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Osteometric Analysis of Talar facet of Lower End of Dry Human Fibula in a Bangladeshi Population

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Abstract

A cross-sectional, descriptive study which was carried out in the Department of Anatomy, Mymensingh Medical College Mymensingh, Bangladesh, from January 2023 to December 2023, to measure talar facet of lower end of the dry human adult fibula in a Bangladeshi population. A total of 300 (right 152 and left 148) dry human fibula were selected through the purposive sampling technique. Any damaged, unossified, fractured fibula were excluded. The mean maximum lengths of talar facet of the lower end of fibula were found 19.60±2.18 mm and 19.76±1.90 mm on right and left side respectively. The mean diameter of the antero-medial border of talar facet on the right side was 18.58±2.04 mm and 18.83±2.20 mm on the left side. The mean diameter of the postero-medial border of talar facet on the right side was 18.84±2.07 mm and 19.16±2.31 mm on the left side. The mean diameter of the base of talar facet on the right side was 16.61±1.66 mm and 16.94±2.39 mm on the left side. Various osteometric measurements of the distal end of talar facet of the fibula bone are essential in considering the fixity of ankle joint in designing of prostheses for use in ankle anthroplasty and in interpretation of diagnostic analogy of the ankle joints.

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Introduction

The fibula has a proximal head, a narrow neck, a long shaft and a distal lateral malleolus.[1] It takes no part in the transmission of body weight, but it provides attachment for muscles.[1,2] The lower end of fibula is expanded antero-posteriorly to form lateral malleolus. The tip of the lateral malleolus is 0.5 cm lower than that of the medial malleolus. The lateral malleolus projects beyond the medial malleous and has a larger triangular surface on its medial aspect for articulation with the body of the talus.[1-3] The tibial and fibular malleoli hold the body of the talus between them. The medial surface of the lateral malleolus bears a facet for articulation with the lateral surface of the talus, thereby forming the lateral part of the ankle joint.[1,4] Just superior to this articular facet is a triangular area, which fits into the fibular notch on the distal end of the tibia. Fibula rotates laterally, due to the slope of the talar lateral malleolar surface during dorsiflexion at the ankle.[1,5] Hence, The talocrural joint is a major weight bearing joint of the body.[1] Fibula plays an important role in the tibiofibular syndesmosis for the stabilization of the talocrural joint.[1,2] Ankle is one of the most commonly injured joint and very few studies are available on osteometry of the articular surfaces of bones forming the tibio-fibular mortise which will help in the reconstruction surgeries and in the manufacture of implants,[6] which is also applicable in Bangladeshi population. The aim of this study was to evaluate osteometric parameters of the talar facet of lower end of human fibula in a Bangladeshi population.

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Methods

This cross-sectional, descriptive study which was carried out in the Department of Anatomy, Mymensingh Medical College Mymensingh, Bangladesh, from January 2023 to December 2023, on 300 fully ossified dry human fibula, which were collected from the students and anatomy museum. 152 bones are right sided and 148 bones are left sided. A non-random purposive sampling technique was used for sample selection. Fully ossified dry human fibula were included in this study and those bones having any deformity, fractured or pathology were excluded. Four different parameters were taken from this studies. Measurement of the maximum length of the talar facet of lower end of fibula was taken first. The fixed jaw of the digital slide calipers was placed on the mid-point of base of talar facet and the sliding jaw on to the apex of the talar facet. Then the distance between them was measured (Fig.1). Then measurement of the diameter of the antero-medial border of talar facet of lower end was taken. The fixed jaw of slide calipers was placed on the anterior end of base of the talar facet and sliding jaw on to the apex of talar facet and the distance was measured (Fig. 2). Similarly, measurement of the diameter of the postero-medial border of talar facet of lower end was done. The fixed jaw of slide calipers was placed on the posterior end of base of the talar facet and sliding jaw on to the apex of the talar facet and the distance was measured (Fig. 3). Finally, measurement of the diameter of the base of talar facet of lower end was taken. The fixed jaw of slide calipers was placed on the anterior end and sliding jaw on to the posterior end of base of the talar facet and the distance between them was measured (Fig. 4).

