COMPARATIVE STUDY OF CEPHALOMETRIC INDICES AMONG IDOMA AND IGEDE ETHNIC GROUPS OF BENUE STATE, NIGERIA

BY

OBAJE, GODWIN SUNDAY

DEPARTMENT OF HUMAN ANATOMY
FACULTY OF MEDICINE
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

MARCH, 2015

COMPARATIVE STUDY OF CEPHALOMETRIC INDICES AMONG IDOMA AND IGEDE ETHNIC GROUPS OF BENUE STATE, NIGERIA

BY

OBAJE GODWIN SUNDAY

(B.Sc ABUZARIA, 2010)

MSc/MED/340/2011-2012

A THESIS SUBMITTED TO SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN HUMAN ANATOMY

DEPARTMENT OF HUMAN ANATOMY
FACULTY OF MEDICINE,
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.

MARCH, 2015

DECLARATION

I, Obaje Godwin Sunday, declared that I carried out this research work titled "**comparative study of cephalometry indices among Igede and Idoma ethnic groups of Benue State, Nigeria"**under the supervision of Dr W.O Hamman and DrIbegbu A. O in the Department Of Human Anatomy, Faculty Of Medicine, Ahmadu Bello University, Zaria.

This work has not been submitted or accepted elsewhere for the purpose of awarding a higher degree and in all scholarly knowledge consulted and referenced for the purpose of clarity and indebtedness of anthropometric study in the chosen state of Nigeria.

-----------------------------------   -----------------------

S. G Obaje   Date

ACKNOWLEDGEMENT

To my God Almighty for His faithfulness, mercy, knowledge and ability for seeing me through the course of this academic research, I will say to Him are all the glory. To every journey they say begins with steps and in the course with people who believed in me and what I'm doing.

I'm greatly indebted to my major supervisor in the person of Dr W.O Hamman for his patience, generosity, devotion and guidance which made the dissertation a research worth and medical standard. Also, I thank my other supervisor DrAustineIbegbu for the time taken to go through my work and his advice throughout the project.

I appreciate the effort of those who helped me like Dr S. B Danborno, Mr. J. A Timbuak and Mr Abel N. Agbon for you people are anthropometrically and statistically significant. I thank the HOD of Human Anatomy and PG coordinator in persons of Prof S.S Adebisi and Dr A.A Buraimoh for advice and administrative assistance. I also thank my postgraduate's friends in persons of Richard Daniel, Omotoyinbo Peter, Umar Faruk, A. Miko and Abraham Akubo.

Finally I thank my brother for all the financial helps in the person of **Eng. Obeya Godwin Obaje.**

DEDICATION

I dedicate this thesis to Ladi Joseph Abah……………………… because you were there with me in the academic journey.

CERTIFICATION

The project thesis titled **COMPARATIVE STUDY OF CEPHALOMETRIC INDICES AMONG IGEDE AND IDOMA ETHNIC GROUPS OF BENUE STATE, NIGERIA BY Obaje Godwin Sunday** meets the regulations governing the award of master's degree of Science in Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literacy presentation.

_________________________ ____________ ___________

Dr W.O Hamman (Bsc, Msc, PhD) Signature Date
Chairman Supervisory Committee
Department of Human Anatomy
Faculty of Medicine
Ahmadu Bello University Zaria

_________________________ _____________________ ___________

Dr Austin I.O (Bsc, Msc, PhD) Signature Date
Member Supervisory Committee
Department of Human Anatomy
Faculty of Medicine
Ahmadu Bello University Zaria

_____________________ _______________ ______________

Professor S.S Adebisi (Bsc, MSc, PhD) Signature Date
Head of Department, Faculty of Medicine
Ahmadu Bello University Zaria

____________________________ _________________ _____________

Professor A. Z HassanSignature Date
Dean School of Postgraduate Studies
Ahmadu Bello University

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 wereclearly established. Four hundred and twenty five subjects were used for the study of which 158 were Igede and 267 were Idoma with mean age of 22.6±0.45 and23.0±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 variables that were significantly different include the head width (55.0±2.60; 59.0±1.30), head length (75.0±2.40; 77.08±1.10) and nose width (11.32±0.4; 10.08±0.19) respectively with correlation coefficient at $P<0.01$. The study derived a linear regression equation of cephalic indices with other anthropometric parameters from which age, head width, head length and skull height could be predicted if one variable is known. The result from the present study showed that the cephalic indices and facial presentations among the two tribes are similar and probably could be an indication of having the same genetic origin. It could also be that after having stayed together for long time in the same environment, that environmental factor could have given rise to similar cephalic indices and facial features. The result 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

Igedeand Idoma ethnic groups of Benue State, Nigeria. The result of the present study showed that the Igede males and females had cephalic indices of 78.86 and 79.43 respectively while the Idoma males and females had cephalic indices of 78.43 and 79.60 respectively. These results showed that the dominant head form among the Idomaand Igede Ethnic groups weremexocephalic head form respectively. Facial indices showed dominant hypereuriprosopic face type for both ethnic groups. The cephalic index showed sexual dimorphism among the two ethnic groups while facial indices showered a significant gender differences in the two ethnic groups studied. The results showed that the data obtained from the present study could be used in forensic anthropology and in establishing similarities in face and headof the two ethnic groups of Idoma and Igede of Benue State of Nigeria.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.1 GENERAL 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 (Gallot, 2004). 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 (Boaz., 2003).

The use of anthropometry 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. 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 et al., 2006).

The term cephalometric anthropology can be coined for this branch of applied physical anthropology, involving the use of methods/techniques of anthropometry in measuring bones of the face and skull both living and dead. 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 and tissue components which in turn, are influenced by environmental and genetic factors (Danborno et al., 1997; Abbie et al., 2009). Anthropometric data are believed to be objective and allow the cephalometric examiner to go beyond subjective assessments (Panero et al., 1979; Radoc 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 (Zahra et al., 2006 and Oladipo et al., 2009).

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 etal., 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 et al., 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. 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).

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. 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 research findings put it that when anthropometry is combined with clinical methodology hadproduced knowledge on craniofacial framework and features that existed in various ethnic groups (Radoc et al., 2000). It is on this note that treatment of congenital anomalies on the face and head are established and has helped to create craniofacial databank on anomalies (Bharati et al., 2001).

Data on facial measurements are indispensable to the precise determination of the degree of deviations from the normal and such data are urgently needed by medical professionals but scanty till now in western and northern Europe, Asia and Africa (Rajlakshmi, et al., 2001). Sexual and racial differences among humans have also been investigated. There is a sharp relationship in the skull of Negroes, Apes and Europeans but sexual dimorphism is marked more in mankind than other older primates (Hernandiz et al., 1992). This was explained using some fossil remains of cranium and facial bones which showed sexual dimorphism among mankind. Also similar statistical data have expressed satisfactorily cranial dimensions in relation to mass among mankind (Oladipo et al., 2009).

With all these available data on cranium and faces, the results using anthropometric studies on height, age, nasal and cephalic length has been scanty in Nigeria. The relationship of measurements to each other is expected to be constant at specific ages. These relationships are expressed as ratio, index and regression technique. These proportions change dramatically from fetal period through childhood to adolescence because of the various interactions in genetic, environment, nutrition and biochemical factors (Daniel, 2004). Generally, cranial dimensions using landmarks like height, nose, length and cephalic indices vary in ethnic nationalities and among sexes (Iscan, 2010).

1.0 STATEMENT OF RESEARCH PROBLEMS

- Anthropometric parameters among ethnic groups are rarely available to evaluate adult relationships and ancestral tracing in Nigeria.
- Comparative data for cephalometric indices and anthropometric variables among ethnic groups in Nigeria are not available.
- Anthropometric study in Nigeria has scarcely been carried out among minority groups in Benue State, Nigeria.

1.1 JUSTIFICATION

- Relationships and differences that exist between the various parts of the body could be of anthropological importance in crime state.
- The variables obtained through anthropometric measurements will serve as reference data for ethnic groups in Nigeria.

1.2 STUDY HYPOTHESIS

- There exist differences in cephalometric indices between the Igede and Idoma ethnic groups.
- Cephalometric indices will predict/correlate with other anthropometric outcomes in the two tribes.

- There exists an association in cephalometric indices between the two ethnic groups.

1.3 AIM AND OBJECTIVES

1.4 AIM

The aim of the present study is to investigate any possible ancestral relationship using cephalometric indices between Igede and Idoma ethnic groups of Benue State, Nigeria.

1.5 OBJECTIVES

The objectives of this study are:

- To compare and establish relationship between Idoma and Igede ethnic groups of Benue State using anthropometric parameters.
- To study the data obtained from the two tribes with a view to compare the cephalometric indices of other tribes in Nigeria.
- To study sexual dimorphisms in the cephalometric indices within the two tribes.
- To study any relationship in the craniofacial indices among Igede and Idoma ethnic groups of Benue state, Nigeria.

1.6 SIGNIFICANCE OF THE STUDY

- The significance of the study is to use cephalometric indices as a means of establishing ancestral relationships between the two tribes which will serve as a tool for settling the age long kingship feud among the two tribes.
- Also the study is relevant in forensic examinations using craniofacial presentations among Igede and Idoma tribes in crime scenes (Hernandsiz et al, 1992). Anthropometric study could be used to established medical template for industrial designs such as shoes and eye glasses.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Cephalometry

Cephalometry is a branch of anthropometry through which anthropological measurements are made that helped in determining health status and human variations (De Onis and Habicht, 1996; Schoenbaum *et al*., 1995). Cephalometric techniques helped in the study of nutritional status, energy consumption, body composition, malnutrition and physical appearances determinations (Eboh and Boye, 2005; Hassan *et al.,* 2008).

Anthropological techniques had in the previous work reviewed satisfactions and identifications of body remains, plastic surgery, archeology and in differentiation between people of different races and sexes (Heidari *et al.,* 2006; Umar *et al.,* 2006). The most widely used in the field of anthropological sciences is cephalometry through which head dimensions are determined using calculated indices (Vojdani *et al.,*2009 and Khandare *et al.,* 2008).

It has been reported that factors like race, ethnicity, genetic interaction, traditions, nutrition, environment, traditional belief and climatic changes influences head and face of humans (vohdani *et al.,* 2009). Various cephalometric studies in the north and southern part of Nigeria had been documented (Raji *et al.,* 2010; Garba *et al*., 2008; Oladipo *et al.,* 2010 and Okupe *et al.,* 1985).

Cephalometry is also the measurement of the human head, using highly accurate techniques to obtain very detailed information (Al-Rewashdeh *et al.,* 2010 and Bayat *et al.,* 2010). X-ray imaging is a common technique, as it allows people to create a record of the skull's appearance and shape (Bayat *et al.,* 2010). Three dimensional clinical imaging of the head and skull is also available. There are a number of applications for cephalometry, including in reconstructive surgery to repair injuries or defects to the head and face (Bharati., 2001).

Any number of medical professionals can use measuring tools to record aspects of a patient's face, like the space between the eyes, the size of the ears, and so forth. Using X-ray imaging, people can map measurements onto an underlying skull structure (Golalipour *et al.,* 2008 and Golalipour *et al.,* 2004). It is also possible to take measurements directly from X-ray or three dimensional imaging and some computer programs will automatically calculate them for convenience and a high degree of accuracy (Kobyliansky *et al., 1983)* with the help of proper knowledge around anatomical configurations of the head and face as shown in figure 1.0

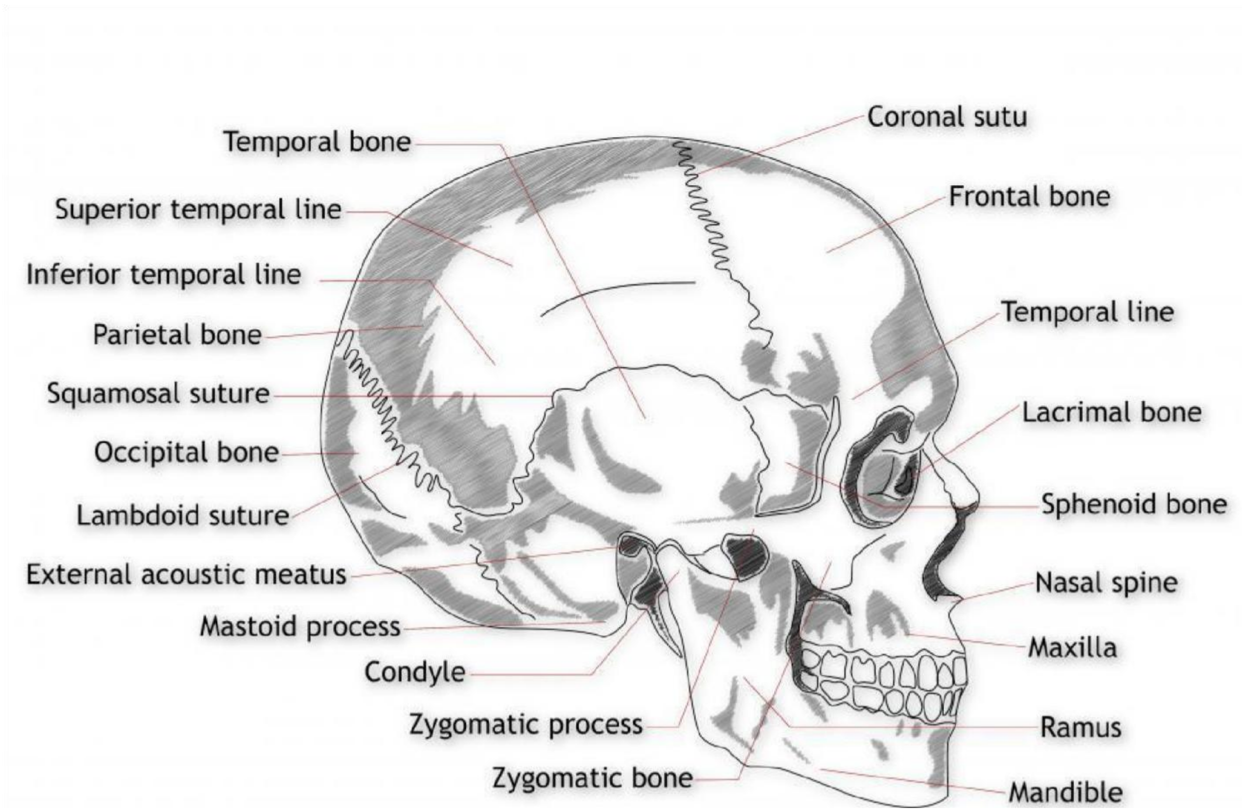


Figure 1.0 showing the anatomical landmarks for cephalometric techniques (Tildesley *et al*., 1993).

2.2 ROLE OF CEPHALOMETRY TO PHYSICAL APPEARANCE

Natural characteristics of human being that influence environment and how physical appearance affects personality had been investigated (Dhima *et al.,* 1985). Recent studies using cephalometric techniques have shown that at a very early age, children began to pick whom they would like for playmates by such standards as facial attractiveness and body form (Behluli *et al.,* 1987). Another study found that across several age groups subjects consistently ranked photographs of numerous people based on attractiveness with similar results ((Behluli *et al.,* 1987). This is possible and achievable when the anatomical configurations of the head and face as shown in figure 1.0 are understood. Interpol report of 1997 with ideas of cephalometry investigated thatmales had their self-esteem intentionally raised or lowered by receiving false reports on a personality test. The males whose self-esteem was intentionally lowered interpreted a positive evaluation from a female as affection more often than those with the higher selfesteem did. Experimenters interpreted this result by postulating that those people with lower selfesteem are more likely to cling to any positive stimulus, whether real or perceived (Gunter *et al.,* 1927). This interpretation makes it easy to see why people with lower self-esteem are more likely to embrace things like drugs which give a temporary and false positive stimulus (Coon *et al.,* 1987 and Gunter *et al.,* 1927).

