Asian Journal of Cell Biology, 2015
ISSN 1814-0068 / DOI: 10.3923/ajcb.2015.

Study of Cephalic Indices among Benue Ethnic Groups, Nigeria

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ABSTRACT
The comparative study of cephalometric indices among the Igede and Idoma ethnic groups of Benue State was undertaken due to lack of adequate cephalometry among Nigerians. The anthropometric characteristics of 425 apparently normal adults of ages 17-40 years of Igede and Idoma ethnic extractions of Benue State, Nigeria with no physical deformities of the face and head were randomly selected for this study. Satisfactorily characterizations between the two ethnic groups was clearly established. There were 425 subjects were used for the study of which 158 were Igede and 267 were Idoma with mean age of 22.6±0.45 and 23.0±0.47 year, respectively. The anthropometric variables measured were head length, head width, bizygomatic distance, upper facial length, lower facial length, total facial length, nose width and skull height from which the cephalometric indices were calculated. The result showed that there were statistically significant differences ($p<0.05$) in some of the measured variables between the Igede and Idoma tribes of Benue State. The results also showed a positive correlation between the head width and bizygomatic distance and other anthropometric variables which could be used to predict cephalic indices among the Igede and Idoma ethnic groups of Benue State, Nigeria. These results showed that the dominant head form among the Idoma and Igede Ethnic groups were mesocephalic respectively. Facial indices showed dominant hypereuryprosopic face type for both ethnic groups. The results showed that the data obtained from the present study could be used in forensic anthropology and in establishing ancestral relationship and in reconstructive surgeries of the face, head and neck of the 2 ethnic groups of Idoma and Igede of Benue State of Nigeria.

Key words: Anthropometry, cephalometry, dimorphism, indices, statistics

INTRODUCTION
All human beings occupying this globe belong to the same species i.e., *Homo sapiens*. No two individuals are exactly alike in all their measurable traits, even genetically identical twins (monozygotic) differ in some respects. These traits tend to undergo changes in varying degrees from birth to death in health and disease and since skeletal development is influenced by a number of factors producing differences in skeletal proportions between different geographical areas, it is desirable to have some means of giving quantitative expression to variations which such traits exhibit. Anthropometry as a study is a technique of expressing quantitatively the different forms of the human body. In other words, anthropometry means the measurement of human beings, whether living or dead or on skeletal material (Barreto and Mathog, 1999). The use of anthropometry and cephalometry in the field of forensic science and medicine dated back to 1882 when Alphonse Bertillon, a French police expert invented a system of criminal identification based on anthropometric measurements such as head length and facial indices. His system explained the

extreme diversity of dimensions present in the skeleton of one individual compared to those using simple constructed calipers (Zollikofer *et al*., 2002). As anthropometry is an important part of biological/physical anthropology, hence the persons specializing in anthropometry are familiar with range of biological variability present in the human populations and its causes and are well trained in comparative osteology, human osteology, craniometry, osteometry, racial morphology, skeletal anatomy and function (Montagu, 1960).

The term cephalometric anthropology as a branch of applied physical anthropology is a methods/techniques that measures anatomical dimensions bones of the face and skull both living and dead (Weinmann and Sicher, 1955; Golalipour *et al*., 2003). Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are intimately linked with each other and are manifestation of the internal structure, tissue components which in turn and are influenced by environmental and genetic factors (Danborno *et al*., 1997; Abbie, 1950). Anthropometric data is believed to be objective and allow the cephalometric examiner to go beyond subjective assessments (Panero, 1979; Radovic *et al*., 2000). Anthropometry can be subdivided into somatometry, cephalometry and osteometry. Somatometry is a subdivision of anthropometry for measurement of different body dimensions while keeping soft tissue intact either in the living body or cadaver including head and face. It is also considered as a major tool in the study of human biological variability including morphological variations. Somatometry is useful in the study of age estimation from different body segments in a given set of individuals (Majekodunmi and Oluwole, 2009; Heidari *et al*., 2006). The importance of anthropology as a course using osteometry in the measurement of the skeleton and its parts cannot be over-emphasized. Anthropometry is being used more often in sexing the skeletal remains. Worldwide, various studies have been conducted on the determination of sex from variety of human bones including skull, pelvis, long bones, scapula, clavicle and the bones like metatarsals, metacarpals, phalanges, patella, vertebrae, ribs etc. and the most popular statistical model in sex determination has been developed (Reichs, 1998). Today, anthropometry plays an important role in industrial design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products (Rajlakshmi *et al*., 2001; Safikhani and Bordbar, 2007). The change in life styles, nutrition and ethnic composition of populations has led to changes in the distribution of body dimensions e.g., the epidemic of obesity which require regular update through the use of anthropometric data collections.

