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Facial types and morphology: A study among Ika subjects in Delta State, Nigeria

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***Abstract*---**Information on an individual's facial morphology can have several important clinical and forensic applications. Such information can help to improve or reduce the need for extensive surgical interventions for craniofacial anomalies and trauma. This study scrutinized different facial types and morphology among the indigenes of Ika ethnic group in Nigeria, by means of facial height, facial breath and facial index. The study adopted a cross sectional study design, and was conducted with 384 subjects from Agbor community in Delta State, Nigeria. Data was collected with the aid of a digital sliding caliper, data collection sheet, and pencil. All required measurements were taken with each subject seated on a chair in a relaxed mood and with the head in the anatomical position. Majority of the subjects 125 (32.6%) were in the 21-25years age set. The predominant facial type observed is the hyperleptoproscopic sort as seen in 148 (38.5%). Chi-square test of association between gender and facial type disclosed a significant relationship (p=0.001). Chi-square test of association between age and facial type divulged a remarkable correlation (p=0.015). This study confirmed that majority of the Ika populace have the hyperleptoproscopic facial type. Majority of the Ika males have the

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mesoproscopic facial type while the Ika females have the hyperleptoproscopic facial type.

***Keywords*---**facial, types, morphology, Ika, Nigeria.

Introduction

Face types have been studied and divided into circular, tapered, square tapered and ovoid forms (Lindemann, 2014). It has been found that there are differences between the classical cube, square tapered and ovoid facial forms (Ashok and Dharaj, 2019). In forensic research, facial anthropometry is important in determining and estimating the age of victims of disasters (Kumari *et al.*, 2015).

The facial index is the criterion that has been used for human face classification. For human identification and communication, facial appearance is important. In humans, facial muscles allow the expression of emotions (Farkas *et al.*, 2015). The facial index is the ratio of the morphological facial height to facial breadth (width) of bizygomatic arch multiplied by 100 (Baral, 2010).

The classification of the facial index is as follows (Tahamida *et al.,* 2014):

- Hyperleptoprosopic (very long face) >95%
- Leptoprosopic (long face) 90–94.9%
- Mesoprosopic (round face) 85–89.9%
- Europrosopic (broad face) 80–84.9%
- Hypereuroprosopic (very broad face) <79.9%

The comparison of changes in the facial index between parents, offspring, and siblings may give a clue to inherited genetic traits (Kurnia *et al.*, 2012). Human facial contours have always been important in the identification of the race of an individual; these parameters are also important components of forensic identification and reconstructive surgery (Praveen *et al.*, 2013). It has been shown that morphological facial height has a correlation with one's age (Akinbami and Ikpeama, 2013). It is sexually dimorphic, with higher values for males than females (Oladipo *et al.*¸ 2010).

There have been studies on facial morphology of individuals from the Ibibio, Bini and Igbo ethnic groups (Oladipo *et al*¸ 2010; Osunwoke *et al.*, 2011; Obinna *et al.*, 2019), as well as the Haryanvi population (Gupta *et al.*, 2019; Mahesh and Mohd, 2013). However, a study of morphological facial measurements of facial index among the Ika ethnic group has not come under attention before now. Hence driven by this need, this research was done on the facial index of the Ikas in Delta State, Nigeria.

When the facial pattern of a patient is not determined before orthodontic treatment commences, the facial esthetics and occlusal function of the patient may be further compromised if the lower facial height (LFH) is unnecessarily increased or reduced by the mechanics used in treatment (Ajisafe *et al.*, 2018). There are differences in the morphology of the face that occur through differential

development. These are regulated by a variety of variables, including genetic heritage, climate and the world in which we live (Prasanna *et al.*, 2013). This study scrutinized different facial types and morphology among the people of Ika ethnic group in Nigeria, by means of facial height, facial breath and facial index.

