Among various populations, the size of upper limb bones varies. African, American, and European populations all have humeri that are of a variable length. Asian populations vary considerably from one another. For a number of Asian groups, the discriminant value for humeral length has been determined.[12] In Forensics, Anatomy and Archeology, the morphometric characteristics of the humerus are crucial. The practitioner can use it to treat fractures of the proximal and distal humerus.[13]

The mean value of the maximum vertical diameter of the head of the humerus was 42.28±3.43 mm. Similar findings were reported in studies conducted at Turkey population, Indian population and Nepalese Population.[14,15] Sinha et al. show the maximum vertical diameter of the head of the humerus was 40.39±5.14 mm in their study.[16]

The mean value of the maximum diameter of the head of the humerus was 39.84±3.45 mm. Similar findings were reported in other study.[16] They conducted a descriptive study on 49 human dry humerus at the Department of Anatomy of Sikkim, Manipal Institute of Medical Sciences in Gangtokand, reported that the mean value of maximum diameter of the head of the humerus was 39.85±5.09 mm. Kumari et al. conducted another study comprising 80 humerii at Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India reported the mean value of the maximum diameter of the head of the humerus was 43.04±5.42 mm.[17]

According to the current study, the mean value of the transverse diameter of the head of the humerus was 39.42±6.29 mm. Therefore, the findings of the study are in well agreement with the findings of the other research works.[18,19,20] A study was conducted in Multan, Pakistan, where the researchers found the maximum diameter of the humeral head were 44.95 ± 1.72 mm in male while 41.34 ± 2.07 mm in female humerus.[12] In a study done by Lokanadham et al. the maximum transverse diameter of the head of the humerus was 40.37±0.42 mm.[14] Kabakci et al. study show the mean value of transverse diameter of the head of the humerus was 38.29±3.04 mm.[19] Another study Kumari et al. reported the mean value of transverse diameter of the head of the humerus was 38.91±6.12 mm.[17]

Epicondylar breadth the mean value of Epicondylar Breadth (EB) of the right was 56.09±6.24 mm in the present study. Similar finding was reported in other studies.[15,18,] Epicondylar breadth was 59.44 ± 3.20 mm in the males and 54.52 ± 2.30 mm in the females, was observed by Khan, Gul and Nizami.[12] In a study of Desai et al. found the mean value of Medial Epicondyle to Capitulum (ME-C) of the right side was 55.50±6.61 mm.[21] Condylar breadth of the study was found 40.42±3.35 mm. Khan, Gul and Nizami, conducted a study involving 122 male humeri and 52 female humeri.[12] Condylar breadth in the male humerus ware 41.23 ± 1.91 mm and female humerus were 38.73 ± 1.76 mm.

Journal of Brahmanbaria Medical College
Volume 07 Issue 01 January 2025 ; 16-19

They also compared the result between the groups. The result was statistically significant ($p<0.05$).

CONCLUSION

The morphometric measurements of the upper and lower ends of the dry human humerus provide valuable insights into the anatomical variations across different populations, sexes and age groups. Those measurements serve as crucial tools in forensic identification, anthropological research and surgical interventions. Overall, the study of humeral morphometrics contributes to advancing knowledge in multiple scientific and medical fields, such as Anatomists, Anthropology and Forensic science for identification of skeletonwith significant implications for both research and practical applications.

DISCLOSURE

All the authors declared no competing interest.

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