



## DETERMINATION OF STATURE FROM STERNAL LENGTH OF ADULTS OF IGBO ETHNIC GROUP OF NIGERIA

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### ABSTRACT

**Introduction:** Stature provides insights into various features of a population including initial health and genetics. It is considered as one of the parameters for personal identification. **Aims and Objectives:** The present study therefore estimate stature from sternal length of adult Igbo in Nigeria. **Methods:** A total of 300 adult Igbo Nigerians traced to the second filia generation, comprising of 150 males and 150 females were included in the study. Direct linear measurements of the length of the sternum were done by locating its sternal notch down to the tip of the xiphoid process using tape measure and height was measured. The data obtained were analyzed using the statistical package of social science (SPSS) version 19.0 for descriptive statistics, t-test, correlation and regression to derive equation for estimation of height. Confidence level was set at 95%; as P-values  $\leq 0.05$  were considered significant. **Results:** The mean height of the studied population was  $1.63 \pm 0.07$ m, as males ( $1.68 \pm 0.06$ m) were taller than females ( $1.58 \pm 0.04$ m). The mean  $\pm$  S.D values for the sternal length of the total population were  $0.16 \pm 0.01$ mm. For males;  $0.16 \pm 0.01$ mm, while female was  $0.16 \pm 0.01$ mm. There was a significant difference in the mean values of males and females for all measured sternal length [ $F_{1,9} >$ ;  $P < 0.001$ ] and were significant predictors of the stature of the general male and female population ( $P < 0.001$ ). The accuracy of prediction model for stature from sternal length for the general population was above average (R-sq; 0.8-73.35). While males had strong prediction (R-sq; 0.77-59.30), the female had (R-sq; 0.69-48.72). Regression equations were derived but with a weak positive correlation. **Conclusion:** This study suggests that the sterna length can predict the stature of adult Igbo Nigerians which is also sexually dimorphic.

**KEYWORDS:** Sternal length, Stature, Sex, Igbo, Anthropometry.

### INTRODUCTION

Stature is a composite of linear dimensions of skull, vertebral column, pelvis and legs.<sup>[1]</sup> Stature provides insights into various features of a population including initial health and genetics. It is considered as one of the parameters for personal identification.<sup>[2]</sup> Indeed, it stands as a tool used in measurement and comparison of human variation.<sup>[3]</sup> Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of the human body skeleton.<sup>[1]</sup> It also expresses known fact that various factor which include age, sex, nutritional status, environment and physical activity influence stature and body dimensions. Hence, racial and ethnic variations are known to exist in the population.<sup>[4]</sup> Many studies have shown that the length of head, height of head, distance between sternal notch and pubic symphysis were significant body segments for estimation of stature.<sup>[5]</sup> Soumeek and Parthaparatin<sup>[6]</sup> used radiological measurements of sternal length to develop a population specific regression formula (regression equation) to correlate the stature of an

individual with length of sternum. Goksin *et al.*<sup>[7]</sup> estimated Stature from four sterna lengths, length of the manubrium (LM), length of the body (LB), length of the manubrium and the body (LMB) and total sterna length, of cadaver. Stature and all sterna lengths were greater in males than in females ( $P < 0.001$ ). All sternal lengths were positively correlated with stature in sexes. Multiple regression equations were derived for stature estimation.

### MATERIALS AND METHODS

The study was designed to determine the stature of Igbo individuals using the length of the sternum by locating its sternal notch down to the tip of the xiphoid process. This study was carried out on a Nigerian population that comprises only Igbo ethnic group. The study was carried out on three hundred (300) adult subjects. Subjects were all adult (20 years and above) Nigerian residing in Abia, Imo and Rivers State. The subject comprises One hundred and fifty (150) males and One hundred and fifty (150) females where both parent of origin were Igbos. Subjects who gave their consents were selected randomly

from Aba, Owerri, Umuahia and Port Harcourt. The length of the sternum and height were measured using standard anthropometric methods using a measuring tape. Subjects who are physically challenged or have any form of disabilities were excluded from the study.

The data obtained were analyzed using the statistical package of social science (SPSS) version 19.0 for descriptive statistics, t-test, correlation and regression to derive equation for estimation of height. Confidence level was set at 95%; as P-values  $\leq 0.05$  were considered significant.