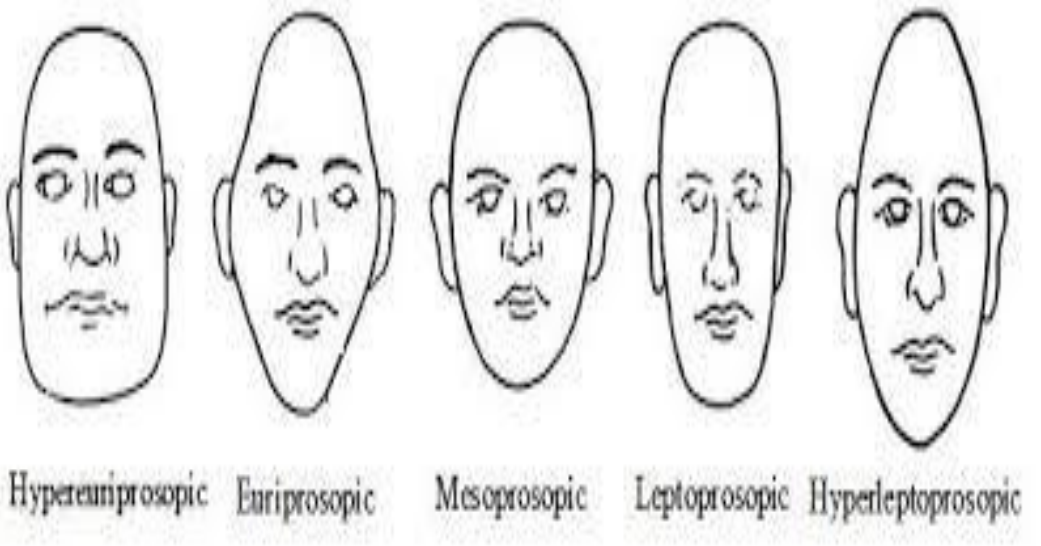

Figure 1. Facial types (source: Deepu *et al.,* 2015)

Materials and Methods

The study sample consisted of both male and female Ika subjects within the ages of 11-35 years. Data was collected with the aid of a digital sliding caliper, data collection sheet and pencil. All required measurements were taken in a relaxed mood and the head was in the anatomical position with the subject sitting on a chair.

The following dimensions were taken with an automated sliding caliper:

Facial height: from nasion (n) to Gnathion (gn).
Facial breadth (width): distance from the left to the right zygion (zy-zy).
The anatomical landmarks were defined as follows:
Nasion (n): the region at the nasofrontal sutures at the root of the nose.
Gnathion (gn): the lowest jawbone point, where the midsagittal plane crosses the lower jaw edge.
Zygion (zy): It is the most laterally located point on the zygomatic arch.

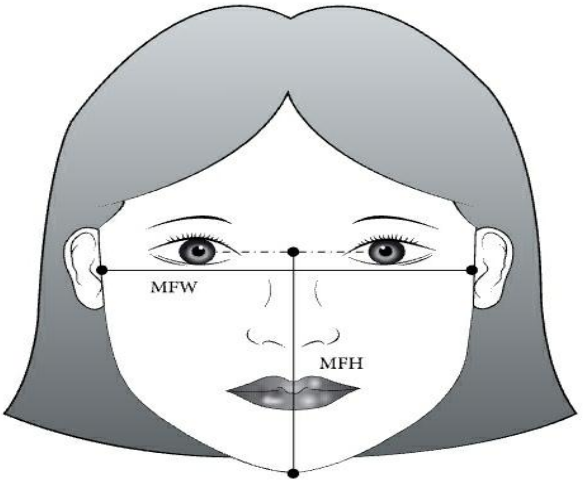

Figure 2: Measurement of morphological facial height (MFH) and morphological facial breadth (MFB) (Tahamida *et al.,* 2014)

$$\text{Facial Index} = \frac{\text{Facial height}}{\text{Facial breadth}} \times 100$$

A well-structured data collection sheet was used to record the data collected from the subjects. The data compiled included the age, gender, facial height, facial breadth, facial Index and facial type. Subjects with facial deformities, craniofacial trauma as well as those with history of plastic surgery were excluded from the current study. Data obtained was subjected to analysis by the use of the Statistical Package for the Social Sciences (SPSS), version 25. The student's t-test was used for inferential statistical analysis of the parametric variables while chi-square test was used for analysis of nonparametric variables, and p value less than 0.05 was considered to be statistically significant. Pearson's correlation coefficient (r) was used to search for the association between age and facial index.

