

Original Research Article

SEX DETERMINATION BY SUBTROCHANTERIC TRANSVERSE DIAMETER OF FEMUR IN GUJARATI POPULATION

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ABSTRACT

Background: Femur is the longest and strongest bone in human body. Determination of sex is relatively easy if the entire skeleton is available for examination. In the absence of skull and pelvis, long bones either individually or in combination has been used for determining sex.

Materials and Methods: In this study, total of 141 human femora (115 male, 26 female) of known sexes were taken from Anatomy Department, M. P. Shah Government Medical College, Jamnagar, Gujarat by using demarcating point method. In this study, we measured the sub trochanteric transverse diameter of the upper end of the shaft of femur, where it shows maximum lateral projection. When the lateral projection was not clear, this measurement was taken 5cm below the base of lesser trochanter, measured with sliding caliper.

Results: The average Sub trochanteric transverse diameter of right male femur was 28.38 mm, average Sub trochanteric transverse diameter of right female femur was 26.33 mm, average Sub trochanteric transverse diameter of left male femur was 28.75 mm and average Sub trochanteric transverse diameter of left female femur was 27.71 mm. Demarcating Point for Sub trochanteric transverse diameter of right male femur was >34.02 mm and for right female femur was <20.76 mm, while for left male femur >39.97 mm and for left female femur <20.64 mm.

Conclusion: Mean Sub trochanteric transverse diameter of male femur is more than the mean Sub trochanteric transverse diameter of female femur in the Gujarati population of present study. Findings of this study may be useful in medico legal cases for estimation of sex from available fragmentary femora. The study can also be useful to anatomist & physical anthropologist.

Keywords: femur, sexual dimorphism, sub trochanteric transverse diameter of femur.

INTRODUCTION

Femur is the longest and strongest bone in human body.^[1] The word femur is derived from Latin word “femur” means a thigh or it may be derived from “ferendum”, a Latin word means bearing.^[2]

Determination of sex is relatively easy if the entire skeleton is available for examination. For determination of sex accurately, skull and pelvis are the highly reliable skeletal element.^[3]

Sometimes determination of sex becomes a difficult task for the forensic anthropologist, especially in the absence of the skull and pelvis. So, most of the long

bones, either individually or in combination, have been subjected to statistical and morphological analysis for determining sex. Sexual dimorphism in the femur is due to modification of the female pelvis with respect to its specialized function of reproduction. Therefore, the stress and strain experienced by the femur is different in a male than it is in a female.^[4]

Several studies have been carried out to determine sex from sub trochanteric transverse diameter of femur by many workers in different population, but in Gujarat few studies have been done. So, this study has been carried out to determine the sex from

subtrochanteric transverse diameter of femur in Gujarati populations.

MATERIALS AND METHODS

The material used for the study contained total of 141 human femora (115 male, 26 female) of known sexes taken from Anatomy Department, M. P. Shah Government Medical College, Jamnagar, Gujarat. The femora were obtained by maceration of the dead bodies received as voluntary donations or unclaimed bodies received at this department.

Selection Criteria: Only fully ossified & unbroken bones without loss of any piece of bone were used in the study.

Exclusion Criteria: Femora showing pathological abnormality, fracture and unknown sex were not included in study.

Method

The present study was conducted after taking approval from the Institutional Ethics Committee. First of all, side of each femur was determined. The sub trochanteric transverse diameter of the upper end of the shaft of femur was measured, where it shows maximum lateral projection. When the lateral

projection was not clear, this measurement was taken 5cm below the base of lesser trochanter, measured with caliper,^[5] (Photograph1). To avoid intra-observer error, each measurement was taken at three different times and their average was used as final reading.

Demarcating point (DP) for femur:^[6]

Demarcating point was measured by using mean \pm 3SD (calculated range, cover 99.75% of sample) for all the parameters.



