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

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(7); 1328-1334

Original Research Article

Reconstruction of Femoral Length from Distal Segmental Morphometry Using Regression Equation Method

Anil Kumar Dwivedi[1], Niyati Airan[2], Rajan Bhatnagar[3]

[1]Associate Professor, Department of Anatomy, Veer Chandra Singh Garhwali Government Institute of Medical Science and Research, Srinagar Garhwal, Uttarakhand, India

[2]Assistant Professor, Department of Anatomy, Veer Chandra Singh Garhwali Government Institute of Medical Science and Research, Srinagar Garhwal, Uttarakhand, India

[3]Professor and Head, Department of Anatomy, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

Received: 29-04-2023 / Revised: 28-05-2023 / Accepted: 29-06-2023

Corresponding author: Dr Niyati Airan

Conflict of interest: Nil

Abstract:

Introduction: Stature is one of the most important parameters for identification of an individual. The estimation of stature can be done by the measurement of long bones of the body and using established formulae. Previous studies have documented that femur has highest correlation with the stature and it is commonly used for deriving regression equation. However, the intact femur is not always recovered in medicolegal cases. The reconstruction of stature from fragmentary skeleton form part of forensic anthropological analysis for the purpose of establishment of identity of an individual.

Aim: To establish a relation, between the dimensions of distal segments of femur and its length and to derive regression equations for the same.

Materials and Methods: The study included 280 femora (136 Right and 144 left), which were measured for length of femur, bicondylar width, anterior posterior diameter of medial and lateral condyle, transverse diameter of medial and lateral condyle and intercondylar notch width with the help of Osteometric board and Vernier calliper. Then, the data was analysed statistically using student t-test, Pearson's correlation coefficient and linear regression analysis. A p-value of <0.05 was considered significant and <0.01 highly significant.

Results: The value of mean length of femur was 412.56$\pm$30.34 mm (Right 414.96$\pm$30.57 mm, left 410.29$\pm$30.05 mm). The length of femur correlates significantly with the dimensions of distal end ($p<0.05$). The linear regression equation for length of femur from distal femoral dimensions were derived.

Conclusion: The morphometric data collected from the lower end of femur will be helpful for Orthopaedic surgeons, Sport physician and forensic experts. Regression equation for length of femur from its distal end dimensions derived in the present study will be useful for anthropologist, archaeologist and forensic investigators for determining the length of femur and thereby stature and identity of an individual.

Keywords: Femur, Condyle, Correlation, Length, Notch, Regression, Stature.

Introduction

The femur or thigh bone is the longest bone of our body. It has proximal end, a distal end and an intervening shaft. The distal end of femur has medial and lateral condyle that articulate with the condyles of tibia to form knee joint. The femoral condyles are continuous anteriorly with patellar articular surface, but they are divided posteriorly by a deep intercondylar notch. The lateral condyle is larger antero-posteriorly than the medial condyle[1, 2].

The femoral length is a key anthropometric measurement that is used in a variety of applications, including forensic anthropology, orthopaedics, and sports medicine. However, the intact femur is not always available, such as in cases where the bone is fragmented or missing. In these cases, it is possible to reconstruct the femoral length using distal segmental morphometry[3]. The measurement of distal segments of femur show correlation with the femoral length, and regression equations can be used to determine the femoral length from these measurements. Physical characteristics of the people of different region, races and ethnicity are different, hence regression formulae used for estimating the length of femur from its fragments must be population specific [4, 5].

Numerous studies have explained that stature can be estimated from a variety of skeletal elements, including the bones of the extremities, crania, other whole bones, as well as fragmentary remains. Regression formulae derived from the major long bone have been generally considered to be more accurate than those derived from other skeletal elements. The length of long bones of lower extremity have been reported to provide better estimate of stature, compared with the bones of upper extremity[6]. The dimensions of an intact femur are considered to have the highest correlation with stature[7, 8].

