

# Craniometric Analysis of Nigerian Population

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## Article info:

Received: 10 Dec. 2013

Accepted: 18 Mar. 2014

## ABSTRACT

**Introduction:** The existence of sexual dimorphism in human skeletons especially skull and its medico-legal importance had long been studied [3] [2,1]. This study has investigated the existence of sexual dimorphism in cranial dimensions of Nigerian population.

**Methods:** A total of 100 adult dry skulls, (78 males, 22 females) free from damage and deformity fully ossified from Departments of Anatomy in Nigerian Universities were used for this study. Spreading calliper, measuring tape were used to measure the following parameters, bregma-lambda, lambda-inion, nasion-bregma, nasion-inion, basion-bregma. Graph pad prism version 5.0 was used to analyze the data, coefficient of variation, correlation, linear regression, percentiles, sexual dimorphism ratio were computed. Student's T-test was used to compare male-female and right-left measurements.

**Results:** The results indicate that the male parameters were higher than female parameters and statistically significant at  $P < 0.05$  in all. The length of Bregma-Lambda of male and female were  $126.3 \pm 0.85$ mm and  $118.1 \pm 1.54$  mm respectively. The length of lambda-inion of male and female were  $71.31 \pm 0.82$ mm and  $60.01 \pm 1.53$  mm respectively. The length of nasion-bregma of male and female were  $135.8 \pm 1.16$ mm and  $128.8 \pm 3.17$  mm respectively. The length of nasion-inion of male and female were  $170.7 \pm 0.93$  mm and  $157.5 \pm 1.34$  mm respectively. The length of basion-bregma of male and female were  $140 \pm 0.73$  and  $132 \pm 1.73$  mm respectively. Sexual dimorphism ratio was greater than unity in all.

**Conclusion:** The anthropometry of these cranial dimensions can be a guide in gender determination of unknown individuals and a guide to surgeons in face of surgical intervention.

## Key Words:

Sexual dimorphism, Sex determination, Skull, Forensic anthropology

## 1. Introduction

**C**raniometric is the measurement of skull. Skull is the skeleton of the head and consists of cranium and facial skeleton. Giles and Eliot 1963, Deshmukh and

Devershi 2006, Ahmed et al, 2011 investigated existence of sexual dimorphism in human skeletons especially skull and its medico-legal importance. Krogman and Iscan (1986) stated that sex assessment in a collection of 750 skeletons was possible, with levels of reliability of 100% when the entire skeleton was present,

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92% using the skull alone, and 98% when combining the pelvis and skull. Despite the increase in research in sex prediction using craniofacial characteristics worldwide, information on such parameters is sparse in Nigerian population. The aim of this study is to develop a sex determination technique using cranial dimensions.

**2. Materials and Methods**

A total of 100 adult dry skulls (78 males, 22 females), free from damage and deformity fully ossified collected from Departments of Anatomy in Nigerian Universities were used for this study. Spreading caliper and tape were used to measure the following parameters Bregma-lambda, lambda-inion, nasion-bregma, nasion-inion length and bregma-basion.

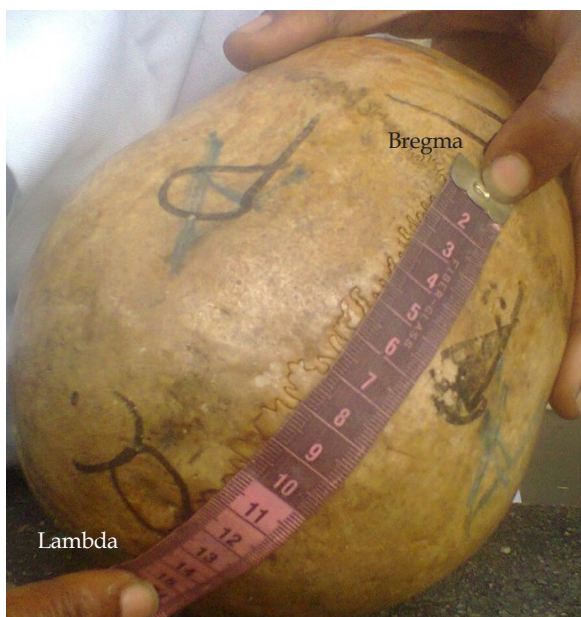
**Lambda:** point of juncture of the left and right lambdoidal sutures and superior sagittal suture.

