OSTEOMETRIC AND COMPARATIVE ANALYSIS OF SEXUAL DIMORPHISM IN THE FEMUR AMONG POPULATION OF DATIA REGION.

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Abstract

Background: Sexual identification from the skeletal parts has medico legal and anthropological importance. The femur the longest and strongest bone in the skeleton.

Objectives: to obtain values of maximum femoral length and to evaluate its possible usefulness in determining correct sexual identification.

Material and Methods: Study sample consisted of 190 dry, normal, adult, human femora (140 male & 50 female) from skeletal collections of Anatomy department, Government Medical College, Datia. Maximum length of femur was considered as maximum vertical distance between upper end of head of femur and the lowest point on femoral condyle, measured with the osteometric board.

Results: Mean Values obtained were, 450.81 and 416.48 for right male and female, and 443.35 and 419.44 for left male and female respectively. Higher value in male was statistically highly significant ($P < 0.001$) on both sides. Demarking point (D.P.) analysis of the data showed that right femora with maximum length more than 474.70 were male and less than 377.99 were female; while for left bones, femora with maximum length more than 484.49 were male and less than 385.73 were definitely female.

Conclusion: Maximum length identified 13.43% of right male femora, 4.35% of right female femora, 7.25% of left male femora and 8% of left female femora

Keywords: Maximum length, Sexual dimorphism, Femur, osteometry, femoral length.

Introduction:

The femur the longest and strongest bone in the skeleton. It is almost perfectly cylindrical in the greater part of its extent. In the erect posture it is not vertical, being separated above from its fellow by a considerable interval, which corresponds to the breadth of the pelvis, but inclining gradually downward and medially, so as to approach its fellow toward its lower part, for the purpose of bringing the knee-joint near the line of gravity of the body.¹ The degree of this inclination varies in different persons and is greater in the female than in the male, an account of the greater breadth of the pelvis. The determination of sex from skeletal remains is of very much medico legal and anthropological importance. Nonmetrical (morphological) methods such as the visual inspection of bone morphology depend entirely on the ability and experience of an observer. Morphometrical methods for sexing from bone in addition to providing simplicity also allow no

individual variations and are entirely objective assessment. Sex determination is relatively easy if the entire skeleton is available, pelvis and skull are the most reliable bones for this purpose.² However, in medicolegal cases one does not always have a complete pelvis or skull. Therefore, it is important to be able to assess sex from the other parts of the skeleton also. According to Krogman and Iscan³ standards of morphological and Morphometrical attributes in the skeleton may differ with the population samples involved and this is true with reference to dimensions and indices (average and range) and as a general rule standards should be used with reference to group from which they are drawn and upon which they are based they are not interchangeable. So, present study was carried out to ascertain sexual dimorphism of maximum femoral length in femora from datia region.

Material and Methods

The present study consisted of 140 male (70 of right & 70 of left side) and 50 female (23 of right & 27 of left side) human adult femora from the skeletal collection of Anatomy department, government Medical College, Datia (M.P.). Femora showing pathological abnormality or from the persons outside Datia were not included in study. Maximum length

was measured with Femur on Osteometric board in such a manner that medial condyle touches the short vertical wall; the moveable cross-piece should touch the highest point of the head. Maximum vertical distance between upper end of head of femur and the lowest point on femoral condyle was measured.⁴ (Figure 1)

Figure 1:

Each bone was measured thrice, and measurement was repeated by two independent observers, mean of these observations was taken as a final reading to nullify any intra and inter-observer error.

Statistical Analysis

All statistical analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Means or medians and frequency/percentage was computed for quantitative and qualitative observations, respectively independent samples t-test was used. P value ≤ 0.05 was considered significant.

