UNIVERSITY OF PORT HARCOURT

“DIFFERENT TAILORS FOR THE SAME PEOPLE; THE SAME SURGEON FOR DIFFERENT PEOPLE”

AN INAUGURAL LECTURE

BY

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DEDICATION:

This work is dedicated to my late father High Chief (Engr.) Hussein O. Fawehinmi and my beloved mother Dame Henrietta Fawehinmi, and to my precious wife, Mrs. Hadeezat Omotayo Fawehinmi and my children (Haleem, Mayowa, Hakeem (Jnr.), Ayoola and Adeola) for their love, support and understanding through these many yearsof effort and for their help in the selection of the topic of this lecture.

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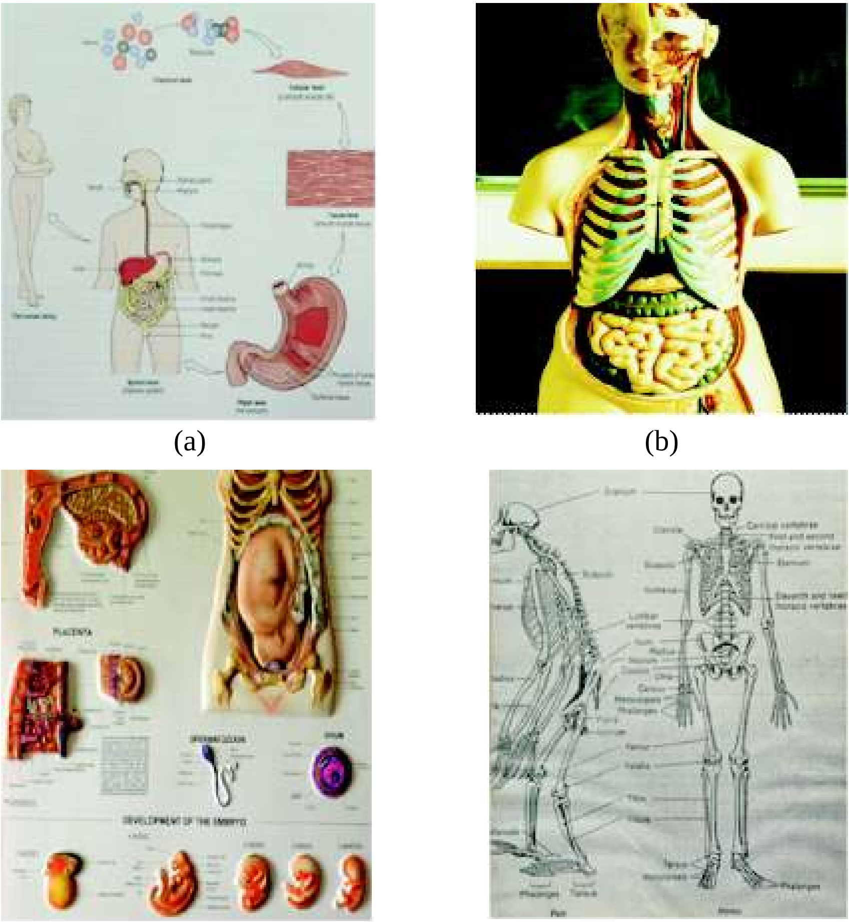
Finally and most importantly, I want to thank the almighty God for his boundless love and infinite mercies!

LECTURE OUTLINE:

1. Introduction
2. Anthropogenesis and Biology of Human Variation
3. Clinical Anthropometry and Biometry
4. My Foray into Anthropology: Koko Toxic Waste Dump
5. Anthropometric Changes in Sickle Cell Anaemia
6. Comparative Anthropometry of Specific Ethnic Populations
7. Proportionality and Photogrammetry
8. Forensic Anthropometry
9. Negroid Gross Anatomical Modelling: The UniPort Experience
10. Recommendations and Conclusion

INTRODUCTION:

Mr. Vice Chancellor Sir, distinguished ladies and gentlemen, the number that fell on me in the series of inaugural lectures of this University is easy to remember as its three digits are consistent: 111th. But we in Anatomy are used to memorizing the very complex details of the finest structures in the human body.



(a) (b) (c) (d)

Fig. 1: (a) Levels of Structural Complexity (b) Regional Anatomy (Ellis, 2006)(c) Stages of Human Embryonic Development and (d) Comparative Anatomy (Boaz and Almquist, 1991)

The science of **Human Anatomy** studies the form and structure of the human body from the sub – microscopic to the macroscopic level, and the regularities of its development (Prives *et al.*, 1985). It is conventionally divided into Gross or Topographical (Surface) Anatomy, Histology (Microscopic Anatomy), Embryology (Developmental Anatomy), Neuroanatomy and Comparative Anatomy (Standring *et al.,* 2005) (Fig. 1). Anatomy can be studied by dissection of the body regions (Regional Anatomy), by examining the structures that form the various systems (Systemic Anatomy) or by radiographs, endoscopic and other imaging techniques in the living human (Radiological Anatomy). It is on the basis of Surface Anatomy that I tell my students "when examining a patient, what you are looking at is their Anatomy". Clinical Anatomy is the

application of the knowledge gained from Anatomy in the practice of Medicine and Surgery, Sports (Functional Anatomy and Kinesiology) as well as Morbid Anatomy.

Human Anatomy is the language of Physical Anthropology which has been a useful tool in the study of the various branches of Anatomy, particularly Comparative Anatomy. This is the aspect we shall be looking at most today.

Physical Anthropology involves the study of the physical variation of man and relies on external measurements of the human body particularly the skeleton, for description, analysis and classification of fossils and human populations. Anthropometry is a branch of Physical Anthropology that deals with the systematized measurements of the external dimensions of the human body and skeleton. Anthropometry is often viewed as the basic tool of Physical Anthropology, but it has found wide application in Forensic and Medical Sciences especially Surgery. No two individuals are exactly alike in all their measurable traits, and these undergo changes to varying degrees from birth to death, and in health and disease. Since skeletal development is influenced by a number of factors producing differences in skeletal proportions between people from different geographical areas, it is desirable to have some means of giving quantitative expression to variations which such traits exhibit (Krishan, 2013).

Humans evolved relatively recently, but with complex culture and technology have been able to spread throughout the World and occupy a wide range of environment. This resulted in subspecies that are highly variable in physical appearance, despite the similar genetic identity. Therefore, in the phenotypic sense of race and ethnicity, we are 'different people'. But race in humans is of no biological significance, as phenotypic variation is a superficial response to climate and there are no significant differences between us 'below the skin'. Therefore from the biological angle of speciation we are 'the same people'.

Mr. Vice Chancellor Sir, distinguished ladies and gentlemen, although Human Anatomy describes the structure of the body as observed in most people and has traditional value in Surgery, there exists a wide range of ethnic and racial variation in the physical appearance and body proportions of different populations (Moore and Agur, 2002).However, all human beings occupying the globe belong to the same species, *Homo sapiens* and are biologically the same people.

Photoplate 1: **Measurement of Femur Length**

Like the tailor, many anthropometric measurements are taken with flexible calibrated tapes using specific anatomical landmarks such as bony prominences, the nipples and umbilicus. Because of these physical variations, tailors are trained locally to master the body dimensions of their specific ethnic populations. On the other hand, surgical training is universal, with foreign values used as the standard most times. So there are “different tailors for the same people, but the same surgeon for different people”. This informed the choice of my topic and has stimulated academic discourse and research effort in Port Harcourt.

ANTHROPOGENESIS AND BIOLOGY OF HUMAN VARIATION:

Mr. Vice Chancellor, because of where I am going, it is important for me to explain why though we look different, we are the same people.

Anthropogenesis is the formation and development of the human being in relation to the development of the environment. Each part of the human body has a long history of evolutionary change behind it, making it necessary for human anatomy and its practical applications in medicine, to appreciate the evolution and development of structures as well as their present functional configurations. Comparative anatomical, paleontological, embryological and biochemical data provide compelling evidence of human connections with and evolutionary differentiation within the animal kingdom, with adaptations inherited from their chordate and vertebrate ancestors (Boaz and Almquist, 1991).The human species shares homologous structures with lower forms of animals; therefore anthropogenesis utilizes the findings of Comparative Anatomy and Evolutionary Morphology for its development. Comparative Anatomy therefore studies not only the structure of the modern human organism, but investigates the human genus from its evolutionary perspective (Prives, *et al.,* 1985).

Population Genetics and Speciation: Population genetics studies the allelic frequencies in a population. It examines the amount of genetic variation within populations and the processes that influence this variation. A population is defined as a group of interbreeding individuals that exist together at the same time. Genetic variation refers to the degree of difference found among individuals e.g. height and skin colour (Cabe, 2011). Populations are able to maintain a reservoir of variability so that the genetic constitution of the population can change. If recessive alleles were continually tending to disappear, the population would soon become homozygous and would provide no variability and opportunity for evolutionary change. On the other hand genes which have no present selective value will nonetheless be retained. Evolution involves changes in the gene pool, and this should not occur under the Hardy- Weinberg law. The population model in classifying the patterns of human biological diversity is based on the idea that the significant evolutionary groups consist of people whose ancestors have exclusively mated more or less, with each other for thousands of years. Individuals in such distinct breeding populations would be expected to share many genetically inherited anatomical and physiological traits and to have a similar appearance (Cabe, 2011).

The fundamental classificatory unit in human taxonomy is the **species,** and includes populations which are capable of interbreeding with each other and producing fully fertile offspring. Species are actual or potential inter-breeding natural populations which do not interbreed with other such populations even when there is opportunity to do so. If on rare occasions breeding between species takes place the offspring produced are not as fertile as either parents. E.g. a mule is the hybrid offspring of the horse and donkey, whose inability to reproduce points to the fact that the parent stocks are distinct species. The *Homo sapiens* species is blessed with great variety and diversity as a result of its global distribution. This global distribution caused the different populations of humanity to be geographically separated and therefore reproductively isolated (McCulloch, 2006). **Speciation** is the formation of many species from few. We believe that our present species has diverged from common ancestors and initially from a single first form of life. Over a period of time, the accumulation of changes in the gene pool of a population must reach a point where we may say that a new species has been formed.

The first requirement for speciation is reduced selection pressure and the intraspecific variability afforded by the process of sexual reproduction. Even with increased variability in a species, there is a continuous intergrading of traits from one extreme to the other. Some form of geographical isolation of the various subpopulations seems essential for natural selection or genetic drift to produce a definite shift away from the gene frequencies of the parental type. Geographical isolation can either be due to physical barriers such as seas or mountains, or zones where there is a change in environment, such as a transition from arable land to desert. Sustained reproductive isolation and exposure to differing environmental conditions enables the process of divergent evolution, causing the isolated populations to establish their own distinct genetic traits as the human **races**. This explains why the different races are in different continents on the globe. If successful interbreeding occurs between susbspecies, their differences would gradually disappear, and a single population with continuously intergrading traits will be formed. On the other hand, if two reunited sub-populations do not interbreed successfully then speciation would have taken place. Therefore, all the living races of today belong to the same species *Homo sapiens sapiens,* since they can interbreed. In this context, they are the same people.

The term race is the generic name commonly used to refer to breeding population of humans that share a common biological ancestry and possessing a set of unique genetically transmitted anatomical, physiological and behavioural traits which distinguish them from other populations. They are usually capable of reproduction with each other without significant diminishment of the racially – distinctive traits of either parent. A race which had been totally isolated from contact with other groups either by geographical or even by social barriers, would certainly constitute a **subspecies**. The races of mankind have evolved divergently over thousands of years leading to the varieties of humans seen today (McCulloch, 2006). Population Genetics arose because of the need to reconcile Mendelism with Darwinism as seen in the somewhat nepotistic view when a Nigerian man meets his kinsman, bringing Population Genetics and Comparative Anatomy together by saying in vernacular: "My brother, na your eye be this?"Evidence from genetics, the fossil record and archaeology has since proved Darwin correct.

The Evolution of the Human Subspecies:

The collective unit of evolution is the population and it is on the population that all the forces of natural selection operate. Technological progress has however, made the world a global village with attendant increase in interbreeding.'Cultural evolution took about one second of the geological clock, one minute of the biological clock and one hour in hominid evolution'. There are 3 rival theories of modern hominid evolution (Harrison *et al.*, 1990):

(a) The **Theory of Separate but Parallel Evolution from Pre-sapiens Ancestor** proposes that the major stocks of mankind evolved separately under substantial degree of genetic isolation from originally separate Homo erectus ancestors to become the separate races of the modern world. This theory has been criticized on the grounds that it underestimates the likelihood of Pleistocene migration.

(b) The theory that: **All Living Races are Local Varieties of a Single *Homo sapiens* Genetic Stock** which colonized the entire world. The problem with this theory is that, since the earliest known *Homo sapiens* fossil remains are only 40,000 years old, the time that elapsed is insufficient for the distinctive features which distinguishes the races to have evolved.

(c) The theory of **Separate Evolution from Distinct Neanderthal Populations** with local differences in selection pressure leading to substantial modification and intermittent migration and admixture. This is the generally accepted view today.

Another theory that was put forward on the Evolution of the Living Races is the **Out – of – Africa Theory:** This theory proposes that the human line began with the African fossil species called *Australopithecus* which later gave rise to *Homo erectus* and then *Homo sapiens*. *Homo sapiens* were anatomically human and were in Africa less than 200,000 years ago. The first split in the human line to the Middle East took place about 100,000 years ago and then the second split of the group that left Africa took place about 40,000 years ago. They replaced the Neanderthal and *Homo erectus* groups they met there by competition and this led to the ancestors of today's 'Whites' and 'Orientals'. This is said to explain why 'Whites' fall in between 'Orientals' and 'Blacks' on the life history variables. They spread out across the globe, and their body morphology and behaviour had to change to adapt to the new regions and climates and thereby developing the racial traits we see today (Rushton, 2000).

Mr. Vice Chancellor, the Out - of – Africa Theory has been largely discarded by me as it is shrouded in racist tendencies, and could not explain the origin of the Neanderthaloid populations the broke away groups met outside Africa. Above all, it is ungodly. Since all animals including hominids normally over reproduce, there would have been slow but persistent competition for survival throughout hominid history. The more evolved stock with better local survival value would spread out over the habitable areas of the globe. In all cases of admixture following migration, the resultant hybrid population would in the course of several generations undergo rigorous natural selection in favour of those qualities inherent in either ancestral line which had local survival value.

Vice Chancellor Sir, I do not want to be ungodly like some Darwinian Biologists along Gower Street, and since Nigerians are the most devout in the world I am spurred to give the biblical account of racial origin as it is in Genesis, the one most of us are familiar with, so that this lecture would be accepted by even men of little faith:

"All people now alive descended from the three sons of Noah and their wives, and ultimately from the first humans, Adam and Eve who were directly created by God. The sons of Noah were alive around 4,500 years ago, and all human races are derived from them. After the flood, all animals including man left Noah's ark two by two and stayed in one area until God confused their languages at the Tower of Babel. This induced the human population to separate and dispersed across the world as the Shemites, Hamites and Japhetic people. Babel resulted in the isolation of distinct groups, each containing a fraction of the total gene pool. Natural selection acted on these, fixing particular characteristics that were regionally favourable and producing the 'different people' as we see them today" (Creation Wiki).

The Categorization of the Living Races: After tracing the general course of hominid evolution into recent prehistoric times, the physical anthropologist is now faced with relating the living hominid population of the world to those of prehistory. Ultimately it is the living parts of the body that are important from an evolutionary point of view, rather than fossilized bone tissue. Traditional methods of physical anthropology relied heavily on the external measurement and description of the human body, which can be applied in the analysis of fossil remains as well as in the categorization of human populations.

Studies of the development of the human cranium from the period of *Homo erectus* can provide valuable information for the comparison of modern living races, and between the various fossils that reveal the course of human evolution. Measurement of the cubic capacity of the brain case is known as **Cranial Capacity.** Large headed populations are described as macrocephalic, while small headed people are microcephalic. When compared to the overall body size, cranial capacity provides a general indication of the growth of the brain at different levels of hominid evolution (Harrison *et al.*, 1990).

Skin colour is one of the most obvious racial differences and one of considerable sociological importance. Heavy pigmentation has survival value in tropical environments while in more temperate northerly climates the rays of the sun are heavily filtered by the greater depth of atmosphere, thus pigmentation has a negative survival value, and impedes the synthesis of vitamin D. It is expected therefore, that after a few hundred generations of selection a darker – skinned subspecies which had migrated into northerly latitude will tend to lose its protective pigmentation as a result of the process of natural selection.

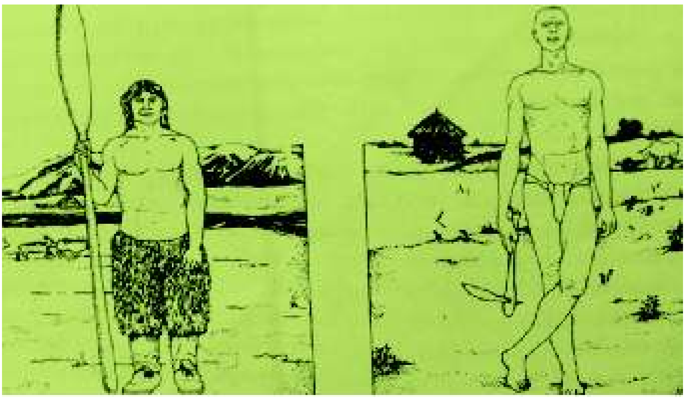


Fig. 2: Differences in Body Size and Shape (Source: McElroy and Townsend, 2004).

The **Relative Length of the Limbs** also tends to vary between different subspecies. Subspecies which are localized in open savannah country commonly have longer limbs than those that evolved over long periods of time in a forest environment. Long arms commonly in sub-Saharan Africa are described as macrobrachion when they reveal an average index of 47 and above, those whose indices fall between 45 and 46.9 metribrachion and below 44.9 and who are relatively short-armed, brachybrachion. The African's long limb causes a high surface area - to - volume ratio which helps to dissipate heat, while the arctic hunter's bulky body conserves heat (Fig. 2). These reflect genetic adaptation to climate (Allen and Bergmann's Rule).

Pelvimetric parameters vary substantially and have been used widely in Obstetrics and Evolutionary Biology of Bipedalism. The Pelvic Index shows considerable racial and sexual dimorphism. Pelvic shape can be android in males, gynaecoid in females or platypeloid. This can be of anthropological, forensic and clinical value. There are racial differences in the mineralization of bones, Negro skeletal material are denser and stronger than that of Caucasoid, while most Asiatic tend to have lighter, less compact skeletons than Caucasoid (Harrison *et al.,* 1990).

The science of **Dermatoglyphics** has revealed substantial racial differences in the inheritance of finger print – patterns. Pygmies have a high percentage of arches, whereas Caucasoid finger tips usually have loop patterns while Mongolian populations have a higher percentage of whorls than the Negroes or Caucasoid people (Kimball, 1983).

Local Physiological Adaptations of obvious adaptive value may also be observed. Eskimos have a better blood circulation in the extremity of their limbs than do members of races which evolved in tropical climates, thus enabling them to resist frostbite better, while Peruvian Indians who have been domiciled at high altitudes in the Andes have experienced selective adaptations to their circulatory systems. Their chests, lungs and hearts are proportionately larger, and their bodies contain around seven quarts of blood in contrast to the five quarts common to most races adapted to low attitudes. Furthermore, their blood contains a greater concentration of red blood corpuscles.

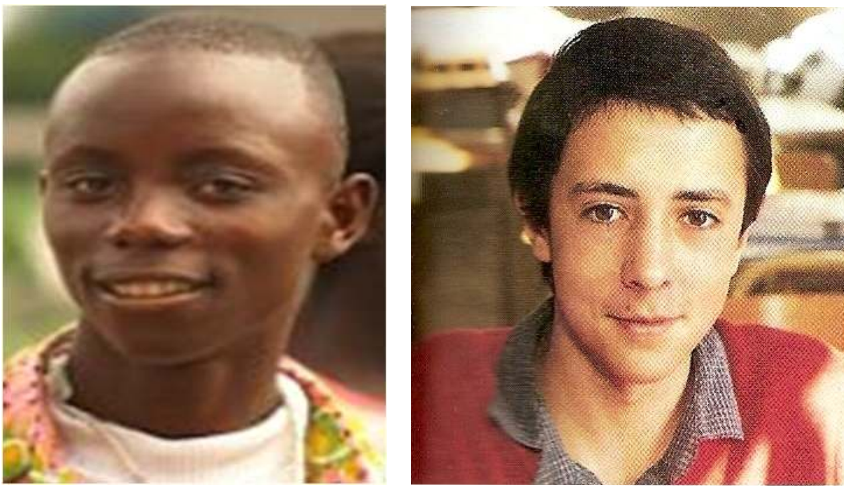
There is a pattern of human geographical variations that tends to occur gradually and evenly over extended distances. There are places where sharp changes occur, particularly where there are barriers to human movement such as oceans, deserts and high mountains. Many physical anthropological features show abrupt changes most marked on continental boundaries. These gradients of phenotypic character variation are termed **phenoclines** and are as a result of evolutionary selective forces which have shaped the morphological and functional adaptation in humans through time.

Caucasoid race **Negroid race** **Mongoloid race** **Australoid race**

Fig. 3: Geographical Distribution of the Living Races after the Pleistocene (Source: Coon, 1962)

Africa: From a human biological point of view, the main continental unit here is that part of Africa south of the Sahara desert, which would have acted as a major isolating barrier in the west and centre. In the East, the Nile valley and the proximity to Arabia have allowed relatively easy exchange of peoples and therefore the categorization of people in the Horn of Africa is difficult (Fig. 3).The **Negroid** of sub-Saharan Africa have heavily pigmented dark - brown to black skin, hair and eyes, helical and spiral head hair, thick everted lips, broad low - bridge noses, some degree of prognathism, lightly developed calf muscle, relatively long forearm and leg, narrower pelvis, and are generally dolicocephalic (narrow) in head shape (Photoplate 2). Stature is variable, but sub – Saharan Africans tend to have a high surface area – to - volume ratio either by being small, like the pygmies or by being linear in physique as in the Nilotic people of southern Sudan. Negroids possess an unusually high incidence of the sickle cell trait, which has survival value in the malarial forests of west and central Africa. They are sub – divided into the Congoids and the Capoids.

Europe: In racial geography perspective Europe is part of the Asiatic land mass, much of North Africa, the Near and middle East including India and the western part of the Soviet Union. Its people called **Caucasoid** are characterized by low skin pigmentation giving them a fair-skin and have lighter shades of hair and eyes. This is particularly true in Northern Europe where melanin in the skin is very low and there are high frequencies of blue eyes and blonde. Hair form is commonly wavy or straight and is oval in cross-section. Their lips tend to be narrow and their noses are usually narrow and high-bridged (aquiline). Physique is variable, but weight and stature tend to be greater in the North than in the South. Dolicocephaly (narrow head) is the prevailing skull shape (Photoplate 2).



Photoplate 2:Negroid and Caucasoid Features (Source: Haviland, 1999)

Asia: Most of the people of the continent can be considered as falling into two district groups: those in the west and India, and those in the centre and east. The former share many of the features of Caucasoid but tend to be more pigmented especially in India. The geographical pattern in Asia is dominated by the effects of the barriers of the Himalayas and other central mountain chains. To the north and east of these are the Mongoloids, while to the south and west are European affinities (Fig. 3).

Mongoloids of eastern Asia are usually brachycephalic (broad- headed) and relatively short in stature. They have a yellowish hue to their skin, with black straight hairs and eyes. Body and facial hairs are sparse. They have low noses, prominent cheekbones and eyes marked by the epicanthic fold. The Japanese resemble the northern Chinese, except that they tend to be more dolicocephalic (Photoplate 3).

Often likened to the Negroes of Africa are the **Negritoes** of Southeast Asia particularly Indonesia, the Phillippines, Malaysia and the Andaman Islands. Negritoes are dark-skinned and moderately prognathous, with tight curly or woolly hair, so that their general appearance resembles that of pygmy Negroes in a superficial way, but their serogenetics is firmly not African. Their closet affinities are probably with Melanesians.

Photoplate 3: Mongoloid and Australoid (Source: Evolution of Racial characteristics, Internetlooks.com)

Australia and the Pacific: Although hominids have been in Africa and Eurasia most of their evolutionary history, they entered and colonized Australasia comparatively recently as anatomically modern man about 60,000 years ago. The Australian aborigines or **Australoids** have moderately pigmented brown skin, hair and eyes, marked supra-orbital bony thickening or brow ridges, receding foreheads and jaws which are markedly prognathous with large teeth. They are platyrrhine (broad noses) with depressed nasal root. Their skull is generally dolicocephalic, with wavy head hair and plenty facial and body hair, linear physique and slightly muscled arms and legs (Photoplate 3).

Generally, 5% to 15% of genetic variation occurs between groups living on different continents with the majority of the variation occurring within such groups. Although the genetic variation between human groups is relatively small, they can however be used to categorize humans into geographical subpopulations. The distribution of many physical traits is similar to the distribution of genetic variation within and between human populations e.g. 90% of variation in head shapes occurs within the population, while 10% separates them (Photoplate 4 (b). An exception to this common distribution of physical traits within and between populations is skin colour. About 10% of variation in skin colour occurs within populations and 90% occurs between (Olson, 2005).


