Journal of Anatomical Sciences
Email: anatomicaljournal@gmail.com

J. Anat Sci 13(2)

Association of Gender and Cephalofacial Types among Five Dominant Ethnic Groups of Gombe State Nigeria

Abdullahi IM-K, Gudaji A, Badamasi IM

Department of Anatomy Bayero University Kano

Corresponding Author: Badamasi IM

Email: bimohammed.ana@buk.edu.ng; +2348037024135

ABSRACT

The study of cephalofacial parameters has been used in various human populations to test heterogeneity in head and face forms for sexual dimorphisms and ethnic variations. These features are used by plastic surgeons, forensic researchers and anthropologists to estimate the sex, shapes and other features of head and face. The aim of the study was to examine the relationship between gender and the different head and face types among the dominant ethnic populations of Gombe State**.** The study was a descriptive and cross-sectional study which involved 500 participants from the five dominant ethnic groups of Gombe State Nigeria, and simple random technique was used for recruitment of participants. Cephalic length, cephalic breadth, facial length and facial breadth were measured using standard protocols. Descriptive statistics was used to determine the mean values of the cephalic and facial indices and Pearson chi-square test was used to investigate the relationship of gender with different head and face types. All data were analyzed using SPSS version 20 and $p < 0.05$ was considered statistically significant. The result of the association of gender with head types revealed that there was no significant relationship between these variables except in the Fulani where a statistically significant relationship ($p < 0.05$) was observed between the two variables. There was a significant relationship between gender and the various face types ($p < 0.05$) in the ethnic groups with the exception of two tribes Bole and Waja. It was found that the ethnic groups have predominantly Mesocephalic and Dolicephalic head types and the Hyper Leptoproscopic and Leptoproscopic face types were also common.

Keywords: Association, gender, cephalofacial, ethnicity.

INTRODUCTION

The study of cephalofacial parameters has been used in various human populations to test heterogeneity in head and face forms for sexual dimorphisms and ethnic variations. Cephalometry can scientifically be referred as the measurement of the dimensions of the head region usually through the use of standardized lateral skull radiographs or cephalograms[1,2]. The priority given to the evaluation of measurement using comparison of cephalic indices between and among population as well as sexual dimorphism is due the numerical categorization of the indices[3]. The Cephalometric results can also be of great assistance while evaluating patients in various fields of medicine like Medical Imaging, paediatrics, craniofacial surgery and also for studying growth trends in various castes/races within a defined geographic zone[4-6].

Cephalometry is one of the most important branches of anthropology that measures head and face dimensions and indices[7,8]. In this modern time, ergonomic professionals apply an understanding of human factors population-specific craniofacial standards in the design of equipment, systems and working methods in order to improve comfort, health, safety, and productivity[9-11]. Variations in cephalic indices between and within populations have been attributed to a complex interaction between genetic and environmental factors[12]. These variations exist in all the measurement obtained from the cephalic and facial parameters. Evidence shows a clear racial variation in the cranial dimensions among different populations[13,14]**.** These different head and face types are affected by ethnic, ecological, biological, geographical, racial, gender, age and nutritional factors[15-20].

Cephalic index

The cephalic index is nothing but the ratio of the maximum breadth of the head to its maximum length multiplied by 100[3]. Cephalic indices play a crucial role in comparison of cephalic morphometry between parents, offspring and siblings and provide information on inheritance pattern. The most important factors of Cephalometric dimension are height and breadth of head that is used in cephalic index determination[5,7]. These cephalometric dimensions had also been used in estimating the age of fetuses for legal and obstetrical purposes as well as determining normal brain development in children[21,22].

Facial index: Facial index is an important anthropological parameter for the determination of craniofacial morphology during development which differs among races and ethnic groups. Many studies reported facial index to be different between sexes and among ethnic groups. It has been shown that the human face shows variability in size and shape that confers individual and group uniqueness[23]. Identification of facial feature points is an important factor in video surveillance, face detection, face recognition, facial expression classification[8,24]. Normative data of facial measurements are indispensable for precise determination of the degree of deviations from the normal[25].

