"MORPHOMETRIC STUDY OF HUMAN FIBULAR INSICURA IN DRY TIBIA BONES"

DISSERTATION

Submitted to the Integral Institute of Medical Sciences and Research, Integral University
In partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
IN
MEDICAL ANATOMY

DEPARTMENT OF ANATOMY
INTEGRAL INSTITUTE OF MEDICAL SCIENCES & RESEARCH, INTEGRAL UNIVERSITY, LUCKNOW

Submitted By

FOUZIA QURAISHI
M.Sc. Medical Anatomy
Session 2022-23

GUIDE

DR. KAMIL KHAN
Professor
Department of Anatomy
IIMS&R, Integral University

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GUIDE

DR. KAMIL KHAN

Associate Professor

Department of Anatomy

IIMS&R, Integral University, Lucknow

Co- guide

DR.PRATIBHASHAKYA

Assistant Professor

Department of Anatomy

KGMU, Lucknow

CERTIFICATE

This is to certify that the dissertation "MORPHOMETRIC STUDY OF HUMAN FIBULAR INCISURA IN DRY TIBIA BONES**."** is a bonafide and genuine research work of FOUZIA QURAISHI**.** necessary for award of degree of Master of Science in Medical Anatomy, Session: 2022-23, under the supervision and guidance of Dr. KAMIL KHAN. in the Department of Anatomy, IIMS&R, Integral University, Lucknow.

Dr. Kamil Khan
Professor
Department of Anatomy, IIMS&R
Integral University

DECLARATION

I hereby declare that this dissertation "MORPHOMETRIC STUDY OF HUMAN FIBULAR INCISURA IN DRY TIBIA BONES." is a bonafide and genuine research work carried out by me as per the Research Committee and Ethical Committee guidelines of IIMS&R, under the guidance of Professor Dr. Kamil Khan, Department of Anatomy, Integral Institute of Medical Sciences & Research, Integral University, Lucknow U.P.

FOUZIA QURAISHI.
M.Sc. Medical Anatomy
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Acknowledgement

I dedicate my research work to Almighty God who provided inspirational opportunities to perform this task of uttermost important.

It is the matter of great pleasure for me with a deep sense of gratitude and heartfelt thanks to my guide Dr. Kamil khan professor and head of the Department of Anatomy, IIMS&R Integral University, Lucknow, who guided me from beginning. I am grateful to him, May God bless him with peace, health and happiness throughout his life. I am also thankful to my co-guide Dr. Pratibha Shakya Assistant professor of king George medical college.

I would also like to acknowledge my teachers, Dr. Stuti Tandon, Dr. Mah Paiker, Dr. Shayista for their valuable advice, useful information and generous support.

I am also very thankful to Mr. Asif, for their technical assistant throughout this study.

I am also heartly thankful to my friends Priyanka, Rajkumar, and Ashok Kumar for their co-operation.

FOUZIA QURAISHI

TABLE OF CONTENTS

INTRODUCTION

Tibia is long bone. It is the second largest bone in the human body. It is present on the medial side in the leg. It is the pre-axial bone. It is homologous with the radius which is situated on the lateral side of forearm in upper limb. Tibia also play a role in transmission of weight from femur to foot.

As it is long bone features are same having upper end, lower end and a shaft. Anterior border of shaft of tibia is subcutaneous throughout. Lower end is small and having a medial malleolus.[1]

Medial surface of medial malleolus is subcutaneous and it is easily palpable at ankle joint. Tibia ossifies from the centers one in shaft one in epiphysis. Ossification begins in 7th week of intrauterine life.[2]

In a lower end of tibia there is a lateral surface which is having a fibular incisura which is also called fibular notch.[3] This notch is also called the peroneal groove or syndesmotic notch.[4] The interosseous border of tibia splits distally into anterior and posterior edges.[4] These anterior and posterior edges and tubercles enclose the fibular incisura.[5]

The floor of notch is roughened proximally by a substantial interosseous ligament but is smooth distally and sometimes covered by articular cartilage.[3] Fibular incisura is a notch for articulation with the distal end of fibula to form Distal tibiofibular joint. [6]

Distal tibiofibular joint is a syndesmosis type of fibrous joint.[7] It does not have a fibrous capsule.[8] The Medial aspect of distal fibula lies in the fibular incisura of the tibia which is bordered by a broad anterior tubercle and smaller posterior tubercle.[9] The distal tibiofibular joint takes on a shape between the medial convex surface on the distal end of the fibula and lateral concave surface of the fibular incisura of tibia.[10]

The anterior and posterior tibiofibular ligament, interosseous ligament and inferior tibiofibular ligament stabilizes the joint.[7] These anterior and posterior tibiofibular ligaments are attached to the corresponding edges of the notch.[3] The distal tibiofibular syndesmosis provides stability to the ankle mortise by maintaining the position of the distal fibula in the incisura fibularis.[10]

An intact syndesmosis is critical in maintaining normal ankle function.[9] The morphometric data of this notch is important in assessing the stability of the inferior tibiofibular joint. [4] During fracture or dislocation of the ankle joint it is very important to look for the syndesmosis for disruption and injury because it is important for the treatment and prognosis.[6]

Syndesmotic injuries may be difficult to examine or analyze by the radiographic criteria because there is a variation in the rotation, the wide anatomic variability in the depth of fibular notch of the tibia, and there is also a variation in the shape of anterior and posterior tubercle.[9]

Ankle fractures involving the distal tibial plafond including traditional pilon fractures are usually the result of combined axial load and shear force.[8] Sometimes they are characterized by concomitant fractures and distal tibiofibular syndesmotic injury.[8] To facilitate some complex fractures of fibular incisura. Some studies provide the direct visualization of direct articular fragments.[9]

Syndesmotic injuries are particularly problematic because of the challenges present in the process of diagnosis, operative decision making and reduction.[11] The ability of radiograph measurement to assess the syndesmosis is post-operatively is unknown.[11]

Ankle is one of the most commonly injured joint and morphometry of fibular incisura and distal auricular surfaces of fibula will help in the reconstruction surgeries after dislocation fractures and in the construction of implants.