Photoplate 4: Mongoloid and Negroid Parents with their Children (a) and (b) Clockwise from top left: Afro-Caribbean, Caucasian, East Asian, West Asian(Source: Haviland, 1999 and CreationWiki)

Certain evolutionary trends were adaptations to the general environment e.g. increase in body size with decreasing ambient temperature, decreasing skin darkness with increasing latitude, while others were driven by local conditions such as by prevalent infectious diseases. These attributes are believed to have been under strong selection pressure. The differences in physical appearance have contributed to the development of the belief that significant inherited differences distinguish humans along the lines of race and ethnicity (Olson, 2005).

Going by this Biblical explanation of the evolution of the living races, Adam and Eve would have looked like this Khoisan boy of southern Africa, who shares 'grand parentage' from the four major stocks of people today. “Let's glory in our differences, safe in the knowledge that we are also all profoundly one people” (Boeree, 2007).

Photoplate 5: A Khoisan Boy (Adopted from: Boeree, 2007)

CLINICAL ANTHROPOMETRY AND BIOMETRY:

Biomedical Anthropology has emerged as a sub-discipline of Anthropology whose main interests are in the teaching and conduct of research in Human Growth and Development, Nutrition and Physique, Human Evolution, Comparative Anatomy, Paleopathology, Population Genetics and Adaptation, Reproduction, Serology, Behavioural Ecology, Epidemiology and Mental Health (Angrosino, 1999). **Biological Anthropology** studies the anatomical, physiological and genetic characteristics of pre-historic and modern human populations. Its studies of the evolutionary development and variation of human species by a comparative analysis of both fossil and living primates is called **Paleoanthropology.**

Physical Anthropology developed in the 19th century and with the development of anthropogenetic mechanisms such as the Darwinian Theory, became part of the wider concept of Biological Anthropology. Apart from the anthropometric parameters, other physical anthropological features that are used to characterize populations include nasal shape, depression, tip and septum; lip shape and thickness; skin, hair and eye colour; hair shape and texture, height, weight and dermatoglyphics.

Digital and palmer dermatoglyphic patterns have been shown to be useful genetic markers for certain diseases. Oladipo *et al.,*(2007, 2009) studied the dermatoglyphic patterns associated with idiopathic dilated cardiomyopathy (IDC) and malignant mammary neoplasm (MMN) in Nigerian patients and concluded that IDC and MMN present characteristic finger print features which can be used as non-invasive anatomical marker for early diagnosis of these diseases (Fig. 3).

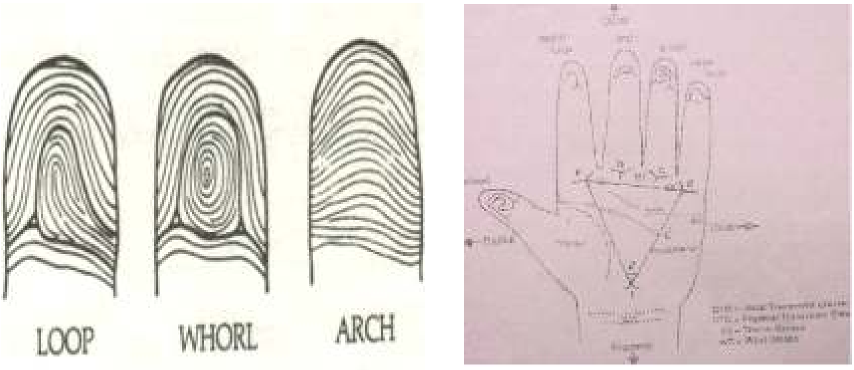


Fig. 4: (a) Three Basic Fingerprint Patterns (Coon, 1962) (b) Digital Patterns and Triradii, ATD and DAT Angles (Oladipo *et al.*, 2009)

Simian and Sydney palmar creases correlate positively with several human chromosomal abnormalities. Oyinbo and Fawehinmi (2009) investigated the prevalence of Simian and Sydney creases in apparently normal Ijaws of Nigeria and found Simian crease in 4.14% and Sydney crease in 0.19% of them. There was no sexual predilection, but the values were lower than that of the Oriental and higher than that for Caucasians. This goes further to confirm the variation of physical anthropological traits amongst populations.

Anthropometry refers to the taking of measurements of the human body according to standardized units, landmarks and instruments. According to Ales Hrdlicka (1920), anthropometric measurements are usually taken for medical, surgical and dental research and procedures, characterization of dysmorphic syndromes and their correction, forensic identification, industrial design, artistic expression of the human body and for military purposes (Hallbeck *et al.,* 1989). Anthropometry studies physical variations in man through measurable parameters used to characterize race and tribes. Its study of polygenic traits such as craniofacial features and body habit us provide data which can be analyzed to determine the relative influence of the gene pool and environment on the phenotypic expression of these traits in populations. Anthropometry is a highly objective and reliable means of quantitatively expressing the form of the human body.

Anthropometry has become a tool for industrial and engineering designers who are, for instance, responsible for determining the amount of leg room needed in an airplane or the size of student desks in a classroom. Standard ways and methods of taking measurements on the skeleton and on the living have been documented. Anthropometry can be subdivided into Somatometry, which includes Cephalometry and Osteometry, which includes Craniometry and Pelvimetry.

(a) Somatometry: is the measurement of bony and soft tissues of the living body or cadaver. It is a major tool in the study of human morphological variation with a comparative focus. Somatometry uses measurements of different body segments in a given set of individuals to estimate age, sex, ethnic group and stature, taking socio - economic status into consideration. Some of its dimensions include height, weight, surface area, skin-fold thickness, bone density, femur– stature ratio, relative limb length and mid - arm, thigh, chest, abdominal and head circumference.

(b) Osteometry: is a technique that involves the measurement of the skeleton including the skull **(Craniometry)** and the pelvis **(Pelvimetry).** It has been successfully used in the estimation of stature, age, sex and race in Forensic Sciences.

1. Craniofacial Anthropometry:

Mr. Vice Chancellor Sir, a good part of what we shall be listening to today will dwell on Craniofacial Anthropometry, so let me take some time to emphasize it to avoid repeating myself.

Craniofacial Anthropometry involves the precise and systematic measurements of bones of the human skull. It is an integral part of Craniofacial Surgery and Syndromology. It has found wide application in forensics, facial reconstruction and Paleoanthropology and up till recently Phylogeography. The vault of the skull is made up of a number of flat bones with 2 layers of compact bone separated by a layer of cancellous bone called the diploe. The cranial part has the calvaria as its upper part and the base as it's the lower part. The bones of the face are suspended below the front of the cranium and comprise the bones of the upper jaw or maxilla, the bones around the orbit and nasal cavities and the mandible.

During infancy, there is a rapid growth in the face and jaws which coincides with the eruption of deciduous teeth and the growth of the paranasal sinuses. This is more pronounced at about 7 years when the change in shape of the skull is further affected by the growth of the maxilla and mandible (Moore and Persaud, 1999). Bone tissue undergoes continuous formation and remodeling with peak velocity at puberty. This chronological process is particularly evident in the changing height and structure of the face (Taister *et al.*, 2000). Anthropometric measurements of vertical and horizontal dimensions are carried out on soft tissues of the face and cranium, on plaster cast, old photographs, on radiographs, by image analysis, radio- stereometrics, computerized axial tomography (CT) scanning, magnetic resonance imaging (MRI), laser scans and holograms (Fig. 5).

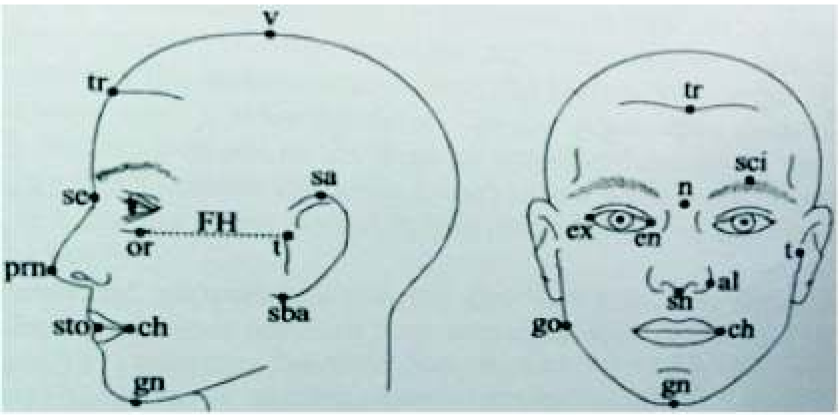
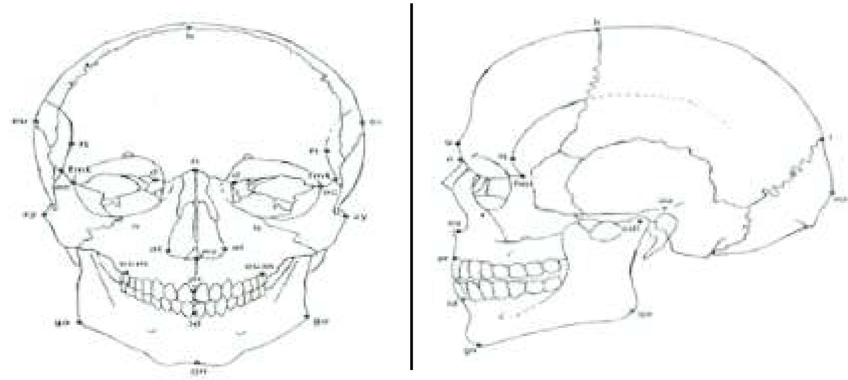
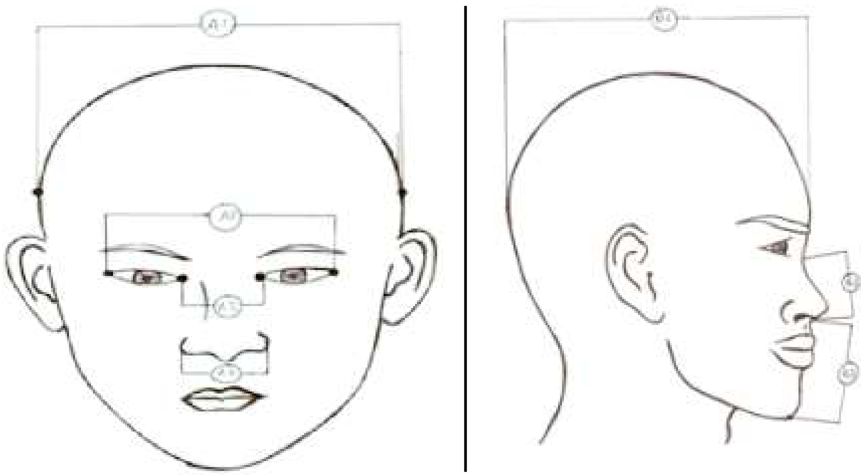


Fig. 5: Anthropometric Landmarks on the Face (Source: DeCarlo)



b: bregma eu: euryon n: nasion zy: zygion ec: ectochantion al: ala g: glabella op: opisthocranion i: inionns: nasospinale gn: gonion gn: gnathion

Fig. 6: Anterior and Lateral View of the Skull Showing Craniometric Measurable Points (Adopted from http://www.geocities.com/pbateman852/ni.htm/2005)



A1- Head Breadth A2- Lateral Canthal A3- Medial Canthal A4- Maximum Nose Breadth B1- Maximum Head Length B3- Subnasale to Gnathion B2- Nasion-Nasospinale

Anatomical features are said to be dysmorphic if their measurements fall outside the normal range for its population (Fig. 8).

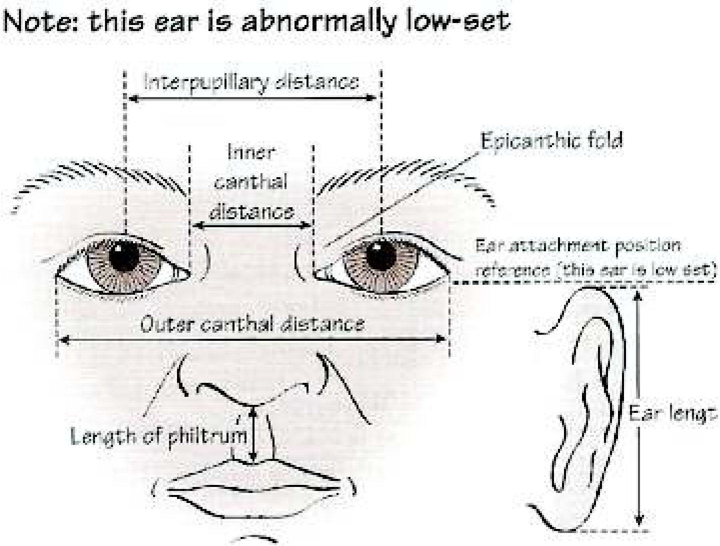


Fig. 8:Some Facial Features Utilized in Dysmorphology (Pritchard and Korf, 2003)

Cephalic Index (CI): Is the ratio of the maximum head breadth to the maximum head length and multiplying the resultant fraction by 100 (Kelly *et al.*, 1999). The CI is determined using a Spreading Caliper which can be a modified in form of Martin caliper to measure the head breadth from euryon (eu) to euryon (eu) and head length from glabella (g) to opistocranion (op) (Hrdlicka's method) (Photoplate 6). CI is useful in determining racial variations and gender differences especially in individuals of unknown identity (Shah *et al.*, 2004). It is used to determine the size and shape of the head, to categorize human populations and estimate the age of fetuses for legal and obstetrical reasons.

Table 1: Classification of Head Shape by Cephalic Index (Zetaman, 2001):

Head Shape	Cephalic Index	Ethnic Population
Hyperdolicocephalic	Less than 70.0	Some Caucasian Populations
Dolicocephalic	70.0 to 74.9	Some African Negroes
Mesocephalic	75.0 to 79.9	Japanese, Australians
Brachycephalic	80.0 to 84.9	Armenians, Alpines of Bavaria
Hyperbrachycephalic	85.0 to 89.9	
Ultrabrachycephalic	More than 90.0	

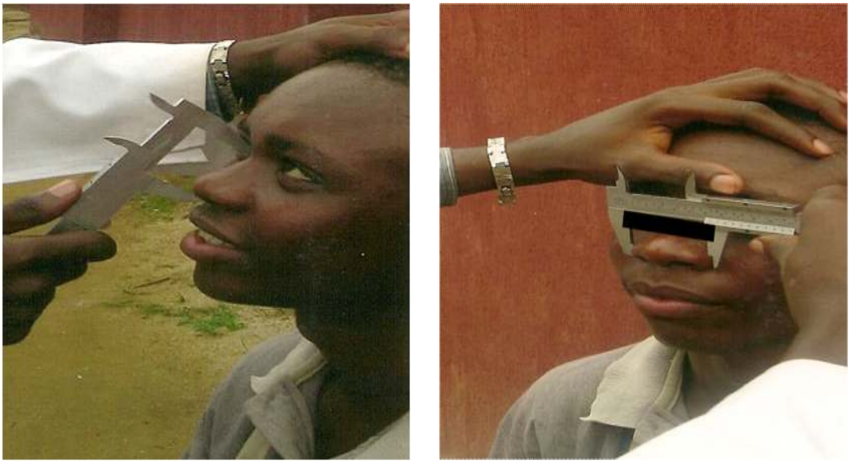
Photoplate 6: Measurement of Maximum Head Length and Breadth (Fawehinmi *et al.*, 2008)

Some investigations have been carried out to determine head shape using CI for various ages in Nigeria and other countries (Fawehinmi and Eroje, 2009, Oladipo and Olotu, 2006; Del Sol, 2005,Shah and Jadhav 2004, Golalipour *et al.*, 2003). CI has been shown to be affected by certain chronic diseases such assickle cell anaemia (Ejele and Fawehinmi, 2004; Fawehinmi *et al.*, 2008)

Nasal Index (NI): Is the ratio of the width to the height of the nose multiplied by 100. The NI (A4/B2×100) is measured with a digital caliper used to improvise the Salib Cephalometer (Fig. 7). Nasal length is taken as the distance from nasion to the nasospinale while the nasal breadth is the distance from ala (al) to ala (al) (Photoplate 7) (Romo and Abraham, 2003). Details of nose form are of great value in determining racial origin (Grant, 2004). Attempt has been made to classify the nose in relation to character or traits (Eden, 1989) and into various categories (Williams *et al.*, 1995; Porter and Olson, 2003):

Table 2: Classification of Types of Nose by Nasal Index

Types of Nose	Nasal Index	Description	Ethnic Populations
Leptorrhine	69.90 or Less	Long and Narrow	Western Europeans
Mesorrhine	70 to 84.90	Medium Noses	Aryans, Obolo
Platyrrhine	85 or More	Broad Noses	Sub –Saharan Africans, Australian Aborigines



Photoplate 7: Measurement of Nasal Length and Breadth

The importance of nasal morphometric parameters have been recognized in nasal surgical management (Akpa *et al.,* 2003; Romo and Abraham, 2003; Macho, 1986). Nasal index is very useful in Anthropology in distinguishing racial and ethnic groups (Romo and Abraham, 2003; Franciscus 1991), is sexually dimorphic (Zang *et al.,* 1990) and in Forensic Science (Xu *et al.,* 2001).

Canthal Index (CNI): The Medial Canthal Distance (MCD) or Interocular Breath is the distance from the medial canthus of the right eye to the medial canthus of the left eye. The Lateral Canthal Distance (LCD) or Biectocanthion Distance is the distance between the right lateral commissure to the left lateral commissure (Photoplate 8). CNI=A3/A2 ×100 (Fig. 7). A Salib Cephalometer which can be improvised with a digital caliper is used to measure the distances in order to determine the Canthal Index (MCD/LCD×100) (Laestadeus *et al.,* 1969). It is important to observe standard hygienic procedure and taking necessary precaution to the eye when using this method.

CNI is important for successful reconstruction of the canthal area in maxillofacial surgery and in the determination of hypo- and **hypertelorism** (Pritchard and Korf, 2003). **Hypertelorism** is abnormal widely spaced orbit of the eyes and features in nearly 400 syndromes, while **hypotelorism** is abnormal closely spaced orbits and features in some 40 syndromes. **Telecanthus** refers to an increased distance between the two inner canthi with normal interocular distance and is found in about 90 syndromes.

Photplate 8: Measurement of Outer and Inner Canthal Distances

Inner and outer canthal dimensions are important in the evaluation of several syndromic and craniofacial abnormalities and in the surgical treatment of post-traumatic telecanthus (Farkas *et al.,* 2003). Its significance is increasingly better appreciated.

Several studies have shown that mean values of the canthal dimensions are age, race and gender sensitive (Fawehinmi *et al.,* 2008, Ozturk *et al.,* 2006) and that canthal values tend to be more constant in the mid to late twenties (Pryor, 1973). Normative canthal values that serve as guide in medical interventions are available for Mexicans and Japanese (Laestadeus *et al.,* 1969), North American Whites (Pyror, 1973), North American Blacks (Juberg *et al.,* 1975).

Subnasale – to – Gnathion Distance: Represents the lower third of the face and is important in determining the facial profile. Measurement of the Subnasale-to-Gnathion Distance (B3) is carried out using a caliper to improvise a Salib Cephalometer. The subnasale (sn) is located at the junction of the columella and the upper lip while the gnathion (gn) is the most inferior midline point on the mandible (Photoplate 9), (Delic *et al.,* 2002).

Photoplate 9: Measurement of Subnasale – Gnathion Distance

Straight flat faces are orthognathic and faces are prognathic when projecting especially in the alveolar area. They are the most often selected points in the determination of vertical dimension of occlusion and are usually determined in the position maximum intercuspation of teeth (Delic *et al.*, 2000).

2. Whole Body Anthropometry:

At the whole – body level, anthropometric measurements have been adopted as methods in clinical and public health works, as they are applicable to large samples and can provide national estimates and data for the analysis of secular changes (Brown and Scurr, 2012). Secular trend is an important anthropological concept observed in the increase in height following accelerated growth rate and an earlier attainment of sexual maturity. It is seen in populations of countries that have had or are experiencing increased prosperity, which is associated with higher caloric intake and improved health care delivery. This phenomenon was thought to have levelled off in most developed countries and is attributed to developmental plasticity, an inherent ability of an organism to respond to changing environmental conditions either in positive or negative ways (Meier, EOLSS).

Clinical Anthropometry has been applied to the study of human growth (auxology) and development in longitudinal and cross – sectional surveys, nutritional assessment, maternal and child health (Meier, EOLSS). Childhood and adolescence represent a rapid growth period in life and studies abound on the parameters of measuring growth and its relationship with well being (Ogunranti and Didia, 1986,Tanner, 1981, Tanner and Whitehouse, 1976, Morley, 1977, Whitter, 1961). Mid arm circumference (MAC), weight and height are important anthropometric parameters utilized clinically for the indication of nutritional status, for alimentation and physical growth in paediatric practice. The measurement of height and weight are essential in calculating Body Mass Index for nutritional assessment and in computing surface area in posology.

The measurement of height is not always practicable in bedridden or frail patients who cannot stand. However, most long bones in the body have easily identifiable surface landmarks that can be used in taking measurements in compromised postures. The ulna length provides an accurate and reliable means of estimating the height of an individual. The ulna length has been proven to be superior to arm span and hand length in predicting height (Ilayperuma *et al.,* 2010).

Ilayperuma *et al.,* (2010) investigated the relationship and proposed a gender and age specific linear regression models between the ulna length and height of adult Sri Lankans. Findings from the study indicated sexual dimorphism in the ulna length and a positive correlation between height and ulna length, indicating a strong relationship between the two parameters in both sexes. The result reinforced that of previous studies on sexual dimorphism and ethnic variation in height and length of long bones. Regression equations for estimation of stature for Sri Lankans were formulated using the ulna length.

The trunks and limbs exhibit consistent ratios among themselves and relative to total body height. These ratios are age, sex, ethnicity and race dependent. Although many formulae for stature estimation from long bones have been proposed, there is concern regarding the accuracy of the use of population specific formulae on other ethnic groups (Ilayperuma *et al.,* 2010). For example, Negros have comparatively longer upper and lower limbs and therefore formulae designed to estimate stature for a Negroid population may not apply to other populations in Europe. Therefore, ethnic group, age and sex specific stature estimation formulae are desirable. A study by Feldesman and Fountain (1996) on the 3 quasigeographic races confirmed that 'Black' femur - stature ratio is significantly different from those of 'Whites' and 'Asians'. Their group coherence was poor. Race – specific ratios slightly outperform the generic ratio when race is certain. However, they recommended the continued use of the generic femur - stature ratio to estimate stature in pre – historic populations, when race attribution is uncertain.

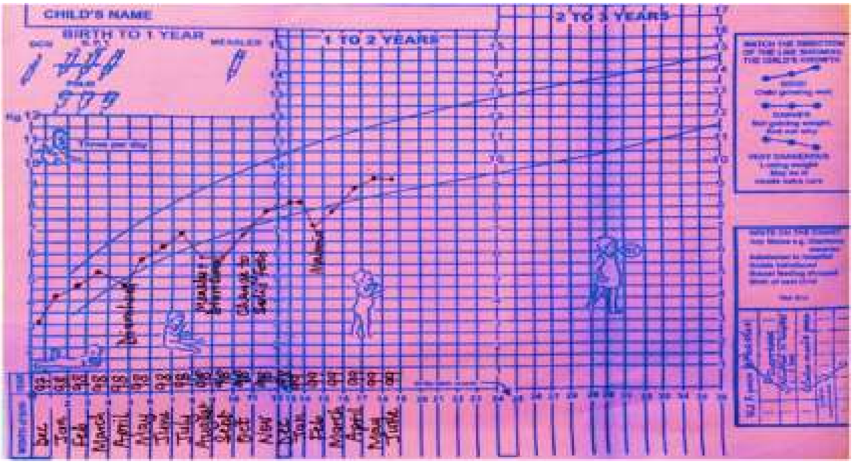


Fig. 9: Growth Monitoring (Road - to - Health) Chart

Measurement of the percentile values of a child's weight for age over time forms the basis of the well known **Road – to – Health Chart** in Child Health Clinics (Fig. 9). Nte *et al.,* (1997) used selected anthropometric indices to study the possible sources of variation and their relationship to neonatal metabolic problems and found significant differences in values obtained for birth weight, mid upper arm circumference, chest circumference and the Ponderal Index. Studies have shown that a variety of factors such as age, race, gender, nutritional status and environmental factors affect human growth and development. There is therefore, the need to develop gender and ethnic group specific nomograms for growth monitoring for different populations (Fawehinmi *et al.,* 2014, Ilayperuma *et al.,* 2010).

Mr. Vice Chancellor Sir, as a way forward, it is important I make the following generalizations concerning our studies: In all our studies involving ethnic groups, we ascertained that recruited subjects had dual parentage and four grand parents from the same ethnic group. Random sampling technique was used in the recruitment of subjects. All measurements followed internationally acceptable standards in Anthropometry to the nearest 0.01 cm, with the subjects or body segment in the Anatomical Position. Appropriate statistical methods were used to analyse the data and determine minimum sample size. Particular measurements were usually taken by one observer to prevent inter – observer error and parallax was avoided in the visual read out of the values. Exclusion criteria included craniofacial syndromes, congenital and acquired deformities, trauma and other conditions that may affect the outcome of the measurements. Necessary precautionary measures were taken, and for all our studies involving human subjects especially patients, ethical clearance was sought and obtained from the Ethics Committee of the College of Health Sciences (CHS) and the University of Port Harcourt Teaching Hospital (UPTH). Informed consent was obtained from all subjects, or their parents or school authority for those below 18 years of age.

