

## **Facial index among Igbo children and adolescents in Enugu.**

**Obinna Remigius Okwesili<sup>1\*</sup>, Emmanuel Nebuwa Obikili<sup>2</sup>, Johnson Uche Achebe<sup>1</sup>**

<sup>1</sup>Department of Surgery, University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State, Nigeria

<sup>2</sup>Department of Anatomy, College of Medicine, University of Nigeria, Enugu State, Nigeria

### **Abstract**

**Facial dimensions are influenced by age, sex, tribe or race. This knowledge is invaluable in craniofacial surgeries, forensic medicine and bioengineering. The purpose of this study is to establish the predominant types of face among Igbo children and adolescents in Enugu based on their facial indexes, to correlate the facial indexes with age, height and weight. The facial parameters of 725 Igbo children and adolescents with a range of 5 and 19 years were measured, their facial indexes calculated with the appropriate formula and the data were analysed using SPSS version 20. The predominant facial types were hyperleptoprosopic and leptoprosopic in both children and adolescents. Facial index had no significant correlation with age, height, weight and body mass index (BMI) but morphological facial height and maximum facial width showed significant positive correlation with age, height, weight and body mass index ( $p < 0.01$ ). Morphological facial height was longer in males than females while maximum facial width was wider among the females. The facial types of Igbo children and adolescents based on cephalic index differ from those of other tribe or race. These findings are important in anthropology, human anatomic studies, forensic medicine and surgical reconstruction of the face.**

**Keywords:** Facial index, Children, Adolescents.

*Accepted on September 26, 2019*

### **Introduction**

The face plays an important role in the identity of an individual, one's sex, one's tribe or race; and one of the unique facial features utilized in this regard is the facial index. Facial analysis using facial index is essential in the study, classification and reconstruction of the human face; and it is therefore useful to anatomists, anthropologists, plastic surgeons and maxillofacial surgeons [1,2] Facial anthropometry is essential in establishing the identity and in the estimation of age of victims in forensic studies [1,3,4]. Facial index is the criterion that has been used in the classification of the human face into hypereuryprosopic face (very broad face, range: <79.9), euryprosopic face (broad face, range: 80-84.9), mesoprosopic face (round face, range: 85-89.9), leptoprosopic face (long face, range: 90-94.9) and hyperleptoprosopic face (very long face, range: >95)[1-7].

Among adult Africans, leptoprosopic face has been considered to be the most prevalent type of face, according to Torres-Restrepo et al. [8]. Ewunonu et al. [9] reported that Igbos from a State in South-East Nigeria also have leptoprosopic face; but a report by Eliakim-Ikechukwu et al. [10] showed Igbos to have hypereuryprosopic face like adult Yorubas.

It is important to note that the facial index in children is not exactly the same as that of adults of the same race and sex.

This is demonstrated by the lower values of facial index observed in children.7 Majority of children in the South of Nigeria have been reported to have mesoprosopic face by Oludiran et al. [11] though lesser percentages of these children were reported to have euryprosopic and leptoprosopic faces.

The types of face and their facial indexes have been studied in other countries. Colombian children were reported to have mesoprosopic and leptoprosopic faces that were equal in predominance<sup>8</sup>, while Malaysian school children were reported to have Hypereuryprosopic face in a study by Swamy et al. [12].

Facial index bears a direct relationship with morphological facial height and an indirect relationship with the maximum facial width of an individual. The morphological facial height was shown to have a positive correlation with age [13]. It is one of the facial parameters with the fastest growth rate.<sup>14</sup> It is sexually dimorphic, with the males having higher values than females [14-18]. On the other hand, Mahdi et al. [19] noted a positive correlation between maximum facial width and age, in contrast with the report of Li et al. [13] where a negative correlation with age was noted among males and females of Hans's ethnic group in China.

Devi et al. [6] noted changes in facial parameters when two generations of males of an Indian population that were decades apart were compared. In this population, morphological facial

height was noticed to be increasing while the facial width was decreasing leading to an increase in facial index.

