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Research Article

How Aggressive are You from Your Face Look? A Facial Anthropological Study of Sub-Saharan Africa Population

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Abstract

Facial dimensions have been shown over the years to correlate with human behavior. However, little is known regarding this correlation among African population, particularly Nigerians. This study aimed to determine the relationship between facial dimensions and different self-reported forms of aggression (physical, verbal, anger, and hostility) among Nigerians. A total of 400 undergraduate students (200 male and 200 female) aged between 16 to 30 years old were randomly selected. A 2D facial images were used to measure facial dimensions (n-sn, sn-gn, go-go and zy-gy) and five facial ratios: upper facial weight/lower facial height (UFW/LFH), upper facial weight/lower facial weight (UFW/LFW), upper facial weight/upper facial height (UFWUFH), upper facial height/facial height (UFH/FH) and fWHR-lower derived from the measured linear dimensions using a Sony digital camera and art face 3 software. Buss and Perry aggression questionnaire was adopted, scores for each aggression scale was recorded. Data analysis was made using IBM SPSS software version 22 and the Cronbach's alpha for each scale was above 0.70. Pearson's correlation analysis was used to determine the relationship of facial biometrics with aggressive tendencies. It was observed that lower facial height (sn-gn) significantly correlates with verbal aggression and anger. Facial height (FH) also correlates with verbal aggression in both sexes, and facial weight to height ratio (fWHR) also correlates significantly with anger (AN). Lower facial height to facial height ratio (LFH/FH) also correlates significantly with verbal aggression (VA) and anger (AN) in respective of sex but correlates with same in male only. Similarly, upper facial width to lower facial height (UFW/LFH) correlates significantly with verbal aggression and anger irrespective of sex and with anger only in males.

In conclusion, facial characteristics are to some extent indicators of one's mood.

Keywords: *Facial Dimensions; Facial Ratios; Aggressiveness; Sub-Saharan Africa*

Introduction

Human personality like aggressiveness, trustworthiness was previously attributed to one's facial characteristics [1] and some behaviors and personalities were also linked to such facial characteristics [2]. Facial photographs have been used over the years by many security agents and people to identify cheaters in certain games and competition [3]. Roney., *et al.* [4] reported that women's judgments of men's interest in infants based on their faces predicted their actual interest in infants. Also, facial information tells about one's fight-

ing ability and strength even though the facial metrics used to make this judgment is not clearly comprehensive [5]. It has been reported recently that individual differences in the facial width-to-height ratio (FWHR) accounted for a significant proportion of variance in aggressive behavior in men, but not women [6,7].

Since a new trend emerged to measure and evaluate 2D facial models, for the past decades two-dimensional facial data were obtained mostly by direct anthropometric measurements. Anatomical landmarks have been used for over a century by anthropometrists interested in quantifying cranial variations. A great body of work in craniofacial anthropometry is that of Leslie [8] who created a database of anthropometric norms by measuring and comparing more than 100 dimensions (linear, angular and surface contours) and proportions in hundreds of people over a period of many years. These measurements include 47 landmark points to describe the face [9].

The human face is perhaps the most salient source of interpersonal information, especially with strangers. People can judge extroversion and conscientiousness accurately from the face at levels slightly above chance [2]. Research has shown consensus in perceptions of facial trustworthiness [1], but evidence for validity in these judgments is patchy.

There is little or no information documented on the use of facial linear dimension and ratios in relation to behavior of the population under study especially owing to the fact that the region suffers from a serious threat of aggressive associated criminalities like insurgency, banditry and gangterism. Therefore, the present study aimed at establishing this relationship through investigating the correlation that may exist between the facial linear dimension and ratios with self-reported forms of aggression. The study also investigated the potential of facial dimensions in prediction of propensity for aggression.

Materials and Methods

The study was conducted at the Faculty of Basic Medical Sciences, Bauchi State University Gadau. The main campus resides in Gadau a village east of Itas-head quarter of Itas/Gadau LGA at 11*829'284" N 10*10'164634" E. It has an area of 1,398 km^2 and a population of 229,996 as at 2006 census.