REVIEW OF LITERATURE

1. Liu Tong, Cheng Yiheng et all; conducted a study on twenty two patient with concomitant fibular and tibiofibular syndesmotic injuries were treated through a fibular notch approach in retrospective study. The quality of fractures and syndesmosis reduction was examined using CT scan and lateral stability of the ankle was assessed by physical examination and stress radiograph safes and reliable approach for the treatment of specific ankle fractures involving the distal tibial plafond studies.[8]

2.Mohd Imtiyaz R.A Sheikh; he conducted a study on 20 males and 20 females for assessing fibular incisura of the tibia. All the individuals were subjected to radio imaging using MRI. Complete details of all subjects were obtained and found that mean depth of fibular incisura among males was greater than females and mean vertical distance of tibiofibular overlapping among males is more than females and concluded that MR imaging is valuable and non-invasive.[9]

3. Michael J. Gardner et all; he conducted a study on 25 patients with ankle fractures and syndesmotic instability who had open reduction and syndesmotic fixation were evaluated. All patients had a standard radiograph series postoperatively followed by a CT scan, axial CT images were judged for quality of reduction of the syndesmosis by measuring the fibula and the anterior and posterior facets of the incisura. He conducted that many syndesmoses were mal reduced on CT scan but were undetected by plain radiographs. Radiographic measurements did not accurately reflect the status of the distal tibiofibular joint in this series of ankle fractures.[11]

4. A Purva S. Shah; They studied on 392 patients (218 females 174 males) with ankle radiographs without knowing clinical abnormality 83 out of 392 patients also had a normal contra lateral radiograph. Tibiofibular overlap and tibiofibular clear space were measured on anteroposterior (AP) and mortise radiographs. Then they sound that there was a subset of patients that had a complete lack of overlap with the greatest gap from this they gave a result that the lack of overlap on the mortise view can represent a normal.[12]

5. Rohul Afza kaloo, Nowsheeba khurshid et all; studied on 30 tibia measurement were taken with the help of vernier caliper. They observed linear association between length of tibia with the breadth of medial malleolus, height of fibular incisura, and the length and width of tibial plafond and concluded that simple linear regression equations were deduced which would predict the expected max length of the bone.[13]

6. Ayfer Mavi and Hanifi Vildrim; took 18 limbs total (9 right 9 left). This group consisted of 10 Males & 8 Females and their ranged between (18-61 yrs). The control group was also made up which is 75 volunteers without previous history of trauma in the ankle. The characteristics, which were observed in the recurrent sprained ankles, may be anatomically predisposed to recurrent ankle sprains.[14]

7. Kim HN, Kim SB, Park Yhl et al; study was performed on 42 patients Group I with 14 cases of ankle fractures with syndesmotic injuries .Group 2nd with 14 cases of without syndesmotic injuries. Group 3rd with 14 cases of volunteers. All patients were of anterior and posterior facet, depth of fibular incisura. Then they found there are some statistical differences of angle between anterior and posterior facet and depth of fibular incisura of the tibia between ankle fractures with and without syndesmotic injuries.[15]

8. Andrazej Bosczyk et al; conducted a study on 75 CT of patients who sustained a high disruption and control group of 75 patients with unrelated foot problems were compared and analyzed the depth of incisura, and rotational orientation of the tibial incisura. Then they dealing with syndesmosis reduction should take into account that the anatomy of the tibial incisura in patients with syndesmotic disruption may not be representative for the whole population.[16]

9. Nabil A. Ebraheim et all (1908); conducted a study on 12 intact embalmed cadavers ‘lower limb (8males 12 females). For assessing the the fibular incisura of tibia on CT, they found that there was an increase in angle between the anterior and posterior facets of the fibular incisura which made the incisura shallow. It was also concluded that evaluation of fibular incisura pre and post operatively clarified the knowledge of interior structure.[17]

10. Hanifi Yildrim , Orhan Buy et all; (2003) conducted a study on 4 males and 32 females aged between 18 to 51 years . Data collected on all subjects included age, Sex, Height and Weight. The MRI was taken 1cm proximal to the tibiotalar joint line with the foot in neutral position. They found that there was a difference according to gender when the ankle mortise was examined and it was also observed that syndesmotic injury might be observed much more frequently in women than men.[18]

11. Ichiro Tonogai et all (2017); assessed measurements from the 120 scans of right feet with a normal distal tibiofibular syndesmosis in Japanese subjects. They found mean posterior tibiofibular distance was greater than the mean anterior tibiofibular syndesmosis and also was significantly greater in males than females.[19]

12. Qing Jun Liu et all (2017); took a CT OF 300 young physical training soldiers with normal ankle and 6 three dimensional scanning of sub cohort participants. From this study they concluded that classification of shapes of distal tibiofibular syndesmosis in three types “C”,” T” And “I”. people with shape type “I” of the distal tibial syndesmosis had more risk of recurrent lateral ankle sprain.[20]

13. Wouter Huysee et all (2018); Studied on CT of 44 diagnosed cases with an unstable high ankle sprain and 25 control subjects with age of 47 years. in this study shallow and shorter fibular incisura of tibia was found in patients with high ankle sprain.[21]

14. Petro Fojtik et all; study was conducted on dry adult tibial bone for assessing the height of fibular incisura at its widest point ,as well as depth as the deepest point 3mm and 10mm above the articular surface of the distal tibia and highest point of this surface and deepest point of this notch from this study they concluded that the deepest of fibular incisura lies 5mm above the articular surface of the distal tibial plafond and mentioned that this region is ideal for assissment of position of distal fibula in fibular incisura.[22]

15. P. Ramasamy et all; conducted study on 30 year old man having an accident and diagnosed with ankle fracture clinic examination revealed a tender ankle joint, particularly anteriorly. The lateral malleolus was much posterior than normal. CT scan confirmed the tibiofibular dislocation than concluded that the distal tibiofibular dislocation injury of the ankle with an intact fibula may present with subtle clinical features.[23]

MATERIAL AND METHODS

Materials & Method:

This study was conducted on the 100 dry tibia (50 right+50 left) which was obtained from the Department of Anatomy in King George Medical University Lucknow, After approval from the institutional ethics committee. Collection of bones from anatomy department was started from the tibia bone measurements of fibular incisura was taken length, depth, height, length of anterior facet, length of posterior facet.