## Materials and Methods

The Igbo people are one of the major tribes in Nigeria that are indigenous to the South East of Nigeria. The target population was Enugu metropolis, the capital of Enugu State. This is a cross-sectional study that involved 725 Igbo subjects with a range of 5 to 19 years. Cluster sampling method was used for selection of groups of the subjects, and the clusters used were primary schools, secondary schools and higher institutions. Each of the subjects was made to sit in an upright position with the head in anatomical position. All the measurements were taken by the same investigator. Each parameter was measured twice and the average of the measurements was taken. Intra-observer variability for the measurements used  $\leq 0.2$  mm for the facial measurements.

### *Craniofacial landmarks used and the dimensions measured*

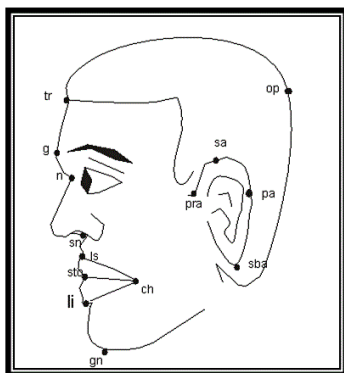
**Nasion (n):** The midpoint on the soft tissue contour of the base of the nasal root at the level of the fronto-nasal suture.

**Gnathion (gn):** The most inferior midline point on the soft tissue chin contour.

**Zygion (zy):** The most lateral point on the soft tissue contour of each zygomatic arch.

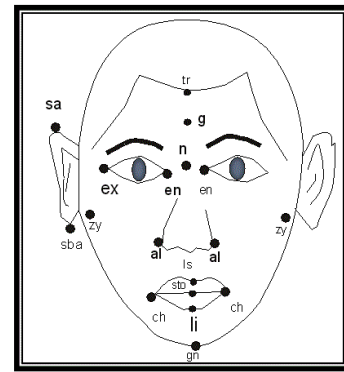
The facial dimensions were measured with a digital 150 mm (6 inches) Vernier's caliper which gives 0.01 mm precision readings through a clear liquid crystal display. No pressure was exerted on the skin by the limb of the calipers during the measurement.

**Morphological facial height:** This is the straight distance measured between the nasion (nasal root) to the gnathion (the lowest mid-point of the mandible) (Figure 1).



**Figure 1.** Lateral view of the face with craniofacial landmarks.

**Maximum facial width/breadth:** It is the widest distance between the zygomatic prominences. The most lateral point of the zygomatic arch was palpated on both sides and the end of the calipers placed on these points (zy-zy) (Figure 2) to take the measurement.



**Figure 2.** The face with the craniofacial landmarks.

Facial index is dependent on morphological facial height and maximum facial width of an individual. The formula for its calculation is given below.

The height of the subject which is the distance from the vertex of the head to the level of the foot was measured using a mobile stadiometer with the subject barefooted, the heels together and the face looking forward. The weight of the subject was measured with a weighing scale that was part of the stadiometer and the subjects were barefooted during the time of weighing and wearing only light clothing.

The data collected were recorded analysed using Statistical Package for Social Sciences (SPSS) software version 20. The data were subjected to statistical analysis for means and standard deviation. Pearson's correlation coefficient ( $r$ ) was used to check for any relationship between age, height, weight, body mass index and with the other variables respectively. Mean values for the sexes were compared using t-test and  $p$  values of less than 0.05 and were considered statistically significant.

Consent to measure children was obtained from the parent teachers association (PTA) through the head teacher of each school used for the study, while adolescents that were up to 18 years gave consent by themselves. Ethical clearance for the original work was obtained from the University of Nigeria Teaching Hospital Health and Research Ethics Committee with certificate number NHREC/05/01/2008B-FWA00002458-1RB00002323.

Subjects selected were those with parents and grandparents that are Igbos. None of the subjects had any history or features of craniofacial anomaly. None had significant facial trauma or surgeries on the face or head.

