OPEN ACCESS

Scholars International Journal of Anatomy and Physiology
Abbreviated Key Title: Sch Int J Anat Physiol
ISSN 2616-8618 (Print) |ISSN 2617-345X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Morphology and Morphometric Study of Human Fibula in Indian Population: A Cadaveric Study

Dr Galphade Samata Pandurang[1]*, Dr Manish Gupta[2]

[1]Msc Medical Anatomy, Index Medical College and Research Centre Indore, Madhya Pradesh
[2]Assistant Professor, Index Medical College and Research Centre Indore, Madhya Pradesh

DOI: https://doi.org/10.36348/sijap.2026.v09i01.002 | **Received:** 19.11.2025 | **Accepted:** 07.01.2026 | **Published:** 10.01.2026

***Corresponding author:** Dr Galphade Samata Pandurang
Msc Medical Anatomy, Index Medical College and Research Centre Indore, Madhya Pradesh

Abstract

Introduction**:* The fibula is an important long bone of the leg that contributes to ankle stability, weight transmission, and serves as a preferred donor site for bone grafting. Knowledge of its morphometry and nutrient foramen characteristics is essential for orthopedic, reconstructive, and vascular procedures. Aim of the research was to study the morphology, morphometry, and position of nutrient foramina of the fibula in an Indian population. A descriptive osteometric study was conducted on 50 dried adult human fibulae, comprising 25 right- and 25 left-sided bones. Measurements of fibular length and articular facet dimensions were recorded using a digital Vernier caliper and osteometric board. Nutrient foramina were identified using a magnifying lens and their positions were classified according to the upper, middle, and lower thirds of the shaft. ***Result: The mean fibular length was slightly higher on the right side (34.52 ± 1.34 cm) compared to the left (34.24 ± 1.42 cm), with no statistically significant side-to-side difference ($p > 0.05$). Measurements of superior and inferior articular facets also showed no significant bilateral variation. A total of 47 nutrient foramina were identified, with the majority (78.7%) located in the middle one-third of the fibular shaft. ***Conclusion:*** The study demonstrates bilateral symmetry in fibular morphometry and a predominant localization of nutrient foramina in the middle third of the shaft. These findings provide useful baseline anatomical data relevant to orthopedic surgery, bone grafting, and forensic applications.

Keywords: Keywords: fibula, morphometry, graft, nutrient foramen.

INTRODUCTION

The fibula is a long, slender bone situated on the lateral side of the leg, running parallel to the tibia. Proximally, it is identified by an expanded head that bears an oval articular facet for articulation with the lateral condyle of the tibia. This head is connected to the shaft by a narrow constricted region known as the neck of the fibula, which serves as a transitional zone between the proximal end and the shaft.[1]

The shaft of the fibula is characteristically twisted and is composed of three borders and three surfaces. On the posterior surface, slightly proximal to the midpoint of the shaft, a nutrient foramen is typically present and is directed distally to transmit a branch of the fibular artery. [2,3]Distally, the fibula enlarges in the anteroposterior dimension to form the lateral malleolus, which contributes to the stability of the ankle joint. The lower end of the fibula also displays a triangular articular facet that articulates with the lateral surface of the talus.[4]

Despite its clinical importance, significant variability exists in the number, position, direction, and course of fibular nutrient foramina[5]. These variations have direct implications for fracture healing, graft harvesting, reconstructive surgery, and forensic identification [6–10]. This research data will strengthen the anatomical database, enhance surgical outcomes, and bridge the gap between basic anatomy and clinical application in orthopedic and reconstructive practice.

The aim this research is to study the morphology and morphometry of fibula in Indian population.

Objectives:

1. To assess morphometric data of fibula.
2. To measure position of nutrient foramen of fibula.

MATERIALS AND METHODS

Study Design: Descriptive observational osteometric study.

Study Setting: The study was conducted in the Department of Anatomy at Index medical college and research centre, Indore, Madhya Pradesh.

Sample Size: A total of 50 samples were included.