All the measurement were done by using Vernier Calipers.

Inclusion criteria:

100 fully ossified dry bones.

Exclusion criteria:

Abnormal, Pathological fracture or congenital anomalies and broken bone was excluded.

Purpose of study:

The purpose of present study is to measure the fibular incisura on dry bones whose sex, age is not known.

AIMS AND OBJECTIVE

AIM and OBJECTIVE:

AIM:

Aim of present study is to obtain the morphometric data of fibular incisura of tibia with the help of dry bones.

OBJECTIVE:

1. To measure width of fibular incisura.
2. To measure depth of fibular incisura.
3. To measure height of fibular incisura.
4. To measure length of anterior facet.
5. To measure length of posterior facet.

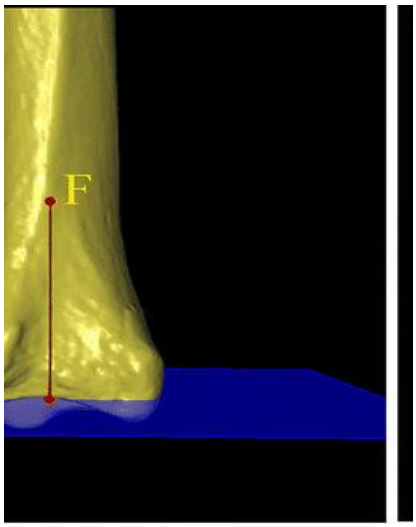
Width of Fibular Incisura: Distance between anterior and posterior tubercle.

(Fig.a)

Depth of fibular Incisura: Distance from the deepest point incisura to the midpoint of the anterior and posterior tubercles.

(Fig.b)

Height of fibular Incisura : Vertical distance between the tibial plafond and the point where interosseous border splits into anterior and posterior edges.



(Fig.c)

Length of anterior Facet: Distance from the tip of the anterior tubercle to the deepest point of fibular incisura.

(Fig.d)

Length of posterior Facet: Distance from the tip of posterior tubercles and deepest point of fibular incisura.

(Fig.e)

OBSERVATIONS & RESULT

Table 1: Test of Normality for different variables for right and left side

Variables	Right side		Left side	
	K-S statistic	p-value	K-S statistic	p-value
Width	0.105	0.200	0.107	0.200
Height	0.108	0.198	0.144*	0.011
Depth	0.197*	0.000	0.186*	0.000
Length of anterior facet	0.147*	0.009	0.150*	0.007
Length of posterior facet	0.125*	0.050	0.175*	0.000

Table 2: Comparison between right side and left side for different variables

Variables	Right side		Left side		p-value
	Mean	SD	Mean	SD	
Width	22.64	2.19	21.18	2.65	0.003*
Height	32.86	4.36	38.16	3.97	0.000*
Depth	5.58	1.13	5.44	1.03	0.490
Length of anterior facet	11.54	1.69	12.12	1.61	0.150
Length of posterior facet	13.88	1.92	12.86	1.69	0.005*

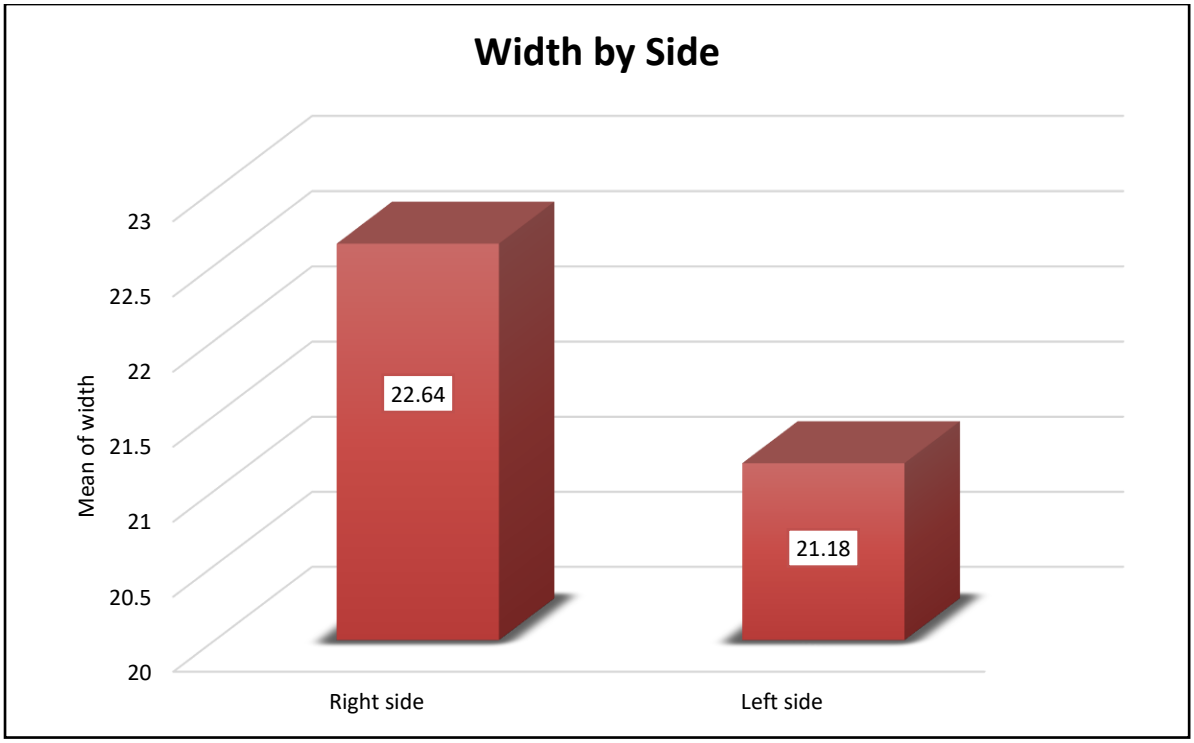


Fig.1: A column chart showing mean width across right and left side.