Four hundred (400) participants who are students comprising of 200 males and 200 females aged between 16 to 30 years, belonging to the Faculty of Basic Medical Sciences, Bauchi State University Gadau participated thus the effect of age on facial measurement was controlled. Male with excessive facial hair, which obscures some of the facial landmarks, and craniofacial anomalies were excluded from the study. Any subjects outside these inclusion criteria were also excluded from the study. Before the commencement of the research, ethical approval was sought from ethical committee of faculty of Basic Medical Sciences Bauchi State University Gadau. Informed consent was sought from the participants and persons whose photograph appears in the study.

Facial photography

Individuals were asked to sit and look directly at the camera in front of them, keeping an upright and normal posture, with both arms free along the body [10]. The head position corresponds to the Broca's natural head Position [11]. Behind the subjects, a white screen was placed to standardize the background. The camera was placed on a tripod stand (WT3570, China) to standardize the distance (100 cm) between it and the subject as well as adjust the camera according to sitting height of the subject. In addition, the tripod stands helped to avoid undesirable movements of operator and camera while taking photographs [12]. Before capturing the face, the operator ensured that glasses had been removed, the participant's forehead, neck and ears were clearly visible during the process [13]. After the images were captured, those images were downloaded to a personal computer and stored in jpeg format for processing and analyses. A Digital Vernier Calliper (Neiko 01407A Stainless Steel SAE-Metric Conversion, China) was used as a direct anthropometric method for measurement of error where by participants were asked to sit with their head in neutral head position and linear facial dimensions were taken. This was to help in the determination of the factor to be used for real size measurements on the photographs.

Facial landmark identification and facial linear dimensions measurements

Standard anatomical landmarks and reference points were used (Figure 1) according to previous works [14] and recognized using Bioanalyzer (a software developed using Microsoft visual basic version 6) for facial analysis [15], while facial linear dimensions were obtained as the distance between one anatomical landmark and another.

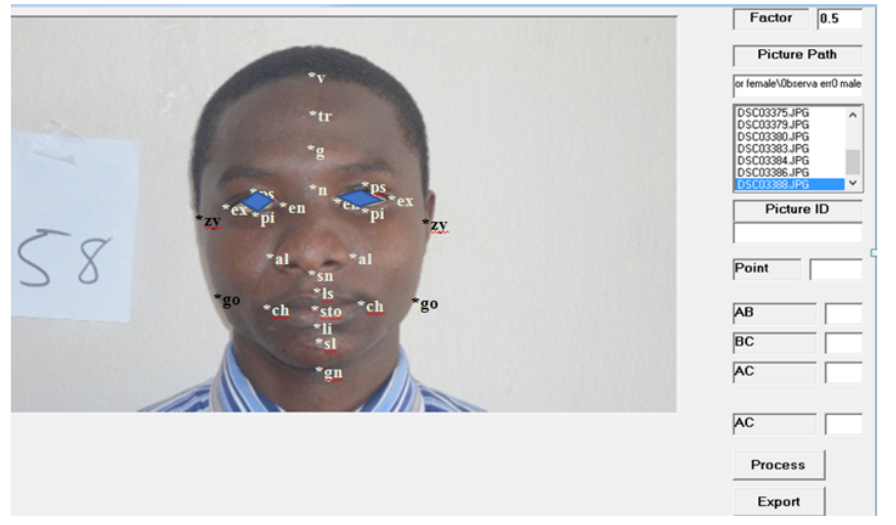

Figure 1: *Facial landmarks.*

S/N	Facial linear distance	Landmark	Facial ratios	Descriptions
1	Upper facial height (UFH)	n-sn	UFW/LFW	Upper facial width to lower facial width
2	Lower facial height (LFH)	sn-gn	UFWUFH	Upper facial weight to upper facial height
3	Special upper face height	g-sn	LFH/FH	Lower facial height to facial height
4	Upper facial width (UFW)	zy-zy	UFW/LFH	Upper facial weight to lower facial height
5	Lower facial Weight (LFW)	go-go	LFW	Lower facial weight
6	Height of lower third of the face	sto-gn	HLTF	Height of lower third of the face
7	Facial height (FH)	n-sn+sn-gn	UFH+LFH	Upper face height plus lower face height
8	FWHR-Lower	Zy-zy/n-sn+sn-gn	UFW/FH	Upper face weight to facial height

Table 1: *Linear facial dimensions and ratios with their corresponding landmarks.*

Measurement of error

Intra observer error was tested using 30 randomly selected subjects and their facial dimensions and other measures were measured two weeks after the first 30 set of measurement. Additionally, inter observer error was also tested by the research assistant using the

same 30 randomly selected subjects and the data of the research assistant were correlated with that of the researcher using Pearson correlation. Those dimensions with much difference between the first and the second measurements were discarded (i.e. not repeatable measurements).

