Global Academic Journal of Medical Sciences

Available online at www.gajrc.com
DOI: 10.36348/gajms.2023.v05i06.001

OPEN ACCESS

ISSN: 2706-9036 (P)
ISSN: 2707-2533 (O)

Original Research Article

Comparison of Osteometric Dimensions of Lower end of Femoral Bone by Side of Femur among Bangladeshi Population

Dr. Afshan Jesmin Alim[1*], Dr. Lubna Shirin[2], Dr. Mohammed Shahjahan Kabir[3]

[1]Associate Professor, Department of Anatomy, Bangladesh Medical College, Dhaka, Bangladesh
[2]Senior Lecturer, Department of Anatomy & Medicine, Universiti Teknologi MARA Sungai Buloh Campus, Jalan Hospital Sungai Buloh, 47000, Selangor, Malaysia
[3]Associate Professor, Department of Medicine, International Medical School, Management and Science University 40100 ShahAlam, Selangor, Malaysia

***Corresponding Author**
Dr. Afshan Jesmin Alim
Associate Professor, Department of Anatomy, Bangladesh Medical College, Dhaka, Bangladesh

Article History
Received: 22.09.2023
Accepted: 27.10.2023
Published: 07.11.2023

Abstract: ***Background:*** Osteometric dimensions of the femoral bone have significant clinical and anthropological implications. However, there is a lack of comprehensive data on these dimensions specific to the Bangladeshi population. This study aims to fill this research gap by analyzing the osteometric dimensions of the lower end of the femoral bone among a sample set in Bangladesh. ***Methods:*** This cross-sectional observational study was conducted in three medical colleges in Dhaka, Bangladesh. A total of 50 dried femurs were collected based on specific inclusion and exclusion criteria. Osteometric measurements, including bicondylar width, medial and lateral condylar depths, intercondylar notch width, and intercondylar notch depth, were obtained using digital sliding calipers. ***Result:*** The study revealed notable differences in osteometric measurements between right and left femurs. For instance, 39.29% of right femurs had below-average Femoral Bicondylar Width (<65 mm) compared to 13.64% of left femurs. The mean Femur Medial Condylar Width was 31.05 mm with a standard deviation of 1.74 mm. ***Conclusion:*** The study provides valuable, region-specific osteometric data that has both clinical and anthropological implications. The findings are particularly important for the preparation of prosthetics and other supporting structures, which can be highly beneficial for both patients and medical practitioners.

Keywords: Osteometric, Femoral bone, Right femur, Left femur, Prosthetics, Anthropological implications.

INTRODUCTION

Osteometric dimensions serve as quantitative measurements of bones and are pivotal in various fields such as anthropology, forensic science, and medicine. These dimensions are crucial for understanding skeletal morphology and can offer valuable insights into population-specific characteristics, including age, sex, and ethnicity [1, 2]. The importance of osteometric dimensions extends to surgical planning, prosthetic design, and forensic identification, making them indispensable in both clinical and research settings [3]. The femoral bone, the longest and strongest bone in the human body, plays a critical role in locomotion and weight-bearing [4]. It is a vital component of the hip joint and knee joint, two of the most complex and load-bearing joints

in the human body [5]. The lower end of the femoral bone, in particular, is crucial for knee stability and is often the focus of orthopedic surgeries such as knee replacement [6-8]. Understanding the osteometric dimensions of the lower end of the femoral bone can significantly impact the success of such surgical interventions [9]. Several studies have been conducted globally to understand the osteometric dimensions of the femoral bone. These studies often focus on population-specific data to account for ethnic variations that can significantly influence bone morphology [10]. For instance, research conducted in the United States has shown variations in femoral dimensions between Caucasian and African American populations [11]. Similarly, studies in Asia have indicated distinct osteometric characteristics unique to Asian populations [12]. However, there is a noticeable gap in the literature concerning the Bangladeshi population. Bangladesh, with its diverse ethnic background, presents a unique opportunity for osteometric research. Preliminary studies have indicated potential variations in skeletal dimensions among the Bangladeshi population, but these have been largely inconclusive due to limited sample sizes or scope [13]. Moreover, most of these studies have focused on cranial dimensions, leaving a significant gap in the understanding of post-cranial skeletal elements like the femoral bone [14].

