Association between Craniofacial Parameters and Aggression among Egyptian Adults: A Case-Control Multi-parametric Study

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KEYWORDS
Aggression;
Violence;
Craniofacial Measurements;
Egyptian.

ABSTRACT

The craniofacial features of a person are unique and critical in the evaluation of age, gender, and ethnicity. The relationship between craniofacial properties and behavioral patterns has been one of the most interesting research topics. This study aimed to identify the correlation between the tendency for aggression and craniofacial anthropometric measurements among a sample of the Egyptian population aged 18-38 years. This was a case-control prospective study involving one hundred twenty-seven (127) subjects (61 males and 66 females). The subjects were divided according to the results of the brief aggression questionnaire (BAQ) score into two groups: the aggressive group (61 subjects) and the nonaggressive group (66 subjects). Demographic data and craniofacial anthropometric data were collected from all individuals. The total aggression score among males was positively correlated with head circumference and cranial width, while the physical aggression score was positively correlated with facial length and the anger score. The verbal aggression score was positively correlated with frontal height in females. The total aggression score was positively correlated with cranial length and facial width, while the physical aggression score and hostility score were positively correlated with frontal height and cranial width, respectively. Craniofacial measurements were found to be correlated with various aggression subdomains of the BAQ among the Egyptian population sample. Our research sheds light on the possibility of using craniofacial dimensions as a tool for predicting aggressive behavior.

Introduction

Anthropologists, forensic experts, anatomists, and surgeons frequently make use of the craniofacial region's dimensions and shape, which vary greatly among human populations and ethnic groups. A person's craniofacial features (CFF) are special and crucial in determining an individual's age, gender, and ethnicity. The association of CFF with patterns of behavior has been one of the most exciting research subject (Gülcen et al., 2021).

Although indirect anthropometric methods of measurement have been employed, the conventional and affordable direct in vivo approach continues to serve as the gold standard. This quantitative approach eliminates the risk of distortions that can occasionally result from using photographs in indirect anthropometry and allows for precise measurement of hair-covered regions (Majeed et al., 2018).

Acts of aggression are deliberate actions intended to cause harm to another person. Violence was described by the World Health Organization (WHO) as "the deliberate

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application of power or physical force, threatened or actual, toward one's self or a group or society that causes or has a high possibility of ending in harm, death, emotional harm, maldevelopment, or deprivation (World Health Organization, 2014; Allen and Anderson, 2017; Salakhova et al., 2019)

Aggression serves as a tool for obtaining and defending essential resources such as food, mates, and territory when it is contained within reasonable bounds. However, when it manifests improperly, it can be dangerous and have detrimental effects on both the aggressor as well as the victim (Weidler et al., 2019).

This study aimed to determine the correlation between the tendency for aggression and craniofacial anthropometric measurements among a sample of the Egyptian population aged 18-38 years.

Materials and methods

This is a case−control prospective study evaluating the possible associations between craniofacial parameters and aggression among Egyptian adults. The research sample size was determined using the Epi-Calc 2000 instrument. Assuming 80% power, a 0.05 level of significance, and a 43% proportion of cases exposed the odds ratio (OR) was 3, and the ratio of cases to controls was 1. The sample size was 108 participants (54 in each group). Given a dropout rate of 10%, the final sample size consisted of 120 participants, with 60 individuals assigned to each group.

This study included 127 urban and rural adult males and females (18-38 years old). The participants were divided according to gender into two groups (61 males, 66 females). Informed written consent was obtained before participation in the study. Additionally, the ethical committee of Kasr-Alainy School of Medicine approved the research (code: MS – 309/2022).

Exclusion criteria:

1. Chronic diseases: liver, kidney, and bone diseases.
2. Congenital disorders.
3. Hematological diseases: thalassemia, and autoimmune diseases affecting bone.
4. People suffering from psychiatric disease or drug abuse.

Materials

The following tools were used:

1. A sliding caliper to measure frontal height, facial length, mandibular length, and mandibular breadth (Figure 1).
2. A spreading caliper to measure frontal breadth, facial breadth, cranial length, and cranial width (Figure 2).
3. A measuring tape to measure head circumference (Figure 3).