The entire variables in this study are within the acceptable measurement error.

Buss and perry aggressive test

Questionnaires were used to obtain an online aggression scores from the BAP Aggressive test and the answer tabulated according to its individual form of aggression. Four items on aggressive behavior were investigated as follows: Physical Aggression, Verbal Aggression, Hunger and hostility.

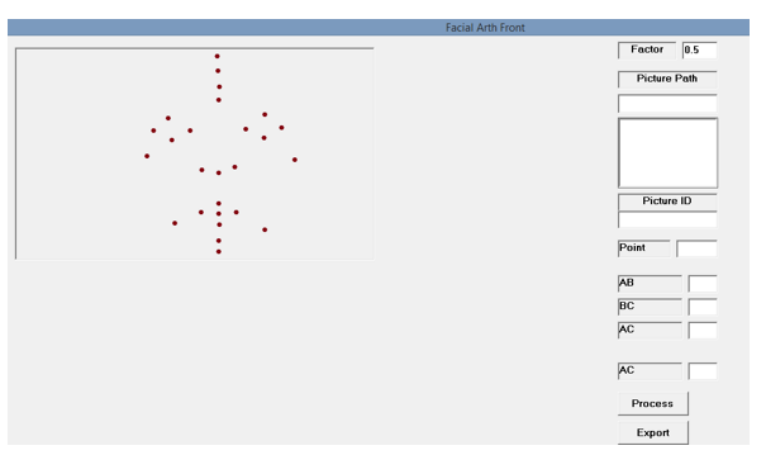

Figure 2: *Art Face 3 interface for facial dimensions analysis.*

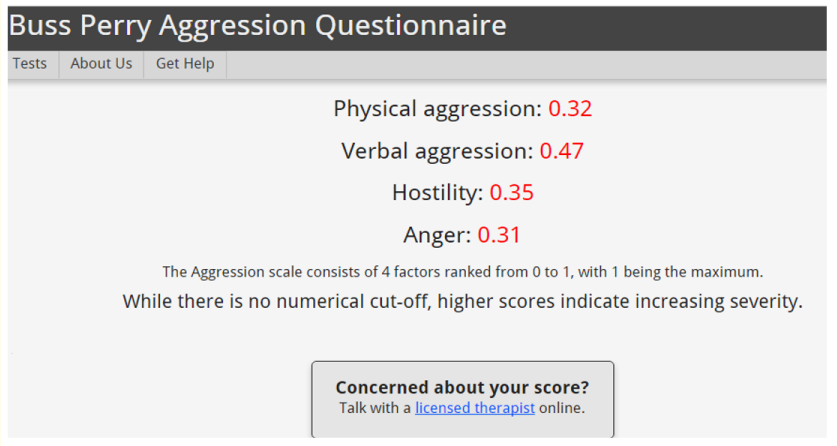

Figure 3: *Buss and Perry aggression questionnaire scores sample.*

Statistical analysis

The data were expressed using mean ± SD, frequency and percentage. Independent-samples t-test was used in assessing sexual dimorphism. Pearson's correlation was used to determine the relationship between the facial parameters and aggression. Step wise multiple regression analyses was employed to determine the best predictor of aggression among the facial dimension and ratio. The data were analyzed using Statistical Products and Service Solution IBM SPSS Version 22 Software (IBM Inc, 2010). $P < 0.05$ was set as level of significance.

Results

The results for both intra and inter-observer measurement errors of facial dimensions, all have a significant correlation ($r > 0.7$, $p < 0.001$), however, those with $r < 0.7$, were not included in the analyses (Osvaldo., *et al*. 2012).