**Bregma;** a point of juncture of the left and right coronal sutures and the superior sagittal suture.

**Inion:** This is the most prominent point in the posterior aspect of the occipital calvarium occurring at the intersection of the left and right superior nuchal lines.

**Nasion:** This is the midpoint of the sutures of the frontal and nasal bones.

**Basion (BA):** The most anterior point of the great foramen magnum in the sagittal plane.



**Figure 1. Bregma-lambda length** ANATOMICAL SCIENCES



**Figure 2. Lambda - inion length** ANATOMICAL SCIENCES



**Figure 3. Nasion - bregma** ANATOMICAL SCIENCES



**Figure 4. Nasion-inion** ANATOMICAL SCIENCES

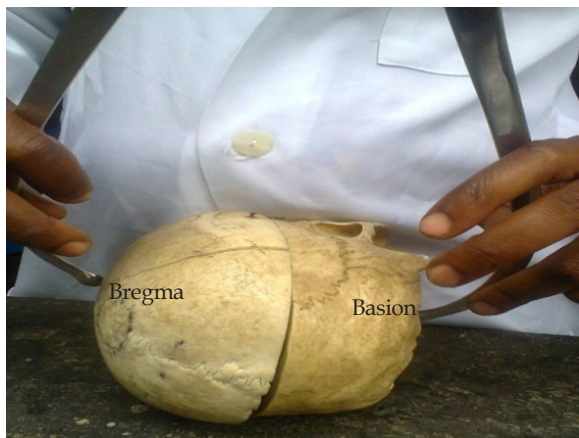


Figure 5. Basion – Bregma

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Data was analyzed with Graph Pad Prism 5.0. The mean, standard deviation, standard error of mean, maximum, minimum, geometric mean, coefficient of variation, correlation, linear regression, percentiles, sexual dimorphism ratio were computed. Student's T-test was used to compare male-female.

### 3. Results

The effect of sex on cranial parameters namely Bregma-lambda, lambda-inion, nasion-bregma, nasion-inion length and bregma-basion is shown on Table 1. The male cranial parameters were significantly higher than female parameter at  $P < 0.05$ . Table 2 shows sexual dimorphism ratio of the various craniometric parameters. The male/female ratios for the mean measurements were greater than unity.

The scatter plot of the linear relationship between female nasion-bregma versus basion-bregma length is shown on Figure 1. There was positive correlation between female nasion-bregma versus basion-bregma length; hence the fit line sloped upward. Figure 2 shows a scatter plot of the linear relationship between male nasion-bregma versus basion-bregma length. There was negative correlation between male nasion-bregma versus basion-bregma length; hence the fit line sloped downward.

### 4. Discussion

Sex determination from the human skull is of paramount value to forensic expert in identification of human remains and racial identity of the deceased. It has long been known that the race and sex of a human skull can in many cases be assessed anthropometrically [3,4,2]. As cases of accidents and death arising from natural disasters like plane crash, flood are on the increase, this necessitated this research in order to create a standard value for Nigeria in the face of dearth of information.

A study by Deshmukh and Devershi (2006), Hong Wei Song (1992), Ahmed et al 2011, Rooppakhun et al. (2011) found male cranial parameters Nasion – bregma length Bregma-lambda, nasion-bregma and bregma – basion to be higher than female and significantly different at  $P < 0.05$ . The present study, however, agrees with the aforementioned study which also reported male parameters to be higher than females. There is a dearth of information on nasion-inion, lambda-inion in both Nigerian and Caucasian populations. Neverthe-

Table 1. Effect of sex on cranial parameters.

