Morphometric Study of Humeral segments for sexual dimorphism in central and south Indian population

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Abstract:
Background: In medicolegal investigations, determining sex from the bones is critical. There is no doubt that population sizes and proportions differ, and that these variances influence the metric assessment of sex. Researchers from all across the world have done studies to create group particular criteria of evaluation because osteometric procedures for determining sex are population specific. Materials & Methods: The current research a morphometric analysis of 250 humerii of unknown sex was performed to evaluate sexual dimorphism, with 145 male and 105 female bones discovered in the current study. The bones had been gathered from dissected cadavers and were already in the Department. Results and conclusion: The current study clearly shows that males have substantially higher statistical values for all parameters when compared to females. Anatomists and orthopaedic surgeons, as well as medico-legal professionals, benefit from these characteristics. More research and studies are needed, based on the findings of this study, to definitely distinguish sex in the humerus. When a humerus is present, this information is likely to benefit forensic investigators in determining an individual's sex. More research, involving a broader range of populations and larger sample sizes, would undoubtedly contribute to the advancement of the scientific record.

Key words: skeletal, Humerus

INTRODUCTION

The determination of sex is an essential part of any human skeletal examination. Observing morphological characteristics in a full human skeleton allows for straightforward sex estimation [1]. When the entire skeleton is accessible, accurate sex diagnosis should be straightforward; but, when only a portion of the skeleton is available, assessment becomes increasingly difficult [2]. When skeletal remains are discovered, anthropologists attempt to reconstruct the person's biological profile, which includes estimating sex, age, and height [3]. Because subsequent methods of age and stature determination are largely sex dependent, determining sex is one of the earliest and most basic aspects of assessment [4]. The pelvic girdle, skull, and long bones are the major anatomical regions utilised to determine sex. The pelvis, skull, or other anatomical elements that point to reasonably precise sex judgments are frequently missing. As a result, parameters for other bones, particularly long bones that are frequently discovered in the collection must be developed [5].In medicolegal investigations, determining sex from the bones is critical. There is no doubt that population sizes and proportions differ, and that these variances influence the metric assessment of sex [6]. Researchers from all across the world have done studies to create group particular criteria of evaluation because osteometric procedures for determining sex are population specific.Two methods, morphological and anthropometric, can be used to infer the subject's sex from skeletal remains. Morphological procedures are based on the study of bones and are particularly significant for a preliminary sex assessment. The second method is anthropometric analysis, which is based on bone measurements.Though it has sometimes exhibited even greater accuracy than other long bones such as the femur, the humerus has rarely been used as a location for sex determination[7]. The major goal of this study was to see if humeral measures could be used as a reliable sex indicator and to create baseline values for sexual dimorphism in the humerus in the North Indian population.

The Humerus is the longest and largest bone in the upper extremity, and its outlines can only be felt indistinctly except in its distal quarter since it is almost totally covered by arm muscles.The main objective of the present study is morphometric analyse of humeral segments for sexual dimorphism in central and south Indian population

MATERIALS AND METHOD

The current research a morphometric analysis of 250 humerii of unknown sex was performed to evaluate sexual dimorphism, with 145 male and 105 female bones discovered in the current study. The bones had been gathered from dissected cadavers and were already in the Department. Surabhi Institute of Medical Sciences, and the Department of Anatomy, Index Medical College and Research Centre, Indore, for this study (MP). The institutional ethical approval was granted by the Ethical Committee of Index Medical College, Hospital & Research Centre, Indore.

The following parameters were taken:

1. **Breadth of proximal end**:
   It's the distance between the head's medial most point and the lateral most point of larger tuberosity.
2. **Breadth of distal end**:
   It's the distance between two epicondyles measured parallel to the previous one.
3. **Maximum transverse diameter of head:**
   It is the linear distance transverse to the vertical diameter between the most anterior and most posterior places on the articular surface of the head.
4. **Maximum vertical diameter of head**:

It is the linear distance transverse to the head's transverse diameter between the highest and lowest places on the articular surface.

RESULTS:

Table-1 Comparison of Breadth of proximal end

Variable	Male (cm)	Female (cm)	p – Value
	Mean ± SD	Mean ± SD	
Breadth of proximal end	4.75 ± 0.33	4.14 ± 0.40	0.001

SD = Standard deviation

Statistical analyzes projected that the breadth of proximal end found to be significantly. This was observed that the average (Mean ± SD) was found in male 4.75 ± 0.33 and in female 4.14 ± 0.40. The breadth of proximal end was found significantly higher in male comparison to that in the female, with a p value of < 0.001.