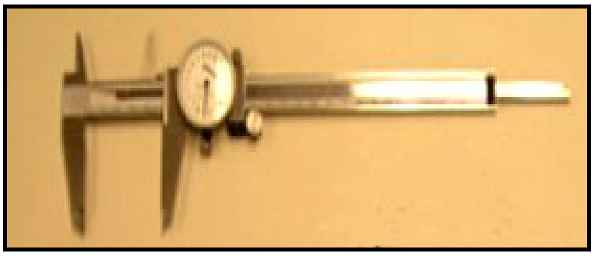

Fig. (1):A sliding Caliper (Dudzik and Kolatorowicz, 2016)

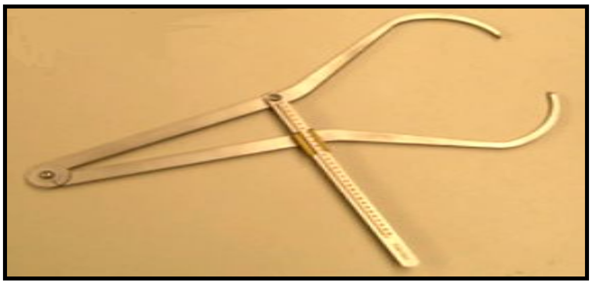

Fig. (2):A spreading Caliper (Dudzik and Kolatorowicz, 2016).

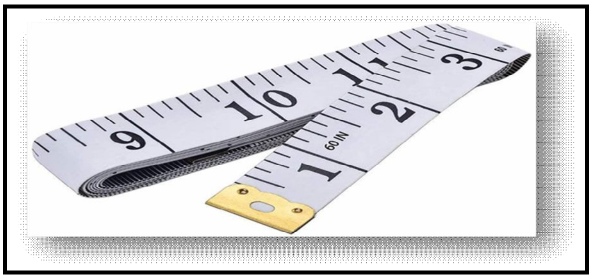

Fig. (3): Measuring tape. (Dudzik and Kolatorowicz, 2016)**.**

Methods

Demographic data (Appendix I)

Age, residency (either urban or rural), and educational level were collected from the participants.

Measuring aggression (Appendix II)

The Brief Aggression Questionnaire (BAQ) (Webster et al., 2014) was used. It consists of four subscales: (1) physical aggression, (2) anger, (3) verbal aggression, and (4) hostility; each of which involves 3 questions, for a total of 12 questions. Agreement levels ranged from (1) strongly disagree to (5) strongly agree. Both confirmatory and exploratory factor analyses were applied. The scale had a total score ranging from 12 to 60. According to the questionnaire scoring, participants were categorized into aggressive (scoring > 36) and nonaggressive groups (scoring < 36) (Kumari, Sharma and Singh, 2022).

The English version of the BAQ has shown good validity and reliability in several studies (Webster et al., 2014, 2015) The original aggression questionnaire was translated to Arabic by (Aljurany, 2013) and has shown good validity and reliability. The translated validated form of the original aggression questionnaire was used to translate the English questions of the BAQ. The Arabic version of the BAQ was also tested on 20 Egyptian adults (10 males and 10 females) to discuss the contents of the items and to ensure that the Arabic version was readable and understandable (Table 1).

Table (1): Subscales of the Brief Aggression Questionnaire (BAQ) (Webster *et al.*, 2014).

Physical aggression	Given enough provocation (action or speech that makes someone angry), I may hit another person.
	If I must resort to violence to protect my rights, I will.
	If I am pushed so far, I use blows.
Anger	I am an even-tempered person.
	Sometimes I fly off the handle (loose temper suddenly and unexpectedly) for no good reason.
	I have trouble controlling my temper.
Verbal aggression	I tell my friends openly when I disagree with them.
	When people annoy me, I may tell them what I think of them.
	My friends say that I'm somewhat argumentative.
Hostility	Other people always seem to get the breaks (to get the opportunity).
	I sometimes feel that people are laughing at me behind my back.
	When people are especially nice, I wonder what they want.

Measurement of craniofacial anthropometric parameters (Appendix III)

Craniofacial measurements were carried out according to (Kolar and Salter, 1997) using a measuring tape, spreading, and sliding calipers.

