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Morphometric Study of Cephalofacial Indices among Ogoni Children in Rivers State

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Abstract

Anthropometry can be defined as the art and science of measurements of physical dimensions of parts or whole of human body. Cephalofacial measurement is an important anthropometry, which generates data that form important indices for studying brain growth and formation of facial types. This descriptive study involves 390 Ogoni Children (215 males and 175 females) between the ages of 5-12 years. Since very few studies have been done on Nigerian infants, the aim of this study is to evaluate the Cephalofacial morphology of Ogoni Children and describe sexual dimorphism among the population study. The length and width of the head and face of each subject was measured to determine the cephalic Index and facial Index of each subject and evaluate the prevalent head and face type of the population study. The results showed that mean values of the cephalic and facial indices were higher for males than females. The mean cephalic Index values were 71.85±3.79 and 71.79±3.86 for males and females respectively. The difference in these values were not found to be statistically significant and thus cannot be useful in describing sexual dimorphism among the study population ($p>0.05$). The mean facial Index values were 85.35±6.05 and 83.86±4.86 for males and females respectively. The difference found in these values were statistically significant ($p<0.05$) and thus was useful in describing sexual dimorphism. The results also showed that dolichocephalic head type was the most prevalent with males (47.44%) having a higher percentage prevalence than females (41.71%), while euryprosopic facial type was the most prevalent with females (42.29%) having a higher percentage prevalence than males (37.21%).

Keywords: Anthropometry, sexual dimorphism, mean cephalic Index, mean facial Index, dolichocephalic, euryprosopic facial type.

1. INTRODUCTION

Anthropometry can be defined as the art and science of measurements of physical dimensions, mass and strength of parts or whole of human body especially in terms of bone, muscle and adipose tissue. It is derived from Greek words “Anthropos” (which means “Man”) and “Metron” (which means “to measure”). Anthropometric studies have employed diverse techniques to measure and produce standard values for skeletal, dental and soft tissue structures for different human population [1].

Anthropometric results from these studies have important application in pediatrics, forensic medicine, plastic surgery, oral surgery, diagnostic and treatment planning. They are also used to make comparison between clinical patients and normal populations, to determine health status, body composition or physical fitness or performance levels of individuals and in physical or industrial ergonomics [1]. The use of anthropometry in the field of forensic science and medicine dated back to 1882 when Alphonse Bertillon, a French police expert invented a system of criminal identification based on anthropometric measurements. His system explained the extreme diversity of dimensions present in the skeleton of one individual compared to those using simple constructed callipers [2]. The importance of anthropology as a course using osteometry in the measurement of the skeleton and its parts cannot be over-emphasized. Anthropometry is

being used more often in sexing the skeletal remains. Worldwide, various studies have been conducted on the determination of sex from variety of human bones including skull, pelvis, long bones, scapula, clavicle, and the bones like metatarsals, metacarpals, phalanges, patella, vertebrae, ribs etc. and the most popular statistical model in sex determination has been developed [3]. Today, anthropometry plays an important role in industrial design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products [4, 5]. The change in life styles, nutrition and ethnic composition of populations has led to changes in the distribution of body dimensions e.g. the epidemic of obesity which require regular update through the use of anthropometric data collections. Morphometry refers to the quantitative analysis of form, a concept that encompasses size and shape. An important branch of anthropometry which involves the morphological study of structures present in the human head or scientific measurement of the dimension of the head is known as cephalometry [1].

Cephalometry is an important branch of anthropometry which involves the morphological study of structures present in the human head or scientific measurement of the dimensions of the head. Some of the most important cephalometric parameters include the length/height and breadth/width of the head, the face and the nose as well as their respective indices. These cephalometric parameters are vital in the description of variation which is a common phenomenon that characterizes human physiognomy [1].