MATERIALS AND METHODS

Study design and sampling techniques: The study was descriptive cross-sectional design and the participants were recruited using simple random technique from five Local Government Areas (LGAs) which were: Kwami, Akko, Billiri, Yamaltu-Deba and Balanga. These local government areas were mainly populated with members of the 5 dominant ethnic groups in Gombe state including the Fulani, Bolewa, Tangale, Tera, and Waja ethnic groups. Five hundred (500) participants were recruited as 50 males and 50 females from each of the ethnic group/LGA.

Inclusion Criteria

1. The age range for the participants was 18-75years and
2. Those whom ethnicity was traced to the third generation as one of the 5 dominant ethnic groups in Gombe state
3. Participants must be free of any apparent deformity.

Exclusion Criteria

1. Participants who did not consent to take part in the study
2. Participants who failed to complete the study even after giving a consent\
3. Participants who an unsure of their gender

Measurement of Craniofacial Features: The subjects were asked to sit on a chair, and their head were in the anatomical position[26]. Facial height and facial width were measured by using a digital vernier caliper. The measurement of facial height was taken as the distance between nasion and gnathion. While the measurement of face width was taken as the distance between zygion of right and left side[26]. The head length was measured by using a standard spreading caliper with scale in cm from glabella to inion and the head breadth was measured as the maximum transverse diameter between the two euryons[3]. The cephalic index and the facial index were calculated as below:

$$Cephalic\ Index\ (CI) = \frac{\text{Head width}}{\text{Head length}} \text{ X } 100$$

$$Facial\ Index\ (FI) = \frac{\text{Total facial height}}{\text{Bizygomatic width}} \text{ X } 100$$

The different cephalic and facial indices were categorized based on the table below.

Table 1: Different Head Types and Face Types

	Different Head Types				**Different Face Type**
S/N	Index	Head Type	S/N	Index	Face Type
1	< 74.9	Dolicephalic	1	<79.9	Hyper Europroscopic
2	75 –79.9	Mesocephalic	2	80 –84.9	Europroscopic
3	80 –84.9	Brachycephalic	3	85 –89.9	Mesoproscopic
4	85 –89.9	Hyper Brachycephalic	4	90 –94.9	Leptoproscopic
5	> 90	Ultra Brachycephalic	5	> 95	Hyper leptoproscopic

(Hrdlicka's method of 1952 used for the assessing cephalic index and Hooten's Method used for assessing total facial index as adapted from Kumar *et al.*,2013).

Ethics: Ethical approval was sought from the Ethical Committee of Federal Teaching Hospital Gombe, Gombe State. And also an informed consent was sought from the participants.

Statistical Evaluation: Descriptive statistics was used to present the average measured values for the age, gender, cephalic and facial indices among the study participants. Pearson chi-square test was used to investigate the relationship of gender with different head and face types. All data were analyzed using SPSS version 20 and $p < 0.05$ was considered statistically significant.

RESULTS

The descriptive statistics revealed that the mean cephalic indices for Bole, Fulani, Tangale, Tera and Waja were 75.00, 75.04, 77.71, 77.82, 75.75 and 75.75 in males, while in females they were 73.78, 77.86, 77.39, 75.73 and 74.80 respectively. The overall mean cephalic indices were 76.26 and 74.72 for males and females when the ethnicity was not taken into account. The mean facial indices for the tribes Bole, Fulani, Tangale, Tera and Waja were 94.38, 97.14, 94.53, 94.56 and 93.76 in males, while in the females they were 94.77, 93.74, 88.70, 90.73 and 97.08 respectively. Nevertheless, when the mean facial indices were evaluated irrespective of the tribe of the participants, it was 94.87 and 92.08 for males and females respectively (Table 2).

Table 2: Descriptive Statistics for Cephalic Index and Facial Index among the Ethnic Groups

		Variables	
Tribe	Group	CI	FI
Bole	Males	75.00	94.38
	Females	73.78	94.77
	Entire (Males+Females)	74.39	94.57
Fulani	Males	75.04	97.14
	Females	77.86	93.74
	Entire (Males+Females)	76.45	95.44
Tangale	Males	77.71	94.53
	Females	77.39	88.70
	Entire (Males+Females)	77.55	91.61
Tera	Males	77.82	94.56
	Females	75.73	90.73
	Entire (Males+Females)	76.78	92.64
Waja	Males	75.75	93.76
	Females	73.86	97.08
	Entire (Males+Females)	74.80	93.10
Overall	Males	76.26	94.87
	Females	74.72	92.08
	Entire (Males+Females)	75.99	93.47

CI = Cephalic Index FI = Facial Index

A Pearson chi-square test was conducted to determine whether there was relationship between gender and different head and face types in the entire population or among the ethnic populations (Table 3).