A. Cranial Dimensions

- Cranial length (anteroposterior length): the distance in mm between the glabella (the most prominent point of the frontal bone in the midsagittal plane between the brow ridges) and the opisthocranion (a point of the occipital squama in the sagittal plane located farthest from the glabella) (Torres-Restrepo et al., 2014) (Figure 4).
- Cranial width**:** the distance in mm between the left Eurion (the most lateral point of the neurocranium) and the right Eurion (Torres-Restrepo et al., 2014) (Figure 5).
- Head circumference: the measurement of the head around its largest area (Canbolat et al., 2019) (Figure 6).
- Frontal breadth: the distance between both frontotemporals measured in a straight line (Canbolat et al., 2019) (Figure 7).
- Frontal height: the distance from Trichion to the glabella (Alam et al., 2015) (Figure 8).

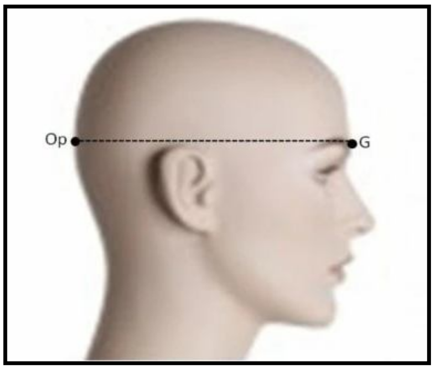

Fig. (4): Cranial Length (Torres-Restrepo et al., 2014). (Op.: opisthocranion, G.: glabella).

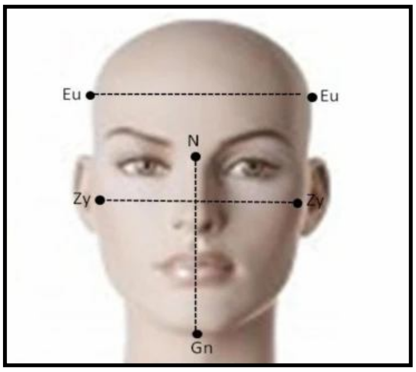

Fig. (5): Cranial Width (Torres-Restrepo et al., 2014)**.** (Eu.: eurion, zy.: zygion, gn.: gnathion).

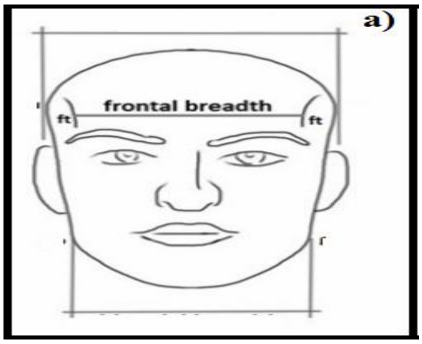

Fig. (7): Measurement of Frontal Breadth (Canbolat et al., 2019). (ft.: frontotemporalis),

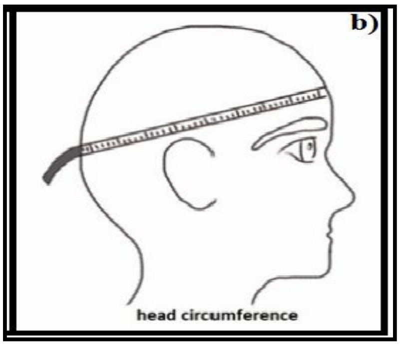

Fig. (6): Measurement of head circumference (Canbolat et al., 2019).