The regression equation method is a reliable and accurate method for reconstructing the femoral length. However, it is important to note that the regression equation is specific to a particular population, and it may not be accurate for other populations[9,10]. Stature reconstruction from skeletal fragments remain form a part of the forensic anthropological investigation for the purpose of identification of an individual[11]. The present investigation was therefore undertaken to find out measurements of distal end of femur and to derive regression equation having high degree of prediction for estimation of total length of femur from fragments of its distal end.

Material and Methods

A descriptive cross sectional observational study was conducted on 280 adult dried femora (136 Right and 144 Left) available in the department of Anatomy of three government medical colleges located in West-central and Marathwada region of Maharashtra. Prior approval of Institutional Ethics Committee was taken for doing measurements of the Femur. All the selected femora were free of damage or deformity and fully ossified indicating adult bones. Femur having grossly deformed appearance and pathological changes were excluded from the study. The side of the femora was determined by using standard Anatomical procedures. The sex of the femur was not considered. The length of femur was measured by osteometric board, Sliding Vernier calliper was used for taking remaining measurements of distal femoral end. All measurements were recorded by single observer for consistency. The measurements were repeated thrice and mean value taken to minimise error during measurements. The values were recorded in millimetre.

The Length of Femur (FML) was measured as the straight distance between the highest point of head and the lowest point on the medial condyle of femur with the help of osteometric board (Table/Fig-1A)[12]. The bicondylar width (BCW) was measured as maximum distance between medial and lateral epicondyle in transverse plane (table/fig 1B)[13, 14]. Medial condyle anterior posterior diameter (MCAPD) was measured as maximum distance between anterior and posterior surface of medial condyle (table/fig 1C)[13, 15]. Lateral condyle anterior posterior diameter (LCAPD) was taken as maximum distance between anterior and posterior surface of lateral condyle (fig 2A)[16, 17]. Medial condyle transverse diameter (MCTD) was measured as maximum distance between medial and lateral surface of medial condyle (fig 2B)[13]. Lateral condyle transverse diameter (LCTD) was taken as maximum distance between medial and lateral surface of lateral condyle (fig 2C)[18]. Intercondylar notch width (ICNW) was measured as maximum distance between medial and lateral surface of intercondylar notch posteriorly (fig 2D)[13, 19, 20].

(FML: Length of femur, BCW: Bicondylar width, MCAPD: Medial condyle anterior posterior diameter).

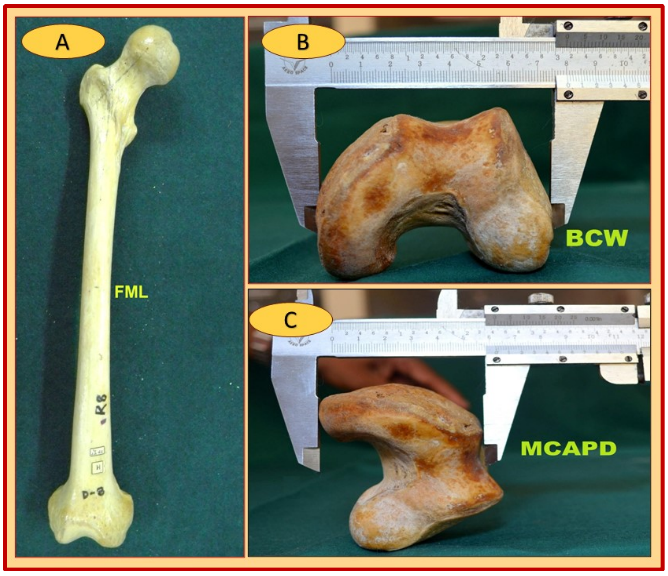

Figure 1: Measurements of femur

(LCAPD: Lateral condyle anterior posterior diameter, MCTD: Medial condyle transverse diameter, LCTD: Lateral condyle transverse diameter, ICNW: Intercondylar notch width).