## Results

From the results represented in Table 1, the males had a higher morphological facial height than the females at all ages except at the ages of 11, 14 and 15. The higher values of the males were only significant at the ages of 6 and 12. The facial height essentially increased progressively with age in both sexes.

The maximum facial width was represented in Table 2 to be wider in the females at all ages except at the ages of 7 and 8

years. This was however only statistically significant at 11 years ( $P<0.05$ ), 12 years ( $P<0.05$ ), 15 years ( $P<0.01$ ), 17 years ( $P<0.05$ ) and 18 years ( $P<0.01$ ).

The mean facial indices of children and adolescents at various ages were represented in Table 3. The facial indices of males were consistently higher than those of their female counterparts at various ages but differences were only statistically significant at 6 years old ( $P<0.05$ ), 10 years old ( $P<0.01$ ), 12 years old ( $P<0.01$ ), 13 years old ( $P<0.01$ ), 16 years old ( $P<0.01$ ) and the 18 years old ( $P<0.01$ ). The males were found to have hyperleptoprosopic faces except at the ages of 8 and 9 years when they were leptoprosopic. The females were predominantly leptoprosopic except for the ages of 6 and 11 years.

From the result in Table 4, the commonest type of face was hyperleptoprosopic face in both sexes, and it was followed by leptoprosopic face. The percentage of females with leptoprosopic face (27.71%) was comparable to those with mesoprosopic face (25.87%) while hypereuryprosopic face was the least common in both sexes.

The Percentage distribution of the types of faces in children and adolescents by sex was represented Figure 3 and it showed that hyperleptoprosopic face was the commonest type in both males and females, though there was a difference in the patterns of distribution of the various types of face in both sexes. The other types of faces in the minority were seen in a higher proportions among females compared to the males.

**Table 1.** The morphological facial heights of children and adolescents by age.

Age (yrs)	No.	Males		Females		p value
		Means	SD	Means	SD	
5	11	94.9	2.7	92.2	4.1	0.08
6	20	97.4	4.4	94.2	4.5	0.03*
7	26	98.7	5	96	5.6	0.1
8	36	98.9	7.1	97.7	5.5	0.38
9	26	99.9	5.3	98	5.5	0.2
10	18	102.9	5.2	100.2	6.2	0.18
11	18	101.8	6.1	103.9	5	0.2
12	15	109.9	12.8	103	4.6	0.00**
13	21	106.8	8.7	104.6	5.5	0.19
14	14	107	7	107.9	6.8	0.68
15	16	104.9	9.6	107.5	5.3	0.22
16	16	112.6	9.3	109.3	5.3	0.18
17	19	110.8	7.3	110.6	6.1	0.91
18	19	114.1	8.2	110.1	6.3	0.06
19	17	111.7	5.6	109.6	5.7	0.2

\*\*Significant at  $p<0.01$

\*Significant at  $p<0.05$

**Table 2.** The maximum facial widths of children and adolescents by age.

Age (yrs)	No.	Males		Females		p value
		Means	SD	Means	SD	
5	11	98.6	4.2	99.9	4.8	0.5
6	20	98.8	4.4	99.2	3.8	0.73
7	26	103.9	4.7	102.7	5.6	0.45
8	36	106	5.9	105.5	7.1	0.76
9	26	105.6	5.2	105.9	6.7	0.8
10	18	105.6	7.3	110.3	7.5	0.08
11	18	104.9	7.3	109.4	5.2	0.02*
12	15	106	4.2	109.9	5	0.01*
13	21	104.8	7.2	113	6.5	0.00**
14	14	111.2	7.5	115	6	0.07
15	16	109.5	9.8	117.2	6.8	0.00**
16	16	113.1	7.4	117.2	5.8	0.06
17	19	112.3	6.3	117.4	7.5	0.03*
18	19	116	5.5	121.1	5.8	0.00**
19	17	115.7	6.8	116.9	6.4	0.54