MY FORAY INTO ANTHROPOLOGY - KOKO TOXIC WASTE DUMP:

Effects on Growth Monitoring Parameters: It is based on the principle of using growth monitoring indices to determine well being in children that led to my foray into Anthropology in 1989, when I undertook a field trip to Koko in the then Bendel State with my project supervisor, Dr. J. O. Ogunranti. Koko is an Itsekiri town in Delta State founded in 1873 by Nanna Olumo, a son of the Royal Family of the Olu of Warri. River Benin passes in front of it, and behind it flows into Ologbo Creek at Ajoki. This continues as a tributary of River Ethiope (Fig. 10). The estimated population of Koko then was between 15,000 – 30,000 inhabitants. Koko forms part of the Niger Delta that opens into the Bight of Benin. This makes it easy for shipment to gain access to the sleepy one jetty Port of Koko, through the Bulge of Africa. Koko was used as a farm settlement and as a coast for trade of palm produce with Europeans.

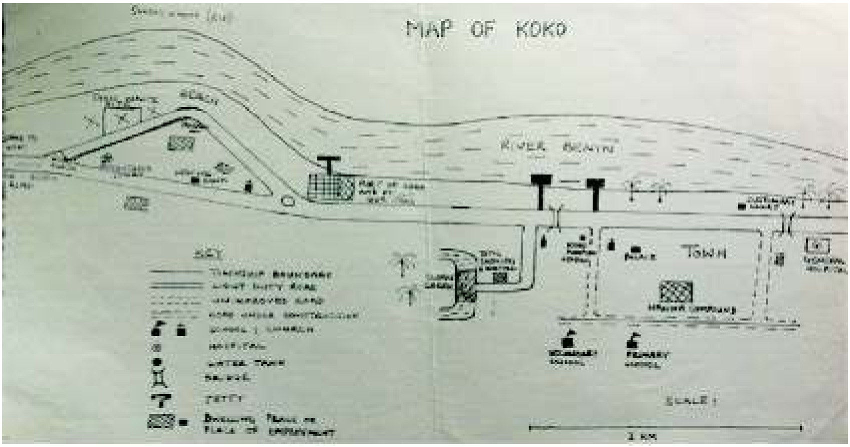


Fig. 10: Map of Koko (Fawehinmi and Ogunranti, 1989)

In November 1987, 15,000 drums of industrial toxic waste made of chemicals and highly radioactive pollutants were dumped in Koko from an Italian transformer and electrical motor repair company. A Japanese team of experts said the waste included radioactive materials, chemicals such as organic vapours, paint pigment residue, corrosive reagents, acids, poisons, polychlorinated biphenyls (PCB) and mercury (Photoplate 10). After discovery of the dump site, the epicentre was cleaned up and the dump site restored.

Photoplate 10: Toxic Waste Dump Site in Koko (Courtesy: Fawehinmi *et al.*, 1989)

It was expected that some of the pollutants at the dump site will sink into the deep soil layer, thus rendering underground water and water washed into River Benin unsafe for plants and animals. These substances can get transmitted to the inhabitants of Koko through a predictable food chain and by direct exposure to irradiation (Fig. 11). This will pose a catastrophic hazard that may be slight, difficult to detect or affect only a small proportion of those exposed. There was the incidence of infants poisoned by PCB pumped into the river, and accumulated through their mothers' milk in Japan. This led to "Coca-Cola" babies (Yamashita *et al.*,). Environmental hazard of radioactive materials have been seen in Hiroshima and Nagasaki (1945) and Chernobyl some years ago.

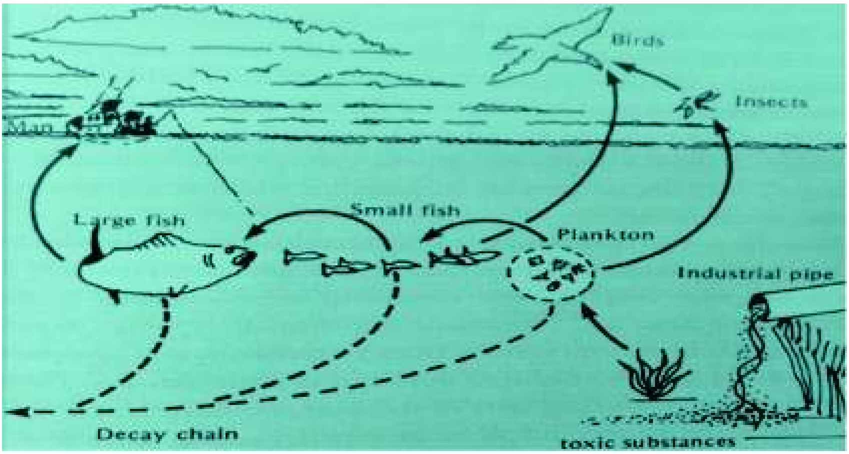


Fig. 11: Path of Toxic Substances in Aquatic Food Chain and Food Web (Source: McElroy and Townsend, 2004)

The biological effects of irradiation can be genetic or somatic. Genetic effects include gene mutations leading to increased frequency of congenital malformations, spontaneous abortions and associated intra-uterine growth retardation. The effects of chemicals and irradiation on the growing foetus are more severe in the early stages of pregnancy and abortions and foetal abnormalities may occur. Possible somatic effects include stunting of growth. There were reports of increased incidence of abortions and other effects of the radioactive waste amongst inhabitants of the beach who were close to the epicentre at that time. There was also report of enterotoxic diarrhoeal disease in Koko. Whether these were due to the radioactive waste and chemical toxins could not be ascertained at that time.

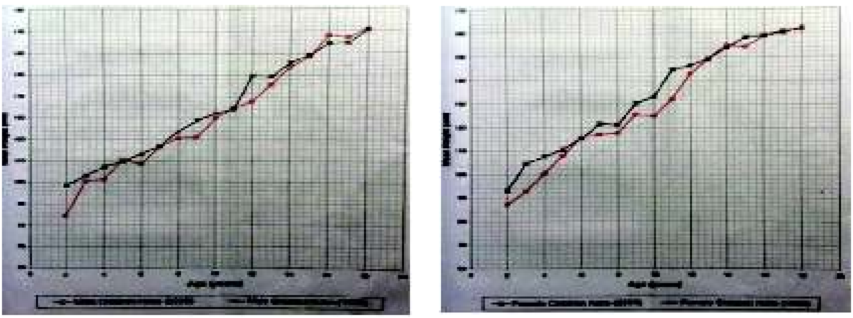
The problems of congenital and somatic diseases caused by toxic waste pollution including growth retardation are quite serious, and we monitored all Koko inhabitants in a longitudinal survey of the area to avert repetitions of the Minamata tragedy. Haematological studies and chemical tests to find out the effects of these pollutants on the haemopoietic system and blood components were also reported (Amanna and Oladimeji, 1989).

In March 1989, we collated the birth weight of babies born in the maternity ward of the Koko General Hospital between 1982 and 1989. The MAC, weight and height of 471 children from schools in Koko aged 2 – 8 years and 40 workers from the toxic waste site were measured in a cross-sectional survey. The techniques of measurement followed those described by Tanner and Whitehouse (1976) and used by David Morley in the research village of Imesi-Ile and Jellife in 1960 (Photoplate 11).

Photoplate 11: Measurement of Mid Arm Circumference (a) and Height (b) of Children in Koko (Fawehinmi *et al.*, 2005)

All data were analyzed statistically and separately for the different ages, and the mean values with SEM used in the computation of a nomogram, which will form the baseline template for the diagnosis of abnormal growth. Any child at Koko who falls below the third centile for his age would be treated as being at high risk of environmental toxicity. The values were compared with growth curve patterns of contemporary growing children of the same socioeconomic class status from the Eastern and Niger Delta areas of Nigeria (Ogunranti and Didia, 1986). This showed that 50th centile values for Koko children were generally lower.

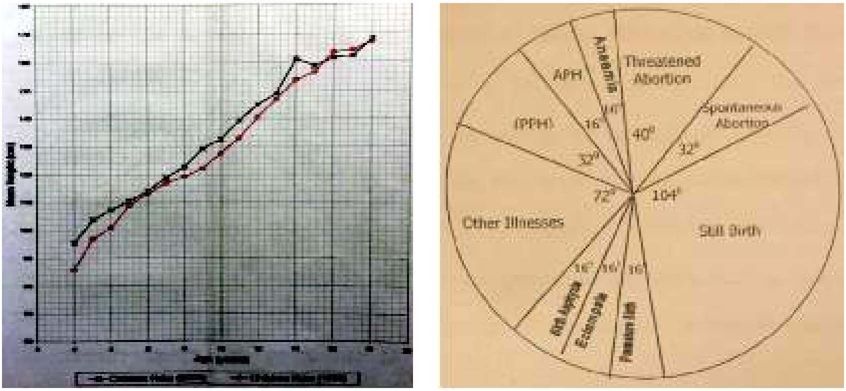
Whether the initial indication of growth retardation in Koko was due to the effects of the toxic waste pollutants could not be ascertained as at then. Although there was no confirmation from the preliminary study of genetic effects of the toxic waste, our constant monitoring of the area in the following years allows the need to rule out such effects. Our preliminary cross sectional study could not indicate if growth had been retarded in Koko in the past few years. Since growth is a gradual process, this could only be adduced from a long -term anthropometric study of the area, taking secular changes into consideration.



(a) (b)

Fig. 12: Comparison of Mean Height of Koko Male (a) and Female (b) Children in 1989 and 2005

We went back to Koko 8 years and 15 years later, and what we met was an irony. We found a general increase in the growth monitoring parameters in Koko children, which was not statistically significant (Fig. 12 and 13 (a). We attributed this to secular trend following the recent creation of Warri – North Local Government Area of Delta State with Koko as headquarters. It is also possible that the difference is due to growth retardation from acute toxicity that followed the immediate post – dump period.



(a) (b)

Fig. 13: Comparison of Mean Height of Koko Children in 1989 and 2005 (a) and (b)Pie Chart of Incidence of Obstetric Cases in Koko General HospitalFrom 1997 to 2005 (Fawehinmi *et al.,* 2005)

Mr. Vice Chancellor what this means is that a contemporary tailor in Koko will have to increase his linear dimensions for Koko children for the different ages.

We also looked at the delivery records from the maternity ward of the Koko General Hospital, from 1989 to 2005 and reported significant increases in the incidence of obstetric complications especially still birth and other teratological findings (Fig. 13 (b). There was no evidence linking these findings to chronic exposure to low dose irradiation and chemical pollutants, as the increased incidence could have been due to better reporting and increased utilization of the hospital services following the secular changes in Koko.

ANTHROPOMETRIC CHANGES IN SICKLE CELL ANAEMIA

Sickle Cell Anaemia (SCA) is the most commonly inherited blood disorder, peculiar to the black race of Africa and Africans in the Diaspora but also affects persons of Hispanic, Mediterranean, Asian, Caribbean and Middle Eastern origin. It is an autosomal recessive disease resulting from a point mutation that produces an abnormal gene that codes for the synthesis of beta globin chain of the Haemoglobin (Hb) molecule in which the amino acid valine which is neutrally charged is substituted at position 6 for glutamic acid which is negatively charged (Okoro and Okafor, 1997).

Only homozygous (HbSS) inheritance or the compound heterozygosity (HbSC) or a beta thalassemia is associated with severe manifestations while heterozygous (HbAS) individuals or carriers of the trait show no apparent ill effects except under stress, but show an increased resistance to malignant tertian malaria. This selective advantage results in a higher occurrence in regions of malarial endemicity due to the relative protection and reduced susceptibility afforded by a process called **balanced polymorphism.** The World Health Organization (WHO) estimates that each year, more than 250,000 babies are born worldwide with SCA. The incidence of the trait in different tribes may vary from 12% to 40%, but in Nigeria the homozygous state is found in about 3% while the trait is about 25% of the population (Adekile, 1999).

The **patho-physiological consequences** of sickling are twofold:

a) Occlusion in the micro-vascular circulation causing ischaemia or infarction of tissues leading to pain, damage and even death of the deprived organ. This is the dominant cause of morbidity and mortality.
b) Haemolysis of sickled cells due to membrane damage and fragility of deformed cells. The sickled red blood cells have a weaker structure and shorter life span of 10 to 20days.

Clinical Manifestations begin in early childhood. Episodic exacerbation of pain, haemolytic anaemia and/or jaundice is called **sickle cell crises.** Mortality is highest during the first five years of life due to infection (Chanarin *et al.,* 1983).

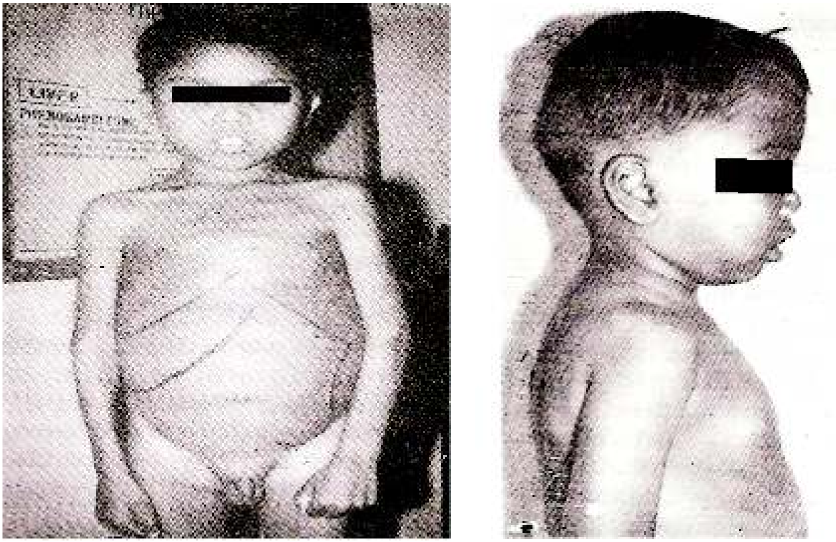
Management of SCA is supportive by intensive follow up and prevention of infections and complications. At each clinic visit baseline steady state physical and laboratory parameters are recorded. Specific treatment will be determined by age and overall health of the child, medical history and extent of the disease and include: Analgesics, intravenous fluids, blood transfusion. Special surgical care will include hydration, acid-base balance and oxygenation. Current trends to achieve a cure include:

1. Pharmacologic attempts to counteract the sickling phenomenon using anti-sicklingagents such as hydroxyurea, **Ciklavit-** a nutritional supplement (Ekeke *et al.,* 2001), induction of hyponatraemia with vasopressin, extracts of Nigerian local chewing stick *Fagara zanthoxyloides* (Adekile, 1999).

2. Bone Marrow Replacement Therapy by Transplantation.
3. Transgenic means at molecular embryological level using Gene Cloning Technologies.
4. Pleuripotent Stem Cell Transplant.

Prevention of SCA is mainly by pre-marital genetic counselling and prenatal diagnosis for possible termination of pregnancy, while it's **Prognosis is determined by the f**requency and severity of crises and nature of specific complications. The present mortality rate is in excess of 10% in early childhood. Recent medical advances that allow early detection and comprehensive medical care have led to an increase in life expectancy well into adulthood i.e. over 50 years. SCA has been associated with a lot of morbidity and mortality, with an attendant emotional, physical and financial burden on the affected population. The degree of its burden probably has been on the decline as a result of a combination of better education, counselling and medicare (Ogamdi and Akpa, 2004).

Characteristic morphological features include general underweight, bossing of the skull and maxilla, linear stature with comparatively narrow shoulder and hips, disproportionately long and spindly extremities and sickle cell gnathopathy. Bone marrow hyperplasia is as a result of chronic haemolytic anaemia which causes bone distortion and lead to bossing of the forehead, tower skull and sickle cell gnathopathy. Sometimes there is delayed puberty with atrophic external genitalia and scanty pubic and facial hairs. Protrusion of the abdomen due to associated hepatosplenomegaly, barrel-shaped chest and small thigh circumference, presents a clinical picture of **sickle cell habitus (Photoplate 12)**. Menarche may be delayed in the girls (Phebus *et al.*, 1984).



Photoplate 12: Anterior and Lateral View Showing Haemolytic Facies and Habitus (Gupte, 2001)

SCA with its multi-system effects is bound to have some influence on growth and developmental parameters (Konotey, 1973; Phebus *et al.*, 1984; Tanner, 1981). Other studies have shown growth deficits in children with SCA (Silva, 2003) in the Niger Delta Area of Nigeria (Asomugha *et al.*, 2008). Some of its long-term complications are growth retardation and developmental deficits, morphometric and craniofacial changes that affect prediction anthropometry. The importance of using ethnically appropriate reference ranges for growth assessment in SCA cannot be overemphasized (Patey *et al.*, 2002). It therefore became paramount to generate data and provide information on the scientific effects of SCA on growth, posology and prediction anthropometry. This will be of eventual benefit in the evaluation of age-associated changes in body morphology in the management of these patients (Ejele and Fawehinmi, 2004, 2008).

Mr. Vice Chancellor Sir, the dedicated research of Professor Gabriel I. Ekeke *FAS* of blessed memory geared towards providing succour and renewed hope to millions of sicklers around the world led to the patenting of Ciklavit which is recognized by the WHO and is currently being marketed by Neimeth Pharmaceutical Plc. This stimulated my interest in research in the Anthropometry of SCA under the auspices of the Sickle

Cell Research and Awareness Group (SCRAG) Inc. as a way of providing additional information for better clinical management and eventual well being of these patients. Anthropometric studies of craniofacial features and body morphology provides data which can be analyzed to determine the relative influence of chronic ailments such as SCA on the phenotypic expression of these traits in these patients (Ejele *et al.*, 2004).

The Objectives of the Comparative Anatomical Studies were to:

1. Investigate the long-term effect of SCA on growth monitoring, morphometric and craniofacial indices as determined by subjective and non-anthropometric description schemes.
2. Provide Anatomical guidelines and baseline from which to begin analysis and evaluation of growth and craniofacial defects and dysmorphology in SCA.
3. Establish objective protocol or criteria for the analysis and evaluation of the sickle cell facie and habitus using sub-categorized anatomical features in Negroid patients.
4. Determine proportional index relationships in the anthropometric parameters that can be used in Craniofacial Prediction Anthropometry in the clinical management of these patients.

(a) Growth and Morphometric Deficits in Sickle Cell Anaemia:

Using the same Anthropometric principles, Ejele, Fawehinmi and Asomugha (2004, 2008) carried out a series of measurements on the growth monitoring indices and morphormetric parameters of confirmed homozygous SCA children from sickle cell clinics in the Niger Delta Area of Nigeria. The values obtained were compared with that of normal growing children (NGC) from primary and secondary schools of the same age and socio – economic status, from the same region.

The results showed significantly higher values in weight and height for NGC, particularly between ages 10 to 18 years (Fig. 14). This delayed effect was attributed to improved health care and availability of counselling services thereby delaying the manifestation of SCA on growth parameters. Growth delay in SCA starts in early childhood but becomes more apparent during adolescence when the growth spurt separates the NGC from the SCA. The difference tends to be higher in girth measurements than in height. Values for head circumstances in the SCA patients were generally higher than those for NGC and adolescents. This we attributed to the frontal bossing of the skull associated with this condition (Fig. 14).

Photoplate 13: Measurement of Chest Circumference

Values for the chest circumference showed variations with age due to the pathological changes associated with the disease (Fig. 14). Mid-thigh circumference values were generally lower for SCA patients in the study (Fig. 15). It has also been indicated that sternomental distance of SCA subjects is significantly reduced when compared with non-SCA subjects (Osunwoke *et al.,* 2009).

Mr. Vice Chancellor the implication of this is that, a dress maker will have to reduce their circumferential measurements for the limbs and increase girth measurements for the chest and abdomen for the SCA children.

(b) Craniofacial Changes in Sickle Cell Anaemia

Before now prescribed empirical criteria to describe quantitatively the facial dysmorphology associated with the chronic effect of SCA on the postnatal skull was scarce.

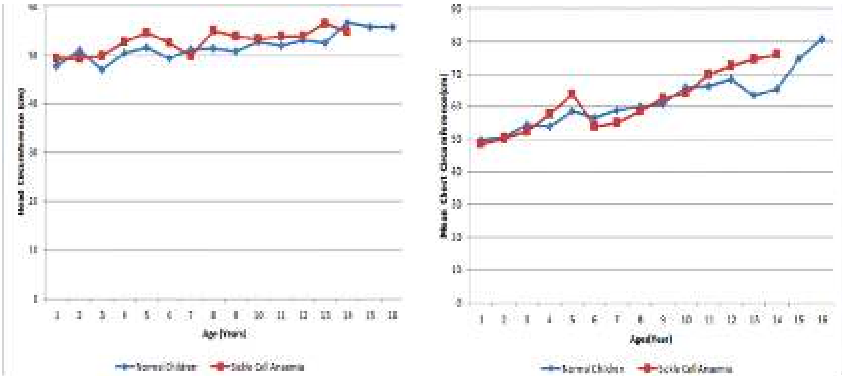


Fig. 14: Mean Head Circumference and Mean Chest Circumference of NG and SCA Children/Adolescents

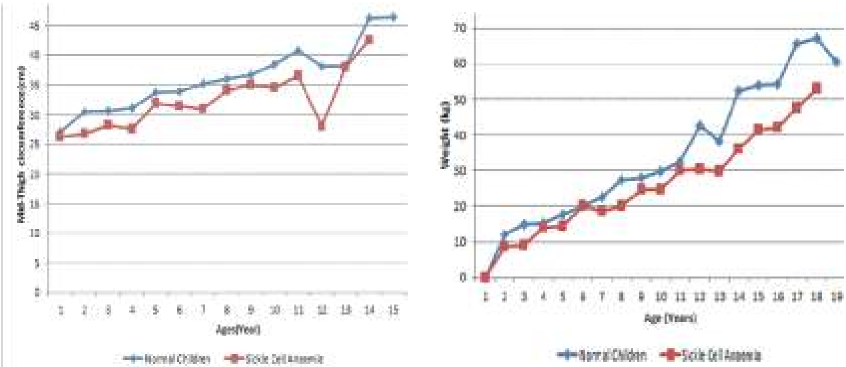


Fig. 15: Mean Mid – Thigh Circumference and Weight of NG and SCA Children

Table 3: Cephalometric Indices in Sickle Cell Anaemia (SCA) and Non-Sickle Cell Anaemia (Non-SCA) Subjects

Mean Parameter	Sex	SCA	Non SCA	Test of Significance (p?0.05)	Categorization
Cephalic	Male	78.69±4.29	79.73±4.43	Significant	Mesocephalic
Index	Female	81.36±4.28	88.13±3.84*	Significant	Brachycephalic
Nasal	Male	82.14±9.16	87.10±10.22**	Not significant	Mesorrhine
Index	Female	88.08±13.78	80.05±10.41***	Not significant	Platyrrhine
Canthal	Male	36.97±2.72	35.02±2.83	Significant	Normotheloric
Index	Female	36.68±0.42	35.31±2.77	Not significant	Normotheloric
Gnathion	Male	6.23±3.14	6.31±0.44	Not significant	Maxillary
Distance	Female	6.16±0.45	6.25±0.41	Not significant	Prognathism

***** Hyperbrachycephalic, **Platyrrhine, ***Mesorrhine

It is based on this that Fawehinmi *et al.*,(2004; 2008) carried out series of measurements to quantitatively define the 'sickle cell facie'. The study involved the measurement of craniofacial indices of 100 SCA subjects who attended the Sickle Cell Clinic at UPTH and compared the values with that of 500 NGC drawn from schools in Port Harcourt, all aged between 3 to 18 years. The results are summarized in table 3.

Results put both NGC and SCA male in the **mesocephalic** group of head shape (Zetaman, 2001) the difference is statistically significant (P<0.05). This study places NGC and SCA females in the **brachycephalic** head group. Values for both groups of children was statistically significant (P<0.05) (Table 3). The Cephalic Index for the SCA children of both sexes were lower due to the increased antero-posterior length of the skull from frontal bossing which serves as the denominator (Ejele *et al.,* 2004, Fawehinmi *et al.,* 2008, Fawehinmi and Ligha, 2011).

Values for mean nasal index for NG male and male SCA children placed them in the **platyrrhine** and **mesorrhine** categories respectively. The difference is not statistically significant (P>0.05). Female values for mean nasal index imply that they are essentially **mesorrhine** and **platyrrhine**. The difference is also not statistically significant (P>0.05) (Table 3). The sicklers particularly the females were on the average more platyrrhine probably due to diploic expansion affecting the paranasal sinuses and maxilla and leading to increased nasal width, and higher inner canthal distance (Fawehinmi and Ligha, 2010). Our result differed from that of Porter and Parker (2003) which gave mean nasal index for African-American women aged between 18 and 30 years as 79.70 with a range of 57 – 102.

Values for mean canthal index in our study showed that the difference between the two groups is statistically significant (P>0.05), with the sicklers tending towards **hypertelorism**. The SCA girls also show the same tendency to hypertelorism though the difference is not statistically significant (P>0.05). A possible reason for this is diploic expansion in the ethmoidal and maxillary bones leading to a disproportionate increase in the medial canthal as against the lateral canthal distance. Slow growth of the orbital contents can also add to this (Fawehinmi and Ligha, 2011). This also explains the slight degree of Telecanthus (Table 3).

The mean SGD values between the two groups are not statistically significant in both sexes (P>0.05). Respective values for the mean SGD show SCA children to have lesser values than NGC (Table 3).

