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Facial and Canthal Indices of Adolescents of Ogoni tribe in Nigeria

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ABSTRACT
Most research work on facial and canthal indices have shown very distinct characteristics across several tribes. These peculiarities are influenced by age, sex, tribe and geographical location. Our aim therefore is to determine the facial and canthal indices in adolescents of Ogoni tribe. This is a descriptive cross-sectional study involving 96 participants (43 males and 53 females) who were within the age range of 13 - 17 years. Anthropometric Measurements of the intercanthal distances (outer and inner canthal distances), canthal index, facial height, facial width, and facial index were done using a high precision stainless steel digital vernier caliper 8" 200mm with 0.02 precision. The male adolescents had higher facial height than their female counterparts. The facial height irrespective of age group was 104.73mm and 101.73mm for males and females respectively. This was statistically significant ($P<0.05$). Also the canthal index irrespective of age group for both male and female adolescents was 33.18 and 33.73 respectively. This however was not statistically significant ($P>0.05$) although there was a statutory increase with age. ANOVA test for individual male and female groups show a statistically significant ($P = 0$) variation across age groups for all the facial and canthal indices studied. Facial height and facial index show sexual dimorphism and are reliable parameters to distinguish between sexes. Females have a higher canthal index as compared to their male counterparts, although this was not statistically significant.

Keywords: Facial index, Canthal index, Facial height, Ogoni, Adolescents

INTRODUCTION
Facial anthropometry has been an interesting area of research in the last few decades. This is due to the fact that it reveals many unexpected facts, which of necessity has become the mainstay in most person identification processes and in forensic investigations. Most research work on facial and canthal indices have shown very distinct characteristics across several tribes. Some of these variations are noticed even among peoples of same tribe and culture. Hence it has become an indispensable topic to study and continue further studies on facial variations seen with humans. Estimation of facial indices among populations gives room for the comparison of changes in facial index between parents, offspring and siblings and can give a clue to genetic transmission of inherited character. Accurate facial analysis is essential for diagnosis of genetic and acquired anomalies, for the study of normal and abnormal growth and for morphometric investigation. A person with euryprosopic facial type favors the nasal breathing mode. Thus facial form may be an important factor in increasing susceptibility to obstructive sleep apnea.[1]

On the basis of the Facial index, the facial phenotype was classified as follows: Facial index ≤ 78.9, the individual is said to have hypereuriprosopic (very broad) face shape and when it is between 79.0–83.9, it is euryprosopic (broad) face shape. Similarly, when the index is between 84–87.9, it is mesoprosopic (round) face shape. Leptoprosopic (long) face is an index between 88.0–92.9 and hyperleptoprosopic (very long narrow) face is ≥ 93.[2]

Okwesili et al., 2016[3] reported that the Igbos of Enugu, South East Nigeria had a mean facial index in adult males as 96.1 and 92.2 in females. The predominant facial types been leptoprosopic and hyperleptoprosopic in children, adolescents and adults. The Ijaws of Nigeria have a morphological facial height of 122.5mm and 111.9mm for males and females respectively [4] while Urhobo people have 126.1mm and 119.1mm for males and females respectively.[5] Mahdi et al., 2012 [6] reported an increase in maximum facial width with age. This was different from the report of Li et al., 2013 [7] where a negative correlation with age was noted among males and females of Hans's ethnic group in China. It was reported to be sexually dimorphic with the males having higher values than females among the Zulus of South Africa and the Angolan people.[8]

It becomes therefore imperative to broaden research in this area especially with the variation in gender and age peculiarities noticed with various tribes. However having no variation in children may not be out of the ordinary, but it becomes an area of concern when variations are not seen in an adolescent or adult population. This is firmly based on age and the expectations of the growth curve.