\*\*Significant at  $p<0.01$

\*Significant at  $p<0.05$

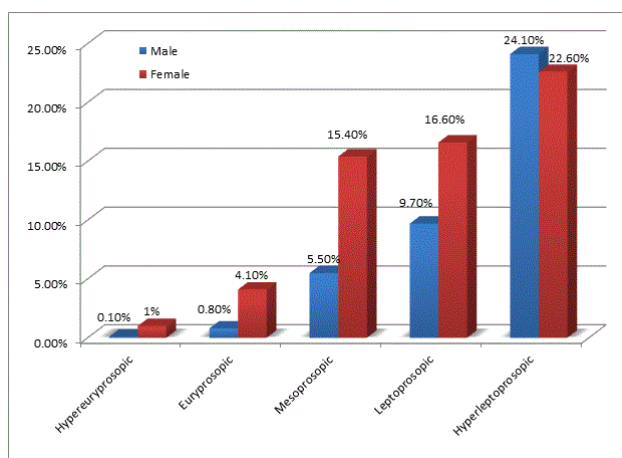
**Table 3.** The facial indices of children and adolescents by age.

Age (yrs)	No.	Males		Females		p value
		Mean	SD	Mean	SD	
5	11	96.3	4.4	92.4	5.1	0.07
6	20	98.8	5.8	95	5.5	0.04*
7	26	95.1	4.6	93.7	6.5	0.4
8	36	93.5	5.9	92.9	7.2	0.72
9	26	94.8	6.1	92.7	5.5	0.18
10	18	97.6	4.7	91.2	8.1	0.00**
11	18	97.3	6.5	95.2	6.1	0.28
12	15	103.7	11.3	93.9	6.2	0.00**
13	21	102.3	10	92.9	7.5	0.00**
14	14	96.5	8.1	94	6.9	0.29
15	16	96.1	8.2	92	6.5	0.06
16	16	100.2	13.6	93.4	4.7	0.03*
17	19	98.9	7.5	94.6	7.5	0.07
18	19	98.5	8.5	91	5.9	0.00**
19	17	96.8	5.5	94	7.3	0.18

\*\*Significant at  $p<0.01$  \*Significant at  $p<0.054$

**Table 4.** The distribution of types of faces in children and adolescents by sex.

Types of Faces	Males (f)	%	Females (f)	%	Both sexes (f)	Both sexes (%)
Hyperuryprosopic ( $\leq 79.9$ )	1	0.35	7	1.62	8	0.011
Euryprosopic (80.0 - 84.9)	6	2.05	30	6.93	36	0.0497
Mesoprosopic (85.0 - 89.9)	40	13.7	112	25.87	152	0.2097
Leptoprosopic (90.0 - 94.9)	70	23.97	120	27.71	190	0.2621
Hyperleptoprosopic ( $\geq 95.0$ )	175	59.93	164	37.88	339	0.4676
Total	292	100	433	100	725	1

**Figure 3.** Percentage distribution of types of faces in the children and adolescents by sex.

The facial height and facial width as represented in Table 5 had significant positive correlation with age, height, weight and body mass index. Facial index on the contrary had no significant correlation with age, height, weight and body mass index.

**Table 5.** Pearson Correlation coefficients of the facial indices with age, height, weight and body mass index.

Variables	Age		Height		Weight		BMI	
	r	p value	r	p value	r	p value	r	p value
Morph. Facial Height (mm)	0.636	0.00**	0.559	0.00**	0.63	0.00**	-0.389	0.00**
Max or Facial Width (mm)	0.638	0.00**	0.575	0.00**	0.67	0.00**	-0.421	0.00**
Facial Indices	0.019	0.6	0	0.99	-0.022	0.56	0.021	0.58

\*\*Correlation significant at  $p < 0.01$

Facial index had no significant correlation with age and this finding is similar to the report of Ewunonu et al. [9]. This present study also showed that facial index had no significant correlation with height, weight and body mass index (BMI). Facial height had significant positive correlation with age in this present study ( $p < 0.001$ ) which is similar to the findings of Li et al [13]. The significant positive correlation of facial width

