

Morphometric Study of the Length and Breadth of the Hip Bone in the Bangladeshi Population

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Abstract

Background: Hip bone morphology varies across populations and provides useful information for anthropology, forensic identification, and clinical anatomy. Population-specific osteometric data on hip bone length and breadth remain limited in Bangladesh. **Objective:** To determine the length and breadth of dry adult human hip bones in a Bangladeshi population, compare these measurements according to anatomical side, and assess the relationship between hip bone length and breadth. **Methods:** This descriptive morphometric study included 150 dry adult human hip bones, comprising 82 right-sided and 68 left-sided specimens, obtained from the Departments of Anatomy of Mymensingh Medical College and Community Based Medical College, Mymensingh, Bangladesh. Hip bone length and breadth were measured in centimeters using standard osteometric methods. Data were summarized as range, mean, and standard deviation. Pearson correlation was used to assess the relationship between length and breadth on the right and left sides. A p-value of <0.05 was considered statistically significant. **Results:** Right hip bone length ranged from 16.7 to 22.0 cm, with a mean of 19.45 ± 1.03 cm, while left hip bone length ranged from 16.8 to 22.0 cm, with a mean of 19.47 ± 1.18 cm. Breadth ranged from 13.0 to 16.2 cm on both sides. The mean breadth was 14.19 ± 0.69 cm on the right side and 14.44 ± 0.82 cm on the left side. A significant positive correlation was observed between length and breadth on the right side ($r = 0.376$, $p = 0.001$) and left side ($r = 0.436$, $p = 0.010$). **Conclusion:** This study provides baseline morphometric reference data for hip bone length and breadth in the Bangladeshi population. Both dimensions showed slight left-sided dominance and significant positive bilateral correlations. These findings may be useful for comparative anatomy, population-specific osteometric databases, forensic anthropology, and skeletal identification.

Keywords: Breadth, Hip Bone, Length, Morphometry, Osteometry.

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INTRODUCTION

The hip bone, or coxal bone, is a major component of the pelvic girdle and contributes substantially to the formation of the bony pelvis. It is formed by the fusion of the ilium, ischium, and pubis around the acetabulum. The hip bone has important structural and functional roles in supporting the body, transmitting weight from the axial skeleton to the lower limbs, and maintaining stability during standing and locomotion [1, 2]. Detailed knowledge of its anatomy is

essential for both clinical practice and anthropological study [3, 4]. Morphometry involves the quantitative assessment of the dimensions and proportions of anatomical structures. Morphometric evaluation of the hip bone is important in anatomical, anthropological, and forensic studies because skeletal dimensions may vary among different populations and between the two sides of the body [5, 6]. Such measurements can provide useful population-specific reference data and may contribute to the assessment and identification of skeletal remains [5,

6]. The length and breadth of the hip bone are important linear parameters for describing its overall size and proportions. Pullanna *et al.*, studied 100 dry adult human hip bones from a South Indian population and reported a mean hip bone length of 20.29 ± 1.02 cm in males and 18.31 ± 0.93 cm in females, with corresponding mean breadths of 14.39 ± 0.73 cm and 13.50 ± 0.75 cm, respectively [7]. Kausar *et al.*, examined 60 dry adult human hip bones from the Kashmir population and reported a mean length of 20.80 ± 1.15 cm on the right side and 19.59 ± 1.26 cm on the left side, with a mean breadth of 14.14 ± 1.16 cm on the right and 14.35 ± 1.18 cm on the left [8]. Purohit *et al.*, evaluated 57 dry adult human hip bones and reported differences in breadth according to sex and side, with values ranging from approximately 13.60 ± 0.69 cm to 14.60 ± 0.80 cm across the examined groups [9]. Demir *et al.*, studied 72 dry adult human hip bones from a Turkish adult population and reported a mean hip bone breadth of 153.22 ± 9.96 mm [10]. These studies demonstrate measurable variation in hip bone dimensions between populations and between sides. The differences reported among South Indian, Kashmiri, North Indian, and Turkish populations highlight the importance of establishing local osteometric reference values. Such data may be useful for comparative anatomy, anthropological research, forensic investigations, and future studies involving skeletal remains. Although numerous studies have investigated hip bone morphometry in Indian, Kashmiri, Turkish, and other populations, available population-specific information for Bangladesh remains limited. Therefore, the present study was undertaken to assess the length and breadth of dry adult human hip bones in a Bangladeshi population. The study also aimed to evaluate these measurements according to anatomical side and determine the relationship between hip bone length and breadth. The findings may provide useful baseline morphometric data for the Bangladeshi population and contribute to the existing literature on population-specific variation in hip bone dimensions.