2.3 MORPHOLOGICAL AND CEPHALOMETRIC CHARACTERISTICS AMONG NIGERIA TRIBES.

Although the human race must be regarded as a unit intellectually and physically, from the anthropologists' viewpoint the particular set of bones most often measured for purposes of racial classification are those of the head (Alex *et al.,* 1996). There were anthropometric work done to determine some relevant cephalometric parameters, particularly in relation to sex and to study the distribution of basic head and face types of a nigerian population (Fawehinmi *et al.,* 2008; Oladipo *et al.,* 2006 and Oladipo *et al.,* 2007).

Although the human race must be regarded as a unit intellectually and physically, from the anthropologists' viewpoint the particular set of bones most often measured for purposes of ethnoanthropological researches are those of the head (Fawehinmi *et al.,* 2008). The information collected from measurements of the cephalometric, variables, enables a chronological study of the anthropological status of the nations and helps comparison of the anthropological features of the today's nations and previous nations too (Coon, 1939; Dhima, 1985; Ylli, 1975).

In cephalometric studies among current methods (photogrametry, ultrasound, computed tomographic, scanning magnetic imaging, optical surface scanning, cephalometry) cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton because of its validity and practicality (Dhima, 1985; Ylli, 1975).

The cephalometric indexes are different for different people (Dhima, 1985; Ylli, 1975). The head of the nigerian type of humans being negroid is generally characterized with a high breadth of the head, a medium length of the neurocranium, the vertical height of the cranium is high, and the face is long and wide (Porter *et al.,* 3003; Fawehinmi *et al.,* 2008; Oladipo *et al.,* 2006 and Oladipo *et al.,* 2007).

2.4 CEPHALIC, NASAL INDICES AND ANTHROPOMETRY

There existed cephalic study which is to provide a baseline data of cephalic and nasal index among tribes north and southern Nigeria (Oladipo *et al.,* 2009). Cephalic index is used to measure the size of the head while nasal index is used to measure the size of the nose (porter *et al.,* 2003,).

The Igede and Idoma people are indigenous people of the north-central part of Nigeria in West Africa (BSG, 2011). Cephalic and nasal index are very useful anthropologically to find out racial differences and medical management (Shah and Jadhav, 2004; Porter et al., 2003; Ochi and Ohashi, 1983). Cephalic index is used to measure the size of the head which is done by determining the ratio of the maximum head breadth to the maximum head length (Kelly et al., 1999). There are three classifications of cephalic index which can be used to describe the human head; these include dolicocephaly, mesocephaly and brachycephaly (Golalipour et al., 2005). Nasal index measurement can be utilized in the analysis and classification of fossil remains as well as the study of living populations (Alex et al., 1996). Studies have shown that the Negroid race mainly of African descent have the platyrrhine nose type (Carleton, 1989).

Fawehinmi et al. (2008) revealed that the cephalic index of normal growing males and females in Port Harcourt (79.8±0.37 and 79.9±3.9, respectively) showed a significant difference with males having a higher value. Their head shape was classified as mesocephalic. Also, Oladipo and Olotu, (2006) conducted a study on the cephalic index of Ijaws and Igbos of Nigeria which reported that the Ijaws and Igbos had cephalic indices of 79.96 and 78.00 respectively. Report on the Ogonis by Oladipo et al. (2009), showed that the Ogonis had a cephalic index of 111.18 and 75.09 for males and females respectively. In another study by Oladipo et al. (2009) on the cephalic indices of Nigerian Ibibios and Efiks, results showed that the mean values of cephalic indices of Efik males and females were 73.16 and 73.80, respectively while those of Ibibio males and females were 73.48 and 73.80, respectively. There was no sexual dimorphism. Bhargav and

Kher (1961) reported the mean cephalic index of 79.80 for Barelias race of India while Shah and Jadhav (2004) reported a cephalic index of 80.81 for Gujarat race of India.

Oladipo et al. (2007) conducted a study on the morphometric analysis of the nasal parameters of Igbo, Ijaw and Yoruba ethnic groups of Southern Nigeria. The results obtained showed that an average Igbo had a mean nasal index of 94.1±0.37, Yoruba 89.2±0.30 and Ijaw 96.37±1.06. Thus the Ijaws had a significant higher nasal index ($p<0.05$). Fawehinmi et al. (2008) reported a mean nasal index of 98.5±0.93 and 94.1±1.18 for male and females of Kalabari ethnic group of Nigeria.The Somalia people in East Africa have a nasal index similar to that of European

Caucasoid of 69.90 or less, which is of leptorrhine nose type (Porter et al., 2003; Carleton, 1989).

Cephalic index is an important parameter for classifying populations (Berry *et al.,* 1976). Measurements are important tools for comparison and in other to achieve a more objective racial assess men t, medical studies have long been practiced. International ally accepted techniques of craniometry/cephalometry have promoted a large number of comparative data for both male and females (Berry et al., 1976).

Cephalic index is very useful anthropologically to find out racial differences (Shah and Jadhav, 2004). It can also be utilized to find out sexual differences (Williams *et al*., 1995). Also, comparison of changes between parents, offspring and siblings could possibly give a clue to genetic transmission of inherited character (Shah and Jadhav, 2004).

Standardized cephalometric records using cephalic and nasal indices enable diagnostic comparison between patients and the normal population (Rabey, 1971). Doliocephalic person have otitis media less often than brachycephalic person (Stolovitsky and Todd, 1990). It has also been reported that individual s with Apert's syndrome are hyperbrachycephalic (Cohen and Kreiborg, 1994).

A large number of reports exist on the cephalic and nasal indices of Caucasians. Cephalic index of Japanese and Australia have been reported (Kasai et al., 1993) while the mean cephalic index of 79.5 0 was reported for Kvangaja race (Basu, 1963). The mean cephalic index of 79.68 has been reported for Bhils race (Bhargav and Kher, 1960). Mean cephalic indices of 79.80 and 80.81 were reported for Barelias and Gujarat races of Indian respectively (Bhargav and Kher, 1961).

Few reports however exist on the cephalic and nasal indices of adult Nigerians in Africa. The studies on Africans have been mostly on fetuses (Obikili and Singh, 1992). A comparative study between fetal cephalic indices of Nigerians and Caucasians showing similarity in significantly higher values have been done (Okupe et al., 1984). The cranial and nasal indices of Nigerian using autopsy was also studied (Ojikutu *et al*., 1980). The cephalic index of Nigerians was also studied using living subjects (Obikili and Singh, 1992). Also, anthropometric comparison of cephalic and nasal indices between the Urhobo and Itsekiri ethnic groups of Nigeria showed mean cephalic indices of 82.16 and 86.80 among the Itsekiris and Urhobos respectively (Oladipo and Paul, 2009). Also, the first comprehensive report on cephalic and nasal indices of Ijaws and Igbos, reported the mean cephalic indices (Oladipo and Olotu, 2006). Again, the Ogonis, studies showed mean nasal indices of males and females respectively (Oladipo *et al*., 2007).

2.5 CEPHALIC AND FACIAL DISORDERS

Cephalic and facial disorders are congenital conditions that stem from damage to, or abnormal development of, the budding nervous system (van Jaarsveld *et al.,* 1993). Cephalic and facial disorders are not necessarily caused by a single factor but may be influenced by hereditary or genetic conditions or by environmental exposures during pregnancy such as medication taken by the mother, maternal infection, or exposure to radiation (Hovland *et al.,* 1999). Some facial and cephalic disorders occur when the cranial sutures join prematurely and most cephalic disorders are caused by a disturbance that occurs very early in the development of the fetal nervous system (Hovland *et al.,* 1999 and van Jaarsveld *et al.,* 1993).

The human nervous system develops from a small, specialized plate of cells on the sur- face of the embryo. Early in development, this plate of cells forms the neural tube, a narrow sheath that closes between the third and fourth weeks of pregnancy to form the brain and spinal cord of the embryo (Haselbeck *et al.,* 1999). Four main processes are responsible for the development of the nervous system: cell proliferation, the process in which nerve cells divides to form new generations of cells; cell migration, the process in which nerve cells move from their place of origin to the place where they will remain for life (van Jaarsveld *et al.,* 1993).

Damage to the developing nervous system is a major cause of chronic, disabling disorders and, sometimes, death in infants, children, and even adults (Grant *et al.,* 1997 and van Jaarsveld *et al.,* 1993). The degree to which damage to the developing nervous system harms the mind and body varies enormously. Many disabilities are mild enough to allow those afflicted to eventually function independently in society. Others are not. Some infants, children, and adults die, others remain totally disabled, and an even larger population is partially disabled, functioning well below normal capacity throughout life (Gottesman et al., 2001).

Nencephaly is a neural tube defect that occurs when the cephalic end of the neural tube fails to close, usually between the 23rd and 26th days of pregnancy, resulting in the absence of a major portion of the brain, skull, and scalp ((Episkopour *etal*., 1993 van Jaarsveld *et al.,* 1993).

There is no cure or standard treatment for anencephaly and the prognosis for affected individuals is poor and most infants do not survive infancy (Dixon *et al.,* 2000).

Also, colpocephaly is a disorder in which there is an abnormal enlargement of the occipital horns; the posterior or rear portion of the lateral ventricles of the brain and this enlargement occurs when there is an underdevelopment or lack of thickening of the white matter in the posterior cerebrum (van Jaarsveld *et al.,* 1993). Colpocephaly is characterized by microcephaly which is abnormally small head and mental retardation (Dickman *et al.,* 2000).

There is also holoprosencephaly which is a disorder characterized by the failure of the prosencephalon being the forebrain of the embryo to develop and formed the face begin in the fifth and sixth weeks of pregnancy (Ang et al., 1997). Holoprosencephaly is caused by a failure of the embryo's forebrain to divide to form bilateral cerebral hemispheres (the left and right halves of the brain), causing defects in the development of the face and in brain structure and function (van Jaarsveld *et al.,* 1993).

Ethmocephaly is the least common facial anomaly which consists of a proboscis separating narrow set eyes with an absent nose and microphthalmia or eyes.

For children who survive, treatment is symptomatic. Although it is possible that improved management of diabetic pregnancies may help prevent ethmocephaly (Ang *et al.,* 1996 and van Jaarsveld *et al.,* 1993).lissencephaly, which literally means “smooth brain,” is a rare brain malformation that is characterized by microcephaly and the lack of normal convolutions in the brain. It is caused by defective neuronal migration, the process in which nerve cells move from their place of origin to their permanent location (van Jaarsveld *et al.,* 1993 and Hovland *et al.* 1999).

The surface of a normal brain is formed by a complex series of folds and grooves (van Jaarsveld *et al.,* 1993). The folds are called gyri or convolutions, and the grooves are called sulci. In children with lissencephaly, the normal convolutions are absent or only partly formed, making the surface of the brain smooths (Grant *et al*., 1997).

Treatment for those with lissencephaly is symptomatic and depends on the severity and locations of the brain malformations. Supportive care may be needed to help with comfort and nursing needs. Seizures may be controlled with medication and hydrocephalus may require shunting. If feeding becomes difficult, a gastrostomy tube may be considered (Dixon *et al.,* 2000 and van Jaarsveld *et al.,* 1993).

There are five facial prominences of development that must be completely fused before birth. Failure for the joining together could lead to clefts of palate or lips (Giles *et al*., 2009 and Panero et al., 1979).

Craniosynostosis is a premature closure of soft spots on the superior part of the cranium in the infants while microsomia is the shortage of muscular development on one side (Weinnman et al., 2005 and Okupe, 1984).

Also, plagiocephaly is the continuous pleasure on one side reducing it too small to extremely larger portion of the area while microstomia is formation of small mouth of the face (Raji et al., 2010; Olivier, 2009 and Gall, 2003).

2.6 IMPORTANCE OF CEPHALOMETRY TO SCIENCE

Cephalometric techniques which required the use of light box, X-ray, tracing paper, geometry Box, sharp pencil, eraser, sharpener, hand gloves, caliper and ruler had assisted medical and biological sciences in no small measures (Bhalajhi et al., 2009 and Yoshiaki *et al.,* 2006).

Cephalometry helps in the study of growth and development, using serial radiograph taken with standardized head position enable the study growth of jaw and dentition. Diagnosis of anatomical body structures which is to assess the resting lip posture, position of tongue, soft palate and posterior pharyngeal wall (Gurkeerat *et al.,* 2007 and William *et al.,* 2006).

Cephalometric contributions to the field of sciences had helped in assessing the relation of lower lip to upper one, to assess the adequacy of dental base to accommodate all teeth, to assess the presence, position and angulations of any interrupted teeth checking any pathology or abnormality of teeth, bone and soft tissue (William *et al.,* 2002 and Houston et al., 1992). This also help in assessing the length of incisors and their inclination, assess the skeletal pattern and for treatment planning, prediction of growth (Gurkeerat *et al.,* 2007 and Thomas *et al.,* 2005).

Assessment of prognosis in upper and lower angulations and position needed for achieving normal overbite and overjet is achievable through cephalometry. Also to assess whether distal movement of buccal teeth is possible for accurate planning before surgical correction (Laura *et al.,* 2001 and Graber *et al.,* 2000).

Assessment of future growth and analysis of tooth movement, anchorage control and prognosis of treatment could be better through cephalometric tracing and analysis (Mitchel *et al.,* 2007; Proffit *et al.,* 2007; Mohammed *et al.,* 2002; Sarver *et al.,* 2002; Samir *et al.,* 2002 and McNamara *et al.,* 2001).

The relationship in craniometric indices and anthropometric measurements is expected to be constant at specific ages (Danborno et al., 1997). These relationships can be expressed as a ratio or by use of regression techniques. These proportions and relationship change dramatically from the fetal period through childhood to adolescence because of various interactions between genetic, biochemical and environmental factors. It was believed that why white women engage more in sporting activities than their black female counterparts is because research had shown their bones contain more bone mineral deport than that of Blacks (Okupe et al, 1984). The bone and fatty masses around the facial region among some ethnic groups in Japanese, Hawaii and Filipinos women are more than their male counterparts. Women with greater consumption of milk showed more bony mass and skeletal presentations around the facial region at the age of 1824 years (Daniel, 2012). The use of radiographic images and cephalometric analysis has been documented in North America on subjects of ages of 15-29 years. Cephalometric data using orbital measurements in black and white Americans was carried out using the Interpupillary (IPD) distance, Papebral Height (PH) and facial height (FH). In this regard, Oluwole et al, (2009) carried out a research on comparison of cephaloemtric indices in Nigerian State of Lagos while comparison of cephalometric indices among hausa was done in Maiduguri, Nigeria by Danborno et al (1997). The result showed that differences occur due to genetic and environmental factors. The study of this kind will help to distinguish the different cranial configurations of various ethnic groups thereby assisting in crime scene investigation (Interpol, 1984, 1990 and 1996).

2.7. SEXUAL DIMORPHISM AND CEPHALOMETRIC CHARACTERIZATIONS

Sexual dimorphism in human body size and composition is well established, and apparent in diverse populations (Leo, 2009 and Oluwole *et al*., 2009). The biological taxonomy and classifications are clearly understood through facial and cranial looks in the sexual dimorphism of the living primates. Primatologist who also study fossil deposits of primates have shown closed relationship in craniofacial presentations (Umar et al., 2011). The viscerocranium tends to be more dimorphic than neurocranum while childhood characteristics and several dimorphic features are retained around the skull and faces of both adult male and female (Hrdlika., 1952). The glabellas are a smooth and prominently placed medially from the superciliary arches. Recent literature reviews have shown that the glabellas are larger and more explained in males than females during the post-natal growth (Gray's, 1935).

Average cephalic and nasal indices tend to be greater in males than females, whereas average adiposity tends to be greater in females than males (Gray and Wolfe, 1980; Gustafsson and Lindenfors, 2009; Norgan, 1990; Seeman, 2001; Stini, 1975; Wells, 2007, 2009). The most widely assumed explanation for sex differences is sexual selection.

Although empirical evidence remains scarce, cephalic and facial indices appear important for mating opportunities especially when devoid of deformities in both males and females (Hughes and Gallup, 2003; Lassek and Gaulin, 2009 and Wells et al., 2012). Also female body shape, strongly associated with adiposity, has also been associated with ratings of attractiveness by males (Brown and Konner, 1987; Furnham et al., 2003; Singh and Young, 1995). However, both the proximate and ultimate mechanisms underlying such sexual dimorphism remain poorly understood (Tovee and Cornelissen, 1999; Tovee et al., 1999).

