JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

VALUES OF NORMAL INNER INTERCANTHAL DISTANCE, OUTER INTERCANTHAL DISTANCE, CANTHAL INDEX, INTERPUPILLARY DISTANCE, FRONTO-OCCIPITAL DISTANCE, BODY HEIGHT AND WEIGHT OF AFIZERE ETHNIC GROUP, JOS-NORTH, PLATEAU STATE, NIGERIA.

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ABSTRACT

Background: The study on Values of Normal Inner Intercanthal Distance (IICD), Outer Intercanthal Distance (OICD), Canthal Index (CI), Interpupillary Distance (IPD), Fronto-Occipital Distance (FOD), Body Height (BH) and Body Weight (BW) of Afizere Ethnic Group, Plateau State, Nigeria was aim to establish standard parameter values to aid diagnosis and treatment of facial injuries or congenital malformation such as telecanthus and hypertelorism among Afizere people. The study will correlate IICD and OICD to CI while FOD and BW to BH for treatment and identity. The study will provide standard values to head and neck surgeons for treatment of craniofacial abnormality and generate regression formula for estimation of CI and BH

Methodology: A total of 600 samples were collected from 302 females and 298 males' subjects. The age limit of 18-32years was selected for study. Ethical clearance was obtained from Ebonyi State University Abakaliki, Nigeria. Anthropometric instruments were used to collect data of Normal IICD, OICD, CI, IPD, FOD, BH and BW.

Result: Data analysis was done using Access and Excel Version 20.00. Results are shown in tables. The result of normal parameter values obtained can aid diagnosis and treatment of abnormal condition by qualify surgeon. Subjects normal general mean and standard deviation values: Age (24.98±7.00), IICD (41.37±2.00), OICD (115.31±2.00), CI (35.75±2.00), IPD (65.00±4.00), FOD (37.82±2.00), BH (1.68±0.05), BW (68.00±7.00). Age range 20-29years had 438 (73%), 10-19years had 114 (19%) and 30-39years had 48 (8%) of participants.

Conclusion: Telecanthus and Hypertelorism can be treated using values of normal IICD, OICD, CI, and IPD while BH, BW and FOD can be use for subjects' identity.

Keywords: Inner Intercanthal Distance, Outer Intercanthal Distance, Fronto-Occipital Distance, Body Height, Interpupillary distance

INTRODUCTION

Forensic anthropometric studies on Anatomical facial body parts had contributed greatly to the field of medicine and health sciences. This is because anthropometric measurement can be use in the estimation of age, sex, races and to some extend the ethnic group of patients by medical practitioners for the purpose of diagnosis and drug administration. The critical study of normal values of inner and outer intercanthal distance in children, young adults and old people help in the diagnosis and treatment of abnormal condition in patients which may be cause by disease or genetic condition in nature. From time in memorial,

anthropometric facial measurement was believed to have it origin trace to the ancient Greek and serves as the main foundation upon which neoclassical canons were established (Farkas 2005 and Fang 2011), and alongside with establishment of young adults and old people normal intercanthal standard.

Intercanthal distance is the distance between the medial and lateral canthi of palpebral fissure bilaterally measure in millimeter. Inner intercanthal distance is the distance between the medial canthi while outer intercanthal distance is the distance between the lateral canthi of the palpebral fissures bilaterally (Umweni 2011). Studies by other authors had shown that the normal values of inner and outer intercanthal distance of Nigerians were significantly different from that of Caucasians values (Saheeb 2004).

When the normal intercanthal distance of subjects were compare with that of patients having cleft palate and lip. The result of the study shows an increased in inter-orbital distance in patience with no syndrome Orofacial cleft (Moss 1965, Aduss 1971, Figalov 1974). This study is intended to ascertain the values of normal inner and outer intercanthal distance of Afizere ethnic group of Plateau state, Nigeria with the aim of establishing standard that may aid proper diagnosis of Afizere people with facial abnormal condition, leading to correct treatment or proper management of the condition if genetic in nature.

