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Cephalometric Indices among Nigerians

M.B.T. Umar, R. Singh and A.I. Shugaba
Department of Human Anatomy, University of Jos, Jos, Nigeria

Abstract: Cranial measurements and indices are used to estimate the sex and race. The study was conducted with a total number of 409 students of university of Jos, St Murumba and School of Higher Islamic Secondary School Jos. Eight cephalometric indices namely cephalic index, upper facial index, nasal index, cranial module, cranial length-height index, cranial breath-height index, mean-basion index, mean height index were calculated. It is concluded that the various indices calculated above agree with the description of Bass of the Negroid cranium as opposed to the Caucasian cranium. The Bass description is that of racial classification of the cranium based on the numerical values of the various cranial indices calculated.

Key words: Cephalometry, indices

INTRODUCTION

Cephalometry is a branch of anthropometry that describes measurement of head and face in cadaveric, living or radiological specimen. Cephalometry use landmarks on the skull to take specific measurements, which are used to calculate indices. These measurements and indices are used to estimate the sex and race of an individual. Europe's anatomists dissected and analyzed the skeletons of animals and humans from every corner of the world in their attempts to substantiate the notion that nature shades continuously from one form to another. Of special interest were the transitional forms bridging the gap between animals and humans. Sexual and racial differences in cranium have also been widely studied. Campers (Petrus Camper, 1803) were one of the first who suggested that skull measurements could illuminate the natural relationship among apes, Negroes and Europeans.

Attempts to established reliable cephalometric differentiation between races are as old as craniometry itself and although the mandible and cranial capacity are in this connection less dependable, satisfactory characterization has been established for some racial groups and especially for Caucasian and Negroes.

With all these data on elsewhere on record of anthropometry data, in Nigeria such records on cephalometry is scanty, especially on measurements like facial features such as facial height, facial index and nasal height.

The relationship of measurements to each other is expected to be constant at specific ages. These relationships are expressed as ratio, as an index, or by

use of regression technique. These proportions and relationship change dramatically from the fetal period through childhood to adolescence because of various interactions between genetic, biochemical and environmental factors.

Generally variation measured in anthropometry controlled by polygenic inheritance and other factors such as sex, age and nutritional status (Varrel, 1990); it was found out that though anterior rotation is the natural growth direction of the mandible, several functional disturbances, including reduced masticatory stimulation due to modern diet, may promote more posteriorly directed growth. Thus, the simplest of the parameters in anthropometry, including, height, weight, length, thickness and width of various parts of the body vary from tribe to tribe and one race to the other on one hand. On the other hand, these measurements also differ amongst different age groups and between the two sexes as well.

Craniometric methods also play apart in attempts to reconstruct the appearance in life of individuals represented only by skeletal remains (Stewart, 1954).

This study will help to distinguish the various configurations of various tribes thereby assisting in security. Example, crime rate, murder, rape and serious assault, for three races namely Whites, Blacks and Orientals showed that blacks in the USA have greater crime rates (Interpol, 1984, 1990 and 1996). Other fields where craniometry is used is in the fields of orthopaedic and ophthalmology.

The objective this study is to provide cranial indices values for Nigerians and set standard for future study for individual tribes.

MATERIALS AND METHODS

This study was carried out in Jos, the capital of Plateau state in 2002, which has been described as the melting pot of Nigeria. This is because of the conglomeration of the various ethnic groups of Nigeria due to its temperate like whether.

The subjects' were students of University of Jos and the surrounding secondary schools.

Instruments used include weighing balance (Essential China), measuring tape sliding and spreading calipers and transparent graded ruler. The following measurements namely, age sex, weight, height, head length, head width, upper facial height, lower facial height, total facial height, nose width, nose length, skull height and bizygomatic distance were recorded with the subjects sitting in upright position Frankfurt's horizontal position see figures attached.

Head length: Figure 1 is the maximum dimension of the sagittal axis of the skull

Land marks: Measure between the glabellas and the opithocranium (the most prominent of the occipital, close to the midline posterior rim of the foramen magnum)

Instrument: Wide spreading calipers.

Head width: Figure 2 is the maximum biparietal diameter

Landmarks: Measure between the most lateral points of the parietal bones (eurion on each of the head.

Instrument: Wide spreading calipers.

Bizygomatic distance: Figure 3 is the maximal distance between the most lateral points of the zygomatic arches (zygion).

Land marks: Measure between the most lateral point of the zygomatic arches (zygion) localized by palpation.

Instrument: Wide spreading calipers.

Skull height: Figure 4 is the distance from the root of the nose (nasion) to the highest point of the head (vertex).

Land marks: Measure from the depth of the nasal roots to the superior most point the skull in the vertical plane.