Inclusion Criteria

- Dried cadaveric fibula
- Bone should be well preserved

Exclusion Criteria

- Damaged fibula (fracture or pathological lesions)
- Fibula with any congenital deformity
- Poorly preserved fibula (erosion of fibula)

Method of Data Collection

Instruments Use

Digital Vernier Caliper (accuracy: 0.01 mm) were used for the length measurements. Osteometric board was used for measuring total fibular length. Magnifying lens for accurate identification of nutrient foramina.

Osteometric Parameters Measured

Fibular Shaft Measurements

Using a Vernier caliper, the following distances were measured from the nutrient foramen to defined anatomical landmarks:

Fibular Length

Total fibular length was measured from the apex of the fibular head to the tip of the lateral malleolus using an osteometric board.

Talar Facet Measurements

On the distal fibula, the triangular talar facet was studied. The three sides were measured:

- Antero-medial distance
- Postero-medial distance
- Base

Statistical Analysis

Data was analyzed using SPSS software. Results were expressed as mean and standard deviation.

RESULTS

The present study analyzed 50 dried human fibulae, comprising 25 right-sided and 25 left-sided specimens, to evaluate morphometric parameters and the distribution of nutrient foramina. All measurements were recorded in centimetres and expressed as mean ± standard deviation. A p-value of <0.05 was considered statistically significant.

Morphometric parameters of the fibula

Comparison of the overall length of the fibula revealed a marginally higher mean value on the right side (34.52 ± 1.34 cm) compared to the left side (34.24 ± 1.42 cm). However, this difference was not statistically significant ($p = 0.24$).

The mean length of the superior articulating oval facet measured 1.47 ± 0.20 cm on the right side and 1.44 ± 0.21 cm on the left side, showing no significant side-to-side variation ($p = 0.35$). Similarly, the breadth of the superior articulating oval facet was comparable between the right (1.54 ± 0.15 cm) and left (1.58 ± 0.12 cm) fibulae, with no statistically significant difference observed ($p = 0.15$).

Assessment of the inferior articulating triangular facet demonstrated a mean length of 1.77 ± 0.26 cm on the right side and 1.74 ± 0.17 cm on the left side. The difference was minimal and statistically insignificant ($p = 0.16$). The breadth of the inferior articulating triangular facet also showed close similarity between the right (1.38 ± 0.13 cm) and left (1.36 ± 0.15 cm) sides, with no significant difference ($p = 0.28$).

Overall, none of the measured morphometric parameters of the fibula demonstrated statistically significant differences between the right and left sides, indicating bilateral symmetry in the studied population.

Position and number of nutrient foramina

A total of 47 nutrient foramina were identified in the 50 fibulae examined. Of these, 25 foramina (53.2%) were observed in right-sided fibulae and 22 foramina (46.8%) in left-sided fibulae.

With respect to their longitudinal distribution, the majority of nutrient foramina were located in Zone II (middle one-third of the shaft), accounting for 37 foramina (78.7%). Zone I (upper one-third) and Zone III (lower one-third) each showed 5 foramina (10.6% each).

On the right side, 3 foramina were located in Zone I, 20 in Zone II, and 2 in Zone III. On the left side, 2 foramina were observed in Zone I, 17 in Zone II, and 3 in Zone III. The middle one-third of the fibular shaft thus represented the most common site for nutrient foramina on both sides.

These findings indicate a predominant concentration of nutrient foramina in the middle third of the fibula, with no marked asymmetry between the right and left sides.