Data was collected, compliled and analyzed using the MS-Excel sheet. Data was expressed as mm and also presented as mean±SD (standard deviation). Histograms showed the frequency distribution of measurements of different dimensions of the talar facet as well.

Ethical clearence was obtained from the Institutional Review Board (IRB) of Mymensingh Medical College, Mymensingh, Bangladesh (Memo No. MMC/IRB/2023/575).

Fig. 1: Photograph showing procedure of measurement of the maximum length of talar facet of lower end of fiblula.

Fig. 2: Photograph showing procedure of measurement of the diameter of antero-medial border of talar facet of lower end of fiblula.

Fig. 3: Photograph showing procedure of measurement of the diameter of postero-medial border of talar facet of lower end of fiblula.

Fig. 4: Photograph showing procedure of measurement of the diameter of the base of talar facet of lower end of fiblula.

Results

The maximum length of the talar facet of the lower end of fibula (right sided) ranged from 14.21 mm to 25.82 mm. More than 80% samples were measured within the range of 17.50 mm to 23.75 mm. The maximum length of the talar facet of lower end of fibula (left sided) ranged from 14.05 mm to 25.68 mm. More than 86% samples were found within the range of 17.50 mm to 22.50 mm. The mean maximum lengths of talar facet of the lower end of fibula were found 19.60±2.18 mm and 19.76±1.90 mm on right and left side respectively (Fig. 5). The diameter of the antero-medial border of talar facet of lower end of fibula (right sided) ranged between 14.14 mm and 24.14 mm. More than 80% samples were measured within the range of 16.25 mm to 21.25 mm. The diameter of the antero-medial border of talar facet of lower end of fibula (left sided) ranged between 12.56 mm and 24.54 mm. More than 86% samples were observed within the range of 16 mm to 21 mm. The mean diameter of the antero-medial border of talar facet on the right side was 18.58±2.04 mm and 18.83±2.20 mm on the left side (Fig. 6). The diameter of the postero-medial border of the talar facet in right sided fibulae ranged from 12.84 mm to 24.33 mm. More than 84% samples were measured within the range of 16 mm to 21 mm. The diameter of the postero-medial border of talar facet of lower end of 148 left sided fibulae ranged from 14.31 mm to 25.05 mm. More than 81% samples were observed within the range of 16.25 mm to 21.25 mm. The mean diameter of the postero-medial border of talar facet on the right side was 18.84±2.07 mm and 19.16±2.31 mm on the left side (Fig. 7). The diameter of the base of the talar facet in right sided fibula ranged from 12.56 mm to 21.53 mm. More than 85% samples were measured within the range of 15 mm to 19 mm. The diameter of the base of talar facet in left sided fibula ranged from 11.02 mm to 24.05 mm. More than 78% samples were observed within the range of 14 mm to 19 mm. The mean diameter of the base of talar facet on the right side was 16.61±1.66 mm and 16.94±2.39 mm on the left side (Fig. 8).

