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A Morphometric Study of the Distal Femur: Correlations and Clinical Relevance

Estudio Morfométrico del Fémur Distal: Correlaciones y Relevancia Clínica

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SUMMARY: The aim of this study was to investigate the morphometric characteristics of the distal femur and to analyze the relationships between basic anatomical parameters that will contribute to anthropological, forensic, and orthopedic applications. Sixty intact adult femurs (31 right, 29 left) of unknown age, sex, and ethnicity were examined. Bicondylar width (BICw), anteroposterior and transverse distances of the medial (MCap, MCtr), and lateral condyles (LCap, LCtr), and intercondylar line width (ICw) were recorded using digital calipers and goniometers. Descriptive statistics, side comparisons, and Pearson correlation analyses were performed with a significance level of $p<0.05$. High interobserver agreement was found for all parameters ($p<0.001$), confirming the reliability of the measurements. No significant differences were observed between right and left femurs ($p>0.05$). The strongest correlation was between MCap and LCap ($r = 0.754$, $p < 0.01$), followed by BICw, which included both MCap ($r = 0.617$) and LCap ($r = 0.616$). Moderate to weak correlations were found among the other parameters. Morphometric analysis of the distal femur revealed strong correlations between certain anatomical measurements, particularly condylar dimensions. These findings may aid in sex prediction, prosthesis design, and understanding joint mechanics across populations.

KEY WORDS: Distal femur; Lateral condyle; Medial condyle; Prosthesis.

INTRODUCTION

The longest, strongest and thickest bone in the human body is the femur (Standring, 2021). It is approximately one-fourth of the body length. The femur has a cylindrical body and two ends, proximal and distal (Standring, 2021). At the proximal, the femur has head, neck, trochanter major and minor. The distal, lower end of the femur is thicker than its proximal (Standring, 2021). On the distal and posterior surface, the triangular area between the medial and lateral lips of linea aspera is called the popliteal surface. The popliteal surface is bordered by the edges called the medial supracondylar line on the inside and the lateral supracondylar line on the outside. There are lateral and medial condyles on both sides. On the anterior surface, there is the patellar surface, which articulates with the patella. There is a pit called the intercondylar fossa on the posterior side of the condyles. The intercondylar line borders the intercondylar fossa above and the popliteal surface below. The bulging areas where the muscles are attached outside the condyles are called the lateral and medial epicondyle. The protrusion on the upper side of the medial epicondyle is called the tuberculum adductorium (Standring, 2021). The anatomical structure of the femur varies according to race, age and sex. There are differences even among individuals from different geographical regions of the same population (Biswas *et al*., 2017). Anatomical examination of the femur concerns many fields such as anthropology, forensic medicine and orthopedics (Biswas *et al*., 2017). In anthropology and forensic sciences, the most important process for determining the biological profile from skeletal remains is determining the sex (Akhlaghi *et al*., 2010; Peckmann *et al*., 2016; Oner *et al*., 2021). The knee joint, formed by the distal end of the femur, the proximal end of the tibia, and the patella, functions under axial compression due to the force of gravity (Rajan & Ramachandran, 2020). The complexity of this joint makes it very vulnerable in many professions and sports. Knee joint stability is influenced by the shape of the femoral condyles and the intercondylar notch. Primary osteoarthritis of the knee joint is a degenerative joint disease, especially seen in old age.

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If there is advanced damage to the joint, total joint replacement is an important operation for the patient (Vinay & Vikram, 2019). For this, it is very important to use the right size prosthesis together with the appropriate surgical method. A good prosthesis should have the right shape and size. Since most knee prostheses are produced in Western countries, differences in the distal femoral end between races should be known and knee prostheses should be designed according to race and sex differences between women and men (Lim *et al*., 2013).

MATERIAL AND METHOD

In this study, sixty intact adult femurs (31 right and 29 left) were used. This study was conducted in accordance with the principles of the Declaration of Helsinki. Bones with obvious deformities or damage were excluded from the study. Age, ethnicity, and sex were not known. Measurements were taken with a digital caliper (0.01 mm precision) and a goniometer. Measurements were performed by three different researchers under the same conditions and at different times. To assess the distal part of the femur, several parameters were measured and recorded (Fig. 1). These included the bicondylar width (BICw), defined as the maximum distance between the medial and lateral condyles in the transverse plane; the anteroposterior distance of the medial condyle (MCap), representing the maximum distance from the anterior to the posterior margins of the medial condyle; and the anteroposterior distance of the lateral condyle (LCap), measured similarly for the lateral condyle. Additionally, the transverse distance of the medial condyle (MCtr) and the transverse distance of the lateral condyle (LCtr) were recorded as the maximum distances between the medial and lateral surfaces of each respective condyle. Lastly, the width of the intercondylar line (ICw) was measured as the greatest separation between the medial and lateral surfaces of the intercondylar line on the posterior surface of the femur.

