

Morphometric measurement of Human femur in Gujarati population and their significance.

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Abstract:

Introduction: morphometric measurement of femur is useful in academic study for anatomist and also useful in medico legal cases and in physical anthropology. The present study has been carried out to establish the normal range of various morphometric parameters of femur in Gujarat populations and compare the various parameters of femur in Gujarat population with other populations. **Material and method:** The study was carried out using 150 dry normal adult femora (97male, 53female) in NHL municipal medical college, Ahmedabad, Gujarat, India. **Result:** The all parameters of femur of Gujarat population is less than that of American white, California, Marathwada, North Central India and population of Maharashtra, while more than the length of Chinese population. **Conclusion:** Findings of the present study is useful in medico legal cases for estimation of sex from available fragmentary femora. The study can also be useful to anatomist & physical anthropologist.

Key Words:- Femur, Measurement, Morphometry.

Introduction:

Femur is the longest and strongest bone in human body. It has a proximal end, shaft and a distal end. Proximal end consists of a head, neck and two trochanters (greater and lesser), while distal end has two condyles (medial and lateral).¹The word femur is derived from Latin word "femur" means a thigh or it may derive from "*ferendum*", a Latin word means bearing.²The present study has been carried out to establish the normal range of various morphometric parameters of femur in Gujarat populations and compare the various parameters of femur in Gujarat population with other populations.

Aims and Objectives:

1. To establish the normal range of various morphometric parameters of femur of known sex in Gujarat population.
2. To compare the various morphometric parameters of femur obtained in the present study with those of other population.

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Materials and method:

Present Study carried out on Dry femora of known sexes in Anatomy Department at Smt. NHL Municipal Medical college, Ahmedabad. The femora obtained by maceration of the dead bodies received as voluntary donations at Anatomy department of Smt. N.H.L. Medical College and B.J. Medical College. A total of 150 human femora (97 male, 53 female) were used for the present study. The adult femur fully ossified with known sex included in the study. The present study conducted after taking approval from the Institutional Ethics Committee.

Following parameter studied.

Maximum length of femur measured on osteometric board. Maximum vertical distance between upper end of the head of femur and the lowest point on femoral condyle was measured³ (Image-1). Vertical diameter of femoral head was considered as a maximum diameter of femoral head³ It was measured with a caliper (Image-2). It measures the straight distance between the highest and deepest points of the head. The distance between the lateral margins of bone at right angle to the sagittal diameter of the middle of the shaft, measured with caliper. The distance between the anterior and posterior surfaces of the approximately at the middle of the shaft i.e. the highest elevation of linea aspera, measured with caliper. It measures the circumference in the middle of the shaft i.e., highest elevation of linea aspera, measured with measure tape. The distance between the most projected points on the epicondyles. This measurement is taken at right angle to the shaft Axis, measured with the caliper. The transverse diameter of the upper end of the shaft of femur, where it shows maximum lateral projection. When the lateral projection is not clear, this measurement is taken 5 cm below the base of lesser trochanter, measured with caliper. The sagittal diameter of the upper end of the shaft of femur taken right angle to the transverse diameter of shaft, measured with sliding caliper.

Mean, standard deviation and range (minimum reading —maximum reading) for the each measurement was calculated. Student "t" test was used and 'p value' was calculated by using statistical aids for comparison of various parameters between male and female.

Image 1: Measurement of maximum length of femur by osteometric board



Image 2: Measurement of vertical diameter of head of femur by Vernier calliper



Results:

As we can see average maximum length of femur of male femur was 440.29 mm and

maximum length of femur of female femur was 393.25 mm.

As we can see average vertical diameter of femoral head of male femur was 43.99 mm and vertical diameter of femoral head of the female femur was 39.13 mm.

Table-1: Different parameters with mean standard deviation and range in male & female

Parameter		Mean (mm)	SD (mm)	Range
Maximum length of femur(mm)	Male(97)	440.29	26.92	353-491
	Female(53)	393.25	31.47	313-448
Vertical diameter of femoral head(mm)	Male	43.99	2.47	37-50
	Female	39.13	3.42	33-49
Mid shaft antero-posterior diameter(mm)	Male	26.42	2.79	21-34
	Female	24.57	3.17	20-33
Mid shaft transverse diameter(mm)	Male	26.29	2.74	19-32
	Female	23.74	2.16	19-30
Mid shaft circumference(mm)	Male	81.70	7.18	61-100
	Female	75.36	7.72	61-99
Bicondylar width(mm))	Male	72.97	4.83	66-95
	Female	71.26	7.62	61-90
Sub trochanteric Transverse diameter (mm)	Male	28.63	2.88	20-37
	Female	26.83	3.38	20-36
Sub Trochanteric anteroposterior diameter(mm)	Male	25.39	2.58	20-31
	Female	23	2.29	20-28

Average mid shaft Antero posterior diameter of male femur 26.42 mm and mid shaft Antero posterior diameter of female femur was 24.57 mm.