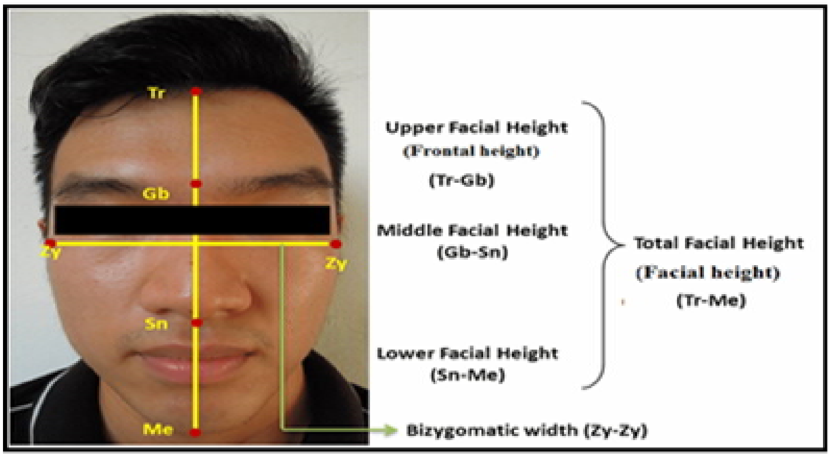

Fig. (8): Measurement of frontal height (Alam et al., 2015). (Tr.: trichion, Gb.: glabella, Sn,: subnasale, Me.: menton)

B. Facial Dimensions

- Facial height: between Trichion and Menton (Alam et al., 2015) (Figure 9).
- Facial width**:** between the left and right zygions (Packiriswamy et al., 2012) (Figure 9).
- Mandibular breadth (width): between the left and right gonium. It was measured using a spreading caliper (Gabarre-Mir et al., 2017) (Figure 10).
- Mandibular height**:** between sublabial and gnathion (Raschke et al., 2016) (Figure 11).

Fig. (9): Facial Height (tr-gn) and Facial Width (zy-zy) (Packiriswamy et al., 2012). (tr.: trichion, zy.: zygion, gn.: gnathion)

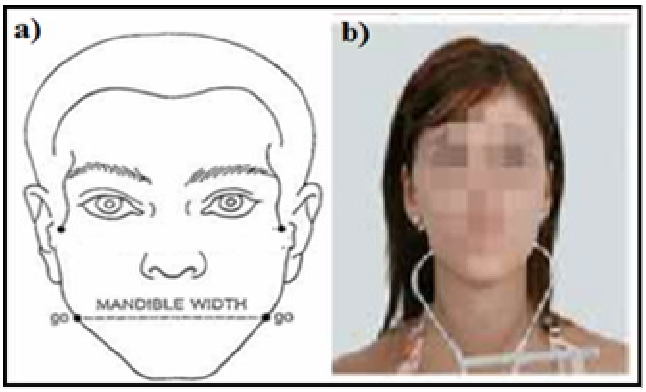

Fig. (10): Mandibular Width using spreading caliper (Gabarre-Mir et al., 2017). (Go.: gonium).

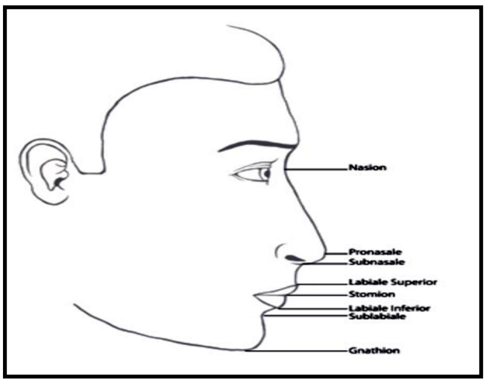

Fig. (11): Mandibular Height (Raschke et al., 2016).

Statistical analysis:

For coding and entering the data, the Statistical Package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA) was used. The mean and standard deviation were used to summarize the data for quantitative variables, while categorical variables were summarized using frequencies (number of cases) and relative frequencies (percentages). To compare the groups, the unpaired t test was applied (Chan, 2003a). Categorical data were compared using the chi-square test. When the anticipated frequency fell below five, an exact test was used instead (Chan, 2003b). Correlations between quantitative variables were analyzed using the Pearson correlation coefficient (Chan, 2003c). P values less than 0.05 were regarded as statistically significant.

Results

Sociodemographic data

The mean age of the participants was 25.83±4.2 years. Sixty-one subjects (48%) were males and 66 (52%) were females. Fifty-nine of the participants (46.5%) lived in rural areas while 68 (53.5%) lived in urban areas. For education, 106 subjects (83.5%) received a high education, 3 (2.4%) received above-average education, and 18 (14.2%) received below average education (Table 2).

Table (2): Sociodemographic data of the studied population.

Age (year)		25.83 (Mean)	4.32 (SD)
		Count	Percent (%)
Gender	Male	61	48
	Female	66	52
Residency	Rural	59	46.5
	Urban	68	53.5
Educational level	High	106	83.5
	Above average	3	2.4
	Below average	18	14.2

S.D.: standard deviation.

