Research Article

THE EFFECT OF ETHNICITY ON FACIAL ANTHROPOMETRY IN IKWERRE ETHNIC GROUP (EMOHUA, PORT HARCOURT AND OBIO/AKPOR) IN RIVERS STATE

[1,] *Benwoke WoromaIbiwari, [2]Bienonwu Emmanuel Osemeke, [1]Osam Joseph Richard, [1]Victor Dakuro Progress and [1]Osaro Patience Chikere

[1]Department of Anatomy, Faculty of Basic Medical Sciences, College of Medicine, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria
[2]Department of Anatomy, Faculty of Basic Medical Sciences, College of Medicine, Igbinedion University Okada, Edo State, Nigeria

Abstract

The human face is a crucial element for identification and social interaction, with its morphology influenced by various factors including ethnicity, age, and sex. While global anthropometric data exists, specific information for many Nigerian ethnic groups remains limited, hindering applications in fields like forensic science and reconstructive surgery. This study aimed to determine the effect of ethnicity on facial anthropometry among adult populations in Emohua, Port Harcourt, and Obio/Akpor ethnic groups in Rivers State, Nigeria. Objectives included directly measuring and documenting facial dimensions, calculating proportion indices, and identifying gender-based and intra-ethnic variations. A total of 370 adult Ikwerre indigenes (188 males, 182 females) aged 16-65 years were recruited using simple random sampling. Facial length (nasion-gnathion height) and facial width (bizygomatic breadth) were measured using a digital Vernier caliper. The prosopic index (PI) was calculated, and face shapes were categorized based on Banister's classification. Statistical analysis involved the independent Student's t-test ($p = 0.05$). Significant statistical differences ($p < 0.05$) were observed in facial length between males and females across all three ethnic groups, with males consistently exhibiting greater facial lengths. The mean length in Emohua, male facial length averaged 109.49±5.94mm compared to female facial length of 100.60±13.63mm. Facial width, however, showed no significant gender difference within each ethnic group. The mean prosopic index for Emohua females was 79.83±11.11, classifying them as Hypereuriprosopic. Emohua males and both males and females from Port Harcourt exhibited Mesoprosopic faces, with mean indices of 88.37±4.84, 88.79±3.82, and 85.18±6.71 respectively. Obio/Akpor females were Euriprosopic (83.91±3.84), while males w-ere Mesoprosopic (89.41±3.23). Slight significant differences in female prosopic indices were noted across the ethnic groups, whereas male prosopic indices showed no significant inter-ethnic variation. There is essential preliminary baseline data for forensic analysis, facial reconstruction, and local cosmetology, emphasizing the need for culturally sensitive anthropometric interpretations.

Keywords: Facial Anthropometry, Ethnicity, Rivers State, Nigeria, Prosopic Index, Sexual Dimorphism, Ikwerre.

INTRODUCTION

Anthropometry of the face examines the dimensions and relationships of the face by using soft tissue landmarks and facial structures like the lips, eyes and nose and this serves as a reference guide for cosmetic surgeries especially when dealing with the lips and nose. The intricate morphology of the human face is a cornerstone of individual identity and social communication[1,2]. Its dimensions are shaped by a complex interplay of ecological, biological, geographical, racial, gender, and age factors[3]. Anthropometric studies, which systematically quantify human physical variations, are vital for understanding these differences and have significant applications in reconstructive and aesthetic surgery, forensic medicine, and the design of facial equipment[4,5]. While extensive research exists on European, American, and some Asian populations, data on Nigerian ethnic groups remain relatively sparse, despite reported racial and ethnic variations in facial traits globally[6]. Previous Nigerian studies have explored nasal parameters and facial dimensions in groups like the Igbo, Bini, and Ekpeye, revealing sexual dimorphism and specific facial types[7,8,9,10].

*Corresponding Author: *Benwoke WoromaIbiwari,*
Department of Anatomy, Faculty of Basic Medical Sciences, College of Medicine, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria.

This study addresses the gap by providing specific anthropometric data for the Ikwerre-speaking people in Emohua, Port Harcourt, and Obio/Akpor local government areas of Rivers State, Nigeria, where such detailed analyses are currently lacking.

