

ANTHROPOMETRY ANALYSIS OF SEXUAL DIMORPHISM OF SACRUM

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ABSTRACT

Introduction: Over the years different authors had carried various types of measurements on human Sacrum of different races and region Anthropometry measurement of dry adult sacrum is as reliable as the radiographic sacrum measurements, since the anthropometric measurements of bones eliminates the restrictions of conventional radiographic measurements like focus distance, rotation of spine, Picture archiving communication system (PACS) measuring software. The present research study will analyses the Anthropometric difference between the male and female sacrum.

Materials and methods: The study was undertaken in 200 adult human dry sacrum in Department of Anatomy BKL Walawalkar Rural Medical College And Hospital, Research lab. Various Parameters like weight, Mid -Ventral Straight Length, Sacral Midventral Curved Length, Maximum sacral width, Sacral index measured using Sliding Vernier caliper, measuring tape, the Anthropometric parameter were recorded and analyzed.

Result: Average value for weight of sacrum in males was 59.70 gms and that of in female was 49.37 gms. Sacrum with weight measuring above 70 gms was definitely male and below 40 gms was definitely female. Difference between male and female mean was statistically significant. sacral index in male was 92.41% and that of female was 107.04%. Sacrum with sacral index measuring below 90.09% was definitely male and that of above 109.3% was definitely female.

Conclusion: Various Anthropometry are analysed and during the investigation. prior Anthropometry knowledge of sacrum is utmost important to Anatomist and Forensic clinician to distinguish between the male and female sacrum.

KEY WORDS: Sacral Index, Base- wing Index, Curvature index, Corporobasal index, Index of body of first sacral vertebra, Auricular index.

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INTRODUCTION

Sacrum also called as holy bone or scared bone component of pelvic girdle, The sacrum is a large

irregular type, triangular shaped bone formed by the fusion of five vertebra and forming the posterior as well as superior wall of pelvic

cavity [1,2]. The transverse process of sacrum is formed by the fusion of transverse process and costal elements. Anthropometry identification of sex of pelvic bones are important in cases where the bones are fragmented and it is uncertain to identify the sex of bone. In Forensic medicine it is very important to identify the sex of human skeleton remains discovered. In lower region of lumbar sacral segment most of the anatomical variations occur making the sacrum one of the most difficult portion of the vertebra for the identification of gender. Accurate estimation of gender of skeletal remains depends upon number of bone available. The accuracy of estimating sex of Femur 39.84 %, Atlas vertebra 31.18%, Skull 91.38 %, Coccyx and Sacrum is 97.18 %, Pelvis 95 %, Atlas vertebra 31.18%[3]. Davivongs et al states that male bone are massive heavier than the female bone, the female sacrum are shorter, wider, less concave and facilitating wider pelvic cavity [4]. Over the years different authors had carried various types of measurements on human Sacrum of different races and region Anthropometry measurement of dry adult sacrum is as reliable as the radiographic sacrum measurements, since the anthropometric measurements of bones eliminates the restrictions of conventional radiographic measurements like focus distance, rotation of spine, Picture archiving communication system (PACS) measuring software. The present research study will analyse the Anthropometric difference between the male and female sacrum.

MATERIALS AND METHODS

A osteological study was conducted on 200 non- fractured, non- pathological adult dry human sacrum of unknown sex analyzed, out of these 100 male and 100 female sacrum. Human adult Sacrum obtained from bone sets from medical students & bone sets from Department. of Anatomy B K L Walawalkar Rural Medical College SarwardeKasarwadi Tal. Chiplun Dist. Ratnagiri.

Inclusion criteria: Sacrum included for the present study were irrespective of sex and age

Exclusion criteria: Fractured sacrum, sacrum already undergone surgery, skeletally immature

sacrum.

Total eleven different anthropometry parameter were collected, various Anthropometric measuring instruments used like Sliding Vernier caliper, Measuring tape & electronic Weighing Machine were incorporated [5].