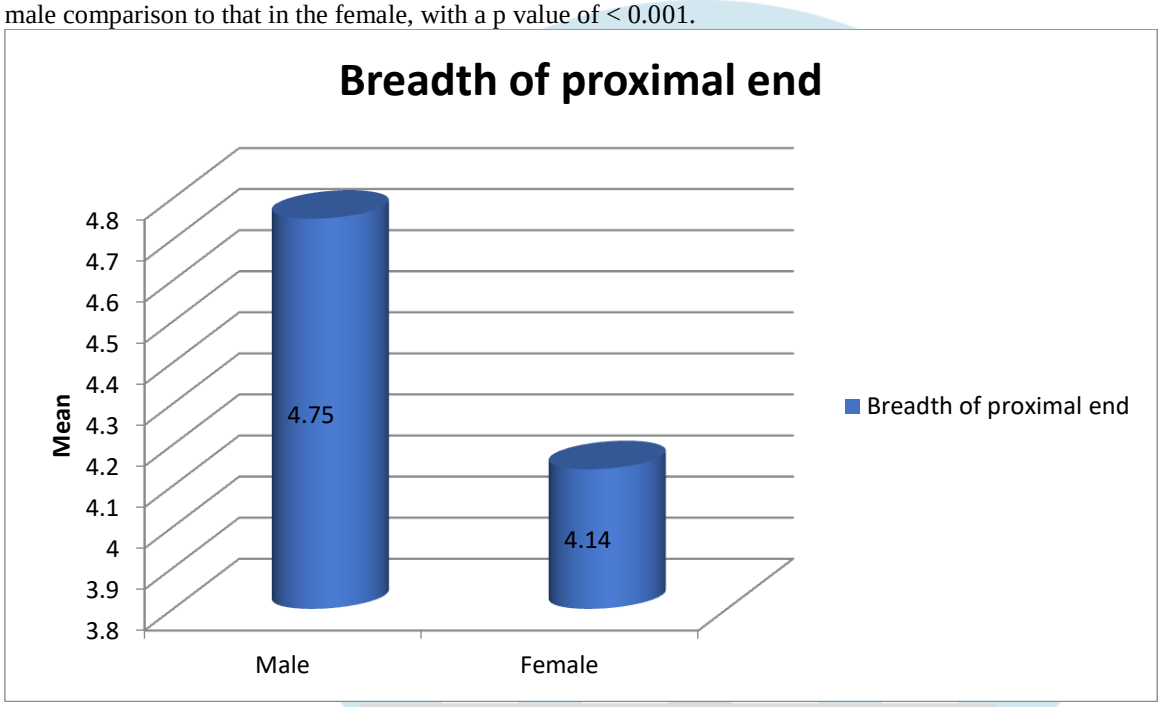

Figure:1 represents the breadth of proximal end in the form of bar diagram.

Table-2 Comparison of breadth of distal end

Variable	Male (cm)	Female (cm)	p – Value
	Mean ± SD	Mean ± SD	
Breadth of distal end	5.92 ± 0.45	5.26 ± 0.36	0.001

SD = Standard deviation

Statistical analyzes projected that the breadth of distal end found to be significantly. This was observed that the average (Mean ± SD) was found in male 5.92 ± 0.45and in female 5.26 ± 0.36. The breadth of distal end was found significantly higher in male comparison to that in the female, with a p value of < 0.001.