MATERIALS AND METHODS

A total of 370 adult Ikwerre indigenes (188 males, 182 females) aged 16 to 65 years were recruited from Emohua, Port Harcourt, and Obio/Akpor local government areas of Rivers State using a simple random sampling method. Participants with a history of facial surgery, significant injury to the face, or congenital anomalies were excluded. Facial measurements, including face length (nasion-gnathion height) and face width (bizygomatic breadth), were taken using a digital Vernier caliper. All measurements were performed by a single observer to minimize errors, with each measurement taken twice.

The sample size is based on the calculation for reference population more than 10,000[11]

$$S= \frac{z^2 \times Pq}{d^2}$$

Where: S= desired sample size (population more than 10,000)
Z= standard normal deviation, usually set at 1.96 and corresponds to a confidence level of 95%.
P= the proportion of the target population estimated to have a particular characteristic, 50% is used when there is no reasonable estimate.
q= 1 – P = 0.5
d= degree of accuracy desired, usually set at 0.03

Therefore,

$$\frac{1.96^2 \times 0.5^2}{0.05^2} = 384.16$$

Adjusted sample size for a population of 10,000
= (S)
1 + [(S – 1) / population]
=   384.16
1+ [(384.16-1)/10000] = 370

A total of 370 subjects were used as samples for this study.

Method of collection

1. The detailed procedure for the measurements was explained to everyone that was selected for the study and written consent was signed and collected.
2. The relevant bio data on the subjects were obtained and recorded confidentially. These include gender, age, state of origin, hometown of subject and that of each parent.
3. The subjects were made to sit in a well-lit room on a low stool with head in anatomical position, resting on the wall.

Fig.1. Female participant being measured with the Digital Vernier Caliper

4. All the measurements to be recorded were taken by the same observer to eliminate inter-observer errors.
5. Measurements of the subjects were taken with a digital electronic Vernier caliper. To minimize intra-observer error, each measurement was taken twice.
6. 6.. The caliper blades will be cleaned with 70% alcohol in between subjects to minimize transfer of skin contaminants
7. Data was then imputed into the proforma designed for this purpose

The face measurements, to be determined with digital vernier calipers include:

• Face length = nasion − gnathion height
• Face width = bizygomatic breath

Prosopic index (PI) = Face l e n g t h × 100
Face width
The above index was determined based on international anatomical descriptions[3]. Based on this index, the types of face shapes were categorized according to Banister's classification[12]:
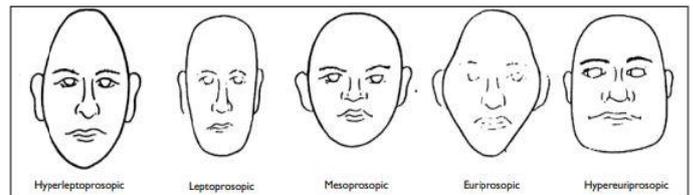
Face shape
PI range

Hypereuriprosopic (very broad face)
≤ 79.9
Euriprosopic (broad face)
80–84.9
Mesoprosopic (round face)
85–89.9
Leptoprosopic (long face)
90–94.9
Hyperleptoprosopic (very long face)
≥ 95

Fig. 2. Different face shapes

Statistical analysis

The data for each person was recorded and then analyzed. To determine the morphological indices in each ethnic group, the independent student's *t*-test (p = 0.05) was used for comparison of the means of the anthropometric measurements.

