e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(6); 87-96

Original Research Article

Comparative Analysis of Squatting Facets on Femur, Tibia, and Talus: Insights from A Population in Northwest Uttar Pradesh and Cross – Population Comparisons

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Received: 29-04-2023 / Revised: 20-05-2023 / Accepted: 30-05-2023
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Conflict of interest: Nil

Abstract

The aim of this study was to compare the occurrence and size of squatting facets on the talus, femur, and tibia in a population from northwest U.P with previous studies conducted on different populations and races.

Materials and Methods: A total of 231 dry adult human bones (75 femurs, 75 tibias, and 81 tali) were examined. Measurements were taken using a digital Vernier caliper.

Results: Squatting facets were present in 49.33% of the femurs, 48.64% of the tibias, and 60.49% of the tali. The average length, width, and area of the femoral facets were 15.34±6.13mm, 12.24±5.54mm, and 128.08±63.71mm2, respectively. On the tibia, the average length was 21.67±9.85mm, width was 6.96±2.44mm, and area was 101.42±52.13mm2. The mean length, width, and area of the medial facets on the talus were 6.75±3.73mm, 4.02±2.40mm, and 17.61±10.20mm2, respectively. The length of the lateral squatting facets on the talus was 9.89±5.28mm, width was 5.43±3.10mm, and area was 38.12±18.15mm2.

Conclusion: Squatting facets are a direct result of changes in lifestyle. The higher occurrence of lateral squatting facets in the talus in this sample can be attributed to an uneven distribution of body weight, particularly towards the lateral side of the foot. It is also concluded that the incidence of these facets in the current sample is higher compared to Europeans, possibly due to different postural habits and lifestyle factors. These findings can be utilized as an anthropological indicator for distinguishing racial and regional characteristics of unidentified bones.

Keywords: Squatting Facets on Femur, Tibia, and Talus.

Introduction

Squatting is a posture of ease and comfort frequently adopted by many communities and ethnic groups and populations in Asia and Africa. The posture allows a sitter to support the entire body on the feet, which remain the only parts of the human anatomy on the ground. Squatting is an acquired posture learnt right from infancy. Continuous and prolonged squatting perforce engenders minor but identifiable changes in many bones of the lower limb. The dorsum talar neck often shows such a facet: it is caused by the abutment of the lower end of the on the talus. The corresponding area of juxtaposition on tibia also may show an identifiable facet [1,2]. These features are population specific and show racial variations also. [3]

The distal end of the tibia is expanded slightly and has anterior, medial, posterior, lateral, and distal surfaces [4,5,6]. It also has an inferomedial projection called the medial malleolus. The smooth anterior surface bulges beyond the distal surface and is separated by a narrow groove. The capsule of the ankle joint is attached to an anterior groove near the articular surface [7,8]. Remodeling of bone occurs in response to physical stress. Habitual squatting is associated with modifications of the neck of the talus (squatting facets) and its trochlear/malleolar surfaces (trochlear extensions), and individual populations exhibit different incidences of these modifications that reflect their lifestyle [9-13].

Talus is the key bone that links the leg and foot through the ankle joint (14). Though it carries the whole weight of the human body, it has neither tendon nor muscular attachments [15]. There are three articulating surfaces on the talus. The superior articular or the trochlear surface of talus is concave transversely and convex parasagittally. It is wider in front. The articular surface for medial malleolus on talus is deep anteriorly and is coma shaped. The lateral talar surface is triangular and concave vertically [16]. The dimensions of these articular surfaces act as useful in making the ankle implants and for total ankle replacements [17,18]. There is limited data on morphometry of the human tali in North Indian population, and this study will be of use to radiologists, sports therapists and surgeons for diagnosis and treatment of talar neck fractures and in making the talar body prosthesis & in the treatment of congenital talipes equinovarus (CTEV) or club foot, to identify the degrees of pes cavus and pes planus and also will be of great help to forensic anthropologists [19,20,21].

Material and Method:

- The present study was conducted in a Tertiary Teaching Hospital on 230 dry adult human bones of unknown age and sex:
  - 75 femurs (34 – right, 41 – left)
  - 74 tibias (37 – right, 37 – left)
  - 81tali (40 – right, 41 – left)
- Bones showing osteoporotic changes, osteophytes, with apparent pathology or physical damage were eliminated.
- The presence of squatting facets was noted and photographed.
- The outlines of the squatting facets were marked with a 2HB pencil.
- Impressions were taken on the butter paper.
- The area was calculated on graph paper.
- The maximum measurements were taken along the two axes of the facet i.e., length and breadth, using digital Vernier caliper.