Results

Table 1
Age distribution of the studied sample

Age group (years)	**Frequency (%)**
11-15	27 (7.0)
16-20	105 (27.3)
21-25	125 (32.6)
26-30	63 (16.4)
31-35	64 (16.7)
Total	**384 (100.0)**

Table 2
Gender distribution of the studied masses

Gender	Frequency (%)
Males	193 (50.3)
Females	191 (49.7)
Total	**384 (100.0)**

Table 3
Distribution of face type in the sampled populace

Face type	Frequency (%)
Europroscopic	32 (8.3)
Hypereuroproscopic	8 (2.1)
Hyperleptoproscopic	148 (38.5)
Leptoproscopic	105 (27.4)
Mesoproscopic	91 (23.7)
Total	**384 (100.0)**

Table 4
Descriptive statistics of observed variables

Observed variables	Minimum	Maximum	Mean	Standard Deviation
Age (years)	11.00	35.00	23.54	5.68
Facial Height (mm)	86.48	122.30	112.45	6.68
Facial Width (mm)	99.33	139.15	121.20	6.54
Facial Index	72.94	109.96	92.97	6.50

Table 5
Chi-square test of association between gender and face type

Face type	Male Frequency	Female (percentage)	Chi-square	Df	p-value
Europroscopic	19 (4.9)	13 (3.4)	21.721	4	**0.001**
Hypereuroproscopic	5 (1.3)	3 (0.8)			
Hyperleptoproscopic	62 (16.1)	86 (22.4)			
Leptoproscopic	44 (11.5)	61 (15.9)			
Mesoproscopic	63 (16.4)	28 (7.3)			
Total	**193 (50.3)**	**191 (49.7)**			

Table 6
Chi-square test of association between age and face type

Age (years)	Europroscopic	Hyper europroscopic	Hyper leptoproscopic	Leptoproscopic	Mesopros copic	Chi-square	df	p-value
11-15	5 (1.3)	1 (0.3)	13 (3.4)	7 (1.8)	1 (0.3)	30.550	16	**0.015**
16-20	8 (2.1)	2 ().5)	41 (10.7)	25 (6.5)	29 (7.6)			
21-25	4 (1.0)	5 (1.3)	45 (11.7)	43 (11.2)	28 (7.3)			
26-30	4 (1.0)	-	24 (6.3)	15 (3.9)	20 (5.2)			

31-35	11 (2.9)	-	25 (6.5)	15 (3.9)	13 (3.4)
Total	**32 (8.3)**	**8 (2.1)**	**148 (38.5)**	**105 (27.4)**	**91 (23.7)**

Table 7
T-test of association between gender and observed variables

Observed variables	**Gender**	**Mean**	**Standard deviation**	**T-value**	**P-value**
Facial Height (mm)	Male	112.71	6.02	0.779	**0.436**
	Female	112.18	7.29		
Facial Width (mm)	Male	123.13	6.38	6.104	**0.001**
	Female	119.24	6.12		
Facial Index	Male	91.72	6.01	-3.862	**0.001**
	Female	94.24	6.74		