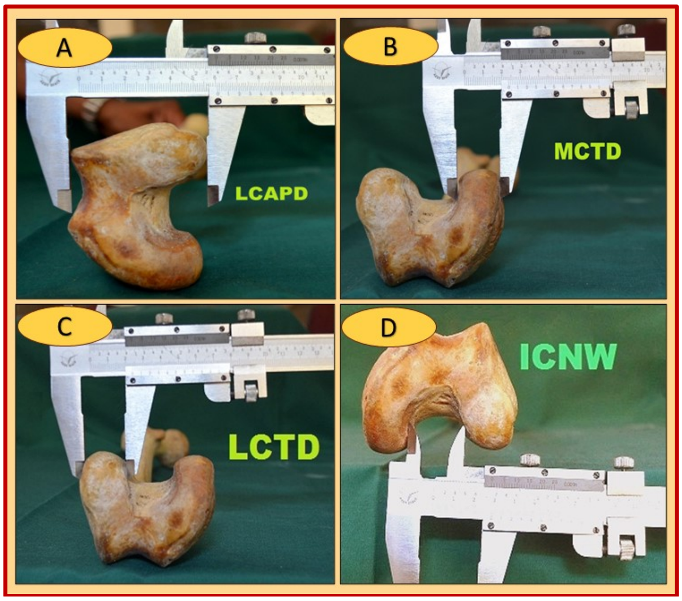

Figure 2: Measurements of distal end of femur

Statistical Analysis

All the measurements were tabulated and analysed statistically using SPSS software v19. Minimum, maximum, mean, standard deviation and p-values were determined for right and left femurseparately. Pearson‘s correlation coefficient was used to find a correlation between length of femur (FML) and dimensions of its distal segment. P-value of <0.05 was considered as significant and <0.01 was considered as highly significant. The values of femur length were compared with those reported in previous studies in different ethnic groups using the unpaired 't' test to see if the difference between the two is statistically significant. Regression equations were formulated for estimation of length of femur from dimensions of its distal segments for right and left femur separately.

Results

The length of femur (FML) ranged from 355mm to 485mm with mean 412.56mm and standard deviation 30.34mm among 280 femora (table/fig 3). Measured variables of femur, bicondylar width (BCW), Medial condyle anterior posterior diameter (MCAPD), Lateral condyle anterior posterior diameter (LCAPD), Medial condyle transverse diameter (MCTD), Lateral condyle transverse diameter (LCTD) and Intercondylar notch width (ICNW)showed highly significant positive correlation (p<0.01) with length of femur. Medial condyle anterior posterior diameter (MCAPD) displayed highest degree of correlation (Pearson‘s correlation coefficient- .303) with length of femur (table 3).

Table 3: Dimensions of distal segments of total femora and Pearson correlation coefficient between length of femur (FML) and dimensions of its distal segment (n=280)

Measurements	Minimum	Maximum	Mean	Std Deviation	Correlation with FL	p-value
FML	355.00	485.00	412.56	30.34	-	-
BCW	58.66	86.22	72.31	5.40	0.235^{**}	<0.01
MCAPD	44.16	67.48	56.07	4.18	0.303^{**}	<0.01
LCAPD	47.20	88.00	56.91	4.78	0.268^{**}	<0.01
MCTD	17.00	30.79	23.65	2.53	0.215^{**}	<0.01
LCTD	18.80	31.59	25.25	2.59	0.196^{**}	<0.01
ICNW	15.28	29.00	21.03	2.53	0.205^{**}	<0.01

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

(FML- length of femur, BCW- bicondylar width, MCAPD- medial condyle anterior posterior diameter, LCAPD- Lateral condyle anterior posterior diameter, MCTD- medial condyle transverse diameter, LCTD- lateral condyle transverse diameter, ICNW - Intercondylar notch width) The dimensions of the distal segments of right femora were measured. The length of right femur ranged from 355mm to 485mm with mean 414.96mm and standard deviation 30.57mm. The variables of lower end of femur bicondylar width (BCW), Medial condyle anterior posterior diameter

(MCAPD), Lateral condyle anterior posterior diameter (LCAPD), Medial condyle transverse diameter (MCTD), Lateral condyle transverse diameter (LCTD) and Intercondylar notch width (ICNW) showed highly significant positive correlation ($p<0.01$) with length of femur. Medial condyle anterior posterior diameter showed highest degree of correlation with femur length (correlation coefficient 0.681) (table 4).