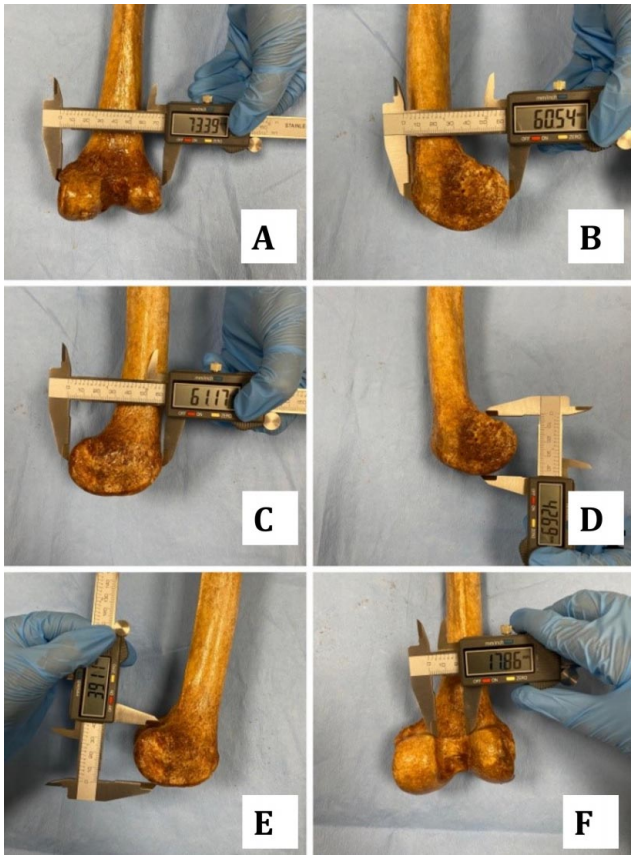

Fig. 1. Demonstration of parameters measured in dry bones. (A) The bicondylar width-BICw, (B) The anteroposterior distance of the medial condyle-MCap, (C) The anteroposterior distance of the lateral condyle-LCap, (D) The transverse distance of the medial condyle (MCtr), (E) The transverse distance of the lateral condyle-LCtr, (F) The width of the intercondylar line-ICw.

Statistical Analyses. Statistical v.13.3.1 was used for statistical analysis of the data. Intraclass correlation coefficients (ICC) were calculated to examine inter-observer agreement and expressed with 95 % confidence intervals. The Kolmogorov-Smirnov test was applied to check normality. Parametric methods were used to analyze variables that conformed to a normal distribution, while nonparametric methods were used to analyze those that did not. Pearson correlation test was used to examine the linear relationship between two continuous variables. Statistical significance was set at $p<0.05$.

RESULTS

In the comparisons between the researchers who made the measurements, statistically significant and high ICC level agreement was found for all variables ($p<0.001$). The high level of these agreement coefficients indicates that the measurements used are reliable. Descriptive statistics for all parameters measured in the femurs included in this study are shown in Table I. No statistically significant difference was observed in the comparison of all parameter values ??between the sides (Table I) ($p>0.05$).

Following the correlation analyses, the most striking correlation was observed between MCap and LCap ($r = 0.754$, $p < 0.01$), suggesting that these two variables largely overlap or complement each other (Table II). Similarly, BICw was found to have strong and significant positive relationships with MCap ($r = 0.617$, $p < 0.01$) and LCap ($r = 0.616$, $p < 0.01$). Regarding the remaining parameters, moderate to weak relationships were found between the variables (Table II).

Table I. Descriptive statistics of parameters.