Table 8
Descriptive statistics of observed variables within age brackets

Age (years)	**Observed variables**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**
11-15	Facial Height (mm)	89.10	122.30	111.51	7.41
	Facial Width (mm)	109.72	138.82	120.38	7.83
	Facial Index	79.52	104.83	92.83	6.45
16-20	Facial Height (mm)	88.81	122.30	112.83	6.23
	Facial Width (mm)	99.33	139.15	121.94	6.60
	Facial Index	79.28	106.47	92.73	6.37
21-25	Facial Height (mm)	86.47	122.28	112.10	7.19
	Facial Width (mm)	109.38	139.11	120.55	6.36
	Facial Index	72.93	109.96	93.150	6.63
26-30	Facial Height (mm)	93.57	121.51	113.36	6.17
	Facial Width (mm)	109.38	135.08	121.69	6.61
	Facial Index	80.41	109.96	93.35	6.20
31-35	Facial Height (mm)	99.23	121.52	112.03	6.60
	Facial Width (mm)	110.09	138.60	121.10	6.19
	Facial Index	81.27	108.35	92.72	6.93

Table 9
Correlation between age and facial index

		AGE	**FACIAL INDEX**
AGE	Pearson Correlation	1	.008
	Sig. (2-tailed)		.873
	N	384	384
FACIAL INDEX	Pearson Correlation	.008	1
	Sig. (2-tailed)	.873	
	N	384	384

Majority of the Ika subjects who participated in the current study belong to the 21-25 years age faction (table 1). The dominant form of facial phenotype was hyperleptoproscopic, with a prevalence of 148 (38.5 percent: precisely 16.1 percent males and 22.4 percent females), which was followed by leptoproscopic with a prevalence of 105 (27.4%: distinctively 11.5 percent males and 15.9 percent females). The mesoprosopic facial form was with a prevalence of 91 (23.7 percent specifically 16.4 percent males and 7.3 percent females). The least common facial form was hypereuroproscopic with a prevalence of 8 (2.1%) as seen in table 3.

The average height of the face was 112.45 ± 6.68mm and the width of the face was 121.20± 6.54mm. The average facial index was 92.97 ± 6.50 (table 4). The mean facial width, facial height, and facial index values in males were 123.13 ± 6.38 mm, 112.71 ± 6.02 mm, and 91.72± 6.01 respectively. The mean facial width, facial height, and facial index values in females were 119.24 ± 6.12 mm, 112.18 ± 7.29 mm, and 94.24± 6.74 respectively (table 7). Table 9 shows the correlation of age and facial index in the Ika ethnic cluster and a positive correlation occurred between age and facial index.

Discussion

Studies have indicated that an etiological link exist between facial morphology and non syndromic cleft lip. An understanding of facial morphology can then enhance the surgical approach for the treatment of facial anomalies. The facial index expressed as a percentage is the facial morphological height to bizygomatic arch width ratio multiplied by 100 (Yesmin *et al.*, 2014). It is the criterion used to identify the human face as hypereuryprosopic (very wide face, range: <79.9), euryprosopic (broad face, range: 80-84.9), mesoprosopic (round face, range: 85-89.9), leptoprosopic (long face, range: 90-94.9) and hyperleptoprosopic (very long face, range: >95) (Gibelli *et al.*, 2012; Kumari *et al.*, 2015).

This analysis determined the facial height, facial width and facial index of the Ika people of Delta State in Nigeria. The authors investigated 384 randomly selected Ikas (193 males and 191 females), aged 11-35 years. The findings from this study showed that majority of the Ika people were males. This finding is in accordance with studies by Lakshmi *et al.,* (2015) and Twisha *et al.,* (2015). These researchers used greater number of males in their study samples as compared to number of the females. The current study indicated that males have higher facial height and width compared to the females. This outcome is in accord with the findings of Jeremic *et al.,* (2013) and Olutu *et al.,* (2009). These scholars showed higher mean values for the males when compared to their female counterparts. The results from this study also showed a significant gender difference in facial width and facial index. This agreed with prior studies by Ernest *et al.,* (2018), Uzomba, (2018) and Olutu *et al.,* (2009).