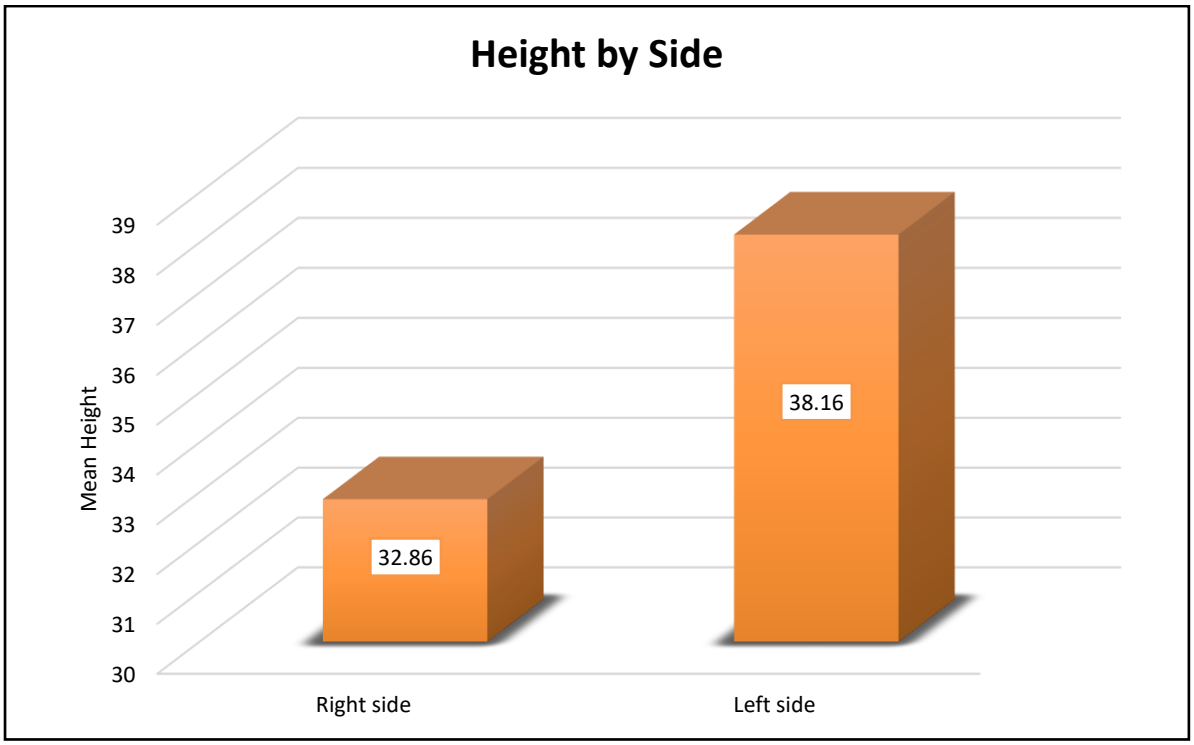


Fig.2: A column chart showing mean width across right and left side.

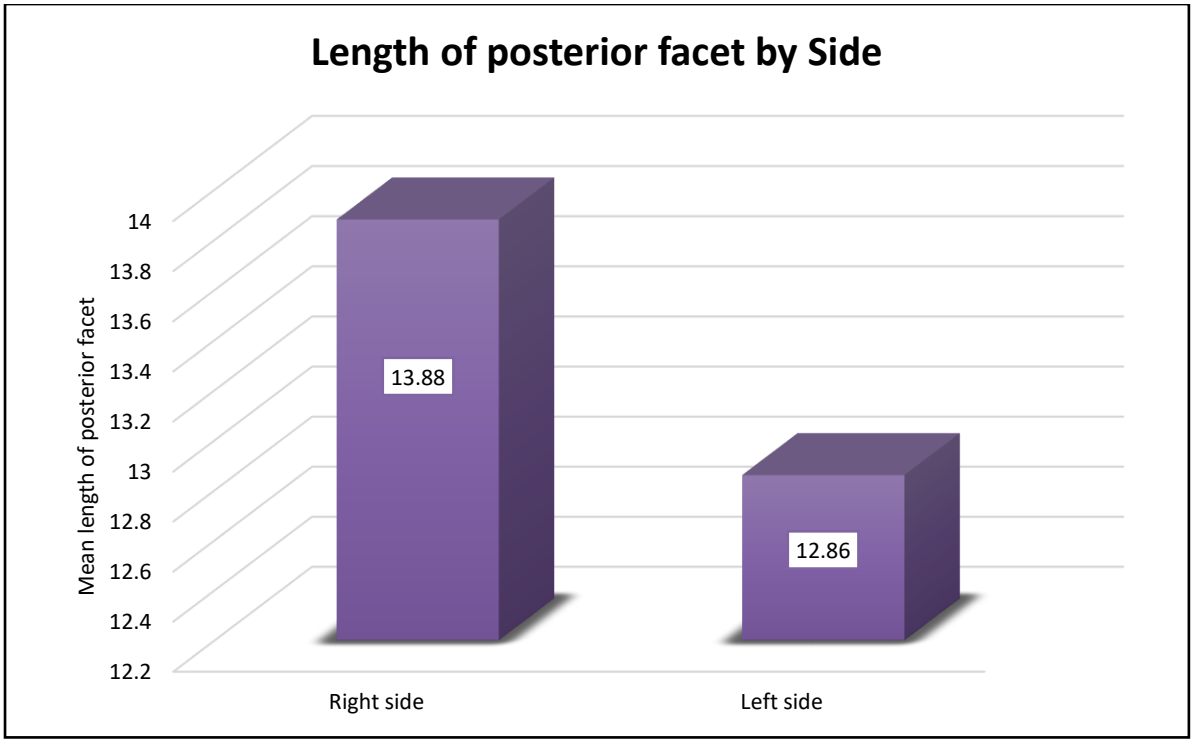


Fig.3: A column chart showing mean length of posterior facet across right and left side.