Parameters	Total (n=60)		Right (n=31)		Left (n=29)		P
	Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max	
BICw	80.79±5.74	68.25-93.07	80.73±6.08	68.25-88.45	80.85±5.46	70.18-93.07	0.929
MCap	60.52±4.44	51.29-70.13	60.77±4.95	51.29-70.13	60.25±3.89	53.34-70.04	0.108
LCap	60.96±4.88	51.83-76.25	61.47±5.55	53.61-76.25	60.42±4.09	51.83-70.40	0.157
MCtr	25.42±2.24	19.79-31.55	25.69±2.37	19.79-31.55	25.13±2.10	21.28-30.27	0.582
LCtr	24.35±2.55	17.19-29.12	24.60±2.28	17.19-28.12	24.08±2.83	17.89-29.12	0.224
ICw	17.80±2.33	12.31-24.98	18.22±2.55	13.41-24.98	17.35±2.01	12.31-21.31	0.205

Table II. Correlation analyses.

Parameters		MCap	LCap	MCtr	LCtr	ICw
BICw	r	**0.617****	**0.616****	0.212	0.335**	0.333**
	p	0.000	0.000	0.104	0.009	0.009
	n	60	60	60	60	60
MCap	r	-	**0.754****	0.290*	**0.565****	0.308*
	p	-	0.000	0.025	0.000	0.017
	n	-	60	60	60	60
LCap	r	-	-	0.309*	**0.442****	0.360**
	p	-	-	0.016	0.000	0.005
	n	-	-	60	60	60
MCtr	r	-	-	-	0.188	-0.013
	p	-	-	-	0.150	0.924
	n	-	-	-	60	60
LCtr	r	-	-	-	-	0.213
	p	-	-	-	-	0.103
	n	-	-	-	-	60

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The morphology of the condyle and intercondylar notch of the femur is particularly important for the stability of the knee joint. Permanent degenerative diseases in the knee region are frequently observed, and replacement arthroplasty is a popular treatment. The anatomy of the femur condyle is crucial for the design of total joint replacement and internal fixation (Terzidis *et al*., 2012). Using a prosthesis that is geometrically compatible with the region is crucial for lasting success in regional arthroplasty (Mistri, 2015). Morphometric data are usually obtained by indirect measurement methods such as radiography, computed tomography, or magnetic resonance imaging (Shelbourne *et al*., 1997; Lombardo *et al*., 2005; Murshed *et al*., 2005; Cheng *et al*., 2009), and indirect measurements are performed by dry bone studies (Taner & Murshid, 2002; Ravichandran & Melanie, 2010; Terzidis *et al*., 2012; Ameet & Murlimanju, 2014; Mistri, 2015; Neelima *et al*., 2016; Biswas *et al*., 2017; Shweta & Renu, 2017; Chavda *et al*., 2019). Methodologically, it has been suggested that indirect methods are still inadequate even with better use of magnification, technique, and projection (Horsman *et al*., 1977; Anderson *et al*., 2007). In this study, morphometric data on human dry bones were measured by direct observation using digital calipers by three independent observers.

Table III compares the findings from this study with other literature. In our study, we recorded the mean BICw as 80.79±5.74 mm. Similar results were presented by Terzidis *et al*. (2012), and Ziylan & Murshid (2002), in their studies on Greek and Anatolian populations. Comparatively lower values were reported in studies conducted in different regions of India.

Radiologically, Angelo *et al*. (2004) reported that the bicondylar width in their radiographic study on Brazilians was similar to the results of our study (Right side: 82.17±4.92 mm, Left side: 82.13±5.42 mm). While the data obtained from CT studies on Asian populations are lower compared to our study, Shah *et al*. (2014), and Suryanarayan *et al*. (2014), reported BICw values in their CT scan study on Asians as 70.46±5.8 mm and 68.3±3.9 mm, respectively, which were lower than the data of our study. In the current study, the difference in bicondylar width between the right

Table III. Comparison of parameters with literature.