Cephalofacial measurement is an important anthropometry, which generates data that form important indices for studying brain growth and formation of facial types. Facts show that development of the face goes pari passu with the growth and development of brain and other craniofacial structures such as the development of paranasal air sinuses, growth of temporary teeth and protrusion of the mandible. Cephalometry therefore plays a very important role in identification, head and face reconstruction, plastic surgery, oral and maxillofacial surgery, orthodontics and clinical treatment and planning [6]. Previous studies on cephalofacial anthropometry have focused mainly on fetuses and adults. The few previous studies on the Nigerian infants were concentrated only on cephalic indices of neonates and children (5-15 years) from the northern part of the country [6]. But no studies on cephalofacial indices have been carried out on children in Ogoni community which is a part of the population of the indigenous people of Rivers state. This study is needed since cephalofacial growth in infants is most rapid in the first year of life, and slows in later years and as well influenced by factors such as age, sex, nutrition and environment. It is therefore needful to provide primary basis for description and identification of Ogoni children especially during accidental cases such as burns, traffic accident, plane crash, natural disasters,

2. MATERIALS AND METHODS

Three hundred and ninety (390) pupils were selected randomly from Port Harcourt, Eleme, and Khana Local Government Areas in Rivers State, Nigeria. The three hundred and ninety consists of 215 males and 175 females. They were all from Ogoni ethnic group by parents and the age of the subjects ranged from 5 years to 12 years. Children considered in this study were pupils of primary schools in the local government areas stated above (from pre-primary classes to primary five). The tools used for the research include: Sliding digital caliper, Record note, Record pen. Verbal consent was sought from authorized individuals with letter of ethical clearance to gain permission to commence study in randomly selected institutions where children are found. The age in years, sex and local government area of children were obtained by instituted authorities in charge of the children. The child must belong to Ogoni ethnic group of Rivers State, Nigeria., must be within the age of 5-12 years, must have been born and grown up in Southern part of Nigeria to avoid the influence of environmental factors on the subject. Any subject within the ages of 5 – 12 years of age, chosen randomly, whose psychophysics, dental and soft tissue condition is not normal were excluded. So, all pathological cases and cases with body abnormality (deformity) were excluded, Subjects less than 5 years were not be used. Subjects who were born or who lived outside Nigeria were not be used. Each measurement was repeated twice and the mean value was recorded. The morphometric parameters were defined as follows;

Head Length

The head length was measured from the two extreme ends of the sagittal axis of the head region using the Anatomical Standard Record of Position such as Frankfurt Plane [7]. Head length is the maximum points on the sagittal axis of the skull as shown in Figure 1.

Fig 1: Showing Head Length

Head Width

Was measured from the subject using gliding calliper measured in to the nearest millimetres (mm) when the head is in anatomical position using the Frankurt plane placed from the two extreme ends of parietal axis around the skull [7, 8]. The sliding calliper was placed at the maximum point of the parietal bone. Head width is the maximum point of biparietal axis aroundthe skull as shown in Figure 2**.**

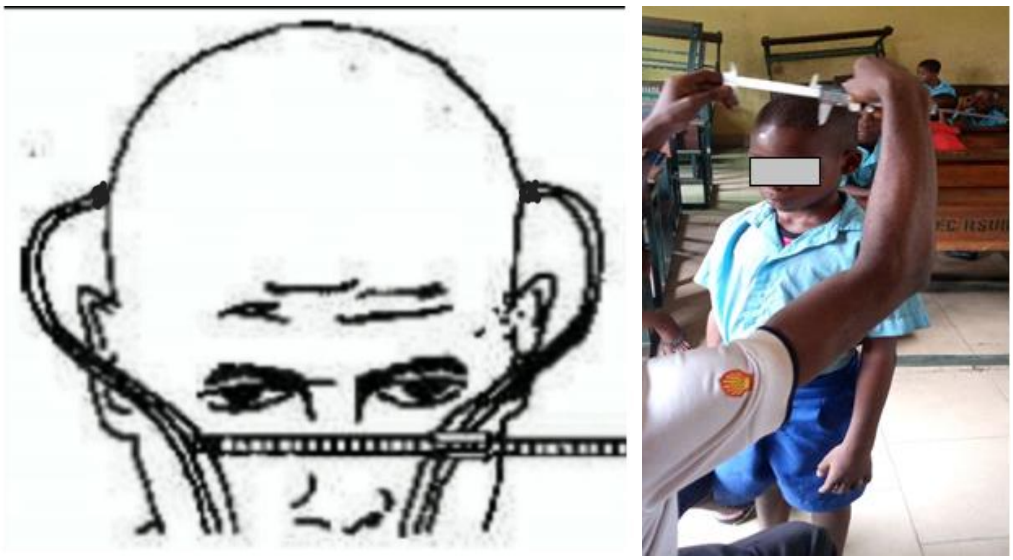

Fig 2: Showing Head Width (Golalipour *et al*., 2006)

Bizygomatic Distance

Was measured when the subject was seated with the head positioned upwards and raised to a certain comfortable degree where sliding calliper was used to nearest millimetres (mm) from the two extreme lateral ends of the zygomatic bones around the face. Bizygomatic distance is the facial distance or width which is the maximum distance between the two lateral sides from zygomatic bones as it is shown in Figure 3.