Sexual dimorphism in humans is widely assumed to have a strong genetic element and Lande (1980) proposed that sexual dimorphism is likely to arise in traits with polygenic basis, such that differential selective pressures acting on the two sexes could drive apart the sex-specific means over time. The lower the correlation between the additive effects of genes expressed in each sex, the more rapid such divergence could occur (Lande, 1980).

The underlying selective pressures could in theory derive either from sexual selection as formulated relating to sex differences in the association between body size and the likelihood of mating, or from natural selective pressures acting differentially on the two sexes (Hedrick and Temeles, 1989; Lande, 1980; Shine, 1989). For example, natural selection could favor sex differences through different foraging strategies or from intrinsic sex-differences in reproductive roles, known as the dimorphic niche hypothesis (Ralls, 1976).

Data from different ecological settings indicate subtle sex differences in body composition around face and head of humans at birth (Andersen et al., 2011; Butte et al., 2000; Fomon et al., 1982), which subsequently become exaggerated through pubertal development (Wells, 2009;
Hattori et al., 2004; Maynard et al., 2001; Bogin, 1999; Haschke, 1989;).

Human size, physique, and body composition are also well established to vary in association with ecological conditions for example, consistent with eco-geographical rules proposed in the 19th century, a number of studies have shown that cold environments favor reduced leg length and increased body mass index (BMI) (Crognier, 1981; Hiernaux, 1968; Hiernaux and Froment, 1976; Katzmarzyk and Leonard, 1998; Newman, 1953; Roberts, 1953; Ruff, 1994). These physical characteristics are assumed to minimize heat loss and maximize heat production.

Dimorphism in stature was recently reported to have a weak association with latitude (Gustafsson and Lindenfors, 2009), but effects of temperature on body composition dimorphism remain unknown. To date, most previous work on human sexual dimorphism variability has focused on stature with cephalometric indices, and little attention has been directed to the question of whether the contrasting strategies for anatomical configurations males and females (Gustafsson and Lindenfors, 2009).

2.8 EMBRYOLOGY AND ANTHROPOMETRY OF FACIAL CHARATERICSTICS

Cephalometric indices use established anatomical dimensions around face and head as controlled by genetic factors during human development. The embryonic development of the human face occurs mainly between 4 – 8 weeks of gestation and the lower jaw or mandible is the first to be formed (Gray’s 2003). The facial proportions such as development of teeth, paranasal sinuses, the facial skeleton increase in size and contribute to the definitive shape of the face (Golalipour et al., 2006; Gray’s 2003; and Eroje, 2001). Early in the 4th week of development, five primordial swellings as frontonasal prominence, maxillary prominences and mandibullar prominences developed (Khammar et al., 2009).

The mesoderm of the five prominences is continuous with each other and there is no internal division corresponding to the grooves that demarcated the prominences externally while the ectoderm lined-depression separated from the primitive pharynx by the buccopharyngeal or oropharyngeal membrane (DelSol, 2005). By the end of 4th week, bilateral oval-shaped ectodermal thickened and appeared on each side of the lower part of the frontonasal prominence and nasal placodes (Bayat, 2010). Mesenchymal cells proliferate at the margin of the placodes and produce horse-shoe shaped swellings that formed medial and lateral nasal prominences. The placodes now lie in the floor of a depression as nasal pits and each lateral nasal prominence is separated from the maxillary swelling by nasolacrimal groove (Gray's, 1935 and Maina et al., 2012).

The maxillary prominences continue to increase in size in which laterally, merged with the mandibular prominences to form the cheek and medial nasal prominences. The medial nasal swelling grows medially and merges with each other in the midline to form the inter-maxillary segment. Human embryo at the 7 weeks of gestational period expressed inter-maxillary segment forming as derivatives as philtrum of lip, premaxillary part of the maxilla, gums and primary palate (Giles et al., 1992). The mesenchyme from the 1st and 2nd pairs of pharyngeal arches invades the facial prominences forming muscles of mastication and facial expression
respectively (Raji et al., 2010 and Radovic et al., 2000).

The frontonasal prominence formed the forehead and the bridge of the nasal bones while maxillary prominences form the upper cheek regions, upper lip, maxilla, zygomatic bone and secondary palate. The mandibular prominences fused forming the chin, lower lip, and lower cheek regions while lateral nasal prominences form the alae ((Kosa, 2009; Ozaslan *et al*., 2003 and Gray's 1935). With the formation of the medial and lateral nasal prominences, the nasal placodes lie in the floor of depressions as nasal pits and by the end of 6th week of gestation formed the ventral of the developing brain (Gray's, 1935). There is a communications called primitive choanae located posterior to the primary palate and immediately after the development, secondary palate and choanae change their position and become located at the junction of nasal cavity and the pharynx (Safikhani et al, 2007 and Okupe et al., 1984)

The nasal septum developed from the internal parts of merged medial nasal prominences and fused with the palatine process in 9-12 weeks while the superior, middle and inferior conchae developed on the lateral wall of each nasal cavity (Golalipour *et al*., 2003 and Okupe et al., 1984). The ectodermal epithelium in the roof of each nasal cavity becomes specialized as the olfactory epithelium while the olfactory cells give origin to olfactory nerve fibers which grow into the olfactory bulb ((Tuli *et al.*, 1995 and Gray's, 1935).

Nasolacrimal duct also developed from a rod-like thickening of the ectoderm in the floor of the nasolacrimal groove. This solid cord of cells separates from the surface ectoderm and lies in the underlying mesenchyme (Gohiya *et al*., 2010 and Majekodunmi et al., 2009). The cord gets canalized to form the nasolacrimal duct. The cranial end of the duct expands to form the lacrimal sac. The caudal end opens into the inferior meatus of the nasal cavity. The duct usually becomes completely patent only after birth (Daniel, 2012; Iscan, 2011; Zahra, et al., 2006; Zollikofer et al., 2002 and Zahra, et al., 2006). Failure of complete canalization of the duct leads to atresia of the duct which is seen in about 6% of newborn infants (Daniel. *et al* 2012; Holland *et al*., 2009 and Gholalipour, 2001).

The skull of fetus is a unique skeletal structure in several ways and it begins as an embryological cells forming neural crest which later formed intramembranous substance by ossification. The cranial vault is formed by intramembraneous ossification while the bones that form the base of the skull form endochondrial part (Gall, 2003). The flexible part of the cranium form suture which allows for the head to pass through the birth canal and secondly postnatal brain growth at mid-age 20years where it is completely fused at old age. In the entire human musculoskeletal system, jaws show early ossification and followed by long bones. This is because of the formation of the osteoblast called bone-forming cells from its extra-mesendymal source (Zollikofer et al., 2002; Zahra, et al., 2006). Recent findings have shown the participation of molecular elements in gene controlling centre like bone morphogenetic protein (Jason *et* *al*., 2010). Embryologically, all voluntary muscles of the head are formed from paraxial mesoderm as somitomeres and somites (Olivier, 2009).

2.9 ANTHROPOMETRY AND MUSCULAR CHARACTERISTICS OF HEAD AND FACE

The face is the mirror of the mind, and eyes without speaking confess the secrets of the heart according to St Jerome of Institute of Medical Center, India. There are common facial expressions in humans as sad, smiles, grief, anger, frowning, horror, surprise, contempt and doubt (Leo, 2009 and Oluwole *et al*., 2009). Also, facial muscles and mastication as part of anatomical configurations of human being have been shown to have anthropometric relevance on sex, ethnicity and environment (Tod et al., 2009). Generally from skull to skin innervated by facial nerve, sphincters and dilators around mouth (lips) and eyes expressed seventeen facial muscles. The craniofacial muscles of the voluntary parts of the face are formed from partial mesoderms which developed from somites and somitomeres (Bayat, 2010; Eroje et al., 2010 and Hrdlika, 1952). (Golalipour, 2003 and Golalipour, 2001). Maxillary and mandibular processes are term specifically by the first pharyngeal arch and innervated by trigeminal nerve and most muscles of mastication which are temporal, masseter, and tensor tympani (Golalipour, 2003; Golalipour, 2001 and Okupe *et al*., 1984). .

2.10 BRIEF HISTORY OF IDOMA AND IGEDE ETHNIC GROUPS OF BENUE STATE, NIGERIA.

Scholarly knowledge has combined oral history with genealogical data and analysis of kinship totems to trace the roots of the Idoma people as a whole. One notable Idoma scholar E.O. Erim cites genealogical data, collected from most modern groups in Idoma suggesting that they derive from several ethnic groups, each with different historical origin.

Several historians had agreed to the claims that Idoma as a people originated from Apa in Kwararafa which is in the present day Taraba State and they settled in the present day Tiv land before migrating to their present location (Abraham, 1951). Some Idoma people are settled in Cross River State and Nasarawa State and speak mainly Idoma language with other dialects such as Ufia and Akweya. The Idomas are separated into different regional presentations known as the West, Central and North and are made up of nine Local Government Areas, which formed Zone C of Benue State. The paramount ruler of the Idoma tribe is addressed as Ochi' Idoma and the stool is currently occupied by His Royal Highness IKOYI ELIAS OBEKPA (Bennett et al., 2004).

The Igede tribe is made up of two local government known as Obi and Oju local government areas of Benue State with unique language as Igede with a believe historically that they migrated from the present day Benin kingdom. They have two dialects known as Izzi and Izza and are ruled by King Ochi Ikande as Ada-Utu (Bennett et al., 2004).

The Idoma and Igede are known to be warriors'and'hunters of class, but hospitable and peace loving. The greater part of Idomaland and Igedeland remained largely unknown to the West until the 1920s, leaving much of the colorful traditional culture intact (Armstrong *et al.,* 1983). The history of the Idoma people precedes the history of Benue state created 1976 and the history of the Republic of Nigeria (created 1960). Oral tradition is the primary method of which history has been passed in Idomaland and Igedeland and is considered a central cultural institution (Bennett, 1977). From a young age among Idoma and Igede children usually learn from their elders stories of old and are brought up around extended families, which make multiple historical resources available.

When Idomas prompted generally will proudly tell you where they are from, and it's not uncommon for Idoma to be able to recite at least four generations of their progenitors. Quite naturally, a number of villages trace origins to single ancestors and further, several Idoma groups trace their heritage to one common ancestor by considering the father of the different groups (Armstrong, 1983). According to traditional history, Iduh, the father of the Idoma had several children who each established different areas. Hence the expression of: Iduh the father of Idoma Iduh who begot all the Idoma He also begot the following children: Ananawoogeno who begot the children of Igwumale; Olinaogwu who begot the people of Ugboju; Idum who begot the people of Adoka; Agabi who begot the people of Otukpo; Eje who begot the people of Oglewu; Ebeibi who begot the people of Umogidi in Adoka, and Ode who begot the people of Yala ” While there may be some truth to the above, the Idoma cannot be said to have a unitary origin. Many Idoma groups and village subsets have their own histories complete with stories about how their people arrived at their current location. As one can imagine, the ever-changing of peoplethrough time makes it difficult to study Idoma history (Abraham, 1951).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 THE STUDY LOCATION

This study was conducted on normal randomly selected Igede and Idoma ethnic goups of Benue State region of East-Central Nigeria in Oju College of Education and Jesus Collge Otukpo.

Since Igede and Otukpo represent a mix of the subject populations of interest in the research study, all participants were chosen to be representatives of the two tribes.

The motto as the food basket of the nation, Nigeria, it has three major ethnic groups known as Igede, Idoma and Tiv and there exist peaceful co-existence among other ethnic tribes like Igala from Kogi, Hausa from Kaduna, and Yoruba from Western part of Nigeria.

The State had a total population of 2,780, 398 according to the 1991 Census and that was projected to 3,100,311 in 1996, with average population density of 99 persons per sq.km (Bennett et al., 2004). This made Benue State, the 14th most populous State in Nigeria. However, the distribution of the population according to LGAs shows marked duality with some areas of low population density such as Guma, Gwer, Ohimini, Katsina Ala, Apa, Logo and Agatu, each with less than seventy persons per sq. km while Vandeikya, Okpokwu, Ogbadibo, Obi and Gboko had densities ranging from 140 persons to 200 persons per sq. km. Makurdi LGA has a restricted coverage around the town of over 380 person per sq. km with a population showed a slight imbalance in favor of the females. The males were 49.8 percent of the total population while the females constituted 50.2 per cent (Bennett et al., 2004).

3.2 SETTLEMENT PATTERN AND URBANIZATION

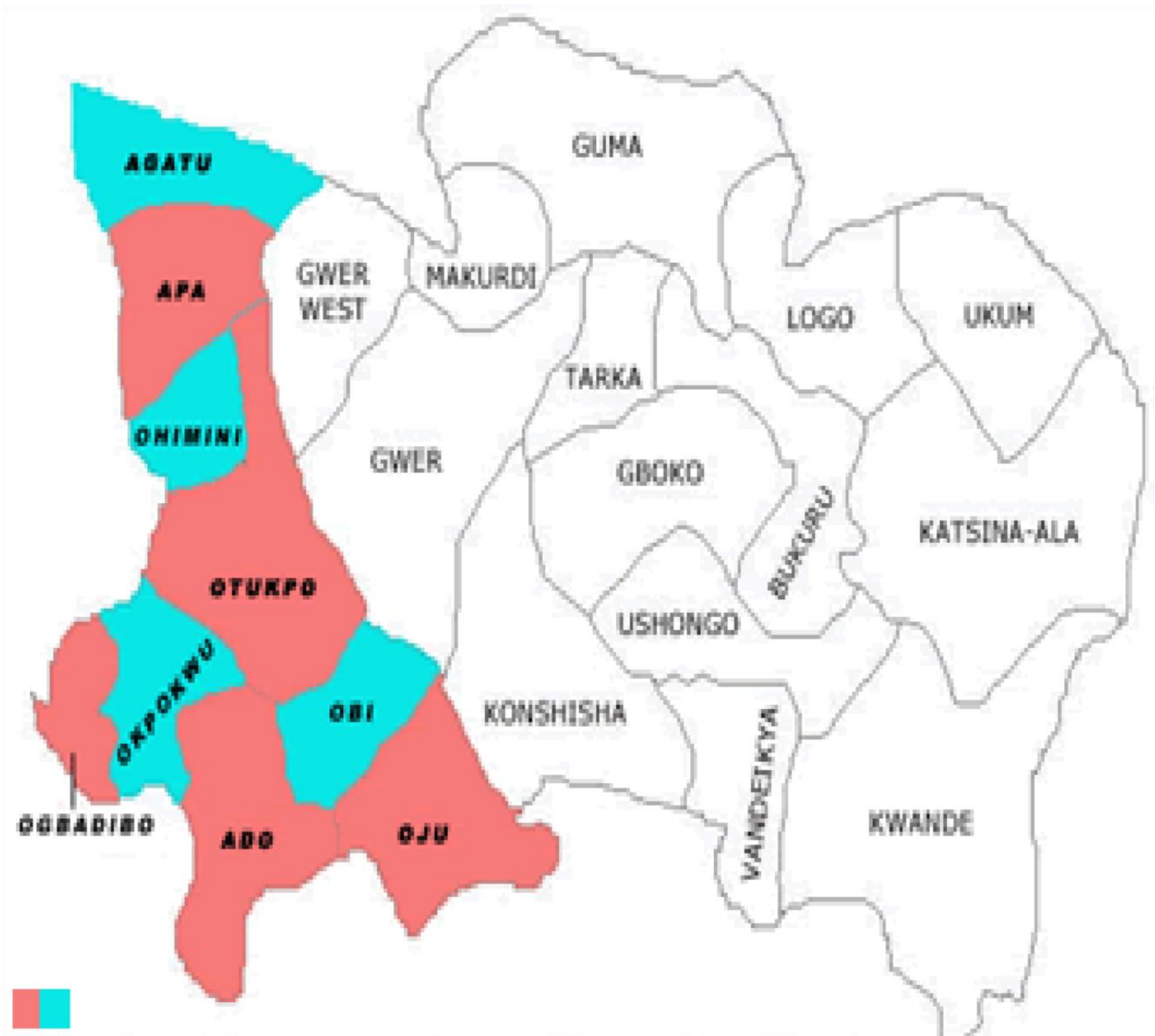
Benue State is one of the most underdeveloped parts of Nigeria which was depleted of its human population during the Trans Saharan and Trans-Atlantic slave trades (Bennett et al., 2004). Benue State is largely rural, with scattered settlements mainly in tiny compounds or homesteads, whose population range from 630 people, most of whom are farmers and with the Idoma speaking part of the state, the settlements are larger (Bennett et al., 2004).