RESULTS

The Results are presented in tables 1-10

Table 1. Age distribution of subjects in PHALGA

Age (Years)	Number of Participant	Percentage
16-25	61	55.5%
26-35	19	17.3%
36-45	22	20.0%
46-55	7	6.4%
56-65	1	0.8%
Grand total	110	100%

Table 2. Age distribution of subjects Emohua

Age	No of Participant	Percentage
16-25	73	61.3%
26-35	29	24.4%
36-45	11	9.2%
46-55	6	5.1%
Grand total	119	100%

Table 3. Age distribution of subjects in Obio/ Akpor

Age	No. of participant	Percentage
16-25	53	37.59%
26-35	47	33.33%
36-45	30	21.28%
46-55	11	7.80%
Grand Total	141	100%

Table 4. Age distribution of total subjects

| Age	No. of Participant	Percentage
16-25	187	50.54%
26-25	95	25.68%
36-45	63	17.03%
46-55	24	6.49%
55-65	1	0.27%
Grand total	370	100%

Table 5. An Independent t-test done to compare the means between males and females of Emohua ethnic group; * = p-value of statistical significance

Facial Parameters(mm)				
	Male Mean ±SD	Female Mean ±SD	Total Mean ±SD	p-value
Facial length	109.49±5.94	100.6±13.63	104.76±10.86	0
Facial Width	123.99±6.51	124.68±6.08	123.71±6.31	0
Prosopic Index	88.37±4.84	79.83±11.11	85.02±9.05	0.1489

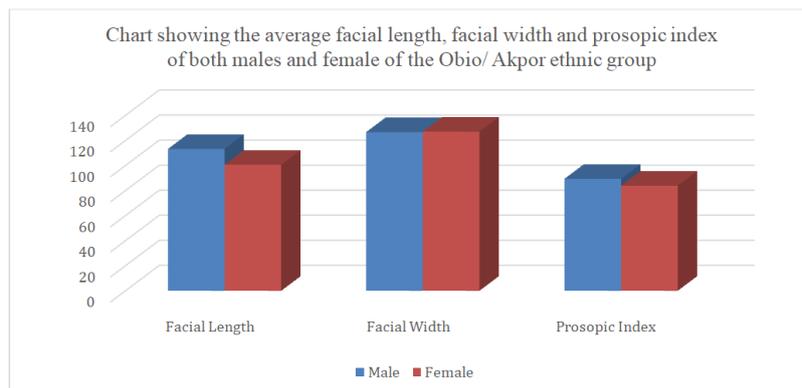Chart showing the average facial length, facial width and prosopic index of the Emohua ethnic group.
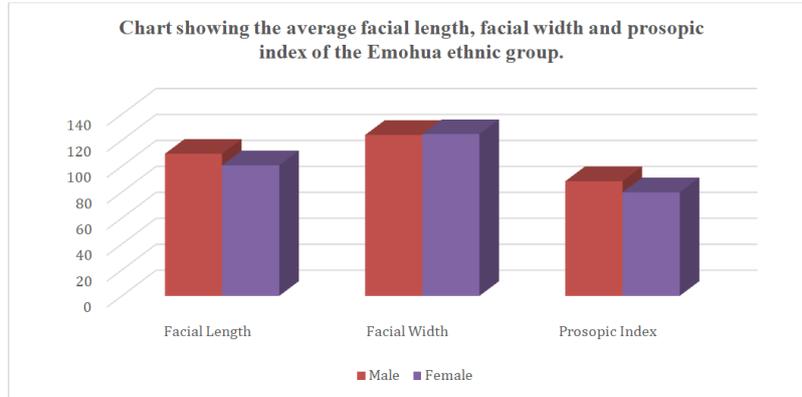
Table 6. An Independent t-test done to compare the means between males and females of Obio/Akpor ethnic group; * = p-value of statistical significance

Facial Parameters(mm)				
	Male Mean ±SD	Female Mean ±SD	Total Mean ±SD	p-value
Facial Length	113.26±3.97	106.60±5.22	109.53±5.75	0
Facial Width	126.73±3.56	127.08±3.67	126.92±3.61	0
Prosopic Index	89.41±3.23	83.91±3.84	86.33±4.5	