Table: 1

S No.	Bone	Squatting facet location
1.	Femur	Infero – medial to the adductor tubercle on the infero – medial angle of the popliteal surface. **Figure 1.**
2.	Tibia	The anterior border of the tibia is in contact with the dorsum of the neck of talus. **Figure 2**.
3.	Talus	**Lateral squatting facet:** dorsum of the neck of the talus and usually continuous with the lateral trochlear surface. **Figure 3.** **Medial squatting facet:** dorsomedial aspect of the neck of the talus, that is not continuous with the trochlear surface. **Figure 3.**

Figure 1: Squatting facet on Femur

Figure 2: Squatting facet on tibia

(M) Squatting facets on Talus

Figure 3: Lateral (L) and Medial

Results

- **Femur:** There was presence of squatting facets on 37 bones (49.33%). It was seen more on left than right. The measurements (mean) were Length: 15.34 ±6.13mm; Breath: 12.24 ± 5.54mm and Area: 128.08 ± 63.71mm^2. Figure 4, 5 and 6.
- **Tibia:** The presence of squatting facet was seen on 36 bones (48.64%). It was seen more on left. The measurements (mean) recorded were Length: 21.67 ± 9.85mm; Breadth: 6.96 ± 2.44mm and Area: 101.42 ± 52.13mm^2. Figure 7,8 and 9.
- Talus: On 49 bones (60.49%) squatting facets were seen. It was seen more on the left. The Lateral squatting facets were seen more than the medial squatting facets.
- **Lateral squatting facets:** The measurements (mean) recorded were Length: 9.89 ± 5.28mm; Breadth: 5.43 ± 3.10mm and Area: 38.12 ± 18.15mm^2. Figure 10, 11, 12.
- **Medial squatting facets:** The measurements (mean) were Length: 6.75 ± 3.73mm; Breadth: 4.02 ± 2.40mm and Area: 17.61 ± 10.20 mm^2. Figure 13, 14, 15.