Additionally, we demonstrated a correlation between length of anterior and posterior facet with height, width, and depth for both the right and left side. A Spearman's rho correlation coefficient suggested that for the right side, length of anterior facet is significantly and positively correlated with width (coefficient = 0.450, $p < 0.05$), height (coefficient = 0.368, $p < 0.05$), and depth (coefficient = 0.450, $p < 0.05$), whereas length of posterior facet was positively and significantly correlated with width (coefficient = 0.385, $p < 0.05$) and height (coefficient = 0.325, $p < 0.05$). Likewise, for the left side, length of anterior facet was positively and significantly correlated with width (coefficient = 0.627, $p < 0.05$) and depth (coefficient = 0.331, $p < 0.05$), whereas length of posterior facet was significantly and positively correlated with width (coefficient = 0.471, $p < 0.05$) only. Fig. 4, Fig. 5, Fig. 6, and Fig. 7 depicted the scatter plots for significant correlations with length of anterior facet for right side and left side, and length of posterior facet for right side and left side, respectively. Fig.4 illustrated that there was a weak to moderate correlation between length of anterior facet and width, height, and depth for

right side, whereas Fig. 5 showed that width was strongly correlated with length of anterior facet for left side. Moreover, Fig. 6 represented that there was a weak to moderate correlation between length of posterior facet and width and height for right side, whereas Fig.7 depicted that width was moderately correlated with length of posterior facet for left side.

Table 3: Correlation between different variables by right and left side

Variables	**Length of anterior facet Coefficient (p-value)**	**Length of posterior facet Coefficient (p-value)**
Right side		
Width	0.450* (0.001)	0.385* (0.006)
Height	0.368* (0.009)	0.325* (0.021)
Depth	0.450* (0.001)	0.247 (0.084)
Left side		
Width	0.627* (0.000)	0.471* (0.001)
Height	0.241 (0.092)	-0.131 (0.363)
Depth	0.331* (0.019)	0.061 (0.674)