In evolutionary science, anthropometric studies today are conducted to investigate the evolutionary significance of differences in body proportion between populations whose ancestors lived in different environments (Adams and Byrd, 2002). Human populations exhibit climatic variation patterns similar to those of other large-bodied mammals, following Bergmann's rule, which states that individuals in cold climates will tend to be larger than ones in warm climates and Allen's rule which states that individuals in cold climates will tend to have shorter, stubbier limbs than those in warm climates (Ganong, 2005). Today, ergonomic professionals apply an understanding of human factors to the design of equipment, systems and working methods in order to improve comfort, health, safety and productivity. This includes physical ergonomics in relation to human anatomy, physiological and biomechanical characteristics; cognitive ergonomics in relation to perception, memory, reasoning, motor response including human-computer interaction, mental workloads, decision making, skilled performance, human reliability, work stress, training and user experiences; organizational ergonomics in relation to metrics of communication, crew resource management, work design, schedules, teamwork, participation, community, cooperative work, new work programs, virtual organizations and telework (Ganong, 2005; Golalipour *et al*., 2003). Measurement of the head and face in anthropometric study is done carefully by understanding some anthropometric landmarks which must be maintained in a better orientation (Iscan, 2001, 2005). This is anatomically termed as Frankfurt Plane meaning that the skull head is positioned in a way where a line passes through the inferior border of left orbit to the upper border of the external auditory meatus. Hominids and primate study used this plane for both pathological and relative studies. Previous study findings put it that when anthropometry is combined with clinical methodology had produced knowledge on craniofacial framework and features that existed in various ethnic groups (Radovic *et al.*, 2000). It is on this note that treatment of congenital anomalies on the face and head are established, has helped to create craniofacial databank on anomalies (Bharati *et al.*, 2001).

The use of this study for reconstructive surgery, forensic examinations in crime scenes and establishing racial differences along geographical locations cannot be over emphasized.

MATERIALS AND METHODS

Study location: This study was carried out in Benue State, the food basket of the nation, Nigeria in Africa. The state has three major ethnic groups known as Igede, Idoma and Tiv. There is peaceful co-existence among other ethnic tribes like Igala from Kogi, Hausa from Kaduna, Yoruba from Western part of Nigeria. The present study was school-based as Oju College of Education (OCE) and Jesus College Otukpo (JCO). The study subjects were apparently normal randomly selected Idoma and Igede people that are residents of the region in Benue State, north-central area of Nigeria.

The tools used for this study include; transparent graded ruler and measuring tape for the measurement of nasal width, Gliding and Sliding Machine (GSM) or caliper used for the measurement of head length, head width, skull height, upper facial length, lower facial length and total facial length and all of them measured to the nearest unit in millimeters (mm). The 425 subjects for this study was recruitment by giving them an inform consent form to fill and the demographics of the subjects used were collected as follows; the age in years, names, place of birth, local government area and parents were giving by their respective class representatives and then filled into the questionnaire. It is a descriptive statistics in cross-sectional procedure conducted in August, 2014 with the sample size determined using Weinmann and Sicher (1955) equation:

$$N = \frac{Z^2Pq}{d^2}$$

Where:

N = Sample size value

P = q+1

Z = Standard normal deviation which is constant at 1.96

D = Degree of freedom from the anthropometric probability at 0.05

P = Prevalence of the research study in the population at 50% (0.5)

N = 384.16 (sample size for the study 425)

Ethical consideration: An introductory letter was obtained from the Department of Human Anatomy, Ahmadu Bello University Zaria and was submitted to the Principal and Provost of Jesus College, Otukpo and College of Education, Oju in Benue State, Nigeria after a postgraduate clearance from Postgraduate Ethical Committee of Ahmadu Bello University Teaching Hospital (ABUTH-Shika).

Anthropometric measurement: Head length was measured to the nearest millimeters (mm) using gliding and sliding caliper with subject seated and head positioned in an upright direction. The head length was measured from the two extreme ends of the sagital axis of the head region using the Anatomical Standard Record of Position such as Frankfurt Plane (Reichs, 1998). Head length is the maximum point on the sagital axis of the skull as shown in Fig. 1.