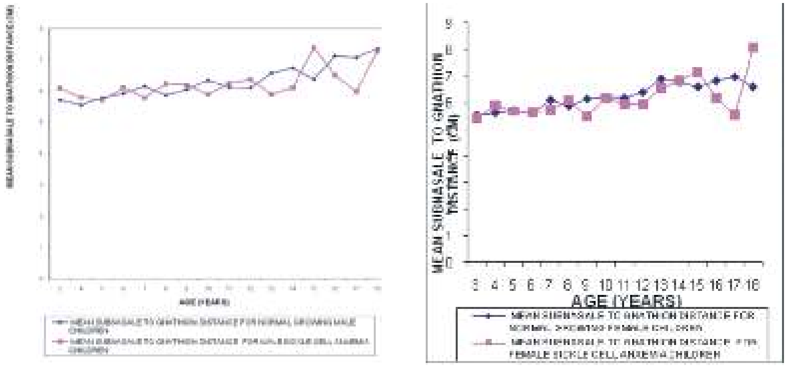


Fig. 16: Mean Subnasale –Gnathion Distance (cm) against Age for Normal Growing and Sickle Cell Anaemia Male and Female Children

Graphs (Fig. 16) showed the expected increase in SGD with increasing age for both groups of children especially from the age of 7 years. Delayed eruption of teeth, dental hypoplasia and type II malocclusion are some oral findings associated with this condition.

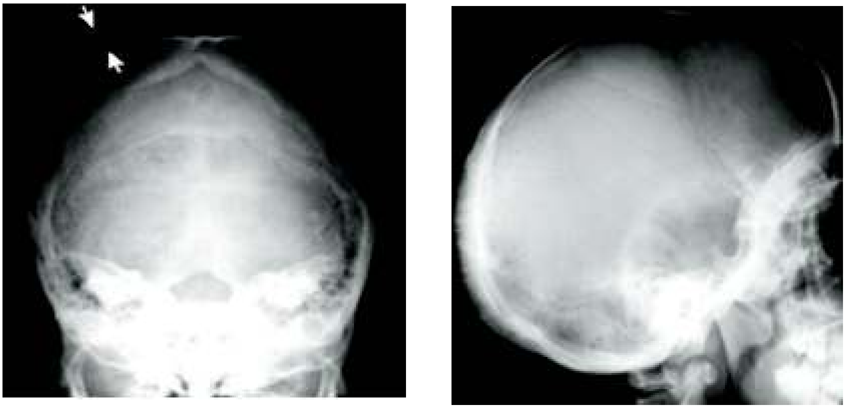
Photoplate 14: Anterior and Lateral View Showing Haemolytic Facies and Habitus (Courtesy: Department of Paediatrics and Child Health, University of Port Harcourt Teaching Hospital)

Other studies carried out in Nigeria have associated SCA with gnathopathy of the permanent incisors with its accompanying **prognathic maxillary profile**, overlapping of the upper jaw with consequent reduction in the distance of maximum intercuspation (Oredugba and Savage, 2002). Sickle cell gnathopathy is often detected clinically but can be evaluated radiographically (Brown and Sebes, 2000) and is expected to affect the subnasale to gnathion distance(Fawehinmi and Ligha, 2010)**.**

Genetics and environmental factors are responsible for the variation in craniofacial indices (Kasal *et al.,* 1993; Oruamabo, 1999, Cem *et al.,* 2001) and no single process predominantly controls craniofacial growth (Christopher, 2003). When compared with the craniofacial features of NGC, sickle cell facie can be described as brachycephalic head shape with a tendency towards mesocephaly, platyrrhine especially in females, are normotheloric to hypertheloric with possible telecanthus and have some degree of maxillary prognathism. This will be beneficial in treatment monitoring and in making spot diagnosis of patients with SCA. This comparative anatomical study was able to established an objective protocol for the analysis of the sickle cell facie using standardized and sub-categorized anatomical references and terminologies, through the significant changes in the cephalometric and facial dimensions between SCA and NGC of the same age and sex.

The study on direct craniofacial measurements opened another vista of inquest on the extent of involvement of sinusoidal and diploic expansions on the observed facial changes. We recommended that this study be subjected to further investigations using radiological techniques as a way of deepening the research and will enable stronger inferences to be made on the effect of SCA on prediction anthropometry, maxillofacial surgery and forensic science.

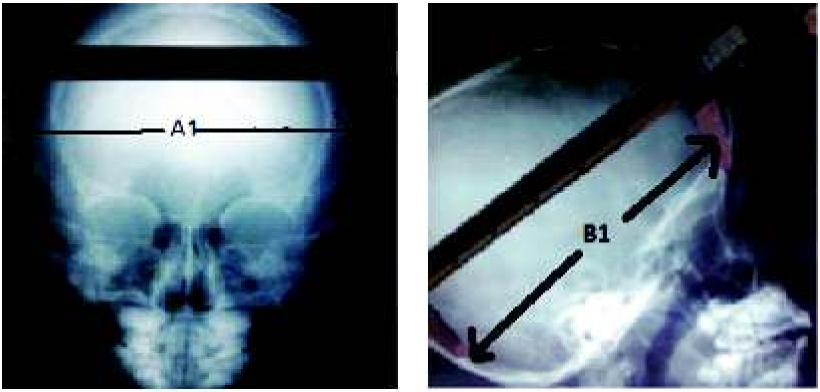
(c) Radiologic Changes in Sickle Cell Anaemia: Studies on anatomic lesions in the skull and other bones associated with severe anaemia were stimulated in 1925 when Cooley and Lee described striking radiographic abnormalities in the bones of children with thalassemia major. Craniofacial deficits in SCA subjects (prognathic maxillary profile, frontal bossing, depression in bridge of nose, malocclusion of teeth, etc) have been reported in Nigeria (Fawehinmi and Ligha, 2010) and other parts of the world (Gupte and Suraj, 2001). Vertical "hair – on-end" striations that project from the outer aspect of the skull vault have also been seen (Sebes *et al.*, 1979). Such striations are due to the prominence of trabeculae and to new bone formation (Photoplate 15). Bone deformities such as kyphosis, scoliosis, saber shin and tower - shaped skull may be encountered in SCA with abnormal roentgenographic appearance (West and Fawehinmi, 2002).



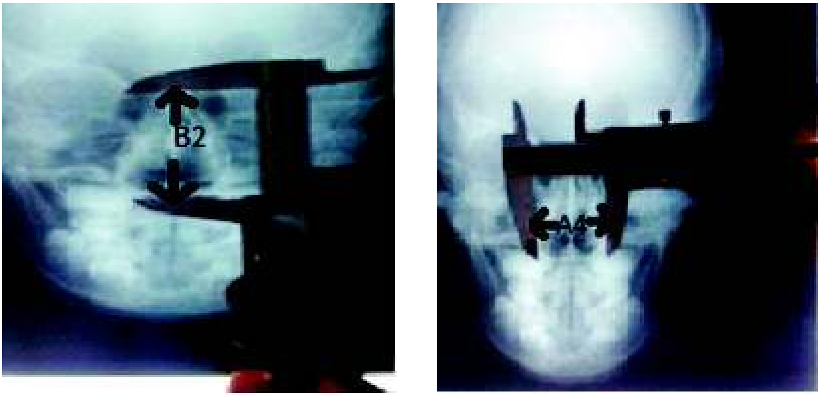
(a) (b)

Photoplate 15: Radiograph of a Child's Skull Showing (a) Diploic Expansion and(b) 'Hair – on – End' Appearance (Gupte, 2001)

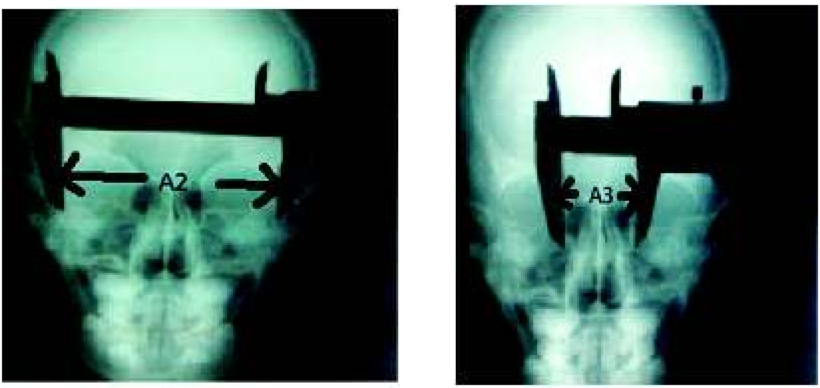
Because the direct measurement of bone dimensions may be affected by tissue and fascia, Fawehinmi, *et al.*,(2014) used radiological means to corroborate their earlier claims on the effects of SCA on craniofacial anthropometry. The study involved measurements of antero-posterior and lateral skull radiographs [Photoplates 16 and 17 (a) and (b)] of 250 non - SCA and 36 SCA subjects aged 3 – 30 years, at the Radiology Departments of UPTH and Braithwaite Memorial Specialist Hospital (BMSH). Radiographs of SCA subjects were prospectively taken as part of their management. The results are summarized in Table 4 below:



Photoplate 16: Measurement of Head Breadth (Left) and Head Length (Right)



Photoplate 17 (a): Measurement of Nasal Height (Left) and Nasal Breadth (Right)



Photoplate 17 (b): Measurement of Outer (Left) and Inner (Right) Canthal Distances

Table 4: Radiological Measurements of Craniofacial Parameters in SCA and Non – SCA Subjects

Mean Parameter	Sex	SCA	Non – SCA	Test of Significance (p<0.05)	Categorization
Cephalic Index	Male	75.99±3.22	78.29±4.72	Significant	Mesocephaly
	Female	76.40±1.14	76.91±6.46	Not Significant	Mesocephaly
	Male + Female	76.21±3.11	77.66±10.67	Not Significant	Mesocephaly
Nasal Index	Male	72.30±4.45	74.69±8.63	Significant	Mesorrhine
	Female	73.19±1.48	74.40±9.14	Not Significant	Mesorrhine
	Male + Female	72.90 ± 4.80	74.71 ± 9.23	Significant	Mesorrhine
Canthal Index	Male	30.02±2.43	29.98±3.90	Not Significant	Normotheloric
	Female	28.77±0.05	30.78±3.71	Significant	towards
	Male + Female	29.79±2.24	30.32±3.90	Not Significant	Hypertheloric

The results showed that values obtained for mean cephalic index in SCA were lower in all age groups than for non-SCA and was not statistically significant(p >0.05). The measured values from radiographs of non-SCA and SCA subjects showed a slight variation but still maintain a consistent trend towards mesocephaly (Table 4). These finding agree with the previous findings by Fawehinmi and Ligha (2011). The possible explanation for this is the significant diploic thickening in frontal and parietal region of the skull which does not involve the squamous portion of temporal bone thereby giving SCA subjects the lower cephalic index recorded in this study.

The Mean Nasal Index determined radiologically shows a mesorrhine type of nose for both non-SCA and SCA subjects (Table 4), however, the values for SCA subjects were generally lower. This agrees with previous findings reported by Fawehinmi and Ligha (2010). The possible reason for these lower values is maxillary overgrowth due to bone marrow hyperplasia (Folakemi and Kofo, 2002). The Radiological values corroborated our findings from direct manual measurements.

In a similar study, Fawehinmi *et al.*, (2012) carried out a comparative anatomo-radiologic study to determine the effect of SCA on the morphometry of the paranasal sinuses, and to determine standard values for the dimensions of these sinuses in SCA subjects in Port Harcourt. The **paranasal sinuses** are four pairs of air-filled spaces located in the frontal, sphenoid, ethmoid and maxillary bones, and named according to these bones. They function primarily to humidify the air, and also reduce the weight of the bony structure of the skull (Moore and Dalley, 1999).

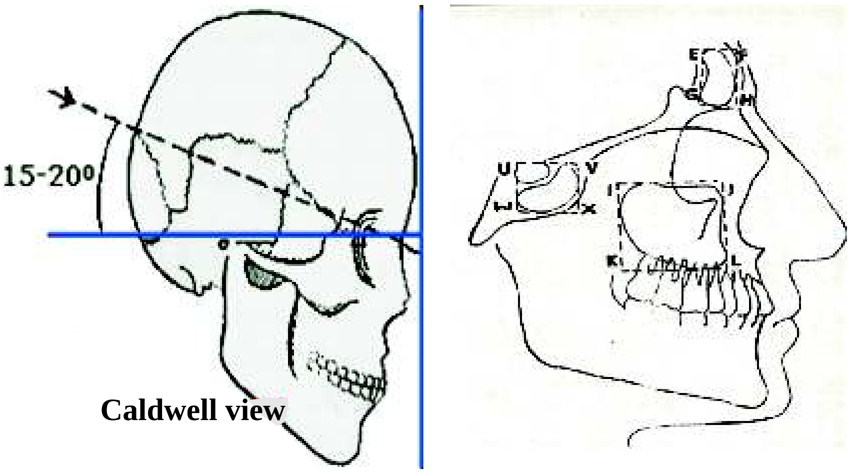


Fig. 17: (a)Caldwell View Position for Occipitofrontal Projection (b) Sinus Measurements Depicted on Lateral Projection(EF = GH= Anteroposterior Dimension (Width) of Frontal Sinus; IK = JL = Height of Maxillary Sinus; IJ = KL = Width of Maxillary Sinus; UV = WX = Anteroposterior Dimension (Width) of Sphenoid Sinus; UW =VX = Height of Sphenoid)

The study involved taking plain x - rays of the paranasal sinuses of 29 SCA children of both sexes, between the ages of 4-20 years, using three standard projections: occipitofrontal, occipitomental (open-mouthed) and lateral.129 radiographs of the paranasal sinuses of non-sicklers, with no known pathologies affecting their cranial bones were obtained from centres in Port Harcourt and used as control.

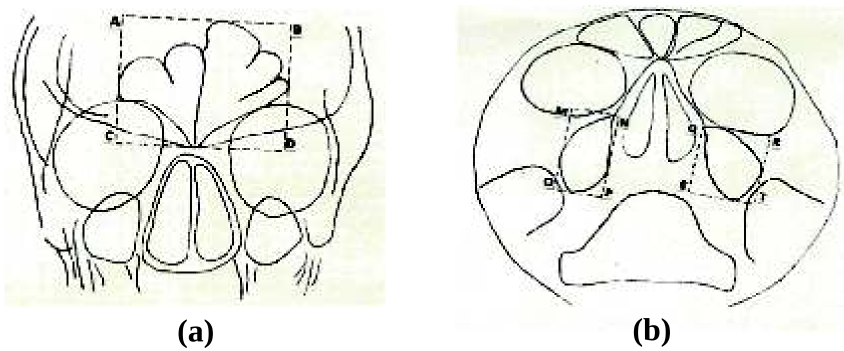
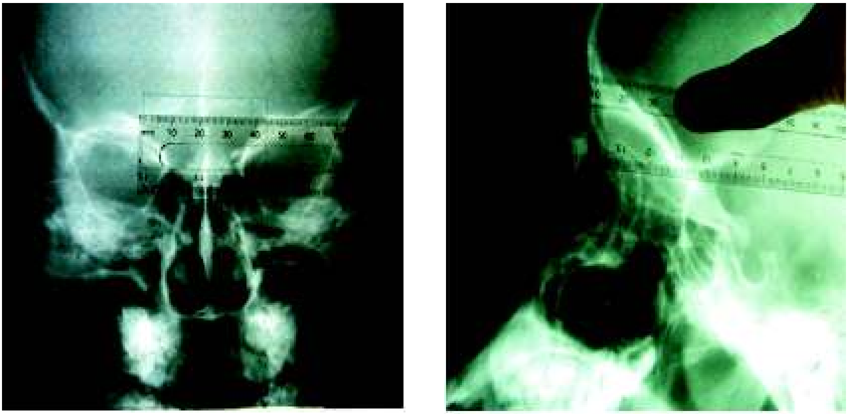
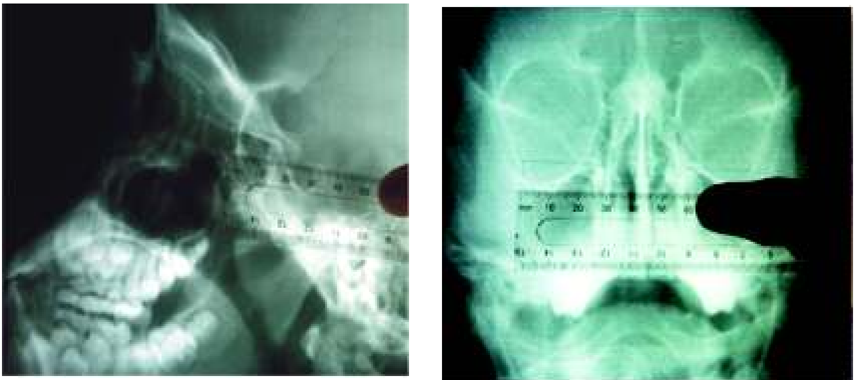


Fig. 18: Sinus Measurements Depicted on (a) Occipitofrontal Projection and (b) Occipitomental Projection (AC = BD = Height of Frontal Sinus; AB = CD = Width of Frontal Sinus; MN = OP = Mediolateral Dimension (Width) of Right Maxillary Sinus; QR = ST = Mediolateral Dimension (Width) of Left Maxillary Sinus)



(a) (b)

Photoplate 18: (a) Measurement of Width of Frontal Sinus and (b) Measurement of AP Length of Frontal Sinus (Fawehinmi *et al.*, 2012)



(a) (b)

Photoplate 19: (a) Measurement of AP Length of Sphenoidal Sinus and (b) Measurement of Width of the Right Maxillary Sinus (Fawehinmi *et al.*, 2012).

Demarking points of the three different views were determined and measurements were taken to the nearest millimetre (Fig. 17 and 18; Photoplates 18 and 19). The dimensions of the paranasal sinuses were compared and the results summarized in a tabular form below:

Table 5: Radiological Measurement of Paranasal Sinus Dimensions in SCA and Non-SCA Subjects

Mean Dimensions (cm)	Sex	SCA	Non SCA	Test of Significance(p?0.05)
Height of Sphenoid Sinus (HTSS)	Male	16.00±4.17	15.08±3.50	Not significant
	Female	16.63±4.72	16.02±4.72	Not significant
Anteroposterior Length of Sphenoid Sinus (APSS)	Male	13.62±2.93	14.45±4.17	Not significant
	Female	14.25±2.38	15.54±5.00	Not significant
Height of Maxillary Sinus (HTMS)	Male	29.45±8.27	28.15±7.12	Not significant
	Female	31.25±10.12	29.09±6.95	Not significant
Anteroposterior Length of Maxillary Sinus (APMS)	Male	34.52±8.69	32.75±7.23	Not significant
	Female	36.63±10.42	33.07±7.51	Not significant
Width of Right Maxillary Sinus (WMS-R)	Male	22.45±4.53	20.90±3.85	Not significant
	Female	23.50±5.04	20.58±4.00	Not significant
Width of Left Maxillary Sinus (WMS-L)	Male	22.72±4.08	21.48±3.85	Not significant
	Female	24.13±3.68	21.35±4.02	Significant
Height of Frontal Sinus (HTFS)	Male	22.72±12.02	23.17±8.52	Not significant
	Female	24.50±15.53	24.28±9.80	Not significant
Anteroposterior Length of Frontal Sinus (APFS)	Male	10.86±6.33	10.08±2.99	Not significant
	Female	12.50±9.17	9.79±2.78	Not significant
Width of Frontal Sinus (WDFS)	Male	38.10±16.65	45.44±16.73	Not significant
	Female	38.38±16.98	41.56±13.94	Not significant

The result showed no statistically significant difference in the dimensions of the sinuses measured between the SCA and NGC. However, the mean values of the anteroposterior length of the frontal sinus and the mean values of the dimensions of the maxillary sinus (Antrum of Highmore) were higher in the SCA subjects (Fawehinmi *et al.*, 2012).

An understanding of the various clinical and radiologic manifestations of SCA is crucial for prompt diagnosis and appropriate treatment (Naoko *et al.*, 2010). Data obtained from this study is useful as diagnostic tool to Maxillofacial Surgeons, Paediatricians, Radiologists and Forensic Anthropologists in the management of SCA patients, in their follow up and monitoring treatment outcomes.

In conclusion Mr. Vice Chancellor, many factors are known to influence the manifestations of SCA, among which are environmental like pollution, poor sanitary conditions, personal hygiene and poor social circumstances (Ejele *et al.*, 2004). Socio-cultural variables such as widespread poverty, poor state of health facilities, illiteracy and the African view of disease causation are likely to be the reasons why the severity of the disease is more in the sub-Saharan Africa (Platt *et al.*, 1994). The study has also brought to the fore the need to determine the possible effects of environmental pollutants on growth pattern for a broader concept of sickler well being.

For the first time we quantitatively reconstructed the sickle cell facie which together with the sickle cell habitus as described by Ejele and Fawehinmi (2002) gives the "**Sickle Cell Syndrome**". This will be of eventual benefit in making a spot diagnosis, and in the clinical management of these patients. Mr. Vice Chancellor, the implication of this is that the clinician and modern day tailor who plan treatment procedure or design of clothes for the SCA children should take these variables into consideration when doing so.

COMPARATIVE ANTHROPOMETRY OF SPECIFIC ETHNIC POPULATIONS

Due to problems surrounding the word 'race' in the last century, the word 'ethnicity' was promoted as a way of characterizing the differences between groups. Ethnicity defines a group's placement in terms of common ancestral origin and socio-cultural affiliation which tends to promote marriage that creates some form of biological cohesion within the group (Molnar, 1998). Research into human population genetic differences has lent credence to the fact that race and ethnic groups have well demarcated biological differences to warrant ethnic group specific studies in Anthropology. In addition, because of the differential socio-economic and psychological experiences, and environmental exposures which have created adaptive biological mechanisms that contributes to disparities between groups, it is inadvisable to ignore race and ethnicity in population genetics research. This will help reduce false – positive results in Anthropological association studies (Olson, 2005).

Mr. Vice Chancellor Sir, Nigeria has the highest population of Negroid race in the world, with an estimated population of 140, 431, 790 by the 2006 census. According to the World Bank estimates, this is expected to rise to 173, 600, 000 by 2013. There are about 374 identifiable ethnic groups in Nigeria with the Igbo, Hausa, and Yoruba as the major ethnic groups (National Population Commission, 2008).Their composition is as follows: Hausa and Fulani 29%, Yoruba 21%, Igbo 18%, Ijaw 10%, others 22% (CIA World Factbook). Each of the Nigerian ethnic groups has its own gene pool and therefore its unique anthropometric variables that can be applied for its categorization, and for medical and forensic purposes. Despite these facts, there is a paucity of information regarding the anthropometric parameters for the ethnic groups in Nigeria. Therefore, there was the dire need to generate baseline data on the anthropometric profiles of the various ethnic populations of Nigeria. This necessitated effort geared towards this in the University of Port Harcourt.

1. Comparison of Craniofacial Parameters of Some Nigerian Ethnic Groups:

Craniofacial dimensions are affected by ethnicity, thus making it necessary to study these dimensions in different ethnic groups in order to provide data that can be used as viable comparison in surgery and forensic science. Traditionally, the use of subjective methods of assessment to plan and evaluate the result of maxillofacial and reconstructive surgery usually leads to poor outcome. Distinct anthropometric measurements from fixed skeletal and soft tissue landmark provide a useful tool to appraise facial aesthetics, evaluate patients pre – operatively, guide and assess the outcome of surgical and dental procedures (Brown and Scurr, 2012).

(a) Cephalic Index: Several studies have confirmed the presence of sex, ethnic and racial variations in the shape of the head. The percentage of head shape observed in different studies may not be unconnected with hereditary factor. Environment including the type of diet may also have a secondary effect and could also play a role in influencing the dominant head shape. Cephalic index can be higher in any sex depending on the particular population under study. Other studies found cephalic index not to be age dependent, while others contrasted this view and posit that cephalic index changes with increasing age of the fetus (Gray *et al.*, 1989).

In 2009, Fawehinmi and Eroje calculated the cephalic index of 114 female and 108 male school children aged 13-17 yrs from schools in Benin City. The Bini are Edo – speaking descendants of the founders of the Benin Empire. Their major occupation is craftsmanship, trading and farming and they are noted for their monastery. In this study, the mean cephalic index for the male (81.15) was higher than that of the female (80.58). The most prevalent head shape in the Benin adolescents was brachycephaly followed by mesocephaly. This is in line with result of cephalic index obtained for the Ijaw and Igbo ethnic groups, by Oladipo and Olotu in 2006.

Another study by Eroje *et al.* (2010) showed a general tendency towards debrachycephalization in many populations due to a significant increase

Table 6: Percentage Cephalotype of Different Ethnic Populations

Authors and Date	Ethnic Group	Percentage Cephalotype (%)			
		Dolicocephaly	Mesocephaly	Brachycephaly	Hyperbrachycephaly
Fawehinmi and Eroje (2009)	Bini	3.61	27.83	40.72	27.85
Eroje *et al.*, 2010	Ogbia	66.82	21.59	10.23	1.36
Abolhasanzadeh *et al.* (2003)	Iran (Tehran)	9.00	24.50	36.60	29.90
Golalipour (2006)	Iran (North)	1.50	21.50	25.00	52.00
Shah and Yadhav (2004)	India	58.50	21.00	1.30	19.20
Shah and Yadhav (2004)	India	7.00	41.00	37.00	14.00
Golalipour*et al.*, (2007)	Turksman	8.10	40.90	42.40	7.60
Del Sol (2005)	Chile	2.00	66.00	28.00	4.00

Mr. Vice Chancellor, what this means is that a tailor who designs caps will have to take the common head shape of their ethnic population into consideration.