Table 4: Dimensions of distal segment of right femora and Pearson correlation coefficient between length of femur (FML) and dimensions of its distal segment (n=136)

Measurements	Minimum	Maximum	Mean	Std Deviation	Correlation with FL	p-value
FML	355.00	485.00	414.96	30.57	-	-
BCW	59.21	86.22	72.83	5.09	.638**	<0.01
MCAPD	44.16	67.48	56.99	3.79	.681**	<0.01
LCAPD	47.20	88.00	57.48	4.96	.605**	<0.01
MCTD	17.00	29.70	23.68	2.68	.235**	<0.01
LCTD	19.56	30.94	25.26	2.56	.632**	<0.01
ICNW	15.28	29.00	21.06	2.45	.377**	<0.01

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

The length of left femora ranged from 355mm to 485mm. The mean length was found to be 410.29$\pm$30.05mm. The variables of left femora like bicondylar width (BCW), Medial condyle anterior posterior diameter (MCAPD), Lateral condyle anterior posterior diameter (LCAPD), Medial condyle transverse diameter (MCTD), Lateral condyle transverse diameter (LCTD) and Intercondylar notch width (ICNW) showed significant positive linear correlation with length of femur. Among the variables Medial condyle anterior posterior diameter showed highest degree of correlation with femur length (correlation coefficient 0.630)(table 5).

Table 5: Dimensions of distal segment left femora and Pearson correlation coefficient between length of femur (FML) and dimensions of its distal segment (n=144)

Measurements	Minimum	Maximum	Mean	Std Deviation	Correlation with FL	p-value
FML	355.00	485.00	410.29	30.05	-	-
BCW	58.66	83.76	71.83	5.65	.571**	<0.01
MCAPD	46.30	65.08	55.20	4.35	.630**	<0.01
LCAPD	47.20	66.00	56.37	4.55	.603**	<0.01
MCTD	18.00	30.79	23.63	2.40	.255**	<0.01
LCTD	18.80	31.59	25.24	2.62	.492**	<0.01
ICNW	15.45	26.92	21.00	2.62	.294*	<0.05

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

Linear regression equations for estimation of length of femur from its distal segments for right and left femora were formulated. (table 6).

Table 6: Regression Equations for estimation of length of femur (FML) from its distal segments

S No.	Regression Equations (Right)	Regression Equations (Left)
1.	FML = 164.903+ 3.532(BCW)$\pm$ 22.823	FML = 118.218 + 4.187(BCW)$\pm$17.653
2.	FML = 140.343 + 4.953(MCAPD)$\pm$21.709	FML = 128.084 + 5.245(MCAPD)$\pm$ 18.270
3.	FML = 225.406 + 3.430(LCAPD)$\pm$23.597	FML = 124.404 + 5.226(LCAPD)$\pm$16.646
4.	FML = 372.751 + 2.083(MCTD)$\pm$29.099	FML = 307.892 + 4.737(MCTD)$\pm$ 27.336
5.	FML = 239.256 + 7.221(LCTD)$\pm$ 22.962	FML = 231.514 + 7.398(LCTD)$\pm$ 22.221
6.	FML = 331.113+ 4.318(ICNW)$\pm$27.450	FML = 318.533 + 4.832(ICNW)$\pm$27.328

Discussion

Age, sex, ancestry and stature are the four principal elements used to established the identity of an individual[11]. Stature is an important anthropometric parameter for establishment of identity of a person in medicolegal issue involving the examination of skeletal remains. The stature can be estimated by adding combine length of bone responsible for height or using regression equation based on measurement of intact long bone[10]. Gleser et al. 1958 has documented that the weight bearing bones of lower limb has the highest correlation with the stature and they must be preferred to the upper limb bones[21]. The available regression equations for estimation of stature are not universally applicable to the diversity of population as these equations are population specific[22]. The anthropometric dimensions vary among different population groups, which could be due to effect of genetic and environmental factor on growth and development of an individual[23].