Chart showing the average facial length, facial width and prosopic index of both males and female of the Obio/ Akpor ethnic group
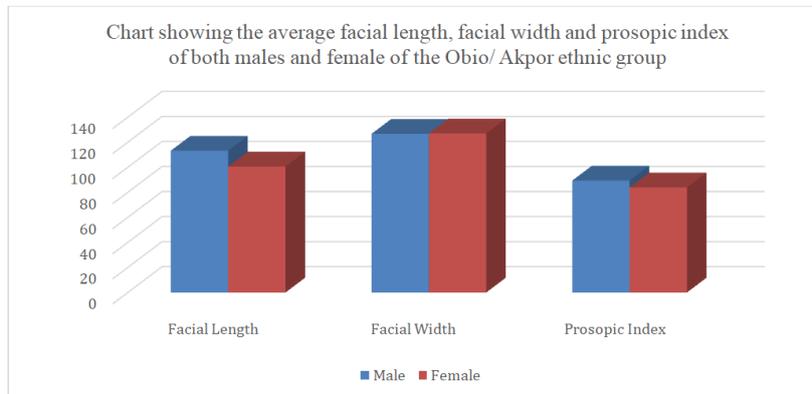
Table 7. An Independent t-test done to compare the means between males and females of Port Harcourt ethnic group; * = p-value of statistical significance

Facial Parameters				
	Male Mean ±SD	Female Mean ±SD	Total Mean ±SD	p-value
Facial length	111.62±4.21	107.92±7.94	109.94±6.43	
Facial Width	126.18±4.55	126.83±4.48	126.47±4.51	
Prosopic Index	88.79±3.82	85.18±6.71	87.14±5.57	

Chart showing the average facial length, facial width and prosopic index of both males and female of the Obio/ Akpor ethnic group
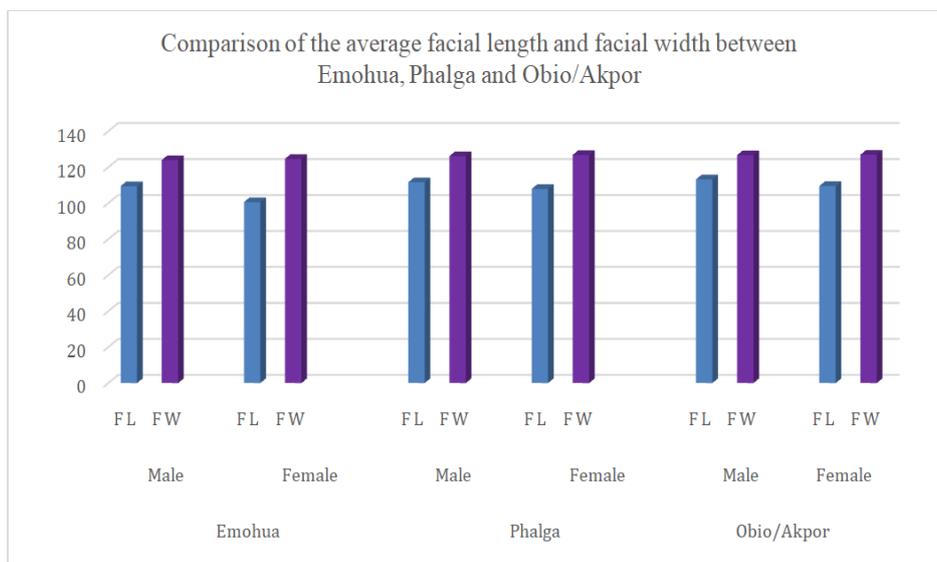
Table 8. Comparison of the Prosopic Index of both male and females in Emohua, Port Harcourt and Obio/Akpor ethnic group

L.G. A	EMOHUA		PHALGA		OBIO/AKPOR	
SEX	Female	Male	Female	Male	Female	Male
Average Prosopic Index(mm)	79.83±11.11	88.37±4.84	85.18±6.71	88.79±3.82	83.91±3.84	89.41±3.23