METHODOLOGY

A descriptive cross-sectional morphometric study was conducted on dry adult human hip bones from the Departments of Anatomy, Mymensingh Medical College and Community Based Medical College, Mymensingh, Bangladesh. A total of 150 fully ossified hip bones were selected by purposive sampling: 82 (54.7%) right-sided and 68 (45.3%) left-sided.

Inclusion and Exclusion Criteria:

Included were morphologically normal, intact, fully ossified adult hip bones suitable for accurate landmark identification. Fractured, deformed,

incompletely ossified, structurally damaged, or abnormal bones were excluded.

Measurement Procedure:

Hip bone length and breadth were measured in centimeters using standard osteometric methods with digital sliding calipers, measuring tape, plastic scale, and metallic scale. Length was the maximum distance between the highest point of the iliac crest and the lowest point of the ischial tuberosity. Breadth was the maximum distance between the anterior superior iliac spine and the posterior superior iliac spine. Each measurement was taken twice; the mean was recorded to the nearest 0.1 cm, with a third reading if the difference exceeded 0.1 cm. Right and left sides were measured separately.

Data Recording and Analysis:

Data were recorded in a predesigned sheet and analyzed statistically. Length and breadth were expressed as range, mean, and standard deviation for each side. Pearson's correlation coefficient assessed the relationship between length and breadth. A p-value <0.05 was considered statistically significant.

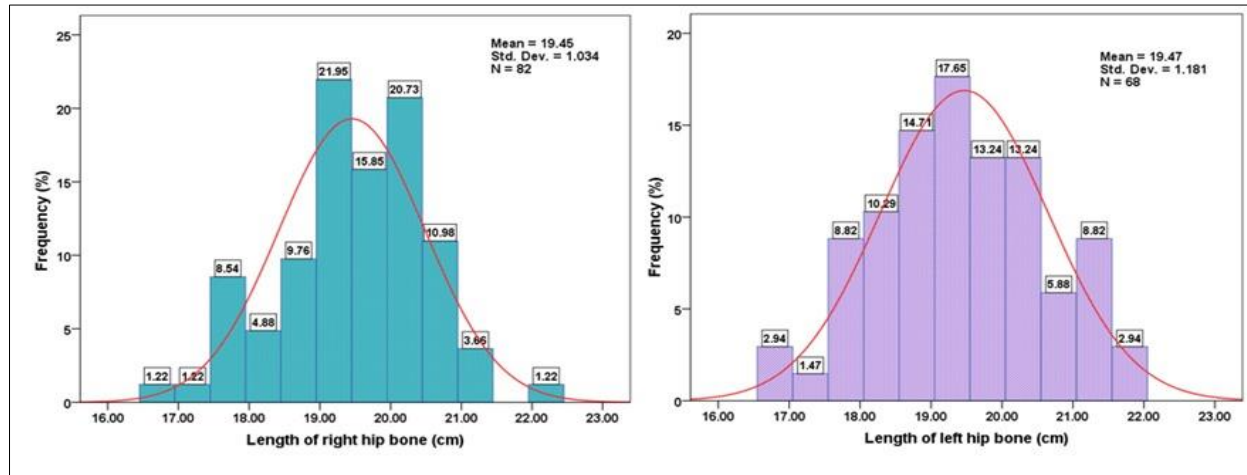
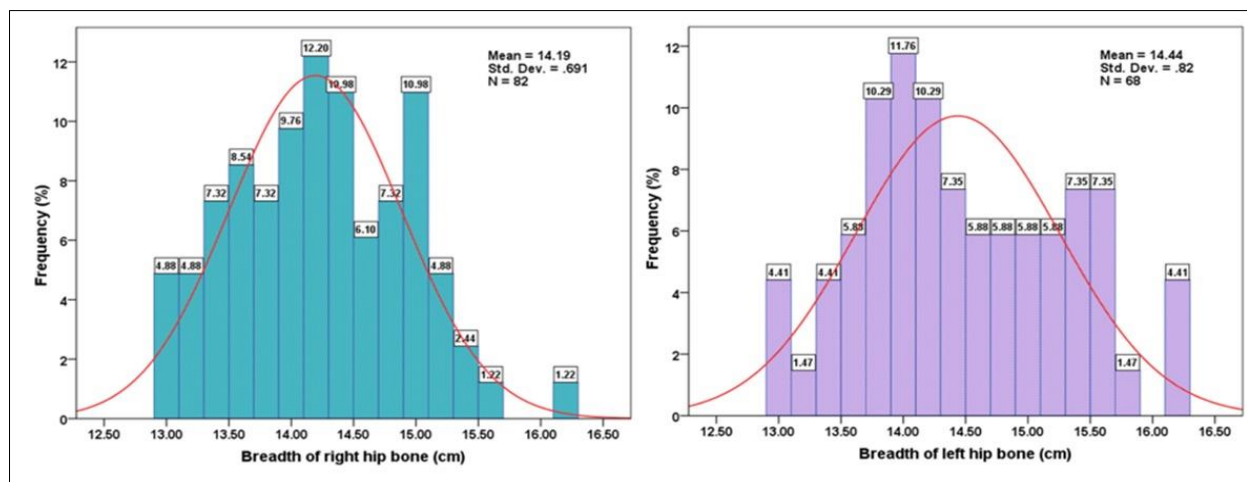
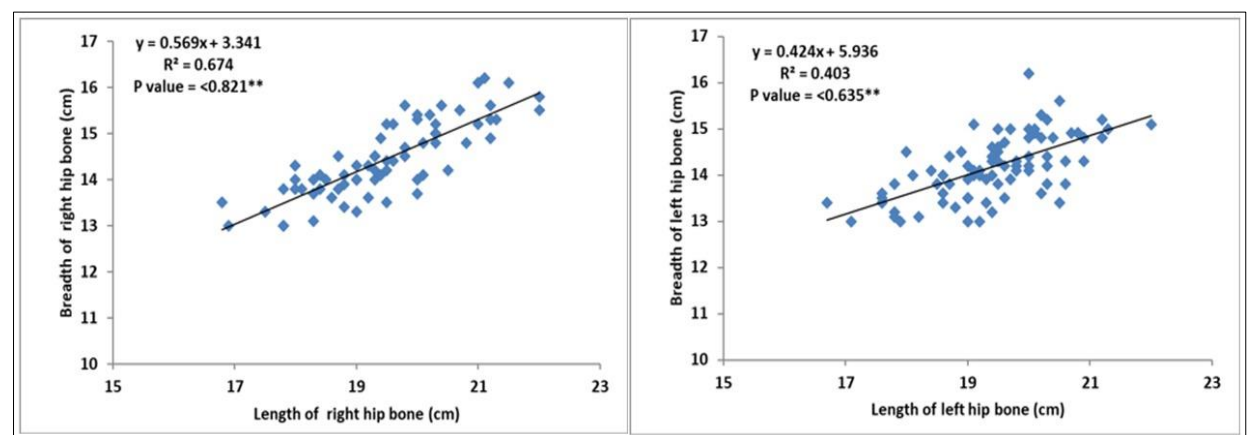
Ethical Considerations: The study used archived dry bones and received institutional ethical approval.