Table 3: Association of Gender and Head Types when the evaluation was done for the entire population or based on the Ethnicity of the study participants

				Head Types					
Tribe	Sex	Dolicephalic	Mesocephalic	B	Hyper B	Ultra B	df	X^2	P-value
Bole	Males	24(27.5)	25(27.5)	1(1.0)	0(0.5)		3	3.42	0.33
	Females	31(27.5)	17(27.5)	1(1.0)	1(0.5)	-			
	Males	25(18.5)	22(22.0)	3(7.5)	0(2.0)		3	13.97	.003
	Females	12(18.5)	22(22.0)	12(7.5)	4(2.0)	-			
Tangale	Males	9(9.5)	30(27.5)	11(12.0)	0(1.0)		3	2.67	0.45
	Females	10(9.5)	25(27.5)	13(12.0)	2(1.0)	-			
Tera	Males	15(17.0)	23(24.0)	9(7.5)	-	3(1.5)	3	4.15	0.24
	Females	19(17.0)	25(24.0)	6(7.5)	-	0(1.5)			
Waja	Males	22(27.5)	20(14.0)	5(4.5)	1(1.0)	2(3.0)	4	8.12	0.08
	Females	33(27.5)	8(14.0)	4(4.5)	1(1.0)	4(3.0)			
	Male	95 (100.0)	120 (108.)	29 (32.)	1(4.5)	5 (4.5)			
Entire tribes (All)	Female	105.0 (100.)	97.0(108.5)	36(32.5)	8 (4.5)	4 (4.5)	4	9.3	.05

X^2: Chi-square value. df: degree of freedom. P-value < .05 considered statistically significant; B= Brachycephalic

The results revealed that there was no significant relationship between these variables when the entire study population was evaluated, however, when the evaluation was done based on the ethnicity of the participant, Fulani ethnic group, had a statistically significant relationship between the variables (head types and gender, X^2 = 13.97, df = 3, P = 0.003 (Table 3). Specifically, the Fulani males were significantly more likely to be Dolicephalic while the Fulani females were Mesocephalic (Table 3).

A general evaluation of the relationship between gender and facial type among the entire study population was observed to be statistically significant (X^2 =36.5 P = 2.3E^{-7}) (Table 4).

Table 4: Association of Gender and Face Types when the evaluation was done for the entire population or based on the Ethnicity of the study participants

				Head Types					
Tribe	Sex	Hyper Euryproscopic	Euryproscopic	Mesoproscopic	Leptoproscopic	Hyper Leptoproscopic	df	X^2	P-value
Bole	Males		1(1.0)	9(7.0)	14(14.5)	26(27.5)	3	1.34	.719
	Females		1(1.0)	5(7.0)	15(14.5)	29(27.5)			
	Males		0(1.5)	1(3.5)	8(12.5)	41(32.5)	3	14.26	.003
	Females		3(1.5)	6(3.5)	17(12.5)	24(32.5)			
Tangale	Males	0(2.5)	0(5.5)	10(10.5)	12(13.5)	28(18.0)	4	27.49	.000
	Females	5(2.5)	11(5.5)	11(10.5)	15(13.5)	8(18.0)			
Tera	Males	0(1.0)	0(3.5)	9(11.0)	15(13.5)	26(21.0)	4	12.44	.014
	Females	2(1.0)	7(3.5)	13(11.0)	12(13.5)	16(21.0)			
Waja	Males	0(0.5)	3(3.5)	6(7.5)	15(16.5)	26(22.0)	4	3.47	.482
	Females	1(0.5)	4(3.5)	9(7.5)	18(16.5)	18(22.0)			
	Male								
Entire tribes (All)	Female	0(5.0)	4(14.0)	36(40.0)	65(71.0)	145 (120.0)			

X^2: Chi-square value. df: degree of freedom. P-value < .05 considered statistically significant

When the evaluation was done in tandem with the ethnicity of the study participants, the Fulani (X^2 =14.26, df = 3, P = 0.03), Tangale (X^2 = 27.49 df = 4, P = 0.000) and Tera (X^2 = 12.44, df = 4 P = 0.014) ethnic groups had a significant association between gender and facial type (Table 4).