Urbanization in Benue State did not predate the colonial era and few towns established during colonial rule remained very small of about less than 30,000 people up to the creation of Benue State in 1976. Benue towns can be categorized into three as in the first group consists of those with a population of 80,000 to 200,000 people which include Makurdi, the State Capital (194,954), Gboko and Otukpo, the headquarters of the two dominant ethnic groups with 125,944 and 88,958 people respectively. The second group comprises towns with a population of between 15,000 and 30,000 people which includes Katsina Ala, Zaki Biam and Adikpo. These are all local government headquarters while the third category comprises towns with a population of 7000 to 14,000 people and includes vandeikya, Lessel, lhugh, Naka, Adoka, Aliade, Okpoga, lgumale, Oju, Utonkon, Ugbokolo, Wannune, Ugbokpo, Otukpa, Ugba and Korinya. Most of these towns are headquarters of recently created LGAs or major Market Centres with some of the headquarters of the LGAs having populations of less than 7,000 people. Such centers include Tse, Agberaba, Gbajimba, Buruku, Idekpa, Obagaji and Obarikeito and apart from earth roads, schools, periodic markets, chemist and provision shops, the rural areas are largely neglected, relying on the urban centers for most of their needs (Abbie et al., 1952).

There are three towns that stand out very clearly as important urban centers which together account for more than 70 per cent of the amenities provided in the state and almost all the industrial establishments. These centers are Makurdi, Gboko and Oturkpo and amongst the oldest towns in the state growing at a much faster rate than the smaller younger towns. The state capital Makurdi doubles as the capital of the state and the headquarters of Makurdi LGA, while Gboko and Otukpo double as local government and ethnic headquarters for the Tiv and Idoma tribes respectively. Amenities such as electricity, telephone, pipe-bone water, hospitals, schools, colleges, sporting facilities, hotels, banks, insurance houses, night clubs and cinema halls, are disproportionately concentrated in these three towns at the expense of the smaller younger towns and the rural areas. However, these three towns also carry their fair share of urban crime, unemployment, congestion, slums and refuse disposal problems.

The State is named after River Benue and was carved out from the former Benue-Plateau along Igala and some part of Kwara State in 1976. Along borders of the state, traces of ethnic tribes like Igbos from Ebonyi and Enugu State are found and with 23 local government council areas. Most of the business activities in the state are highly backed with educational activities and commercial companies such as the Otukpo Rice Meal and Fruit producing centre in Gboko. The presence of schools like University of Agriculture and Benue State University located in the capital Makurdi, presence of resorts and recreational centers makes the state viable for tourism and socioeconomic activities. Religiously, Christianity is the strongest and widely practiced religion but other forms exist like Islam, pagans and animalistic worshippers.

Figure 3.0; showed the local government areas that make up the Zone C of Benue State of Nigeria. The part of the map colored comprises of the following Local Government Areas such as Okwogwu, Ogbadibo, Oju, Obi, Apa, Agatu, Ado, Otukpo and Ohimini while painted white form Zones A and B of the State whith Igede as a tribe that makes up the two local government areas namely Oju and Obi respectively (Bennett *et al*., 2004).



Idoma Local Government Areas of Benue State Nigeria

3.3 SUBJECT USED

In the present study, eight hundred (425) students were selected randomly from Igede and Idoma Communities, all in Benue state of Nigeria. The four hundred and twenty five adult subjects comprised 204 males and 221 females. They were from Igede and Idoma ethnic group by both parents and grandparents. The age of the subjects ranged from 17-40 years and the research conducted between March and November 2013.

The choice of these two schools was deliberate being that the college of education located in the heart land of Igede people while Jesus College located in Otukpo which believed to be the Centre of Idoma civilization.

3.4 MATERIALS USED

The tools used for this research include; transparent graded ruler and measuring tape for the measurement of nasal widths, Gliding and sliding machine or caliper (GSM) 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).

3.5 INCLUSION CRITERIA

- Must belong to the Idoma and Igede ethnic groups of Benue State, Nigeria.
- Must be from 17_40 years of age to allow ossifications and morphological characterizations of subject's bones.
- Must have been born and grown-up in Nigeria to exclude any environmental influence on the subject.

3.6 EXCLUSION

- Any subject 17 – 40 years of age, chosen randomly, always respecting the rule that their psycho-physic, dental and soft tissue condition not normal will be excluded. So, all pathological cases and cases with body abnormality (deformity) were eliminated from further study and measurements.
- Subject less than 17 years will not be used
- Subjects born or lived outside Nigeria

3.7 SAMPLE SIZE DETERMINATION

The anthropometric sample size for this study was determined using the formula below**:**

N = Pq/d^2 **(Nainge et al., 2006)**

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)

The number of sample size obtained for this study was 425 subjects which represented the Igede and Idoma tribes of Benue State, Nigeria.

3.8 SUBJECT RECRUITMENT

A total of 425 subjects (204 males and 221 females) were used. Prior and informed consent was obtained from the subjects and the study was carried out after clearance from ethical committee of Ahmadu Bello Teaching Hospital Shika, Nigeria. 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.

3.9 METHODOLOGY

BIO-DATA USED IN THE STUDY

The parameters used for the study included names of the subjects, age (years), sex (male or female), place of birth, Local Government Area (Ogbadibo, Okpogwu, Oju, Obi, Ohimini, Apa, Agatu, Otukpo and Ado) and parental origin (Igede and Idoma).

The methods of (Hrdlicka, 1952), and (Martins and Saller, 1957), the measurements were taken by an anthropological cephalometer (gliding and sliding), with measurement interval of 300 mm and accuracy of 1 mm, some variables were measured:

3.10 ANTHROPOMETRIC DATA USED

The anthropometric data obtained included; head length (mm), head width (mm), lower and upper facial lengths (mm), bizygomatic distance (mm), nose width (mm) and skull height (mm).

3.11 ANTHROPOMETRIC DIMENSION USED IN THE STUDY

The demographics of the subject used were collected as follows; the age in years, names, place of birth, local government area and parents were given by the class representatives and then filled into the questionnaire. Head length, head width, skull height, nasal heights and bizgyomatic distance were measured between 9am to 3pm each day.

3.12 ANTHROPOMETRIC MEASUREMENTS

1. 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 et al., 1998).

Head length is the maximum point on the sagital axis of the skull as shown in Figure 3.2.

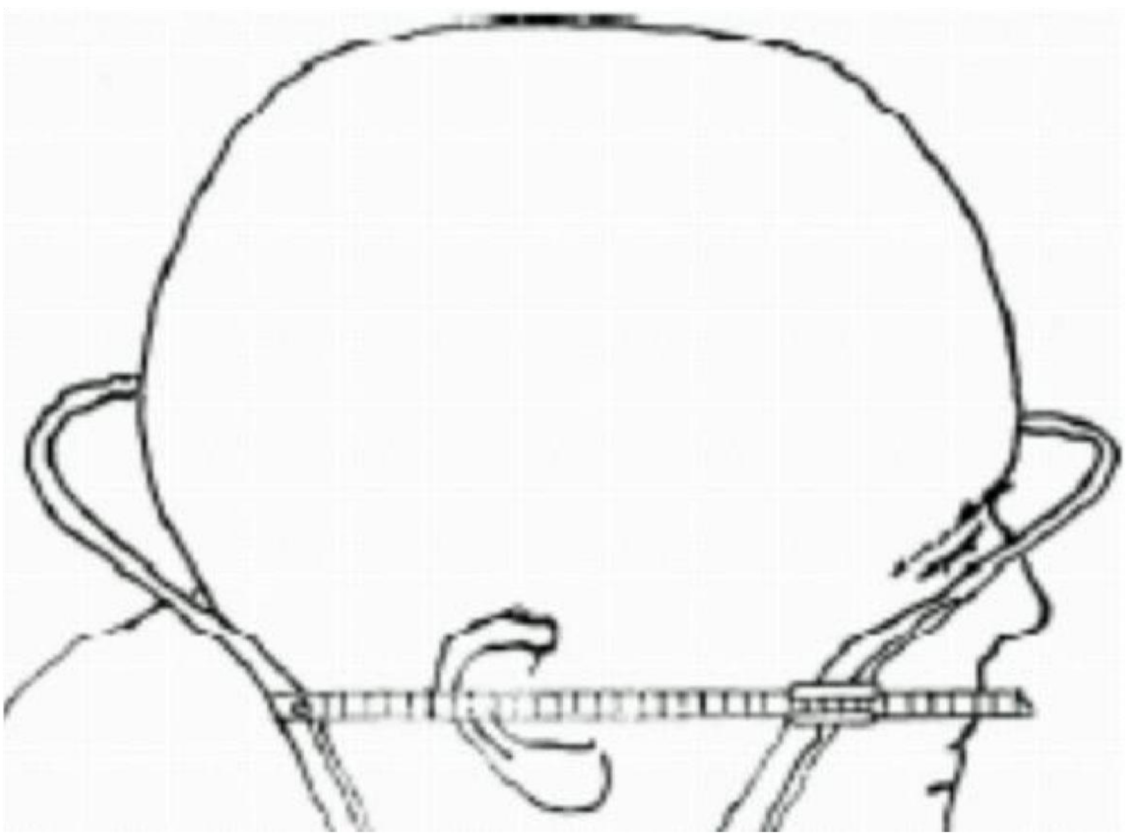


Figure 3.1 showing head length (Eroje, 2010).

2. 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 (Reich., et al 1998). Head width is the maximum point of biparmetal axis around the skull as shown in Figure 3.2.

Figure 3.2 showing head width (Golalipour et al., 2006).

3. 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) from the two extreme lateral ends of the zygomatic bones around the face. Bizyomatic distances is the facial distance or width which is the maximum distance between the two lateral sides from zygomatic bones as it is shown in figure 3.3.

Figure 3.3 showing bizygomatic distance

4. 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: this 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 Figure 3.4

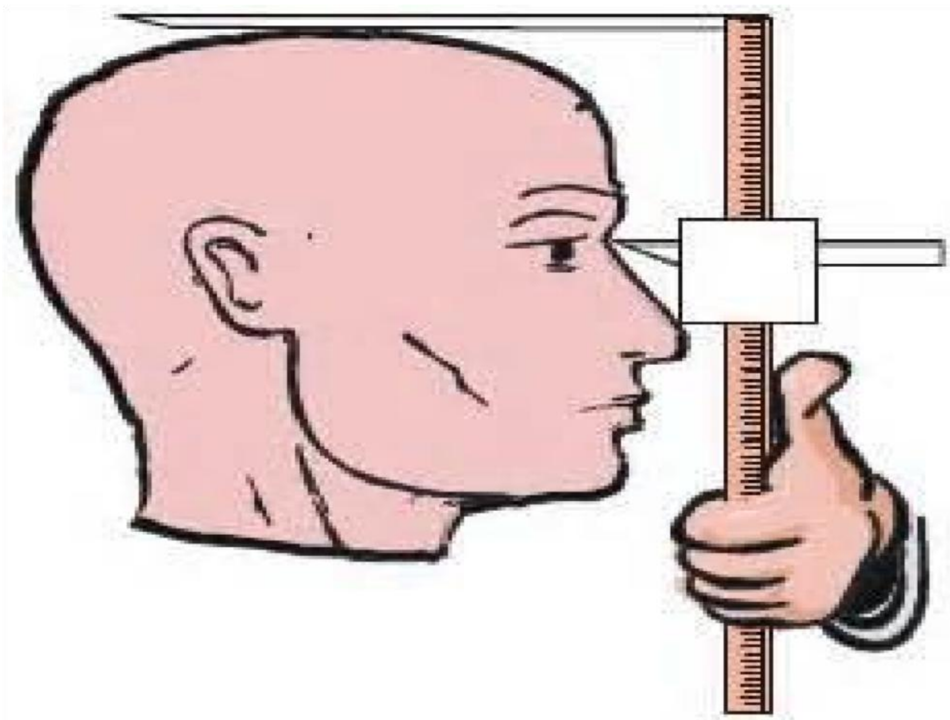


Figure 3.4 showing skull heights.

5. 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 – this 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 Figure 3.5

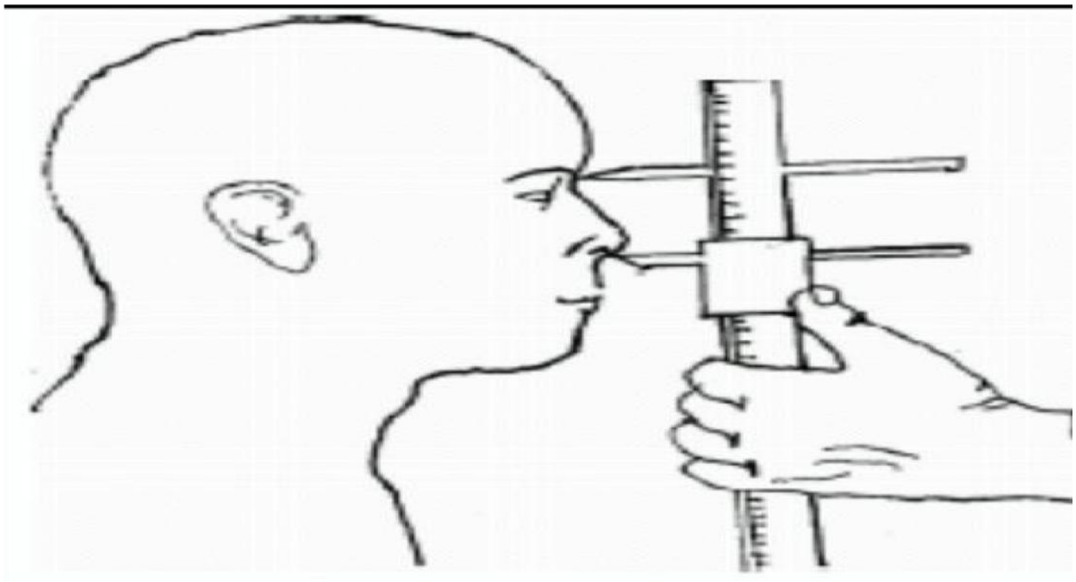


Figure 3.5: Showing Upper facial height.

6. 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 Figure 3.6. Lower facial length is the measurement of the distance from the root of the nose to mental portion on the lower jaw (mandible).