Instrument: Sliding calipers

Upper facial height (nasal height): Figure 5 this is the distance from the root of the nose (nasion) to the base of the nose (sub nasion)

Land marks: Mmeasures from the deepest part of the nasal to the deepest point of concavity at the base of the nose (sub nasion) in a vertical plane.

Instrument: Sliding calipers.

Lower facial height: Figure 6, this is the length of the lower one third of the craniofacies.

Land marks: Measures from the base of the nose (sub nasion) to the lowest median landmarks on the lower border of the mandible (mentum).

Instrument: Sliding calipers.

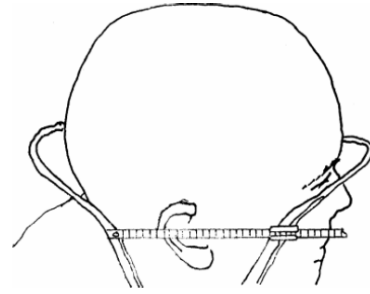


Fig. 1: Measurement of head length

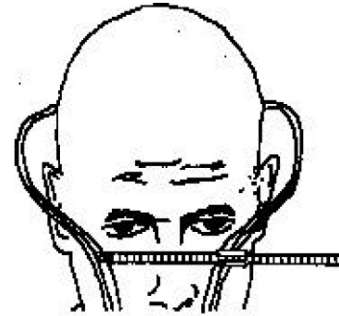


Fig. 2: Measurement of head width

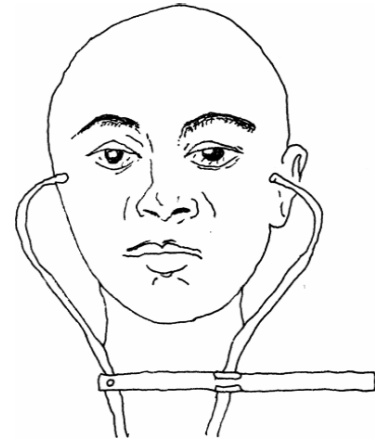


Fig. 3: Measurement of bizygomatic distance

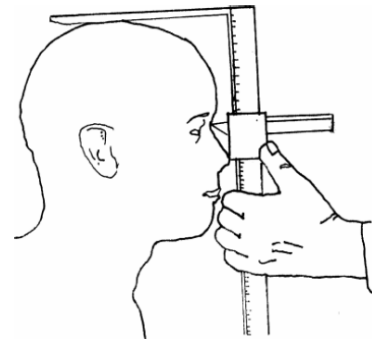


Fig. 4: Measurement of skull height

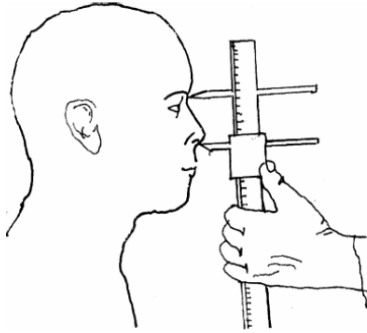


Fig. 5: Measurement of upper facial height (Nasal length)

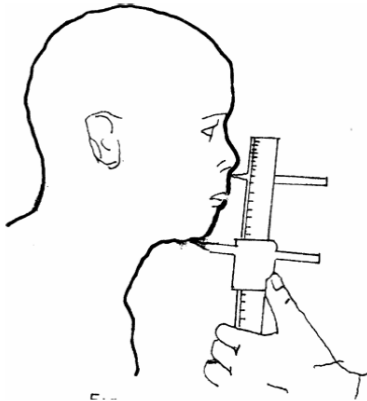


Fig. 6: Measurement of lower facial height

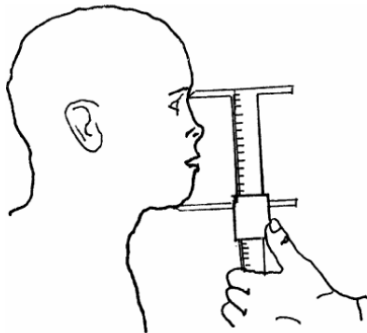


Fig. 7: Measurement of facial height (Total) distance

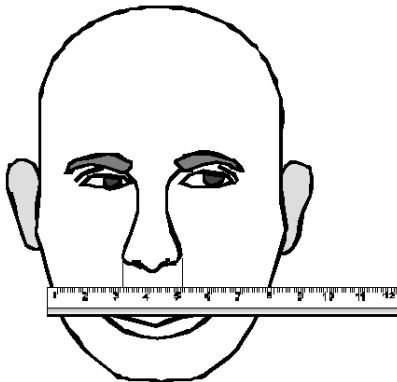


Fig. 8: Measurement of nose width

Remarks: This measurement can also be obtained from the lateral radiograph.

