



SACRAL INDICES FOR SEXUAL DIMORPHISM IN NAVI MUMBAI POPULATION

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ABSTRACT

Sacrum is a large triangular bone. It is formed by fusion of five sacral vertebrae and forms the caudal end of the vertebral column. It forms posterosuperior wall of the pelvic cavity wedged between the two innominate bones.

This study was carried on 60 human sacra (30 males and 30 females) which were collected from Department of Anatomy, MGM Medical College, Navi Mumbai, Maharashtra, India.

Result- The mean sacral index for males was 92.31 and for females was 104.

Mean auricular index for males was 56.7 (right) and 56.6 (left) with mean auricular index for females was 52.5 (right) and 49.1 (left).

Mean value of 1st sacral vertebra index was 65.1 in males and 75.2 in females respectively.

The mean sacral index of the male sacra of the present study is 92.32 and female sacrum is 114.08.

In our study male sacra fall under Dolichohieric group (narrow sacrum with sacral index up to 99.9). While the female sacra fall in the Plathyhieric group (broad sacra with SI more than 106).

Conclusion: All the three indices have significant statistical difference which can be used for sex determination in Mumbai population

Sacral-index is important amongst all because it shows significant statistical p-value of 0.000.

KEYWORDS :

Introduction:

Sacrum is described in Greek "hieron" as sacred but also a "Temple". There is some archeological evidence to support the use of sacrum as a vessel to hold the sacrifice in ancient sacred rites. Egyptians considered this bone sacred to "Osiris" the God of resurrection and of agriculture (Sugar, O. (1987)).

The sacrum is a large triangular bone, and is formed by fusion of five sacral vertebrae in the adult. The sacrum presents a base, an apex, pelvic, dorsal and lateral surfaces, and a sacral canal (Stranding, S., (2005)).

Anatomical variations occur frequently in this region making the sacrum the most variable portion of the spine (Esses, S. E., & Botsford, D. J. (1997)). The variation may be attributed to the depending of the final sacral morphology to the load related fusion of the bone structure. Failure to complete the ascending fusion may create a sixth lumbar vertebra, leaving a four-piece or "lumbarized" sacrum. Conversely, continuation of sacral fusion that incorporates the last lumbar vertebra may form a six-piece sacrum (sacralization). This same phenomenon may occur inferiorly as well, with incorporation of the coccyx into the sacral bone mass (Estin, D., & Cohen, A. R. (1995)).

This makes sacrum wide variant bone and makes its morphological study relevant in different geographical distribution.

Material and Method

Study Area

M.G.M. Medical College at Anatomy dissection hall after ethical clearance certificate at Navi Mumbai.

Study Sample

Study was carried on 30 dry human sacra and 30 cadaver sacral bones which were collected from Department of Anatomy, M.G.M. Medical College.

These specimens were divided in half male and half female, i.e. 15 male and 15 female dry and cadaveric specimens.

Inclusion Criteria

Only sacra with complete sacral hiatus were taken for the present study.

Exclusion Criteria

Damaged, mutilated and deformed sacra were excluded. Sacra exhibiting variations were not included in taking measurements.

Parameters taken for collection of data

Maximum sacral length: it is the maximum straight vertical height taken from mid ventral promontory to the apex of the sacrum in centimeter (cm)

Maximum sacral width: it is calculated as maximum straight transverse length at the level of alae (cm).

Maximum auricular length: it is the maximum vertical height of the auricular surface of sacrum (cm).

Maximum auricular width: maximum transverse length of the auricular surface of the sacrum (cm).

Maximum transverse diameter and antero-Posterior (AP) diameter of 1st sacral vertebral body (cm).

Index for sexual dimorphism

Sacral index :

$Width\ of\ sacrum\ x\ 100 / Straight\ Length\ of\ sacrum$

Auricular index :

$Vertical\ Length\ of\ auricular\ surface\ x\ 100 / Width\ of\ sacrum$

Index of body of 1st Sacral vertebra :

$Anteroposterior\ diameter\ of\ body\ of\ 1^{st}\ sacral\ vertebra\ x\ 100 / transverse\ diameter\ of\ 1^{st}\ sacral\ vertebra$

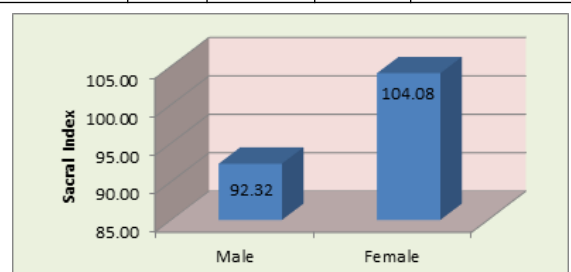
Observations and results

Observations were made in 60 sacra, complete, undamaged human sacra, of known sex collected from Department of Anatomy, M.G.M Medical College, Navi Mumbai, Maharashtra, India.