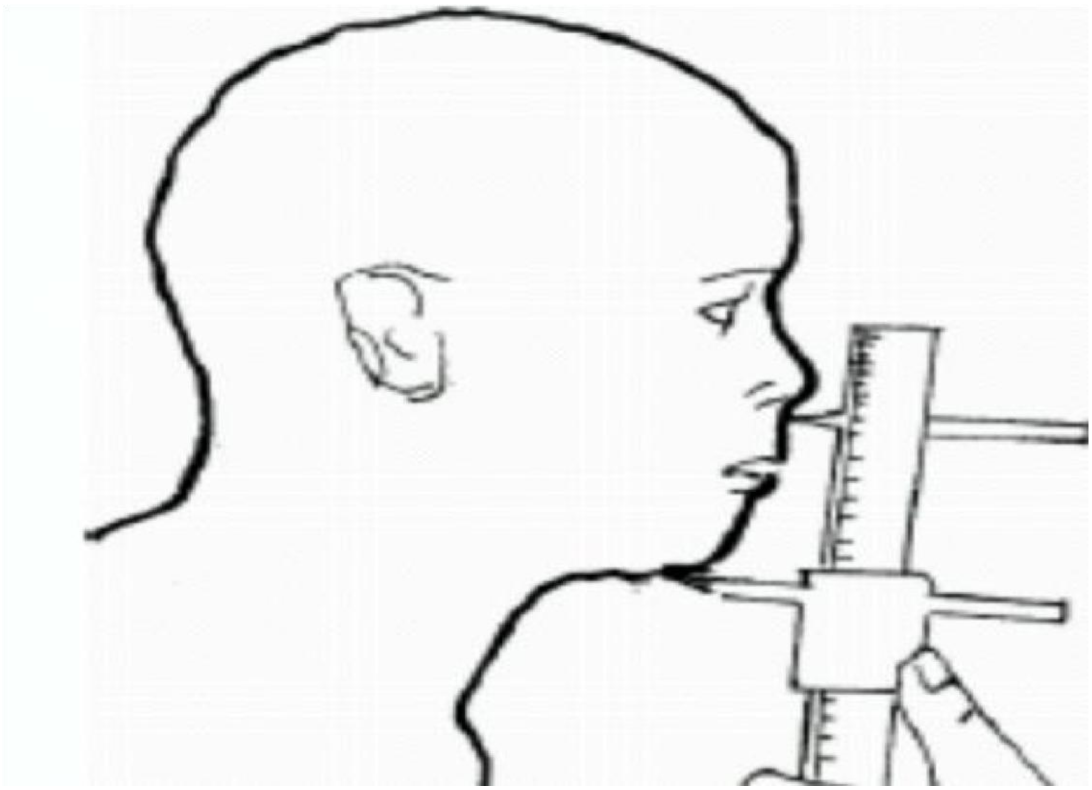


Figure 3.6 showing the lower facial length.

7. 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 Figure 3.7. Facial height (total) is the total distance from the root of the nose to the lower border of jaw (mandible).
8. In Figure 3.8, nose width was measured as the distance between two alae of the nose using sliding graded transparent ruler to the nearest millimeters (mm). Nose width is the total distance between two alae of nose.

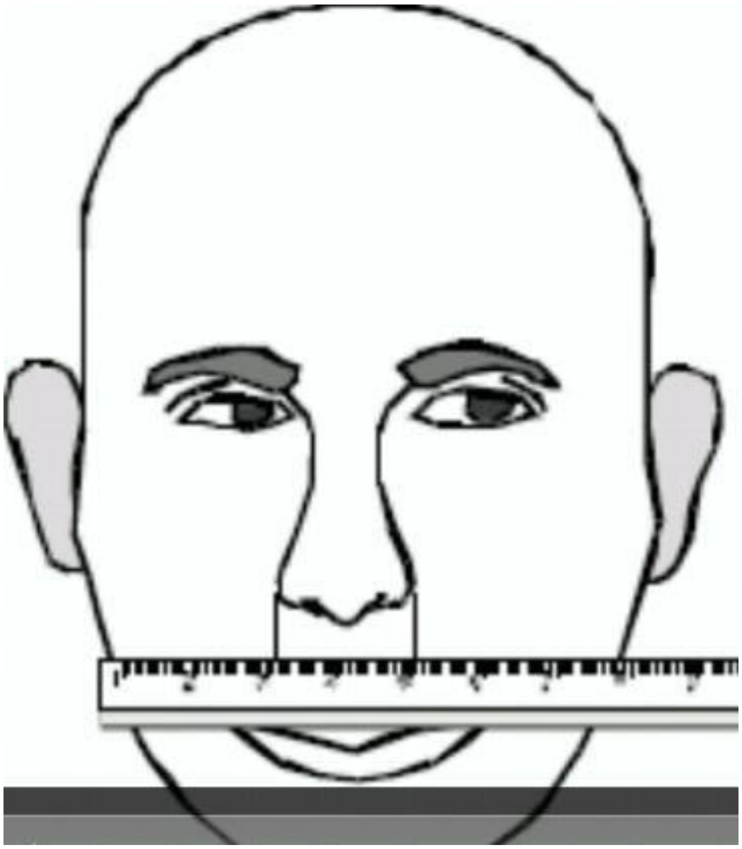


FIGURE 3.7 SHOWING NASAL WIDTHS

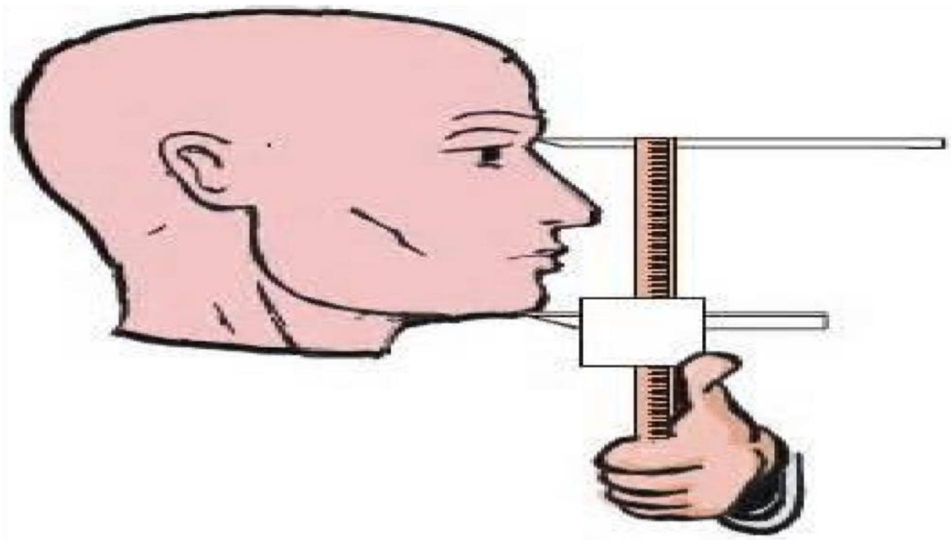


Figure 3.8: Showing Total facial length.

9. 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 Figure 3.7

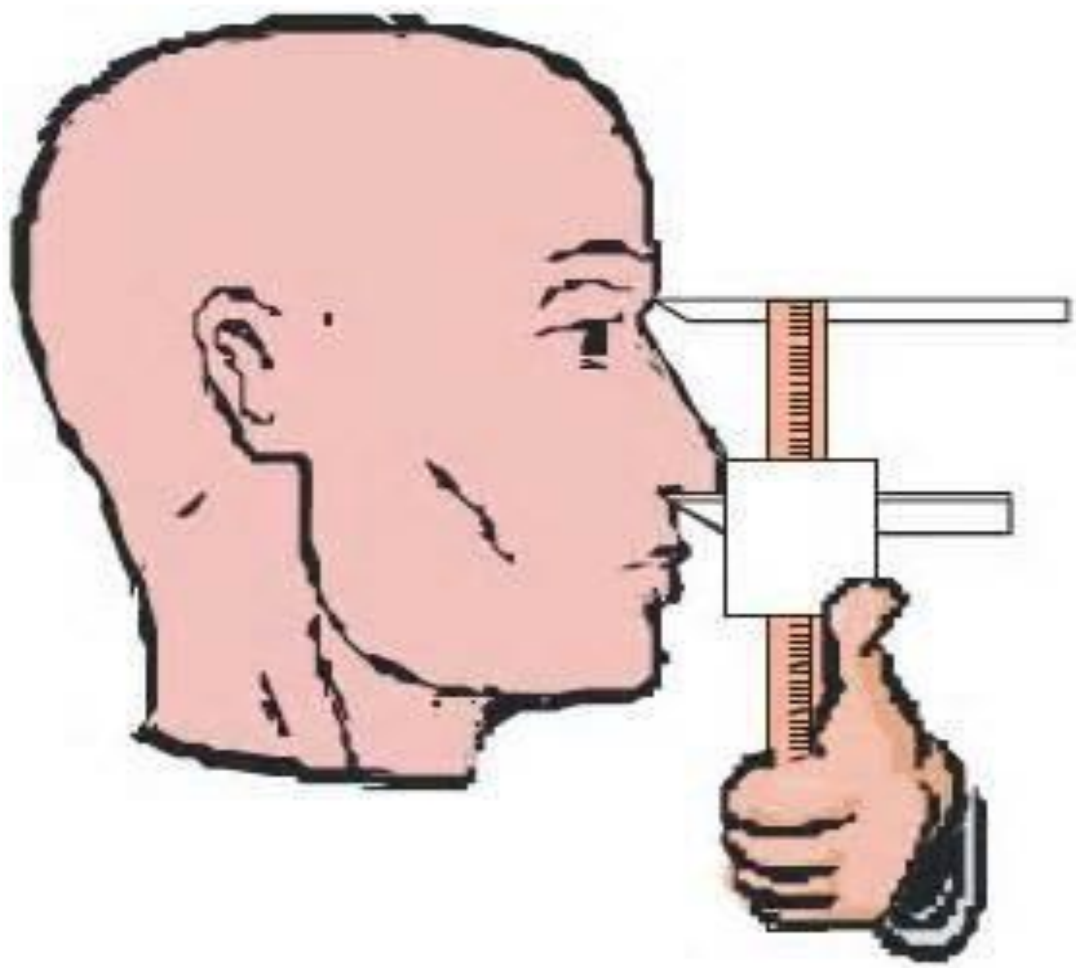


Figure 3.9: Showing nose length

3.13 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).

Table 3.1 showing International Classification Standard of head types (Williams *et al.*, 1995).

Head shape	Cephalic index (CI)	Range
Dolicocephalic (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

The table show the international classification standard of head types using the anthropometric parameters available as head length, head width, nasal length, upper facial length, lower facial length, bizygomatic distance and skull height. From table 3.1, 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 brachycephalic within 80-84.9 and very short head hyperbrachycephalic in the range of 85-89.9 respectively.

Table 3.2 showing comparative data on cephalometric indices of various populations

Populations	Country /People REFERENCES	Cephalic Index
Kvangaja race	Basu (1963)	79.50
Bhils race	Bhargav and Kher (1960)	76.98
Gujarat	Shah et al., 2004	80.81
Ijaw males		80.98
Ijaw females	Oladipo and Olotu, 2006	78.24
Igede males	Present Study	78.86
Igede females	Present study	79.43
Idoma	Present study **males**	78.43
Idoma females	Present study	79.60
obaje, s.g copy		

3.14 STATISTICAL ANALYSIS

Data was obtained in a recording sheet and transferred for statistical analysis using SPSS (ver.20.0) presented as mean±$SEMwhile$frequency by tribes and sex was determined to show the distributions of the data. Students' T-test was used to express the level of statistical significance between the groups. Pearson's correlation matrix and regression analysis were used as post-hoc test to test the level of Association between the two tribes. A P-value less than or equal to 0.05 ($P \leq 0.05$) was considered to be statistically significant.

CHAPTER FOUR

4.0 RESULTS

4.1 DESCRIPTIVE STATISTICS OF THE STUDY POPULATION

Out of five hundred and six questionnaires distributed, four hundred and twenty five were retrieved forming about Eighty-Four percent (84%) of the questionnaires that was retuned. The information contained in each questionnaire was analyzed and presented in a tabular form. A total of 135 questionnaires which constitute about 16% were either not returned or returned blank. Four hundred and twenty five (425) 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 4.0 was further subdivided into sex where Igede tribe had 75 males and 83 females while Idoma tribe had 129 and 138 respectively.

The values of all the anthropometric parameters, head length, head width, bizygomatic distance, nasa length, nasal width, and skull height were analyzed and recorded as follows: table 4.0 gave frequency by tribe and sex, table 4.1 (general descriptive statistics), table 4.2 (Mean±SEM of upper facial length and total facial length among Igede and Idoma males), table 4.3 (SEM of bizygomatic distance and nose width of Igede male and Idoma male), table 4.4 upper facial length and head length table, 4.5 (Mean±SEM of upper facial length for Idoma males), table 4.6 (general cephalometric indices), table 4.7 upper facial index and breadth-height, table 4.8 (nasal facial index and mean height indices), table 4.9 (cephalic index and breadth-height index), table

4.10 **(**cephalic module), table 4.11 (correlation matrix of anthropometric parameters) and table 4.12 (linear regression of cephalic index)

Table 4.1: shows frequencies by sex and tribe of cephalometric parameters among the Idoma and Igede ethnic groups of Benue State, Nigeria.

TRIBE	MALE	FEMALE	COUNT	PERCENT
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

The Table show frequency distribution between the two tribes and sexes

The result in Table 4.1 show the general descriptive statistics of cephalometric parameters of Igede and Idoma ethnic groups of Benue State, Nigeria with the mean age of Igede lower than Idoma as 22.6±0.45 and 23.0±0.47 respectively. There was a statistical significant increase in head length and head width between the Idoma and Igede (P≤0.05). Other parameters as shown in the table were head length (HL), head width

(HW), bizygomatic distance (BZD), upper facial length (UFL), lower facial length (LFL), total facial length (TFL), nose width (NW) and skull height (SH) in both tribes. The results showed the mean head length of both Igede and Idoma tribes as 75.0±2.40mm and 77.08±1.10mm while head width was 55.0±2.60 and 59.0±1.30 respectively. There was an increase in head length and width in Idoma and Igede which was statistically significant ($p< 0.05$). Other parameters such as bizygomatic distance and lower facial length showed similar values among the two tribes as in Table 4.1, with values as 66.9±2.50mm and 42±2.50mm respectively and the difference was significant. Also, the upper facial, total facial length and nose width with the exception of skull height were higher in mean values in Igede than Idoma ethnic group. The mean values are 46.0±2.70mm, 88.0±5.12mm,

11.32±.40mm, 151.90±3.40mm and 42.36±1.21mm, 85.20±2.21mm, 10.08±0.19mm,

152.10±2.4mm for Idoma which was statistically significant difference in value ($P\leq0.01$). Apart from age which was similar in the two tribes as 17-40, the range of head length, head width, bizygomatic distance, upper facial length, lower facial length, total facial length, nose width and skull height of Igede tribe are 22-168, 13-137, 14-126, 10-89, 12-137, 32-189, 4-24 and 87-267 while Idoma tribe are 34-196, 12-130, 13-109, 10-98, 12-120, 35-137, 5-21 and 74-379 respectively.

Table 4.2 showing 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	23.0±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	59.0±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±2.50	12—137	42.50±1.00	12—120
Total Facial length(mm)	88±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±2.4	74—379

***p≤0.05 shows statistically significant value among Igede ethnic group.**

Table 4.3 show the mean and the standard error of mean (SEM) of upper facial length and total facial length of Igede and Idoma males of which the mean age (years) was 22.4±0.47 and 22.6±0.47. The mean values for Idoma males were higher in head length, head width and total facial length than Igede males as follows, 79.3±1.10mm, 62.2±1.30mm, 87.50±2.20mm which showed a statistical significance difference (P≤0.05) over 68.0±2.40mm, 55.0±2.60mm, 69.1±5.10mm respectively with statistically significant difference in total facial length (P≤0.01).

With the exception of skull height with similar values among the two tribes, 151±3.40mm, other parameters of Igede males such as nose width, lower facial length, upper facial length and bizygomatic distance were 11.32±0.43mm, 23.1±2.70mm, 46.0±2.70mm and 67.9±2.60mm with statistical significance difference (P≤0.01) in the mean values for the nose width, and bizygomatic distance while Idoma males had mean values of 9.20±0.19mm, 42.50±1.00mm, 45.9±1.21mm and 66.8±1.31mm respectively. Also apart from age among Igede and Idoma ethnic groups with value of 17-40, the respective range in head length, head width, bizygomatic distance, upper facial length, lower facial length, total facial length, nose width and skull height were 21-167, 15-133, 14-126, 12-137, 32-187, 4-24, 86-268 and 36-195, 14-130, 13-129, 11-88, 12-120, 35-137, 5-21, 5-21, 74-237 respectively as shown in Table 4.3.