Significant sexual dimorphism exists in aggressive behavior, facial dimensions and facial ratios (male > female) in all, except for a few parameters.

From table 2, Height of the lower face (sn-gn) significantly and inversely correlated with verbal aggression ($r = -0.112$, $p < 0.05$) and anger ($r = -0.138$, $p < 0.01$). Facial height (FH) also inversely correlated with verbal aggression in both male and female subjects ($r = -0.106$, $p < 0.05$), while facial width to height ratio lower (fWHR- L) postively and significantly correlated with anger (AN) ($r = 0.150$, $p < 0.01$). Furthermore, lower facial height to facial height ratio (LFH/FH) significantly and inversely correlated with verbal aggression (VA) ($r = -0.103$, $p < 0.05$) and anger (AN) ($r = -0.154$, $p < 0.01$) but inversely and significantly correlated with only male ($r = -0.180$, $p < 0.05$). Similarly, upper facial width to lower facial height (UFW/LFH) correlated significantly with verbal aggression ($r = 0.120$, $p < 0.05$), and anger ($r = 0.174$, $p < 0.01$) but appeared significantly correlated with anger only in male ($r = 0.154$, $p < 0.05$).

	All				Male				Female			
Parameters	**PA**	**VA**	**HO**	**AN**	**PA**	**VA**	**HO**	**AN**	**PA**	**VA**	**HO**	**AN**
n-sn	-0.030	-0.029	0.003	0.051	-0.06	-0.01	-0.01	0.12	-0.04	-0.09	-0.02	-0.03
sn-gn	-0.080	-.112*	-0.031	-.138**	-0.11	-0.14	-0.07	-.141*	0.01	-0.02	0.08	-0.10
zy-zy	-0.026	-0.038	-0.016	0.064	-0.07	-0.10	-0.09	0.06	-0.08	-0.09	-0.03	0.00
go-go	-0.010	0.011	-0.014	0.028	0.02	0.04	-0.06	0.03	-0.08	-0.06	-0.02	0.00
FH	-0.079	-.106*	-0.025	-0.095	-0.12	-0.12	-0.07	-0.07	0.00	-0.05	0.06	-0.09
fWHR	0.072	0.083	0.037	.150**	0.05	0.02	0.00	0.11	-0.09	-0.03	-0.10	0.11
UFWLFW	-0.026	-0.066	-0.012	0.030	-0.10	-.170*	-0.06	0.03	0.00	-0.04	-0.01	0.00
UFW/UFH	0.017	-0.019	-0.015	0.008	0.01	-0.11	-0.08	-0.07	-0.03	0.02	0.01	0.05
LFH/FH	-0.065	-.103*	-0.042	-.154**	-0.05	-0.11	-0.05	-.180*	0.03	0.04	0.09	-0.05
UFW/LFH	0.093	.120*	0.055	.174**	0.06	0.07	0.02	.154*	-0.07	-0.03	-0.11	0.10

Table 2: *Correlation between facial dimensions and different forms of aggression.*

** P < 0.05, **P < 0.01, AN: Anger, PA: Physical Aggression, VA: Verbal Aggression, HO: Hostility, fWHR: Facial Weight to Height Ratio, UFW/LFW; Upper Facial Weight to Lower Facial Weight Ratio, UFW/UFH: Upper Facial Weight to Upper Facial Height, LFH/FH: Lower Facial Height to Facial Height, Upper facial Weight to Lower Facial Height.*

Table 3 shows multiple regression analyses between aggression and facial dimensions irrespective of sex. Multivariate analyses were conducted with facial dimensions and ratios as the independent variables and specific form of aggression that has been proven to be

correlated with the dimensions from table 2 as the dependent variable, and through model optimization by Akaike Information Criterion (AIC) stepwise backward elimination, the analyses yielded a statistically significant best minimal model (Adjusted r = 0.175, F-stat = 12.56, P < 0.001) with anger as the dependant variable. The formula becomes AN = 0.068 × UFWLFH + 0.327 and from the r-value of 0.121 with verbal aggression as the dependent variable, the formula becomes VA = 0.42 × UFWLFH+0.363, and for 0.183 r-value and verbal aggression as the dependent variable the formula becomes VA = 0.67×UFWLFH+(-0.197) ×UFWLFW+0.523 this implies that out of the entire facial dimensions, only UFW/LFH, UFW, LFW are best predictors of both verbal aggression and anger.

