



ORIGINAL ARTICLE

Sexual Dimorphism in Total Length of Fully Ossified Dry Human Left Tibia

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Abstract

Background: Determination of sex from skeletal remains is one of the important aspects of Osteometric analysis. **Objectives:** The present study was planned to collect data regarding total length of fully ossified dry human left tibia and to find out possible variations in male and female. **Methodology:** This analytical type of cross-sectional study was conducted in the Department of Anatomy at Sir Salimullah Medical College, Dhaka, Bangladesh from July 2014 to June 2015 for a period of one year. In this study fully ossified dry human left tibia of unknown sex were collected from In this study fully ossified dry human left tibia of unknown sex were collected from the department of Anatomy and also from the students of Sir Salimullah Medical College (SSMC), Dhaka, Ibrahim Medical College (IMC), Dhaka, Dhaka National Medical College (DNMC), Dhaka and Bangladesh Medical College (BMC), Dhaka. The study samples were distributed in male and female sex groups by discriminate function analysis. Total lengths were measured with the help of an osteometric board. **Results:** A total number of two hundred (200) fully ossified dry human left tibia of unknown sex were analyzed. The mean (\pm SD) values of total length were greater in male (38.82 ± 2.94) cm than female (33.48 ± 1.68) which was statically significant ($p < 0.001$). **Conclusion:** In conclusion the total length is greater in male compared to female. [*Journal of Current and Advance Medical Research* 2018;5(1):7-10]

Keywords: Total length; discriminant function analysis; sex differentiation

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Introduction

Sex estimation is one of the prime factors which are employed to establish the identity of a person¹. In human body, tibia is the stronger and second largest bone next to femur. It is commonly recognized as the large weight bearing bone of the leg. The knee joint has a screw-home mechanism, where the joint is locked during the process of extension and is then unlocked during the process of flexion². Overuse injuries of knee include tendinitis, bursitis, muscle sprains and ilio-tibial band syndrome. Extensive knowledge of morphological variation of tibial plateau can lead us to better prevention and preparation of possible surgical interventions of knee³. The thick shell is the cortical part of bone, which provides most of the mechanical strength. A tibial stress fracture or “hairline fracture is caused by repeated bending, usually from weight-bearing activity⁴. Medial tibial stress syndrome or shin splints are commonly seen in athletes who suddenly increase their duration or intensity of regular practice training⁵. Location and number of nutrient foramina in long bone is important in orthopedic surgical procedure such as joint replacement therapy, fracture repair, bone grafts and vascularized bone microsurgery as well as in medico legal cases⁶. Fracture of tibia is relatively common and occurs most frequently in middle aged and elderly people. Fracture of tibia can be divided into Bumper fracture, Segond fracture, Gosselin fracture, Toddler's fracture. Fracture of tibia is among the most serious long bone fracture, due to their potential for nonunion, mal-union and long-term dysfunction as well as their propensity for open injury⁷. Intra-medullary nailing is the gold standard treatment option for displaced closed or open tibial diaphyseal fracture⁸.

The bone in female slants down and slightly outward in each leg as the result of women typically having wider hips than men. Sex estimation is one of the prime factors which are employed to establish the identity of a person⁹. The anthropometric study of bone is important to determine race and also in medico legal cases for determination of sex. Tibia is an ideal long bone of the limb which is used for sex determination, as it resists erosive forces which act upon it and it remains unaffected even after burial of body¹⁰.

Total length of tibia is by far the best single variable for estimation of sex. So far it is known the morphometric measurement of tibia have not yet been studied in Bangladesh. This study was undertaken to measure the total length of left tibia

and to evaluate the difference in total length of the same between male and female.

Methodology

This analytical type of cross-sectional study was conducted in the Department of Anatomy at Sir Salimullah Medical College, Dhaka, Bangladesh from July 2014 to June 2015 for a period of one years. Dry left sided adult human tibia of unknown sex were collected from the Department of Anatomy and also from the students of Sir Salimullah Medical College (SSMC), Dhaka, Ibrahim Medical College (IMC), Dhaka, Dhaka National Medical College (DNMC), Dhaka and Bangladesh Medical College (BMC), Dhaka. Then the sex was determined by linear discriminant function analysis technique⁸. This linear discriminant function analysis technique was applied to the collected data in as follows: $Z = b_0 + b_1 x_1$; Here Z = Discriminant function, b_0 = Constant*, b_1 = Co- efficient* and x_1 = Total length of left tibia (independent variable).