Head width was taken from the subject using gliding caliper measured in to the nearest millimeters (mm) when the head is in anatomical position using the Frankurt plane placed from the two extreme ends of parietal axis around the skull (Reichs, 1998). Head width is the maximum point of biparietal axis around the skull as shown in Fig. 2.

Bizygomatic distance was taken when the subject is seated with the head position upward and raised to a certain comfortable degree where sliding caliper was used to nearest millimeters (mm)

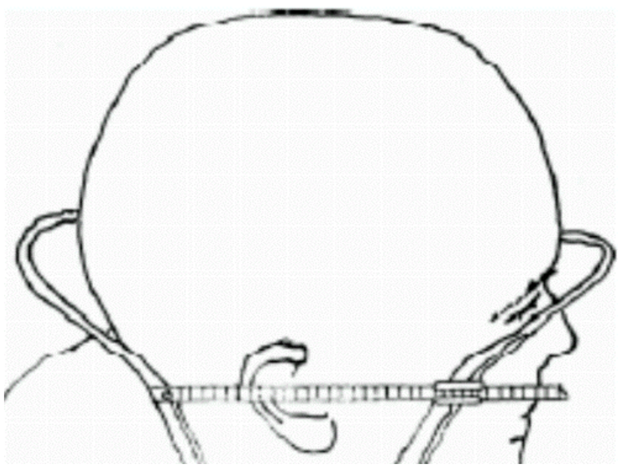

Fig. 1: Head length (Eroje *et al*., 2010)

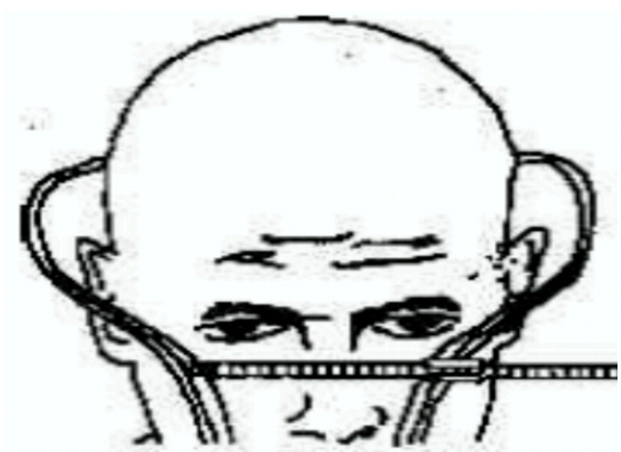

Fig. 2: Head width (Golalipour, 2006)

