



Study of Robusticity Index of Femur in Gujarat Region

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Abstract

*Robusticity index of femur is obtained by dividing sum of midshaft AP diameter & transverse diameter with the physiological length of femur. It provides relation between midshaft femoral diameters with the femoral length. Present study was aimed to ascertain values of robusticity index in Gujarat region and to evaluate its possible efficacy as a racial characteristic. Study sample consisted of 242 dry, human, adult femora [176male (87 right, 89 left) and 66 female (32 right, 34 left)] from skeletal collections of Anatomy departments of M. P. Shah Medical College, Jamnagar, Gujarat & P. D. U. Govt. Medical College, Rajkot, Gujarat. Midshaft AP diameter, midshaft transverse diameter and the physiological length of femur were measured and robusticity index was calculated using the formula, Robusticity index = (Mid Shaft AP diameter + Mid Shaft) *100]/ Physiological length. Mean values of robusticity index of normal human adult femora from Gujarat region, in male were 11.91 (Right) & 11.80 (Left) and for female were 12.05 (Right) & 11.84 (Left). Mean robusticity index of male in present study was lower than the English and Male Thai; similar to India, Japan and China and was lower than Maharashtra. Mean robusticity index of female in present study was lower than the English; similar to India, Japan and China and was lower than Maharashtra.*

Keywords: Robusticity index, racial characteristic, Femur.

Introduction

The femur is the longest, strongest and heaviest bone in the skeleton, which transmits the weight of the trunk from the hip bone to the tibia^[1].

According to Susan Standring (2004)^[2], length of the femur is associated with striding gait and its strength with weight and muscular forces.

The human femur, as consequence of its central role in bipedal posture and locomotion is subjected to loads, during walking three to four times of

bodyweight which accounts for large size and robusticity of this bone^[3].

Robusticity index is calculated by following formula^[4].

Robusticity index = [(Mid Shaft AP diameter + Mid Shaft transverse diameter) *100]/ Physiological length of femur.

Robusticity index of shaft provides relation between diameters of midshaft with the femoral length. It indicates whether the femur is long & slender or short & thick. Robusticity index of shaft is used by the anthropologists to distinguish human femora

from the femora of anthropoids and the homos. Its mean value indicate relation between various subtype of homo with each other, between homo and human races and between different types of human races with each other^[5].

Robusticity index of femur has been studied by several workers in different populations [Pearson & Bell (1919) in English femora^[5], Vadhana S. & Sood S. (1967) in Male Thai sample^[6], Kate B.R. (1976) in Indian, Japanese & Chinese population^[7], Bokariya P. et al. (2009) in Maharashtra population^[8].

Standards of morphological and morphometric 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^[8].

So, present study was carried out to ascertain Robusticity index of femur of femora from Gujarat region; and to compare its values with other populations

Material and Methods

Study sample consisted of 242 dry, human, adult femora [176 male (87 right, 89 left) and 66 female (32 right, 34 left)] which included the femora from the skeletal collection of Anatomy department, M. P. Shah Medical College, Jamnagar, Gujarat [136 male (67 of right & 69 of left side) and 48 female (23 of right & 25 of left side)] & Anatomy department, P. D. U. Govt. Medical College, Rajkot, Gujarat [40 male (20mright, 20mleft) & 18 female (9 right, 9 left)]. Femora showing pathological abnormality or from the persons outside Gujarat region were not included in the study.

Robusticity index was calculated by following formula^[4].

Robusticity index = [(Mid Shaft AP diameter + Mid Shaft transverse diameter) *100]/ Physiological length of femur.

Mid Shaft Anteroposterior Diameter: The distance between the anterior and posterior surfaces of bone

at right angle to the ventral surface of the middle of the shaft, measured with the caliper^[4,10].

Mid Shaft Transverse Diameter: The distance between the lateral margins of bone at right angle to the sagittal diameter of the middle of the shaft, measured with the caliper^[4,10].

Physiological length: It measures the projective distance between the highest point of the head and the tangent to the lower surface of the two condyles and it was measured with the osteometric board and femur should be place in such a manner on the board that the two condyles touch the short vertical wall^[4].

Each bone was measured thrice and measurements were repeated by two independent observers, mean of these observations was taken as a final reading to nullify any intra and inter-observer error. Data collected was tabulated and analyzed statistically

Results

Right Femur

The robusticity index of right male femur varied from 9.94 to 13.38 (average: 11.91 & S.D.:0.85), and of right female femur varied from 10.2 to 13.49 with average of 12.05 & S.D. of 0.86. (Table: 1)

Mean value of robusticity index was higher in female as compared to male. Calculated z-value and P value showed that the difference in the mean index in male and female was statistically insignificant with $P > 0.05$.