Table 4.3 showing the Mean and Standard Error of Mean (SEM) of upper facial length and total facial length Igede male and Idoma male ethnic group of Benue State, Nigeria

VARIABLES	IGEDE MALE Mean±SEM	RANGE	IDOMA MALE Mean±SEM	RANGE
AGE (years)	22.4±0.47	17_40	22.6±0.47	17−40
Head length (mm)	68.0±2.40	21_167	79.3±1.10**	36_195
Head width (mm)	55.0±2.60	15_133	62.2±1.30**	14−130
Bizygomatic Dist.(mm)	67.9±2.60*	14—126	66.8±1.31	13—129
Upper Facial Length	46.0±2.70	10—80	45.9±1.21	11—88
Lower Facial length	23.1±2.70	12—137	42.50±1.00**	12—120

Total Facial length(mm)	69.1±5.10	32—187	87.50±2.20	35—137
Nose Width (mm)	11.32±0.43*	4.0—24	9.20±0.19	5.0—21
Skull Height (mm)	151.90±3.40	86—268	151.10±2.4	74—237

***p≤0.05 shows statistically significant differences among Igede Males in Benue State**

****p≤0.01 shows high significant values among Idoma Male tribe of Benue State, Nigeria.**

Table 4.4 show the mean and the standard error of mean (SEM) of bizygomatic distance and nose width of Igede and Idoma females ethnic groups. The respective mean values for age of Igede females and Idoma females were 22.41±0.46 and 22.90±0.47. Other parameters namely head length, head width, total facial length were higher among Idoma females than Igede females and was statistically significant (P<0.05). The mean values were as follows; 79.3±1.10mm,

63.2±1.40mm, 86.10±2.0mm and 73.4±2.40mm, 58.3±2.20mm, 84.5±3.20mm. With the

exception of upper facial length which was similar in value of 42.9±2.22mm, nose width and skull height were 11.31±0.35mm and 156.8±5.40mm which was significantly different (P<0.01) between the Igede and the Idoma tribe with mean values of 9.30±0.14mm and 150.10±2.4mm respectively. There was an increase in bizygomatic distance in the Igede females over the Idoma females though difference was not significant. The mean values were 67.1±2.20mm and 66.8±1.21mm for Igede and Idoma females respectively. Apart from age, which was of the same range 17 – 40 year, the range of other anthropometric parameters in both

Igede and Idoma females were as follows; 21-167, 15-133, 14-126, 10-80, 12-137, 32-187, 4-24, 86-268 and 36195, 14-130, 13-139, 12-88, 12-122, 15-139, 4-22 and 75-235 respectively as shown in Table 4.4.

Table 4.4 show the Mean and Standard Error of Mean (SEM) of nose width and bizygomatic distance of Igede 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)	73.4±2.40	21_167	79.3 ±1.10**	36_195
Head width (mm)	58.3±2.22	15_133	63.2 ±1.40**	14−130
Bizygomatic Dist.(mm)	67.1±2.20	14_126	66.8±1.21	13_139
Upper Facial Length	42.9±2.22	10_80	42.0±1.2	12_88
Lower Facial length	41.5±2.70	12_137	43.10±1.00	12_122
Total Facial length (mm)	84.5±3.20	32_187	86.10±2.0**	15_139
Nose Width (mm)	11.31±0.35*	4.0_24	9.30±0.14	4.0_22
Skull Height (mm)	156.8±5.40*	86_268	150.10±2.4	75_235

*p≤0.05 shows statistically significant differences among Igede Females in Benue State, Nigeria **p≤0.01 shows high significant values among Idomale Females in Benue State, Nigeria.

Table 4.5 show results in mean and standard error of mean (SEM) of upper facial length and head length of Igede males and females of Benue State, Nigeria with age as 22.4±0.47 and 22.61±046 years respectively. Other parameters such as head length, head width, total facial length and skull height were higher in values among the Igede females and there was statistically significant different (P<0.05) from that of Igede males as 73.4±2.40mm, 58.3±2.30mm,

84.40±3.20mm, 156.8±5.4mm and 68.0±2.40mm, 55.0±2.60mm, 69.1±5.10mm, 151.90±3.40mm.

Also apart from upper facial length which showed significant difference (P<0.01) with mean value of 46.0± 2.70mm among Igede males while the Igede females had 42.9±2.22mm, the bizygomatic distance and nose width were the same as 67.9±2.60mm and 11.30±0.35mm. The value in rangeamong the males and females of Igede tribe of Benue State, Nigeria as shown in Table 4.5 are as follows; 17-40, 21-167, 15-133, 14-126, 10-80, 12-137, 32187, 4-24, 86-268 respectively.

Table 4.5 show the Mean and Standard Error of Mean (SEM) of upper facial length and head length of Igede male and Igede female tribes of Benue State, Nigeria.

VARIABLES	IGEDE MALE Mean±SEM	RANGE	IGEDE FEMALE Mean±SEM	RANGE
AGE (years)	22.4±0.47	17–40	22.6±0.46	17−40
Head length (mm)	68.0±2.40	21_167	73.4±2.40**	21_167
Head width (mm)	55.0±2.60	15_133	58.3±2.30**	15−133
Bizygomatic Dist.(mm)	67.9±2.60	14_126	67.1±2.21	14_126
Upper Facial Length	46.0±2.70*	10_80	42.9±2.22	10_80
Lower Facial length	23.1±2.70	12_137	41.5±2.20	12_137
Total Facial length (mm)	69.1±5.10	32_187	84.40±3.20**	32_187
Nose Width (mm)	11.32±0.43	4.0_24	11.30±0.35	4.0_24
Skull Height (mm)	151.90±3.40	86–268	156.8±5.4**	86–268

***p≤0.05 shows statistically significant differences among the Igede Males**

****p≤0.01 shows high significant values among Igede Females**

The results of cephalometric parameters of both males and females of Idoma ethnic group of Benue State showed the mean age as 22.60±0.47 and 22.90±0.47 respectively. The head width and skull height in Idoma females were higher than that of Idoma males of which the difference was statistically significant ($P<0.05$) with values of 63.2±1.40, 150.10±2.4 and 62.2±1.10, 129.8±3.14 respectively while the upper facial length and total facial length of Idoma males were 45.9±1.30 and 87.5±2.20 which showed significant difference ($P<0.01$) from that of the Idoma females with mean values of 42.0±1.2, 86.10±2.0 respectively. The results showed that the bizygomatic distance and nose width with mean values of 66.8±1.30, 9.21± 0.19 and 66.8±1.40, 9.30, 0.14 respectively had the same value in both male and female Idoma tribe. The lower facial length was reduced in Idoma males than the females though the reduction was not significant as follows 42.5±1.00 and 43.10±1.00 respectively as shown in Table 4.6.

Table 4.6 showing the Mean and Standard Error of Mean (SEM) of upper facial length Idoma male and Idoma female tribe of Benue State, Nigeria.

VARIABLES	IDOMA MALES Mean±SEM	RANGE	IDOMA FEMALES Mean±SEM	RANGE
AGE (years)	22.60±0.47	17_40	22.9±0.47	17−40
Head length (mm)	79.3±1.20	36–195	79.3±1.10	36–195
Head width (mm)	62.2±1.10	14_130	63.2±1.40**	14−130
Bizygomatic Dist.(mm)	66.8±1.30	13_129	66.8±1.21	13_139
Upper Facial Length	45.9±1.30*	11_88	42.0±1.2	12_88
Lower Facial length	42.5±1.00	12_120	43.10±1.00	12_122
Total Facial length (mm)	87.5±2.20*	35_137	86.10±2.0	15_139
Nose Width (mm)	9.21±0.19	5.0_21	9.30±0.14	4.0_22
Skull Height (mm)	129.8±3.14	74_237	150.10±2.4**	75_235

*p≤0.05 shows statistically significant differences among Idoma Males

**p≤0.01 shows high significant values among Idoma Females of Benue State, Nigeria

Results showed the cephalometric indices calculated in percentages from anthropometric variables among Igede and Idoma ethnic groups of Benue State, Nigeria where the cephalic indices of the former was 76.54 which was of moderate type while the later was 77.33 which was according to the International Standard as shown in Table 3.1. However, the upper facial index, nasal facial index and breadth-height index in Idoma were higher than that of the Igede tribe as follows 68.76, 24.61, 117.00 and 63.27, 23.79, 110.87 respectively while the cephalic module, length-height index, height index of Idoma were lower in Idoma than Igede tribe as shown in Table 4.7.

Table 4.7 show 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
Bredth– Height Index (B-HI)	110.87	117.00
Mean - Height Index (MHI)	116.85	111.76

Results showed upper facial index and breadth-height index in percentages of Igede and Idoma male tribes of which both have cephalic indices of mexocephalic type (moderate head) as 78.86 and 78.43 respectively. Other parametric variables among Idoma males and Igede males such as upper facial index, nasal facial index, and breadth-height index are 68.71, 26.34, 116.23 and 67.75, 24.60, 114.21 while mean height index, length-height index and cephalic module are

91.73, 77.48, 90.43 and 123.49, 90.96, 91.63 respectively as shown in Table 4.8.

Table 4.8 showing upper facial index and breadth-height index among Igede male and Idoma male ethnic group of Benue State, Nigeria.

VARIABLE (%)	IGEDE MALE	IDOMA MALE
Cephalic Index (CI)	78.86	78.43
Upper Facial Index (UFI)	67.75	68.71
Nasal Facial Index (NFI)	224.60	26.34
Cephalic Module (CM)	91.63	90.43
Length _Height Index (L- HI)	90.96	77.48
Bredth− Height Index (B- HI)	114.21	116.23
Mean Height Index (MHI)	123.49	91.73

The result showed nasal facial index and mean-height index in percentage among Igede females and Idoma females such as cephalic index, upper facial index and nasal facial index with their respective values as follows; 79.43, 63.93, 26.36 and 79.60, 62.87, 21.98 while other parameters such as cephalic module, length-height index, breadth-height index and mean height index are 96.17, 93.89, 117.89, 119.08 and 97.53, 76.97, 115.46, 105.48 respectively as shown in Table
4.9.

Table 4.9 show nasal facial index and mean height index among Igede female and Idoma female ethnic group of Benue State, Nigeria.

VARIABLES (%)	IGEDE FEMALE	IDOMA FEMALE
Cephalic Index (CI)	79.43	79.60
Upper Facial Index (UFI)	63.93	62.87
Nasal Facial Index (NFI)	26.36	21.98
Cephalic Module (CM)	96.17	97.53
Length _Height Index (L- HI)	93.89	76.97
Bredth– Height Index (B-HI)	117.89	115.46
Mean- Height Index (MHI)	119.08	105.48

Table 4.10 show cephalic index and breadth-height index in percentage from available anthropometric parameters among Idoma females while Table 4.11 show similarity in cephalic, facial index, cephalic module, length-height index, breadth-height index and mean height index.

Table 4.10 show cephalic index and breadth-height index among Igede male and Idoma female ethnic group of Benue State, Nigeria.

VARIABLES (%)	IGEDE MALES	IDOMA MALES
Cephalic Index (CI)	78.86	79.60
Upper Facial Index (UFI)	67.75	62.87
Nasal Facial Index (NFI)	24.60	21.98
Cephalic Module (CM)	91.63	97.53
Length _Height Index (L- HI)	90.96	76.97
Breadth− Height Index (B- HI)	114.21	115.46
Mean - Height Index (MHI)	123.49	105.48

Table 4.11 show cephalic module and length-height index among Igede female and Idoma male ethnic group of Benue State, Nigeria.

VARIABLES (%)	IGEDE FEMALE	IDOMA MALE

Cephalic Index (CI)	79.43	79.60
Upper Facial Index (UFI)	63.93	62.87
Nasal Facial Index (NFI)	26.36	21.98
Cephalic Module (CM)	96.17	97.53
Length _Height Index (L- HI)	93.89	76.97
Breadth− Height Index (B- HI)	117.89	115.46
Mean -Height Index (MHI)	119.06	105.48

Table 4.11 show Pearson correlation matrix of cephalometric parameters among the Igede and Idoma ethnic groups of Benue State, Nigeria with results presented in a two-tailed correlation. The result from Igede tribe with one hundred and fifty eighth (158) subjects showed correlation between age and head

width (r = 0.096; p<0.01), head length and head width (r = 0.284; p<0.01), head length and bizygomatic distance (r = 0.097; p<0.01), head width and bizygomatic distance (r = 0.232; p<0.01), upper facial length, lower facial length, total facial length with bizygomatic distance (r = 0.130; p<0.01, r = 0.301; p<0.01, r = 0.207; p<0.01) while upper facial length with lower facial length and total facial length (r = 0.36; p<0.01, r =0.749, p<0.01) and lower facial length with total facial length (r = 0.527; p<0.01) which showed positive correlation.

Also from table 4.11, Idoma tribe with two hundred and sixty seven (267) participants with correlation between head width with age (r = 0.071; p<0.05), head length with head width (r = 0.382; p<0.05), head length and bizygomatic distance (r = 0.090; p<0.05), head width with bizygomatic distance (r = 0.202; p<0.05). Also, bizygomatic distance with upper facial length, lower facial length and total facial length (r = 0.134; p<0.05, r = 0.401; p<0.05, r = 0.307; p<0.05). However, upper facial length with lower facial length and total facial length (r = 0.37; p<0.05, r = 0.849; p<0.05) while the lower facial length with total facial length (r = 0.525; p<0.05) showed positive correlation.

Table 4 .12: correlation matrix of anthropometric parameters among Igede and Idoma ethnic groups of Benue State, Nigeria.

Ag	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***	.03
HL				0.13**	0.30***	0.21***	-0.03	.13
BZD					0.36***	0.75***	-0.09	0.08
UFL						0.53***	-0.08	-0.03
TFL							-0.07	0.03
NW								0.082
SH								

Results in Table 4.12 show linear regression of cephalic index with anthropometric parameters such as head length, head width, upper facial length, total facial length and nose width among students of Igede and Idoma ethnic groups of Benue State, Nigeria where standard error of estimate (SEE) of lower and higher values are

(0.003 and 0.009mm) respectively. Also, cephalometric variables among Idoma tribe in linear correlation show standard error of estimate between (0.002 and 0.009) respectively as shown in Table 4.12.

Table 4.13: Linear regression of cephalic index from anthropometric parameters among students of Igede and Idoma ethnic groups of Benue State, Nigeria.

Population	parameters	prediction equation for cephalic index	SEE	R	R^2	P

IGEDE (N=158)

CI &HL	0 .877 HL+80.02	0.004	0.131	0.017	0.046
CI & HW	2.087HW+260.6	0.009	0.366	0.134	0 .000
CI & BZD	0.161BZD+131.3	0.003	0.963	0.927	0.041
CI & UFL	0.252 UFL +131.3	0.004	0.165	0.027	0.013
CI & TFL	0.391TFL +189.3	0.005	0.285	0.081	0.000
CI & NW	0.355NW +101.9	0.042	0.285	0.081	0.000

IDOMA (N=267)

CI &HL	0 .867 HL+80.01	0.003	0.130	0.016	0.047
CI & HW	2.097HW+270.50.009	0.355	0.144	0 .000	
CI & BZD	0.261BZD+131.4	0.002	0.965	0.925	0.042
CI & UFL	0.352 UFL +132.3	0.004	0.160	0.025	0.014
CI & TFL	0.390TFL +180.3	0.004	0.385	0.071	0.000
CI & NW	0.345NW +100.7	0.041	0.385	0.082	0.000

Cephalic Index (CI), Head Length (HL), Head Width (HW), Bizygomatic Distance (BZD), Upper Facial Length (UFL), Total Facial Length (TFL) and Nose Width.

Head length(HL), Head width(HW), Bizygomatic distance(BZD), Upper facial length(UFL), Lower facial length(LFL), Nose width(NW) and Skull height(SH).

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

1.0 DISCUSSION

Results of the present study 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. The present cephalometric study among the Igede and Idoma ethnic groups of Benue State, Nigeria was compared with some results from craniometric studies. Although it appeared scanty scholarly knowledge on Nigerian cephalometrics, some anthropometric work like: 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 NorthEastern Nigerian population, Jackes et al. (1997) , studied the cephalofacial indices among young students of Western Europe, Oluwole et al. (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 and Efiks, Umar et al. (2011) studied the Comparison of Cephalometric indices between the Hausa and Yoruba ethnic groups of Nigeria and Taura et al. (2004), studied cephalometric indices in Kano State of Northern Nigeria, all these were used for comparison with the present study.