## Discussion

Hyperleptoprosopic face was the commonest type of face among Igbo children and adolescents in Enugu metropolis. It was seen in 46.6% of the population, while 26.2% of the children had leptoprosopic face and 21.0% had mesoprosopic face. Males were predominantly hyperleptoprosopic (59.93%), with 23.97% being leptoprosopic and only 13.7% of males were mesoprosopic. Among females, hyperleptoprosopic face was still the commonest with 37.88% of males having it, but a considerable percentage of the females had leptoprosopic face (27.71%) and mesoprosopic face (25.87%). This was quite different from a study a younger population by Ukoha et al. [20] which showed that children of less than 6 years old from South Eastern Nigeria had hyperuryprosopic face as the most dominant type of face followed by the euryprosopic type; in this present study, only 1.1% of the population had hyperuryprosopic face. The difference in the result of the two studies may be due to huge difference in the age ranges of the subjects in these studies.

with age noted in this present study was similar to the findings of Mahdi et al. [19], but varied from the report of Li et al. [13] which showed correlation that was negative. Morphological facial height and maximum facial width had significant positive correlation with height, weight and body mass index of the subjects ( $p > 0.01$ ).

The sexual dimorphism noticed in this study was not consistent since it was noticed only at some ages for the three parameters. For facial height, it was noted only at the ages of 6 and 12 years; for facial width, it was noted at the ages of 11 to 13 years as well as 15, 17 and 18 years respectively; while sexual dimorphism for facial index was at the ages of 6, 10, 12, 13, 16, 18 years. These may be due to the differential growth pattern of boys and girls at different stages of their development. In a study among children less than 6 years of age in the East of Nigeria, Ukoha et al. [20] noted that there was no sexual dimorphism in facial height, facial width and facial index as has been documented among adults and older children. In this study the males were observed to have higher facial indices than the females. There was sexual dimorphism in facial height with the males having longer facial heights than females at some age which was similar to the findings of Obaje and Uzomba [21] On the other hand, the pattern of sexual dimorphism in facial width is such that the females had wider facial width than males in the various age groups and this was significant at most ages among children and adolescents of 10 to 18 years.

## Conclusion

Majority of Igbo children and adolescents in Enugu of the Southeast of Nigeria have very long faces, but males have longer faces than females. A small percentage of this population has either round face or broad face but this was seen more among the females. Facial height and width had significant correlation with age, body height, weight and body mass index while facial index had no correlation with any of these. The facial parameters exhibited sexual dimorphism among Igbo children and adolescents but this is not as well established as that seen among adults. The data in this study can serve as guide in making diagnosis of facial anomaly among Igbo children and adolescents and should be useful in the planning of craniofacial surgeries carried out by craniofacial surgeons, maxillofacial surgeons, as well as by plastic, reconstructive and esthetic surgeons. It will also be important in anthropology, human anatomic studies, forensic medicine, especially those of Igbo children and adolescence.