As regards the distribution of face types, it was shown that the studied subjects had different face types thus; europroscopic, hypereuroproscopic, hyperleptoproscopic, leptoproscopic and mesoproscopic. Among these observed face types, the majority of the subjects had the hyperleptoproscopic face type. This finding concurs with the outcome of a study by Obinna *et al.,* (2019) who

showed that the prevailing facial sort is hyperleptoproscopic. Another study by Dodangheh *et al.,* (2018) also found out that the most preponderant facial sorts were hyperleptoproscopic and hyperleptene. The current scrutiny is not in agreement with studies by Panday *et al.,* (2016) and Tahamida *et al.,* (2014) who found out that the mesoproscopic facial type was the dominant form. The reason for the dissimilarities in findings may be as a result of ethnic interplay and environmental factors.

The results from this study further showed that the mesoproscopic facial type was the dominant form of face type in males while the hyperleptoproscopic was the dominant form among females. This agrees with a study by Lakshmi *et al.,* (2014) who found the mesoproscopic or round facial type to be dominant among the males. Also, Pandey *et al.,* (2015) reported that the mesoproscopic face was the dominant form of face shape in men. In their study, they stated that the mesoproscopic facial category was found more in both males and females. These unique findings may be associated or linked to hormone or genetic interplay.

The outcome of this scrutiny was different from that of Tahamida *et al.*, (2014) who studied the facial height, facial width and facial index among 81 Malay people (40 men and 41 women) between 19 and 30years old. Significant differences were observed in all male facial parameters when compared to females. The average height of the face was 111.9 ± 8.4mm and the morphological width of the face was 127.3 ± 8.0mm. The dominant phenotype in the Malay population was mesoprosopic or round face (45 percent) and hyperleptoprosopic or very long face (5 percent) was the least common face form.

This inquiry differed from that done by Lakshmi *et al.* (2015) who investigated facial index of 170 male and 110 female adult Indians and observed that the male facial index had a prevalence of 20.4 percent mesoprosopic, 21 percnt euryprosopic, 10 percent leptoprosopic, hyperleptoprosopic and hypereuryprosopic respectively.

This investigation varied from that of Pandey *et al.,* (2015) who determined the total facial index in medical students. They documented that the mean morphological facial length was 110.7mm. The (mean) facial index was 86.09 for males and 84.84 for females. Mesoproscopic (48.66 percent) was the dominant form of face shape in men, followed by euriprosopic (23 percent), leptoprosopic (13.33 percent), hypereuriprosopic (13 percent) and hyperleptoprosopic (2 percent). In females, mesoprosopic (37%) was also the dominant form of face, followed by hypereuriprosopic (22%), euriprosopic (20.33%), leptoprosopic (19%) and hyperleptoprosopic (1.66%).

The values documented from the current survey are quite large compared to the facial indices determined by Twisha *et al.* (2015). They considered 901 Gujarati (676 males, 225 females) and 300 Non-Gujarati (100 males, 100 females) in India. The mean facial indexes in the sample were 75.19 in Gujarati and 75.17 in Non-Gujarati, respectively. The facial index in the studied groups was distributed mainly into hypereuryprosopic, followed by euryprosopic types of the face.

This analysis is diverse from a research carried out by Jeremic *et al.* (2013) to determine the facial parameters of the population of the central part of Serbia. They investigated 700 individuals (360 males and 340 females). The mean facial width, facial height, and facial index values in males were 129.12 ± 6.38mm, 121.42 ± 5.79mm, and 91.72± 7.00 respectively. The mean facial width, facial height, and facial index values in females were 119.98 ± 6.38mm, 110.84 ± 5.61mm, and 92.38 ± 6.72 respectively. The dominant form of phenotype was leptoprosopic, with a prevalence of 81.71 percent (76.66 percent males and 87.05 percent females), then came the mesoprosopic with a prevalence of 14.28 percent (17.77 percent males and 10.58 percent females).