Interpupillary distance (IPD) is the distance between pupils of the right and left eyes medially. It is the distance between the centers of the eyes measure medially in millimeter. Standard values of IPD when obtain can help in the diagnosis and treatment of orbital hypertelorism, (Batut 2019). Orbital hypertelorism is cause by abnormal increase in IPD, IICD and OICD, (Sirkek 2023, Tessier 1974). This condition is usually associated with other craniofacial malformation such as meningoencephalocele and frontonasal dysplasia. Orbital hypertelorism can be corrected by box osteotomy and facial bipartition surgical technique, (Sousa 2024, Patel 2022). Orbital hypertelorism was first described in 1924, (Greig 1924). Fronto-Occipital (FOD), is the distance from the glabella of forehead to inion of occipital region measure in centimeter. Body Height (BH), is the

distance from the heel of the foot to the vertex of the head, measure in centimeter. Body Weight (BW) is the body mass index of individual measure in kilogram.

Studies made by Charles (2008), Egwu (2008), Singh (1983), Sivan (1982), Feingold (1974) and Laestadius (1969), clearly shows the significance of establishing standard values for normal inner and outer intercanthal distance. They independently state that the results can help in proper diagnosis, treatment and management of facial abnormal condition caused by acquired or genetic diseases. This study on Afizere people is also intended to establish intercanthal standard which may help medical practitioners in the diagnosis and treatment of conditions related to facial injuries and diseases. The study may help in the development of data bank of normogram for inner intercanthal distance (IICD), outer intercanthal distance (OICD), Canthal Index (CI), Interpupillary Distance (IPD), Fronto-Occipital Distance (FOD), Body Height (BH), and Body Weight (BW) of Afizere ethnic group of Plateau State Nigeria, which can be access through internet search engine. Just as Everekliglu (2002), inserted that the aim of establishing standard intercanthal distance for ethnic or race was to developed a data bank to aid diagnosis because standard result reflect potential different pattern of craniofacial growth that result from racial, ethnic and sexual differences which can be compare to abnormal condition for treatment.

Furthermore, the study can serve as a guide post to surgeon in the detection of abnormalities and trauma induced craniofacial changes for treatment, just as Greig (1924) used the standard he developed for the detection and treatment of hypertelorism in some specific group of people. This study will also correlate IICD, OICD and canthal index (CI) with other anthropometric parameters like fronto-occipital distance (FOD), weight and body height of subject. Identity is an important tool to proper diagnosis and treatment for this reason the research will estimate the body height of subjects or patients using body weight and fronto-occipital distance. Manual anthropometric caliper will be use in taking measurement of this study even though McFee (1986) used computed tomography in the evaluation of orbital and bony interorbital distance.

Several studies shows the mean values of facial measurements including intercanthal distance normal values for different race, age and gender as important tools to medical practitioners in diagnosis and treatment of facial abnormalities (Ozturk 2006, Osuobent 1993, Juberg 1975 and Laestadius 1969). It had also been shown that canthal values for an individual may varies with age and tend to become constant in mid to late twenties (Fleidalius 1986). In the study made by Dike (2019) on Yoruba and Igbo ethnic group of Nigeria the mean OICD of males was 100.31±9.51mm while that of females was 97.86±7.94mm. The study was in agreement with this study because the mean OICD of Afizere obtained was 117.56±3.20mm for male and 113.06±1.86mm for female. In both studies the OICD values of males was higher than that of females, Likewise the IICD. However the only difference was in age limit selected for the study. Dike 2019 age limit ranges within 3-18years while the study on Afizere of this research made used of 18-32years age limit. The study of Dike (2019) on children and Afizere on adults clearly shows that the values of normal parameters of children were smaller than that of adults.