Total Facial height: Figure 7 is the distance from the root of the nose to the lowest median

Landmark on the lower border of the mandible.

Instrument: Sliding calipers.

Nose width: Figure 8 is the distance between the two-ala nasi.

Landmark: Measure the distance between the two ala nasi.

Instrument: Measuring tape.

RESULTS

A total of four hundred and nine (409) subjects were used with a mean age of 20.9853 ± 3.7963 years, mean weight of 58.7995 ± 10.401 kg and a mean height of $1.6796 \pm 8.70E-02$ m.

Cephalometric variables used in calculating the indices. (measurements in mm)					
	N	Min.	Max.	Mean	SD
Age (years)	409	12	36	20.9853	3.7963
Weight (Kg)	409	26	111	58.7995	10.401
Height (M)	409	12.5	1.92	1.6796	8.70E-02
Nose width	409	25	60	40.377	0.5493
Head length	409	92.0	270	194.218	1.1621
Head width	409	125.0	196	153.242	0.7402
Upper facial height (Nasal length)	409	40.0	110.0	60.137	0.7468
Lower facial height	409	45.0	120.0	59.147	0.6362
Total facial height	409	42.0	145.0	126.425	0.9664
Bizygomatic distance	409	41.0	20.90	122.496	1.1650
Skull height	409	61.0	224.0	106.80	1.5931

These indices are calculated from the above table as shown below;

1. Cephalic index = Head Breadth / Head Length X 100
 $= 153.24 / 194.22 \times 100 = 78.90$
2. Upper Facial index = Nasion-Prosthion (Upper facial height) / Bizygomatic distance X 100
 $= 60.13 / 122.50 \times 100 = 49.09$
3. Nasal index = Nasal Breadth / Nasal Length X 100
 $40.38 / 60.137 \times 100 = 67.14$
4. Cranial Module = Length + Breadth + Height / 3
 $194.22 + 153.24 + 106.80 / 3 = 151.42$
5. Cranial Length-Height Index
 L-H Index = basion-Bregma height X 100 / Maximum length / 270.00 X 100 = 39.56
6. Cranial Breadth - Height Index
 B-HI = Basion - bregma height X 100 / Maximum breadth = Height to Breadth in Percentage.
 $= 106.8 / 196.0 \times 100 = 54.50$
7. Mean-height index (MHI) = basion - bregma height X 100 / mean of cranial length + breadth
 $= 106.8 / (194.22 + 153.24) \times 100 = 30.73$

8. Mean Basion height index

$$\text{Mean B-HI} = (\text{basion-bregma height} \times 100) / (\text{Cranial Length} + \text{breadth}) / 2 \\ = 106.8 / 194.22 + 153.24 / 2 \times 100 = 61.47$$

DISCUSSION

The various indices calculated, the cephalic index, which is 78.90, belongs to the mexocephalic or mexocrania (below 74.9 is dolycronia above 80 to 84.9 is brachycephalia) this is higher than what was obtained among the Hausas (a dominant tribe in Nigeria (Taura, 2002), which was 75.4. Even though, this belongs to the same ethnic group. The upper facial height index obtained in this study is 49.09 and is higher than that of the Hausas (Taura, 2002) which is 44.58 but the nasal index obtained in this study is 67.14 and is slightly lower than 68.67 as obtained by Taura (2002).

Cranial module obtained here is 151.42 and this is a numerical value for the size of the cranial vault.

Cranial Length index has been interpreted as either low average or high skull in percentage and the number, 39.56 obtained in these studies could be regarded as an average skull height. Similarly cranial breadth height index has also been interpreted as above average and with a value of 69.70, thereby indicating a high skull. But the mean height index has been interpreted as low, medium or high skull and the value obtained here is 30.73, which is a low skull. Also, mean basion height index has also been interpreted as low medium or high and the value obtained here, 61.47 is therefore a medium skull. All these indices have indicated that, the values obtained is characteristics of the Negroid cranium and this include nasal guttering, prognathism, little or no nasal depression rounded forehead, a bregmatic depression, wide nasal opening, (Bass, 1995) as opposed to the Caucasoid cranium which is characterized by the presence of a nasal depression, retreating zygomatics, little or no prognathism a long

narrow face, narrow nasal aperture, depressed nasal root and narrow high-bridge nose, (Bass, 1995) or the mongoloid cranium as having projecting zygomatic (creating a Flat or moon-like face, inferior zygomatic projection and nasal over growth (Bass, 1995).

In general, knowledge of the correlations between all major measurements of the head and face on the surface and skeleton is essential for anticipating changes in the morphologic characteristics of the growth of the face (Farkas *et al.*, 1999).

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