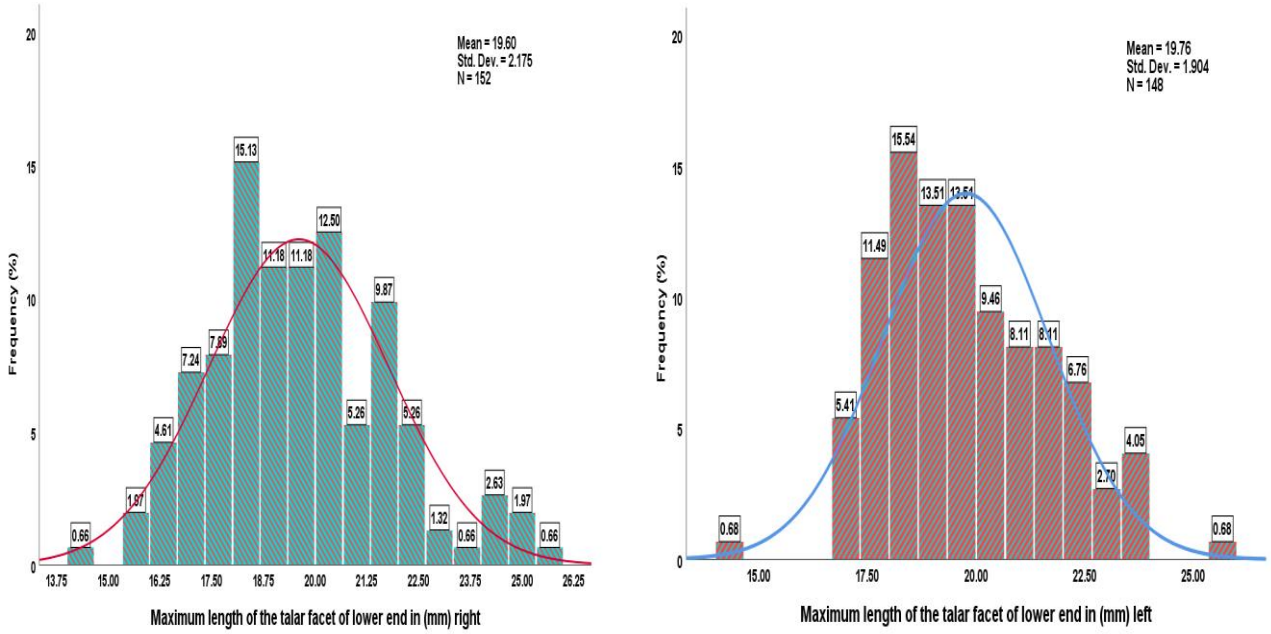

Fig. 5: Histogram showing the frequency distribution of the maximum length of the talar facet of lower end of both sided fibula.

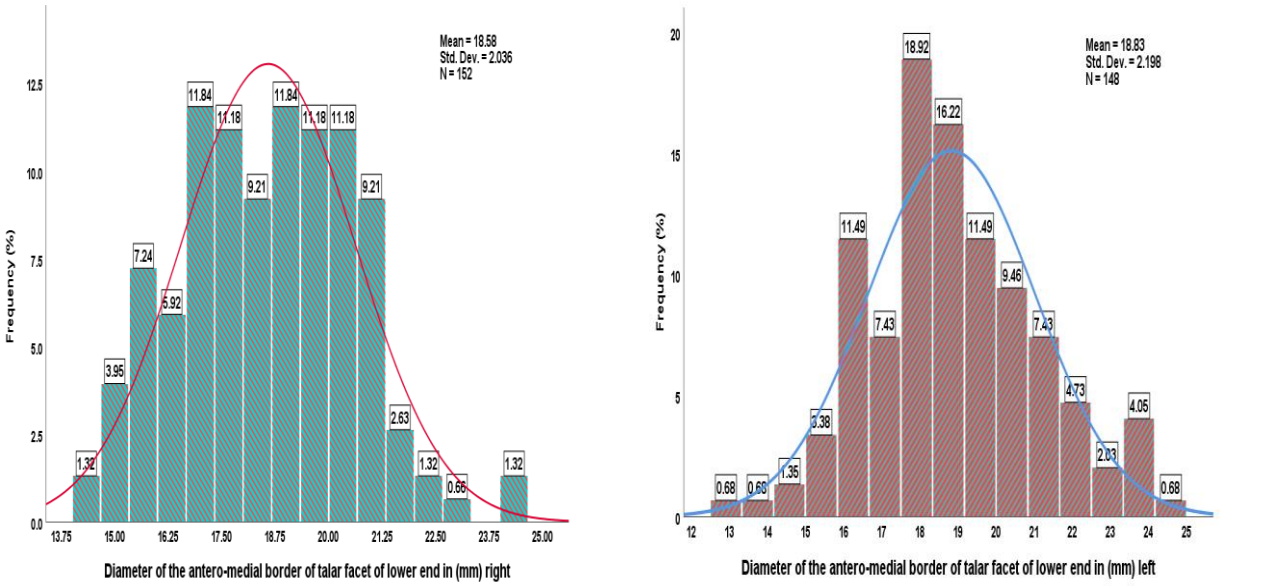

Fig. 6: Histogram showing the frequency distribution of the diameter of the antero-medial border of the talar facet in both sided fibula.