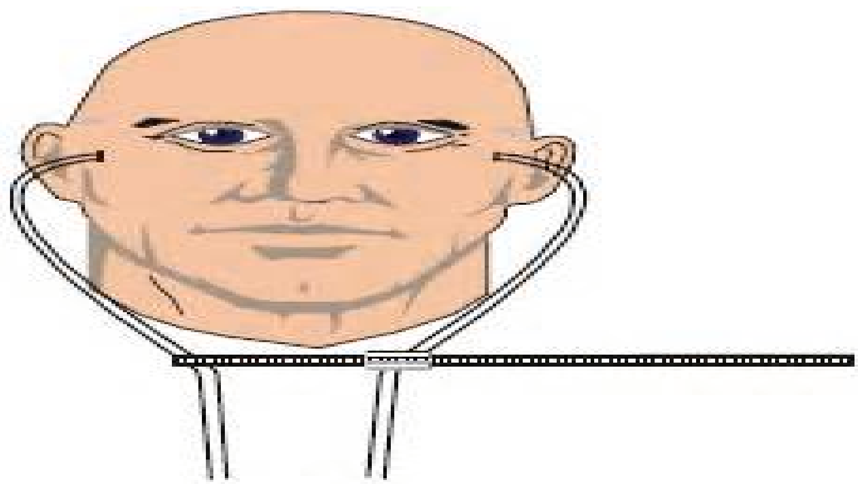

Fig. 3: Bizygomatic distance

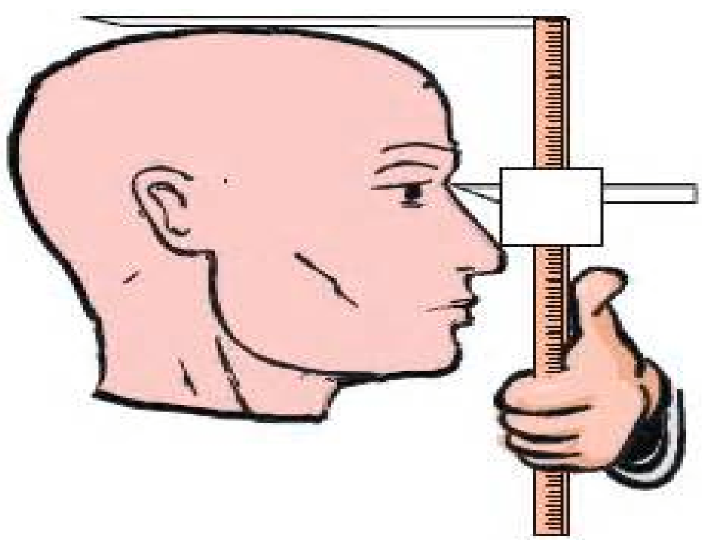

Fig. 4: Skull height

from the two extreme lateral ends of the zygomatic bones around the face. Bizygomatic distance is the facial distance or width which is the maximum distance between the two lateral sides from zygomatic bones as it is shown in Fig. 3.

Skull height was measured with the head in anatomical position using Frankfurt plane with gliding caliper spread from the maximum point of the skull to the root of the nose and measured in millimeters (mm) to the nearest point. Skull height, is also called the forehead which is the maximum distance from the root of the nose to the highest point of the head as it is shown in Fig. 4.

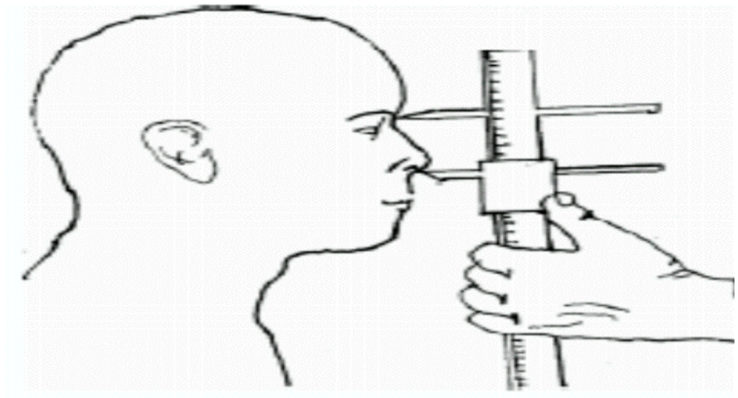

Fig. 5: Upper facial height

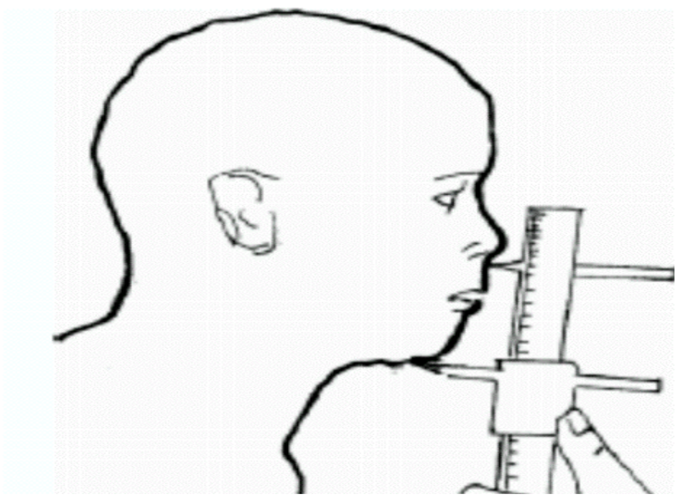

Fig. 6: Lower facial length

Upper facial height was measured using sliding caliper when the head of the subjects is placed upright in tilted neck so that the caliper measured to the root of the nose from lower portion of zygomatic bones in both sides all measured to the nearest millimeters (mm). Upper faced height, is the measurement also called nasal length which is the distance from the root of the nose is the base of the nose as shown in Fig. 5.

Lower facial length was measured to nearest millimeters (mm) using sliding caliper measured from the lower jaw region at the point of mentalis prominence to the root of the nose as shown in Fig. 6. Lower facial length is the measurement of the distance from the root of the nose to mental portion on the lower jaw (mandible).

Facial height was measured to the nearest millimeters (mm) using sliding caliper when the head was in anatomical position at Frankfurt plane from the lower portion of the mandible to the root of the nose as shown in Fig. 7. Facial height (total) is the total distance from the root of the nose to the lower border of jaw (mandible).