This study aims to fill this research gap by focusing on the osteometric dimensions of the lower end of the femoral bone among the Bangladeshi population. This research seeks to provide comprehensive data that could be pivotal for various applications ranging from forensic anthropology to orthopedic surgery. Proper osteometric dimensions can help in preparing appropriate prosthetics and other supporting structures, which can be greatly beneficial for future patients and medical practitioners. By comparing the osteometric dimensions by the side of the femur, this study aims to offer a nuanced understanding that could be critical for both clinical practice and academic research in Bangladesh.

METHODS

This cross-sectional observational study was conducted across three medical colleges in Dhaka, Bangladesh: Bangladesh Medical College, Holy Family Red Crescent Medical College, and Anwar Khan Modern Medical College. The study was approved by the respective Institutional Review Boards of the participating colleges. A total of 50 dried femurs were collected based on specific inclusion and exclusion criteria set forth by the research team. The inclusion criteria consisted of adult femurs with no pathological deformities, while the exclusion criteria ruled out femurs with any signs of fractures or surgical interventions. The samples were obtained from the Department of Anatomy of the participating colleges. All osteometric measurements were taken by trained personnel to ensure accuracy and consistency. The dimensions measured included bicondylar width, medial and lateral condylar depths, intercondylar notch width, and intercondylar notch depth. A digital sliding caliper was used for all measurements, and each measurement was rounded to two decimal places for uniformity. The data were then compiled and analyzed using statistical software to draw meaningful conclusions relevant to the Bangladeshi population.

RESULTS

Table 1: Distribution of osteometric measurements among the collected femur

Osteometric Measurements	Frequency	Percentage
Femoral Bicondylar Width		
Below Average (<65 mm)	14	28%
Average (65 - 70 mm)	9	18%
Above Average (70 - 75 mm)	15	30%
High (75 - 80 mm)	12	24%
Mean ± SD	69.78 ± 5.38	
Range	62.20-79.12 mm	
Femoral Intercondylar Width		
Low (< 23 mm)	13	26%
Medium (23 - 25 mm)	25	50%
High (> 25 mm)	12	24%
Mean ± SD	23.77 ± 1.55	
Range	20.10-26.70 mm	
Femur Medial Condylar Width		
Low (< 30 mm)	14	28%
Medium (30 - 32 mm)	15	30%
High (> 32 mm)	21	42%

Mean ± SD	31.05 ± 1.74	
Range	28.00-34.53 mm	
Femur Lateral Condylar Width		
Low (< 26 mm)	18	36%
Medium (26 - 29 mm)	19	38%
High (> 29 mm)	13	26%
Mean ± SD	27.32 ± 2.46	
Range	20.15-31.50 mm	
Intercondylar Depth		
Low (< 26 mm)	16	32%
Medium (26 - 28 mm)	17	34%
High (> 28 mm)	17	34%
Mean ± SD	26.99 ± 1.67	
Range	24.12-30.44 mm	

Table 1 presents the distribution of various osteometric measurements among the 50 collected femurs. For Femoral Bicondylar Width, 28% of the samples fell below the average range (<65 mm), 18% were average (65-70 mm), 30% were above average (70-75 mm), and 24% were high (75-80 mm). The mean bicondylar width was 69.78 mm with a standard deviation of 5.38 mm, and the range was 62.20-79.12 mm. In terms of Femoral Intercondylar Width, 26% were low (<23 mm), 50% were medium (23-25 mm), and 24% were high (>25 mm). The mean intercondylar width was 23.77 mm with a standard deviation of 1.55 mm, and the range was 20.10-26.70 mm. For Femur Medial Condylar Width, 28% were low (<30 mm), 30% were medium (30-32 mm), and 42% were high (>32 mm). The mean medial condylar width was 31.05 mm with a standard deviation of 1.74 mm, and the range was 28.00-34.53 mm. Regarding Femur Lateral Condylar Width, 36% were low (<26 mm), 38% were medium (26-29 mm), and 26% were high (>29 mm). The mean lateral condylar width was 27.32 mm with a standard deviation of 2.46 mm, and the range was 20.15-31.50 mm. For Intercondylar Depth, 32% were low (<26 mm), 34% were medium (26-28 mm), and 34% were high (>28 mm). The mean intercondylar depth was 26.99 mm with a standard deviation of 1.67 mm, and the range was 24.12-30.44 mm.