Aggressive versus nonaggressive males and females regarding age, residence, and education

Males in the aggressive group were significantly older than those in the nonaggressive group (27.57±5.74 vs 24.00±4.61 years; P=0.010). Moreover, the incidence of living in urban areas was significantly greater among subjects in the aggressive group than among those in the nonaggressive group (73.3vs 32.3%; p = 0.001) while neither group showed significant differences in educational level. However, in females, there was no significant difference reported (Table 3).

Table (3): Comparison between aggressive and nonaggressive males and females regarding age, residence, and education.

		Males			Female		
		Aggressive group	**Nonaggressive group**	**P value**	**Aggressive group**	**Nonaggressive group**	**P value**
	Age (Mean ±SD)	**27.57±5.74**	**24.00±4.61**	**0.010***	**26.16 ±3.46**	**25.69 ±2.45**	**0.517**
		Count (%)	**Count (%)**		**Count (%)**	**Count (%)**	
Residency	**Rural**	**8 (26.7**	**21 (67.7)**	**0.001***	**12 (38.7)**	**18 (51.4)**	**0.300**
	Urban	**22 (73.3)**	**10 (32.3%)**		**19 (61.3)**	**17 (48.6)**	
Educational level	**High**	**23 (76.7)**	**24 (77.4)**	**1**	**28 (90.3)**	**31(88.6)**	**0.538**
	Above average	**1(3.3)**	**1(3.2)**		**1 (3.2)**	**0 (0.0)**	
	Below average	**6 (20.0%)**	**6 (19.4)**		**2 (6.5)**	**4 (11.4)**	

Unpaired t test; * statistical significance: $p < 0.05$; S.D.: standard deviation

Aggressive versus nonaggressive male and female aggression and anger scores, cranial dimensions, and facial dimensions.

Regarding total aggression, physical aggression, anger, verbal aggression, and hostility scores, males in the aggressive group had significantly greater scores than did those in the nonaggressive group ($p < 0.001$ for all). In females, the aggressive group had a significantly greater mean score as compared with the non-aggressive group ($p < 0.001$, < 0.001, 0.003, < 0.001, and < 0.001 respectively).

In terms of cranial dimensions, males in the aggressive group had significantly greater cranial width than did those in the nonaggressive group ($p = 0.027$); however, no significant difference was detected between females in the aggressive and nonaggressive groups.

With respect to facial dimensions, males in the aggressive group had significantly greater facial length than did those in the nonaggressive group ($p = 0.039$); however, no significant difference was reported between females in the aggressive and nonaggressive groups (Figure 12).