Studies	Population	Total N (Rigth/Left)	BICw Right	BICw Left	MCap Right	MCap Left	LCap Right	LCap Left	MCtr Right	MCtr Left	LCtr Right	LCtr Left	ICw Right	ICw Left
Ziylan & Murshid (2002)	Anatolian	72 (36 right/ 36 left)	76.8±5.90	77.30±5.20	-	-	-	-	-	-	-	-	-	-
Ravichandran & Melanie (2010)	South India	200 (100 right/ 94 left)	74.58±0.57	73.97±0.61	-	-	-	-	-	-	-	-	18.89±0.29	18.65±0.27
Terzidis *et al.* (2012)	Greek	360 (180 right/ 180 left)	84.10±0.62	83.70±0.63	58.60±4.10	58.70±4.10	58.40±4.00	58.50±4.00	-	-	-	-	20.50±2.30	20.50±2.20
Ameet *et al.* (2014)	Not specified	97 (45 right/ 52 left)	72.50±5.30	73.30±5.30	-	-	-	-	-	-	-	-	18.00±3.00	17.90±2.50
Mistri *et al.* (2015)	West Bengal	127 (65 right/ 62 left)	74.43±6.10	73.98±5.99	-	-	-	-	-	-	-	-	19.12±2.50	18.65±2.80
Neelima *et al.* (2016)	Southeast India	60 (30 right/ 30 left)	-	-	57.83±0.70		58.00±0.51		-	-	-	-	22.83±0.41	
Shweta & Renu (2017)	North India	100 (51 right/ 49 left)	73.10±6.14	72.16±6.58	-	-	-	-	-	-	-	-	20.82±2.57	21.03±3.13
Biswas *et al.* (2017)	West Bengal	70 (35 right/ 35 left)	71.71±4.50	70.71±5.25	52.97±3.77	54.74±3.85	56.20±3.36	56.05±4.29	25.48±2.05	27.28±2.29	27.80±2.91	28.03±2.56	20.86±2.52	19.45±2.57
Chavda *et al.* (2019)	Gujarat Region	74 (37 right/ 37 left)	69.60±5.04	69.80±4.96	52.90±4.99	53.5±4.15	54.70±4.01	55.00±4.31	26.70±2.03	26.90±2.23	30.30±3.05	29.60±2.03	20.40±3.17	18.70±2.52
Current study	Anatolian	60 (31 right/ 29 left)	80.79±5.74	80.85±5.46	60.77±4.95	60.25±3.89	61.47±5.55	60.42±4.09	25.69±2.37	25.13±2.10	24.60±2.28	24.08±2.83	18.22±2.55	17.35±2.01

Parameters (mm)

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed)

and left sides was not statistically significant (p > 0.05). This finding was accordance with the literature data. In the present study, the mean MCap was found to be 60.77±4.95 mm on the right side and 60.25±3.89 mm on the left side (total: 60.52±4.44 mm). Our findings were found to be consistent with the values ??obtained in the studies conducted by Terzidis *et al*. (2012), in the Greek population and by Neelima *et al*. (2016), in the Andhra Pradesh population. In the present study, the mean LCap was found to be 61.47±5.55 mm on the right side and 60.42±4.09 mm on the left side (total: 60.96±4.88 mm). The results closest to our data in the literature were similar to the results of the study by Terzidis *et al*., (2012). In our study, no statistically significant difference was observed between the two sides in terms of the anteroposterior distance of the medial and lateral condyle (p>0.05), and this finding was consistent with the studies of Terzidis *et al*. (2012), and Biswas *et al*. (2017), on dried femurs. Additionally, the mean MCtr and LCtr in the present study agree with the results of Biswas *et al*. (2017), and Neelima *et al*., (2016).

In the present study, the mean intercondylar notch width was found to be 18.22±2.55 mm on the right side and 17.35±2.01 mm on the left side (Total: 17.80±2.33 mm). Our findings showed a narrower notch structure than other authors (Angelo *et al*., 2004; Ameet & Murlimanju, 2014; Neelima *et al*., 2016; Biswas *et al*., 2017; Shweta & Renu, 2017; Chavda *et al*., 2019). Therefore, it was thought that Anatolian specimens may have a narrower notch structure compared to other Asian specimens. Intercondylar notch measurements are clinically important, and smaller intercondylar notches have been reported by some authors to be associated with smaller ACLs and more frequent ACL ruptures (Shelbourne *et al*., 1997). The most fundamental reasons underlying the differences in measurements between different populations are genetic and environmental factors, work and lifestyle, and the influence of civilization. These multiple factors can influence human body structure, height, and bone morphometry. There was a strong positive correlation between medial and lateral condyle morphometry and BICw. Our data are consistent with the MRI study by Murshed *et al*. (2005). In the current study, there were no statistically significant differences between the parameters. Terzidis *et al*. (2012),

suggested that if there was no statistically significant difference in total knee reconstruction, the contralateral healthy side could be safely used for preoperative templating.