Photograph 1: Showing measurement of sub trochanteric transverse diameter of femur

Table 1: Showing the sub trochanteric transverse diameter of femur (mm) and its statistical analysis (N= number, SD=standard deviation, mm= millimeter, DP = demarcating point)

Statistical values	RIGHT		LEFT	
	Male(N=55)	Female(N=12)	Male(N=60)	Female(N=14)
MEAN (mm)	28.38	26.33	28.75	27.71
SD (mm)	2.54	2.57	2.70	4.08
3SD (mm)	7.63	7.71	8.11	12.25
MEAN \pm 3SD(mm)	20.76-36.01	18.62-34.04	20.64-36.86	15.46-39.97
DP (mm)	>34.02	<20.76	>39.97	<20.64
% of DP (N)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
P VALUE	<0.01		>0.05	
REMARKS	Highly significant		Not significant	

Demarcating point for maximum diameter of both male and female femur was calculated as follows: Greatest diameter recorded for the female femur by using calculated range was the demarcating point-for male femur and the shortest diameter recorded for the male femur by using the calculated range was the demarcating point for female femur.

All bones having diameter more than the Demarcating point for male was identified as male femur and all bones having diameter less than the Demarcating point for female was identified as female femur.

RESULTS

Table1 shows the average Sub trochanteric transverse diameter of right male femur was 28.38 mm, average Sub trochanteric transverse diameter of right female femur was 26.33 mm, average Sub trochanteric transverse diameter of left male femur was 28.75 mm and average Sub trochanteric transverse diameter of left female femur was 27.71 mm.

DP for Sub trochanteric transverse diameter of right male femur was >34.02 mm and for right female

femur was <20.76 mm, while for left male femur >39.97 mm and for left female femur <20.64 mm.

Data for Sub trochanteric transverse diameter for right male and female was statistically highly significant, as p value was < 0.01, while for left male and female femur was statistically insignificant, as p value was >0.05.

Mean Sub trochanteric transverse diameter of male femur was more than the Sub trochanteric transverse diameter of female femur and the data was statistically highly significant, as p value was <0.01.

DISCUSSION

The results of this study suggest that the mean Sub trochanteric transverse diameter of male femur was higher than the female femur & it was statistically highly significant which is similar with findings Liu wu,^[8] and Slaus M et al.^[9]

In present study, by using DP method for Sub trochanteric transverse diameter of femur identified none of the femur correctly.

Dittrick J & Myers, correctly identified male and female femora using only Sub trochanteric transverse

diameter of femur in 55.1 % femora by discriminate analysis.^[7]

The Sub trochanteric transverse diameter of Gujarati population is less than the Sub trochanteric transverse

diameter of California, Chinese & Croatian population.

Table 2: Showing the comparison of sub trochanteric transverse diameter of male and female femur (mm) of Gujarati population with the findings of other workers (N= number, mm= millimeter, M= male, F= female, R= right, L=left, HS = highly significant)

Author	Population	Sex	No.	Mean (mm)	SD (mm)	DP (mm)	% Of Identified Bones	P value	Remark
Dittrick J& Myers (1986) ⁽⁷⁾	California	M	177	30.4	2.8	-	55.1	-	-
		F	173	29.0	2.8	-			
Liu wu (1989) ⁽⁸⁾	Chinese	M	74	31.9	3.1	-	-	<0.001	HS
		F	67	28.6	2.4	-	-		
Slaus M (2003) ⁽⁹⁾	Croatian	M	104	32.09	2.48	-	-	<0.0001	HS
		F	91	30.47	1.95	-	-		
Present study	Gujarat	M	115	28.57	2.62	>37.51	0	<0.01	HS
		F	26	27.08	3.47	<20.77	0	<0.01	HS

The difference between the present study & that of Dittrick J & Myers,^[7] is the low percentage of correct sexual classification of femur in present study by Sub trochanteric transverse diameter. This could be explained on the basis of statistical method applied. While the studies referred above were based on discriminate analysis, present study had used the demarcating point analysis.

CONCLUSION

Mean Sub trochanteric transverse diameter of male femur is more than the mean Sub trochanteric transverse diameter of female femur in the Gujarati population of present study. In Gujarati population, if Sub trochanteric transverse diameter of male femur is >37.51 mm than it is definitely male femur and if it is <20.77 mm than it is definitely female femur.

The Sub trochanteric transverse diameter of Gujarati population is less than the Sub trochanteric transverse diameter of California, Chinese & Croatian population.

As human skeletons from forensic studies are usually not complete, so it is necessary to have techniques applicable to various parts of the body for determination of sex. Findings of this study may be useful in medico legal cases for estimation of sex from available fragmentary femora. The study can also be useful to anatomist, orthopedic surgeons & physical anthropologist.

Abbreviations

DP – Demarcating point

SD – Standard deviation

Conflict of interest: None

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