

## Morphometric Study of the Maximum and Curved Vertical Diameters of the Head of the Humerus in Bangladeshi Population

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### Abstract

The head of the humerus bone articulates with the glenoid cavity of the scapula to form the glenohumeral joint. Glenohumeral joint is a multi-axial joint, which is one of the most mobile and unstable joints in human body. Morphometric analysis of the head of the humerus is important to understanding of shoulder joint's stability and functions. A cross-sectional, descriptive study was conducted in the Department of Anatomy, Mymensingh Medical College, Bangladesh, from July 2021 to June 2022, to determine the maximum and curved vertical diameters of the humeral head in a Bangladeshi population. We collected 100 dry adult humerus bones (right sided 43 and left sided 57) through the non-random, purposive sampling technique. Damaged, unossified or fractured bones were excluded. A digital slide calipers was used to measure the maximum vertical diameter of the head of the humerus, while its curved vertical diameter was measured by flexible measuring tape. The mean maximum vertical diameters of the head of the right and left humeri were found  $41.965 \pm 3.425$  mm and  $41.548 \pm 3.647$  mm respectively. The mean curved vertical diameters of the head of the right and left humeri were found  $59.093 \pm 5.706$  mm and  $57.403 \pm 5.506$  mm respectively. We expect that the findings of our study will be helpful for clinical anatomists, orthopaedic surgeons, radiologists, anthropologists, and forensic experts.

CBMJ 2025 July: vol. 14 no. 02 P:93-97

**Keywords:** Morphometry, humerus, gleno-humeral joint, shoulder joint, Bangladesh

### Introduction

The humerus is a long bone and consists of three parts: upper end, lower end, and shaft. The upper end presents five features: head, neck, greater tubercle, lesser tubercle, and intertubercular sulcus. The head is smooth and rounded and forms less than half of a sphere. It is directed medially backwards and upwards. It articulates with the glenoid cavity of the scapula to form the glenohumeral (shoulder) joint. The shoulder joint is the most movable joint of the body and consequently one of the least stable. It is most common joint to dislocate and to undergo recurrent dislocations.<sup>1,2</sup> Shoulder dislocation and deciding the proper size of the humeral component in the shoulder arthroplasty show the dire need of morphometric data of humerus in a specific population.<sup>3,4</sup>

Due to scarcity of data on the morphometry of the humerus in our Bangladeshi population, the urgency of the present study arises. We mainly depend on foreign data and statistics. Hence, we proposed this study to obtain morphometric data of the head of the

humerus, especially the maximum and curved vertical diameters of the head of the humerus in a Bangladeshi population.

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## Methods

This cross-sectional, descriptive study was conducted in the Department of Anatomy, Mymensingh Medical College, Bangladesh, from July 2021 to June 2022. One hundred (100) fully ossified dry human humerus were collected for the study. We collected 100 dry adult humerus bones (right sided 43 and left sided 57). A non-random purposive sampling technique was used for sample selection. The sample was excluded if the bones were unossified, developmentally abnormal, and broken (or fractured). At first, the maximum vertical diameter of the head of the humerus was measured vertically from the uppermost point to the lowermost point of the head of the humerus (Fig. 1). The diameter was measured by using a digital slide calipers and expressed in mm. Then the curved vertical diameter of the head of the humerus was measured vertically from the uppermost point to the lowermost point of the head of the humerus (Fig. 2). The diameter was measured by flexible measuring tape and expressed in mm.