The findings from this study revealed that differences exist among the population of the two ethnicities but not statistically significant along anthropometric variables. This result agrees with reports that postulated the effect of ethnicity on cephalometric dimensions (Golalipour and Heydari, 2004; Bayat and Ghanbari, 2010). The findings from the study also revealed sexual dimorphiosm in cephalic inices, which was best pronounced in the mexocephalic form. This therefore agrees with other findings which revealed sexual dimorphism in head dimensions (Maina *et al*., 2011; Raji *et al*., 2010).

The similarities in head and face among the ethnic groups of Benue state as shown in the study could because the main factor that differ the groups is their ethnicity but they are subjected to same environmental, nutritional and geographical conditions. Looking at cephalic index and skull height in Nigeria head forms of Ogoni males and females in the south-eastern Nigeria are hyperbrachycephalic and mexocephalic with hyperprosopic face respectively (Oladipo *et al*, 2009). The Ibibio males and females of south-south Nigeria is mexocephalic (Oladipo *et al*., 2010) and that of Ogbia tribes of southern Nigeria is dolicocephalic (Eroje *et al*., 2010).

The head forms in the present study among Nigerians in the middle belt specifically Benue and Jos were mexocephalic which also agreed with work of Umar *et al*., (2006) in Hausa and Yoruba. The North-eastern Nigeria, the head and face regions of Kanuri and Baburi newborns are dolicocephaly and mexocephalic, respectively (Garba *et al*., 2008). In the North-eastern part of Nigeria, the rarest and dominant form of head and face were mexocephalic and hyperprosopic (Raji *et al*., 2010) which agreed with the present study. The present study has revealed that the rarest forms of head and face among Igede and Idoma ethnic groups of North- central part of Nigeria were mexocephalic and hyperprosopic.

Earlier report on head and face forms with cephalometric indices of the present study showed that Negroids, Melanesians and Caucasoids were hyperbrachycephalic and hyperprosopic (Sullivan, 1923). While other recent studies suggested that a part of China expressed mexocephalic and hyperprosopic (Pi *et al*., 2011); Yunnan Mongols are mexocephalic (Lian-Bin *et al*., 2011); Sri Lanka are mexocephalic (Hayperuma, 2011) and Kosovans are hyperprosopic and mexocephalic (Rexhepi and Vjollca, 2008). Therefore, comparison of mean cephalic indices in this study with other related reports in Bhils and Gujarat (table 3.2) revealed some variations between the populations. The mean cephalic indices of Igede males and females were relatively higher at significant level ($p<0.05$) than the Ijaw males (Oladipo and Olotu, 2006) while Idoma females in mean cephalic indice with Ijaw females were in closed similarity (Oladipo, 2006).

There were eight different cephalometric indices calculated namely cephalic index, nasal index, upper facial index, cephalic module, breadth- height index, height – breadth index, skull height and mean- height index which well represented the two ethnic groups in the study in the present study.

According to international standard of classification of head and face (able 3.0), Nigerians, Kosovans and Sri Lankans are mexocephalic. Again there are reported differences in nasal and facial lengths (table 4.4) with Sri Lankans. The reasons to difference in populations is being that bodily dimensions could be affected by environment, genetic/biological, social, geographical, ethnic and age factors (Kobyliansky, 1983; Kobyliansky and Livshits, 1985, Nagaoka *et al*., 2011; Okupe *et al*., 1984; Golalipour *et al.,* 2003; Rexhepi and Vjollea, 2008).

Also the similarities in head form and face of Nigerians with Sri Lanka could probably be because of similar study (Leary *et al*., 2006) and in similar geographical location between as in tropical zone while difference with Kosovinians was due to difference in location as in temperate region (Bharatti *et al*., 2001), confirming that head forms and face differs in tropical from temperate zones.

Mean height-height index and cephalic module are affected by genetic, nutritional, environment, ecological, biological, racial, gender, age factors (Buretic-Tomljanovic *et al*., 2007; Bharati *et al*., 2001; Kassai *et al*., 1993; Oladipo et al., 2006; Heidari *et al*., 2006; Golalipour and Heydari, 2004; Golalipour et al., 2003, 2005; Tuli *et al*., 1995; Rajlakshmi *et al*., 2001; Maina *et al*., 2011). These factors above could have been responsible for some anthropometric different in values as a result affected anatomical configurations around the face and head studied. Time has been also known to influence shape of the face and head forms (Nakashima 1986; Vojdani *et al*., 2009).

Having expressed dissimilarity in nasal and skull heights (table 4.4) in the present study with study on the morphological evaluation of head and face of Iranian children of aged 12-15 years, maybe attributed to the paedomorphic tendencies of humans not only females but males being less divergent in adults development, from their young age than in the case among others (Safikhani *et al*., 2007, Zahra *et al*., 2006 William *et al*., 1995 and Abbie *et al*., 1952). This study has therefore provided information in 17-40 years old Igede and Idoma ethnic groups of Benue State, North-central region of Nigeria that can be used in diagnosis and treatments in orthodontics (Grau et al., 2001), plastic and oral surgery (Williams *et al*., 1995), forensics for the reconstruction of craniofacial remnants (Hayperuma, 2011) and for the study of ethnicity and race in this region.

The mean bizygomatic distance obtained in the present study among the Igede and Idoma ethnic groups (66.90 $\pm$2.50) was lowered in value with the work of Golalipour *etal*., (2005), but increase in the mean bizygomatic distance among Southern Nigeria ethnic groups according to the work of Oladipo et al. (2009) and Garba et al. (2009). The mean-height index among Igede and Idoma was higher in the former than the later tribe (116.85 and 111.76), and which was lower than in the work of Umar et al. (2004), for Hausa ethnic group of Nigeria. The differences could possibly because of the age in the present study (17-40) years with compared literatures.

Pearson correlation matrix put the sample estimate of values of cephalometric parameters in 2tailed forms such as head length, head width, bizygomatic distance, nasal index, skull height and somatometric study of age. There was a positive correlation among Igede and Idoma ethnic groups between age with head width and head length. But this disagreed with Umar et al. (2004) in head length among Hausa and Ibo tribes of the Northern region, Nigeria. Oladipo et al; observed a correlations of age, head width, head length, upper facial length with bizygomatic distances in Ibibios and Efiks tribes.

There was a linear correlation and linear regression models in the anthropometric parameters amongst Igede and Idoma ethnic groups of Benue State, Nigeria. These formulae were calculated and only valid for the age of 17-40 years of the subjects among the two tribes. The present study put sample estimate between cephalic indices and cephalofacial variables such as head length, width, nose width, total facial length and bizygomatic distance. The present work agreed with the anthropometric study amongst the Ibibios and Efiks in Southern Nigeria as reported by Oladipo et al. (2009), though there appeared to be a relationship in cephalic indices with the tribes. The equation for estimating cephalic indices among the two tribes in the present study differed in the work of Umar et al. (2004) in cephalometric study among Hausa and Yoruba ethnic groups maybe probably because of the method used in the course of the study or different parametric views.

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 (Leary et al., 2006).

CONCLUSION

The study compared, revealed and established anthropometric relationship between Igede and Idoma ethnic groups of Benue State using anthropometric parameters such as head length, length, head width and skull height (75.mm, 55.0mm and 151mm). The study had also established a comparable relationship of cephalometric indices with other tribes in Nigeria that they both belonged to Negroids in head and face shapes (76.54 and 77.33). Sexual dimorphic features like length height indexes (90.42 and 77.82) between the two ethnic groups existed and cephalofacial characteristics by tribes using correlation and regression analysis expressed similarities (0.25 and 0.23).

It is therefore, concluded that these two Nigerian tribes (Igede and Idoma) belong to the Negroids skull (Bass, 1995). Future studies to using larger samples on anthropometric functions to tribal settings could be carried out as this study is of importance in forensic science and clinical anthropometry.

RECOMMENDATION

It is hence recommended that further studies be carried out using larger population to validate the level of cephalic indices as an indicator for anthropometric relationships amongst Igede and Idoma ethnic tribes of Benue States. Also, the used of aged 17-40 years in the present study be extended and other other forms of anthropometry like palmar, lips prints and foot indices of individual tribes for wider coverage in Nigeria.

REFERENCES

Abbie A.A. (1952). A new approach to the problem of human evolution. Trans. R. Socks. Aust., 75: 70-88.

Adams B.J and Byrd J.E. (2002).Interobserver variation of selected postcranial skeletal remains. J Forensic Sc. 47(6):1193-1202.

Abbie, A.A. (2009) .Closure of cranial articulation in the skull of Australian Aborigine, Anat. 86:1-12.

Al-Rewashdeh, Y.A.A and Al-Dmoor, M.H. (2010). Anthropometry and dietary assessment of males and females students at Mu'tal University. J. Applied Sci., 10:759-765

Alex, F.R., B.H. Steven and Timothy G.L.(1996). Human body composition.4th Edn., Human Kinetics Publishers, U.S.A, pp.: 167-172

Attallah N.L. and Marshal W.A. (2009). Estimation of chronological age from different body segments in boys and girls aged 4-19 years, using anthropometric and photogrammetric techniques. Med Sci Law: 147-155.

Basu, A. (1963). Anthropometry of the Kayasthas of Bengal. J. Anat. Soc. India., 3: 20-25.

Berry, A.C. and Berry R. J. (1976).Epigenetic variation in the human cranium. J. Anat., 101: 362 380

Bhargav, T. and Kher, G.A. (1960). An anthropometry study of central india, Bhil of Dhar district of Madhya Pradesh. J. Anat. Soc. India., 9: 14-19

Bhargav, T. and Kher, G.A. (196 1). A comparative anthropometric study of Bhils and Barelas of central India. J. Anat. Soc. India, 10: 26-23.

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

Buretic-Tomljanovic, A., Giacometti., J., Ostojic, S. and M. Kapovic, M. (2007). Sex specific differences of craniofacial traits in Croatia: The impact of environment in a small geographical area. Ann. Hum. Biol., 34: 296-314.

Bass, F. M. (1995).Opening and Closure of craniofacial articulations of Europian Origin'. Int. J. Basic Med. Sc. Pp. 67:129-421.

Barrette, R.L. and Mathog, R.H. (2009).Orbit Measurement in black and White population. Laryngoscope.109: 105.

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

Boaz, RL. (2003) Modification of the Trotter and Gleser formulae for stature estimation formulae. J Forensic Sc. 37(5):1230-1235.

Bennett, S.B., Patrick, R. And Sterk, R.M. (2004). South Central Niger-Congo: A reclassification studies in African Linquistics. J Cultural Sci. Pp. 241-273.

Coon, C. S. The races of Europe.2nd Edition. Macmillan, New York, (1939). p. 293.

Con, C. S. The mountain of Giants (1950). A racial and cultural study of the North Albanian Mountain Greg's, Cambridge, Massachusetts .p. 105.

De Onis, M. and Habicht, J.P. (1996).Anthropometric reference data for international use. Recommendations from a World Health Organization Expert Committee. Anat. J. Clin.Nutri., 64: 650-658.

Dhima, D. H. A. (1985). Anthropology participation in Tirana, Pp28-9, 106-12, 126-8.

Danborno, B. and Asala, S.A. (1997).Craniometric study and derived indices in Nigerian.Proc. West African J. Anat 5:20.

Delsol, M. (2005).Cephalic index in a group of Mapuche individuals in the IX Region of Chile'.*Int. J. Morphol.,25:*241-246.

Daniel, A. C. (2012). Racial Anthropology and Genetics of the Lebanese.*Phoenician International Research Centre (PIRC).*

Eroje, M. A. (2001).Cephalic index of Ogbia tribe of Bayelsa State'.*Int. J. Morphol., 28:*389- 392.

Eroje, M. A., Fawehinmi, H. B., Jaja, B. N. and Yaakor, L. (2010). Cephalic index of Ogbia tribe of Bayelsa State'. *Int. J. Morphol., 28:*389-392.

Eboh, L. O. and Boye, T. E. (2005). Investigation of normal and malnourished children (3-11) years in the Niger Delta region of Nigeria. Parck. J. Nutr., 4:418-422.

Fawehinmi, H..B., Osunwoke, E.A. Ligha, A.E and Okoh, P.D (2008). A comparative study on the cephalic indices of normal growing children and children with sickle cell anaemia in Port Harcourt. J. Expt. Clin. Anat., 7(1): 27-29.

Fawehinmi, H.B., Edibamode, E.I., Osunwoke, E.A., Hart, J. and Ligha, A.E. (2008). Anthropometric study of nasal index of Kalabari people of Rivers state. Sci. Afr., 7(2): 140-142.

Fawehinmi, H.B., Osunwoke, E.A., Ligha, A.E.and Okoh, P.D. (2008). A comparative study on the cephalic indices of normal growing children and children with sickle cell anaemia in Port Harcourt. J. Expt. Clin. Anat., 7(1): 27-29.

Garba, L. M., Mahdi, O.and Maina, M. B. (2009). Craniofacial forms among three dominant Ethnic groups of Gumbo state, Nigeria. *Int. J. Morphology.,* (1): 210.

Golalipour, M.J., Haidari, K., Jahanshahi, M. (2005). The variation of head and face shapes in females newborns in South-East of Caspian Sea (Iran- Gorgan). Eur. J. Anat., 9(2): 95-98.

Golalipour, M.J., Haidari, K., Jahanshahi, M. and Farahani, R.M. (2003). The shape of head and face of new born in south east of Caspian Sea (Iran-Gorgan). J. Anat., Sci.,India 52; 28-31.

Golalipour, M.J. and Heydari, R.M. (2004). Effect of ethnic factor on cranial capacity and brain weight of new born in northern Iran. Neuroembry. Aging, 3: 146-148.

Golalipour, M.J., Haidari, K., Jahanshahi, M. and Farahani, R. M. (2006). The variation of head shapes in 17-20 years old native for males in Gorgan North of Iran. Intl. J. Morphol. 24: 187-190.

Gohiya V. K., Sudha S. and Sarita G. (2010). Estimation of Cranial Capacity in 20–25 Year Old Population of Madhya Pradesh, a State of India.*Int. J. Morphol.,* 28(4):1211-

1214.

Gunter, H. F. K. (1927). The racial elements of European history. Methuen and Company, London.

Garba, S. H., Numan, A.I and Mishara, I.G. (2008). Craniofacial classifications of new borns in Maiduguri Metropolis, Nigeria. Int. J. Morph., 26: 407-410.

Garba, L. M., Mahdi, O. and Maina, M. B. (2009). Craniofacial forms among three dominant ethnic groups of Gombe state, Nigeria. *Int. J. Morphol.,* (1): 210.

Haberlant, A. and Lebzelter, V. Z. (1919).Physical anthropology of of Albaner. J. Anthropo., 45: 123-42,

Hrdlika.O.P. (1952).*Practical anthropometry*.4th edition. Philadelphia. The Wister Institute of Anatomy and Biology, pp. 87-89.

Handarai, F., Euvrard T., Durand-Dubief F., Pachai C., Cucherat M., Ramirez R. F., Bonmartin A., Guihard- Costa A.M., Tran Minh V.A., Vallee B. and Froment J.C. (2003). Correlation between cranial vault size and brain size over time: preliminary MRI evaluation. *J.Neuroradiology.* 32(2):131-7.

Holland, T. (2008).Estimation of adult height from fragmentary tibias. J Forensic Sci. 37:1223-1229.

Holland, F. Jr., Di Vella G. and Petrachi S. (2009). Determination of height in life using multiple regressions of skull parameters. Boll Soc Ital. Biol. 69:153-160.

Hassan, N. E., EL-Masry, S.A., Solomon, N.L. and EL-Batran, M.M. (2008). Different techniques for body composition assessment. Intl .J. Medical Sci., 8: 15-21.

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

Iscan, M.Y. (2010). Global forensic anthropology in the 21st century (Editorial). Forensic Sci Int.117:1-6.

Iscan, M.Y. (2011). Forensic anthropology of sex and body size (Editorial). Forensic Sci Int.112:1-7.