Figure 4: Length on femur

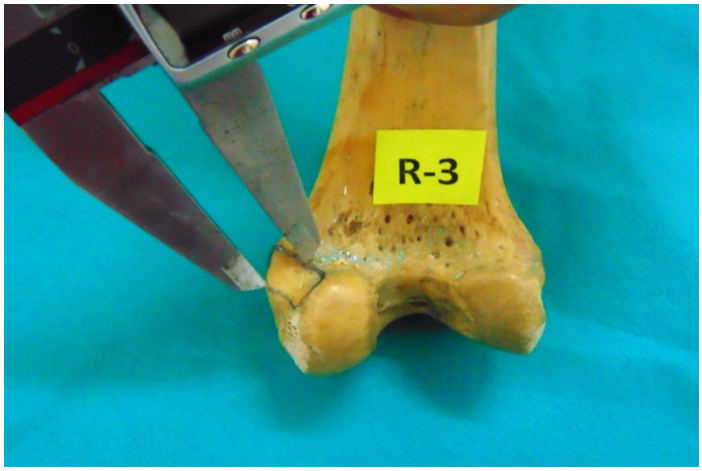

Figure 5: Breadth on femur

Figure 6: Area on femur

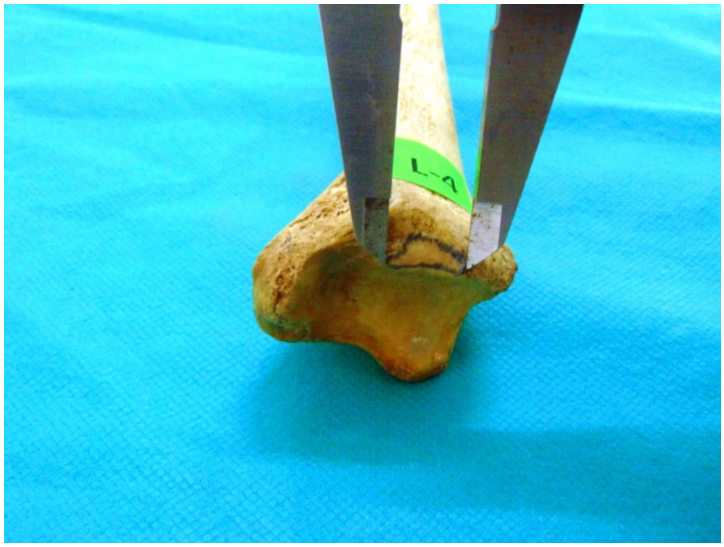

Figure 7: Length on Tibia

Figure 8: Breadth on Tibia

Figure 9: Area on Tibia

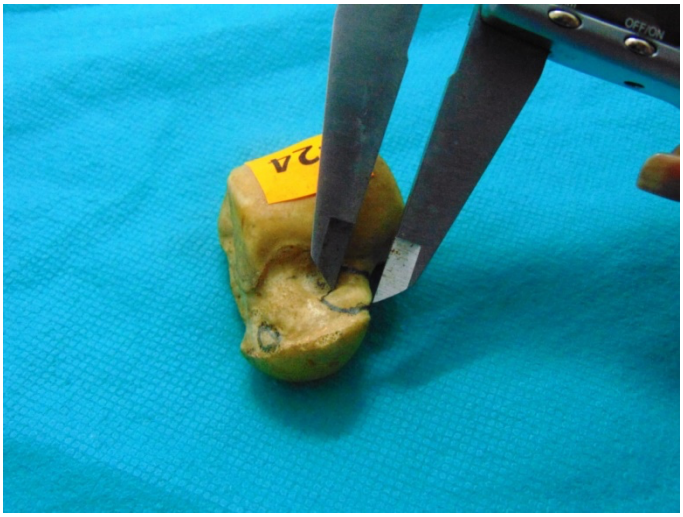

Figure 10: Length of Lateral squatting facet on talus

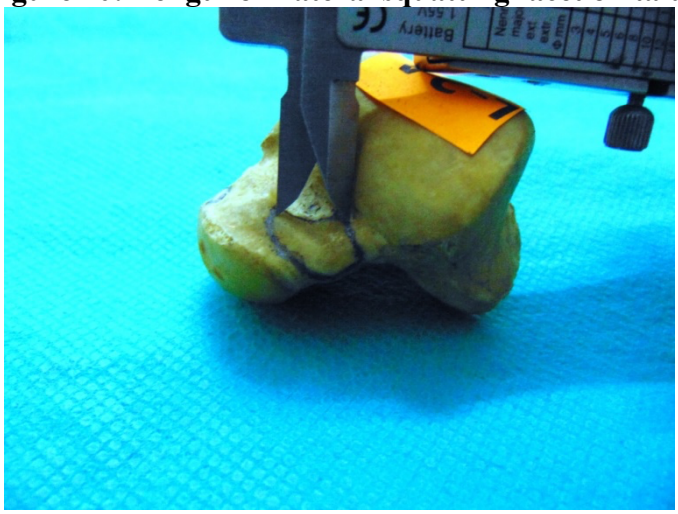

Figure 11: Breadth of Lateral squatting facet on talus

Figure 12: Area of Lateral squatting facet on talus

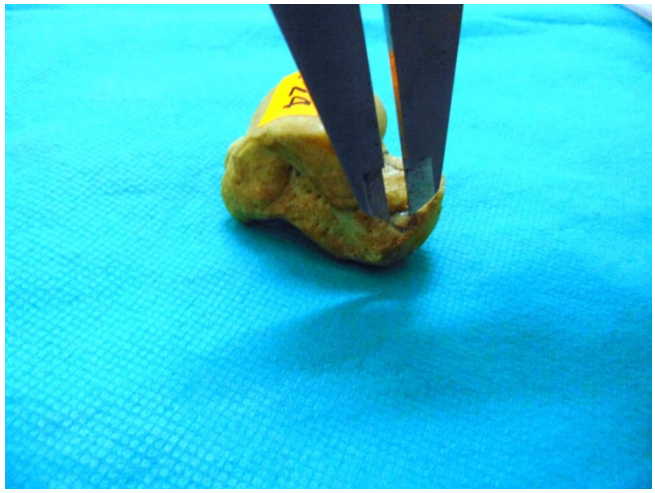

Figure 13: Length of Medial squatting facet on talus

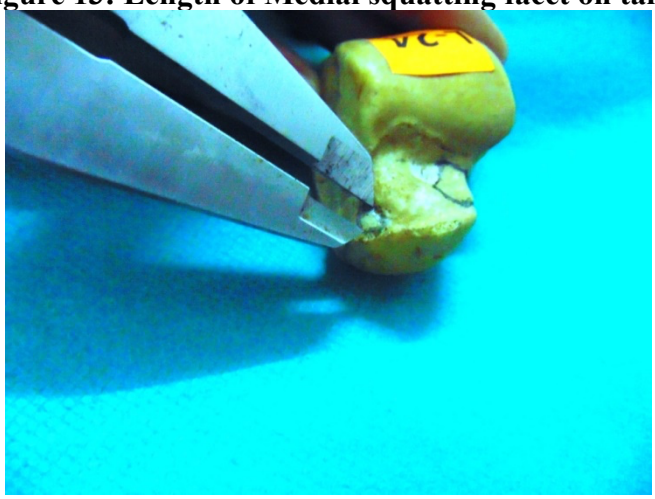

Figure 14: Breadth of Medial squatting facet on talus

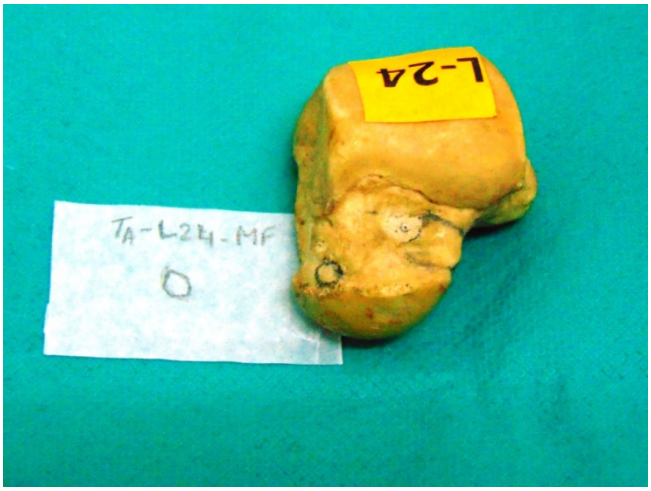

Figure 15: Area of Medial squatting facet on talus

Discussion

Kumar A et al have documented, 104 out of 108 adult femora from the West Coastal region of India show a distinct identifiable squatting facet on their popliteal surface [20]. Arunachalam K have studies 40 femur bones out of which 32 bones have visible and palpable facets & confirmed that femora from Indians show a femoral facet caused by squatting on a very consistent scale[21]. In the present study 37 bones femur out of 75 femurs have shown squatting facets. This drastic difference between the studies might be due to lifestyle changes in people's life as the need for squatting has significantly decreased.

Kumar S et al[22] have studied 30 tibia bones, of which 36.6% have facets on them. in the present study 36(48.64%) of 74 bones have facets, which is on a higher side.

Dixit SG et al[23] studied 147 tali in North Indian population and found 97 (65.9%) bones to have lateral squatting facets and only 12 (8.2%) to have medial squatting facets. Javia M et al[24]also studied 221 bones, in which 114 (51.58%) had lateral squatting facet and 6 (2.72%) had medial squatting facet. Garg et al[25] have studied 300 tali, of which 136(45.3%) have lateral squatting facet and 23(7.7%) have medial squatting facet. In the present study out of 81 tali, 48(59.25%) have lateral squatting facet and 21(25.92%) have medial squatting facet.

In the present study incidence of squatting facet was found more on the left than right side. This may be because the habitual weight bearing limb is left. Higher incidence of lateral squatting facet in talus in this sample can be attributed to unequal distribution of body weight mainly towards lateral side of foot. The later reports of decrease incidence over the years can be attributed to the change in postural habits of the population. These modifications offer an opportunity to study the relationship between past and modern population and describes the daily activity of life and cultural structure.

Conclusion

Squatting facet is a direct consequence of lifestyle modifications. The incidence of facet in the present sample is higher as compared to Europeans due to different postural habits and commodities. This can be used as an anthropological marker for racial and regional differentiation of unidentified bones.

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