**Fig. 1:** Photograph showing the procedure of measurement of maximum vertical diameter of the head of the humerus .



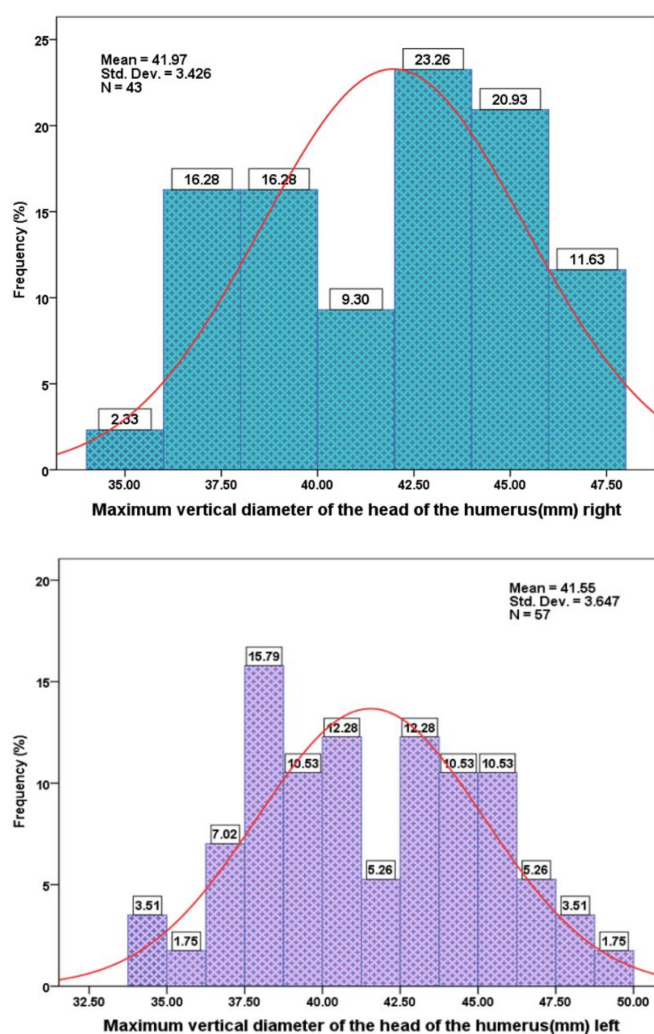
**Fig. 2:** Photograph showing the procedure of measurement of the curved vertical diameter of the head of the humerus.

Following data collection, data input was done. The collected data was assessed for completeness, accuracy, and consistency before analysis. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 22.0 for windows. Continuous variables were expressed as mean and standard deviation (SD). The data were presented in graphs and figures. Ethical clearance was obtained from the Institutional Review Board (IRB) of Mymensingh Medical College, Mymensingh, Bangladesh.

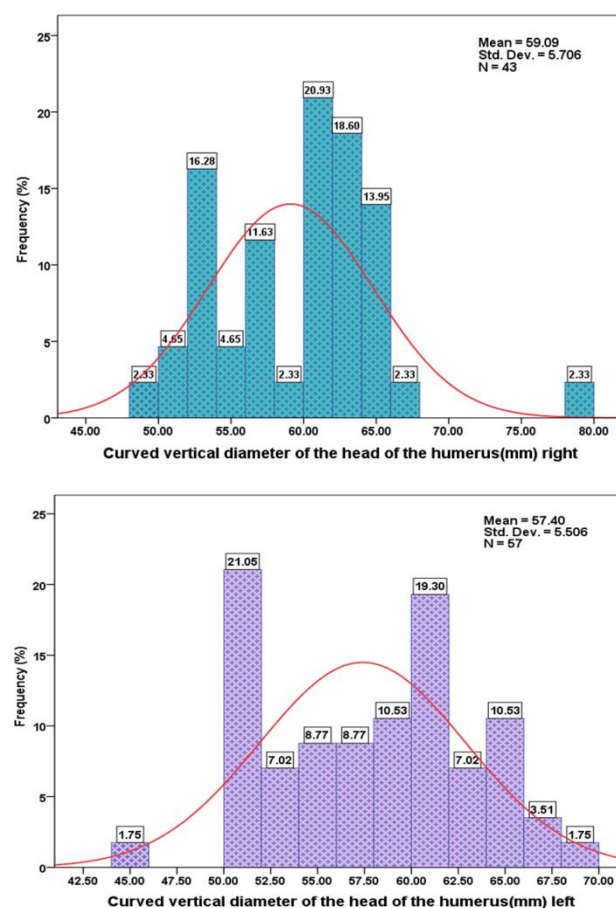
## Results

The mean maximum vertical diameters of the head of the right and left humeri were found  $41.965 \pm 3.425$  mm and  $41.548 \pm 3.647$  mm respectively. The maximum vertical diameter of the head of the 43 right humeri ranged between 35.86 mm and 47.87 mm. More than 81% of samples were measured within the range of 38.00 mm to 47.50 mm. The maximum vertical diameter of the head of the 57 left humeri ranged between 33.98 mm and 48.87 mm. More than 77% of samples were measured within the range of