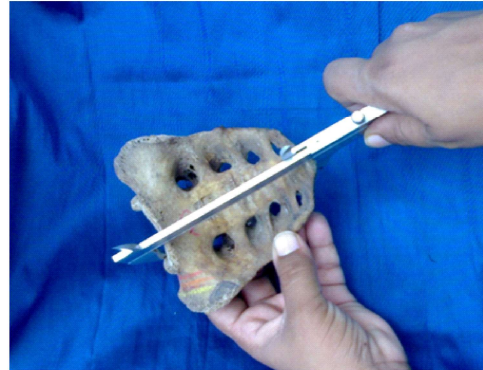


Fig.1: Showing Mid - Ventral straight length.



Fig.2: Showing Sacral Midventral Curved Length.



Fig.3: Showing Maximum sacral width.



Fig.4: Showing Transverse Diameter of Body of First Sacral Vertebra.



Fig.5:Showing Antero-Posterior Diameter of Body of First Sacral Vertebra.



Fig.6:Showing Length of Alae.



Fig.7:Showing Length of Auricle.

Mid -Ventral Straight Length: Superior Surface of Sacral promotory to the tip of the scarum (Figure 1) [6].

Sacral Midventral Curved Length-Flexiable measuring tape from the Anterior lip of sacral promotory to tip of the scarum (Figure 2)[7].

Maximum sacral width:Maximum superior transverse width base of sacrum (Figure 3) [8].

Transverse Diameter of Body of First Sacral Vertebra: The maximum width of the body of the first sacral vertebra was measured by taking the lateral part each side of the superior surface of the body of the first sacral vertebra(Figure 4)[9]

Antero-Posterior Diameter of Body of First Sacral Vertebra:It is measured by using Vernier caliper, the maximum antero- posterior diameter at midline of first sacral vertebra (Figure 5) [10].

Length of Alae:Maximum Transverse length from lateral edge of first sacral vertebra to the midpiont of alae of sacrum (Figure 6)

Length of Auricle:Maximum Verticle length of Auricle part of sacrum (Figure 7)

Weight of Sacrum:Weight of the sacrum is calculated by using electronic weighing machine.

Sacral index: - $\frac{\text{Width (maximum breadth)} \times 100}{\text{Maximum Height}}$

Curvature index:- $\frac{\text{Straight length} \times 100}{\text{Midventral curved length}}$

Corporoasalindex:-Transverse diameter of body of S1 x 100/Width of sacrum[11].

Table 1:Anthropometric of sacrum with various parameters.

Parameters	Gender	Range	Mean	P value
Mid ventral straight length	Male	8.26-11.45	10.30±0.41	<0.0001***
	Female	7.63-10	9.19 ±0.12	
Sacral Midventral Curved Length	Male	10.14-12.10	10.79 ±0.34	<0.0001***
	Female	8.54-12.23	10.27±0.20	
Maximum sacral width	Male	9.50-12.14	10.55±0.46	0.063
	Female	9.89-12.20	10.45±0.23	
Transverse Diameter of Body of First Sacral Vertebra	Male	4-6.25	4.37 ± 0.59	<0.0001***
	Female	4.21-5.51	4.12 ±0.63	
Antero-Posterior Diameter of Body of First Sacral Vertebra	Male	2.33-4	3.05 ± 0.24	0.0019*
	Female	2.13 -3.58	2.83 ± 0.33	
Length of Alae	Male	3.14- 4.63	3.45 ±0.42	0.063*
	Female	3.59 - 4	3.38 ± 0.14	
Length of Auricle	Male	4 -6.13	5.64± 0.46	<0.0001***
	Female	4.15 - 6	5.32± 0.54	
Weight of Sacrum	Male		59.70±0.39 (Grams)	<0.0001***
	Female		49.37±0.50 (Grams)	

Table 2: Showing sacral Index.

Index	Gender	Range	Mean	P value
Sacral index	Male	81.43- 110	92.41%	<0.0001***
	Female	106 - 135	107.04%.	

Table 3: Showing sacral curvature Index.

Index	Gender	Range	Mean	P value
Curvature index.	Male	84 – 110	95.45%	<0.0001***
	Female	79 – 105	89.57%	

Table 4: Showing Sacral corporobasal Index.