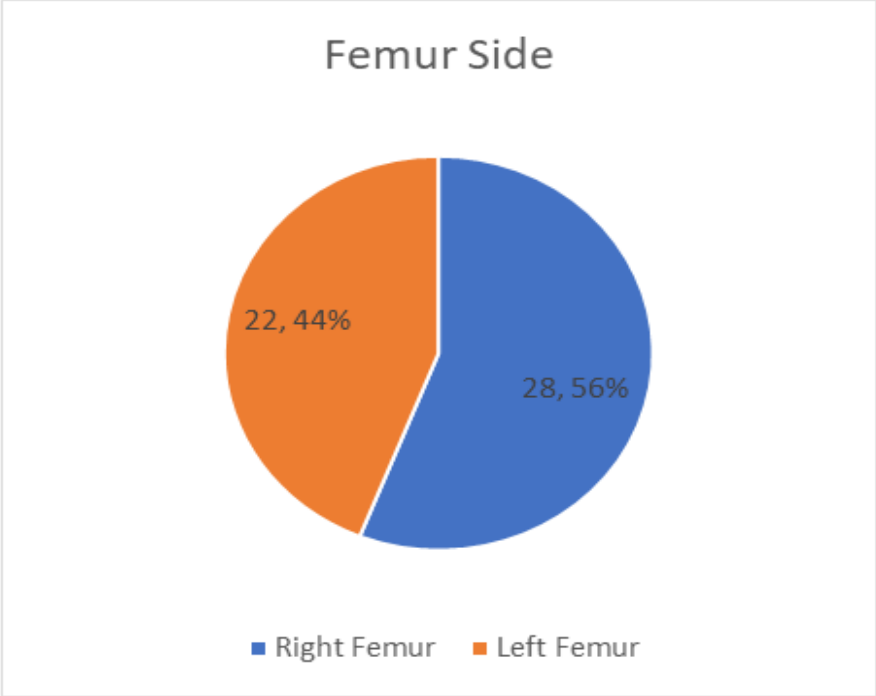

Figure 1: Distribution of femur side among the collected femur

Out of the 50 femurs analyzed in this study, 28 were identified as right femurs, constituting 56% of the sample. Conversely, 22 were left femurs, making up the remaining 44% of the sample.

Table 2: Comparison of osteometric measurements between right femur and left femur

Osteometric Measurements	Right Femur (n=28)		Left Femur (n=22)	
	Frequency	Percentage	Frequency	Percentage
Femoral Bicondylar Width				
Below Average (<65 mm)	11	39.29%	3	13.64%
Average (65 - 70 mm)	4	14.29%	5	22.73%
Above Average (70 - 75 mm)	8	28.57%	7	31.82%
High (75 - 80 mm)	5	17.86%	7	31.82%
Femoral Intercondylar Width				
Low (< 23 mm)	9	32.14%	4	18.18%
Medium (23 - 25 mm)	12	42.86%	13	59.09%
High (> 25 mm)	7	25.00%	5	22.73%
Femur Medial Condylar Width				
Low (< 30 mm)	10	35.71%	4	18.18%
Medium (30 - 32 mm)	9	32.14%	6	27.27%
High (> 32 mm)	9	32.14%	12	54.55%
Femur Lateral Condylar Width				
Low (< 26 mm)	12	42.86%	6	27.27%
Medium (26 - 29 mm)	10	35.71%	9	40.91%
High (> 29 mm)	6	21.43%	7	31.82%
Intercondylar Depth				
Low (< 26 mm)	8	28.57%	8	36.36%
Medium (26 - 28 mm)	10	35.71%	7	31.82%
High (> 28 mm)	10	35.71%	7	31.82%