37.50 mm to 46.00 mm (Fig. 3). The mean curved vertical diameters of the head of the right and left humeri were found  $59.093 \pm 5.706$  mm and  $57.403 \pm 5.506$  mm respectively. The curved vertical diameter of the head of the 43 right humeri ranged between 49 mm and 78 mm. More than 74% of samples were measured within the range of 55.00 mm to 67.50 mm. The curved vertical diameter of the head of the 57 left humeri ranged between 45 mm and 68 mm. More than 75% of samples were measured within the range of 50.00 mm to 62.00 mm (Fig. 4).



**Fig. 3:** Histogram showing the frequency distribution of maximum vertical diameter of the head of the humerus (both sides)



**Fig. 4:** Histogram showing the frequency distribution of curved vertical diameter of the head of the humerus (both sides)

## Discussion

In the present study, the mean maximum vertical diameter of the head of the right humerus was observed  $41.965 \pm 3.425$  mm. Our study finding is nearly similar to the value described by Paul *et al.* ( $41.31 \pm 3.46$  mm), Udhaya, Devi & Sridhar ( $40.37 \pm 4.04$  mm), Kabakci *et al.* ( $42.41 \pm 3.25$  mm), Kumari, Subhash & Sinha ( $43.04 \pm 5.42$  mm), Sinha *et al.* ( $41.55 \pm 1.12$  mm), Sinha, Bhutia & Tamang ( $42.0124 \pm 4.39$  mm), Chaudhary *et al.* ( $41.90 \pm 0.37$  mm), Naqshi *et al.* ( $43.30 \pm 3.80$  mm) and Jahan & Srivastava ( $41.63 \pm 1.55$  mm).<sup>3-11</sup> However, our value is higher than that of Gayatri *et al.* as they found  $34.30 \pm 5.00$  mm and lower than that of Salles *et al.* as they reported  $44.00 \pm 4.00$  mm.<sup>12,13</sup>



The mean maximum vertical diameter of the head of the left humerus in the present study was observed  $41.548 \pm 3.647$  mm. Our study finding is nearly similar to the value described by Paul *et al.* ( $40.91 \pm 3.27$  mm), Udhaya, Devi & Sridhar ( $41.03 \pm 3.39$  mm), Kabakci *et al.* ( $42.94 \pm 4.01$  mm), Kumari, Subhash & Sinha ( $41.96 \pm 6.17$  mm), Sinha *et al.* ( $41.30 \pm 0.90$  mm), Sinha, Bhutia & Tamang ( $40.9325 \pm 5.14$  mm), Chaudhary *et al.* ( $43.00 \pm 5.70$  mm), Naqshi *et al.* ( $42.30 \pm 3.70$  mm), and Salles *et al.* ( $42.00 \pm 3.00$  mm).<sup>3-10,13</sup> However, our value is higher than those reported by Jahan & Srivastava ( $38.89 \pm 3.71$  mm) and Gayatri *et al.* ( $32.20 \pm 5.19$  mm).<sup>11,12</sup>

According to the present study, the mean curved vertical diameters of the head of the right and left humeri were  $59.093 \pm 5.706$  mm and  $57.403 \pm 5.506$  mm respectively. However, no previous study was available to analyze and compare the curved vertical diameter of the head of the humerus with our study findings.

## Conclusion

In the present study, the mean maximum vertical diameters of the head of the right and left humeri were found  $41.965 \pm 3.425$  mm and  $41.548 \pm 3.647$  mm respectively. The mean curved vertical diameters of the head of the right and left humeri were found  $59.093 \pm 5.706$  mm and  $57.403 \pm 5.506$  mm respectively. Data obtained in this study is expected to play a crucial role in forensic medicine, orthopaedic surgery, anatomy, and anthropology. These results are instrumental in identifying unknown bodies and determining the stature of individuals within the Bangladeshi population. Additionally, they aid orthopaedic surgeons in treating fractures of the humerus and facilitating their reconstruction. These measurements are invaluable for prosthesis manufacturing units and authorities, as they enable

the design of prostheses that account for racial and ethnic variations influencing prosthesis remodelling.

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