RESULTS

A total of 150 dry adult human hip bones were included in the present study, comprising 82 (54.7%) right-sided and 68 (45.3%) left-sided specimens. The linear measurements of hip bone length and breadth are summarized in Table 1. The length of the right hip bone ranged from 16.7 to 22.0 cm, with a mean of 19.45 ± 1.03 cm. The left hip bone length ranged from 16.8 to 22.0 cm, with a mean of 19.47 ± 1.18 cm. Thus, the mean length was slightly greater on the left side, although the difference was small. The frequency distribution of hip bone length on both sides is shown in Figure 1. The breadth of the hip bone ranged from 13.0 to 16.2 cm on both sides. The mean breadth was 14.19 ± 0.69 cm on the right side and 14.44 ± 0.82 cm on the left side, again showing a slightly higher mean value on the left. The frequency distribution of hip bone breadth on both sides is presented in Figure 2. Pearson correlation analysis demonstrated a significant positive correlation between hip bone length and breadth on both sides. On the right side, the correlation coefficient was $r = 0.376$ ($p = 0.001$), and on the left side, it was $r = 0.436$ ($p = 0.010$). These findings indicate that greater hip bone length is associated with greater breadth. The correlation between length and breadth on both sides is illustrated in the scatter diagram in Figure 3.

Table 1: Linear measurements of hip bone (N=150)

Variable	Side	Range		Mean	±SD
		Minimum	Maximum		
Length of hip bone (cm)	Right	16.7	22	19.45	1.03
	Left	16.8	22	19.47	1.18
Breadth of hip bone (cm)	Right	13	16.2	14.19	0.69
	Left	13	16.2	14.44	0.82

**Figure 1: Histogram showing the frequency distribution of the length of both hip bones****Figure 2: Histogram showing the frequency distribution of the breadth of both hip bones****Figure 3: Scatter diagram showing correlation between length and breadth of hip bones on both sides**