Omotoso *et al.,*[9] documented about the Bini tribe of Nigeria as having a more dominant mesoprosopic face type among adults irrespective of sex. However some authors described decades ago that the mean facial index for a middle European population to be 86-90, North Europe ≥ 90, Mediterranean Africa 89.2 and Indian population as 86 to 90.[10] Several authors have studied and documented the facial and canthal indices for various Nigerian populations.[11-15]

MATERIALS AND METHODS

This is a descriptive cross-sectional study involving 96 participants (43 males and 53 females) who were within the age range of 13 - 17 years. Consent for the study was obtained after thorough information was given assuring of no risk or damage however.

Anthropometric Measurements of the intercanthal distances (outer and inner canthal distances), canthal index, facial height, facial width, and facial index were done using a high precision stainless steel digital vernier caliper 8" 200mm with 0.02 precision (Kales Industry and Trade Co., Ltd, Jinhua, Zhejiang, China).

The inner canthal distance was determined with the head faced forward in an anatomical position with the sliding digital vernier caliper held against the bridge of the nose from the left medial angle to the right medial angle of the palpebral fissures. The outer canthal distance was measured from the left lateral angle to the right lateral angle of the palpebral fissures. An imaginary line was drawn down on the skin from the central point of the pupil to assess the interpupillary distance. Measurements were done with utmost care and the vernier caliper recalibrated to 0.00 at various intervals to prevent measurement errors. Our data was analyzed with Microsoft Excel Toolpak.

RESULTS

Table 1: Descriptive statistics and comparison of mean of facial indices of Adolescents

Age (Years)	Facial indices	Sex	N	Mean (mm)	SD	P value	Inference
13	FH	M	21	100.49	6.30		NS
		F	20	98.78	6.79	0.41	
	FW	M	21	104.55	7.99		NS
		F	20	106.76	6.06	0.32	
	ICD	M	21	32.65	2.08		NS
		F	20	33.08	2.44	0.55	
	OCD	M	21	98.34	4.71		NS
		F	20	99.25	3.58	0.49	
	IPD	M	21	68.39	5.23		NS
		F	20	70.36	4.85	0.22	
	FI	M	21	96.51	7.96		NS
		F	20	92.85	8.68	0.17	
	CI	M	21	33.26	2.51		NS
		F	20	33.31	1.94	0.94	
14	FH	M	8	103.24	6.77	0.71	NS
		F	13	102.18	5.52		
	FW	M	8	109.41	7.84	0.94	NS
		F	13	109.13	7.09		
	ICD	M	8	32.84	3.31	0.23	NS
		F	13	34.81	3.79		
	OCD	M	8	100.02	3.57	0.37	NS
		F	13	101.97	6.15		
	IPD	M	8	74.21	4.38	0.04	S
		F	13	70.13	3.39		
	FI	M	8	94.82	9.68	0.83	NS
		F	13	93.93	7.24		
	CI	M	8	32.84	3.35	0.37	NS
		F	13	34.19	3.09		
15	FH	M	8	110.29	5.27	0.01	S
		F	18	103.88	5.36		
	FW	M	8	108.21	7.85	0.49	NS
		F	18	110.44	6.05		
	ICD	M	8	33.43	3.13	0.90	NS
		F	18	33.58111	2.33		
	OCD	M	8	100.36	6.55	0.99	NS
		F	18	100.32	5.28		
	IPD	M	8	74.01	4.52	0.00	S
		F	18	71.44	3.99		
	FI	M	8	102.42	9.07	0.05	S
		F	18	94.32	7.00		
	CI	M	8	33.29	1.96	0.80	NS
		F	18	33.53	2.51		
16/17	FH	M	6	112.70	4.82	0.50	NS
		F	2	105.61	9.87		
	FW	M	6	109.14	5.74	0.63	NS
		F	2	118.82	20.66		
	ICD	M	6	33.21	3.97	0.05	S
		F	2	37.43	0.16		

SD = Standard Deviation, P – value = Probability value, FH = Facial Height, FW = Facial Width, ICD = Inner Canthal Distance, OCD= Outer Canthal Distance, IPD = Interpupillary Distance, CI = Canthal Index, FI = Facial Index, NS – Non Significant, S – Significant, P Value ≤ 0.05 was considered significant.