In the present study, 280 adult dried femora (136 Right and 144 Left) available in the department of Anatomy of three government medical colleges located in West-central and Marathwada region of Maharashtra were measured for femoral length, bicondylar width, medial condyle anterior posterior diameter, lateral condyle anterior posterior diameter, medial condyle transverse diameter, lateral condyle transverse diameter and Intercondylar notch width. Minimum maximum, mean and standard deviation was derived for femoral length and various other dimensions of lower end fortotal femur, right and left femur separately. The femoral length was correlated with various dimensions of lower end of right femur, left femur and total femur, which shows highly significant positive linear correlation (p<0.01). Medial condyle anterior posterior diameter displayed highest degree of positive linear correlation with femur length on right side ((Pearson‘s correlation coefficient- 0.681), left side (Pearson‘s correlation coefficient- 0.630)) and in total femur ((Pearson‘s correlation coefficient- 0.303).

The length of femur observed in the present study was compared with femoral length reported by various authors in different population(Table 7). The study by Raina S et al. Punjab[11], Nanayakkara D et al. Sri Lanka[6], Vora RK et al. Gujarat[24], Chaudhary N, Uttar Pradesh[25], Abledu JK et al. Ghana[7], Parmar AM et al. Rajasthan[26], Solan S et al. Karnataka[27], Chandran M et al. Tamil Nadu[28] and Mysorekar VL et al. Maharashtra [29]showed statistically significant (p<0.01) different femoral length from present study. The mean femoral length reported by Nayak AK et al. Uttar Pradesh[2], Oommen AM et al. Kerala[4], Mukherjee S et al. West Bengal[5], Kumar MA et al. Andhra Pradesh[30] and Mukhopadhyay PP et al. west Bengal[31] was statistically not significantly different (p >0.05) from those reported in the present study.

The mean length of femur is maximum among Ghana (449.7±23.4) followed by Tamil Nadu (449.0±15.0) and Punjab (434.80±26.09), minimum value was reported in Andhra Pradesh (409.0±16.60) and West Bengal (410.33±27.01)(Table 7), in the present study we reported femur length 412.56±30.34(Table 3). This shows regional and racial variation in length of femur.

The present study has used linear regression analysis to derive regression equation for formulating length of femur. Similar regression analysis was done by Abledu JK et al in Ghana[7], Nanayakkara D et al in Sri Lanka population[6]. In India, regression formulae was derived by Nayak AK et al[2] and Chaudhary N[25] in Uttar Pradesh population, Mukherjee S et al[5] and Mukhopadhyay PP et al[31] in west Bengal population, Raina S et al in Punjab[11], Vora RK et al in Gujarat[24], Parmar AM et al in Rajasthan[26] and Mysorekar VL et al Maharashtrian population[29]. In south India regression formulae was derived by Oommen AM et al in Kerala[4], Kumar MA et al in Andhra Pradesh[30], Solan S et al in Karnataka[27] and Chandran M et al in Tamil Nadu population[28]. The measurement of length of long bones from the available fragments play a vital role in estimation of stature of individual.

Table 7: Comparison of present study with studies done by other authors in different ethnic groups.