DISCUSSION

The present study evaluated the morphometric characteristics of 150 dry adult human hip bones from a Bangladeshi population, comprising 82 right-sided and 68 left-sided specimens. The mean length of the hip bone was 19.45 ± 1.03 cm on the right and 19.47 ± 1.18 cm on the left, while the corresponding mean breadths were 14.19 ± 0.69 cm and 14.44 ± 0.82 cm. Both length and breadth were slightly greater on the left side, although the differences were small. A significant positive correlation was observed between length and breadth on both sides, indicating that larger hip bones tend to have greater breadth. The mean hip bone length in the present study was lower than that reported in a South Indian population, where mean lengths of 20.29 ± 1.02 cm in males and 18.31 ± 0.93 cm in females were documented [7]. The overall value in the present study falls between these sex-specific values, which may partly reflect the unknown sex composition of the present sample. The same study reported mean breadths of 14.39 cm in males and 13.50 cm in females, whereas the present study recorded mean breadths of 14.19 cm and 14.44 cm on the right and left sides, respectively [7]. Direct comparison should be interpreted cautiously because the present specimens were of unknown sex. A study from a Kashmiri population reported mean hip bone lengths of 20.80 ± 1.15 cm on the right and 19.59 ± 1.26 cm on the left [8]. Compared with these findings, the present study showed a lower right-sided mean but a comparable left-sided mean. The difference may be related to population characteristics, sample composition, or methodological variation. That study similarly emphasized that differences between morphometric series may reflect ethnic and racial variation [8]. Another study from a North Indian population reported variation in hip bone breadth according to sex and side, with values ranging from approximately 13.60 ± 0.69 cm to 14.60 ± 0.80 cm across the examined groups [9]. The mean breadths observed in the present study, 14.19 cm on the right and 14.44 cm on the left, are within this previously reported range. This similarity suggests that the breadth of the Bangladeshi hip bones may be broadly comparable with measurements reported from neighbouring South Asian populations, despite possible differences in sex distribution and sampling. A study in a Turkish population examined 72 adult hip bones of unknown sex and reported a mean hip bone breadth of 153.22 ± 9.96 mm (15.32 cm) [10]. The mean breadths in the present study were slightly lower than this value. Such differences further support the existence of population-specific variation in pelvic morphology and the need for local reference data [11]. Several studies have emphasized that skeletal dimensions vary among populations and that population-specific osteometric databases are essential for accurate anthropological and forensic assessment [12]. In the context of Bangladesh, published morphometric data on the hip bone remain scarce, and the present findings help address this gap [13]. Standardized osteometric methods, as employed in

this study, are essential for obtaining reliable and comparable measurements across populations [14]. The hip bone is of considerable importance in forensic anthropology, where linear dimensions such as length and breadth can contribute to skeletal identification and biological profiling [15]. Although the present study did not assess sex, previous research has demonstrated that hip bone dimensions exhibit sexual dimorphism and can aid in sex determination when used alongside other morphological traits [16]. Advanced morphometric techniques, including geometric morphometrics, have further improved the understanding of hip bone shape variation and sexual dimorphism [17]. Such approaches complement traditional linear osteometry and highlight the value of combined metric and morphological assessment [18]. In summary, the present study provides baseline morphometric data on the length and breadth of dry adult human hip bones in a Bangladeshi population. The findings contribute useful population-specific osteometric information for anatomical, anthropological, forensic, and comparative skeletal studies.

Limitations

The study had several limitations. The sex and exact age of the hip bone specimens were unknown, which precluded sex- and age-specific analysis. The sample was obtained from limited anatomical collections in Mymensingh, which may restrict the generalizability of the findings. Interobserver measurement variation and population-level representativeness could not be fully assessed.

CONCLUSION

The present study provides baseline morphometric data on the length and breadth of dry adult human hip bones in a Bangladeshi population. Mean length and breadth were slightly greater on the left side than on the right. A significant positive correlation was observed between length and breadth on both sides. These findings provide useful population-specific osteometric information for anatomical, anthropological, forensic, and comparative skeletal studies.

Recommendation

Further multicenter studies involving larger samples from different regions of Bangladesh are recommended to establish comprehensive population-specific reference standards. Future investigations should document the sex and age of specimens and evaluate additional relevant morphometric parameters. Standardized measurement protocols and advanced statistical analyses may improve the reliability and applicability of future findings.

Conflict of Interest Statement

The authors declare that they have no conflicts of interest related to this study. No financial or external funding was received for the research. The corresponding author had complete access to the study

data and assumed full responsibility for the final decision to submit the manuscript for publication.

AI DECLARATION

Artificial intelligence (AI) tools were used to a limited extent during manuscript preparation and development. All scientific content, data interpretation, and final manuscript material were reviewed and verified by the authors.

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