Table 2: Descriptive statistics and sex differences in facial indices of adolescents irrespective of age group

Parameters	N	Sex	Mean (mm)	SEM	SD	Variance	Z score	Critical Z score at 0.05 level	Inference
FH	43	M	104.73	1.17	7.60	57.79	2.04	1.96	S
	53	F	101.73	0.88	6.37	40.60			
FW	43	M	106.72	1.21	7.82	61.20	-1.46	1.96	NS
	53	F	109.02	1.01	7.24	52.55			
ICD	43	M	32.96	0.42	2.75	7.56	-1.58	1.96	NS
	53	F	33.88	0.40	2.88	8.29			
OCD	43	M	99.29	0.78	5.05	25.47	-1.19	1.96	NS
	53	F	100.55	0.70	5.06	25.61			
IPD	43	M	71.32	0.87	5.64	31.86	0.47	1.96	NS
	53	F	70.83	0.58	4.16	17.28			
FI	43	M	98.51	1.32	8.57	73.44	2.89	1.96	S
	53	F	93.63	1.05	7.59	57.66			
CI	43	M	33.18	0.39	2.51	6.31	-1.06	1.96	NS
	53	F	33.73	0.34	2.46	6.07			

SD = Standard Deviation, P – value = Probability value, FH = Facial Height, FW = Facial Width, ICD = Inner Canthal Distance, OCD= Outer Canthal Distance, IPD = Interpupillary Distance, CI = Canthal Index, FI = Facial Index, SEM = Standard Error of mean, NS – Non Significant, S - Significant

Table 2 shows the comparison between sexes which reveals that there was no statistically significant difference between male and female adolescents for all the facial indices and canthal indices studied except for the facial height and facial index ($P < 0.05$).

Table 3: Test for variation among adolescent male age groups using ANOVA

Source of variation	SS	df	MS	F value	F critical	P value
Between groups	169544.20	4	42386.05	1165.26	2.414642	0.00
Within groups	7638.70	210	36.37476			
Total	177182.90	214				

SS = Sum of Squares, DF = Degree of Freedom, MS = Mean Sum of Squares, * significant difference
ANOVA test for variation among male adolescents shows that there was a statistically significant difference in the facial and canthal indices (P= 0.00).

Table 4: Test for variation among adolescent female age groups using ANOVA

Source of variation	SS	df	MS	F value	F critical	P value
Between groups	206565	4	51641.25	1807.913	2.406362	0.00
Within groups	7426.641	260	28.564			
Total	213991.6	264				

SS = Sum of Squares, DF = Degree of Freedom, MS = Mean Sum of Squares, * significant difference.
ANOVA test for variation among female adolescents shows that there was a statistically significant difference in the facial and canthal indices (P= 0.00).

DISCUSSION

The descriptive statistics and comparison of mean of facial indices for both Ogoni male and female adolescent population shows sex differences (Table 1). The mean and standard deviation of facial height of 13, 14, 15, and 16/17 years aged Ogoni males and females were 100.49 ± 6.30, 98.78 ± 6.79 (mm); 103.24 ± 6.77, 102.18 ± 5.52 (mm); 110.29 ± 5.27, 103.88 ± 5.36 (mm) and 112.70 ± 4.82, 105.61 ± 9.87 (mm) (Table 1). The male adolescents had higher facial height than their female counterparts. The mean and standard deviation of facial width of 13, 14, 15, and 16/17 aged Ogoni males and females were 104.55 ± 7.99, 106.76 ± 6.06 (mm); 109.41 ± 7.84, 109.13 ± 7.09 (mm); 108.21 ± 7.85, 110.44 ± 6.05 (mm) and 109.14 ± 5.74, 118.82 ± 20.66 (mm) respectively (Table 1). This shows that Ogoni female adolescents had higher facial width than male adolescents. Our study also shows that from age 14, the interpupillary distance shows a statistically significant difference (P≤ 0.05) between the male and female sexes (Table 1). This could be due growth changes with age as was noted with the inner canthal distance, facial height and facial index (Table 1).