Limitation. This study was limited to sixty intact adult femora, a relatively small sample size that may not be fully representative of the Anatolian population. Additionally, due to the unknown sex and age of the specimens, sex- and age-specific analyses could not be performed. To enhance understanding in this area, future studies involving larger sample sizes with bones of known origin, age, and particularly sex are recommended

CONCLUSION

This study provides detailed morphometric data on the distal femur based on direct measurements of dry bones, providing valuable anatomical insights relevant to orthopedic surgery and implant design. The results showed no interlateral differences in any of the measured parameters, suggesting bilateral symmetry in the distal femur. High interobserver reliability confirmed the robustness of the measurement protocol. Strong positive correlations between bicondylar width and both medial and lateral condylar dimensions highlight the interrelated nature of distal femoral morphology. Comparisons with previous studies indicate that, while there is overall consistency across populations, some variations, such as the narrower intercondylar notch observed in the Anatolian population, may reflect underlying genetic and environmental influences. These findings highlight the importance of considering population-specific anatomical characteristics in clinical practice and prosthesis design. Additionally, the lack of side-specific differences supports the use of the contralateral femur as a reference in preoperative planning for knee reconstructive procedures.

Ethics Approval

The ethical approval was taken from the Kahramanmaras Sütcü Imam University NonInterventional Scientific Research Ethics Committee of Medicine Faculty (2025/14-13).

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RESUMEN: El objetivo de este estudio fue investigar las características morfométricas del fémur distal y analizar las relaciones entre parámetros anatómicos básicos que contribuirán a aplicaciones antropológicas, forenses y ortopédicas. Se examinaron sesenta fémures adultos intactos (31 derechos, 29 izquierdos) de edad, sexo y etnia desconocidos. Se registraron el ancho bicondíleo (BICw), las distancias anteroposterior y transversal de los cóndilos medial (MCap, MCtr) y lateral (LCap, LCtr), y el ancho de la línea intercondílea (ICw) mediante calibradores digitales y goniómetros. Se realizaron estadísticas descriptivas, comparaciones laterales y análisis de correlación de Pearson con un nivel de significación de $p < 0,05$. Se encontró una alta concordancia interobservador para todos los parámetros ($p < 0,001$), lo que confirma la fiabilidad de las mediciones. No se observaron diferencias significativas entre los fémures derecho e izquierdo ($p > 0,05$). La correlación más fuerte se observó entre la MCap y la LCap ($r = 0,754$, $p < 0,01$), seguida de la BICw, que incluyó tanto la MCap ($r = 0,617$) como la LCap ($r = 0,616$). Se encontraron correlaciones moderadas a débiles entre los demás parámetros. El análisis morfométrico del fémur distal reveló fuertes correlaciones entre ciertas medidas anatómicas, en particular las dimensiones condilares. Estos hallazgos podrían ayudar en la predicción del sexo, el diseño de prótesis y la comprensión de la mecánica articular en diferentes poblaciones.

PALABRAS CLAVE: Fémur distal; Cóndilo lateral; Cóndilo medial; Prótesis.

REFERENCES

Akhlaghi, M.; Sheikhazadi, A.; Naghsh, A. & Dorvashi, G. Identification of sex in Iranian population using patella dimensions. *J. Forensic Legal Med., 17(3)*:150-5, 2010.

Ameet, K. J. & Murlimanju, B. V. A morphometric analysis of intercondylar notch of femur with emphasis on its clinical implications. *Med. Health, 9(2)*:103-18, 2014.

Anderson, A. F.; Anderson, C. N.; Gorman, T. M.; Cross, M. B. & Spindler, K. P. Radiographic measurements of the intercondylar notch: are they accurate? *Arthroscopy, 23(3)*:261-8, 2007.

Angelo, R. D. C. D. O.; Moraes, S. R. A. D.; Suruagy, L. C.; Tetsuo, T. & Costa, H. M. Morphometric study of the femoral intercondylar notch of knees with and without injuries of anterior cruciate ligament (ACL), by the use of software in digitalized radiographic images. *Acta Ortop. Bras., 12(3)*:220-37, 2004.

Biswas, A. & Bhattacharya, S. A. Morphometric and radiological study of the distal end of femur in West Bengal population. *Ital. J. Anat. Embryol., 122(1)*:39-48, 2017.

Chavda, H. S.; Jethva, K. N. & Gupta, S. A study of morphometric analysis of condyles of adult dry femur of humans in Gujarat region. *Int. J. Anat. Radiol. Surg., 8(1)*:1-5, 2019.