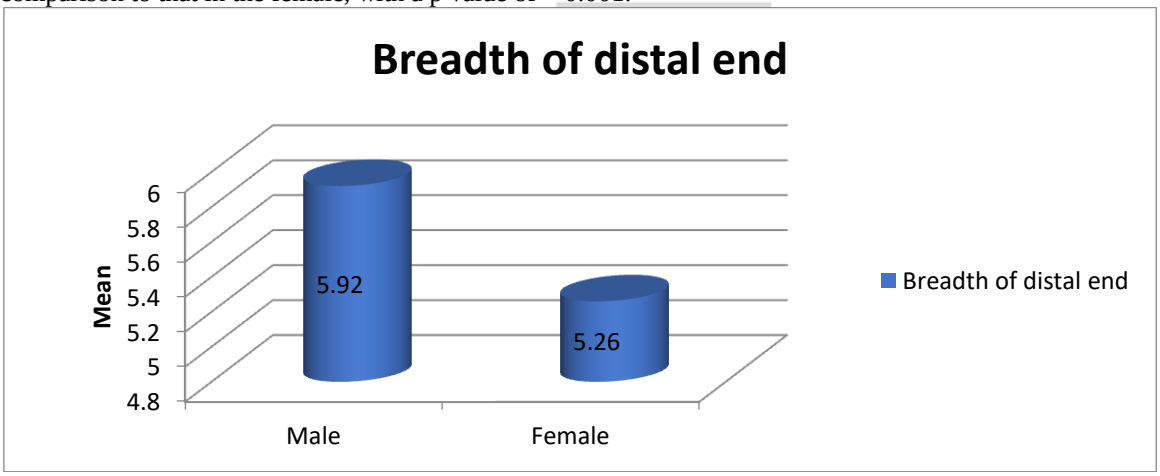

Figure:2 represents the breadth of distal end in the form of bar diagram.

Table-3 Comparison of Maximum transverse diameter of head

Variable	Male (cm)	Female (cm)	p – Value
	Mean ± SD	Mean ± SD	
Maximum transverse diameter of head	4.14 ± 0.27	3.51 ± 0.29	0.001

SD = Standard deviation

Statistical analyzes projected that the maximum transverse diameter of head found to be significantly. This was observed that the average (Mean ± SD) was found in male 4.14 ± 0.27 and in female 3.51 ± 0.29. The maximum transverse diameter of head was found significantly higher in male comparison to that in the female, with a p value of < 0.001.

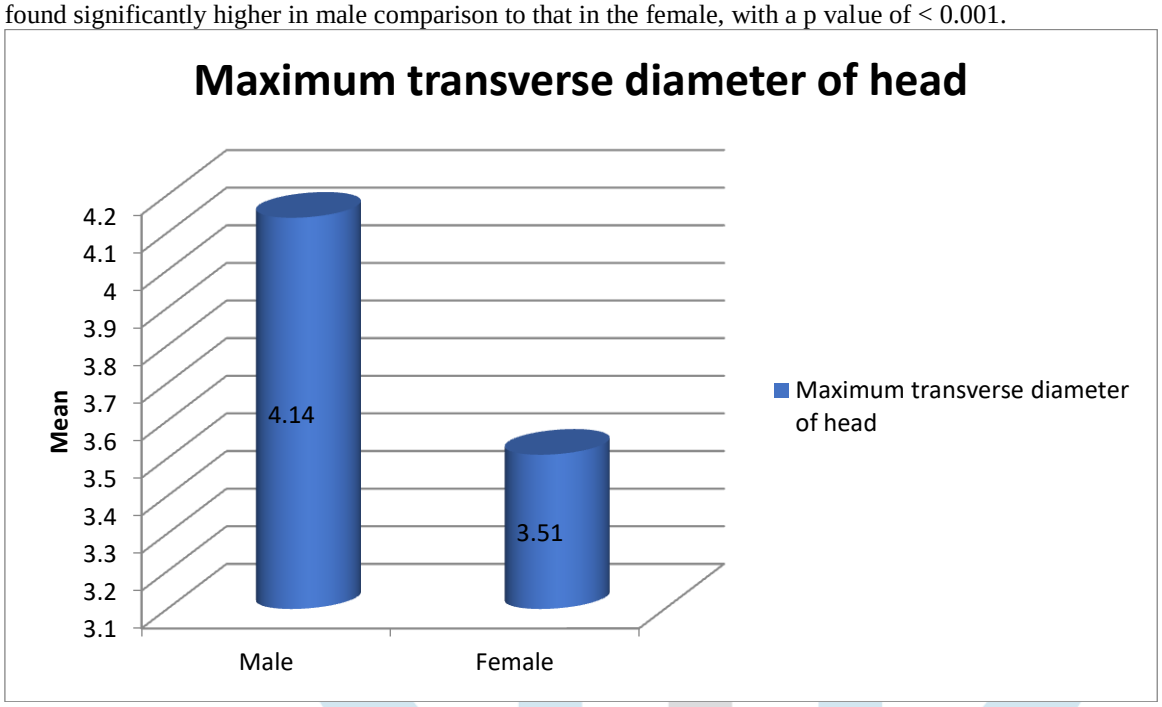

Figure:3 represents the maximum transverse diameter of head in the form of bar diagram.