## References

1. Kumari KL, Babu PVS, Kumari Pk, Nagamani M. A study of cephalic index and facial index in Visakhapatnam, Andhra Pradesh, India. *Int J Res Med Sci.* 2015;3:656-658.
2. Yesmin T, Thwin SS, Urmi SA, Wai MM, Zaini PU, Azwan K. A study of facial index among Malay population. *J anthropol.* 2014; 5: 1-4.
3. Gibelli D, Mapelli A, Oberton Z, Poppa P, Gabriel P, Ratnayake M. Age changes of facial measurements in European young adult males: Implication of identification of the living. *J Comp Hum Biol.* 2012; 63:451-458.
4. Benova J, Stankova J, Benus R, Zeman T, Masnicova S. Facial indices method of age approximation from photographic material. *Ceska Antropologie.* 2016; 66:4-7.
5. Maina MB, Mahdi O, Kalayi GG. Craniofacial forms among three dominant ethnic groups of Gombe state, Nigeria. *Int J Morphol.* 2012;30:211-216.
6. Devi TB, Singh TN, Singh SJ, Tamang BK. Facial morphology and facial index: A study on secular trend of Meitei male population of Bishnupur District, Manipur, India. *Int J Anat Res.* 2016;4:3279-3283.
7. Ebrahimipour A, Rahbar F, Ghasemi H, Taghian M, Pashmaki M. Evaluation of facial anthropometric index among 15-20 Year old individuals in Sari City. *Helix.* 2017; 8:1083-1087.
8. Torres-Restrepo AM, Quintero-Monsalve AM, Giraldo-Mira JF, Rueda ZV, Velez-Trujillo N, Botero-Mariaca P. Agreement between cranial and facial classification through clinical observation and anthropometric measurement of Envigado school children. *BMC Oral Health* 2014;14:50.
9. Ewunonu EO, Anibeze CIP. Anthropometric study of facial morphology in a South-Eastern Nigerian population. *Hum Bio Rev* 2013;2:314-323.
10. Eliakim-Ikechukwu C, Onuh E, Bassey T, Mesembe OE. Cephalofacial indices of the Ibo and Yoruba ethnic groups in southern Nigeria. *J Biol Agric Healthc* 2012;2:144-148.
11. Oludiran OO, Omotoso DR, Sakpa CL. Nasofacial indices among children in Southern Nigeria. *African Journal of Biomedical Sciences* 2012;15:141-143.
12. Swamy LB, Zubaidi AL, Suwaibah A, Azmi H, Norizahar K, Husbani MAR, Rohayah H. The craniofacial indices correlate with age, gender and environmental influences: A study in Malaysian school children. *World Appl Sci J* 2013;27:250-256.
13. Li Y, Zheng L, Yu K, Lu S, Zhang X, Li Y, Wang Y, Xue H, Deng W. Variation of head and facial morphological characteristics with increased age of Han in Southern China. *Chinese Sci Bull.* 2013;58:517-524.
14. Akinbami BO, Ikpeama M. Analysis of facial height between prepubertal and postpubertal subjects in Rivers state, Nigeria *J Anthropol* 2013;4:1-5.
15. Farkas LG, Katic MJ, Forrest CR, Alt KW, Bagic I, Baltadjiev G. International anthropometric study of facial morphology in various ethnic groups/races. *J Craniofac Surg.* 2005;16:615-646.
16. Anibor E, Okumagba MT, Onodaro E. The facial and nasal height of Ijaw ethnic group in Delta state of Nigeria. *Adv Appl Sci Res.* 2013;4:1-5.
17. Ebeye O, Emore E, Ebite E, Ijeh N. Facial dimensions in Urhobos of Nigeria. *Internet J of Biol anthropol.* 2009;4:5-7.
18. Oladipo GS, Isong EE, Okoh PD. Facial, nasal, maxillary, mandibular and oro-facial heights of adult Ibibios of Nigeria. *Aust J Basic & Appl Sci.* 2010;4:6306-6311.
19. Mahdi E, Abolfazl N, Fariba K, Mohammad B. An Investigation on cephalometric parameters in an Iranian population. *J Dev Biol Tissue Eng.* 2012;4:8-11.
20. Ukoha UU, Dimkpa U, Ofoego UC, Eteudo AN, Asomugha LA, Egwu OA, et al. Cephalofacial characteristics of children under 6 years of age In East of Nigeria. *Natl J Integr Res Med.* 2013;4:21-25.
21. Obaje GS, Uzomba GC. The cephalofacial characterization in humans: The study using Igbo tribe in Nigeria. *Egypt J Med Hum Genet.* 2018;19(4):399-402.

**\*Correspondence to** *Okwesili/Obikili/Achebe*

Obinna Remigius Okwesili  
Department of Surgery  
University of Nigeria Teaching Hospital  
Enugu State  
Nigeria