Table 7: Comparison of Cephalic Index in Different Ethnic Populations

Authors / Year	Ethnic Populations	Cephalic Index	Category
Bhargava and Kher, 1960	Bhils of Central India	76.98	Mesocephalic
Bhargava and Kher, 1961	Berelas of Central India	79.80	Mesocephalic
Shah and Yadhav, 1960	Gujarat, India	80.81	Brachycephalic
Del Sol, 2005	IX Region of Chile	80.42	Brachycephalic
Oladipo and Olotu, 2006	Igbo	77.94	Mesocephalic
Oladipo and Olotu, 2006	Ijaw	79.61	Mesocephalic
Golalipour *et al.,* 2007	Turkman, Iran	80.40	Brachycephalic
Fawehinmi *et al.,* 2008	Port Harcourt, Nigeria	79.80	Mesocephalic
Fawehinmi and Eroje, 2009	Benin, Nigeria	80.86	Brachycephalic
Eroje *et al.,* 2010	Ogbia, Nigeria	72.96	Dolicocephalic

(b) Nasal Index: The nose of different tribes has been categorized by many authors based on the nasal index. Nasal index is also useful in the analysis and classification of fossil remains as well as in the study of living populations. Variables that determine the shape of the nose include race, tribe and environmental conditions. Narrower noses are favoured in cold and dry climates while broader noses are favoured in warmer, moister climates as a result of natural selection (Hall and Hall, 1995). Studies have shown that platyrrhine values are typical of the Negroid race as against the leptorrhine noses of the European Caucasoids.

Fawehinmi *et al.,* (2008) carried out an anthropometric study to ascertain the standard values of nasal index of randomly selected indigenous adult Kalabari people of Rivers State, south – southern Nigeria. The result gave the combined mean nasal index of the Kalabari people to be 96.30 confirming platyrrhine nose types. The males had a nasal index of 98.50±9.74, while the females had an index of 94.10±9.61. There was no significant difference between the sexes. Other parameters like age were also used to correlate the measurements, as well as evaluating the proportional relationship and the degree of the variability found among the males and females.

Fawehinmi and Eroje (2009) documented baseline data for nasal index of the Ogbia people for the first time. The study measured 440 randomly selected children and adolescents (221 females and 219 males). Their nasal indices of these young Ogbia people were calculated and analyzed for sex and age variations. The study revealed platyrrhine values of 97.94±12.48 and 97.33±12.89 for males and females respectively, with no sexual dimorphism (p=0.3084). This finding is in agreement with the previous work done by Fawehinmi *et al.,* (2008) on Kalabari people.

Oladipo *et al.* (2009), carried out a comparative study on the nasal indices of indigenous adult Obolo and Okrika tribes of Rivers State. Their predominant occupation is fishing. The study involved measurements from 200 males and 200 females, randomly selected from each tribe. The mean nasal index of the Obolo males and females was 79.83±4.19 and 83.77±1.09 respectively while that for the Okrika males and females were 86.23±1.72 and 86.46±2.37, respectively. The mean nasal index of the Okrika was significantly higher than that of Obolo ($p<0.05$). There was no significant difference between sexes among the Okrika. However, sexual dimorphism was observed in the Obolo ethnic group with females having significantly higher values than the males ($p<0.05$). This contradicts some studies on nasal index that put the male values higher even when not statistically significant.

Table 8: Comparison of Nasal Indices of Some Ethnic Populations

Authors / Year	Ethnic Populations	Nasal Index	Category
Heimaux and Hartono, 1980	Bantus	85.00	Platyrrhine
Heimaux and Hartono, 1980	Western Europeans	69.90	Leptorrhine
Franciscus and Long, 1981	Sudroid	89.80	Platyrrhine
Franciscus and Long, 1981	Aryans	83.00	Messorrhine
Franciscus and Long, 1981	Onges	71.40	Mesorrhine
Nichang, 2004	Germans	71.00	Mesorrhine
Oladipo *et al.,* 2007	Igbo	94.10	Platyrrhine
Oladipo *et al.,* 2007	Ijaw	96.40	Platyrrhine
Oladipo *et al.,* 2007	Yoruba	89.20	Platyrrhine
Fawehinmi *et al.,* 2008	Kalabari	96.30	Platyrrhine
Fawehinmi and Eroje, 2009	Ogbia	97.64	Platyrrhine
Oladipo *et al.,* 2009	Okrika	86.38	Platyrrhine
Oladipo *et al.,* 2009	Obolo	81.86	Mesorrhine

The values for Yoruba were revalidated in another study by Oladipo, Fawehinmi and Suleiman in 2009. The study used a larger sample size to evaluate the different nasal parameters. Nasal measurements were taken from 500 male and 500 female randomly selected adult Yoruba subjects. The results were analyzed using discrete statistics while z-test was used for test of significance. Males had mean nasal index of 90.02,while that for females was 83.58.There was sexual dimorphism in the mean nasal index of the Yoruba which fell within the platyrrhine nose type.

Report from a previous study (Oladipo *et al.*, 2007) showed that the mean nasal index of the Igbo males and females were significantly higher than those of the Yoruba.

The nasal index has been studied by several authors, and indicated racial and ethnic variations. Apart from the Obolos who are mesorrhine, values of nasal indices for other major ethnic groups in southern Nigerian fell within the platyrrhine category. Sexual dimorphism in nasal index exists in many populations, with males having higher values in most cases. Our result conforms to earlier reports on nasal index for sub – Saharan Africans as being platyrrhine. Data of average nasal anthropometric values for different ethnic populations is invaluable in planning aesthetic nasal surgery.

(c) Canthal Index: Normative canthal values that serve as guide in facial surgical interventions have been published by many authors for different populations (Oyinbo *et al.*, 2008). These studies revealed that not only do canthal dimensions display racial dimorphism, but that there are also ethnic variations. Canthal measurements vary significantly with age, sex and tribe and other environmental and socioeconomic variables (Christopher, 2003, Fawehinmi and Oladipo, 2008). Negroid populations are sometimes known to exhibit illusionary hypertelorism when the individuals have flat nasal bridges. Reference to non – African canthal values arise because of the non availability of African standard values.

Some authors have used photogrammetry for a variety of anthropometric applications including the measurement of Inner (ICD) and Outer Canthal Distance (OCD), but this has been fraught with technical errors. Others have employed inter-orbital measurements which are technically more accurate than ICD and OCD assessment. Because of few studies highlighting canthal dimensional differences between Nigerian ethnic groups, we set out to generate a database of normative values for some ethnic populations in Nigeria.

Oyinbo *et al.* (2008), generated normative canthal dimensions in the Ijaw ethnic group of southern Nigeria for the first time. The measurements were taken directly from 435 Ijaw subjects, comprising 250 males and 185 females aged between 22 – 40 years. Measured values were analysed with the paired student's t-test using the NCSS 2000 software (Table 9).

Eroje *et al.* (2010), compared the canthal dimensions of Bini and Ogbia tribes of south – south Nigeria. We studied a total of 76 Bini and 76 Ogbia subjects of both sexes, aged between 3 – 18 years. The measured values were analysed with the student's t-test using Graph pad instant 3 Demo software. There was no significant difference in the mean OCD between Bini and Ogbia ethnic groups, however, the difference in mean ICD was significant (<0.05). The Bini had higher values for all canthal measurements due to their wider facial profile and this should be remembered in facial evaluation in these tribes. Differences in OCD between the sexes of both tribes were also not statistically significant. This disagrees with the study by Oyinbo *et al.* (2008), which revealed a significant difference in mean OCD between Ijaw males and females (Table 9). This study has shown ICD as a reliable anatomic dimension in distinguishing between ethnic groups since 93% of ICD growth would have been achieved by age 5 years and fully by 11 years.

In another study, Oladipo *et al.*(2009), determined the canthal indices of Urhobo and Itsekiri people of Delta State, Nigeria.500 adult Urhobos and Itsekiri comprising 250 males and 250 females each, aged between 18 – 45 years were randomly selected in Warri, Delta State. The mean values of canthal measurements for the two tribes established ethnic variation and sexual dimorphism that were statistically significant ($p<0.05$). The mean canthal index of the Urhobos was 26.88 while that for Itsekiri was 26.55 indicating different ethnic origin [(Table 9 (b)].

Table 9 (a) : Comparison of Mean Inner and Outer Canthal Distance for Southern Nigerians

Authors	Ethnic Group	Sex	OCD(mm)	ICD(mm)
Oyinbo *et al.*,	Ijaw	Males	110.91±13.77	42.37±4.98
2008	Ijaw	Females	119.62±7.01	39.05±3.19
Fawehinmi and	Igbo	Males	104.51±7.18	38.09±4.33
Nwafor, 2008	Igbo	Females	113.24±17.81	37.27±1.69
Eroje *et al.*	Bini	Males	91.30	33.60
2010	Bini	Females	90.00	34.20
	Ogbia	Males	89.70	31.50
	Ogbia	Females	89.50	31.00

Table 9 (b): Comparison of Mean Canthal Indices of Different Ethnic Populations

Investigator/Year	Population	Male Canthal Index	Female Canthal Index
Singh and Benerjee, 1983	India	37.32	37.82
Cem *et al.,* 2001	Turkish	34.67	34.66
Juberg *et al.,* 1975	African – American	38.38	38.50
Erika *et al.,* 2005	Latvian	27.38	26.44
Oladipo *et al.,* 2008	Ijaw	37.04	33.11
	Igbo	35.15	32.59
Oladipo, Fawehinmi	Urhobo	24.38	29.38
and Okoh, 2008	Itsekiri	26.03	27.70

The results from these studies have shown sexual dimorphism and ethnic variations at significant levels ($p \leq 0.05$) for both ICD and OCD dimension [Table 9 (a)]. These works also revealed the heterogeneous nature of the Nigeria population, and generated normative values for ICD and OCD for different ethnic populations that would be beneficial to Maxillofacial and Plastic Surgeons, Orthodontists, Paediatricians, Forensic Anthropologists and Dysmorphologists.

(d) Other Facial Parameters: Fawehinmi *et al.* (2009), studied the mean values of facial, nasal, maxillary, mandibular and oro-facial heights of adult Urhobos aged between 18 and 45 years. 1000 randomly selected subjects comprising 500 males and 500 females were measured using a sliding calliper. Results showed sexual dimorphism with males having significantly higher values than females in all the facial parameters measured ($P<0.05$). The data from this study will be of surgical and forensic value.

2. Comparison of Somatometric Variables of Some Tribes in Nigeria : Anthropometric studies of polygenic traits also provide data which can be analysed to determine the relative contributions of genetic and environmental factors such as regional climatic differences on phenotypic expression. **Standing height** is the distance from the floor to the vertex of the head with the subject standing in the anatomical position without foot wears (Photoplate 11 (b). It is an important indicator of past nutritional status. **Knee height** is a measure of the distance from the superior margin of the patella to the heel in a sitting position. It is useful in the estimation of stature in elderly and disabled subjects, since the long bones are not as affected as the vertebral column by aging or compromised posture. But there is the need to generate ethnicity specific regression equations.

Foot length is the length of the foot as seen on the ground (footsteps). It is the distance from the tip of the hallux (great toe) to the heel of the foot with the subject sitting or standing. The human foot, the foundation for bipedal locomotion, is a complex adaptation that evolved through extensive remodelling of the hind appendage of our arboreal primate forebears. Although varying in degree across populations and proportionate to stature, female foot length is consistently smaller than male foot length (Susman, 1983). Foot length and width have been shown to vary considerably and has been known to be wider in those who engage in racing sports and long distance trekking like the nomadic Fulani. **Arm span** is the distance between the tips of the middle finger of both hands with both arms stretched out horizontally and parallel to the ground at the shoulder and making an angle of 90º with the body, when the subject is standing and facing a vertical wall in the anatomical position (Photoplate 20).

Photoplate 20: Measurement of Arm Span (Fawehinmi, *et al.*, 2013)

When arm span and knee height were correlated with height, arm span showed a better correlation coefficient among adults compared to elderly subjects. Also estimation of height from arm span showed a consistent variation among ethnic groups and between the both sexes. This brings to the fore the need to formulate ethnicity and gender specific equations in estimating height from arm span and knee height.

Based on this, Paul and Fawehinmi (2008) carried out a study to determine the differences in stature of Hausa and Ibo adults and relating these to their geographical factors at play. The study involved the measurement of height, arm span, knee height and foot length from 400 Hausa and 400 Ibo adults drawn from some Universities in northern and eastern parts of Nigeria. Equal number of males and females were selected at random and the z-test was used to analyse the results (Table 10).

Table10: Mean Values of Parameters Measured for Hausa and Igbo Tribes for both Sexes

Measured Parameters (cm) ± SD	Ethnic Group			
	Igbo		Hausa	
	Male	Female	Male	Female
Standing Height	174.65±9.54	164.75±7.12	191.00±7.99	182.15±12.97
Knee Height	53.30±3.30	51.75±2.78	58.03±2.37	55.25±2.37
Foot Length	27.23±1.53	25.33±2.37	27.24±3.04	26.25±1.49
Arm Span	185.95±9.16	172.95±7.64	202.37±6.56	191.15±10.43

The results showed statistically significant difference between the two tribes for all parameters measured ($p < 0.05$) and for both sexes. The Hausas had higher values that can be attributed to interplay between genetics and environment factors. The arm span showed the highest correlation with height, while knee height showed the least correlation. Our results conformed to special references for gender and ethnicity on stature for both tribes (Paul and Fawehinmi, 2008).

Despite the anthropological importance of arm span, foot length and height, there was no documentation on them for the Ijaw and Ikwerre people of Nigeria. This spurred us (Ogoun, Fawehinmi and Okoseimiema, 2013) to carry out another study to determine the average arm span and foot length of the Ijaw and the Ikwerre, and evaluate if arm span can be a reliable substitute for human height in anthropological study for these two ethnic groups. The study also generated baseline data for foot length and arm span for these tribes and determined possible ethnic and racial differences.

The study utilized 500 Ijaws and 500 Ikwerre people obtained from tertiary institutions and communities in Rivers and Bayelsa States. Equal number of males and females (250) aged between 18 to 40 years were selected at random from both tribes. Their arm span and foot length measurements were taken and recorded in centimetres. The data were analysed statistically, using the z – test to determine significant differences ($p<0.05$) in sex and ethnic group.

Table 11: Comparison of Mean Arm span of Different Ethnic Groups (cm)

Researchers and Year	Tribe	Male	Female
Fawehinmi and Paul (2008)	Igbo	185.95±9.16	172.95±7.64
	Hausa	202.37±6.56	191.15±10.43
Samira *et al.*, (2011)	Bangladeshi	154.74±5.69	
Ogoun *et al.,* (2013)	Ijaw	188.4±0.48	171.7±11.3
	Ikwerre	174.8±10.1	166.4±8.34

Table 12: Comparison of Mean Foot Length of Different Ethnic Groups (cm)

Researchers and Year	Tribe	Male	Female
Ogoun *et al.,* (2013)	Ijaw	27.9±1.59	25.9±1.92
	Ikwerre	24.8±2.30	24.1±1.82
Japan Leather and Leather	Japanese	21.10-28.70	19.40- 26.30
Goods Industry Association(1987)	Mean:	24.9±1.05	22.8±0.89
Industrial Product Research Institute (IPRI) (1991,1992)		25.4±1.10	23.3±0.97
Fawehinmi and Paul (2008)	Igbo	27.23±1.53	25.33±2.37
	Hausa	27.2±3.04	26.25±1.19

The tables show the Ijaw males and females had significantly higher values in both parameters measured when compared to the Ikwerres ($p<0.05$). We observed gender and ethnic / racial differences when we compared our results for arm span and foot length with that of Hausa and Igbo, and with other populations (Tables 11 and 12). This is in line with previous work on other ethnic groups (Fawehinmi and Paul, 2008).Tayie *et al*. (2003) reported that arm span can be used to predict height and is about 5 to 6% greater than stature. This is in accordance with our results as arm span cannot be used as direct substitute for height for people whose height cannot be obtained directly in these tribes (Tables 10 and 11).

3. Comparison of Some Osteometric Variables of Clinical Importance:

(a) Position of Mental Foramen in Adult Nigerian Mandibles: Knowledge of the most frequent position of the mental foremen is essential to dental and surgical practice. Very few values which can be used as reference data by health care practitioners in Nigeria on the position of mental foremen had been reported. In 2004, Oladipo and Fawehinmi investigated the position of the mental foramen in adult Nigerian mandibles and provided anatomical information on its shape and size (diameter) and distance in relation to the lower teeth, lower border of the mandible, alveolar margin, mandibular symphysis and posterior border of the mandible ramus.

25 adult Nigerian mandibles were examined in a cross sectional study, with the aid of a digital Venier calliper with a measuring accuracy of 0.01cm. The frequency of mental foramen in relation to the lower teeth was determined by simple percentage analysis involving mean, standard deviation, and standard error, coefficient of variation and student's t-tests.

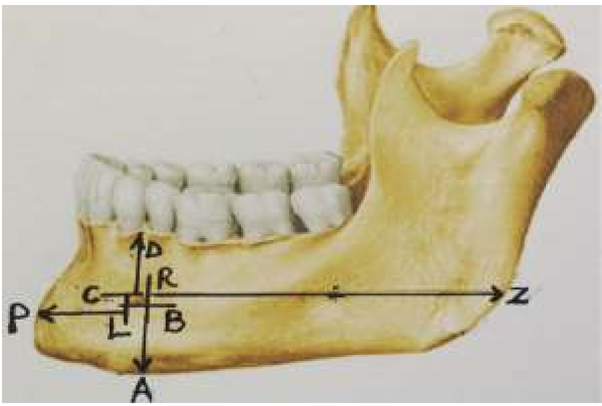


Figure 19: Mandible showing Measurable Points along Vertical and Horizontal Planes

P – Most prominent part of mandibular symphysis, **Z** – Posterior border of the mandibular ramus along horizontal line from P through the mental foramen, **L** - Anterior border of the mental foramen, **R** – Posterior border of the mental foramen, **A** – Inferior margin of the body of the mandible along a vertical line drawn through the mental foramen, **B** – Inferior border of the mental foramen, **C** – Superior border of the mental foramen, **D** – Alveolar margin.

The margins of the foramina of the mandibles examined in this study were smooth. This was in agreement with the report of Mbajiorgu *et al.* (1998), for Zimbabweans. It was observed that the mental foramen was round in 64% and oval in 36% of the mandibles studied. Nigerian mandibles however showed a higher percentage of round shape foramina than the one reported for Zimbabweans. The shape was bilaterally symmetrical in all the mandibles. The percentage occurrence of the mental foramen was highest below a midpoint between the second premolar and first molar teeth (position 5) on the right side (44%) and below the apex of the second premolar (position 4) on the left (56%) (Table13).The relationship between the mental foramen and lower teeth agrees with the report of Mbajiorgu *et al.* (1998), for positions 4 and 5 but shows racial differences when compared to other populations. There was no mental foramen in position 1 for Nigerians.

Table 13: Summary of Percentage (%) Position of Mental Foramen in Relation to Lower Teeth in Adult Nigerian Mandibles

Parameter Measured	Anterior to Pm_1 (Position1)		Below Pm_1 (Position2)		Between Pm_1 and Pm_2 (Position3)		Below Pm_2 (Position4)		Below Pm_2 and M_1 (Position5)		Below M_1 (Position6)	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Percentage	0	0	4	0	0	4	36	56	44	20	16	20
Percentage Average	0		2		2		46		32		18	

Pm = Premolar, M = Molar

In the horizontal plane, the ratio PL: PZ for both sides was approximately equal and indicated that mental foramen lay approximately at 28% and 27.7% of the distance from the mandibular symphysis to the posterior border of mandibular ramus (PZ) for the right and the left sides respectively. This is similar to those of previous authors (Mbajiorgu *et al.*, 1998). The mental foramen in Nigerian mandibles was thus symmetrically located. This may suggest that both sides of the mandible may be subjected to equal use by Clinicians for Nigerians. In the vertical plane, the mental foramen lay approximately at the midpoint of the distance from the lower border of the mandible and alveolar margin of the mandible on both sides.

Table 14: Summary of Percentage Distribution of Mental Foramen in Relation to the Lower Teeth in Different Populations

Population	Between Pm1 and Pm2	Below Pm2	Between Pm2 and M1	Below M1	Authors
East Africans	31–35	55–58	-	-	Zivanovici 1977
Indians (Middle East)	26–29	42–44	15-19	-	Nicholson, 1985
Kenyans	12.1	56.1	31.9	-	Mwaniki, 1992
Chinese	21.0	58.9	20.0	-	Wang*etal.*, 1986
Black Zimbabweans	12.5	56.3	31.3	-	Mbajiorgu*etal.*, 1998
Nigerians	2.0	46.0	32.0	18.0	Oladipo *et al.*, 2004

Pm: Premolar M: Molar

This study revealed that the ratios AB:AD and PL:PZ appear reliable in locating the position of mental foramen in the vertical and horizontal planes respectively, and can serve as reference data in clinical practice. This data is of anthropological and clinical importance, especially to the Dental and Plastic Surgeon in Nigeria in preventing damage to the mental nerve during apicocurretage, endodontic treatment, preprosthethic surgery, surgical orthodontics and periodontal surgery, when raising mucocutaneous flaps in the lower teeth region and when a mental nerve block anesthesia is preferred to local infiltration or general anaesthesia - 'the same Surgeons for different people'.

(b) Normal Limit of Congruence (Q) Angle of the Patella in Nigerians: From the same idea of establishing comparative anatomical profiles for distinct ethnic populations, Didia *et al.*(2003), established the normal limit of congruence (Q) angle of the patella in Nigerians as reference values for Orthopaedic Surgeons. The patella is the largest sesamoid bone in the body and functions as fulcrum for the quadriceps muscles of the thigh to increase power during extension, by raising the moment arm from the centre of rotation of the knee joint. The Q angle is the angle between the long axis of the femur and the long axis of the tibia. It is used to access patella alignment and is usually below 12º (Fig. 20). Q angle is important in Sports Medicine and Kinematics as abnormal Q angle can result in anterior knee pain, patella subluxation and dislocation.

The study design involved the measurement of Q angle in 104 freshly obtained cadavers (64 males and 40 females) from centres in Port Harcourt and Nnewi in southern Nigeria, using an improvised goniometer.

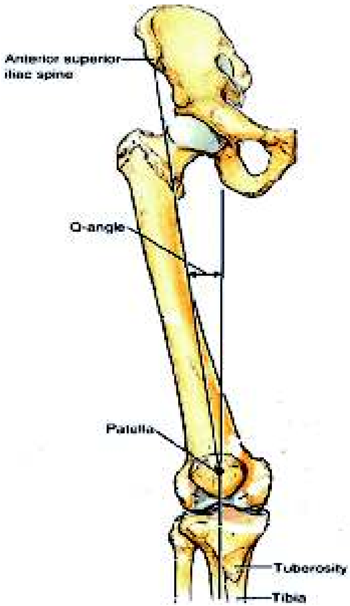


Fig. 20: Evaluation of the Q angle of the Patella

The values obtained for Nigerians were compared with those of Caucasians (Table 15):

Table 15: Comparison of Q - Angle for Both Lower Limbs in Nigerians and Caucasians

Reference Population	Q–Angle (L)	Q–Angle (R)	Authors
Adult Nigerians	12.17° ± 3.23	12.12°± 3.35	Didia, Fawehinmi and Dapper, 2002
Adult Caucasians	11.30°	10.00°	Messier, Dans, Curl and Lowery, 1991

We discovered that the mean values of Q angle were significantly higher in female limbs when compared to males (P<0.0.5). This can be attributed to the wider female pelvis and is consistent with previous studies. Bilateral asymmetry was observed in female cadavers with Q angle of the left limb being significantly higher than that of the right (P<0.05).We also found out that the mean values of Q angle obtained for Nigerians in our study were similar to, but marginally higher than that reported for Caucasians.

These values of Q angle as established for Nigerians will be of immense orthopaedic importance for the surgical evaluation, diagnosis and reconstruction of lower limb deformities such as coxa valga and coxa vara in Nigerians (Didia *et al.*,2002).

(c) Radiological Measurement of Orbital Dimensions in Adult Nigerians: An understanding of the anatomical structure, proportion, mechanical function and racial variations in orbital dimensions is vital to clinical assessment and can serve as a guiding principle in decision making during surgical interventions in patients with orbital pathologies and trauma. Although computed tomography (CT) scan has since been recognized as the best imaging technique for diagnosing orbital and ethmoidal fractures, Nigeria still relies heavily on plain radiographs as CT scan is not readily available and beyond the reach of many.

Fawehinmi and Ligha (2008), studied plain radiographs of 50 adult Nigerian skulls from centres in Port Harcourt. The measurements for height and width of the anterior orbital margins were taken from the postero-anterior (occipito – frontal) radiographs and that for depth from the standard lateral view. A range of 36 - 46mm, 34-45mm and 24-33mm were obtained for height, width and depth respectively. These dimensions revealed the existence of distinct racial and ethnic anatomical variations in the ocular anatomy. Standard measurements for Caucasians have been given as 40 mm, 35 mm and 40 to 50 mm for height, width and depth respectively. Our result correlates with other studies that have ascribed higher values in orbital dimensions to Caucasoid in comparison to Negroid. This variation is attributed to the various constitutional, genetic and geographical factors affecting the regions (Golalipour *et al.,* 2003). Studies of this nature became imperative to enable Nigerians and Africans define normative values in line with our biological and physical profile as against those of other races.