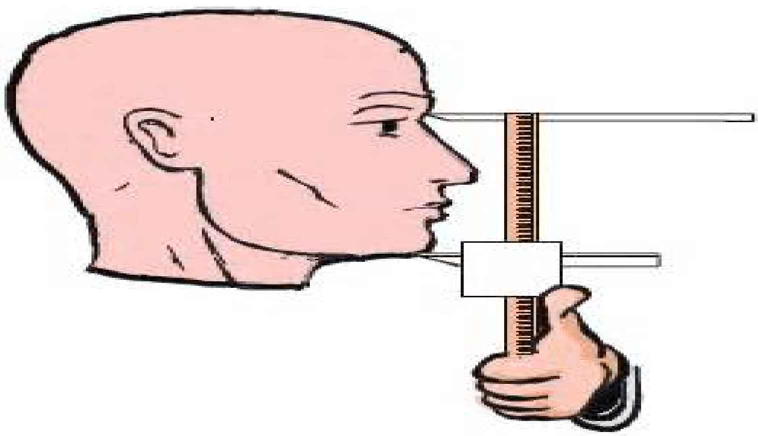

Fig. 7: Total facial length (facial height)

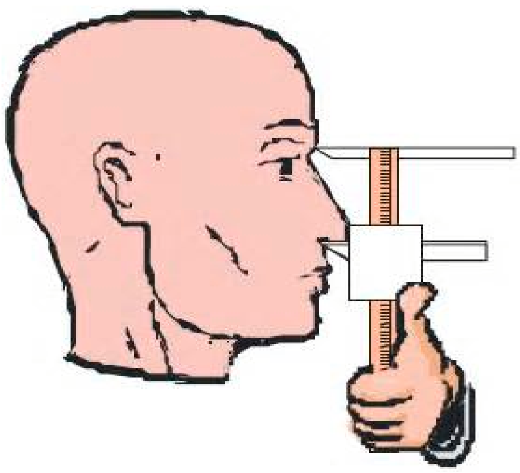

Fig. 8: Nose length

Nose length was taken when the subject is seated with the head placed in anatomical position and raised to a certain comfortable degree where sliding caliper was used to nearest millimeters (mm) from the two extreme lower base of the nose and to the root of nose. Nose length is also called upper facial length which is the maximum distance from the root of the nose as show in Fig. 8.

RESULTS AND DISCUSSION

Four hundred and twenty five subjects which composed of 158 Igede and 267 Idoma, with their percentages as 37.2 and 62.8%, respectively. The sample population as shown in Table 1 was further subdivided into sex where Igede tribe had 75 males and 83 females while Idoma tribe had 129 and 138, respectively. Table 2 shows the international classification standard of cephalic indices using cephalometric parameters. From the Table 2, long head called dolichocephalic is within a range of 70-74.9, moderate head called mesocephalic lies in a range 75-79.9, short head also called

Table 1: Frequencies by sex and tribe of cephalometric parameters among the Idoma and Igede ethnic groups of Benue State, Nigeria

	Male		Female		Count	
Tribe	No	%	No	%	No	%
Igede	75	47.5	83	52.5	158	37.1
Idoma	129	48.3	138	51.7	267	62.8
Total	204	48.0	221	52.0	425	100

Table 2: International classification standard of head types

Head shape	Cephalic index (CI)	Range
Dolichocephalic (Long head)	>70	70-74.9
Mesocephalic (Moderate head)	>75	75-79.9
Brachycephalic (Short head)	>80	80-84.9
Hyperbrachycephalic (Very short head)	>85	85-89.9

Source: Williams *et al*. (1995)

Table 3: Cephalometric indices from anthropometric variables among Igede and Idoma ethnic group of Benue State, Nigeria

Variables (%)	Igede	Idoma
Cephalic Index (CI)	76.54	77.33
Upper Facial Index (UFI)	63.27	68.76
Nasal Facial Index (NFI)	23.79	24.61
Cephalic Module (CM)	96.06	93.97
Length Height Index (L-HI)	90.42	77.60
Breadth Height Index (B-HI)	110.87	117.00
Mean Height Index (MHI)	116.85	111.76

Table 4: General descriptive statistics of cephalometric parameters of Igede and Idoma ethnic group of Benue State, Nigeria