Sr No.	Name of worker	Sample Size	Mean	SD	p-value
1.	Nayak AK et al. Uttar Pradesh[2], 2023.	96	418.68	33.12	>0.05
2.	Raina S et al. Punjab[11], 2022.	50	434.80	26.09	<0.01
3.	Oommen AM et al. Kerala[4], 2022.	121	419.0	34.0	>0.05
4.	Mukherjee S et al. West Bengal[5], 2020.	60	410.33	27.01	>0.05
5.	Nanayakkara D et al. Sri Lanka[6], 2020,	86	428.58	26.42	<0.01
6.	Vora RK et al. Gujarat[24], 2019.	208	431.45	18.29	<0.01
7.	Chaudhary N, Uttar Pradesh[25], 2019.	30	434.20	24.0	<0.01
8.	Abledu JK et al. Ghana[7], 2016.	50	449.7	23.4	<0.01
9.	Kumar MA et al. Andhra Pradesh[30], 2016	70	409.0	16.60	>0.05
10.	Parmar AM et al. Rajasthan[26], 2015.	50	432.4	33.8	<0.01
11.	Solan S et al. Karnataka[27], 2013.	150	434.2	24.0	<0.01
12.	Chandran M et al. Tamil Nadu[28], 2012,	60	449.0	15.0	<0.01
13.	Mukhopadhyay PP et al. west Bengal[31], 2010.	65	418.2	30.5	>0.05
14.	Mysorekar VL et al. Maharashtra[29], 1980.	210	422.20	30.60	<0.01
15.	Present Study, Maharashtrian population.	280	412.56	30.34	-

Limitation: Sexual dimorphism during femoral morphometry has not been taken into consideration while selecting femur for the study. Demographic characteristics of bones such as age, occupation, sex and nutritional status etc were unknown.

Conclusion

One hundred thirty six right and one hundred forty four left dried fully ossified human femora have been studied to derive regression formulae for the estimation of total length of femur from fragments of lower end. Derived formulae are statistically significant. Regression formulae derived in the present study have high degree of prediction, can be used in reconstruction of femoral length from distal fragments and establishing the stature of an individual.

Acknowledgement

Authors would like to acknowledge the Head of Department of Anatomy of BJ Medical College Pune and GMC Aurangabad for support during data collection. Authors extend their heartfelt thanks to all faculty of Department of Anatomy of AFMC Pune for theirconstant support and valuable guidance.