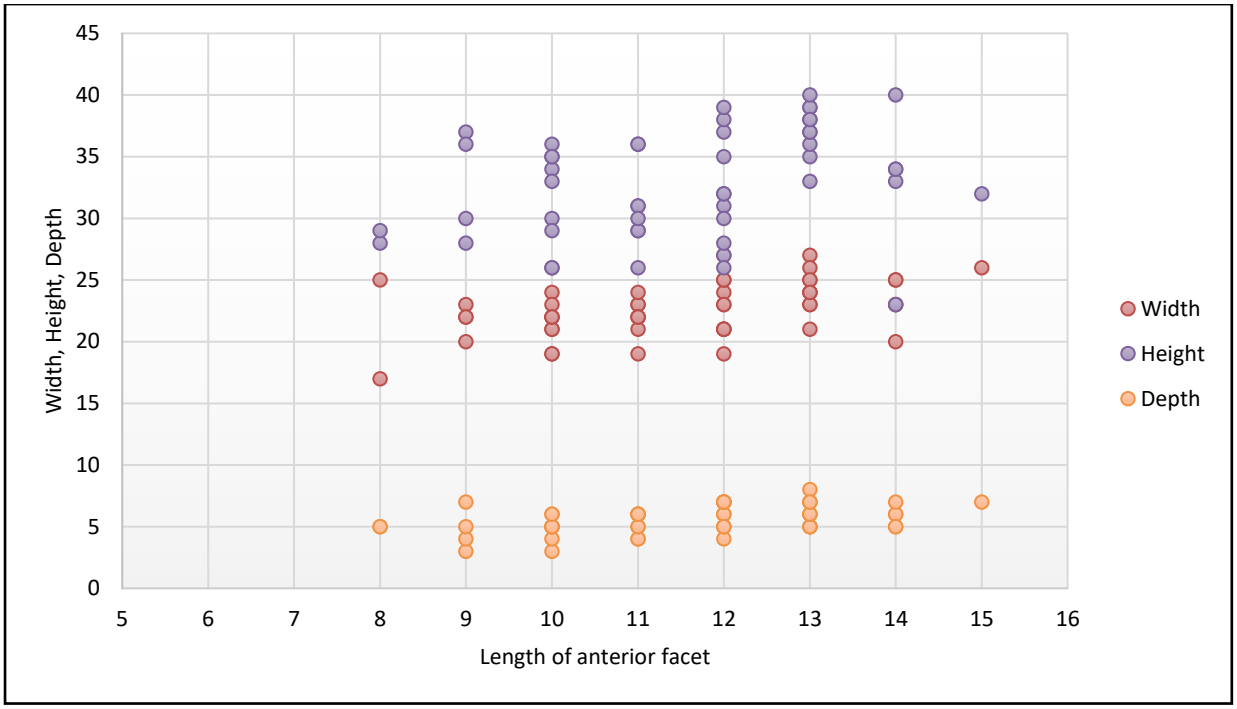
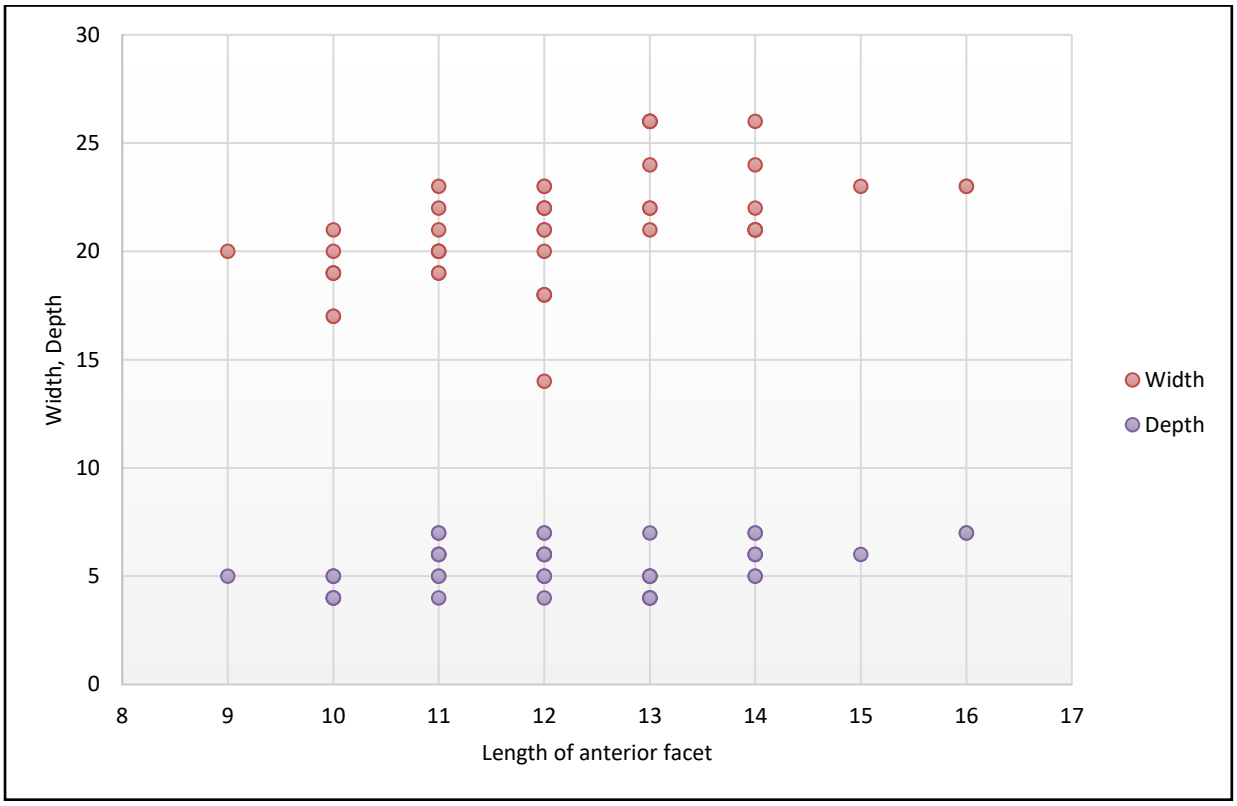
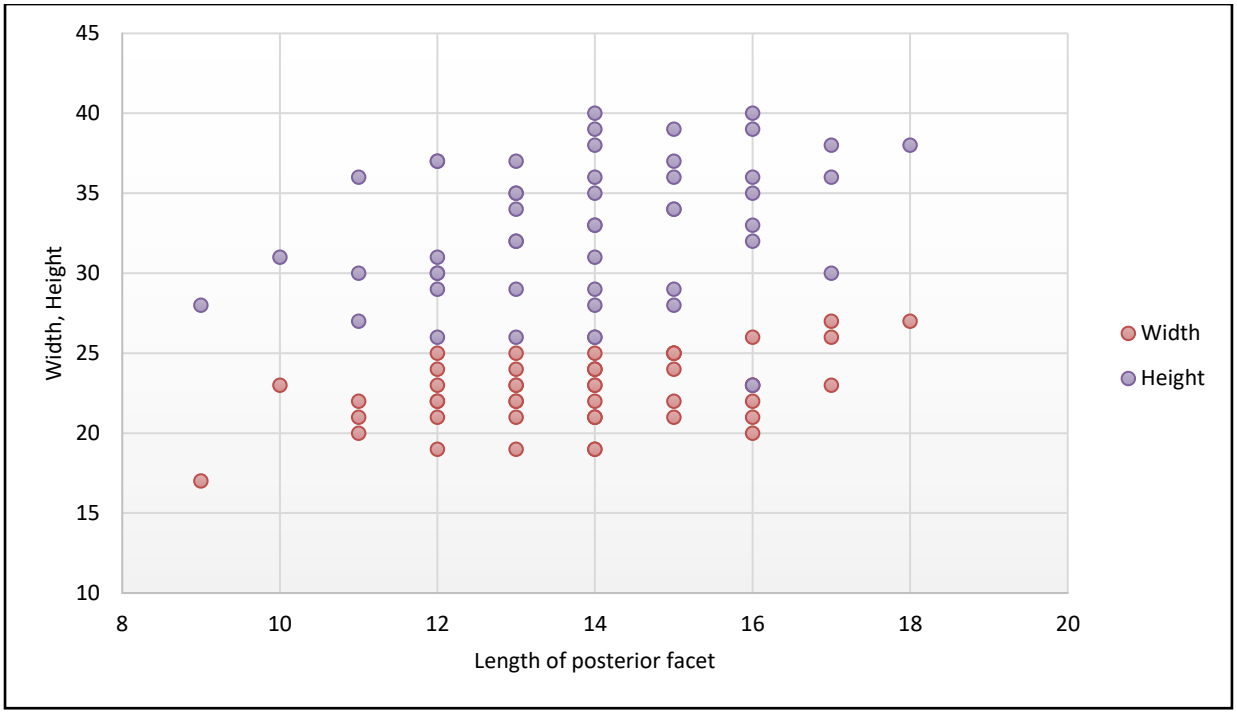
6. 

Fig.4: A scatterplot showing correlation between length of anterior facet and width, height, and depth for right side.