Variables	Igede (Mean±SEM)	Range	Idoma (Mean±SEM)	Range
AGE (years)	22.6±0.45	17-40	23.00±0.47	17-40
Head length (mm)	75.0±2.40	22-168	77.08±1.10**	34-196
Head width (mm)	55.0±2.60	13-137	59.00±1.30**	12-130
Bizygomatic dist (mm)	66.9±2.50	14-126	66.95±1.31	13-109
Upper facial length	46.0±2.70*	10-89	42.36±1.21	10-98
Lower facial length	42.0±2.50	12-137	42.50±1.00	12-120
Total facial length (mm)	88.0±5.12*	32-189	85.20±2.21	35-137
Nose width (mm)	11.32±0.4*	4.0-24	10.08±0.19	5.0-21
Skull height (mm)	151.90±3.40	87-267	152.10±2.40	74-379

*$p \leq 0.05$ shows statistically significant value among Igede ethnic group, **$p \leq 0.01$ shows highly significant values among Idoma ethnic group

brachycephalic within 80-84.9 and very short head hyperbrachycephalic in the range of 85-89.9, respectively. This agrees with the present study where there were similar presentations in the facial and cephalic regions in Table 3 among Igede and Idoma ethnic groups.

Results of the present study as shown in Table 1-7 using cephalometric indices namely the head length, head width, age, bizygomatic distance, upper facial, lower facial length, total facial length, nose width and skull height can be successfully used to predict anthropometric relationships between the two ethnic groups (Tuli *et al*., 1995; Okupe *et al*., 1984; Bayat and Ghanbari, 2010). Some of the parameters studied showed statistical significant difference between the two tribes of Igede and Idoma ethnic groups of Benue State, Nigeria as shown in Table 4 and 5 of head length,

Table 5: Mean and Standard Error of Mean (SEM) of the cephalometric parameters of Igede male and Idoma male ethnic group of Benue State, Nigeria

Variables	Igede male (Mean±SEM)	Range	Idoma male (Mean±SEM)	Range
AGE (years)	22.40±0.47	17-40	22.6±0.47	17-40
Head length (mm)	68.00±2.40	21-167	79.3±1.10**	36-195
Head width (mm)	55.00±2.60	15-133	62.2±1.30**	14-130
Bizygomatic dist. (mm)	67.90±2.60*	14-126	66.8±1.31	13-129
Upper facial length	46.00±2.70	10-80	45.9±1.21	11-88
Lower facial length	23.10±2.70	12-137	42.5±1.00**	12-120
Total facial length (mm)	69.10±5.10	32-187	87.5±2.20	35-137
Nose width (mm)	11.32±0.43*	4.0-24	9.2±0.19	5.0-21
Skull height (mm)	151.90±3.40	86-268	151.1±2.40	74-237

*$p \leq 0.05$ shows statistically significant differences among Igede males in Benue state, **$p \leq 0.01$ shows highly significant values among Idoma male tribe of Benue state, Nigeria

Table 6: Mean and Standard Error of Mean (SEM) of cephalometric variables of Igede female and Idoma female tribes of Benue State, Nigeria

Variables	Igede Female (Mean±SEM)	Range	Idoma Female (Mean±SEM)	Range
AGE (years)	22.41±0.46	17-40	22.9±0.47	17-40
Head length (mm)	73.40±2.40	21-167	79.3±1.10**	36-195
Head width (mm)	58.30±2.22	15-133	63.2±1.40**	14-130
Bizygomatic dist. (mm)	67.10±2.20	14-126	66.8±1.21	13-139
Upper facial length	42.90±2.22	10-80	42.0±1.20	12-88
Lower facial length	41.50±2.70	12-137	43.1±1.00	12-122
Total facial length (mm)	84.50±3.20	32-187	86.1±2.00**	15-139
Nose width (mm)	11.31±0.35*	4.0-24	9.3±0.14	4.0-22
Skull height (mm)	156.80±5.40*	86-268	150.1±2.40	75-235

*$p \leq 0.05$ shows statistically significant differences among Igede females in Benue State, Nigeria, **$p \leq 0.01$ shows highly significant values among Idomale females in Benue State, Nigeria

Table 7: Simple Pearson correlation of anthropometric variables

Parameters	Age	HL	HW	BZD	UFL	LFL	TFL	NW	SH
Age		0.19	0.10*	-0.17	-0.19***	-0.09	-0.20	-0.13**	-0.02
HL			0.28***	0.10*	0.04	-0.06	0.04	-0.06	-0.01
HW				0.23***	-0.20***	0.08	-0.18***	-0.26***	0.03
HL					0.13**	0.30***	0.21***	-0.03	0.13
BZD						0.36***	0.75***	-0.09	0.08
UFL							0.53***	-0.08	-0.03
TFL								-0.07	0.03
NW									0.08
SH									

HL: Head Length, HW: Head Width, BZD: Bizygomatic Distance, NW: Nose Width, UFL: Upper Facial Length, LFL: Lower Facial Length, TFL: Total Facial Length and SH: Skull Height

head width, upper facial length and total facial length. This study (Table 1) showed an indication that the human body dimensions are affected by ecological, biological, geographical, gender, age and ethnic groups, are major determining factors for head dimensions (Olivier, 1969; Golalipour, 2006).