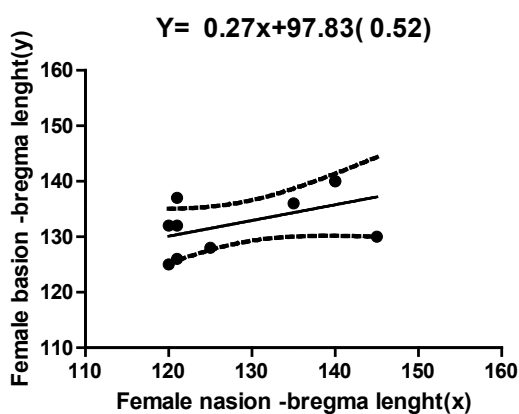
Parameters	Sex	Mean $\pm$ SEM	Coefficient of variation	Maximum	Minimum	Significant level
Bregma -lambda	M	126.3 $\pm$ 0.85	6.31%	145.00	105.00	$P < 0.05^*$
	F	118.1 $\pm$ 1.54*	4.53%	128.01	110.10	
Lambda –inion	M	71.31 $\pm$ 0.82	10.18%	95.00	50.00	$P < 0.05^*$
	F	60.01 $\pm$ 1.53*	11.97%	78.00	50.00	
Bregma-nasion	M	135.8 $\pm$ 1.16	7.76%	160.00	110.00	$P < 0.05^*$
	F	128.8 $\pm$ 3.17*	7.78%	145.00	120.00	
Nasion –inion	M	170.7 $\pm$ 0.93	4.69%	190.0	149.00	$P < 0.05^*$
	F	157.5 $\pm$ 1.34*	2.70%	160.00	150.00	
Bregma –basion	M	140 $\pm$ 0.73	4.71%	152.00	128.00	$P < 0.05^*$
	F	132 $\pm$ 1.73*	4.13%	140.00	125.00	

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Table 2. Sexual dimorphism ratio.

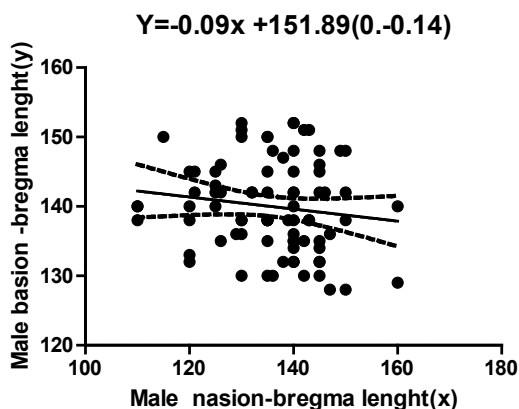
Parameters	Male mean(mm)	Female mean(mm)	Sexual dimorphism ratio =M. mean/F. Mean
Bregma-lambda	126.3	118.1	1.06
Lambda-inion	71.31	60.01	1.18
Nasion-bregma	135.8	128.8	1.05
Nasion-inion	170.5	157.5	1.08
Bregma –basion	140	130	1.08

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Figure 1. Linear regression graph of male nasion-bregma versus basion bregma length.



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Figure 2. Linear regression graph of male nasion-bregma versus basion-bregma length.

less related studies by Steyn (1998), Hong Wei Song (1992), Deshmukh and Devershi (2006) showed that male parameters are higher than female and statistically significant at  $P < 0.05$  which correlates well with our results which also reported male parameters to be higher than female and statistically significant at  $P < 0.05$ .

Ahmed et al, (2011) reported that sexual dimorphism ratio (male/female ratios) for the mean measurements were greater than unity, indicating that the male crania were larger in all linear dimensions than female crania. This correlates well with the present study which reported that sexual dimorphism ratio for the mean measurements were greater than unity too, indicating that the male crania were larger in all linear dimensions.

In a bid to model the relationship between two anthropometric parameters, this study has employed linear regression and correlation tools as aforementioned using the equation  $y = ax + b$ . With this equation the value  $y$  can be predicted when  $x$  is known. Hitherto information is scanty on the mathematical models of these craniometric parameters [8]. A positive regression coefficient indicate a positive relationship between two variables and from the graph the fit line sloped upward as in female Basion –bregma v Nasion bregma while a negative regression coefficient indicate a negative relationship between two variables and from the graph the fit line sloped downward as in male Basion–bregma v Nasion bregma.

Sexual dimorphism in Nigeria is well reflected in cranial dimensions, thus this study will be useful to forensic expert in the identification of skeletal remains and also to surgeons with respect to surgical intervention.

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