Research Paper Medical Science

Maximum Femoral Length and Bicondylar Width as a Tool for Sexual Dimorphism

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ABSTRACT

Introduction-Sexual dimorphism from the long bones of skeleton plays an important role in anthropology. Length and bicondylar width of femur is the reliable element for sex determination.
Materials &methods-Present study was conducted in the department of Anatomy, Yenepoya Medical college, Mangalore. Study sample consisted of 66 dry adult hum an femora of which 25 bones were of females and 41 of males. Maximum length of femur was measured using osteometric board. Maximum bicondylar width was measured with the help of callipers.
Result- The mean maximum femoral length in males was 44.14 cms and in females it was 39.6 cms. Mean bicondylar width of male femora was 6.55±0.45and of female femora was 5.8±0.37.Stastical analysis revealed higher value in males and was significant (p<0.0001).

Keywords : Sexual dimorphism, Maximum femoral length, bicondylar width

Introduction:
Determination of sex from long bones of skeleton is of great medico legal significance. Determination of sex from pelvis and skull are the most reliable method used in anthropology[1]. However determination of sex from other parts of skeleton becomes important when a complete pelvis or skull is not available.

Sexual dimorphism of femur from length and bicondylar width has been extensively studied by many researchers in different population. The morphometric attributes differed from one population to another[2-4].Study conducted by Krogman and Iscan showed that morphological and morphometric parameters in the skeleton differs with population samples involved and this is true with reference to dimensions and indices[1]. Standards for the morphometric attributes should be used with reference to group from which the sample is drawn. So the aim of the present study was to measure the maximum femoral length and bicondylar width to determine the sexual dimorphism of femora in south Indian population.

Materials and methods:-
This cross-sectional study was conducted in the department of Anatomy, Yenepoya Medical College, Mangalore. Total of 66 dry adult human femora (41 male and 25 female) was measured .Femur showing any pathological abnormalities were not included in the study .sex determination of all femora was done with distinct anatomical features. Maximum length of femur was measured with the help of osteometric board in such a way that the medial condyle touches the short vertical wall and the moveable crosspiece touches the highest point of head of femur. Maximum vertical distance between head of femur and the condyle was measured With the help of verniercallipers, the maximum width between the medial and lateral epicondyles were measured. The measurements were taken in centimetres and the values were statistically analysed using student t test.

Results:-
Total of 66 femora were studied of which 41 were male femora and 25 were female femora .The maximum length recorded was 49.5 cms and minimum length was 40.5 in males .In case of females ,the maximum length recorded was 43.7 cms and minimum length was 34.4 cms. Mean length of male femora was 44.14 ±2.2 and in females it was 39.6± 2.1.Mean value of maximum length was higher in case of males when compared to females. p-value was <0.0001 and it was statistically significant. t value recorded was 8.27 with a standard error of 6.54.

Maximum bicondylar width recorded in male femora was 7.0 and minimum width was 5.7 cms. Maximum bicondylar width in case of females was 6.5cms and minimum width recorded was 5.1 cms. Mean bicondylar width of male femora (n=41) was 6.55±0.45.Mean bicondylar width of female femora was 5.8±0.37. Mean bicondylar width of male femora was higher in comparison to females .p value was <0.0001 and was highly significant.

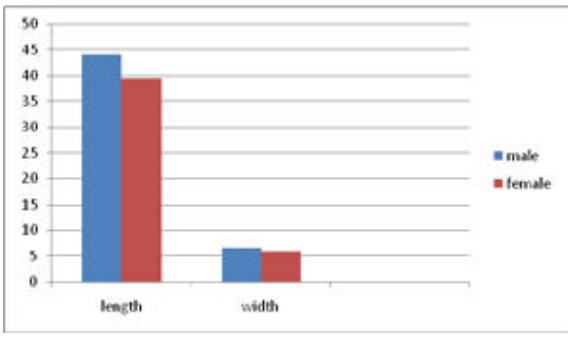
Table 1 showing mean femoral length in male & female

PARAMETER	MALE (n=41)	FEMALE (n=25)
Maximum length (cm)	49.5	43.7
Minimum length (cm)	40.5	34.4
Mean & Standard deviation	44.14±2.2	39.6±2.1
P value 0.0001		

Table 2 showing mean femoral width in male & female

PARAMETER	MALE (n=41)	FEMALE (n=25)
Maximum width (cm)	7.0	6.5
Minimum width (cm)	5.7	5.1
Mean & Standard deviation	6.55±0.45	5.8±0.37
P value 0.0001		

Graph 1 showing mean length & bicondylar width of femur in male and female



Discussion:

Male skeleton is considered to be longer and more robust than the average female, the magnitude differs from population to population .This difference can be attributed to genetic factors, environmental factors affecting growth and development like nutrition, physical activity and other pathologies[5]. The measurement of long bones carry additional advantage because of its tubular nature and it can be better preserved than short bones.

The mean maximum length of femur was higher in case of males in comparison to females. From the calculated p value, the difference in mean maximum length in males and females was highly statistically significant (p<0.0001).Calculated range for male femora was 37.54 - 50.74 cm and for female bones it was 33.3-41.9 cm. From the above values, the demarking points can be calculated and the femur with maximum length more than 41.9 cm can be classified male and maximum length less than 37.54 can be categorised as female. However if the length is between 37.54 - 41.9 cm, it is not possible to determine sex due to overlapping. The mean maximum femoral length in males was 44.14 cm and in females it was 39.6 cm. The mean maximum length in present study was higher than Thai population where the mean maximum femoral length was 39.7 cm[6] and in Chinese femora which measured 40 cms[7].similarly present study showed that mean bicondylar width in males was 6.55±0.45and in females 5.8±0.37. Mall et al tested sexual dimorphism by discriminate Analysis and the results showed that 67.7% of cases could be grouped correctly with single maximum femoral length measurement and 81.4% with bicondylar width[8]. Direct Analysis done in thai skeletons by King, Iscan and Loth revealed that bicondylar width as a best single dimension in sex diagnosis[9]. It is based on the fact that axial skeletal weight of male is heavier than female and this body weight is borne by femur, so that articular sufaces taking part in weight transmission is massive in males[10].

Conclusion:-

It is the common among forensic expert to be confronted with fragmentary skeletal remains. Results of the study confirm that maximum femoral length and the bicondylar width is a good indicator of sexual dimorphism. Sex determination is very accurate when the demarking point is used.

Figure 1 – Showing measurement of maximum femoral length by osteometric board.

Figure 2 showing measurement of bicondylar width by verniercallipers

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