This study shall clearly show the total number of participants by gender and percentage range. Despaired the fact that Nigeria has the highest population in Africa observation had shown that only few studies were done on anthropometric craniofacial research (Oladipo 2008). True parameter values of normal IICD, OICD, CI, IPD, FOD, BH and BW are vital tools for successful reconstruction of canthal area. Thus it is necessary to obtain local data parameters since standard values reflect different pattern of craniofacial growth resulting from dietary, sexuality, ethnicity, and racial differences (Oladipo 2009). The study on this topic was the first to be conducted on Afizere people and when carried out to obtain normal IICD, OICD, CI, IPD, FOD, BH and BW it will help in establishing standard parameter values for diagnosis and treatment of craniofacial abnormality specifically to Afizere ethnic group of Plateau State, Nigeria.

MATERIALS AND METHODS

Materials: The materials used for this research work are as follows: i. Transparent metric ruler calibrated in millimeters. Ii. Measuring tape. iii. Calculator. Iv. Writing pen v. Record book. vi. Calculator vii. Hand gloves.

Method of Measuring Inner Intercanthal Distance (IICD)

The subject who consented to participate in the research work was told to seat down on the chair provided for him/her. The researcher required that the subject should seat in an erect posture with his/her head been in alignment with the researcher head. The researcher will then place a non stretchable transparent metric ruler calibrated in millimeters on the bridge of the nose of the subject tightly held on it. The researcher may made necessary adjustment to ensure that the IICD was measured from the medial angle of the right eye to the medial angle of the left eye as shown in figure .1 and with clear illumination the measurement was taken and recorded in the recording book. The same method was adopted on the entire participant in obtaining their IICD measured in millimeters.

Measurement of Outer Intercanthal Distance (OICD)

Immediately after measuring the IICD, the non stretchable transparent metric ruler was adjusted by extending the initial point of the metric ruler to the right lateral angle of the right eye to the left lateral angle of the left eye while ensuring the metric ruler was firmly attached to the bridge of the nose. The subject seating down in an erect posture was made to alignment his/her head in straight direct posture with the head of the researcher. The researcher will then take the measurement of the subject OICD and record it in a book using a writing pen. The same methodology was carried out on all participants in obtaining the OICD measured in millimeters.

Method of Measuring Canthal Index (CI)

The canthal Index of a subject was obtained through computation using a calculator by dividing the inner intercanthal distance with the outer intercanthal distance and multiplying the result by hundred (100). Since the result of the canthal index depend on the inner intercanthal distance and the outer intercanthal distance, this clearly shows that the canthal index depend totally on the data obtained (Everekliogluu 2001). The same procedure was computed for all participants.

Method of measuring Interpupillary Distance (IPD)

The subject who agreed to participate in the study was told to seat down erect on the chair provided with his/her head been in alignment with the researcher head. The researcher will then place a non stretchable transparent ruler calibrated in millimeters, on the bridge of the nose of subject tightly held on it. All necessary adjustment was made by the researcher to ensure that the interpupillary distance was measured in millimeters from the right pupil to the left pupil of the eyes. The measurement was then recorded in a book using a writing pen. Same procedure was carried out on all participants.

Measurement of Fronto-Occipital Distance (FOD)

The fronto-occipital distance (FOD) of a subject was measured using a non stretchable anthropometric measuring tape. The initial point of the measuring tape was place at the glabella of the subject forehead and extends the tape to the inion at the occipital region of the subject head. The measurement was taken in centimeters and recorded in a book using a writing pen. The same procedure was carried out on all the participants.