Table: 1 Statistical Values of Robusticity Index

Statistical values	RIGHT		LEFT	
	MALE (n=87)	FEMALE (n=32)	MALE (n=89)	FEMALE (n=34)
Range	9.94-13.38	10.2-13.49	9.72-13.42	9.91-13.21
Mean	11.91	12.05	11.80	11.84
S.D.	0.85	0.86	0.83	0.86
z-value	0.79		0.25	
P value	$P > 0.05$		$P > 0.05$	

Left Femur

The robusticity index of left male femur varied from 9.72 to 13.42 (average: 11.80 & S.D.:0.83), and of left female femur varied from 9.91 to 13.21 (average: 11.84 & S.D.:0.86). (Table: 1)

Mean value of robusticity index was higher in female as compared to male. Calculated z-value and

P value showed that the difference in the mean robusticity index in male and female was statistically insignificant with $P > 0.05$ on left side.

Discussion

The robusticity index of right male femur varied from 9.94 to 13.38 (average: 11.91 & S.D.:0.85), and of left male femur varied from 9.72 to 13.42 (average: 11.80 & S.D.:0.83). Calculated z-value and P value showed that the difference of the mean between right & left male was statistically insignificant with $P > 0.05$.

The robusticity index of right female femur varied from 10.2 to 13.49 (average: 12.05 & S.D.:0.86), and of left female femur varied from 9.91 to 13.21 (average: 11.84 & S.D.:0.86). Calculated z-value and P value showed that the difference of the mean

between right and left female was statistically insignificant with $P > 0.05$.

In present study, mean value of robusticity index was higher in female on both sides. Calculated z-value and P value showed that the difference in the mean robusticity index in male and female was statistically insignificant with $P > 0.05$ on right and left side.

Comparison of robusticity index between present study and other studies has been shown in table: 2. Mean male robusticity index value in present study was 11.91 (right) & 11.80 (left). In other studies it varied from 12.1 to 12.96.

Value of right side and left side in present work were equal; in the English femora also right & left side mean were similar^[5].

Table: 2 Comparison of Robusticity Index

Population & Study		Robusticity Index					
		Male			Female		
		Mean	S.D.	% Identified	Mean	S.D.	% Identified
Pearson & Bell (1919), English	Rt.	12.96	0.37	-	12.65	0.46	-
	Lt.	12.72	0.34	-	12.48	0.43	--
Kate B. R. (1976), India		Mean : 11.6					
Kate B. R. (1976), Japan		Mean : 12.8					
Kate B. R. (1976), China		Mean : 11.7					
Bokariya P. et al. (2009), Maharashtra	Rt.	Mean: 13.11, S.D. : 0.93					
	Lt.	Mean: 14.11, S.D. : 1.23					
Vadhana S. & Sood S. (1967) Male Thai		12.1	0.8				-
present study (n=242)	Rt.side (119)	11.91	0.85	-	12.05	0.86	-
	Lt.side (123)	11.80	0.83	-	11.84	0.86	-

Kate B.R., 1976^[7] (in India, Japan and China) and Bokariya P. et al., 2009^[8] (in Maharashtra) reported mean robusticity index values without sexwise division. Mean male value of Mean male value in present study was lower than the mean values of the study in English^[5] and Male Thai^[6]. Mean present work was similar to India^[7], Japan^[7] and China^[7] and was lower than Maharashtra^[8].

Mean female value in present study was 12.05 (right) and 11.84 (left), while in English femora, index was higher than these values on both side (12.65 right & 12.48 left)^[5].

Mean female value of present work was similar to India^[7], Japan^[7] and China^[7] and was lower than Maharashtra^[8].

Conclusion

Mean values of robusticity index of normal human adult femora from Gujarat region, in male were 11.91 (Right) & 11.80 (Left) and for female were 12.05 (Right) & 11.84 (Left). Difference in the mean robusticity index between male and female was statistically insignificant with on both sides. Mean robusticity index of male in present study was lower than the English and Male Thai; similar to India, Japan and China and was lower than Maharashtra. Mean robusticity index of female in present study was lower than the English; similar to India, Japan and China and was lower than Maharashtra.

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