Iscan, M. Y. (2012). A comparison of techniques on the determination of race, sex and stature from the Terry and Harmann-Todd collections. In Gill GW, Rhine JS (Eds.). Skeletal Attribution of Race: Methods for Forensic Anthropology. Maxwell Museum of Anthropology, Pp. 73-81.

Jason, D. R., Taylor, K. (2010). Estimation of stature from the length of the cervical, thoracic and lumbar segments of the spine in American Whites and Blacks. J Forensic Sci. 40:59-62.

Kasai, K. L. C., Richard, T. and Brown, T. (1993). Comparative study of craniofacial morphology in Japanese and Australian Aboriginal population. Hum. Biol., 65: 821- 834.

Khandare, A. L., Siruguri, V., Rao, A., Venkaiah, K., Reddy, G. and Rao, G. S. (2008). Diet and nutritional status of children in four tribal blocks of thane district of Maharashtra,India (nutritional status of children). Pak. J. Nutr., 7: 174-178.

Kobyliansky, E. (1983). Changes in cephalic morhpology of Israelis to migration. J. Human, Evol. 12: 779 -786.

Kobyliansky, E. and Livshits, G. (1985). A morphological approach to the problem of similaritiesof Jewish and non-Jewish populations. Ann. Human Biol., 12: 203-212.

Kosa, F. (2000). Application and role of anthropological research in the practice of forensic medicine. Act Bio. Szeged. 44 (1-4):179-188.

Khammar, A.G. and Devershi, D.B. (2006). Comparison of Cranial Sex Determinationby Univariate and Multivariat Analysis.*J. Anat.Soc. India,* 55 (2).

Leary, S., Fall, G., Osmond, C., Lovel, G. and Campbell, D. (2006). Ceographical variation in neonatal phenotype. Act Obstetric Gynecol., 85: 1080-1089.

Lian-Bin, Z., L. Shun-Hua, D., Hui-Xin, Y., Hai-Ping, L., Xing-Hua, Z. (2011). A study of the physical characteristics of the Yunnan Mongol people. Act Anthropology. Sin.

Lobo, S. W., Chandrashekhar, T. S. and Kumar, S. (2005). Cephalic index of Garung community of Nepal: An anthropometric study. Kathmandu Univ. Med. J., 3: 263-265.

Maina, Y. C., Shapu, S.H., Garba, M., Muhammad, A., Garba, A.M., Yaro, A.U and Omoniyi, O.N. (2011).Assessments of Cranial Capacities in a North-Eastern Adult Nigerian Population.*Journal of Applied Sciences.*

Maina M. B., Mahdi, O. and Kalayi, G. G. (2012). Craniofacial forms among three dominant ethnic groups of Gombe state, Nigeria'. *Int. J. Morphol.,* (1): 210.

Majekodunmi, F. M. and Oluwole S. B. (2009). A comparative study of Cephalic indices in Lagos Western region of Nigeria *J. Arts Cult., 4 (1):* 12-65.

Montagu, A. A. (2006). Handbook of Anthropometry. Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd.

Martin, R. And Saller, K. (1957).Intl .J. of Med. Sci., Stugghtut.

Nagaoka, T., Kawakubo, K. and Hirata, K. (2011).Evidence for temporal and social differences in cranial dimensions in Edo-Period Japanese. Int. J. Osteoarcheol., 10: 1002/ao.1215.

Nakashima, T., (1986).Brachycephalization in the head form of school girls in North Kyushu.

J. UOEH., 8: 411-414.

Ozaslan, A., Iscan, M.Y, Ozaslan I., Tugcu H., Koc, S. (2003). Estimation of stature from body parts. Forensic: 132:40-45.

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

Olivier, G. (2009). Practical anthropology. Springfield, Illinois, USA: Charles C. Thomas Pub Ltd.

Oladipo, G. S., Olutu, E. J., Osah, T., Osunwoke, E. A., Hart, J. and Ordu, K. (2009). A comparative study of Cephalic indices of Nigerian Ibibios and Efiks. *J. Arts Cult. 4 (1):* 62-65.

Oluwole, O.S. and Osah, T. (2009). Morphological evaluation of head and face shapes in a South-Western Nigeria population.*J. Basic Med. Sci., 4*-41.

Oladipo, G. S., Olutu, E. J. (2009) anthropometric comparison of cephalic indices between Ijaw And Igbo tribes.Global J. Pure Apple. Sci., 12(1): 137-138.

Obikili, E. N. and Singh, S.P. (1992).Secular growth trend in the adult stature of Nigerians. Orient.Med.., 4: 44-47.

Porter, J., Parker, M.D. and Olson, K.L. (2003).Analysis of the African-American female nose. File//a/Plastic Reconstruct Surgery. 20: 1-2.

Panero, J. (1979). *Human dimension and inferior space*.First edition. Architectural Press Ltd, London, p 15.

Rabey, G. P. (1971). Craniofacial morphanalysis. Proc. R. Soc. Med., 64: 103-111.

Rexhepi. A. And Vjollca, M. (2008). Cephalofacial and morphological characteristics of Albania Kosova population. Intl .J. Morphol., 26: 935-940.

Rajlakshmi, C. H., Shyamo, S.M., Bidhumukhi, T.H. and Chandramani, S. L. (2000). Cephalic index of fetuses of Manipuri population: A baseline study. *J. Anat. Soc. India*, Pp 8- 10.

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

Radovic, Z., Muretic, Z., Nemirovskij, V. and Coklica, V. (2000). Craniofacial variations in a South Dalmatian population'.*Acta Stomatol.Croat. 34*: 399-403.

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

Rajlakshmi, C. H., Shyamo Singh, M., Bidhumkhi, T. H. and Chandramani, S. L. (2001).Cephalic index of foetuses of Manipuri population– A Baseline study'*. J. Anat. Soc. India, 50*(1):13-16.

Reichs, K. J., Bass, W. M. (1998). Forensic Osteology: Advances in the Identification. of Human Remains (2nd Edition). Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd.

Safikhani, Z., Afzali, N. and Bordbar, H. (2007). Determination of Anatomical type of head and face in children under 6 years in Ahwaz. *Iran-Act MediaIronical, 45*(1):43-45.

Stolovitsky, J. P. and Todd, N. W. (1990). Head, shape and abnormal appearance of tympanic membrane. Otolaryngol Head, Neck Surg., 102: 322-325.

Shah, G. V. and Jadhav, H.R. (2004).The study of cephalic index in students of Gujarat. B. J. Med. College, 153: 25-26.

Schoenbaum, M., Tulchinsky, T. H. and Abed, Y. (1995). Gender differences in nutritional status and feeding patterns among infants in the Gaza Strip. Am. J. Public Health, 85: 965 – 969.

Sullivan, L. R. (1923). The racial diversity of the Polynesian people. J. Polynesian Soc., 32: 79- 84.

Tuli, A., Choudhry, R.; Aggarwal, S. A. and Gary, H. E. (1995). Correlation between Craniofacial dimensions and foetal age.*J. Anat Soc India, 44* (1):1-12.

Tildesley, M. L. (1933). The Albanians of the north and south. Biometrika, 25: 21-51.

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

Umar, M. B.T., Singh, S. P. and Shugaba, A. I. (2006).Cephalometric indices among Nigerias*. J.Applied. Sci*., 6: 939-942.

Vojdani, Z., Bahmanpour, S., Momeni, S., Vasaghi, A. and Yazdizadeh, A. (2009). Cephalometry in 14-18 years old boys and girls of Shiraz, Iran high school. Intl. J. Morph., 27: 101-104.

Williams, P. M., Dyson, J. E., Dussak, L. H., Bannister, M., Berry, M. Collins, P. and Ferguson. M. W. J. (1995). Grays Anatomy. Intl., Skeletal system, 38th Edition, Williams, P. L., L. H. Bannister and M.M. Berry (Eds.). Churchill Livingston, London, pp.: 607-612.

Weinmann, P. S. (2005). Bones and Bones- Fundamental of Bones Biology 2nd edition 102-133, Kimpton; London.

Zahra, H., Hamid-Reza, M. S. and Mohammad-Hosein, N. M. (2006). Morphological evaluation of head and face in 18-25 years old woman in south-east of Iran. *J. of Med. Sci.,6:*400-404.

Zollikofer, C. P., Ponce De Leon, M.S. (2002). Visualization patterns of craniofacial shape and variation in Homo sapiens. Proc. R. Soc. Lond. Bio.Science 269 (207).

Zollikofer, C. P., PonceDeLeon, M. S. (2012). Estimation of stature from parts of craniofacial bones among Homo sapiens. Med. Sci., Law; 24:113-116.

APPENDIX

CEPHALOMETRIC INDICES CALCULATED FROM ANTHROPOMETRIC PARAMETERS AMONG THE IDOMA AND IGEDE ETHNIC GROUPS OF BENUE STATE, NIGERIA.

The anthropometric variables in the study population according to the proposal by Bass (1995) using head length, head width, upper facial length, lower facial length, total facial length, bizygomatic distance nose width and skull height to calculate indices as followed:

A: Cephalic index = $\frac{\text{Head breadth(width}}{Head\ length} \times 100$

B: Upper facial index = $\frac{upper\ facial\ length(NL)}{bizygomatic\ distance} \times 100$

C: Nasal facial index = $\frac{nasal\ breath}{nasal\ length} \times 100$

D: Cephalic module = $\frac{head\ length + head\ width + skull\ height}{3} \times 100$

E: Length-height index (cephalic) = $\frac{\text{skull Heigth} + \text{Total facial length}}{maximum\ head\ length} \times 100$

F: Breath – height (B-HI (Cephalic) = $\frac{skull\ Height}{maximum\ head\ width} \times 100$

G: Mean Height Index (MHI) $= \frac{Skull\ Height}{mean\ of\ head\ length + head\ width} \times 100$

H: Mean Basion Height Index $= \frac{skull\ height}{mean\ (HL+HW/2} \times 100$

IGEDE

1 Cephalic index $= \frac{56}{75} \times 100 = 75.54$

2 Upper facial index $= \frac{45.96}{66.92} \times 100 = 68.7$

3Nasal index = $\frac{9.90}{45.96} \times 100 = 21.70$

4 Cephalic module = $\frac{148.4+75+65}{3} = 140.2$

5 L-H index= $\frac{148.41+88.56}{169} \times 100 = 140.2$

IDOMA

1 Cephalic index $= \frac{59}{77.08} \times 100 = 76.54$

2 Upper facial index $= \frac{42.36}{66.95} \times 100 = 63.$

3Nasal index = $\frac{10.08}{42.36} \times 100 = 24.0$

4 Cephalic module = $\frac{77+68+152}{3} = 99.02$

5 L-H index= $\frac{152+85.20}{200} \times 100 = 121.0$

Igede Male Cephalometric Indices

1 cephalic index $= \frac{55}{68} \times 100 = 78.80$

2 Upper facial index $= \frac{46}{7567.10} \times 100 = 68.55$

3 Nasal facial index $= \frac{11.32}{46} \times 100 = 24.6$

4 Cephalic module $= \frac{151.9+68+55}{3} = 91.63$

IGEDE FEMALE CEPHALOMETRIC INDICES

1 cephalic index $=\frac{58.3}{73.4}\times 100 = 79.4$

2 Upper facial index $=\frac{42.9}{67.1}\times 100 = 63.9$

3 Nasal facial index $=\frac{11.31}{42.9}\times 100 = 26.36$

4 Cephalic module $= \frac{156+73.4+58.3}{3} = 96.2$

IDOMA MALE CEPHALOMETRIC INDICES

1 cephalic index $=\frac{62.2}{79.3}\times 100 = 78.00$

2 Upper facial index $=\frac{45.9}{66.8}\times 100 = 68.7$

3 Nasal facial index $=\frac{9.2}{45.9}\times 100 = 20.04$

4 Cephalic module $= \frac{151+79.2+62.2}{3} = 97.4$

IDOMA FEMALE CEPHALOMETRIC INDICES

1 cephalic index $=\frac{63.3}{79.30}\times 100 = 79.10$

2 Upper facial index $=\frac{42}{66.80}\times 100 = 62.8$

3 Nasal facial index $=\frac{9.34}{42}\times 100 = 22.2$

4 Cephalic module $= \frac{150+763.3+79.36}{3} = 97.2$

HEALTH RESEARCH ETHICS COMMITTEE

AHMADU BELLO UNIVERSITY TEACHING HOSPITAL

SHIKA - ZARIA, NIGERIA.

E-mail: abuth@yahoo.com *Website: www.abuth.org*

Our Ref: ABUTH/HREC/TRG /36

Date: 8th Oct, 2014

Your Ref:

ABUTH HREC FULL ETHICAL CLEARANCE CERTIFICATE

Comparison of Cephalometric Indices among the Igede and Idoma Ethnic Groups in Benue State Nigeria.

ABUTH Ethics Committee assigned number:	-	ABUTHZ/HREC/K27/2014
Name of the principal investigator:	-	Mr. Obaje Godwin Sunday
Address of the Principal Investigator:	-	Dept. of Human Anatomy Faculty of Medicine, ABU, Zaria.
Date of receipt of valid application:	-	12/3/2014
Date of meeting when final determination on ethical approval was made:	-	3rd & 4th Sept, 2014

This is to inform you that the research described in the submitted protocol, the consent forms and other participant information materials have been reviewed and ***given full approval by the Health Research Ethics Committee.***

Please note: this approval dates from **9th October, 2014– 9th October, 2015**

No participant recruitment into this research may be conducted outside these dates.

All informed consent forms in this study must carry the ABUTH HREC number assigned to this research and the duration of ABUTH HREC approval of the study.

This HREC expects that you submit your application as well as an annual report for ethical clearance renewal 3 months prior to expiration of study dates. This is to enable you obtain renewal of your approval and avoid interruption of your research.

If there is delay in starting the research please inform the ABUTH HREC so that starting dates can be adjusted accordingly.

No changes are permitted in the research without prior approval by ABUTH HREC, except in circumstances outlined in national code for Health Research Ethics: http://www.nhrec.net.

ABUTH HREC reserves the right to conduct compliance assessment visits to your research site without prior notification.

Prof. A. I. Mamman
Chairman, ABUTH HREC

QUESTIONNIARE

BIO-DATA:

SEX------------- AGE--------------- DOB------------------TRIBE------------------- LGA--------------------------------------

ETHNIC BACKGROUND:

FATHER'S TRIBE......................... GRD FATHER'S TRIBE-------------------------- MOTHER'S MOTHER --------------

GRD FATHER'S TRIBE------------------------

RELIGION: ISLAM......................CHRISTIAN---------------------------OTHERS-----------------------

MEASUREMENT:

HEAD LENGTH------------------

HEAD WIDTH--------------------

BIZYGOMATIC DISTANCE---------------------------

UPPER FACIAL LENGTH--------------------- LOWER FACIAL

LENGTH ----------------- TOTAL FACIAL LENGTH ----------------

---

NOSE WIDTH -------------------

SKULL HEIGHT ....

INFORMED CONSENT/GUARDIAN CONSENT FORM

I have been asked to participate in a medical research conducted by Obaje Godwin Sunday, a postgraduate student at the Department of Human Anatomy, Faculty of Medicine, Ahmadu Bello University Zaria. This research entitled **“comparative study of cephalometric indices indices among Igede and Idoma ethnic groups of Benue State, Nigeria”.**

The research project will provide useful information as to whether any relationship exists in head and face of the tribes.

There is no potential risk, infections or discomfort in the procedure and all the survey data will be kept confidential. I understand that participation in this research is voluntary and refusal to this will no not warrant any penalty or loss of benefits to which anyone is otherwise entitled. Furthermore, I may stop participating at any time I choose.

I certify that I have read all of the above, asked questions and received answers concerning areas I do not understand, and have received satisfactory answers to these questions.

I willingly give my consent for participation in this research study. **(A copy of this consent form will be given to the person signing as the subject or as the subject’s authorized representative.)**

Participant’s name **Participant’s signature** **Date**

Parents or Guardian’s name **Parent/guardian signature** **Date**