References

1. Standring S, Borley N, Collins P, Crossman AR, Gatzoulis MA, Healy JC, et al., editors. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40 ed. London: Churchill livingstone Elsevier; 2008.
2. Nayak AK, Sahni C, Gupta M, Tiwari PK, Mishra A, Devadas D. Anthropometric Analysis of Distal Femur Parameters in the Eastern Uttar-Pradesh Population. Cureus. 2023;15(1):1-6.
3. Ebert LC, Rahbani D, Luthi M, Thali MJ, Christensen AM, Fliss B. Reconstruction of full femora from partial bone fragments for anthropological analyses using statistical shape modeling. Forensic Sci Int. 2022; 332:1-8.
4. Oommen AM, Sarasammal SR, Sukumaran SK. Estimation of length of femur from its distal segment. Journal of the Anatomical Society of India. 2022;71(1):30-3.
5. Mukherjee S, Das A, Sarkar D, Majumder A, Mukhopadhyay PP. Reconstruction of Length of Femur from Its Fragments- A Preliminary Study in Eastern Indian Population. Indian Journal of Forensic Medicine & Toxicology. 2020;14(4):570-5.
6. Nanayakkara D, Vadysinghe A, Nawarathna LS. Prediction of the length of the femur from its fragments in a Sri Lankan population. Australian Journal of Forensic Sciences. 2020;52(3):303-12.
7. Abledu JK, Offei EB, Osabutey CK. Reconstruction of femoral length from fragmentary femora. Anat Cell Biol. 2016;49(3):206-9.
8. Bidmos MA. Fragmentary femora: evaluation of the accuracy of the direct and indirect methods in stature reconstruction. Forensic Sci Int. 2009;192(1):131-5.
9. Singh S, Nair SK, Anjankar V, Bankwar V, Satpathy DK, Malik Y. Regression equation for estimation of femur length in central Indians from inter-trochanteric crest. J Indian Acad Forensic Med. 2013;35(3):223-6.
10. Babu U, Sadashiv R, Roshni KJ. Reconstruction of femur length from its fragments. Indian Journal of Forensic Medicine & Toxicology. 2013;7(3):168-71.
11. Sunanda Raina, Kalra N. Study to Estimate the Femur Length using fregmantory. Journal of Cardiovascular Disease Research. 2022;13(8):242-5.
12. Bhasin MK, Singh IP. Anthropometry. Delhi: Bharti Bhawan educational publishers and booksellers; 1968.
13. Devi YE, Thounaojam O, Gangte D. Study of Morphometric Analysis of Distal End of Femur in the North Indian Population. Sch J App Med Sci. 2022;10(1):157-61.
14. Shah DS, Ghyar R, Ravi B, Hegde C, Shetty V. Morphological Measurements of Knee Joints in Indian Population: Comparison to Current Knee Prostheses. Open Journal of Rheumatology and Autoimmune Diseases. 2014; 4:75-85.
15. Yazar F, Imre N, Battal B, Bilgic S, Tayfun C. Is there any relation between distal parameters of the femur and its height and width? SurgRadiol Anat. 2012;34(2):125-32.
16. Rashid S, Ahmad T, Saleem A, Gupta S, Jan S. Morphometric Study of Distal End of Femur in Indian Population. Int J Adv Res. 2018;6(6):662-7.
17. Vinay G, Vikram S. A study of morphometric analysis of distal end of femur and its clinical importance. IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain. 2019;5(4):114–7.
18. Neelima P, sunder RR, bindu AH. A Study on Morphometric Measurements of Adult Dried Femora in Visakhapatnam. Int J Adv Res. 2016; 4(8):564-7.
19. Chawre HK, Singrolay R, Trivedi A, Alam F. Study of Distal Femoral Anthropometry in the Population of Eastern Madhya Pradesh, India. International Journal of Health and Clinical Research. 2021;24(4):96-9.
20. Chaurasia A, Tyagi A, Santoshi JA, Chaware P, Rathinam BA. Morphologic Features of the Distal Femur and Proximal Tibia: A Cross-Sectional Study. Cureus. 2021;13(1):2-10.
21. Gleser GC, Trotter M. A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death. American Journal of Physical Anthropology. 1958;16(1):79-123.
22. Auerback BM, Ruff CB. Stature estimation formulae for indiginous North American population. Americal Journal of Physical Anthropology. 2010; 141:190-207.
23. Lee J-H, Jeong Y-G, Lee NS, Han SY, Han S-H. Stature estimation from partial measurements and maximum length of upper limb

bones in Koreans. International Journal of Research - Granthaalayah. 2015;3(10):100-7.
24. Vora RK, Patel SM. Estimation of Total Femoral Length from Epicondylar Breadth of Femur. Academia Anatomica International. 2019;5(2):25-8.
25. Chaudhary N. Estimation of total length of femur from measurements of proximal and distal segments. Journal of Advanced Medical and Dental Sciences Research. 2019; 7(12): 309-12.
26. Parmar AM, Shah KP, Goda J, Aghera B, Agarwal GC. Reconstruction of Total Length of Femur from Its Proximal and Distal Fragments. International Journal of Anatomy and Research. 2015;3(4):1665-8.
27. Solan S, Kulkarni R. Estimation of total Length of Femur from Its Fragments in South Indian Population. J Clin Diagn Res. 2013;7(10):2111-5.
28. Chandran M, Kumar V. Reconstruction of femur length from its fragments in South Indian males. J Forensic Leg Med. 2012;19(3):132-6.
29. Mysorekar VL, Verma PK, Mandedkar AN, Sarmat TCSR. Estimation of Stature from Parts of Bones-Lower End of Femur and Upper End of Radius. Med Sci Law. 1980;20(4):283-6.
30. Kumar MA, Reddy CK. Anthropometric study of Femur in Krishna District of AP. Sch J App Med Sci. 2016;4(10):3822-5.
31. Mukhopadhyay PP, Ghosh TK, Dan U, Biswas S. Correlation between Maximum Femoral Length and Epicondylar Breadth and Its Application in Stature Estimation: A Population Specific Study in Indian Bengali Males. J Indian Acad Forensic Med. 2010;32(3):204-7.