Cheng, F. B.; Ji, X. F.; Lai, Y.; Feng, J. C.; Zheng, W. X.; Sun, Y. F.; *et al*. Three-dimensional morphometry of the knee to design the total knee arthroplasty for Chinese population. *Knee, 16(5)*:341-7, 2009.

Horsman, A.; Leung, W. K.; Bentley, H. B. & McLachlan, M. S. F. Effect of rotation on radiographic dimensions of the humerus and femur. *Br. J. Radiol., 50(589)*:23-8, 1977.

Lim, H. C.; Bae, J. H.; Yoon, J. Y.; Kim, S. J.; Kim, J. G. & Lee, J. M. Sex differences of the morphology of the distal femur and proximal tibia in a Korean population. *Knee, 20(1)*:26-30, 2013.

Lombardo, S.; Sethi, P. M. & Starkey, C. Intercondylar notch stenosis is not a risk factor for anterior cruciate ligament tears in professional male basketball players: an 11-year prospective study. *Am. J. Sports Med., 33(1)*:29-34, 2005.

Mistri, S. A study of femoral condylar morphometry. *Indian J. Basic Appl. Med. Res., 4(4)*:500-10, 2015.

Murshed, K. A.; Çiçekcibasi, A. E.; Karabacakoglu, A.; Seker, M. & Ziylan, T. Distal femur morphometry: A sex and bilateral comparative study using magnetic resonance imaging. *Surg. Radiol. Anat., 27(2)*:108-12, 2005.

Neelima, P.; Ravisunder, R. & Himabindu, A. A study on morphometric measurements of adult dried femora in Visakhapatnam. *Int. J. Adv. Res., 4(8)*:564-7, 2016.

Oner, S.; Turan, M. K. & Oner, Z. Estimation of sex by using decision tree, a machine learning algorithm, with patellar measurements obtained from MDCT images. *Med. Records, 3(1)*:1-9, 2021.

Peckmann, T. R.; Meek, S.; Dilkie, N. & Rozendaal, A. Determination of sex from the patella in a contemporary Spanish population. *J. Forensic Legal Med., 44*:84-91, 2016.

Rajan, M. & Ramachandran, K. Morphometric analysis of lower end of adult dry femur in South Indian population – A cross-sectional observational study and its clinical significance. *Biomedicine, 40*:128-33, 2020.

Ravichandran, D. & Melanie, R. Morphology of the intercondylar notch and its clinical significance. *Int. J. Anat. Sci., 1(1)*:26-30, 2010.

Shah, D. S.; Ghyar, R.; Ravi, B.; Hegde, C. & Shetty, V. Morphological measurement of knee joints in Indian population: Comparison to current knee prostheses. *Open J. Rheumatol. Autoimmune Dis., 4(2)*:75-85, 2014.

Shelbourne, K. D.; Facibene, W. A. & Hunt, J. J. Radiographic and intraoperative intercondylar notch width measurements in men and women with unilateral and bilateral anterior cruciate ligament tears. *Knee Surg. Sports Traumatol. Arthrosc., 5(4)*:229-33, 1997.

Shweta, J. & Renu, C. Morphometric analysis of condyles and intercondylar notch of femur in North Indian population and its clinical significance. *J. Evol. Med. Dent. Sci., 6(32)*:2605-8, 2017.

Standring, S. *Gray's Anatomy E-Book: Gray's Anatomy E-Book*. Amsterdam, Elsevier Health Sciences, 2021.

Suryanarayan, P.; Jain, N. & Ashok, P. CT evaluation and study: Anthropometric measurement of knee joint in Asian population. *Int. J. Sci. Res. Publ., 4(12)*:1-12, 2014.

Terzidis, I.; Totlis, T.; Papathanasiou, E.; Sideridis, A.; Vlasis, K. & Natsis, K. Sex and side-to-side differences of femoral condyles morphology: osteometric data from 360 Caucasian dried femora. *Anat. Res. Int., 2012*:679658, 2012.

Vinay, G. & Vikram, S. A study of morphometric analysis of distal end of femur and its clinical importance. *Indian J. Anat. Surg. Head Neck Brain, 5(3)*:114-7, 2019.

Ziylan, T. & Murshid, K.A. An analysis of Anatolian human femur anthropometry. *Turk. J. Med. Sci., 32*:231-5, 2002.

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