Average mid shaft transverse diameter of male femur was 26.29 mm and mid shaft transverse diameter of female femur as 23.74 mm.

Average mid shaft circumference of male femur was 81.70 mm and mid shaft circumference of female femur was 75.36 mm. Average bicondylar width of male femur was 77.97 mm and bicondylar width of female femur was 71.26 mm. Average Sub trochanteric transverse diameter of male femur was 28.63 mm and Sub trochanteric transverse diameter of female femur was 26.83 mm.

Average Sub trochanteric antero posterior diameter of male femur was 25.39 mm and Sub trochanteric antero posterior diameter of female femur was 23.00 mm. All the results

between male and female statistically highly significant, as p value was <0.01.

Discussion:

All the parameters considered in our study compared with the other studies. Various studies on the femur on other populations have been done by other workers

Table-2: Comparison of maximum length of male and female femur (mm) of Gujarat population with the findings of other workers.

Author	Population	Sex	No.	Mean (mm)	SD (mm)
Dibernardo & Taylor et al (1979) ⁴	American white	M	50	450	20.4
		F	35	423	22.1
Dittrick J & Myers et al (1986) ⁵	California	M	148	450	20.1
		F	145	420.6	17.2
Liu Wu et al (1989) ⁶	Chinese	M	74	431.3	25.8
		F	67	394.1	17.5
Purkait R & Chandra et al (2002) ⁷	Central India	M	200	451.47	23.38
		F	80	436.9	19.79
Maske SS et al. (2012) ⁸	Marathwada	M	189	443.6	22.6
		F	179	398.6	26.6
Srivastava R et al. (2012) ⁹	North Indian	M	94	435.5	26.26
		F	28	404.1	20.55
Our Study	Gujarat	M	97	440.29	26.92
		F	53	393.25	31.47

In present study found that the mean maximum length of male femur was higher than the female femur & it was statistically highly significant which is similar with findings of Liu Wu et al⁶, Maske SS et al⁸, Srivastava R et al⁹

Table-3: Comparison of vertical diameter of femoral head of male and female femur (mm) of Gujarat population with the findings of other workers

Author	Population	Sex	No.	Mean (mm)	SD (mm)
Dittrick J & Mayers et al (1986) ⁵	California	M	175	47	2.5
		F	171	42.2	1.9
Liu Wu et al (1989) ⁶	Chinese	M	74	45.3	3.2
		F	67	40.4	1.9
Iscan & Shihai et al (1995) ¹⁰	Chinese	M	37	46.16	2.62
		F	39	41.13	2.64
King CA et al. (1998) ¹¹	Thai	M	70	45.1	1.98
		F	34	39.3	1.93
Our Study	Gujarat	M	97	43.99	2.47
		F	53	39.13	3.42

In present study found that the mean vertical diameter of femoral head was higher than the female femur & it was statistically highly significant which is similar with findings of Liu wu et al⁶, iscan & shihai et al¹⁰, king CA et al¹¹

In present study found that the mean mid shaft antero posterior diameter of male femur was higher than the female femur & it was statistically highly significant which is similar with findings of Liu wu et al⁶, Soni G et al¹², Maske SS et al⁸ Gaikwad K.R. et al¹³

In present study found that the mean mid shaft transverse diameter and mid shaft circumference of male femur was higher than the female femur & it was statistically highly significant which is similar with finding of Maske SS et al⁸, Gaikwad et al¹³.

In present study found that the mean bicondylar width of male femur was higher than the female femur & it was statistically highly significant which is similar with findings of Iscan & Shihai et al¹⁰, King CA et al¹¹, Pandya AM et al¹⁴, laeeque Md et al¹⁵

In present study found that the mean Sub trochanteric anteroposterior and transverse diameter of male femur was higher than the female femur was statistically highly significant which is similar with findings Liu wu et al⁶ and Slaus M et al¹⁶.

Conclusion:

In present study, among all parameters, the maximum length of femur can identify higher % of male & female femur, followed by bicondylar width, vertical diameter of femoral head, mid shaft measurements and sub trochanteric parameters by demarcating point method. The all parameters of femur of Gujarat population is less than that of American white, California, Marathwada, North Central India and population of Maharashtra, while more than the length of Chinese population. Findings of the present 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.

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