Fig 3: Showing Bizygomatic Distance

Facial Height

Was taken when the subject was seated with the head positioned upwards and raised to a certain comfortable degree such that the sliding caliper was used to measure to the nearest millimeters (mm) from the nasion down to the gnation, which is the lower border of the chin. Facial height is the morphological distance from the nasion to the gnation as shown in figure 4.

Fig 4: Showing Morphological Facial Height

Statistical Analysis

Data obtained was recorded in a recording sheet and transferred for statistical analysis using Microsoft Excel and SPSS (ver. 25.0) to be presented as mean ±SD along with the Standard Error of Mean (SEM) while frequency by sex was determined to show the distribution of the data. Two sample t-test was used to determine the P – value of the different mean index values. Percentage prevalence was determined for each sex for the different head types and face types of the distribution.

3. RESULTS

The results presented are based on anthropometric measurements used to obtain anthropometric details of the head and face. Data were presented as mean values with their Standard Deviations (S.D) and Standard Error of Means (S.E.M) as presented in Table2 and Table 3 Values were tabulated with respect to gender (male and female). Two sample t–test (of assumed unequal variance) was used to evaluate the P-value of the indices to determine the level of statistical difference between the male and female data of the population study The morphometric details of the head and face were presented with respect to the following:

i. Frequency of the population genders with respect to their head count which was presented in Table 1
ii. Descriptive statistics of the mean values of male and female variables which were presented in Table 2 showing every anthropometric parameter used for the study.
iii. Descriptive representation of cephalic and facial indices which were presented in Table 3.
iv. Cephalofacial indices showing percentage prevalence of different head types which were presented in Table 4, while Table 5 showed the percentage prevalence of different facial types.

Table 1: Showing the Frequency of the different Gender of the Population Study

Participants of Study	Frequency	Percentage
Male	215	55%
Female	175	45%
Total	390	100%

Table 2: Descriptive Statistics of the Mean Values of Male and Female Variables of Ogoni Children

	Males N=215				Females N=175			
VARIABLES	**MEAN ± SD**	**SEM**	**MIN.**	**MAX.**	**MEAN ± SD**	**SEM**	**MIN.**	**MAX.**
AGE (years)	8.31 ± 2.11	0.14	5.00	12.00	8.29 ± 2.07	0.16	5.00	12.00
MSW (mm)	126.70 ± 5.20	0.35	114.91	142.58	124.48 ± 5.07	0.38	113.80	126.33
MSL (mm)	176.58 ± 6.92	0.47	153.93	193.98	173.62 ± 6.64	0.50	154.53	192.40
CIDX (%)	71.85 ± 3.79	0.26	62.40	83.23	71.79 ± 3.86	0.29	62.34	87.01
NML (mm)	94.19 ± 5.95	0.41	56.25	111.55	92.46 ± 5.50	0.42	81.21	108.62
BMW (mm)	110.61 ± 6.73	0.46	97.52	166.68	110.41 ± 5.84	0.44	96.20	123.74
FIDX (%)	85.35 ± 6.05	0.41	48.16	99.29	83.86 ± 4.86	0.37	71.05	98.82

***NOTE*: N** = number of samples, **SD** = standard deviation, **AGE** = age of samples, **MSW** = maximum skull width, **MSL** maximum skull length, **CIDX** = cephalic index, **NML** = nasomental length, **BMW** = bizygomatic width, **FIDX** = facial index, **SEM** = Standard Error of Mean, **MIN** = Minimum variables, **MAX** = Maximum variable.