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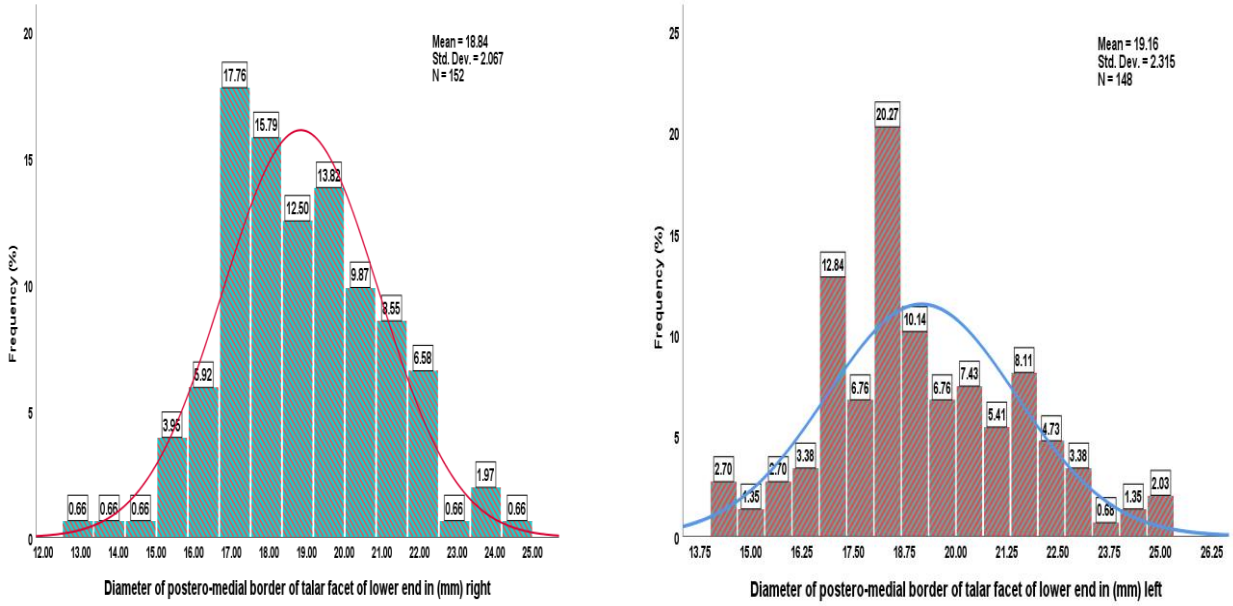

Fig. 7: Histogram showing the frequency distribution of the diameter of postero-medial border of the talar facet in both sided fibula.