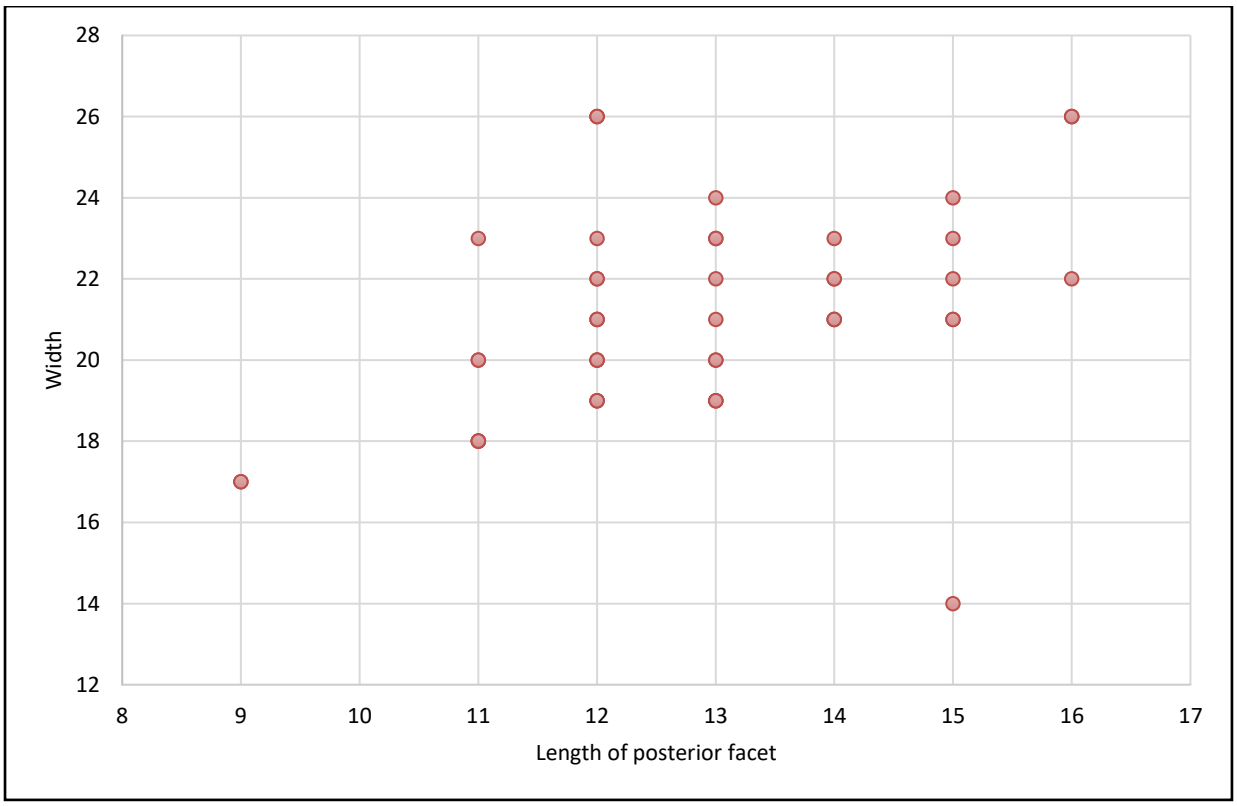
7. 

8. **Fig.5: A scatterplot showing correlation between length of anterior facet and width and depth for left side.**

9.



10. **Fig.6: A scatterplot showing correlation between length of posterior facet and width and height for right side**



RESULTS:

The data analysis was performed on the data collected on 100 dry tibia bones. which was obtained from the king George medical college. All the measurements were taken with the help of vernier calipers. The main objectives of the study were to evaluate width, height, depth, length of anterior and posterior facet on both the right and left sides. For this purpose, we utilized Kolmogorov-Smirnov test for normality and a Mann-Whitney U test (or Independent Sample t-test). Further, we determined the relationship between width, height, and depth of different bones with length of anterior and posterior facet according to the right and left sides.

The results of normality test show that except width, heigh, depth, length of anterior and posterior facet is not normally distributed across right and left side ($p < 0.05$), as presented in Table 1. Thus, a Mann-Whitney U test (or Independent Sample t-test) was employed for a non-normal distribution (or normal distribution). Table 2 represents the comparison between the sides for different bone-related variables. The results suggest that width ($M_R = 22.64$, $M_L = 21.18$; $p < 0.05$), height ($M_R = 32.86$, $M_L = 38.16$; $p < 0.05$), and length of posterior facet ($M_R = 13.88$, $M_L = 12.86$; $p < 0.05$) were significantly distributed across the sides – right and left. A significant difference could be observed in width, height, and length of posterior facet when switching between the right and the left side, as presented in the Fig.1, Fig. 2, and Fig. 3. In Fig. 1, there was a decrease of 1.46 mm in the width of bone, whereas Fig.2 illustrated an increase of 5.3mm in the height of bone when moving from right to left side. Likewise, Fig. 3 depicted a decrease of 1.02 mm in the length of posterior facet when changing from right to left side.

DISCUSSION

An intact tibiofibular syndesmosis joint is important in acquiring the normal functioning of ankle mortise. The anatomical knowledge of tibiofibular syndesmosis is important for the pre and post-operative assessments of ankle surgeries, ankle fractures and ankle sprains either there is a dislocation of joint or not. Therefore, there is a great importance of articulation between fibular incisura and fibula in maintaining the functional and structural integrity of ankle joint. There are many studies which are done by using radiographic images of ankle joint. However, morphometric study on dry bones is less reported.[4]

In the present study the mean width of fibular incisura was 22.64mm on right side and 21.18mm on left side. Study conducted by Rachana et all also found the mean width of fibular incisura was 23.5mm,23.11 on right and left side.

Similar findings by Taser 23.26, Missiani 21.50 and Shivaji 23.94.

Kulkarni RR et all: found the total mean value of the width was 2.35 and 2.31cm right and left side which is almost near to our study.[4]

Hermans et all described that the width of fibular incisura is the representative site of the size of the tibiofibular syndesmosis. A wider incisura indicates a greater separation of the anterior and posterior facets.[4]

The mean depth of fibular notch from the current study was 5.58 and 5.44 mm of right and left side. which is compared to the mean depth obtained by Sora et all (2004) which is 5.07. Our observation is also nearer to the observations given by Rachana et all those observations are 6.22mm 6.14 mm of right and left side.