Table 3: Showing mean Cephalofacial Indices among Ogoni children

Variables	Males		Females		p-Value
	Mean ± SD	SEM	Mean ± SD	SEM	
Cephalic Index	71.85 ± 3.79	0.26	71.79 ± 3.86	0.29	0.91
Facial Index	85.35 ± 6.05	0.41	83.86 ± 4.86	0.37	0.01

Table 4: Cephalometric Indices of Ogoni children

SN		Males N=215		Females N=175	
	Skull/head type	Number of subjects	Percentage prevalence	Number of subjects	Percentage prevalence
1	Hyperdolichocephalic	72	33.49 %	64	36.57 %
2	Dolichocephalic	102	47.44 %	73	41.71 %
3	Mesocephalic	36	16.74 %	35	20.01 %
4	Brachycephalic	5	2.33 %	2	1.14 %
5	Hyperbrachycephalic	-	0 %	1	0.57 %
6	Ultabrachycephalic	-	0 %	-	0 %

Table 5: Facial Indices of Males and Female Ogoni Children

	Males N=215		Females N=175	
Facial Type	Number of Subjects	Percentage Prevalence	Number of Subjects	Percentage Prevalence
Hypereuryprosopic	29	13.49 %	35	20.00 %
Euryprosopic	80	37.21 %	74	42.29 %
Mesoprosopic	64	29.77 %	42	24.00 %
Leptoprosopic	35	16.28 %	21	12.00 %
Hyperleptoprosopic	7	3.25 %	2	1.71 %

Table 6: Comparison of Previous Studies of Cephalic Index Values with Present Study

Authors	Population	Cephalic index
Mibodi *et al*., 1996	Iran	87.50
Enahowo *et al*., 2006; Garba *et al*., 2008	Babur/Bura	75.41
Eroje *et al*., 2010	Ogbia	72.95
Eliakim-Ikechukwu *et al*., 2012	Ibo	81.71
Eliakim-Ikechukwu *et al*., 2012	Yoruba	79.44
Ukoha *et al*., 2013	Anambra	79.96
Omotoso *et al*., 2019	Bini (Benin)	81.40
Mansur *et al*., 2020	Dhulikhel (Nepal)	72.57
Present study	Ogoni (Rivers)	71.82

Descriptive Statistics of the Study Population

The study was done in 390 individuals whose population was divided into male and female sex group of the Ogoni ethnic group and the frequency distribution of the different gender of the population was demonstrated in Table 1.

The result in Table 2 shows the general descriptive statistics of children in Ogoni ethnic group in Rivers state, Nigeria with mean age of males higher than the females as 8.31±2.11 and 8.29±2.07 respectively. The maximum skull width (MSW) and maximum skull length (MSL) shows significant increase in the mean values between the males and females of the population study with that of the males higher than the females. The mean values of the maximum skull width (MSW) were 126.70±5.20 and 124.48±5.07 for males and females respectively while that of the maximum skull length (MSL) were 176.58±6.92 and 173.62±6.64 for males and females respectively. There was also a significant increase in the mean nasomental length (NML) between males and females given as 94.19±5.95 and 92.46±5.50 respectively. Unlike the other parameters, there was no significant increase in the mean value of the bizygomatic width (BMW) between the different genders. This reveals that the males have a higher mean value for every anthropometric parameter considered for this study (to determine cephalic and facial indices) than the females except for the bizygomatic width (BMW) which had no significant increase in mean value between male and female given as 110.61±6.73 and 110.41±5.84 respectively.

The mean cephalic index for Ogoni male and female children were 71.85±3.79 and 71.79±3.86 respectively. The mean facial index for Ogoni male and female children is 85.35±6.05 and 83.86±4.86 respectively. This showed that the cephalic and facial index values are higher among the Ogoni males than the

females as seen in Table 3. However, the mean values of the cephalic indices showed that there was no statistically significant difference between male and female Ogoni children ($p>0.05$). But that of the facial indices showed statistically significant difference between males and females of the population ($p<0.05$).

Morphological classification of head types shows the prevalence of dolichocephalic head type as the most prevalent among both male (47.44%) and female (41.71%) Ogoni children followed by hyperdolichocephalic head type among males (33.49%) and females (36.57%) while the least common head type was hyperbrachycephalic which existed only among females (0.57%) and completely absent among males of the population studied as seen in Table 4.