The present cephalometric study among the Igede and Idoma ethnic groups of Benue State, Nigeria was compared with some results from craniometric studies (Table 2-7). Though there was scanty of literature reviews on cephalometrics, some anthropometric works that was used such as Maina *et al.* (2012) compared the craniofacial indices among tribes in Gombe State, Nigeria, Raji *et al.* (2010) in morphological evaluation of head and face shapes in a North-Eastern Nigerian population and Umar *et al.* (2011) studied the cephalofacial indices among young students of Western Europe. Other reviews in comparison with the present study are Majekodunmi and Oluwole (2009) studied craniofacial indices in Lagos Western region of Nigeria, Danborno *et al.* 1997), studied craniofacial indices in Maiduguri Northern part of Nigeria, Kosa (2000) in comparative study of Cephalic indices amongst Ibibios with Efiks while Umar *et al.* (2011) studied the Comparison of Cephalometric indices between the Hausa and Yoruba ethnic groups of Nigeria and the last but not the least was Taura (2002), who studied cephalometric indices in Kano State of Northern Nigeria.

In Table 2 showing international standard classification of cephalometric presentations (Williams *et al.*, 1995) is in support of this study in which cephalic indices of Igede and Idoma were similar (Table 3). Also frequency by tribe and sex among the study population was 51.7% in Idoma while 52.5% among Igede ethnic group of Benue State. Also frequency by sex and tribe among Igede and Idoma tribes put in this study that there was lower subjects recorded in the former than later tribe as 158 and 267, respectively.

The general descriptive statistics expressed in Table 4 shows that the of head length and head width among Idoma were higher and statistically significant than the Igede subjects as 77.08±1.10 and 59.0±1.30, respectively.

The Table 7 put correlation between head length and head width and statistically significant among Igede and Idoma ethnic groups of Benue State, Nigeria and agreed with Umar *et al.* (2011).

CONCLUSION

The study showed predominantly similar mesocephalic and hypereuryprosopic head and face among Igede and Idoma ethnic groups of Benue State, Nigeria. There exist sexual dimorphic features and the ancestral relationship investigated with similarities in cephalometric indices among Igede and Idoma ethnic groups of Benue.

ACKNOWLEDGMENT

I appreciate the effort of those who helped to enriched this study like Dr. S.B. Danborno, Mr. J.A. Timbuak and Mr. Abel N. Agbon for you people are anthropometrically and statistically significant.

REFERENCES

Abbie, A.A., 1950. Closure of cranial articulations in the skull of the Australian aborigine. J. Anat., 84: 1-12.

Adams, B.J. and J.E. Byrd, 2002. Interobserver variation of selected postcranial skeletal measurements. J. Forensic Sci., 47: 1193-1202.

Barreto, R.I. and R.H. Mathog, 1999. Orbital measurement in black and white populations. Laryngoscope, 109: 1051-1054.

Bayat, P.D. and A. Ghanbari, 2010. Comparison of the cranial capacity and brain weight of arak (Central Iran) with other subgroups of Iranian population. Int. J. Morphol., 28: 323-326.

Bharati, S., S. Som, P. Bharati and T.S. Vasulu, 2001. Climate and head form in India. Am. J. Human Biol., 13: 626-634.

Danborno, B., S.A. Asala and U.E. Ekanem, 1997. Craniometric study and derived indices in Nigerians. West Afr. J. Anat., 5: 20-20.

Eroje, M.A., H.B. Fawehinmi, B.N. Jaja and L. Yaakor, 2010. Cephalic index of Ogbia tribe of Bayesla state. Int. J. Morphol., 28: 389-392.

Ganong, W.F., 2005. Review of Medical Physiology. 22nd Edn., McGraw-Hill Medical, New York, ISBN-13: 978-0071440400, pp: 392-397.

Golalipour, M.J., K. Haidari, M. Jahanshahi and RM. Farahani, 2003. The shapes of head and face in normal male newborns in south east of Caspian sea (Iran-Gorgan). J. Anat. Soc. India, 52: 28-31.