Average Prosopic Index for each of the ethnic group
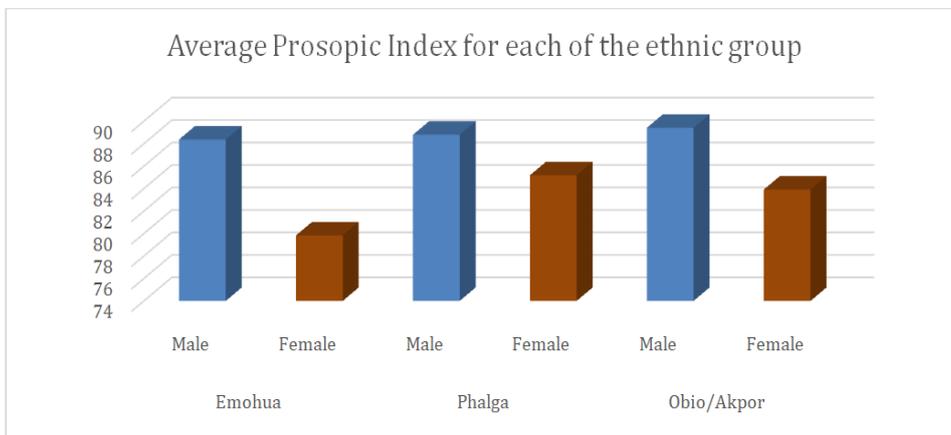
Table 9. Comparison of the average facial length and facial width of Emohua, Obio/Akpor and Port Harcourt ethnic group

	Male		Female	
	Face Length Mean ±SD	Face Width Mean ±SD	Face Length Mean ±SD	Face Width Mean ±SD
Emohua	109.49±5.94	123.99±6.51	100.60±5.22	124.68±6.08
Phalga	111.62±4.21	126.18±4.55	107.92±5.22	126.83±3.61
Obio/Akpor	113.26±3.97	126.73±3.56	109.53±5.22	126.92±3.67

Comparison of the average facial length and facial width between Emohua, Phalga and Obio/Akpor

Table 10.Comparison of the facial length, facial width and prosopic index of other studies to the current study

People/Place	Reference	Male		Female		Prosopic Index	
		Facial Length (mm)	Facial Width (mm)	Facial Length (mm)	Facial Width (mm)	Male	Female
Turkman, Iran	Jahanshahi et al., 2008	Not included	Not Included	Not Included	Not Included	87.25	81.48
Fars, Iran	Jahanshahi et al., 2008	Not Inluded	Not Included	Not Included	Not Included	88.22	84.48
Maiduguri	Raji et al., 2010	114.40	115.10	107.60	111.30	99.39	97.54
Bini	Omotoso et al., 2011	.110.50	124.60	106.70	124.50	87.98	85.88
Dagaaba	Maalman et al., 2019	132.40	133.50	122.50	125.00	99.70	98.29
Sisaala	Maalman et al., 2019	136.00	130.90	126.00	123.90	104.25	102.11
Ekpeye	Ereokosima et al., 2023	121.77	124.27	113.00	122.06	101.722	93.18
Ogoni	Benwoke et al., 2023	94.19	110.61	92.46	110.41	85.35	83.86
Emohua	PS	109.49	123.99	100.60	124.68	88.37	79.83
Port Harcourt	PS	111.62	126.18	107.92	126.83	88.79	85.18
Obio/Akpor	PS	113.26	126.73	109.53	126.92	89.41	83.91

PS = Present Study

DISCUSSION

The human body dimensions are affected by ecological, biological, geographical, racial, sex, and age factors[13]. In this study, there was statistically significant difference in the facial length between the male and female participants in each of the ethnic group and in comparison, to each of the ethnic group but the facial width in the male participants had no significant difference from that of the female participants. Based on Banister's Classification of prosopic index for face shape, the results in table 7 (the correct number for this illustration is table 8 not table 7). Shows that females in Emohua have an Hypereuriprosopic face (very broad face) and the males have a Mesoprosopic face (round face). It also shows that the females and males of Port Harcourt present with a mesoprosopic face. Lastly, it shows that the females in Obio/Akpor have an euriprosopic face (broad face) while the males have a mesoprosopic face[12]. In another research by Ereokosima et al., (2023)[10] which agrees with the present study, the Ekpeye people were presented to have mean facial length for the males which was 121.77±19.34mm while females presented with 113.00±11.76mm. There was a statistically significant difference observed in the mean values between males and females but the mean facial width for the males was 124.27±11.97mm while females presented with 122.06±8.03mm which is not in agreement with the present study as the facial width for females is slightly higher than that of males. The mean facial index for the males was 101.72±59.52 while females presented with 93.18±12.65. The result of this study showed that the Ekpeye people have hyperleptoprosopic face type.