Step	Model	R	R^2	SEE	F	P
1	AN = 0.068 × UFWLFH + 0.327	0.175	0.031	0.15	12.56	< 0.001
1	VA = 0.42 × UFWLFH+0.363	0.121	0.015	0.13	5.88	0.016
2	VA = 0.67×UFWLFH+(-0.197) ×UFWLFW+0.523	0.183	0.033	0.13	6.86	0.001

Table 3: *Stepwise multiple linear regression analysis for prediction of aggressive behavior from facial dimensions.*

Discussion

The current study demonstrated sexual dimorphism as shown in the previous studies, with males mostly having higher values on most of the facial dimensions [16].

Previous studies established a strong relationship between some facial linear distances like FH, and facial ratios with aggression negatively or positively in either sex. Faces with smaller height were perceived as less more aggressive compared to faces with bigger height [17].

Here, incoherently with this literature, it has been demonstrated that faces with either small or large upper facial height do not have relationship with any aggressive behaviour even though less feminine this could have been due to the type of aggressive test employed. Despite mixed findings in the literature, results of this research demonstrate a robust positive link between fWHR-lower and aggression specifically anger form (r = 0.150**)., even though the facial width to height ration here used was the FWHR-Lower as used by the Lafevre., *et al.* [18] and Hodges-Simeon., *et al* [19]. This was also consistent with the work of Lefevre CE., *et al*. [18] where anger correlated with fWHR in male (r = 0.37**) and in respective of sex (r = 0.28**) suggesting that fWHR is a reliable marker (and signal) of aggression irrespective of sex. The differences in fWHR measurement seems to account for variation in the degree of relationship of the said dimension and aggressive tendencies.

This work has also established that upper facial width and lower facial width were not positively correlated with aggression of any king, regardless of the sex identity. These results are incoherent with previous literature showing that during puberty under the influence of testosterone, males would get larger facial width and that, in return, the faces with larger width would be perceived as more aggressive [20].

LFH/FH another facial ratio that shows negative correlation with verbal aggression irrespective of sex (r = -0.103*) and anger (r = -0.154**), with anger also in male (r = -0.180*). UFW/LFH also shows positive correlation with verbal aggression and anger with r-value of 0.120* and 0.174* respectively irrespective of sex and correlates with anger (r = 0.154) in male. UFW/LFW also correlates negatively with verbal aggression (r = -0.170*) in Male. These findings are unprecedented as little or no data has been reported elsewhere correlating the specific variables with the said forms of aggression, this also implies that aggression is related to not only the facial dimensions previously discovered but to other dimensions.

It has been established here that anger can be best predicted by UFW/LFH with r-value of 0.17 and verbal aggression can be best predicted by UFW/LFH and a combination of UFW//LFH and UFW/LFW with an r-value of 0.121 and 0.183 respectively irrespective of sex, this is similar to another finding which states that for men, face ratio predicted 15 per cent of unique variance in aggressive behavior ($R^2 = 0.18$) [6].

Notably, angry facial expressions consist of lowering the brow and raising the upper lip, a facial movement that inevitably increases the facial WHR and, by implication, increases the saliency of the ''signal'' advertising propensity for aggression Thus, it is also possible that the relationship between facial WHR and aggression reflects social conditioning whereby a person's aggressive behavior has been shaped by others' expectations of their aggressive behavior. Furthermore, it may be some other cue in the face correlated with the facial WHR that is influencing estimates of aggression [6,21,22].

Conclusion

The results of this study indicate that there is a relationship between linear facial dimensions and facial ratios (other than fWHR) and a self-reported measure of aggressive tendencies especially anger and verbal aggression using Buss and Perry aggressive scale (BPAQ). The prediction of aggression and its relationship with facial dimensions estimation in this case can supplement other methods of identifying propensity for aggression and in diagnosis of Psychiatric disorders like affective disorders. The findings of this study also indicate that males have higher values of facial measurements than female.

Conflicts of Interest

There are no conflicts of interest.

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