Index for sexual dimorphism

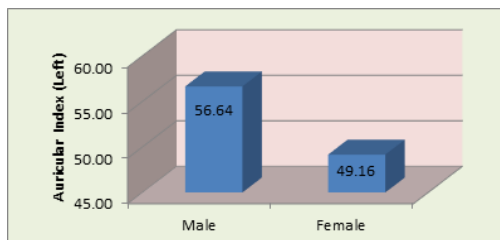
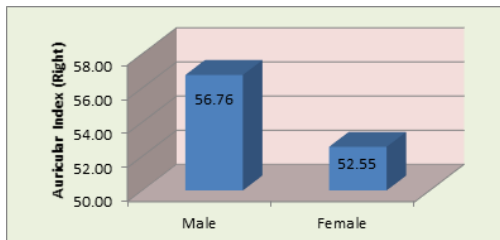
1) Sacral index : $Width\ x\ 100 / Straight\ Length$

Sacral index SD-standard deviation p-calculated probability ** significant p value				
Gender	Number	Mean	SD	p-value
Male	30	92.31	13.1	.000**
Female	30	104.0	8.0	



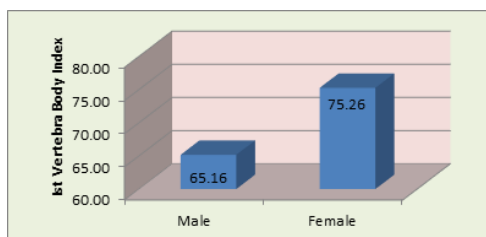
2) Auricular index: Length of auricular surface x 100 /Width of sacrum

Auricular index SD=standard deviation p-calculated probability **=significant								
Gender	Right side				Left side			
	Number	Mean	SD	p-value	Number	Mean	SD	p-value
Male	30	56.7	7.2	.000**	30	56.6	7.5	.000**
Female	30	52.5	7.4		30	49.1	10.4	



3) Index of body of 1st sacral vertebra: AP diameter of body of 1st Sacral vertebra x 100/transverse diameter

Index of body of 1st Sacral vertebra SD=standard deviation p-calculated probability **=significant				
Gender	Number	Mean	SD	p-value
Male	30	65.1	7.6	.000**
Female	30	75.2	29.1	



Discussion

Sexing of the skeletal remains is mainly a medico-legal work, where 100% accuracy is required. Previously many studies have been done to determine the sex of bones, but most studies recommended to have separate Demarking Point (D.P) for specific region or population. Jit and Singh (Jit, I., & Singh, S. (1966)) found that the maximum and minimum units of parameter values which is determined on the basis of mean±3 S.D. and which they have named Demarking Point would be of great value of determining the sex of sacrum with almost 100% accuracy.

The mean sacral index of the male sacra of the present study 92.32 and female sacra is 114.08. Male index is low as seen in Shreekrishna HK (Shreekrishna, H. K., Yatiraj, S., & Vijayakumari, N. (2013)) study which is falling under dolichoheric group (narrow sacrum with sacral index up to 99.9). Similar observation was reported by Jana et al (Jana, T. K., Koley, T. K., Saha, S. B., Basu, D., & Basu, S. K. (1988)) in their study of sacra Burdwan region, West Bengal in 1988, mean sacral index of male being 95.7), and Singh et al (Singh, H., Singh, J., & Bargotra, R. N. (1988)).

However, Davivongs (Davivongs, V. (1963)) and Raju et al (Raju, P. B., Singh, S., & Padmanabhan, R. (1981)) reported that the male sacra of their study fall under sub-plathyheric group. The mean sacral index of the female bone of the present study falls under-plathyheric group, which is similar to the observations of Raju et al (Raju, P. B., Singh, S.,

& Padmanabhan, R. (1981)) and Davivongs (Davivongs, V. (1963)) Martin (Comas, J. (1960)) reported that the European sacrum both male and female means fall into the plathyheric group, being 112.4 in the male and 114.8 in the female. But an attempt to use the sacral index for ethnic discrimination is very doubtful. However, its importance in sex determination cannot be denied since the differences between the males and females are highly significant, statistically.

The mean for index of body S1 vertebrae of male sacra for present study tallies with that of Davivongs and Singh et al, is slightly higher than findings of Mishra (Mishra, S. R., Singh, P. J., Agrawal, A. K., & Gupta, R. N. (2003)) but significantly lower than those of Mazumdar (Mazumdar, S., Ray, A., Mazumdar, A., Majumdar, S., Sinha, A., & Vasisht, S. (2012)).

However for female sacra it exceeds values of Shreekrishna HK (Shreekrishna, H. K., Yatiraj, S., & Vijayakumari, N. (2013)), Davivongs (Raju, P. B., Singh, S., & Padmanabhan, R. (1981)), Singh et al (Jit, I., & Singh, S. (1966)), (Mishra, S. R., et al (2003)) and Mazumdar (Mazumdar, S., Ray, et al (2012)).

Conclusion

In our study male sacra fall under *Dolichoheric group* (narrow sacrum with sacral index up to 99.9). While the female sacra fall in the *Plathyheric group* (broad sacra with SI more than 106).

All the three indices have significant statistical difference which can be used for sex determination in Mumbai population

Sacral-index is important amongst all because it shows significant statistical p-value of 0.000.

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