Shallow fibular incisura have been implicated in pathomechanics of displacement of the fibula associated with fracture dislocation that results in stability of the tibiofibular syndesmosis and the ankle joint.[24]

Anatomy of distal tibiofibular syndesmosis in adults a pectorial essay with a multimodality approach.[24]

Mean height of fibular incisura in the present study is 32.86mm on right side 38.18mm on left side. Missiani , Taser and Shivaji reported it as 32.35 mm,29.43mm and 31.87mm respectively.[4]

A shorter height of the fibular notch indicates a lower bifurcation of the interosseous tibial ridge.[25]

The length of anterior and posterior facets in the present study of right and left side is 11.54mm and 12.12mm which co-relates with the findings of [Rachana]reported as 11.59mm and 14.63mm on right and left side.[4]

CONCLUSION

There is a decrease in width of incisura with increase in height of incisura when moving from right to left.

Width of fibular incisura was strongly co-related with length of anterior facet of left side and moderately co-relate with length of posterior facet of left side.

And there was also a weak to moderate co-relation between length of posterior facet, width and height for right side.

REFERENCE

1.Singh Vishram vol 2. 3rd edition: page no 310

2.Faruqi N.A handbook of osteology .2 edition 2018: page no 145

3.Gray anatomy 14 edition: chapter 83 page no 1412-1414

4. 1.G. Sreedev, Sangam reddy murlidhar; Morphometric study of human fibular incisura in dry bones.vol-7[2] page.69-73[2018]

5.Musa misiani, Pamela mandela, Moses obimbo, Beda olabu, Gichambria gikenya; Morphometric characteristics of fibular incisura in adult Kenyans.Anatomy journal of Africa 2014;3(1):216-222

6.C.Gupta,N Nayak,V Palimar;A morphometric study of incisura fibularis in south Indian population with its clinical implication :Anat Appl phsiol .2018;4(1):84-86

7. Taşer Figen, M.D.,1 Toker Serdar, M.D.,2 Kılınçoğlu Volkan, M.D;Evaluation of morphometric characteristic of the fibular incisura in dry bones .Joint Dis Rel Surg 2009:20(1)52-58. .

9. Sheikh.A.R Imtiyaz ;Assessment of the human fibular incisura of the tibia. Journal of cardiovascular disease research.vol.10.

10.Misir Abdulhamit, uzun Erdal, Tokmak Tursem Turgut; Morphology of the incisura fibularis in the Turkish population: Ann Med Res2021;28(3):464-70.

11.Gardner.J Michael, Demetrakopoulos demetrics,Briggs .M Stephen,Helfet.L David,Lorich G.Dean; Malreduction of the tibiofibular syndesmosis in ankle fractures.Foot and ankle international \vol.27,no.10\october 2006.

12.Shah.S Apurva, Kadakia.R Anish,Tan .J Giselle,Mark S.Karasheh,Wolter D.Troy, and Sabb Brian; Radiographic Evaluation of the Normal Distal Tibiofibular Syndesmosis.Foot and ankle international \vol33

13.Afza Rohul and Khursheed Nowsheeba;Morphometric study of Distal end of Tibia ,with special emphasis on morphometry of fibular incisura and its clinical implication. volume 8.

14.Mavi ayfer, Yildrim hanifi, Gunes hasan, Pestamalci Turan,Gumusburn Erdem;The fibular incisura of the tibia with recurrent ankle on magnetic resonance imaging. Saudi Med J 2002;vol.23(7):845-849.

15.HN Kim, SB Kim, YW Park; Anatomical differences of the fibular incisura of the tibia between ankle fracture and syndesmotic injury and without syndesmotic injury. J Korean foot and ankle soc.2008 dec ;12(2):150-155.

16.Boszczyk Andrzej, Kwapisz Slawomir,Rene Greass,Stefen Remmelt;Anatomy of the tibial incisura ;Anatomy of the tibial incisura as a risk factor for syndesmotic injury.Foot and ankle surgery .

17.Ebraheim.A Nabil,LuJike,Yang ted Hua,Rollins jim; The fibular incisura of tibia on ct scan Cadaveric study:1998 by the American orthopaedic foot and ankle society.

19.Tonogai Ichiro, Hamada Daisuke, Sairyokoichi; Morphology of the incisura fibularis at the distal tibiofibular syndesmosis in Japanese population: 2017 by the American college of foot and ankle surgeons.

20.Liul Quingjum,Lin Bin,Guo Zhimin,Ding Zhenqi ,Lian Kejian,Lin Dasheng; Shapes of distal tibiofibular syndesmosis are associated with risk of recurrent lateral ankle sprain:Received:8 November 2016,Accepted:14 June 2017,Published online:24 July 2017.

21. Huysee Wouter,Burssens Arne, Peiffer Matthias, Cornelis Bert, S.A Sjoerd, Stufkens, buedtskristian, Audenaert. AE mmanuel, Kerkhoffs. J.M.M Gino; Morphometric analysis of the incisura fibularis in patients with unstable high ankle sprains: Skeletal radiol

22.Fojtik Petro, Kostlivy Karel; The fibular notch .an anatomical study.surgical and radiological anatomy.

23.Ramasamay.P and Ward .A; Distal tibiofibular joint dislocation with an intact fibula:a classification system. Injury, Int. J Care Injured 34 (2003)862-865.

24.Hermans J. John, Beumer Annechian ,Jong de.W.A.Ton and Kleirenlands Jan-Gert;Anatomy of the distal tibiofibular syndesmosis in adults:a pectorial essay with a multimodality approach. J. Anat.(2010)217,pp633-645.

25.Standring S. Gray anatomy In William A, ankle and foot chapter 115. 39 edition London Churchill living stone page no .1525-30.

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