**RESULTS**

**Table 1: Descriptive statistics of measured parameters**

PARAMETERS	Male (N=150)		Female (N=150)		Total (N=300)	
	Mean±S.D	Range (min-max)	Mean±S.D	Range (min-max)	Mean±S.D	Range (min-max)
STERNAL (mm)	0.16±0.01	0.15 - 0.18	0.16±0.01	0.14 - 0.17	<b>0.16±0.01</b>	<b>0.14 - 0.18</b>
HEIGHT (mm)	1.68±0.06	1.57 - 1.83	1.58±0.04	1.5 - 1.7	<b>1.63±0.07</b>	<b>1.5 - 1.83</b>
AGE (yrs)	27±7	20 - 50	28±7	20 - 49	28±7	20 - 50

Note: N=Population distribution, S.D=Standard deviation, min=minimum, max=maximum mm=milimeters, yrs=years.

**Table 2: Analysis of variance in mean values of male and female parameters**

		S <sup>S</sup>	df	M <sup>S</sup>	F-value	P-value	Inf.
STERNAL * SEX	Between Groups	0.006	1	0.006	197.367	<0.001	S
	Within Groups	0.010	298	0.000			
	Total	0.016	299				
HEIGHT * SEX	Between Groups	0.749	1	0.749	306.996	<0.001	S
	Within Groups	0.727	298	0.002			
	Total	1.475	299				

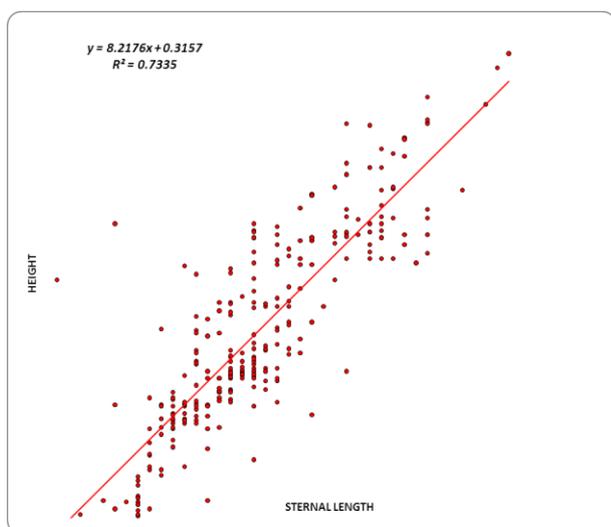
Note: S<sup>S</sup>=Sum of square, M<sup>S</sup>=Mean square, df=degree of freedom, F-value=Fisher's value, P-value=Probability value r=Pearson's corelation coefficient; R<sup>2</sup>=Coefficient of determination; R<sub>E</sub>=Regression Equation (S=significant)

**Table 3: Prediction model for Igbo poulation (with regression equations)**

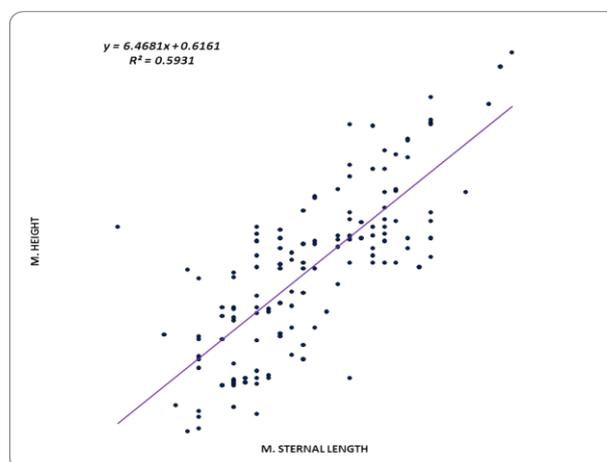
Variables	STATURE PREDICTION (in m)			
	r	R <sup>2</sup> (%)	R <sub>E</sub>	P-Value
MALE	0.770	59.30	6.468 SL + 0.616	< 0.001
FEMALE	0.698	48.72	6.542 SL + 0.564	< 0.001
GENERAL	0.856	73.35	8.218 SL + 0.316	< 0.001

Note: SL=Sternal length

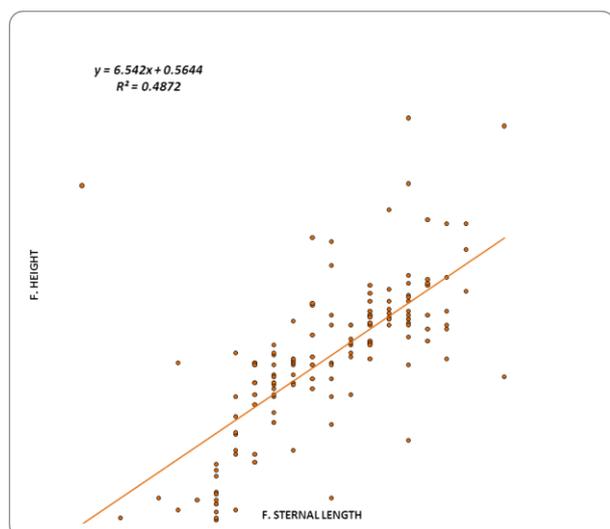
r=Pearson's corelation coefficient; R<sup>2</sup>=Coefficient of determination; R<sub>E</sub>=Regression Equation