Index	Gender	Range	Mean	P value
Corporobasal index	Male	39 - 45	41.53%	<0.001***
	Female	35 - 40	41.53%	

DISCUSSION

By taking the account of various parameters of the sacrum, merits and demerits of each measurements were discussed by consideration of average value (mean). The value of determining sex of sacrum was mostly medicolegal where 100% accuracy was required. In the discussion of sexual dimorphism of the human bones, Davivongs (1963) has stated “as a general rule the male bones were more massive and heavier than female bones [4]. The crests, ridges, tuberosities and lines of muscle and ligament attachments were more strongly marked in males. This rule also governs the size of joints and auricular surfaces as well.”

Weight of Sacrum: Average value for weight of sacrum in males was 59.70 gms and that of in female was 49.37 gms. Sacrum with weight measuring above 70 gms was definitely male and below 40 gms was definitely female (Table 1)

Difference between male and female mean was statistically significant..Present finding nearly agree with findings[12].

Mid ventral straight length: Average value for ventral straight length of sacrum in male was 10.30 cms and that of female was 9.19 cms. Sacrum with ventral straight length measuring above 11 cms was definitely male and that of below 8.62 was definitely female. Mean value for male bones was significantly higher than in female bones. Present finding agree nearly with findings of [12, 13].

Sacral Midventral Curved Length: Average value for midventral curved length of sacrum in male was 10.79 cms and that of female was

10.27 cms. Sacrum with midventral curved length measuring above 12.6 cms was definitely male and that of below 9.6 was definitely female (Table 1). Difference between male and female mean was statistically highly significant. Present finding agree nearly with findings of [8].

Maximum sacral width: Average value for maximum sacral width of sacrum in male was 10.55 cms and that of female was 10.45 cms. Sacrum with maximum sacral width measuring above 11.8 cms was definitely male and that of below 9 was definitely female (Table 1). Difference between male and female mean was not statistically.

Transverse Diameter of Body of First Sacral Vertebra: Average value for transverse diameter of body of first sacral vertebra in male was 4.37 cms and that of female was 4.12 cms. Sacrum with transverse diameter of body of first sacral vertebra measuring above 4.9 cms was definitely male and that of below 3.5 was definitely female (Table 1).

Antero-Posterior Diameter of Body of First Sacral Vertebra: Average value for anteroposterior diameter of body of first sacral vertebra in male was 3.05 cms and that of female was 2.83 cms. Sacrum with anteroposterior diameter of body of first sacral vertebra measuring above 3.3 cms was definitely male and that of below 2.5 was definitely female (Table 1). Difference between male and female mean was statistically significant.

Sacral index: Average value for sacral index in male was 92.41% and that of female was 107.04%. Sacrum with sacral index measuring below 90.09% was definitely male and that of above 109.3% was definitely female (Table 2).

Curvature index: Average value for curvature index of sacrum in male was 95.45% and that of female was 89.57%. Sacrum with curvature index measuring above 98.05% was definitely male and that of below 80% was definitely female (Table 3). Difference between male and female mean was statistically significant.

Corporobasal index: Average value for corporobasal index of sacrum in male was 41.53% and that of female was 39.48%. Sacrum with corporobasal index measuring above 46.31% was definitely male and that of below

33.63 was definitely female (Table 4). Difference between male and female mean was statistically highly significant. Present finding agree nearly with findings of (Fawcett, 1938):

The extensive overlap in male and female ranges in various parameters of the sacrum was felt awfully during this work. However the sex overlap was observed in all parameters and indices, the probable reasons for overlap and inability to identify the bones on application of criterion of demarking point may be as follows. Considerable frequency of hypermasculinity in male bones and hypofemininity in female bones, these factors related to genetic, dietary, physical stress in individuals, all of which perhaps be accounted for, in the present study for the obvious reasons. The hypothesis was based on the observation that the variations among the measurements within the sex as well as between the sexes were seen when the comparisons were made between the two races, two sexes, and two countries and even within the regions of the same country.

CONCLUSION

The continuation of such studies in different areas in a coordinated manner will certainly help in analysing which of the factors mentioned above were capable of exerting predominant influence on the phenotype. If the genetic factor and geographic factor and racial factor were observed to be the important factors, we can safely presume that the standards laid down for different areas after the extensive and correlated studies will remain constant for a long period of time. However, if predominant influence was observed to be plastic ones (e.g. dietary habits, lifestyle and physical stress), it was hypothesized that the anthropometric standards will have to be evaluated from time to time in the perspective of such influences for their validity.

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Conflicts of Interests: None

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