Table 1: Descriptive statistics for the morphometry of fibula

S. No	Parameters	Right side Mean ± SD (cm)	Left side Mean ± SD (cm)	p-value
1	Length of fibula	34.52 ± 1.34	34.24 ± 1.42	0.24
2	Length of superior articulating oval facet	1.47 ± 0.20	1.44 ± 0.21	0.35
3	Breadth of superior articulating oval facet	1.54 ± 0.15	1.58 ± 0.12	0.15
4	Length of inferior articulating triangular facet	1.77 ± 0.26	1.74 ± 0.17	0.16
5	Breadth of inferior articulating triangular facet	1.38 ± 0.13	1.36 ± 0.15	0.28

Table 2: Position of nutrient foramen according to the side of fibula

Position of Nutrient Foramen	Right Fibula	Left Fibula	Total
Zone I (Upper 1/3rd)	3	2	**5**
Zone II (Middle 1/3rd)	20	17	**37**
Zone III (Lower 1/3rd)	2	3	**5**
Total	**25**	**22**	**47**

DISCUSSION

The purpose of this research was to measure the morphometric data of the fibula using vernier caliper. The present study revealed that mean length of fibula was found to be 34.52 ± 1.34 for the right side and 34.24 ± 1.42 for the left side. Also we have found mean value of the articulating facet measurements. Apart from its shape-shift ability and morphometric consistency, the fibula appears to be superior to any other bone group as it allows for a reduction in operative time (Matsuura *et al.,* 1999).[11] Since the fibula is considered to provide an osseous platform for the prosthetic restoration of an individual, osteometric and morphological data pertaining to the fibula may prove pivotal for reconstruction following disarticulation and fracture (Fernandes; Taser *et al.;* Nguyen & Lin, 2011).[3]

The study also shows the position of nutrient foramen according to the side of fibula. Most common finding was from zone 2 of the fibula which was 20 in right side and 17 in left side. The zone 2 is middle one third of scapula and total 37 foramen was found in this zone. The data obtained from this study may be useful for surgeons for taking the graft of fibula in bone transplant. The limitations of the study include small sample size and should also be done in all age groups.

CONCLUSION

The present study highlights mean length of the fibula of both sides with the number nutrient foramen for each side. The findings may contribute to better understanding of morphometric data of fibula with position and number of foramen and can serve as baseline data for future studies.

REFERENCES

1. Rakesh G, Alok SK. Morphological Study of Nutrient Foramen in Human Fibulae of North Indian Region.
2. Sharma M, Prashar R, Sharma T, Wadhwa A, Kaur J. Morphological variations of nutrient foramina in lower limb long bones. 2015 [cited 2025 Feb 25]; Available from: http://imsear.searo.who.int/handle/123456789/178303
3. Naidoo N, Ishwarkumar S, Lazarus L, Pillay P, Satyapal KS. Osteometría y Morfología de la Fíbula Humana: Un Estudio de Sudáfrica. Int J Morphol. 2015 Sept;33(3):1071–7.
4. Fojtík P, Kostlivý K, Bartoníček J, Naňka O. The fibular notch: an anatomical study. Surg Radiol Anat. 2020 Oct 1;42(10):1161–6.
5. Heitmann C, Khan FN, Levin LS. Vasculature of the peroneal artery: an anatomic study focused on the perforator vessels. J Reconstr Microsurg. 2003 Apr;19(3):157–62.
6. Choi SW, Kim HJ, Koh KS, Chung IH, Cha IH. Topographical anatomy of the fibula and peroneal artery in Koreans. Int J Oral Maxillofac Surg. 2001 Aug 1;30(4):329–32.
7. Kocabiyik N, Yalçin B, Ozan H. Variations of the nutrient artery of the fibula. Clin Anat N Y N. 2007 May;20(4):440–3.
8. Craig JG, Widman D, van Holsbeeck M. Longitudinal stress fracture: patterns of edema and the importance of the nutrient foramen. Skeletal Radiol. 2003 Jan 1;32(1):22–7.
9. Olewnik Ł. Fibularis Tertius: Anatomical Study and Review of the Literature. Clin Anat. 2019;32(8):1082–93.
10. Gupton M, Munjal A, Kang M. Anatomy, Bony Pelvis and Lower Limb: Fibula. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Jan 22]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK470591/
11. Matsuura M, Ohno K, Michi K ichi, Egawa K, Takiguchi R. Clinicoanatomic Examination of the Fibula: Anatomic Basis for Dental Implant Placement. Int J Oral Maxillofac Implants. 1999 Nov 1;14(6):879.