**Figure 1: Scatter plot of sternal length against height of the total Igbo population (with regression equation)**



**Figure 2: Scatter plot of sternal length against height of the Igbo male population (with regression equation)**



**Figure 3: Scatter plot of sternal length against height of the Igbo female population (with regression equation)**

Table 1 represents the study population of 300 subjects with mean age of  $28 \pm 7$  years; of equal proportion of males (mean  $\pm$  S.D =  $27 \pm 7$  years) and females (mean  $\pm$  S.D =  $28 \pm 7$  years). The mean height of the studied population was  $1.63 \pm 0.07$  m, as males ( $1.68 \pm 0.06$  m) were taller than females ( $1.58 \pm 0.04$  m).

The mean  $\pm$  S.D values for the sternal length of the total population were  $0.16 \pm 0.01$  mm. For males;  $0.16 \pm 0.01$  mm, while female was  $0.16 \pm 0.01$  mm.

#### Sex Difference in sternal length

Table 2 shows that the statistical analysis using t-test revealed a significant difference in the mean values of males and females for all measured sternal length [ $F_{1,9} >$ ;  $P < 0.001$ ]. For Igbo population, Age, height, varied significantly between both sexes [ $F > 3.00$ ;  $P < 0.001$ ].

#### Stature prediction using sternal length

From the correlation analysis in Table 3 for male and female, all variables were significant predictors of the stature of the general male and female population ( $P < 0.001$ ). The accuracy of prediction model for stature from sternal length for the general population was above average (R-sq; 0.8-73.35). While males had strong prediction (R-sq; 0.77-59.30), the female had (R-sq; 0.69-48.72).

Figure 1 shows a scatter plot of sternal length against height for the total population. A regression equation was derived;  $Y = 8.2176x + 0.3157$  and a regression coefficient,  $R^2 = 0.7335$ . The regression coefficient shows a weak positive correlation.

Figure 2 shows a scatter plot of sternal length against height among the Igbo male population. A regression equation,  $Y = 6.468x + 0.6161$  was derived with a coefficient of regression,  $R^2 = 0.5931$ . The coefficient of

regression for the males also showed a weak positive correlation but stronger than that of the total population.

Figure 3 shows a scatter plot of sternal length against height of the female Igbo population. A regression equation,  $Y = 6.542x + 0.5644$  was derived while the coefficient of regression was  $R^2 = 0.4872$ . It also showed a weak positive correlation but stronger than that of the males and the total population.

#### DISCUSSION

Stature is important and a useful anthropometric parameter that helps completes the physical identity of an individual. Sternum in previous studies has been useful in forensic anthropometry as it has been used to determine stature.<sup>[3]</sup> Long bones are often used because they relatively give more accurate prediction.<sup>[8]</sup>

However, a study done by<sup>[7]</sup> produced a correlation coefficient: 0.721 and 0.740 in males and females as compared to the present study of 0.770 and 0.689 in males and females. They established that the sternum has 90% accuracy in determining sex but not stature which in this presents studies the sternal length has 73.35% accuracy in determining stature. This is in agreement with the present study in which male values were higher than female values.

In the same way, the present study agrees with the work done by Ekezie<sup>[9]</sup> on sexual dimorphism as a significant difference was observed at ( $P < 0.001$ ) with accuracy of 68.23% while a significant difference ( $P < 0.001$ ) with an accuracy of 73.35% was observed in Ekezie.<sup>[9]</sup> In both cases, the male mean values were found to be higher than the female.

The result obtained in the present study shows that the Igbo males are taller ( $1.68 \pm 0.06$ ) than the females ( $1.58 \pm 0.04$ ), with an accuracy of 73.35% in estimating stature from sternal length. Although previous works done by Dahipale<sup>[10]</sup> and Guatam<sup>[11]</sup> reported sex dimorphism with significance of  $P < 0.001$  suggesting that estimation of stature can be 95% accurate from the measurement of the length of the mesosternum with the male values still being higher. This present study correlates with Ashley<sup>[12]</sup> and Dwight<sup>[13]</sup> confirming that the total sternal length provides useful guide to the stature of an individual.

#### CONCLUSION

This study has successfully documented the sternal length values for Igbos especially with respect to stature prediction. This can be useful in forensic anthropometry and clinical practice.

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