DISCUSSION

Anthropometric data are believed to be objective and they allow the researcher to go beyond subjective assessments such as ´similar' or ´different'. The researcher is able to quantify the degree of difference or similarity and state how much confidence can be placed in this interpretation[27]. In the current study, it was observed that males presented higher mean values for the cephalic and facial indices except for the facial index in Bole, cephalic index in Fulani and the facial index in Waja where females presented higher mean values. Some studies reported higher indices in males[11], while others reported higher indices in females[20]. In the present study, when the moderating effect of ethnicity was not evaluated, the commonest head type in females was Dolicephalic while in males it was mesocephalic. However, on controlling for the ethnicity of each of the study participants, all the males of the different ethnic groups had more of the Mesocephalic head type except among the Fulani and Waja males. All the females of the different ethnic groups had more of the Mesocephalic head type with the exception of those from the Bole and Waja ethnic groups. This agreed with the earlier studies among different ethnic groups in Nigeria - the Hausas/Fulanis, Fulani, Tera, Tangale, Ibibios, Igede Idoma, Igbo and the Yoruba ethnic groups of Nigeria[20,28-32]. The findings in an earlier study reported the Mesocephalic head type was the commonest head type head type among resident of Mumbai and this was in keeping with the finding from the current study[5]. There was an earlier study among the Ogoni ethnic group in Southern Nigeria that had a contrary finding to the current study because the Brachycephalic head type was the commonest among the Ogonis[9]. In the current study, the evaluation of the association between the head types based on gender only and not controlling for the ethnicity of the study participants, did not reveal a remarkable finding. The significant finding observed among the ethnic Fulanis may be due to a Type 2 error. This error may be sequel to the fact that one of the cells in the statistic table had no observed value probably arising from a lower sample size for participants.

The findings for the association of gender and face types grouped by ethnicity in the present study revealed that the most dominant face types among all the ethnic groups for both males and females were Hyper Leptoproscopic and Leptoproscopic except among the Tangale females who had the Mesoproscopic face type as the commonest face type. These results were similar when the evaluations were done without the moderating influence of ethnicity of each of the study participants. The current finding of higher numbers of Hyper Leptoproscopic and Leptoproscopic facial types is in tandem with an earlier study of facial type among the some of the ethnic groups in Gombe state (Fulani, Tangale and Tera of Gombe)[20]. The present result also agrees with the earlier findings regarding the preponderance of the Hyper Leptoproscopic and Leptoproscopic facial types even though the studies were carried out among different populations - Rajput people of India, Ibibios, Ukwanis and Idoma people of Nigeria[10,33-35]. Nevertheless, there are studies among Nigerian population that did not reveal a preponderance for the Hyper Leptoproscopic and Leptoproscopic facial types and this studies were in contrast with the finding in the current study. Specifically, Hyper Europroscopic and Europroscopic face types were reported to be the commonest facial types among the ethnic groups of Benue State, Nigeria[31,36]. The probable reason for the inconsistency

facial types among the different study populations may include the ethnicity as well a very important feature of low sample size with a propensity for type 2 error. The risk of type 2 error is ripe because in each of the analysis for association between gender and facial type (with and without) the moderating effect of ethnicity, certain cells were not populated and remained empty.

CONCLUSION

The commonest head types in all the ethnic groups were Mesocephalic and Dolicephalic, and the dominant face types were Hyper Leptoproscopic and Leptoproscopic, nevertheless, there were some degrees of ethnic variations. The association between facial types and gender was established among the Fulani, Tera and Tangale ethnic groups of Gombe state, while the association of gender with head type was only established among the Fulani ethnic group.

ACKNOWLEDGEMENT

We will like to thank all the participants for consenting to take part in this study. We will like to thanks staffs and lecturers of the department of Anatomy for contributing towards ensuring that the research was made better by several suggestions at the initial proposal stage.

Funding

The study was sponsored by the researchers only.

Conflict of interest

The authors have no conflict of interest to declare.

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