(d) Radiological Determination of Ischiopubic Indices of the South-South and Middle Belt Nigerian Populations: In 2010, Oladipo, Fawehinmi and Okoh evaluated the ischiopubic indices of South-South and Middle Belt Nigerians using radiological methods. The study involved the examination of antero-posterior radiographs of 120 adult pelvises, aged between 18 to 65 years. 70 of the radiographs (30 males and 40 females) were those of South-South people while 50 (20 males and 30 females) were of Middle Belt people of Nigeria. The morphological measurements were pubic length and ischial length. 3 measurable points were determined on the radiographs: Point A was the acetabular point where the three pelvic bones meet. Points B and C were the ischial tuberosity and pubic tubercle respectively. The ischiopubic index was calculated by dividing AC by AB and multiplying the resultant fraction by 100.

The mean pubic length was significantly higher in males in the two Nigerian populations (P<0.05). The mean ischiopubic index was significantly higher in females than in males (P<0.05) with South-South females showing higher values than Middle Belt females and Middle Belt males showing higher values than South-South males. The differences between the two populations were however not significant. Using the radiographs, sex could be assigned to 83.5% of South-South males and 97.5% of South-South females while sex could be assigned to 87.6% of Middle Belt males and 98% of Middle Belt females. These Nigerian values differed from that of most populations of the world from previous studies. Therefore, the accurate determination of ischiopubic index is important for ethnicity specific obstetric evaluation of the pelvis and in Forensic Anthropology for the determination of sex and race.

Mr. Vice Chancellor what this means is that a modern day Tailor and Surgeon would have to take the anthropometric variables of specific ethnic populations into consideration when planning clothe design or treatment procedure in these people and in evaluating their outcomes.

PROPORTIONALITY AND PHOTOGRAMMETRY:

Proportional Index Relationship is a fairly recent concept in Anatomy and Forensic/Prediction Anthropometry that tries to relate different body parts as fraction of the other. **The golden proportion** results from the division of a straight line in such a way that, that part is to the longer part as the longer part is to the whole. Linear progressions and surface division by the same number are common in nature both geometrically and arithmetically. The ideal facial proportions are universal regardless of race, sex and are based on the phi ratio of 1:1.618 (facial proportions and health.html). The mandibular height is related to the maxillary height as: 1.000:0.618. The orofacial height is related to the nasal height as 1.618: 1.000. Farkas *et al.* (1996), have revealed that the key to restoration of facial harmony is the renewal of the uniformity of proportional index qualities by elimination disharmonies and/or disproportionate relationships.

We reported for the first time Proportional Index Ratios of various craniofacial measurements in sickle cell anaemia (SCA) children using precise landmarks and descriptive schemes (Table 16). This Proportional Index Ratio which also guided the reconstruction of the sickle cell facie will be of immense benefit in making a spot diagnosis in these children and find wide application in maxillofacial and dental surgical evaluation in reducing facial disharmony in these patients.

Table 16: Proportional Index Relationship of Different Craniofacial Parameters in SCA and Normal Growing Children (NGC)

Mean Craniofacial Parameter (cm)	SCA	NGC
Head Length:Subnasale-Gnathion Distance	2.90 : 1.00	2.89 : 1.00
Head Length:Nasal Length	4.18 : 1.00	4.35 : 1.00
Nasal Length:Subnasal-Gnathion Distance	1.44 : 1.00	1.50 : 1.00
Head Breadth:Nasal Breadth	3.93 : 1.00	4.00 : 1.00
Head Breadth:Medial Canthal Distance	4.08 : 1.00	4.40 : 1.00
Lateral Canthal Distance:Nasal Breadth	2.64 : 1.00	2.58 : 1.00

The Second to Fourth Digit Ratio (2D:4D) is the ratio of the length of the index finger as measured from the bottom crease to the top of the finger to the ratio of the length of the ring finger. 2D:4D is lower in men than women with women generally having a ratio of about 1.0. Reports have shown racial variation in the 2D:4D and the variation have been said to be related to latitude, such that more northerly populations have higher digit ratio. There is correlation between digit ratio and some traits such as autism, physical aggression, sporting and musical ability and sexual orientation. A low 2D:4D has been associated with high testosterone level, particularly prenatal concentrations which is characteristic of males (Manning *et al.*, 2004).

Oladipo *et al.* (2009), investigated the 2D:4D of Igbos and Yorubas of Nigeria for tribal or sexual differences. 2D:4D was measured from 210 randomly selected teenagers of each sex from each tribe using a digital Venier calliper and data analysed with the z-test. Result showed 2D:4D to be sexually dimorphic in both tribes. Males demonstrated lower digit ratios with 0.96 on the right hand and 0.94 on the left hand for both tribes. Females had 0.97 on the right hand and 0.95 on the left hand. The differences observed between males and females of both tribes were statistically significant ($p<0.05$). However, no significant difference was observed between the two ethnic groups ($p<0.05$). Thus, digit ratio amongst Yorubas and Igbos is sexually dimorphic and may not necessarily be affected by tribe and ethnicity. This agrees with a previous report for Igbo and Urhobo (Oladipo *et al.*, 2006). Its racial variation is more related to latitude as suggested by various researchers.

Photogrammetry:

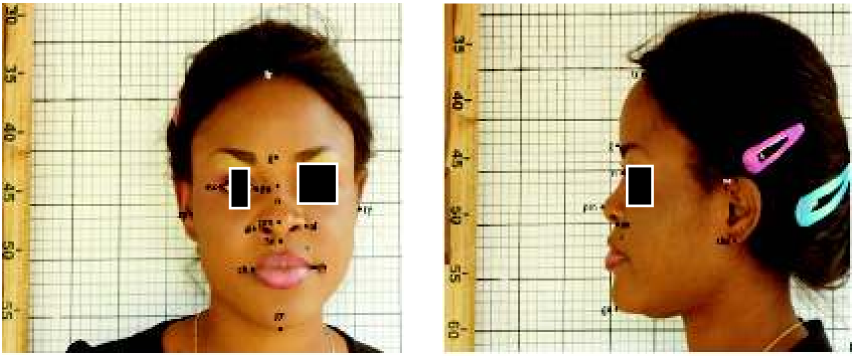
The most common means of surgical and forensic facial comparison is by photographic identification. Photography has been used as an excellent and convenient anthropometric tool for facial analysis and to compare pre and post-operative outcome in facial plastic surgery. There are several methods used for facial analysis. These include manual anthropometry, cephalometric radiography, 2D photogrammetry and 3D stereophotogrammetry. The obvious drawback of 3D Surface Digital Stereophotogrammetric technology is the high cost of equipment, complex procedure and high level of expertise, which put it out of the reach to many researchers in developing countries. All the methods have comparable accuracy in producing results.

Methods currently employed include the photogrammetric approach, which entails the comparative measurements from facial images, anthroscopy (qualitative examination of facial features) and image superimposition. In 2D Digital Photogrammetry, image acquisition is relatively simple, equipment is cheap and a very high level of technical expertise may not be needed. The photogrammetric approach typically involves 2 sets of 3 or more near parallel lines drawn through defined facial features on the offender image e.g. the jaw line, the pupils, the nasal bridge. These are compared with similar set on the suspect image. An assumption is made that the two 2–D images are taken effectively from the same pose angle. The two sets are compared for congruence in shape and proportionality in order to establish a match or exclusion (Evison and Vorder -Bruegge, 2008).

Studies have been carried out using anthropometric data in the form of Farkas' proportion indices to quantify facial attractiveness and to relate measured change through surgery to clinical judgement, using photographic techniques. The least attractive faces subsequently showed the most improvement through treatment suggesting that individuals who are relatively more attractive ab initio, have less to gain from treatment. Where the patients are at the extreme ends of the range of attractiveness, more clinical assessors agreed with each other regarding their attractiveness than those at the middle. There was a strong correlation between proportion index changes and clinical assessment of improvement through surgery, encouraging the use of proportion indices in the objective quantification of facial attractiveness (www.EurJof Orth.html).

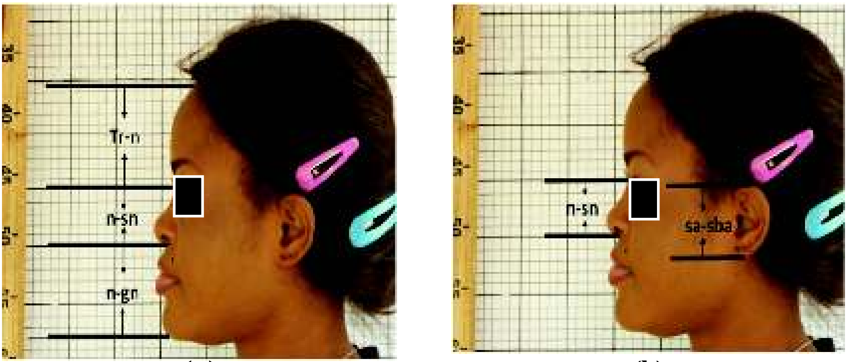
Aesthetic Facial Analysis: A Need for Trans – Cultural Basis: All over the world, there is an increase demand for aesthetic enhancement of the face as it provides identity for individuals. The face plays a major role in the physical appearance of a person and therefore, facial defects have marked consequences on social acceptance (Oghenemavwe *et al.,* 2011). Surgical treatment to enhance, attain or preserve optimal attractiveness of the face is based on thorough facial analysis. Greek philosophers and the renaissance artists formulated a template known as **aesthetic neoclassical facial canons** used for analysis of the face prior to aesthetic procedure in the 5th century. The evaluations of aesthetic neoclassical facial canons have been carried out amongst Caucasians (Farkas *et al.*, 1985), African - Americans (Porter and Olson, 2001).

In literature, studies of these canons in African populations are difficult to come by, necessitating the study by Oghenemavwe, Fawehinmi and Dapper in 2011. The study evaluated the facial neoclassical canons and its validity as the template for modern day facial analysis in Nigerian women. 431 Nigerian women (NW) volunteered for the study. They were between 18 and 35 years of age to minimize the effect of aging on facial dimensions. Inclusion criteria included a pleasing facial profile as judged by 3 authors. Standard anterior and lateral view photograph of the face were obtained with a digital camera in the Natural Head Position (NHP) (Lumdrom *et al.*,1998). Photographic records were analyzed using computer aided facial analysis programme from 13 anatomical landmarks (Photoplates 21 – 25). Neoclassical facial cannons were evaluated from the following parameters and proportions:



(a) (b)

Photoplate 21: Frontal (a) and lateral (b) View Photos of Soft Tissue Landmarks Used in Facial Analysis: trichion (tr), glabella (g), nasion (n), endocanthion (en), exocanthion (ex), pronasale (Prn), subnasale (sn), zygion (zy), cheillion (ch), alare (al), superaurale (sa), subaurale (sb).

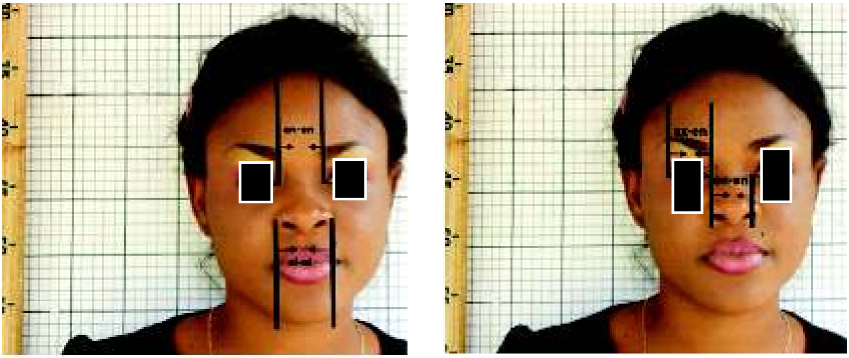


(a) (b)

Photoplate 22:Canon 1 (a): 3 Section Facial Profile (tr-n=n-sn=sn-gn) and Canon 2 (b): NasoauralProportion (n-sn=sa-sba)

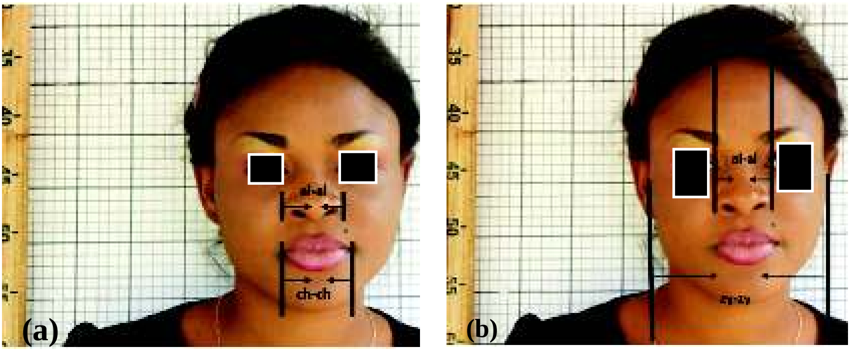
Of the seven neoclassical canons, the orbitonasal canon was found to be the most proportional for subjects (17.5%), followed by the orbital (3%), nasoaural (2.5%) and naso-oral (0.5%) canons.

In our study, the traditional template for horizontal and vertical proportions was a poor guide to facial analysis in Nigerian Women. The case is the same for other populations of women (Porter and Olson, 2001). However, the degree of compliance amongst Caucasian is higher (Farkas *et al.*, 1985). There are inherent problems associated with this outdated artists' impression to modern facial analysis and surgery.

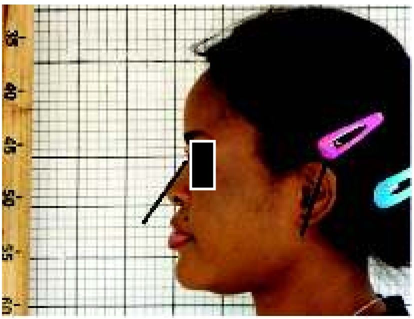


(a) (b)

Photoplate 23: Canon 3 (a): Orbitonasal proportion (en-en=al-al) and Canon 4 (b): Orbital proportion[ex-en=en-en]



Photoplate 24: Canon 5 (a): Naso-oral [ch-ch=1.5(al-al)] and Canon 6 (b): Naso - zygoma[al-al= 0.25(zy-zy)]



Photoplate 25: Canon 7: Nasoaural inclination (nasal bridge inclination - ear inclination)

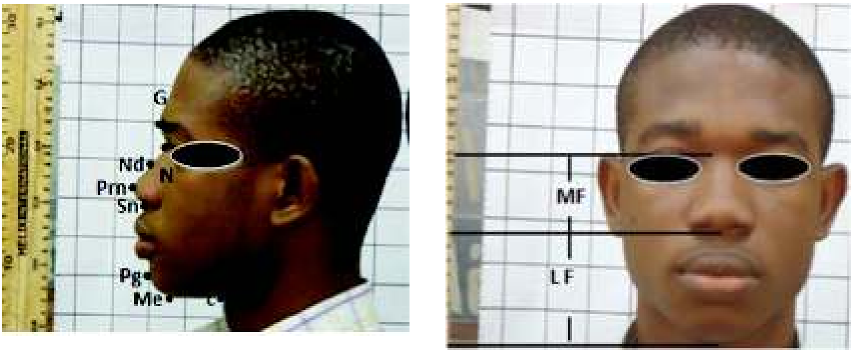
The subjects used to formulate the neoclassical paradigm were exclusively 'Whites'. This fails to represent the heterogeneity of races and ethnic groups. In many parts of the world interracial marriages are creating original and distinct ethnic identities and facial appearances.

There is craniofacial diversity with respect to facial parameters across various populations. This disparity in facial features amongst the different populations will obviously create proportions that are unique to them.

Therefore, any given set of ideal facial proportion must take into consideration people from different geographical populations. The racial differences revealed by this study were expected. Using the canon as a standard for beauty, the perception is that Nigerian Women have wide nose to mouth and wide nose to interocular distance disproportion. Nigerian women do not fit the neoclassical facial cannons.

Photogrammetric Analysis of Soft Tissue Profile of the Face of Igbos: The understanding of soft tissues of the face in relation to the underlying dentoskeletal tissues is an essential guide in aesthetic treatment plan. We have established that a single facial aesthetic template is not appropriate for application to the diverse races and ethnic populations, as facial traits are largely influenced by factors such as race, ethnicity, age, sex, culture, etc. Various methods such as anthropometry and photogrammetry have been used to study soft tissue norms in different populations. Soft tissue profile standards using photogrammetry have been reported for certain populations. In literature, several studies have been carried out to determine facial traits of African tribes. Most of these studies focused on facial dimensions rather than soft tissue analysis.

Therefore, we initiated studies on the soft tissues of the face in different ethnic groups to establish anthropometric data for the populations. Oghenemavwe *et al.* (2011), quantified the average parameters that define the facial soft tissue norms for young Igbo adults in Port Harcourt by means of standardized photogrammetric methods. Inclusion criteria are as for those required for facial analysis. Standard photographic records of the lateral and front view of the face of 100 male and 100 female subjects were taken in the Natural Head Position (NHP) by adjusting the photographic set up. Statistical analysis (using the Z score) showed significant gender differences for all parameters ($p<0.05$). The nasofrontal and nasomental angles were wider in the females. The greatest variability was found for the nasofrontal angle (Photoplates 26 – 28). Data published from this study could have potential use in facial plastic surgery and orthodontics.



(a) **(b)**

Photoplate 26: Soft Tissue Landmarks (a): glabella (G), nasion (N), nasal dorsum (Nd), pronasale (Prn), subnasale, pogonion (Pg), mention (Me) cervical point © and (b) Vertical Measurements: middle face height (ML), lower face height (LF)

(a) **(b)**

Photoplate 27: Measurement of Nasofrontal (a) and Nasofacial (b) angles

(a) **(b)**

Photoplate 28: Measurement of Nasomental (a) and Mentocervical (b) angles

Table 17: Comparison of Vertical and Angular Measurements in Different Populations

Author/Date	Population	MF (%)	LF (%)	NFR (º)	NFA (º)	NM (º)	MC (º)
Oghenemavwe *et al.*, 2011	Igbo: M F	41.85±0.03 43.03±0.03	58.15±0.03 56.97±0.03	130.00±8.84 134.29±9.18	39.92±4.72 38.06±5.22	112.99±8.91 117.25±8.24	91.92±2.25 90.37±1.28
Oghenemavwe *et al.*, (2010)	Urhobo: M F	42.27±3.17 43.51±3.67	57.73±57 56.49±3.69	121.75±9.07 127.85±8.50	40.77±6.29 35.60±7.46	121.95±7.93 126.55±6.93	93.33±3.27 90.88±3.58
Fernandez-Riveiro *et al*. (2003)		138.57(M) 141.98(F)					
Anic-Milosevic *et al.*, (2008)	Croatians	139.11(F) 136.38(M)					
Jain *et al.*, (2004)	Himachalis	44.63	55.37	134	33.26	128	99.88
Epker (1992)	Caucasians	130					
Powell and Humphreys (1984)	North American Caucasians	47	53	122.5	35	126	87.5
Farkas (1981)	Caucasians	53-56					

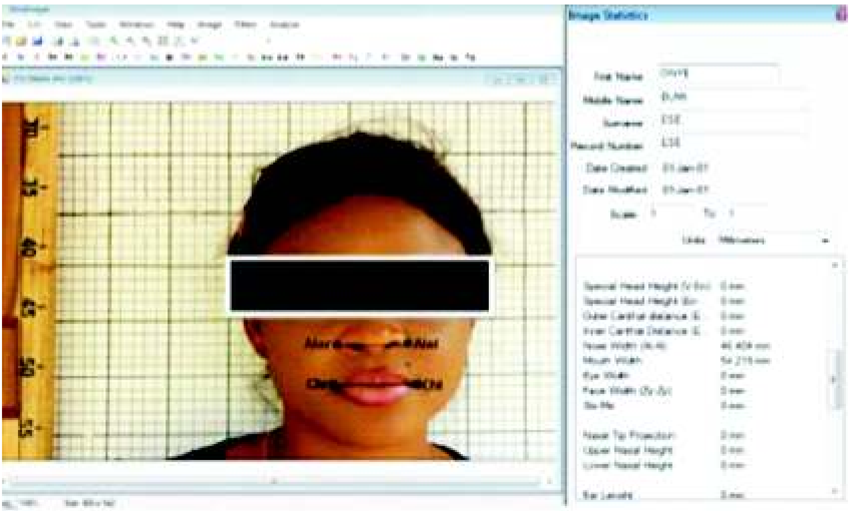
From this study, the lower face proportion was higher than the middle. A previous study has shown a lower face of 53% for very attractive and 54% for attractive females (Farkas and Kolar, 1987). The lower face proportion obtained in this study and that of Powell and Humphreys (1984) contradict the assertion by Farkas (1981) that the normal range for lower face is 53 to 56%. The middle and lower face are extremely important in surgical orthodontic diagnosis and treatment planning. Decrease in the lower face is found in vertical maxillary deficiency like sickle cell anaemia and deep bite mandibular retrusion. The ultimate compensators of facial contour are soft tissues.

Extensive evaluation of angular relationship are essential in soft tissues profiling as not all facial traits directly follow the underlying dentoskeletal profile (Subtenly, 1959). The nasofrontal, nasofacial and nasomental angles were formulated by Powell and Humphreys (1984) to show the relationship between the nose and the face. Currently these parameters dominate facial plastic surgery literature. The nasofrontal angle in our study is lower than those reported for most Caucasians. The reason for the lower value may be due to prominent glabella. The relationship of the nose with the facial plane is of aesthetic importance. Values for North American Caucasians and Himachalis population are low when compared to the subjects of our study. The higher nasofacial angle in this study suggests that the projection of the nose in the Igbos is more than those of the Himachalis and North American population. Less prominent glabella results in higher mentocervical and nasofrontal angles. This study in the Igbos has shown that, as in most other populations the vertical and angular variables of tissue profile are sexually dimorphic (Table 17).

Because of racial and ethnic differences in facial structure, it is imperative to establish norms for different races and ethnic groups. Hitherto, the 'European ideal facial proportion' dominated the international scene as the standard for beauty. But the perception of an attractive face is largely subjective with ethnicity, age, culture, gender and personality influencing average facial trait. The implication is that a beautiful face in the Nigerian context may not be so in the European context. This lends credence to the view that a single aesthetic concept is too simplistic to apply to diverse ethnic groups. Rather, several guides sensitive to the differences in facial features across different culture is necessary, and bolsters the need for the development of a Software Tool for Facial Analysis for Nigerians - 'Same Surgeon for different people'.

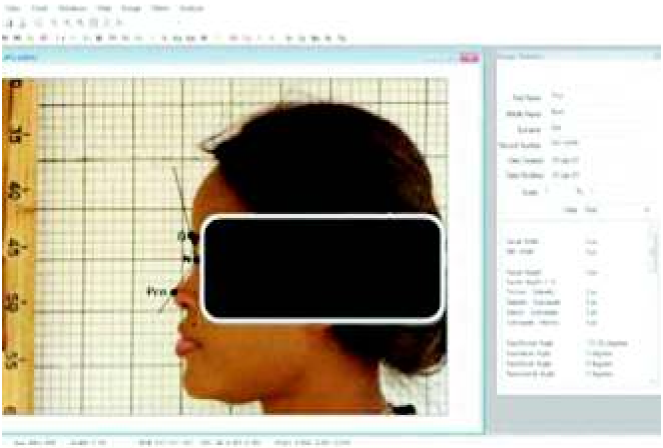
Development of Software Tool for Facial Analysis: An accurate and thorough facial analysis is needed for the formulation of treatment plan in rhinoplastic, dental and aesthetic surgical procedures. Oghenemavwe, Fawehinmi and Daewin (2012) designed a software tool to simplify the analysis of facial parameters. Facial analysis is the term used to describe detailed examination of facial features using standard anatomical landmarks. It gives the dimension and spatial correspondence between definable points of the face. We introduced software designed for 2D photogrammetry which can be conveniently used in clinical and research settings in urban and rural areas. The method involves direct capturing of 2D photographic images of the face taken from a digital camera under illumination and analyzing the facial parameters with the aid of standard anatomical landmarks. The results generated are in a suitable format that can be exported to spread sheet and databases. The photographic set-up should be made for capture in the Natural Head Position (NHP). Images from any digital camera can be evaluated with this tool, with a minimum resolution of 640×480 pixel. Photographic images produced by higher resolution can be resized using any picture tool such as Microsoft office picture manager, Picasa etc.

Installation and set-up of software tool: The software is compatible with Window 7, Vista and XP Microsoft Soft Window versions and it can be installed from the set-upfile. After installation, the "pro-image" icon will appear in the programme area. On clicking on the "pro-image" icon, the work page will appear on the screen. The page will display a blank sheet where the image to be analyzed can be uploaded with an image statistics sheet where the data of the image will be displayed. The software tool can analyze photographic images of the front and side views. To measure **linear dimensions**, it is imperative that real life size is obtained. This is done by clicking on the icon "analyse"and then on "facial width". The values obtained will be shown on the image statistics sheet in the icon tagged "facial width". To measure these dimensions, click on the icons representing each of the anatomical parameters that serves as landmarks and placed them correctly on the appropriate position on the photograph. The value will automatically appear on the image statistics sheet (Photoplate 29).The procedure is simple and measurements can be made in pixel, centimeter, millimeter and inches.