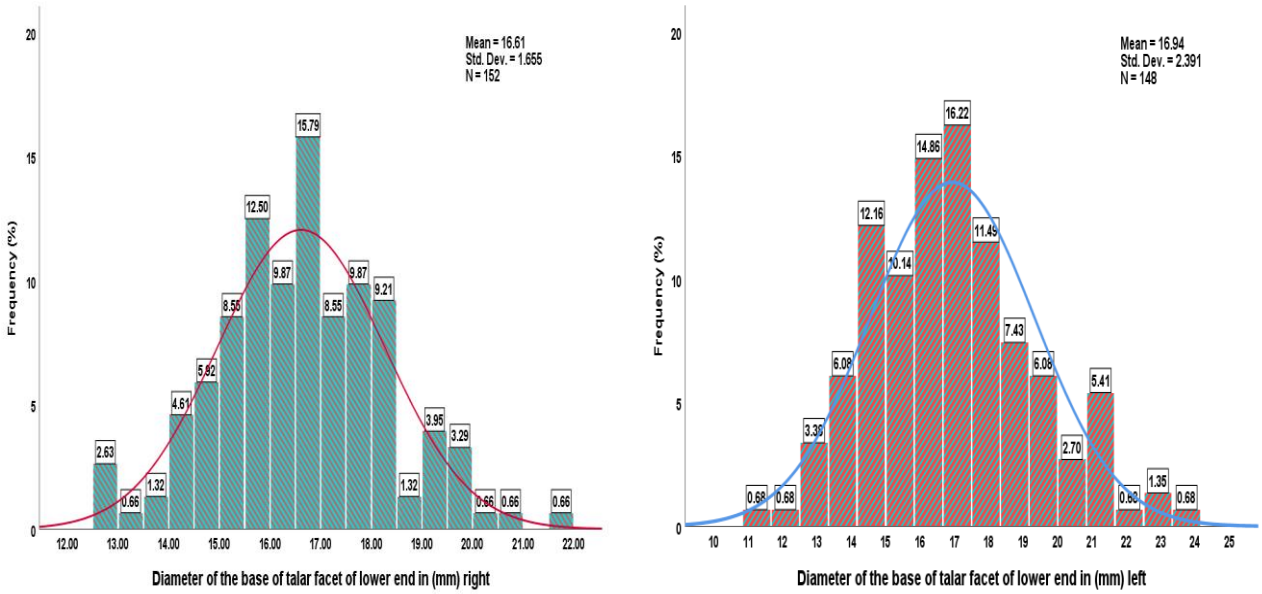

Fig. 8: Histogram showing the frequency distribution of the diameter of the base of the talar facet in both sided fibula.

Discussion

In the present study, The maximum lengths of the talar facet of the lower end of fibula were found 19.60±2.18 mm and 19.76±1.90 mm on the right side and the left side respectively. The mean value of present study was nearly similar to the findings of Labbai & Tapiyawala, as they observed the maximum lengths of the talar facet of the lower end of fibula 20.63±1.64 mm on right side and 20.61±2.07 mm on left side.[7] The mean value of present study was higher than that of Mukhia *et al.,* as they found the maximum lengths of the talar facet 17.5±2.4 mm on right side and 16.9±1.4 mm on left side.[8] In the present study, the mean diameter of the antero-medial border of the talar facet was observed 18.58±2.04 mm on the right side, while 18.83±2.20 mm on the left side. Labbai & Tapiyawala found the diameter of the antero-medial border of talar facet 19.71±1.85 mm on the right side and 19.87±2.10 mm on the left side,[7] and Lingamdeene found 18.62±2.45 mm (both sided fibula).[9] The mean values of our study were nearly similar to the findings of Labbai & Tapiyawala and Lingamdenne. In the present study, the mean diameter of the postero-medial border of the talar facet was found 18.84±2.07 mm on the right side, while 19.16±2.31 mm on the left side. Labbai & Tapiyawala found the diameter of the antero-medial border of talar facet 19.91±1.81 mm on the right side and 20.44±2.05 mm on the left side,[7] and Lingamdeene found 19.76±2.17 mm (both sided fibula).[9] The mean values of our study were nearly similar to the findings of Labbai & Tapiyawala and Lingamdenne. In the present study, the mean diameter of the base of the talar facet were found 16.61±1.66 mm and 16.94±2.39 mm on the right side and the left side respectively. The mean values of our study was nearly similar to the finding of Lingamdenne, as he reported 17.96±2.19 mm (both sided fibula).[9] However, our values were lower than that of Labbai & Tapiyawala, as they reported 18.03±1.98 mm on the right side and 18.07±2.14 mm on the left side.[7] In contrast, our values were higher than that of Mukhia *et al.* as they observed 13.6±1.5 mm on the right side and 13.4 ±1.0 mm on the left side.[8] The talar facet of the fibula is crucial for ankle joint stability and function and also plays a key role in the talocrural joint, which is responsible for dorsiflexion and planter flexion of the foot.[1,10] In addition, the osteometry of the talar facet will lead to advances in design of prosthesis regarding the talocrural joint.[11]

Conclusion

Our data suggests that the size and inclination of triangular articular facet showed remarkable variations from plane to concave/convex, which may signify the amount of variation of morphological dimension and angulation between the talus and fibula in the ankle bony mortice. Our study provides comprehensive data on osteometry of the talar facet of the distal end of dry human adult fibula which will help in building information pool for anatomist, anthropologist, forensic specialist, radiologists, and orthopaedic and reconstructive surgeons.

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