



# A study of sexual dimorphism of the human sternum in the southern Nigerian population

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## ABSTRACT

*Objective:* To study sexual dimorphism of the human sternum in southern Nigeria population.

*Methodology and results:* The study was conducted on 94 adult human sterna comprising 68 males and 26 females. Measurements were carried out along the length of the manubrium and mesosternum. The results showed that the average mean length of male and female manubrium was  $60.7 \pm 10.7$ mm and  $46.0 \pm 6.13$ mm, respectively. The average mean length of the male and female mesosternum was  $101.3 \pm 13.22$ mm and  $77.9 \pm 7.07$ mm, respectively. The combined length of the manubrium and mesosternum for male and females was  $164.6 \pm 19.96$ mm and  $123.3 \pm 11.8$ mm, respectively.

*Conclusion and application of findings:* There was a significant difference between the male and female sternum which is of great importance in medical science in areas of forensic investigations.

**Key words:** Sexual dimorphism, human sternum, southern Nigeria.

## INTRODUCTION

The human sternum is a flat elongated bone that forms the middle of the anterior part of the thoracic cage. It is attached to the clavicles superiorly and its margin articulates with the cartilages of the first seven ribs (Moore *et al.* 1999). The correct determination of skeletal sex is a critical requirement for medico-legal cases, and the accuracy with which sexing can be done depends on the nature of the materials and methods applied.

According to Ashley (1956a), Wenzel in (1788) conducted a study on the difference in the ratio between the length of manubrium and that of mesosternum in both sexes. His findings were supported by Dwight (1890) and Hyrtl (1893). They stated that the ratio between the manubrium and

mesosternum is 1:2 in the case of women and less in men (Hyrtl's law.). Paterson (1904) recorded that the mesosternum was longer and narrower in males than in females. For sexing the European sterna, Ashley (1956b) formulated the 149 rule according to which a male sternum exceeded 149mm in length whereas the female sternum was less than 149mm. This rule was applicable to 77.6% males and 80.4% females for European sterna.

Jit *et al.* (1986) conducted a study on the sexing of the North Indian sterna and concluded that the first rule as stated by Ashley (1956b) was not applicable to Indian sterna, which were shorter than the European steerna. In this study the mean length of the manubrium for males was 51.73mm



and 48.42mm for females. The combined length of manubrium and mesosternum was 147.08mm for males and 127.02mm for females.

A study conducted on the human sternum as an index of age and sex revealed that the mean length of manubrium was 53mm and 48mm for males and females, respectively, and the combined mean length of manubrium and mesosternum was 149mm and 124mm for males and females, respectively (Gautam *et al.* 2003). In another study done on sexual dimorphism of the human sternum in the Maharastrian population of India, 115 adult fully ossified dried sterna comprising of 75 males and 40 females were used.

The parameters measured were length of manubrium, length of body and combined length of manubrium and mesosternum. Application of the 50<sup>th</sup> rule confirmed sex in 77.3% male and 77.5% female bones, while application of the 81<sup>st</sup> rule for the mesosternum confirmed sex in 73.3% males and 75% females (Hannargi *et al.*, 2007).

## MATERIALS AND METHODS

A total number of 94 sterna comprising of 68 males and 26 females were used for this study. The sterna were obtained from University of Port Harcourt, University of Benin, Niger Delta University, Imo State University and University of Calabar all in south –south and south-

## RESULTS

Results (Table 1) show the length of manubrium in males and females, table 2 shows the length of mesosternum in males and females, while table 3

A study was done on 55 males and 65 females where complex morphometric analysis of breadth, length and thickness of the sterna was performed on the sterna segments which were defined by coastal notches. Morphometric analysis showed that the females and males were equal. The standardization according to shape was present in one standard sternal shape present in more than 2/3<sup>rd</sup> of the analyzed samples of both sexes (Selthiefer *et al.*, 2006).

In a study carried out on morphometric studies of x-rays of the sternum, sex determination of a sufficient certainty was possible using measurement of length and breadth obtained from x-rays of the human sternum if a wide range of dispersion is given. The given relations and formula are valid only when measuring the sternum of adults (Terje, 1983).

This study aimed at using the sternum to distinguish factors for medico-legal studies where examination of human skeleton is obviously of utmost importance for identification purposes.

east Nigeria. Measurements were done along the length of the manubrium, mesosternum and combined length of the manubrium and mesosternum using a meter rule. The data obtained was statistically analyzed using z-test and windows SPSS.

shows the combined length of the sternum in males and females.

**Table 1:** Length of males and females manubrium in southern Nigerian population.

Interval of manubrium (mm)	Frequency	
	Male	Female
30-39		2
40-49	9	19
50-59	26	4
60-69	18	1
70-79	12	
80-89	9	
Total	68	26

**Table 2:** Length of the mesosternum in males and females in southern Nigerian population.

Males		Females	
Interval of mesosternum (mm)	Frequency	Interval of mesosternum (mm)	Frequency
80-89	7	65-69	2
90-99	15	70-74	8
100-109	25	75-79	6
110-119	10	80-84	5
120-129	9	85-89	3
130-139	2	90-94	2
Total	68		26

**Table 3:** Combined length of the sternum in males and females in southern Nigerian population.

Males		Females	
Interval of sternum (mm)	Frequency	Interval of sternum (mm)	Frequency
130-139	4	100-109	2
140-149	12	110-119	10
150-159	17	120-129	6
160-169	13	130-139	5
170-179	6	140-149	3
180-189	6		
190-199	6		
200-209	2		
210-219	2		
Total	68		

## DISCUSSION

This study has demonstrated that in the manubrium 33 (48.5%) of the male sternum, the length was less than 61mm which was the maximum length recorded of the female sterna, while 2 (7.69%) of the female sterna was less than 40mm which was the smallest length of the male sterna. Ashley (1956b) got 52.2mm for males and 47.9mm for females. Jit and Bakshi (1986) obtained 51.73mm for males and 48.42mm for females, which agreed with our findings of 60.7mm for males and 46.0 mm for females.

This observation indicates that the difference between the average length of the male and female sternum is 14.7mm, which is statistically significant

( $P < 0.05$ ) with the length of the male sternum being longer than that of the female. In the human sternum, which is a highly sexually dimorphic bone, only the mesosternum and combined length of the sternum was seen to be highly useful in distinguishing a male from a female sternum.

From the parameters used in this study, the length of the mesosternum distinguishes 89.70% males and 61.5% females while the combined length of the manubrium and mesosternum distinguished 94.11% males and 69.23% females, which can distinguish sex correctly. The length of the manubrium was not found to be useful in sexual dimorphism of the sternum.

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