Table 4 showed that the prevalence of dolichocephalic head type is higher in males (47.44%) than in females (41.71%) among Ogoni children, thus demonstrating sexual dimorphism with significant difference in values of the most prevalent head type. But that of hyperdolichocephalic head type is lower in males (33.49%) than in females (36.57%). There was no ultabrachycephalic head type observed among the Ogoni children. Thus, the least common head type that existed among male Ogoni children is the brachycephalic head type with frequency value of 2.33% while the least common head type that existed among female Ogoni children is the hyperbrachycephalic head type with frequency value of 0.57% as presented in Table 4.

Morphological classification of the facial types for the population study showed a prevalence of euryprosopic facial type as the most prevalent among both male and female Ogoni children with prevalence percentage values of 37.21% and 42.29% respectively. This reveals that the females have a higher prevalence of euryprosopic facial type than the males, thus demonstrating sexual dimorphism through the most prevalent facial type as presented in Table 5. The next most common facial type after euryprosopic facial type was mesoprosopic facial type with prevalence values of 29.77% and 24.00% for males and females respectively. The least common facial type that existed among Ogoni children is the hyperleptoprosopic facial type with frequency values of 3.25% and 1.71% for both males and females respectively. Thus, the males have a higher frequency for the least common facial types than the females as shown in Table 5.

4. DISCUSSION

Variation in physical morphology is an important phenomenon in the description of human population. This morphological variation can be quantified, analysed and described by using anthropometric measurements or parameters of body parts (such as head and face) that characteristically define the identity of an individual or groups of people (tribes or race). Geographical location has been described as a vital tool in description of population differences and craniofacial morphology offers important anthropometric indicators to make such description [1]. The determination of sex, is an important concern for the osteologist and forensic anthropologist as it is critical for individual identification. Sex determination eliminates approximately 50% of the population from further considerations in cases of missing persons. Moreover, many individualization criteria are sex specific. Several factors such as genetic factors are responsible for Morphological differences between the sexes. However, the phenotypic expression is due to mixture of genetic and environmental factors. Studies on sexual dimorphism are primarily based on biological differences between male and female. Male are more robust than female. The weight of axial skeleton in male is relatively and absolutely heavier than female approximately by 8% [9].

The present study provides valuable data pertaining to the cephalic and facial indices in Ogoni children between 5-12 years of age belonging to Rivers state, Nigeria with a sample size of 390 pupils as presented in Table 1. According to the results of this study, facial index values showed sexual dimorphism among Ogoni children with males having higher values than the females ($p<0.05$). Comparatively, both indices showed similarities and variations from the values obtained among other ethnic groups in different geographical location.

According to the standard anatomical classification, dolichocephalic was the most predominant head type while euryprosopic was the most predominant face type in the present data of Ogoni male and female children in Rivers state. But this head and face types differ when compared with those obtained from previous study and may be similar with other previous studies.

Table 2 of the present data indicated mean cephalic index of 71.85±3.79 for males and 71.79±3.86 for females which are lower when compared with those obtained from previous studies conducted on neonates in the East of Nigeria (Anambra) [6] with values of 80.35±5.42 for males and 79.56±4.92 for females with no statistically significant difference as well ($p>0.05$).

Table 3 showed that the mean facial index value from this present study indicated 85.35±6.05 for males and 83.86±4.86 for females with statistically significant difference between them ($p<0.05$), demonstrating sexual dimorphism. These values are lower when compared with the study that was done in Serbian population [10] where the mean facial index of male and female was 94.04±7.00 and 92.38±6.70 respectively which were almost similar to that of Nepalese population whose facial index values for

males and females were 98.21±4.89 and 95.78±3.29 respectively [11]. A study was done among North Indian population they also observed that the facial index was 101.04±1.95 in male and 107.7±7.69 in female among [12]; 100.28±1.77 in female in South Indian population male and 85.39±6.33 in female which were also higher than the values of this study [13].

Table 4 revealed that the prevalence of dolichocephalic head type among Ogoni male and female children had the highest value and was similar to those reported among the Obia males (73.7%) and females (72.2%) in Nigeria [13] and those reported among the Nepalese males (73.78%) and females (71.35%) [11] but at variance to the prevalence of brachycephalic head type among both Bini male and female children [1] and the prevalence of hyperbrachycephalic type among the Iranians [14].