Our data noted the canthal index for adolescent Ogoni population to range between 33.26 and 35.68 (Table 1). Also the canthal index irrespective of age group for both male and female adolescents was 33.18 and 33.73 respectively (Table 2). Although there was a statutory rise with age affirming the outcome with the growth scale for children and adolescents, Z test however shows that this change was statistically none significant (P > 0.05) (Table 2). Singh et al., 1983 [16] documented the canthal index for an Indian adolescent population as 37.23 and 37.83 for males and females respectively. Jaja et al., 2011 [11] also on Kalabari adolescent population of Nigeria reported 17.84 and 20.08 for males and females respectively. The females just like in the present study seem to have higher values for the canthal index. Some other authors reported higher canthal index values for female adult population.[17-19] Again some authors reported higher values for adult males.[20-22]

Furthermore when a Z test was conducted for the various parameters of the male and female adolescents irrespective of their age group, there was no statistically significant variation for the facial width, inner and outer canthal distances as well as the canthal index and

interpupillary distance (Table 2). The facial height and facial index shows statistically significant ($P < 0.05$) variation between male and female adolescents of Ogoni population (Table 2). Hence the facial height and facial index shows sexual dimorphism and can be used to differentiate between sexes. This finding is in agreement with the studies conducted by Enya et al.,[23] Gbeneol et al.,[24] Oladipo et al.,[18] who all documented sexual dimorphism in most of the facial indices for the ethnic groups studied.

Our study shows that Ogoni male and female adolescents have Hyperleptoprosopic and Leptoprosopic face shape respectively. This finding is observed to be in agreement with the study of Okwesili et al., [3] on Igbo children and adolescents in Enugu, South East Nigeria who reported hyperleptoprosopic and leptoprosopic face shape as the predominant face types. Raji et al., [25] on North–Eastern Nigerian population documented prevalence of hyperleptoprosopic face shape while Ewunonu et al., [26] on South Eastern Nigerian population reported their face shape to be leptoprosopic.

These studies appear to affirm our findings on the adolescent population of Ogoni. Although some of these previous studies were carried out on adult age population, the few who worked on adolescents seem to agree with our findings. It is possible that most tribes within the Southern part of Nigeria have predominantly same face type. However further studies on adolescents of different tribe would be necessary to strengthen these findings.

According to the result of this study, 25% of our female adolescent population was observed to have a mesoprosopic face shape. This finding is in agreement with the study conducted by Oludiran et al.,[27] on Southern Nigerian that showed the prevalence of a mesoprosopic face shape. Mesoprosopic face types were also found among adult Tiv population of Nigeria and adult Bini tribe [28, 23, 9] as well as children population of Bini tribe.[28] Hypereuryprosopic face types were also documented for adult populations of Ogoni [24], Yoruba [29], Ibos [29].

Independent inter-group variation was tested for the male and female adolescent population using ANOVA and our findings demonstrated a statistically significant variation ($P = 0$) among the male group (Table 3) and among the female group (Table 4). This means among the males and as well the females there exists variation in the facial indices and canthal indices. This therefore confirms that growth changes are present for each sex due to age differences.

CONCLUSION

There appears to be very distinct variation of the facial and canthal indices across ethnic groups and sex differences are obvious. Our findings are unique for the Ogoni adolescents as they demonstrate sexual dimorphism especially for the facial height and facial index. All the other parameters show statistically significant variation across age groups for both male and female population independently, which could be due to growth changes.

Conflict of interest: There is no conflict of interest

Ethical approval: Ethical approval was sought and granted by the Ethics Review Committee of Faculty of Basic Medical Sciences, Rivers State University.

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