Table 2 provides a detailed comparison of osteometric measurements between right and left femurs. For Femoral Bicondylar Width, 39.29% of right femurs were below average (<65 mm) compared to 13.64% of left femurs. In the average range (65-70 mm), 14.29% of right femurs and 22.73% of left femurs were observed. Above-average measurements (70-75 mm) were seen in 28.57% of right femurs and 31.82% of left femurs. High measurements (75-80 mm) were found in 17.86% of right femurs and 31.82% of left femurs. For Femoral Intercondylar Width, low measurements (<23 mm) were observed in 32.14% of right femurs and 18.18% of left femurs. Medium measurements (23-25 mm) were seen in 42.86% of right femurs and 59.09% of left femurs. High measurements (>25 mm) were found in 25.00% of right femurs and 22.73% of left femurs. In terms of Femur Medial Condylar Width, low measurements (<30 mm) were observed in 35.71% of right femurs and 18.18% of left femurs. Medium measurements (30-32 mm) were seen in 32.14% of right femurs and 27.27% of left femurs. High measurements (>32 mm) were found in 32.14% of right femurs and 54.55% of left femurs. For Femur Lateral Condylar Width, low measurements (<26 mm) were observed in 42.86% of right femurs and 27.27% of left femurs. Medium measurements (26-29 mm) were seen in 35.71% of right femurs and 40.91% of left femurs. High measurements (>29 mm) were found in 21.43% of right femurs and 31.82% of left femurs. Regarding Intercondylar Depth, low measurements (<26 mm) were observed in 28.57% of right femurs and 36.36% of left femurs. Medium measurements (26-28 mm) were seen in 35.71% of right femurs and 31.82% of left femurs. High measurements (>28 mm) were found in 35.71% of right femurs and 31.82% of left femurs.

DISCUSSION

The primary focus of this study was to explore the osteometric dimensions of the lower end of the femoral bone among the Bangladeshi population. Our results revealed distinct variations in osteometric measurements between right and left femurs, a finding that has both clinical and anthropological implications. In a study conducted in the Rajasthan region of India, researchers found no significant difference between the osteometric dimensions of right and left femurs [15]. This is in stark contrast to our findings, where we observed a higher percentage of above-average Femoral Bicondylar Width and Femoral Intercondylar Width in left femurs compared to right femurs. One hypothesis for this discrepancy could be the influence of genetic and environmental factors that are unique to each population. Another study from Egypt emphasized the role of distal femur end measurements in gender determination [3]. While our study did not focus on gender-specific differences, the Egyptian study underlines the importance of precise osteometric measurements in forensic anthropology, a point that our study also advocates for but in the context of clinical applications. A Malawian study suggested that

femoral dimensions are population-specific, particularly in the context of the femoral sulcus angle [9]. This aligns with our study, which also advocates for the need for region-specific osteometric data. Such data is crucial for various clinical applications, including the preparation of prosthetics and other supporting structures, which can be highly beneficial for both patients and medical practitioners. The discrepancies between our findings and those of similar studies in other regions could be attributed to several factors. Genetic predispositions unique to the Bangladeshi population could be one such factor. Environmental influences, including lifestyle and dietary habits, could also play a role. Further research is needed to explore these hypotheses in detail. Our study fills a significant research gap by providing comprehensive osteometric data specific to the Bangladeshi population. This data is pivotal for various applications, including the preparation of appropriate prosthetics and other supporting structures. Accurate osteometric dimensions can lead to better-fitted prosthetics, thereby improving the quality of life for patients requiring such interventions. Given the aging population in Bangladesh, future research could also focus on age-related variations in femoral osteometric dimensions. A study on male Wistar rats revealed significant variations in femur histological and biomechanical parameters with aging [16]. Exploring this avenue could provide valuable insights into the needs of an aging population. In summary, our study not only contributes to the existing body of knowledge but also provides actionable data that can be used in various clinical applications. The need for region-specific osteometric data cannot be overstated, and our study takes a significant step in fulfilling this need.

CONCLUSION

The present study offers a comprehensive analysis of the osteometric dimensions of the lower end of the femoral bone among the Bangladeshi population. Our findings reveal notable differences in osteometric measurements between right and left femurs, particularly in Femoral Bicondylar Width and Femoral Intercondylar Width. These differences have significant implications for both clinical and anthropological applications. Our study fills a critical gap in the existing literature by providing region-specific osteometric data. The findings are particularly relevant for the preparation of prosthetics and other supporting structures, which can be highly beneficial for both patients and medical practitioners. Accurate osteometric dimensions can lead to better-fitted prosthetics, thereby improving the quality of life for patients requiring such interventions. The study also opens avenues for future research, particularly in understanding the genetic and environmental factors that may contribute to these observed differences. Given the aging population in Bangladesh, further studies could also focus on age-related variations in femoral osteometric dimensions. In summary, the data presented in this study not only contributes to the existing body of knowledge but also provides actionable insights that can be applied in various clinical settings. The need for region-specific osteometric data is evident, and this study takes a significant step in fulfilling this need.

Funding: No funding sources

Conflict of interest: None declared.

Ethical approval: The study was approved by the Institutional Ethics Committee.

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