The present study showed a significant variation in the prosopic index across the genders particularly the females just as in research done by Omotoso et al., (2011)[9] which showed the Adult Bini People in Nigeria to have mesoproscopic face type and platyrrhine nose type where the mean facial and nasal indices showed a significant variation across gender with higher values observed among the males than the females. The overall facial and nasal indices were 86.93 and 97.32 respectively. Another study which correlated with the results of the present study done by Jahanshahi et al., (2008)[14] recorded that the mean and standard deviation (SD) of the prosopic index was higher in Turkman males than that of the females which were 87.25 ± 5.18 and 81.48 ± 5.28, respectively and that the mean and SD of the PI in Fars males was also higher than that of the females which were 88.22 ± 5.21 and 84.48% ± 5.85, respectively. The dominant type of face shape in both native Fars and Turkman females was euriprosopic and the dominant type of face shape in both native Fars and Turkman males was mesoprosopic showing no intra ethnic variation unlike the present study where the prosopic index shows variations amongst the ethnic group.

Maalman et al., (2019)[15] in their studies on the facial indices of adult Dagaabas and Sisaala in which the results recorded as 98% and 99% for female and male Dagaabas respectively. The Sisaala male and female participants facial indices recorded 102% and 104% respectively. Thus, as high as 83% and 72% of the Sisaalas and Dagaabas respectively had hyperleptoprosopic facial type thus in agreement with the present study that the prosopic index of males are higher than that of the females. It was recorded that there was variation between ethnic groups considered and this could be because of factors such as migration, intermingling of populations,

changes in lifestyle, and socio-economic factors[16]. Table 10. shows the facial length of the males to be repeatedly higher than the females with little significance just as the current study presented. Although, the mean facial length presented by Raji et al., (2010)[17], for the males appeared to be significantly higher than that of the of the males in this study and this could be because of influence from environmental condition or even the genetic makeup. The mean facial width was the opposite as the present study showed higher dimensions across the ethnic groups to the males of Maiduguri, and this could be as result of dietary habits and nutritional availability. Based on the prosopic index the males were classified as having hyperleptoprosopic face type which is against the present study showing its males to have a mesoprosopic face. The study also presented the females with facial length with almost no significant difference except the Emohua ethnic group which presented with a lower facial length and this may be because of influence from the societal factors or genetics, but the facial width across the ethnic groups in this study was significantly higher than that of the females in Maiduguri.

In another recent study by Benwoke et al., (2023)[18], the cephalofacial measurements of Ogoni children that were recorded corresponded with the present study as the males presented to have a higher mean for facial length to the females presenting as 94.91mm and 92.46mm respectively although the Ikwerre people did tend to have a higher facial length and this could be as a result of the effect of ethnicity peculiar to each of this ethnic group. The facial index placed the Ogoni people to have an euryprosopic face which again differs from the facial index of the present study except the females in Obio/Akpor ethnic group. Although these ethnic group present with the same facial indices, it is key to note that the female of the Obio/Akpor ethnic group have significantly bigger facial width, and this could be highly influenced by choice of diet of aesthetic choices. This investigation has determined the facial dimensions in males and females of Emohua, Obio/Akpor and Port Harcourt ethnic groups under the Ikwerre speaking people and showed that there was significant difference between face length, width and face shape in both genders thus and across the ethnic groups. The data obtained from this study can be used as local standards for diagnostic and anthropometric evaluation.

Conclusion

This study successfully documented the facial anthropometric dimensions and variations among adult Ikwerre ethnic groups in Rivers State, Nigeria. It confirmed significant gender-based differences in facial length and revealed diverse face shapes across the studied populations. The data contributes valuable baseline information for forensic science, reconstructive surgery, and the design of facial equipment specific to this region. It emphasizes that anthropometric data should be interpreted with cultural sensitivity, acknowledging individual variations within ethnic groups and the influence of environmental factors.

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