Golalipour, M.J., 2006. The variation of head shapes in 17-20 years old native fars male in gorgan-north of Iran. Int. J. Morphol., 24: 187-190.

Golalipour, M.J. and K. Heydari, 2006. Effect of the ethnic factor on cranial capacity and brain weight of male newborns in northern Iran. Neuroembryol. Aging, 3: 146-148.

Heidari, Z., H.R.M. Sagheb and M.H.N. Mugahi, 2006. Morphological evaluation of head and face in 18-25 years old women in Southeast of Iran. J. Med. Sci., 6: 400-404.

Iscan, M.Y., 2001. Global forensic anthropology in the 21st century. Forensic Sci. Int., 117: 1-6.

Iscan, M.Y., 2005. Forensic anthropology of sex and body size. Forensic Sci. Int., 147: 107-112.

Kosa, F., 2000. Application and role of anthropological research in the practice of forensic Medicine. Acta Biologica Szegediensis, 44: 179-188.

Maina, M.B., G.G. Mahdi and G.G. Kalayi, 2012. Craniofacial forms among three dominant ethnic groups of Gombe state, Nigeria. Int. J. Morphol., 30: 211-216.

Majekodunmi, F.M. and S.B. Oluwole, 2009. A comparative study of Cephalic indices in Lagos Western region of Nigeria. J. Arts Cult., 4: 12-65.

Montagu, M.F.A., 1960. Handbook of Anthropometry. Charles C. Thomas Publ. Ltd., Springfield, IL., USA.

Okupe, R.F., O.O. Coker and S.A. Gbajumo, 1984. Assessment of fetal biparietal diameter during normal pregnancy by ultrasound in Nigerian women. Br. J. Obstet. Gynaecol., 99: 629-632.

Olivier, G., 1969. Practical Anthropology. Charles C. Thomas Publ. Ltd., Springfield, IL., USA.

Panero, J., 1979. Human Dimension and Inferior Space. 1st Edn., Arehitectual Press Ltd., London, pp: 15.

Radovic, Z., Z. Muretic, V. Nemirovskij and V. Gazi-Coklica, 2000. Craniofacial variations in a South Dalmatian population. Acta Stomatologica Croatica, 34: 399-403.

Raji, J.M., S.H. Garba, A.I. Numan, M.A. Waziri and M.B. Maina, 2010. Morphological evaluation of head and face shapes in a North-Eastern Nigerian population. Aust. J. Basic Applied Sci., 4: 3338-3341.

Rajlakshmi, C., S.M. Shyamo, T.H. Bidhumukhi and S.L. Chandramani, 2001. Cephalic index of foetuses of manipuri population: A baseline study. J. Anat. Soc. India, 50: 8-10.

Reichs, K., 1998. Forensic Osteology: Advances in the Identification of Human Remains. 2nd Edn., Charles C. Thomas Pub. Ltd., Springfield, Illinois, USA., ISBN-13: 978-0398078768, Pages: 576.

Safikhani, Z. and N.A.H. Bordbar, 2007. Determination of Anatomical type of head and face in children under 6 years in Ahwaz. Acta Medica Iranica, 45: 43-45.

Taura, M.G., 2002. Cephalometry of Hausa tribe of Kano State of Nigeria-a Preliminary study. M.A. Thesis, Submitted to Postgraduate, ABU Zaria.

Tuli, A., R. Choudhry, S. Agarwal, C. Anand and H. Garg, 1995. Correlation between craniofacial dimensions and foetal age. J. Anat. Soc. India, 44: 1-12.

Umar, M.B.T., A.S. Ojo, S.A. Asala and J.O. Hambolu, 2011. Comparison of cephalometric indices between the Hausa and Yoruba ethnic groups of Nigeria. Res. J. Med. Sci., 5: 83-89.

Weinmann, J.P. and H. Sicher, 1955. Bone and Bones: Fundamentals of Bone Biology. 2nd Edn., C.V. Mosby, Saint Louis, USA., pp: 130-134.

Williams, P.L., L.H. Bannister, M.M. Berry, P. Collins, M. Dyson, J.E. Dussak and M.W.J. Ferguson, 1995. Gray's Anatomy. 38th Edn., Churchill Livingston, Philadelphia, pp: 607-612.

Zollikofer, C.P. and M.S.P. De Leon, 2002. Visualizing patterns of craniofacial shape variation in Homo sapiens. Proc. Biol. Sci., 269: 801-807.