The current study is unlike that of Deepu *et al.*, (2015) who analyzed the North Indian population's facial Index to find out the distribution of their face types. There were 400 students between 18 and 25 years (200 males and 200 females). The average facial heights in males and females were 11.35cm and 10.37cm, while the middle facial widths in males and females were 13.149cm and 12.237cm. In both men and women, the mesoprosopic form was most common and the difference was significant. The euriprosopic and hypereuriprosopic facial types were more frequently seen in females, while the hyperleptoprosopic, leptoprosopic, and mesoprosopic, facial types were common in males.

This scrutiny is comparable to that of Obinna *et al.*, (2019) who conducted a study based on facial indexes to assess the predominant facial types among Igbo children and adolescents in Enugu. The parameters of the face of 725 Igbo children and adolescents were assessed within the age range of 5 and 19years. In both children and adolescents, the prevailing facial types were hyperleptoprosopic and leptoprosopic. The facial index showed no significant correlation with age, but a significant correlation ($p<0.01$) between morphological face height as well as maximum facial weight and age occurred.

The present inquest did not agree with that of Ballin *et al.,* (2018) who did a study on Caucasians, precisely 100 Caucasians who are students of the medical school of the Federal University of Parana aged between 18-55years. All measurements were more in males than in females. Majority of the faces were mesoproscopic (49.66 percent) followed by euriprosopic (24 percent), leptoprosopic (12.33 percent), hypereuriprosopic (11 percent) and hyperleptoprosopic (3 percent).

This research differed from a previous one on facial index conducted by Himanshu *et al.,* (2017). Their research was carried out on 1000 individuals (437 females and 563 males) randomly chosen, aged 18-40 years. The faces included the euryproscopic sort (53.2%), the mesoprosopic (21.6%), the hypereuryprosopic (19%), the leptoprosopic (5.6%) and the hyperleptoprosopic (0.6 percent). There was a substantial difference in facial morphology between the two sexes ($p<0.001$).

The current research had some similarity with that of Dodangheh *et al.*, (2018) who evaluated the facial features of an Iranian population; precisely 200 (100 males and 100 females) volunteer medical students (aged between 20 and 25years). The face variables, including the facial height, and facial width, as well as the total facial index were evaluated. For the subjects, the average age was

22.97±1.12years. The most popular facial types were hyperleptoprosopic (54%) and hyperleptene. The facial characteristics of male and female participants were substantially different ($p<0.001$). Conversely, the present study had lack of correspondence with a previous research by Gupta *et al.* (2019) who scrutinized the Haryanvi population; precisely 300 people (150 males and 150 females) aged 17-30 years. The facial phenotype in both men and women was mesoprosopic.

This inquiry differed from a research on facial index among the Igbo ethnic group which was carried out by Olotu *et al.*, (2009). The facial height were measured for 600 Igbo adults (18-69yrs) consisting of 300 males and 300 females. The findings showed that adult Igbo males' face height was 12.55 ± 2.11cm, whereas that of the adult Igbo female was 11.19 ± 1.92cm and there was sexual dimorphism ($p <0.05$). Also the current survey was at variance with an analysis of the facial soft tissue anthropometric values for 400 subjects which was conducted by Ernest *et al.,* (2018). The men mostly had euryproscopic faces, while the women had mesoproscopic faces and sexual dimorphism was demonstrated. The present scrutiny did not concur with Omotoso *et al.*, (2019) who noticed sexual variation in the face markers of Bini children with higher values for male than for female. They examined both male (51.1%) and female (49.8%) Bini children and demonstrated that the popular face form among the Bini children was mesoproscopic as seen in most male (62.6%) and female (47.4%) subjects. The uniqueness of the researches appraised above could be due to ethnic ties, racial features, hormones, age and methodology.

Conclusion

This study confirmed that majority of the Ika subjects have the hyperleptoproscopic facial type. Majority of the Ika males have the mesoproscopic facial type while the Ika females have the hyperleptoproscopic facial type.

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