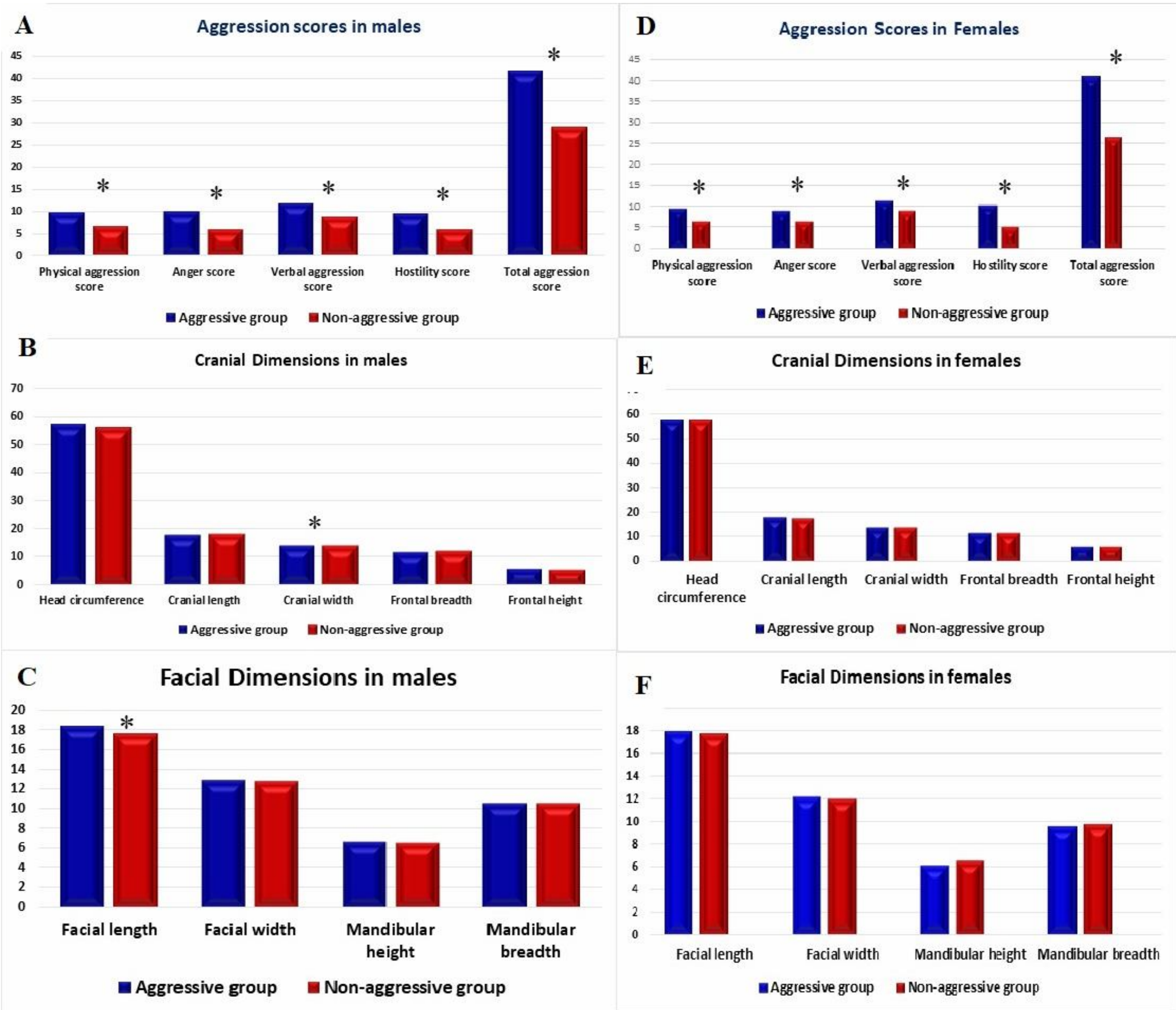

Fig. (12): Comparison between aggressive and nonaggressive males regarding (A) aggression scores (B) cranial dimensions, and (C) facial dimensions. Comparison between aggressive and nonaggressive females regarding (D) aggression scores, (E) cranial dimensions, and (F) facial dimensions. * Statistically significant at p value < 0.05.

Correlations between cranial dimensions, facial dimensions, and aggression scores among all male participants:

The total aggression score among males showed a positive correlation with head circumference ($r = 0.319$; $p = 0.012$) and cranial width ($r = 0.454$; $p < 0.001$); however, no significant correlation was reported with other cranial dimensions or facial dimensions. No significant correlation was reported between the physical aggression score and cranial dimensions among males. Among males, physical aggression scores were positively correlated with facial length ($r = 0.310$; $p = 0.015$); however, no significant correlation was found with other facial dimensions.

Anger score among males showed a positive correlation with frontal height ($r = 0.256$; $p = 0.047$); however, it showed no significant correlation with other cranial dimensions or facial dimensions. The verbal aggression score among males showed a positive correlation with frontal height (r = 0.318; p = 0.013); however, it showed no significant correlation with other cranial dimensions or facial dimensions. No significant correlation was reported between hostility scores and cranial dimensions or facial dimensions (Table 4).

Table (4): Correlations between cranial dimensions, facial dimensions and aggression scores among all male participants.