Table 5 showed that the most prevalent facial type among both Ogoni male and female children was the euryprosopic facial type. This was similar to the results obtained in a study [15] by Heidari *et al.,* (2006) among the Sistani and Baluch women in Iran [15] but at variance with the result obtained in a study by Pandey (2006) which showed hypereuryprosopic face type as the most common among the Onge males (59.29%) and females (76.92%) in India [16].

Table 6 showed that the mean cephalic index values of this present study are lower when compared with those conducted on Babura males (77.15%) and females (77.23% [17], on Bini male (81.58%) and females (81.23%) children of Benin, Southern Nigeria [18], on Ibo and Yoruba population with mean cephalic index values of 81.71% and 79.44% respectively [19] and those obtained among Babur/Bura male (73.60%) and female (77.23%) neonates in Nigeria [17]. Mibodi and Frahani (1996) reported a significantly higher cephalic Index (87.50±6.4) among the Iranians [1] than those obtained in the present study as presented in Table 6.

Table 7 revealed that the mean facial index value among Ogoni children is at variance with the values obtained among the three major tribes in Nigeria: Yoruba (85.06±3.64), Igbo (86.56±4.08) and Hausa (87.67±3.69) [19]. The mean facial index value of the present study is also at variance with the result obtained in the study among Bini children [1] in Benin with mean facial index value of 85.88%; and is at variance with the results obtained among Ibo (74.63%) and Yoruba (75.66%) population [19] and as well the result obtained (2013) in the study among male and female children under the age of 6 in Anambra with mean facial index values of 80.86% and 80.41% respectively [6].

These variations in cephalic and facial index values across different population studies could be due to genetic and environmental factors that have led to the different head and face types prevalent in different population studies.

Individuals chosen for this study were from different parts of Rivers State. However, since the sample size is relatively small, it cannot be generalized. Thus, this study had focused on anthropometric data and has not focused on the factors which might be responsible for these anthropometric presentations.

In this study, anthropometric measurements were found to be higher for males than females with respect to the mean values of each anthropometric parameter.

The maximum skull width had a mean value of 126.70mm for males which was higher than that for females (124.48mm). The maximum skull length had a mean value of 176.58mm for males which was higher than that of females (173.62mm). The mean cephalic index value for males showed very little difference in mean value from that of females which were 71.85% and 71.79% respectively. This difference was statistically not significant using two sample t-test ($p>0.05$).

The nasomental length was also found to have a higher mean value in males (94.19mm) than females (92.46mm). The Bizygomatic width showed very little difference in mean values between males (110.61mm) and females (110.41mm) of the population study. The calculated facial index values showed a statistically significant difference between the males and females of the population study with values of 85.35% and 83.86% ($p<0.05$). Thus, the facial index values can be useful for sexual dimorphism than the cephalic index values obtained from the present study.

The percentage prevalence of the different head types found in the study population showed that dolichocephalic head type was the most prevalent with percentage values higher for males (47.44%) than for females (41.71%). The percentage prevalence of the different facial types found in the population study showed that euryprosopic facial type was the most prevalent with percentage values higher for females (42.29%) than males (37.21%). Thus, the males were known to have more dolichocephalic head type than the females while the females were known to have more euryprosopic facial type than the males based on the results of the population study.

5. CONCLUSION

The present data defined the baseline cephalofacial measurements in healthy Ogoni children in Rivers state within the age range of 5-12 years. The study was also able to demonstrate sexual dimorphism using the cephalofacial indices obtained from the anthropometric measurements taken, as there was a

significant difference in the values obtained. The most prevalent head and face type was evaluated also in this study.