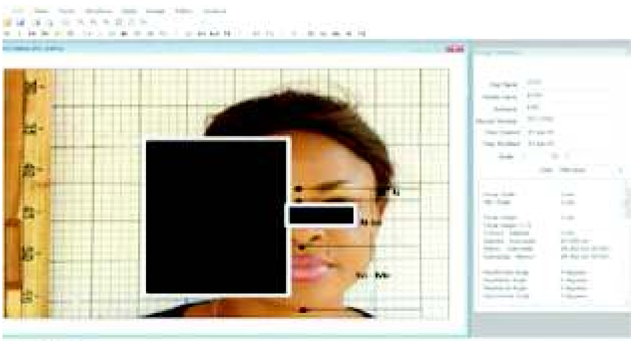
Photoplate 29: Linear Measurements: Nose and Mouth Widths

Measurements of **angular parameters** is usually from up loaded lateral view images, then clicking on the icon that represent the anatomical landmark after placing correctly on the appropriate position in the photograph. The value for the angle will automatically appear on the image statistics sheet (Photoplate 30).



Photoplate 30: Angular measurements: Nasofrontal angle

Measurement of middle and lower face height ratios is similar to that of linear measurements. As the middle and lower face heights are measured, the ratio of the middle to lower face height expressed in percentage will automatically be displayed on the image statistics sheet (Photoplate 31).



Photoplate 31: Ratio Measurements: Lower and upper face ratios

The software is capable of depicting and quantifying craniofacial dimensions and facial soft tissue profile at an increased speed and accuracy. Accuracy of the tool was tested by comparative manual analysis which showed an accuracy of up to 0.1 degree for angular measurements and 0.1 mm for linear measurements. Use of technology for objective assessments of face are becoming increasingly important for research in dysmorphology, genetics, orthodontics, surgical disciplines even in developing countries (Oghenemavwe *et al.,* 2012). The equipment is simple and inexpensive with minimal invasiveness, quick capture speed for data acquisition, ability to archive images for subsequent analyses and a high degree of precision and accuracy. This innovative technique won the 3rd prize at the 5th National Universities Research and Development Fair which held at the Federal University of Technology, Minna in 2012.

FORENSIC ANTHROPOMETRY:

Mr. Vice Chancellor let us return to Genesis. The Lord said to Cain: *"Where is your brother Abel?" He said, "I do not know; am I my brother's keeper?" And the Lord said "What have you done? Listen; your brother's blood is crying out to me from the ground!"- Genesis 4: 9 – 10.* We felt edified to heed to the call of God by using our values to resolve Cain's denial.

Forensic Anthropology is the application of the science of physical anthropology and human osteology in the analysis and identification of human remains to aid medico - legal examination. A forensic analysis assesses the biometric profile such as age, sex , stature, ancestry, and racial classification of the individual as corroborative evidence, as well as determine if the individual was affected by accidental or violent trauma or disease prior to or at the time of death. Forensic anthropologists frequently works on a team with other specialists in physical evidence such as forensic pathologists, finger print experts, odontologists, and homicide investigators on multiple remains of victims of terrorist attacks, mass executions or casualties, to identify the deceased, discover evidence of trauma and determine the post-mortem interval (Behrensmeyer *et al.,*2000). Though they typically lack the legal authority to declare the official cause of death, which is the job of forensic pathologists, their opinions are taken into consideration by the medical examiner. They may also testify in court as expert witnesses.

Forensic Anthropometry is the branch of applied physical anthropology that uses biometric techniques in the identification of human remains with a view to resolving medico – legal problems. Forensic Anthropometrists are familiar with the range and causes of biological variability present in human populations. Anthropometric data are objective and allow the forensic examiners go beyond subjective assessments in the quantification of the degree of similarity or differences and to state how much confidence can be placed in this interpretation. Forensic Anthropometry is based on three fundamental principles (Krishan, 2013):

1. The fixed condition of the skeletal system from the age of 20 years till death.
2. The diversity of dimensions present in the skeleton of 'different people'.
3. The relative ease and precision with which certain dimensions of the bony structure of living persons can be measured using simply constructed callipers.

Faced with unfamiliar human skeletal material, the coroner must use teeth and bones to estimate age, identify sex and racial or ethnic features, estimate height and weight or build and identify other individualizing characteristics such as amputation and bone pathologies. Repetitive activities, muscular development, left or right-handedness all leave their mark on bone, as do disease and trauma.

Human vs. Nonhuman Remains: Human bones can be distinguished from nonhuman primarily based on size and structure. Human subadult bones are easily distinguished based on their maturity i.e. non-fusion of the epiphyseal plates.

Forensic Value to Coroner: The preservation of the remains, presence of natural or artificial modifications to teeth and skeleton, manner of interment, Archeological goods such as pottery, stone tools and clothing and other items found with remains will be of forensic value to the coroner.

Minimum Number of Individuals: Can be determined by examining remains for duplication of elements. When not duplicated, differences in size, age and structure can be used. In some cases, DNA analysis may be required.

Postmortem Interval: Is most difficult but useful in homicide and to narrow the pool for positive identification. It is dependent on a wide variety of factors which influence the process of decomposition such as temperature, weight of deceased, depth of burial. Each case must be examined for the state of soft tissue preservation bearing in mind that the rate of skeletonization depends on the environment.

Race/Ancestry, Age, Sex and Height: Have been considered the 'Big Four' of Forensic Anthropology. Their determination is intertwined. Sex, race and height determination are more problematic in children before the onset of puberty. Attribution of race is difficult but anthropologists attempt this primarily from biological markers of cranium, especially analysis of facial morphology. Methods for determination of age are the same for all ethnic populations and can easily be accomplished by a Radiologic Anatomist. Features of sexual dimorphism and stature estimation are however subject to much ethnic variation globally, lending credence to the saying that there are 'different coroners for the same people'.

(a) Age Determination: The most appropriate specific age determination technique depends on age. For relatively young individuals (< 16yrs) dental formation and eruption of deciduous and permanent dentition are the most accurate (Fig. 21). Because the fusion of epiphysis with diaphysis occurs at regular times in different bones the age of an individual can be determined by this (Fig. 22). For fetuses, radiological measurement of the bi – parietal diameter provides good age estimates. In evaluating a full adult skeleton in which all teeth are erupted and all epiphyses are united, there is the need to look at degenerative changes such as arthritis and osteoporosis in other parts of the skeleton. Age determination in adults is more problematic but can be done by examining morphological traits of specific phases of age-related changes of pubic symphyseal face, sternal ends of the right 3 to 5 ribs, auricular surface of ilium and cranial suture closure.

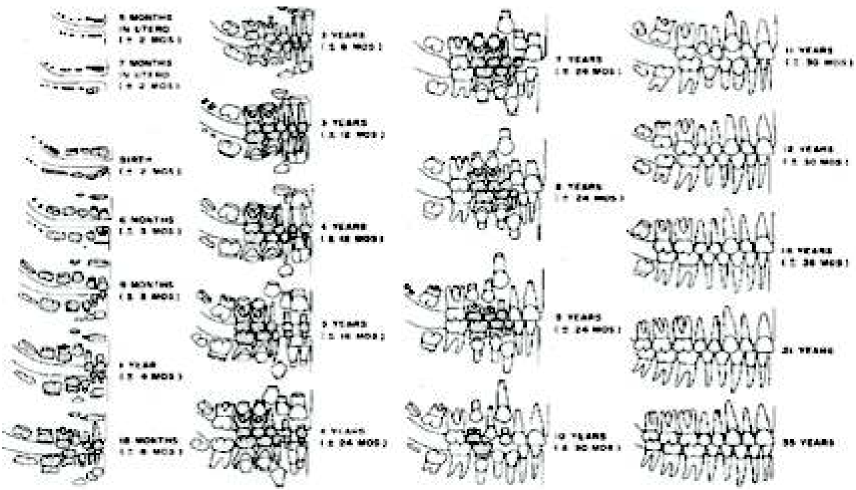


Fig. 21: Determination of Age Using Dental Chart (Source: Higgins (Ubelaker, 1985)

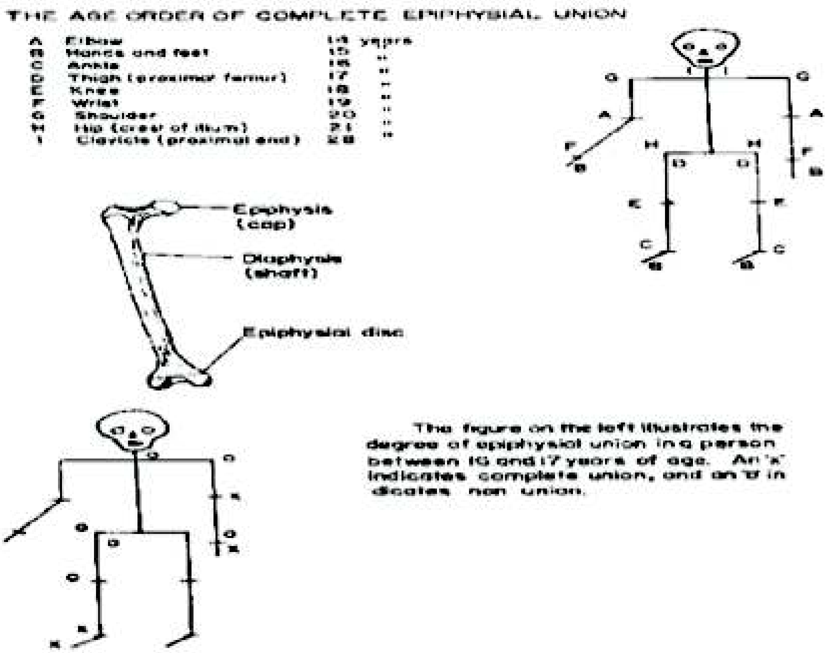


Fig. 22: Determination of Age Using Bone Fusion(Source: Higgins, 1985)

(b) Sex Determination: Worldwide anthropometry is being used more often in sexing skeletal remains as it eliminates approximately 50% of the population from further consideration in cases of missing persons. Studies on sexual dimorphism are based on three primary biological differences between males and females: size, body proportions and architectural differences. Males are generally bigger and have more muscle mass with heavier axial skeleton by about 8%. Sex determination is best accomplished by examination of the pelvis (90-95% accuracy), skull (80-90%) and long bone (80%) morphology. Female pelvis is wider with classic differences in the shape of the pelvic outlet, sub-pubic angle and greater sciatic notch (Fig. 23).

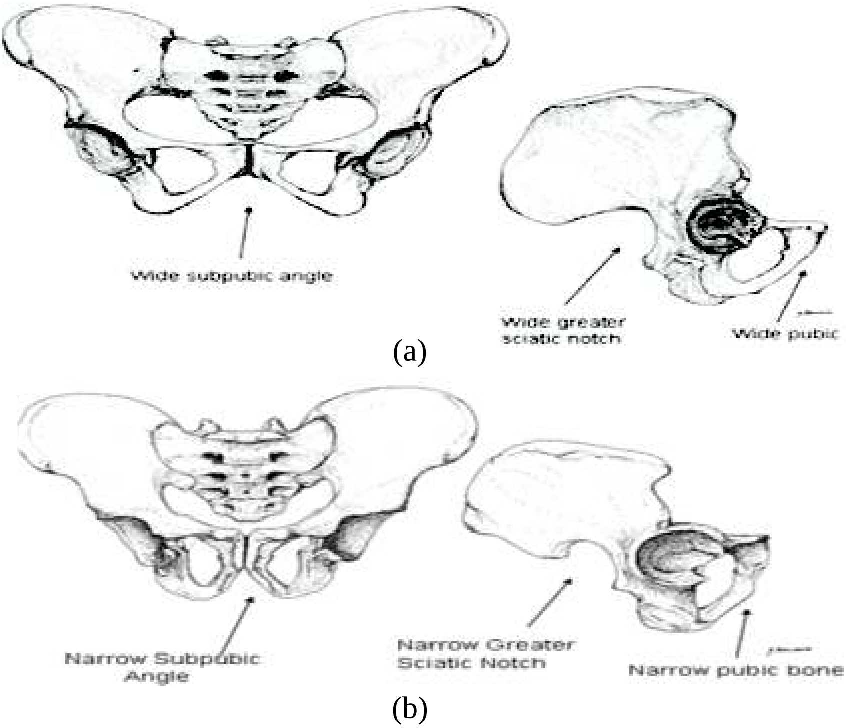


Fig. 23: Comparison between Male (a) and Female (b) Pelvis
(Source: Behrensmeyer *et al.*, 2000)

Accurate determination of sex from the human skull is of great importance to Osteologists and Forensic Anthropologists as it is critical to individual identification. The skull is probably the most studied bone in the context of sex assessment, with levels of reliability of 92% using the skull alone, 98% when combining the pelvis and skull and 100% when the entire skeleton is present (Fig. 24).

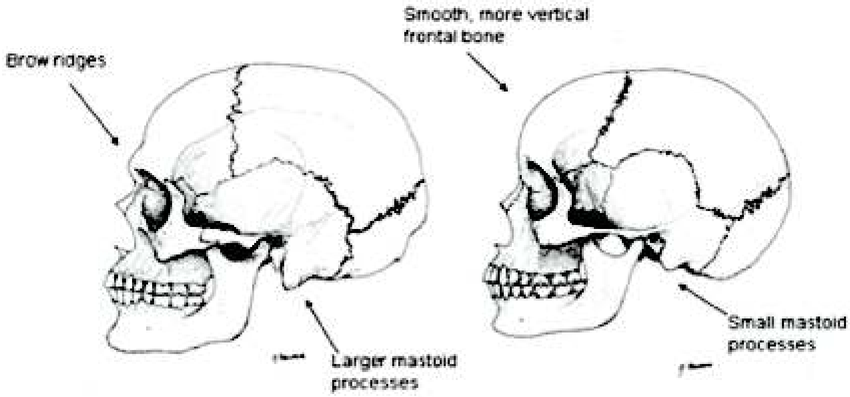


Fig. 24: Comparison between Male (a) and Female (b) Skulls (Source: Behrensmeyer *et al.,* 2000)

Even though several postcranial elements have recently proved to be more effective sex predictors, the skull remains among the most dimorphic parts of the skeleton (St. Hoymes and Iscan, 1989).

Determination of Sex Using the IOA Triangle in Nigerian Skulls: In cases where the pelvic bones are absent as in some ritual killings, when the facial features of the skull are missing or the mastoid process size has been affected by certain cultural practices, such as women carrying load on their heads, some authors have developed methods of sex determination using other bones of the cranium. Saavedra de Paiva and Segre (2003) introduced an easy technique for sex determination using the temporal bone. Some earlier studies the follow this approach include those on Europeans, Americans, South Africans, Japanese and Chinese. Despite much research on sex prediction using craniofacial characteristics worldwide, information on such parameters is sparse for Nigerians.

Orish, Didia and Fawehinmi (2014) devised a method of sex determination using the Inion – Opistocranium - Asterion (IOA) Triangle in Nigerian Skulls. 100 adult dry skulls (78 males; 22 females) from Departments of Anatomy in Nigerian Universities were measured with an Automatic Digital Calliper. Coefficient of variation, correlation, linear regression, percentiles, and sexual dimorphism ratio were computed from the IOA triangle measurements and the IOA triangle area was compared between sexes. Data were anaylzed with Graph Pad Prism5.03.

The male parameters were significantly ($P < 0.05$) higher than that of female. The mean total area of IOA triangle for males was 1938.88mm^2 and 1305.68mm^2 for females. ***Inion*** is the most prominent point on the posterior aspect of the occipital calvarium, at the intersection of the left and right superior nuchal lines. ***Opistocranium*** is the most posteriorly protruding point on the back of the skull, located in the midsagittal plane. ***Asterion*** is the meeting point of the lambdoid, occipitomastoid, and parietomastoid sutures. The union of these points determines the IOA triangle (Fig. 25).

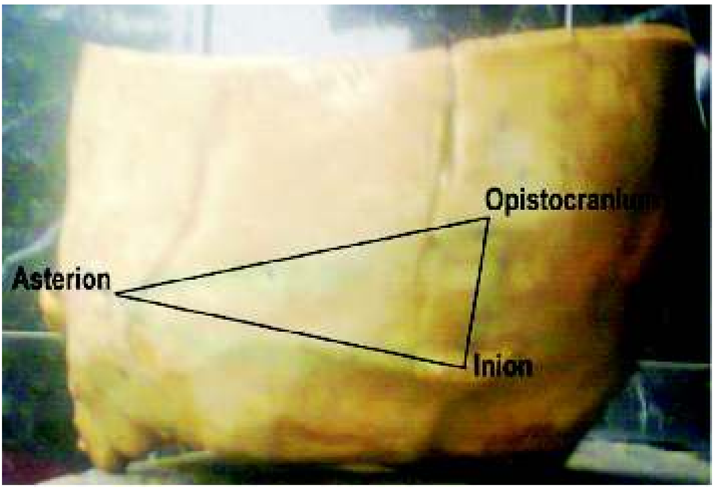


Fig. 25: Area Demarcated by Triangle with Skull in Norma Occipitalis

In this study, the mean male-female ratio for thelinear measurements weregreater than unity, indicating that the male crania were largerin all dimensions.

Sexual dimorphism ratios had the inion–opisthocranion as the highest (1.34), while inion – asterion was the least (1.09) and opisthocranion-asterion was 1.15. Our result on IOA triangle, agree with the findings of Saavedra de Paiva and Segre (2003) and Suazo *et al.,* (2008) on the mastoid triangle of Caucasians skulls. Using Heron's report, the sexual dimorphism ratios calculated for Sudanese population by Ahmed *et al.* (2011), showed similar relationships as our study with a ratio greater than unity.

Table 18: IOA Index of Male and Female Nigerian Skulls (%)

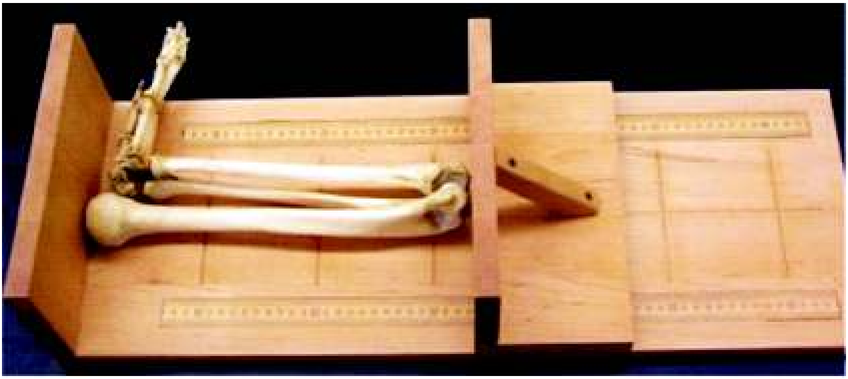
Sex	Left IOA Index	Right IOA Index	Average IOA Index
Male	46.42	47.19	46.81
Female	37.40	38.87	38.14

Hitherto, information was scanty on the mathematical models of these craniometric parameters in the determination of sex. A positive regression coefficient indicated a positive relationship with fit line of the graph for all the parameters sloping upward for both male and female. The male IOA index was higher than that of female (Table 18).Taken together the Anthropometry of IOA triangle showed high level of sexual dimorphism and can be a guide in gender determination of unknown individuals by forensic experts including the Coroner.

Mr. Vice – Chancellor, we report for the first time sex determination technique using the IOA triangle. Thus, when the total area of the IOA triangle is higher than or equal to 1938.88mm^{2}the skull is diagnosed as male skull, and a value near to 1305.68mm^2 or less is indicative of a female skull.

(c) Determination of Stature: Estimation of maximum living stature from the skeleton is a routine part of the analysis of remains, but is not very precise and should not be used alone in establishing identity. Stature reconstruction becomes more important in sorting of commingled remains as in mass casualties. Stature is estimated using **regression formulae** from maximum long bone length, using the average length of each of the 6 long bones of the upper and lower limbs of both sides i.e. right and left. An Osteometric Board is used to obtain the precise measurements of long bones (Photoplate 32).

Weight is a function of stature. The result is a range of values based on the average standard error that will show if the minimum or maximum values are outliers. It should also be noted that the regression formula varies with sex and ethnic population.



Photoplate 32: Osteometric Board for Measurements of Length in Long Bones (Source: Higgins, 1985)

Stature is usually estimated by comparing the lengths of certain bones to tables of published data or by incorporating length into published regression formulae such as For Disc 2.0. **Potential stature** refers to the stature of an individual who has not undergone skeletal changes due to the aging process, while **living stature** refers to stature that has undergone degenerative changes associated with aging, resulting in decrease in stature. Most people who are 30years and older at the time of death would have undergone some degenerative changes.

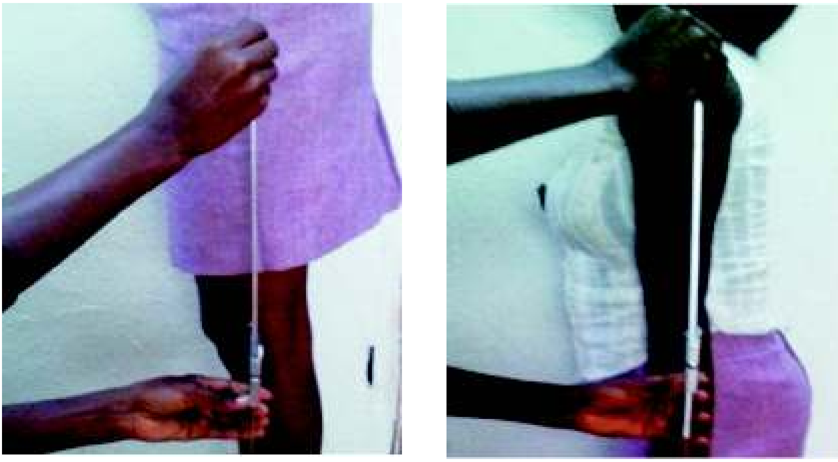
There are biologically and statistically significant variations between human populations in body proportions. In the recent past, a lot of workers have established stature formulae specific to their populations using whole length of limbs, fragmented bones, circumference of long bones and even length of vertebrae. Some authors have criticised the Trotter and Gleser stature regression equations (y = a + bx) as inappropriate for estimating the stature of certain modern populations due to secular allometric increases and concluded that the stature group specific formulae are more reliable for forensic cases (Didia *et al.*, 2009).

Bass (1994) has published regression formulae for stature estimation for the three major races using the length of the 3 long bones of the upper limb and the 3 long bones of the lower limb. These regression equations however predict height more accurately when applied to specific ethnic groups. Because of this, population specific equations have been developed (Fawehinmi *et al.,* 2014, Ilayperuma *et al.,* 2010). But o**ur continuous search for literature** did not reveal much work on the use of long bone length for stature estimation in Nigerians. Didia and Nduka (2009) used the regression model to establish a formula specific for Nigerian males and females, from the length of the tibia bone. Our bid to provide more information to ameliorate this paucity in Nigeria led to studies on the femur and humerus - stature ratios and their use in the prediction of height for some major Ethnic groups in Nigeria.

Femur-Stature and Humerus-Stature Ratio in the Estimation of Height in Nigerians: Despite the anthropological and forensic importance of femur-stature ratio in our society, its values for Nigerians are few. Femur length bears a nearly constant relationship with stature in humans regardless of ethnicity or gender. An earlier study by Feldesman (1992), revealed that, the femur-stature ratio average 26.75% in adult human and the ratio was used to predict stature from femur length and yielded a remarkably accurate estimate. This fact is related to inter-populational differences in body proportions, which is a phenotypic trait mainly correlated with climatic parameters (Trotter and Gleser, 1958). Ibegbu *et al.,* (2013) studied association of hand length with height in Nigerian school children of Gbagyi tribe of Abuja and derived linear and a multiple linear regression equations for them from which height, age and hand length could be predicted if one factor is known.

Femur length is measured with the lower limb extended at the hip and the knee, from the lateral-most bony point at the hip joint (i.e. greater trochanter of femur) along the lateral side of the limb to the lateral-most extension of the knee (i.e. lateral condyle of the femur), at approximately the midpoint of the kneecap (patella) (Photoplate 33 (a). **Femur-stature ratio** is calculated as the length of the femur divided by stature and multiplying the resultant fraction by 100 i.e. 100 × Length of femur / height.

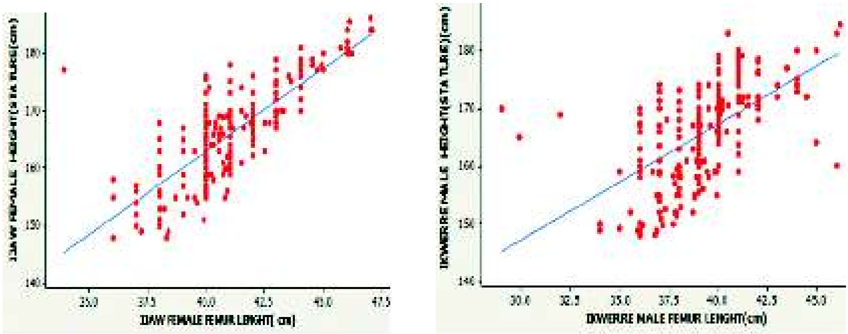
Humeral length is measured with the upper limb by the side of the trunk in the anatomical position. Measurements a re taken from the lateral-most bony point of the shoulder joint (i.e. greater tubercle of humerus) along the lateral side of the limb to the lateral-most bony extension of the elbow (i.e. lateral epicondyle of the humerus). **Humerus-stature ratio** is calculated as the length of the humerus divided by height and multiplying the resultant fraction by 100 i.e. 100 × Length of humerus / height.