Results

Table 1: Descriptive statistics of Maximum Femoral length among study participants (in mm)

Statistical values	Right		Left	
	Male (n=70)	Female (n=23)	Male (n=70)	Female (n=27)
Range	395-504	376-471	395-502	381-463
Mean	450.81	416.48	443.35	419.44
S.D.	23.74	19.54	22.34	21.35
t-value	6.80		6.50	
P value	P< 0.001		P< 0.001	
Calculated Range mean $\pm$ 3S.D.	379.99-523.63	358.26-476.70	385.73-520.97	356.39-484.49
Demarking Points (D.P)	>474.70	<377.99	>484.49	<385.73

As per table 1 Right femur: The maximum length of right male femur varied from 395mm to 504mm (Mean: 450.81 & S.D.: 23.74) and of right female femur varied from 376mm to 471mm (Mean: 416.48 & S.D.: 19.54). Mean value of maximum length was higher in male as compared to female. Calculated t-value and P value showed that the difference in the mean maximum length in male and female was statistically highly significant with P<0.001. By demarking points, definite sexual classification in male right bone (>474.70) and in female right bone (<377.99). Left femur: The maximum length of left male femur varied from 395mm to 502mm (Mean: 443.35 & S.D.: 22.34) and of left female femur varied from 381mm to 463mm (Mean: 419.44 & S.D.: 21.15). Mean value of maximum length was higher in male as compared to female. Calculated t-value and P value showed that the difference in the mean maximum length in male and female was highly statistically significant with P<0.001.

Table 2: Descriptive statistics of Femur

Parameters (in cm)	Right femur		Left femur	
	Mean	Standard Deviation	Mean	Standard Deviation
Neck Shaft angle(degree)	125.0309	1.3477	124.9127	1.2816
Weight of femur (gm)	235.45	68.70	231.60	56.46
Max.Length of femur (cm)	41.2255	2.6656	41.4164	2.0703
Max. head diameter (cm)	4.1	0.43	4.09	0.34
Mid shaft circumference (cm)	7.15	0.60	6.91	0.67
Bicondylar width (cm)	7.2818	0.3752	6.2982	0.4145

As per table 2 the mean and standard deviation of femur was compared among the study participants. Except maximum length of femur, all the parameters like neck shaft angle, weight of femur, head diameter, mid shaft circumference and bicondylar width all are higher in right femur than left.

Discussion

Dimensionally the adult male: female ratio is about 100: 92, i.e. female measurements are about 92% of male measurements, this does not precisely hold for the entire living body¹. Generally male bones are longer and massive, and this difference is reflected by the greater values of the mean maximum femoral length in male on both the sides. Comparison of maximum femoral length of male between present study and other studies has been explained. Mean maximum male femoral length value in present study was 450.81(right) & 443.35(left). In other studies, it varies from 429.4 to 477.7. Mean maximum femoral length in present study was lower than the American Blacks⁵ & South African Whites⁶; was higher than the Thai⁷ & Chinese femora⁸ and it correspond with the value seen in American Whites³, Californian sample⁹ and sample from Bhopal⁴. Comparison of maximum length of female between present study and other studies. Mean femoral length in female in present study was 416.48(right) & 419.44(left). In other studies, it vary from 397-443. While mean maximum female femoral length in present study was lower than the American Blacks³ & South African Whites⁶; was higher than the Thai⁷, Chinese⁸ and sample from Bhopal⁴ and was like the value in American Whites³ and Californian sample⁹. This difference in mean femoral length in between populations may possibly be a result of factors affecting bone morphology like genetic constitution, diet, nutrition status, environment and physical activity. While most of the studies referred above were based on multivariate analysis, present study had used the

demarking point (D.P.) analysis.¹⁰ Biological variables may show wide variations, which the simple analysis may not cover even if the sample size is large, this problem can be overcome by subtracting and adding S.D.s to mean value($\pm 3S.D.$), these will give the maximum and minimum values the range of which covers 99.75% of population of that area, while percentage of correctly sexed bone dropped down sharply with the statistically calculated demarking points but 100% classification accuracy is achieved for any sample from the region which is very useful in medico legal cases¹². The D.P. is also easy to work out as compared to multivariate analysis

Conclusion

Mean values of maximum length of normal human adult femora from Datia region, in male were 450.81 mm (Right) & 443.35 mm (Left) and for female were 416.48 mm (Right) & 419.44 mm (Left). It identified 13.40% of right male femora, 7.25% of left male femora, 4.35% of right female bones and 8.00% of left female bones.

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