REFERENCE

1. Omotoso, D., Olanrewaju, A., Okwuonu, U., Adagboyin, O., & Bienonwu, E. (2019). Morphometric study of cephalo-facial indices among Bini children in southern Nigeria. *Anatomy Journal of Africa*, *8*(2), 1580-1585. https://doi.org/10.4314/aja. v8i2.189031.
2. Zollikofer, C. P., & Ponce de León, M. S. (2002). Visualizing patterns of craniofacial shape variation in Homo sapiens. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, *269*(1493), 801-807.
3. Montagu, A. A. (2006). Handbook of Anthropometry. Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd
4. Rajlakshmi, C. H., Shyamo Singh, M., Bidhumkhi, T. H., & Chandramani, S. L. (2001). Cephalic index of foetuses of Manipuri population– A Baseline study'. *Journal Anatomy Society India*, *50*(1), 13-16.
5. Safikhani, Z., Afzali, N., & Bordbar, H. (2007). Determination of Anatomical type of head and face in children under 6 years in Ahwaz. *Iran-Act MediaIronical*, *45*(1), 43-45.
6. Ukoha, U., Dimkpa, U., Ofoego, U., Eteudo, A. N., Asomugha, L., Egwu, O., Okafor, J. I., Eze, A. A., & Uchefuna, R. (2013). Cephalofacial Characteristics of Children Under 6 Years of Age in East of Nigeria. *National Journal*, 4, 21-25.
7. Reichs, K. J., & Bass, W. M. (1998). Forensic Osteology: Advances in the Identification of Human Remains (2nd Edition). Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd.
8. Golalipour, M. J., Haidari, K., Jahanshahi, M., & Farahani, R. M. (2006). The variation of head shapes in 17-20 years old native for males in Gorgan North of Iran. *International Journal Morphology*, 24, 187-19.
9. Doni, R. P. K., CS, J., & Vijayaraghavan, V. (2013). A study on measurement and correlation of cephalic and facial indices in males of South Indian population. *International Journal of Medical Research & Health Sciences*, *2*(3), 439-446. https://doi.org/10.5958/j.2319-5886.2.3.076
10. Jeremić, D., Kocić, S., Vulović, M., Sazdanović, M., Sazdanović, P., Jovanović, B., ... & Živanović-Mačužić, I. (2013). Anthropometric study of the facial index in the population of central Serbia. *Archives of Biological Sciences*, *65*(3), 1163-1168.
11. Mansur, D., Maskey, S., Shrestha, P., Shrestha, A., Sharma, K., & Yadav, A. (2020). Measurement of cephalic and facial indices among students of KUSMS. *Journal of Chitwan Medical College*, *10*(31), 31-35. https://doi.org/10.3126/jcmc.v10i1.28067
12. Prasanna, L. C., Bhosale, S., D'souza, A. S., Mamatha, H., Thomas, R. H., & Sachin, K. S. (2013). Facial indices of north and South Indian adults: reliability in stature estimation and sexual dimorphism. *Journal of Clinical & Diagnostic Research*, *7*(8), 1540-1542.
13. Eroje, M. A., Fawehinmi, H. B., Jaja, B. N., & Yaakor, L. (2010). Cephalic index of Ogbia tribe of Bayesla state. *Int J Morphol*, *28*(2), 389-392.
14. Mibodi, I. M. A., & Frahani, M. R. (1996). Study of normal range of anatomical dimensions of one-day old newborn by cephalometry. *Journal of Medical Council of Islamic Republic of Iran*, *14*(1), 1-8.
15. Zahra, H., Hamid-Reza, M. S., & Mohammad Husein, M. (2006). Morhorlogical Evaluation of Head and Face in 18-25 years old women in Southeast of Iran, *J Med Sci*, 6(3), 462-466.
16. Pandey, A. K. (2006). Cephalo-facial variation among Onges. *The Anthropologist*, *8*(4), 245-249.
17. Enaohwo, T. M., & Igbigbi, P. S. (2006). Cephalix index in Ovu community of Delta state. *Abstract of Anat. Soc. Nigeria*, *3*, 26.
18. Garba, S. H., Numan, A. I., & Mishara, I. G. (2008). Craniofacial classification of normal newborns in Maiduguri metropolis, Nigeria. *Int J Morphol*, *26*(2), 407-10.
19. Ewunonu, E. O., Ekanem, T. B., Aligekwe, A. U., Igiri, A. O., Igbigbi, P. S., Obikili, E. N., ... & Eteudo, A. N. (2006). Comparative study on the Facial Indices of the three major tribes in Nigeria. *Abstract of Journal of Anat. Soc of Nig*.
20. Eliakim-Ikechukwu, C., Onugh, E., & Mesembe, O. (2012). Cephalofacial Indices of the Ibo and Yoruba Ethnic groups in Southern Nigeria. *Journal of Biology, Agriculture and Healthcare*, 2.