Table-4 Comparison of Maximum vertical diameter of head

Variable	Male (cm)	Female (cm)	p – Value
	Mean ± SD	Mean ± SD	
Maximum vertical diameter of head	4.26 ± 0.24	3.75 ± 0.29	0.001

SD = Standard deviation

Statistical analyzes projected that the maximum vertical diameter of head found to be significantly. This was observed that the average (Mean ± SD) was found in male 4.26 ± 0.24 and in female 3.75 ± 0.29. The maximum vertical diameter of head was found significantly higher in male comparison to that in the female, with a p value of < 0.001.

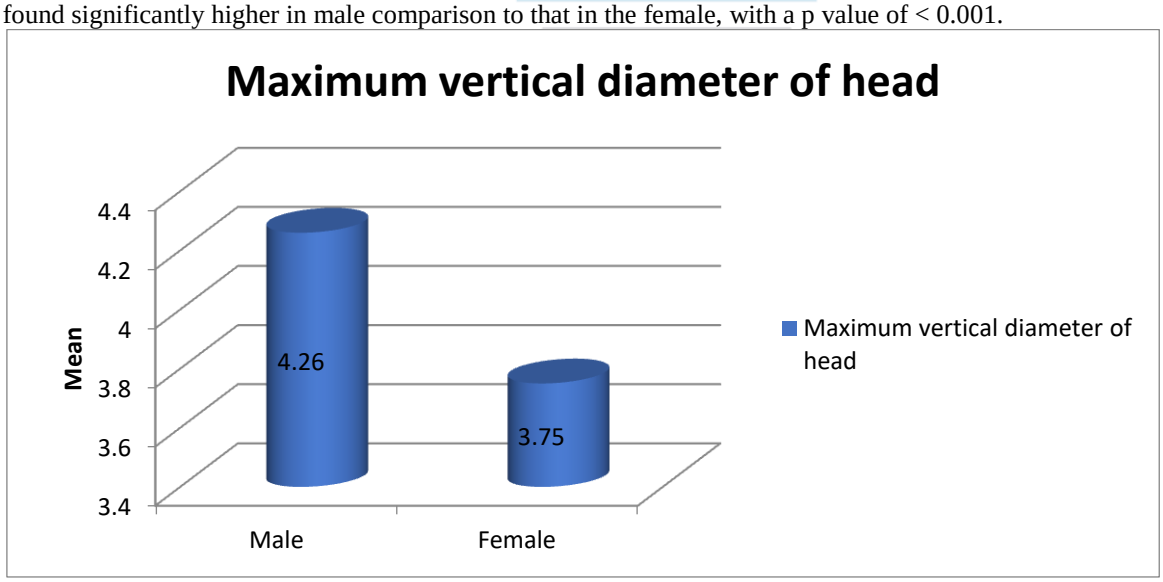

Figure:4 represents the maximum vertical diameter of head in the form of bar diagram.

DISCUSSION

The average (Mean ± SD) of breadth of proximal end, breadth of distal end, maximum transverse diameter of head and maximum vertical diameter of head were found significantly higher in male comparison to that in the female, with a p value of < 0.001. These findings were in line with the findings of prior research conducted by Vaishnani et al., (2019)[8], Ahmed et al., (2018)[9], Reddy et al., (2017)[10], Tomczyk et al., (2017)[11] and Lokanadham et al., (2013)[12] demonstrated that the sex estimation approaches based on humerus measurements are population-specific. Males and females were first found to have significant differences in all metrics. Males had an accuracy rate of 91.53 percent, while females had an accuracy rate of 86.95 percent, for an overall accuracy rate of 90.34 percent. They came to the conclusion that multivariate analysis of a set of metric factors can aid in the accurate determination of sex from the humerus bones. The strongest significant link between referential sex and the vertical diameter of the humeral head was discovered.

CONCLUSION

The current study clearly shows that males have substantially higher statistical values for all parameters when compared to females. Anatomists and orthopaedic surgeons, as well as medico-legal professionals, benefit from these characteristics. More research and studies are needed, based on the findings of this study, to definitely distinguish sex in the humerus. When a humerus is present, this information is likely to benefit forensic investigators in determining an individual's sex. More research, involving a broader range of populations and larger sample sizes, would undoubtedly contribute to the advancement of the scientific record.

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