Measurement of Body Height (BH) and Body Weight (BW)

Body Height: The body height (BH) of each subject was measured using an anthropometric steel measuring tape. The subject was made to stand on a level ground surface, floor or horizontal platform with his/her heels touching each other medially. The subject back was made to be in straight posture. This may be achieved by relaxing the shoulder, adducting the hands and stretching upward the legs, neck and head. After ensuring these the researcher placed the initial end of the steel measuring tape at the level of the subject heel and extend it to the vertex of the subject head before taking measurement in centimeters. The measurement was recorded in a book using a writing pen. The same procedure was carried out on all the participants

Body Weight: The body weight (BW) of individual subject was measured using an anthropometric weighing balance place on a level flat surface. The weighing balance was switch on and set to start reading from initial point measured in kilogram. The subject was then told to clamp the platform of the weighing balance and stand upright in an erect posture. The researcher takes the record of the subject body weight directly from the calibration in the screen of the weighing balance and recorded it in a book using a writing pen. The same procedure was carried out on all the participants.

The study was conducted at Tudun Wada Community of Jos-North Local Government Area of Plateau State, Nigeria. Correlation study design was adopted for this study with the aim of establishing standard for normal values of IICD, OICD, CI, IPD, FOD, BH and BW. The type of statistics used for this study was descriptive statistics which allow the description of parameters and data population. The data analysis of this study was done using statistical package for social sciences (SPSS) version 20.00. The study was conducted on subjects that have no history record of craniofacial trauma or congenital malformation of head and neck and were willing to participate in the research work. The duration of this study was five months starting from 3rd June to 3rd October 2024. Ethical approval was obtained from the research and ethics committee, faculty of basic

medical sciences, Ebonyi State University, Abakaliki, Nigeria and was used to obtained permission from the committee head of Tudun Wada, Jos-North, Nigeria before the commencement of the study. The age limit used in this study was 18years to 32years.

Financial Support

Izang Adijah's Family supported this research work financially.

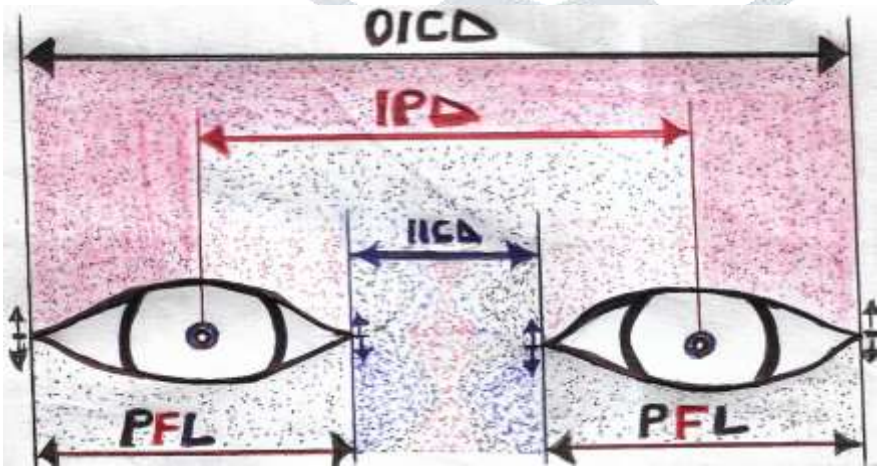
Conflict of Interest

The author declared that there was no conflict of interest associated with this study.

Acknowledgement

The author wish to acknowledge with thanks the support render by the community head of Tudun Wada, Jos-North, Nigeria and the willingness of the subjects to participate in this study.

Figure 1. Shows Facial Parameters Distance Measurement around the Eyes Region



IICD: Inner Intercanthal Distance, OICD: Outer Inter Canthal Distance, IPD: Interpupillary Distance, PFL: Pupillary Field Lenghth

RESULT

Table 1, shows the general mean of all parameters under consideration in determining values of normal IICD, OICD, CI, FOD, BH and BW of males and females. General mean population parameters: Age (24.98±7.00years), IICD (41.37±2.00mm), OICD (115.31±2.00mm), CI (35.75±2.00), FOD (37.82±2.00cm), BH (1.68±0.05cm) and BW (68.00±7.00kg). Furthermore the result shows that there was no significant difference between the mean canthal index (CI) of males and females of this study since the differences between them is only 1.28±2.00, IICD with the difference of 2.82±2.00mm between the mean parameter of males and females, FOD with the difference of 0.08±1.71cm, BH with the difference of 0.08±0.05cm. However there was significant difference between the mean OICD of males and females with 4.50±2.00mm. The result of canthal index was obtained from the computation involving IICD and OICD.