(a) **(b)**

Photoplate 33: Measurement of Femoral (a) and Humeral Length (b) (Fawehinmi *et al.*, 2014)

Ogoun *et al.*, (2013) studied the average femur length and stature and femur - stature ratio of the Ijaw and the Ikwerre people of South – South Nigeria and determined relationships between these parameters in these ethnic groups. The study also sought to establish a formula for prediction of height from their femur lengths and determine possible sexual dimorphisms, ethnic or racial differences between them and other populations. The study was on 500 Ijaw and 500 Ikwerre people with equal numbers of both sexes, aged between 18 to 40 years. Correlation between their height and femur length and a regression analysis was carried out to predict their stature from their femur length (Fig. 26).Male values were significantly higher in all parameters measured for both groups ($p< 0.05$) and Ijaw values were significantly higher than Ikwerre values for all variables and in both sexes ($p < 0.05$).



(a) (b)

Figure 26: Pearson Correlation for Ijaw Females r= 0.793 (a) and (b) Ikwerre Males r= 0.578

In a recent study, Fawehinmi *et al.*, (2014) sought to determine height from the femoral and humeral lengths, and also gender and ethnic variations for two major Nigerian ethnic groups (Yoruba and Igbo). Measurements were taken from 300 Yoruba and 300 Igbo for both sexes, aged between 18 and 45 years. Their heights were measured using a standiometer, while their femoral and humeral lengths were taken using a sliding calliper as described by Fawehinmi *et al.* (2014), (Photoplate 33).

Results showed that males of both populations were significantly taller than the females ($p \leq 0.05$). Sexual dimorphism was also observed in the mean femoral and humeral lengths for both populations. However, Yoruba had higher femoral values than the Igbo, while the Igbo had longer arms than the Yoruba. There was a strong positive correlation between the femoral and humeral lengths with height for both populations. Regression equations for the estimation of stature in both sexes, using the femoral and humeral lengths were established for the two ethnic populations. When data of the two ethnic groups were compared, it showed ethnic variation and when compared with other populations from previous studies, it showed ethnic and racial differences.

The results of these studies and comparison with other populations are summarized in the tables below:

Table 19: Height and Femur Length of Some Ethnic Populations (cm)

Researcher/ Year	Ethnic Group	Mean Height		Mean Variable	
		Male	Female	Male	Female
				Mean Femur Length	
Bhavna, 2009	Shia Muslims, India	167.66 ±5.69	154.40±4.91	41.71±1.96	38.93±1.62
Ogoun *et al.*, 2013	Ijaw Ikwerre	175.12±7.76 164.50±8.13	166.30±8.29 156.40±7.20	46.72±2.82 39.50±2.20	40.90±2.34 37.80 ±2.81
Fawehinmi *et al.*, 2014	Yoruba Igbo	172.43±6.72 171.20±10.32	161.72±5.98 166.08±10.53	49.01±4.17 42.98±6.14	42.26±1.68 40.59±5.70
				Mean Humeral Length	
Fawehinmi *et al.*,2014	Yoruba Igbo	172.43±6.72 171.20±10.32	161.72±5.98 166.08±10.53	30.11±4.27 33.39±4.85	28.711±2.22 30.94±5.44
				Mean Ulna Length	
Ilayperuma *et al.*, 2010	Sri Lankans	170.14±5.22	157.55±5.75	27.56±1.30	25.11±1.24

Table 20: Linear Regression Equation for Estimation of Height (cm)

Researchers	Ethnic Group	Variable (cm)	Regression Equation	
			Male	Female
Ogoun *et al.*, 2013	Ikwerre	Femoral Length (FL)	Height = 87.2 + 2.00 FL	Height = 102 + 1.50FL
	Ijaw	Femoral Length (FL)	Height = 49.0 + 2.82 FL	Height = 47.5 + 2.89FL
Fawehinmi *et al.*, 2014	Yoruba	Femoral Length (FL)	Height = 141 + 0.65 FL	Height = 136 + 0.55FL
		Humeral Length (HL)	Height = 161 + 0.37 HL	Height = 124 + 1.33HL
	Igbo	Femoral Length (FL)	Height = 105 + 1.54 FL	Height = 98.00 + 1.68FL
		Humeral Length (HL)	Height = 107 + 1.94 HL	Height = 113 + 1.71HL
Ilayperuma *et al.*, 2010	Sri Lankans	Ulna Length (UL)	Height = 97.25 + 2.65 UL	Height = 68.73 + 3.54UL

Table 21: Mean Femur-Stature Ratio of Some Ethnic Populations

RESEARCHERS	ETHNIC GROUP	MALE	FEMALE
Fawehinmi *et al.*, 2014	Yoruba Igbo	28.43±2.21 24.99±2.30	28.61±2.36 24.34±2.10
Ogoun *et al.*, 2013	Ijaw Ikwerre	25.50 ± 0.72 23.60±0.99	24.60 ± 0.77 23.20 ± 0.92
Feldesman and Lundy (1988) Feldesman *et al.*,1990 Feldesman, 1992	All over the world	26.74 27.19±0.47 27.44	26.74 27.05±0.29 27.16

Our study is in line with previous studies that show a positive correlation between the height of the ethnic groups and the femur length as seen with the Pearson correlation ($p < 0.05$) (Fig. 26 and Table 19).Mean femur - stature ratios as determined by Feldesman (1990) without age, ethnicity and gender boundaries were significantly higher than the result of our studies (Table 21). Table 21 signifies that, an Indian man's measurement, if used for an Ikwerre man of the same height and body composition, it will produce a trouser too long for him - “different tailors for the same people”.

Discrete populations of humans present a diversity of body sizes and shapes. Environmental differences, differing levels of modernization and socioeconomic development between nations are an important source of variation in stature and body proportions. Our formulae comply with the general formulae by Trotter and Gleser (1958) and we therefore assert that when stature is to be reconstructed from long bones in these Nigerian ethnic populations our formulae should be applied. The values derived from this study will be of forensic, anthropological and clinical significance, especially when dealing with individuals from these ethnic populations. Further research should be carried out in other ethnic groups in Nigeria.

NEGROID GROSS ANATOMICAL MODELLING - The University of Port Harcourt Experience:

Mr. Vice Chancellor Sir, we felt that all these values we have derived through many years of research effort will be more meaningful when applied in the reconstruction of the standardized Negroid human. Anatomical Modelling is the production of three-dimensional representation of the human body using design from different materials. The concept was brought to the fore due to difficulty in obtaining and preserving cadavers and the attendant overcrowding in dissecting rooms, variations present in cadaveric specimen and the need to learn layout to recreate common surgical operations (Fawehinmi *et al.,* 2007).The methodology involved a collaborative research between Department of Anatomy and Fine Arts and Design of the University of Port Harcourt, using a combination of clinical and studio approach in the production of Negroid models of various body parts for students of the Health Sciences and Biology.

Transverse sections are drawn out to demonstrate the three-dimensional view of particular body parts, thereby enhancing the value of the model. We plan to produce improved models at commercial quantities that will be more affordable and available to meet the needs of our Universities and Health Institutions. This is in line with the National Universities Commission's (NUC) guideline on saleable research. These products have been exhibited at National Conferences and Research Exhibition Fairs in Nigeria and won the 3rd prize at the 4th National Universities Research and Development Fair which held at the University of Nigeria, Nsukka in 2011.

Anatomical modelling was given birth to in the 16th century as people sought better ways to understand the structure and function of the human body through tactile learning (Dale, 1986). Before X-rays in 1895, the only practical way of seeing inside the body was to observe an operation. Cultural and religious beliefs about dissection made the practice illegal and when eventually accepted cadavers could swiftly decay due to lack of refrigeration at that time. Two dimensional anatomical painting such as atlases and schematic drawings could only represent parts of the human body on a flat surface enabling the anterior and lateral views only (Keith and Arthur, 1999). Medical illustrations such as anatomical drawings by Frank Netter (1906-1991) detailed life-like renderings that became the benchmark by which lots of medical art is judged. These volumes covered human anatomy, embryology, physiology, pathology and pertinent clinical features of diseases arising from the systems.

Earliest known models were figures carved and fashioned by people of primitive societies e.g. fetishes. One of the oldest historical records of model-making dates back to the Egyptian culture of 400BC (Cabeceiras, 1982). Access was not given to use these models for medical purposes. Some of these models were placed in tombs to provide comfort for the spirit of the deceased. The first known human anatomical representation was a sculpture called **flayed man**, a statue in red wax measuring 61cm in height, so called because the body is shown without its skin and was produced in 1699 by Hodovico Cardi. Anatomical Models were designed using wax in the 16th century, but by the 20th century papier-mâché decorative and plastic models were created.

Interest in structure of human body was stimulated by the desire of medical profession to explain body dysfunctions. Physicians used anatomical models to convey information to their patients while protecting them from the realities of human body, as the medical encounter became more collaborative. In recent times Anatomical Models have found use in the study of Human Anatomy and they came in variety of forms that include:

1. **Non – Working Model:** Solid or static models with no moving parts (Hicks *et al*., 1970), like the manikins seen in boutiques.

2. **Partially Working Model:** Operation of only certain parts, such as life-sized model of an infant with inflatable lungs for cardiopulmonary resuscitation (CPR) (Meeks, 1956).

3. **Cross – Sectional Model:** This cut- away model provides a representation of the interior which would not ordinarily be visible. It shows internal structures and gives an idea of the parts, which make up the whole (http://www.anatomyresources.com).

Significance of Cadaver in the Study of Anatomy: The period of Renaissance characterized by a rebirth of science, ushered in the first recorded cadaveric dissection by William of Saliceto (1215-1280) at the University of Bologna. By 1300 human dissection had become an integral part of medical curriculum. Interest then was on techniques of dissection rather than to further knowledge of the human body. Ineffectiveness of embalming then became a persistent problem and made Anatomy Professors to lecture from throne-like chairs by distancing themselves from the cadavers.

Integration of cadaveric dissection into medical curriculum led to another developmental stage in the study of Anatomy: Knowledge of the internal structures of the body became greatly disclosed and appreciated, interest in the study of Anatomy expanded as work was being made easier through cadaveric dissection and Anatomy as a subject became more popular and flourished in several universities of the world. By 17^{th} and 18^{th} centuries Anatomy attained better acceptance. Exorbitantly priced tickets were sold for admission into dissection arena where elegantly robed anatomists were orators. Executed criminals were the cadaveric subjects.

Cadavers were preserved in Dissecting Halls and there was an upsurge in Medical Students enrolment. Gross inadequacy of cadavers in medical colleges led to overcrowding in dissection rooms with a ratio of over 30:1.Students who suffer from pulmonary lung diseases such as asthma or are allergic to cadaveric dissection due to the odour emanating from the orifices of the human body and from the preservation fluid (formalin). Cadavers are prone to deterioration and decay even after embalming and anatomical variations observed when dissecting or inspecting prosected specimens have severally rendered medical students confused. Often, the students ignore these variations or inadvertently damage them by attempting to produce conformity (Bergman *et al.*, 1988).

Intellectual Collaboration: Having in mind the racial variations that exist in human anthropometry, we commenced a purposeful search for an alternative method of teaching Gross Anatomy in our medical schools to complement the use of cadaver. Since patients we attend to in our hospitals are mostly Negroid, the search led to the development of the first Negroid Anatomical Models. The objectives were to:

1. Solve the major problems associated with the use of cadavers in the study of Human Anatomy.
2. Expand the tools used in the study of the Anatomy of the Negroid human.
3. Initiate and encourage positive collaborative works among inter-disciplinary Faculties.
4. Produce local anatomical models in the bid to alleviate the problem of overcrowding in the dissection room and as a commercial venture for revenue generation.

The Anatomist provides the gross anatomical description of the details of a particular body region with the help of atlases, while the skilled Sculptor uses the procedure of an 'outside-in' approach in the art of sculpturing on a durable material called Fibreglass. Finishing touches involved alignment, brushing, painting, pigmenting and labelling of the different parts of the model is carried out. Fibreglass is a light weight material composed of polyester resin, catalyzing agent, accelerating agent and synthetic fibre mat. There are plans to expand the level of collaboration to include Polymer Chemistry in formulating a more durable and lighter material for better colouring of the Negroid skin.

The negative impression of a living human body part is picked using Plaster of Paris, filled with clay to bring out the positive impression and covered with silicon rubber. The negative impression on the silicon rubber is then filled with fibreglass to bring out the final positive impression of the body part. The model is then smoothened with abrasives, painted with appropriate colours, sealed with transparent cellulose lacquer and finally labelled (Photoplates 34 – 36).This team of experts in Human Anatomy and Sculptor added piquancy to learning as they configured, developed and produced anatomical models of different body parts. The result was the production of potable Negroid anatomical models for effective teaching and learning of the structures of the human body in our medical schools (Fawehinmi *et al.*, 2007).

(a)

(b)

Photoplate 34: Anterior View of the Upper Arm with Brachial Artery In-Situ (a) and Deep Palmer Dissection of the Hand (b) (Fawehinmi *et al.*, 2007)

There are changes in the balance of medical power and new cultural beliefs about science and medicine in the 20th Century. Thus anatomical models have gained commercial success and are presently used by schools, Universities and hospitals, as well as private individuals who could rent models at low cost. At present we are on a research team cataloguing normative values for the dimensions and proportions of the different body regions with a bid to producing the first standardized three – dimensional, cross – sectional and working Negroid anatomical models.

(a) **(b)**

Photoplate 35: Antero-Lateral View of the Neck Showing Superficial Muscles (a) and Anterior View of Thoracic Cage Showing Mammary Gland (b) (Fawehinmi *et al.*, 2007)

(a) **(b)**

Photoplate 36: Anterior View of Superficial Layer of the Right Forearm (a) and Antero-Lateral View of the Left Leg Showing Muscles of Anterior and Lateral Compartments (b) (Fawehinmi *et al.*, 2007)

These products are in the process of being patented through the Intellectual Property and Technology Transfer Office (IPTTO) of the University of Port Harcourt. The UniPort experience is a successful one as these models are the first of its kind in Africa. We plan to proceed to use 3D radiological images for the reconstruction of the Negroid human, and it is our belief that this will open room for more collaborative works to achieve maximum results.

RECOMMENDATIONS AND CONCLUSION:

Mr. Vice Chancellor, distinguished ladies and gentlemen based on my submissions in the last one hour or so, I make the following recommendations:

1. Before now, apart from dermatoglyphics, there were no known medico-legal practices requiring the aid of forensic experts in Nigeria, and they were largely under utilized. But with the recent spate of intertribal and religious wars, and mass casualties, there is increasing need for the forensic identification of affected individuals. I recommend the establishment an Institute for Forensic Science for Nigeria in Port Harcourt, where a databank of ethnic specific forensic anthropometric values can be accessed for Coroner's inquest. With this Nigeria can conduct a sizing national survey of its population to be termed Size Nigeria. Mr. Vice Chancellor, Port Harcourt has been leading in this area of research in the Country.

2. Development of a Clinical Anthropometry Laboratory that will index body and photogrammetric measurements for the formulation of a 'Standardized Anthropometric Reference Manual' for Nigerians. This can be accessed by clinicians to guide medical procedures in Nigerians. There is currently a dearth of sufficient data on reference values for the use of Anthropometry and Photogrammetry as surgical assessment methods in Nigeria. Further research should establish additional surgical reference values for the major ethnic groups in Nigeria using standard anthropometric protocol, as we have done.

3. I advocate the establishment of an Anatomical Modelling Studio or Workshop in partnership with the University of Port Harcourt, so that negatives derived from the catalogued normative values of the average Nigerian can be developed, in a bid to producing the first standardized three – dimensional and cross – sectional, working Negroid anatomical models at commercial quantities, in line with our aspiration of becoming a world class entrepreneurial University.

4. Endow a Professorial Chair in Sickle Cell Anaemia in honour of late Prof. Gabriel I. Ekeke with the active partnership of Neimeth Pharmaceuticals Plc, to further research in sickle cell haemoglobinopathy, for their better management and the ultimate discovery of a cure or its extermination.

Conclusion: Mr. Vice Chancellor, distinguished ladies and gentlemen, a tailor and surgeon practising in Nigeria, or any other part of the world will have to take cognizance of these findings when designing a dress or planning a surgical or dental procedure for their clients and in evaluating the outcome.

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CITATION
ON

PROF. HAKEEM BABATUNDE FAWEHINMI

B.Med Sc., MB.BS (UPH), M.Sc. (London), MD, FRAI, FIIA, FASN, FECAN

Department of Anatomy, Faculty of Basic Medical Sciences,

College of Health Sciences, University of Port Harcourt

Introduction:

Mr. Vice Chancellor Sir, it is my singular honour and privilege to introduce the 111th Inaugural Lecturer of the University of Port Harcourt, in the person of Prof. Hakeem Babatunde Fawehinmi, an internationally recognized Professor of Anatomy and Biomedical Anthropology and immediate past Dean of the Faculty of Basic Medical Sciences, University of Port Harcourt. Prof. Hakeem Fawehinmi hails from Ondo State and was born on the 29th of September, 1969 at Ibadan, to the Royal Families of High Chief Seriki Gbobo Fawehinmi and Chief Michael Romeo Georgewill of Ondo and Abonnema. He is the third child and first son of his mother's stock.

Education:

Prof. Hakeem Fawehinmi commenced his kindergarten education at the Sea Bed Nursery School in Port Harcourt in 1973 and had his Primary Education at the Port Harcourt Primary School from 1974 to 1979.

Between 1979 and 1984 he proceeded to the famous Government Comprehensive Secondary School Borikiri Port Harcourt for his Secondary Education. While in Comprehensive, he was an active member of the school's Debating Society and became the Library Prefect in 1983. He was the Best Graduating Student in Biology and Economics in the Mock Examination of the School and in the West African Schools Certificate Examination in 1984.

He was admitted into the University of Port Harcourt in 1985 to study Zoology, where he made the Dean's List of the Faculty of Science and was granted Inter-faculty Transfer to Medicine in 1986. He graduated with a B. Med. Sc (Anatomy) in 1989 and an MBBS in 1992 from the University of Port Harcourt. He bagged an M. Sc degree in Medical Anthropology from the University of London in 2003and an MD (Doctor of Medicine) of the University of Port Harcourt in 2008. During his days as a medical student he held several leadership positions some of which are: President, National Union of Ondo State Students Uniport Branch (1988 – 1989), Lord Chancellor, Dollar Klobb Exclusive, Uniport Chapter (1989 – 1990), President, Port Harcourt University Medical Students Association (1990 – 1991) and the coveted President of the Nigerian Medical Students Association (NIMSA) between 1991 and 1992.

Professional Career:
On completion of his medical training in 1992, Prof. Hakeem Fawehinmi undertook his pre-registration internship training as a House Officer with the University of Port Harcourt Teaching Hospital between 1993 and 1994 before proceeding for his one year obligatory National Youth Service Corps as Medical Officer In-Charge of the Nigerian Air Force Clinic, Ilorin in 1995. He gained employment into the University of Port Harcourt on the 1st of June 1995 as a Lecturer II with the Department of Anatomy and rose through the ranks to become the youngest Professor in the University in May 2010, a Chair he occupies to date.

Academic Leadership and Administrative Experience:
Prof. Hakeem Fawehinmi has had a rewarding public service and academic career with a wealth of experience in Institutional administration. He was Head of Department of Anatomy, University of Port Harcourt from 2005 to 2007, Head of Department of Anatomy Niger Delta University, Bayelsa State from 2007 to 2009, Associate Dean (2010

– 2012) and Dean Faculty of Basic Medical Sciences, College of Health Sciences University of Port Harcourt (2012 – 2014). He was Honorary Research Fellow to the Department of Anatomy and Developmental Biology, University College London in 2006 under the McArthur Foundation Teachers Upgrade Programme. While in the United Kingdom he taught Anatomy to medical Students of UCL and to students of the British Chiropractic and Osteopathic Schools. Prof. Fawehinmi has held several sensitive academic and administrative responsibilities within the University, such as Secretary, Medical Education Consultancy Committee (MECC), College of Health Sciences Uniport, Chief Examinations Officer and Chairman Degree Results Verification Committee of the Faculty of Basic Medical Sciences and Chairman, Assessment Committee of Final Ph. D Dissertation Seminar Series of the College of Graduate Studies University of Port Harcourt.

Prof. Fawehinmi has served in many Statutory and Ad – hoc Committees and Boards of the University, some of which are: Member, Representing Congregation and College of Health Sciences in the Board of Governors of the University of Port Harcourt Demonstration Primary School (UDPS), Member, Strategic Research Plan Committee of the University of Port Harcourt, Member, College of Health Sciences Committee for the Establishment of the Faculty of Allied Medical Sciences. Chairman, College of Health Sciences Committee on the Implementation of Telemedicine in Uniport, Member, University of Port Harcourt Committee on 5 Years Strategic Plan (2014 – 2019).He was Social Secretary, Senior Staff Club, Uniport (1997 – 2000) and Hall Warden, Post-Graduate Block "C" Donald Ekong Medical Hostels, Uniport (2005 – 2007). Prof. Fawehinmi has been External Examiner to the Undergraduate and Postgraduate Programmes of almost all the Colleges of Medicine in the South – South and South – East geopolitical zones of Nigeria, and also to the Universities of Lagos and Ilorin. He is a Visiting Professor to two Universities in Nigeria and was on the Visitation Panel of the Medical and Dental Council of Nigeria to some medical Schools.

Membership of Professional Associations:

Prof. Hakeem Fawehinmi has been an active member in all his professional groups. He is the Executive Secretary, Board of Trustees, Sickle Cell Research and Awareness Group (SCRAG) Inc. and was Secretary - General and Member, National Executive Council (1999 –

2000) and later Vice Chairman and Chairman Welfare Committee, Nigerian Medical Association, Rivers State Branch (2004 – 2006).He is at present, a Fellow of the Royal Anthropological Institute of Great Britain and Ireland (FRAI), Fellow, Anatomical Society of Nigeria (FASN), Fellow, Institute of Industrial Administration of Nigeria (FIIA), Fellow Anatomical Society of Great Britain and Ireland, Member American Anthropological Association and Fellow Experimental and Clinical Anatomists of Nigeria (FECAN). He is the current Editor – in – Chief of the Journal of Anatomical Sciences, the official journal of Anatomical Society of Nigeria and President of the Society of Experimental and Clinical Anatomists of Nigeria. It is pertinent to mention that for all the leadership positions Prof. Fawehinmi held, he went through the rungs to get to the top.

Research and Publications:
Prof. Fawehinmi has contributed Chapters to 2 books in Anatomy, has 3 Monographs and over 50 scientific publications in reputable Local and International peer reviewed Indexed Journals to his credit. He has reviewed 2 books and presented 8 Guest Lectures. He has actively participated in over 46 conferences within and outside the Country, and presented papers in 16.He has supervised 3 Ph. D,10 M. Sc, and numerous B. Sc Anatomy and Biomedical Science students. He is currently supervising 5 Ph. D and working on the Standardization of Negroid Gross Anatomical Models and on the development of a Software Tool for Photogrammetric Analysis of facial profile in Nigerians. Both inventions are in the process of being patented by the Intellectual Property and Technology Transfer Office of the Federal Ministry of Science and Technology. These innovations won National Prizes by coming 3rdposition at the 4th and 5th National Universities Research and Development Fair which held at the University of Nigeria, Nsukka and Federal University of Technology, Minna in 2011 and 2012 respectively.

Community Service and Awards:
He has the following Awards to his credit: Award of Excellence, Students Union Government, Uniport (1997), Life Patron Federated Union of Kalabari Students (FUKS) (1999), Award of Excellence as Outstanding Patron Uniport Collegiate JAYCEES (1999), Scientist of the 21st Century by American Biographical Institute Inc. (2005), Life Patron of the League of Character Club of Nigeria (2005), Distinguished Award of Excellence,

Yoruba Students Association (2005), Patron Anglican Youth Fellowship of the Kalabari Central Archdeaconry (2008),Lecturer of the Year, Anatomical Students Society of Nigeria (2009), Prof. N. D. Briggs Award of Excellence in Recognition of his Selfless Service to PUMSA (2011), Welfare Personality of the Year, Department of Anatomy Uniport (2013).Because of his public spirited approach to life within and outside the State, Prof. Hakeem Fawehinmi holds the chieftaincy titles of:

1. Eze Omenu - Oha I of Oro-Esara Kingdom by HRH Eze (Dr.) J. A. Utchay (Jp) Eze Esara III
2. Lobosin Ifore Ondo by Kabiyesi Oba Vincent Adenuoye
3. High Chief Enyi Di Oha Mma I of Akwaette Ndoki by HRH Prof. Sir G. Ekeke (Jp) Nwangbuobu II

Conclusion:

Prof. Hakeem Fawehinmi is married to Mrs. Hadeezat Omotayo Fawehinmi and the marriage is blessed with 5 children, 4 boys and a girl. Mr. Vice Chancellor, distinguished Ladies and Gentlemen, please join me to welcome a humble achiever, a seasoned administrator, an erudite scholar, a dependable family man per excellence and a worthy alumnus who has made remarkable impact in the areas of Medical Education and Health within and outside the Country, Prof. Hakeem Babatunde Fawehinmi as the 111th Inaugural Lecturer of the University of Port Harcourt. Thank you.

Prof. Julian O. Osuji
16th October, 2014