Figure I: Photograph showing total length of tibia by osteometric board; TL= total length

In this study the value of Z for each specimen was calculated by substituting the values of the variables in the linear function. A sectioning point was created by using the mean discriminant scores which were also known as the group centroids. To assign the case to either male or female sex the product Z was compared to the sectioning point derived by the discriminant function analysis. A value higher than the sectioning point was considered to be male and a value below it was considered to be female. By discriminant analysis

technique the sex was determined and the grouping was done. Afterwards for the measurement of total length of tibia, the straight distance from lateral condyle to the tip of medial malleolus were determined by osteometric board (Figure I). After collection of data, the findings of the study was analyzed by SPSS version 20.0 and revealed important information regarding morphometric variation. Comparison of the values of different variables between male and female was done by unpaired Students 't' test. This study was approved by the Institutional Ethics Committee (IEC) of Sir Salimullah Medical College, Dhaka.

Results

A total number of two hundred (200) dry left sided adult human tibia of unknown sex were collected. The fully ossified dry human left tibia were grouped into male and female by discriminant function analysis technique (Table 1).

Table 1: Distribution of Study Subjects into Different Sex According to Discriminant Functional Analysis Technique

Gender	Frequency	Percentage
Male	102	51
Female	98	49
Total	200	100.0

The range of total length of tibia was 34.61 cm to 46.76 cm in male and 31.11 cm to 39.94 cm in female. The mean (\pm SD) value of total length was 38.82 (\pm 2.94) cm in male and 33.48 (\pm 1.68) cm in female. There was significant difference between total length ($p=0.000$) (Figure II).

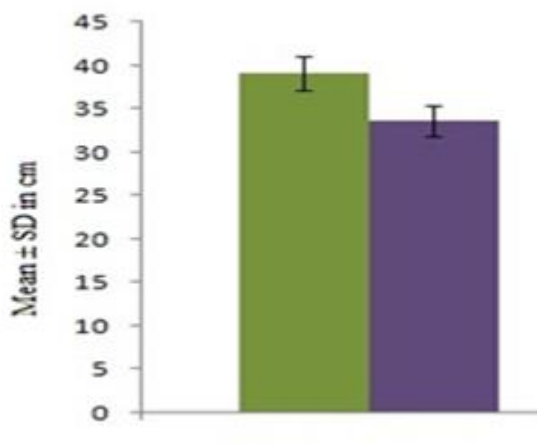


Figure II: Bar diagram showing total length of left tibia in male (n=102) and female (n=98)

Discussion

In the present study the mean (\pm SD) of total length of tibia was found greater in male than female which was statistically significant ($p < 0.01$). This finding which was similar to the study represented by Fernandez et al¹¹ who carried out study on the Ireland population; Kuykendall et al¹² on the South African; Tomicic et al¹³ on the Croatian population. Fernandez et al¹¹ conducted a study on skeletal remains in Ireland population. For this purpose they collected 59 tibias (45 male and 14 female) and had reported the mean (\pm SD) maximum length of tibia was 36.91 \pm 2.626 cm and 33.47 \pm 1.38 cm in male and female respectively. Kuykendall et al⁸ conducted a study on South African Whites for sexual dimorphism. A total number of 169 tibia were measured according to standard osteometric technique. The mean (\pm SD) of total length of tibia was 38.25 \pm 2.36 cm and 35.21 \pm 1.99 cm in male and female respectively. Tomicic et al¹³ conducted a study on medieval Croatian population. A total number of 180 tibias (96 males and 84 females) were measured according to standard osteometric technique. The mean (\pm SD) of total length of tibia was 38.22 \pm 2.140 cm and 34.91 \pm 1.96 cm in male and female respectively. The measured values of the present study was found significantly dissimilar ($p < 0.01$) to the findings reported by Mahajan, Seema¹⁴ and Sirisha et al¹⁵ who worked on the Indian population. Though there was racial similarity but the values of this study showed somewhat contrary ($P < 0.01$).

The present study was carried out in tibia collected from Bangladesh. Skeletons that are available in Bangladesh also come from neighboring countries. Bangladeshis are mixed race of Caucasoid, Negroid, Mongoloid and Australoid group. However the total length in present study was nearly similar to the mean values of other researchers.

Conclusion

This study reveals that the total length of tibia is greater in male than female. The differences in length can be useful in sex differentiation. Further radiographic study of living tibia and comparison of the radiographic findings of fully ossified dry human left tibia might be beneficial in this study.

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