Table 2, shows total population, age range, and percentage of females and males subjects used in this study. The age range 20-29 had 73% the highest population percentage with the total of 438 subjects. Females with 302 subjects had the highest population compared to males with 298 subjects used in this study.

Standard regression formula was developed for estimation of body height for identity and canthal index for studying normal and abnormal craniofacial intercanthal variation in race for clinical diagnosis and treatment as derived below:

Body Height (BH) = Body Weight (BW)/Fronto-Occipital Distance (FOD)-0.02 (Female).

Body Height (BH) = Body Weight (BW)/ Fronto-Occipital Distance (FOD)-0.09 (Male).

Canthal Index = IICD/OICD X 100.

Where IICD is Inner Intercanthal Distance and OICD is Outer Intercanthal Distance

Table 1: Shows the Normal Mean and Standard Deviation Parameter Values of Intercanthal Distance, Interpupillary Distance, Fronto-Occipital Distance, Body Height and Weight.

Parameters	Females	Males	Range Values	Overall Mean Values
Age (years)	23.99±8.00	25.98±6.00	18 - 32	24.98±7.00
IICD (mm)	39.96±2.00	42.78±2.00	30 – 45	41.37±2.00
OICD (mm)	113.06±1.86	117.56±3.20	110 – 121	115.31±2.00
CI	35.11±2.00	36.39±2.00	29 – 38	35.75±2.00
IPD (mm)	63.00±4.00	67.00±4.00	59 – 71	65.00±4.00
FOD (cm)	37.78±1.70	37.86±2.30	35 – 40	37.82±2.00
BH (cm)	1.64±0.03	1.72±0.07	1.58 – 1.78	1.68±0.05
BW (kg)	62.84±7.00	73.16±7.00	55 – 81	68.00±7.00

IICD: Inner Intercanthal Distance, OICD: Outer Intercanthal Distance, CI: Canthal Distance, IPD: Interpupillary Distance, FOD: Fronto-Occipital Distance, BH: Body Height, BW: Body Weight.

Table 2: Shows the Total Percentage Population of Females and Males Subjects with Respect to their Age Range

Age Range	Females	Males	Overall population	Percentage
10 – 19	60	54	114	19%
20 – 29	220	218	438	73%

30 – 39	22	26	48	8%
Total	**302**	**298**	**600**	**100%**

DISCUSSION

The parameters mean of Afizere ethnic group of Plateau State, Nigeria males' values was higher than that of females' values of this study. This was contrary to the study made by Oladipo (2009) on Urhobos and Isekiris ethnic group of Nigeria, Juberg (1975) on Africa American population living in the United State and the researched made by Singh and Banerjee (1983) on Indian population which shows the parameters of females higher than that of males in their respective studies. However the studies made by Erika (2005) on Latvians population, Cem (2001) on Turkish population and Oladipo (2008) on Ijaw and Igbo populations of Nigeria was in agreement with this study since the Inner Intercanthal Distance (IICD), Outer Intercanthal Distance (OICD), Canthal Index (CI), Interpupillary Distance (IPD), Fronto-Occipital Distance (FOD), Body Height (BH) and Body Weight (BW) mean parameter values of male population was higher than that of female population.

The establishment of standard values for normal CI, IICD, OICD and IPD are important for successful reconstruction of abnormal canthal area. IICD, and OICD can be correlated to canthal index for proper diagnosis and treatment while FOD and body weight can be correlated to body height for subject or patients identity. Age is a factor that relate with growth which have impact on gene. Therefore all the developed parameters are important measurement for variety of reason including: Evaluation of craniofacial malformation and syndromes, Diagnosis of condition such as hypertelorism and traumatic telecanthism, and assist in forensic investigation. Research shows that IICD tentatively help in the estimation of width of maxillary central incisors which is a factor in facial aesthetics.

Table 1, of this study shows that the IICD of Afizere, Nigerians, with general mean of 41.37±2.00mm was in the higher side when compare with the studies of others independent researchers. Gupta (2003) reported that the IICD of Indian population ranges between 20-36mm this is lower than Afizere Nigerians result with difference of 5mm. Ngeon (2005) established a standard for IICD of Malasian in Kuala Lumpur as 33.00±2.60mm, this result was lower than that of Afizere population in Nigeria with the difference of 8.37±0.60mm. The study made by Murphy and Laskin (1990) shows that the IICD of black population in United State of America was 33.90±300mm, this value was lower than that of Afizere population in Nigeria with the different of 7.47±1.00mm. The result also shows that both the IICD and OICD of this study vary with different age group and that the OICD of Afizere population of Nigeria was significantly wider in male than in female population. This assertion was in agreement with the research work of Everekliogl u (2002) and the study made by Egwu (2008).

The standard established values of IICD, OICD, CI, IPD, FOD, BH and BW are for the purpose of accuracy in diagnosis and treatment. This is because numerous studies had shown that pathological congenital and trauma induce condition do affect canthal index in relation to IICD and OICD parameters (Zhang 2000, Everekliogl u 2000 and Freihofer 1980). Genetic and Environmental factor play a role in the correlation of IICD, OICD with CI and FOD and BW with body height. The correlation of canthal index with height, age and fronto-occipital distance is useful in the design of facio-orbital component with optimum fit users and patients within an environment. The result of this study shows that the standard measurements of Afizere mean IICD for males with 42.78±2.00mm and females with 39.96±2.00mm. Therefore an increase value above the normal standard of Afizere IICD can be diagnosed as telecanthus condition. This abnormal condition may be cause by genetic disorder, trauma or having a tumor that was surgically removed may cause telecanthus. Telecanthus is an abnormal increase between the inner corners of the eyelid.

The general mean values of IICD, OICD, CI, and IPD obtained as standard are 41.37±2.00mm, 115.31±2.00mm, 35.75±2.00mm and 65.00±mm.00mm respectively. Above the normal values was often been diagnose as abnormality which may be cause by the following: Intake of recreational drug not prescribe by a qualified medical practitioner, Exposure of pregnant woman to harmful chemical or radiation and having a biological family history of specific genetic disorder. Researched have shown that abnormal values of inner and outer intercanthal distance may cause low vision, myopia and hyperopia. It is also the cause of congenital telecanthus, the tendons that position medial canthal of eyelids are too long or aren't in the right place and instead of pulling the inner corners of eyelids closer together, its spread far apart. Surgery is the main treatment for telecanthus. Occuloplastic surgeon usually treat telecanthus by alleviating problems associated with eye socket, tears duct and facial bones. Otolaryngologist (ear, nose and throat doctor) specializing in head and neck surgery also treat telecanthus and hypertelorism by cutting to shorten the length of the tendons responsible for the conditions. Traumatic telecanthus can be treated using transnasal wiring, here the surgeon will detached the medial canthal tendons from affected eye and reposition it using a thin wire, that run through tiny holes drilled into eye sucket and nose bone. Mild telecanthus that does not affect vision or self-esteem might not need treatment this is because the variation of the canthal distance of subject is just a small distance when compare with standard values. The establishment of standard parameter values for IICD, OICD and IPD may help in ascertaining the abnormal increase in distance for orbital hypertelorism. Surgery is the main option for orbital hypertelorism treatment which is easily successful in children than adults. The abnormal distance of IPD can help surgeon in the correction of hypertelorism by box osteotomy and facial bipartition technique using the standard parameter values established for specifcific ethnic group.

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