	Male (n= 61)	Total aggression score		Physical aggression score		Anger score		Verbal aggression score		Hostility score	
		R	p valve	R	p value	R	p valve	R	p value	R	p value
Cranial dimensions	Head circumference	0.319	0.012*	0.230	0.074	0.156	0.231	0.176	0.174	0.223	0.084
	Cranial length	0.121	0.351	-0.023-	0.861	-0.070-	0.593	0.089	0.496	-0.091-	0.483
	Cranial width	0.454	< 0.001*	0.234	0.069	0.157	0.227	0.318	0.013*	-0.109-	0.405
	Frontal breadth	0.004	0.978	0.017	0.895	-0.103-	0.430	-0.031-	0.810	0.077	0.557
	Frontal height	0.077	0.556	0.237	0.066	0.256	0.047*	0.017	0.897	0.140	0.283
Facial dimensions	Facial length	0.203	0.116	0.310	0.015*	0.087	0.504	0.185	0.153	-0.043-	0.744
	Facial width	-0.005-	0.969	0.107	0.410	-0.049-	0.709	0.134	0.304	-0.091-	0.486
	Mandibular height	0.033	0.799	0.088	0.502	0.006	0.961	0.188	0.147	-0.209-	0.105
	Mandibular breadth	-0.050-	0.702	-0.039-	0.765	-0.038-	0.770	0.055	0.671	-0.191-	0.141

Pearson correlation coefficient test; * statistical significance: $p < 0.05$; r: correlation coefficient; N: number

Correlations between cranial dimensions, facial dimensions, and aggression scores among all female participants:

The total aggression score among females showed a positive correlation with cranial length (r = 0.262; p = 0.033); however, it showed no significant correlation with other cranial dimensions**.** The total aggression score among females showed a positive correlation with facial width (r = 0.252; p = 0.041); however, it showed no significant correlation with other facial dimensions. The physical aggression score among females showed a positive correlation with frontal height (r = 0.260; p = 0.035); however, it showed no significant correlation with other cranial dimensions**.** No significant correlation was reported between the physical aggression score and facial dimensions among females.

No significant correlation was reported between cranial dimensions, facial dimensions, or anger scores. No significant correlation was reported between cranial dimensions, facial dimensions, or verbal aggression scores. The hostility score among females showed a positive correlation with cranial width (r = 0.322; p = 0.008); however, it showed no significant correlation with other cranial dimensions**.** No significant correlation was reported between hostility scores and facial dimensions among females (Table 5).

Table (5): Correlations between cranial dimensions, facial dimensions and aggression scores among all female participants.

	Females (n= 66)	Total aggression score		Physical aggression score		Anger score		Verbal aggression score		Hostility score	
		R	p value	R	p value	R	p value	R	p value	R	p value
Cranial dimensions	Head circumference	-0.173-	0.165	0.088	0.483	-0.223-	0.071	-0.005-	0.965	-0.003-	0.979
	Cranial length	0.262	0.033*	0.097	0.437	0.038	0.765	0.166	0.183	0.242	0.050
	Cranial width	0.166	0.182	0.156	0.210	-0.138-	0.271	0.135	0.280	0.322	0.008*
	Frontal breadth	0.132	0.291	-0.012-	0.922	-0.068-	0.590	0.011	0.933	0.143	0.252
	Frontal height	-0.015-	0.905	0.260	0.035*	-0.063-	0.615	-0.163-	0.192	0.007	0.956
Facial dimensions	Facial length	0.048	0.702	0.212	0.088	-0.164-	0.189	0.014	0.910	0.008	0.947
	Facial width	0.252	0.041*	0.087	0.485	-0.066-	0.600	0.224	0.070	0.211	0.089
	Mandibular height	-0.203-	0.103	-0.006-	0.962	-0.077-	0.539	-0.198-	0.111	-0.230-	0.063
	Mandibular breadth	-0.132-	0.290	-0.128-	0.304	0.078	0.534	0.001	0.996	-0.083-	0.507

Pearson correlation coefficient test; * statistical significance: $p < 0.05$; r: correlation coefficient; N: number.

Comparison between aggressive males and females

Regarding aggression and anger scores, no significant difference was found between aggressive males and females regarding aggression, anger, or hostility scores. Additionally, regarding cranial dimensions, no significant difference was reported between aggressive males and females. However, regarding facial dimensions, males in the aggressive group had significantly greater facial length, facial width, mandibular height, and mandibular breadth than females in the aggressive group (p = 0.035, < 0.001, 0.005, and 0.002 respectively) (Figure 13).

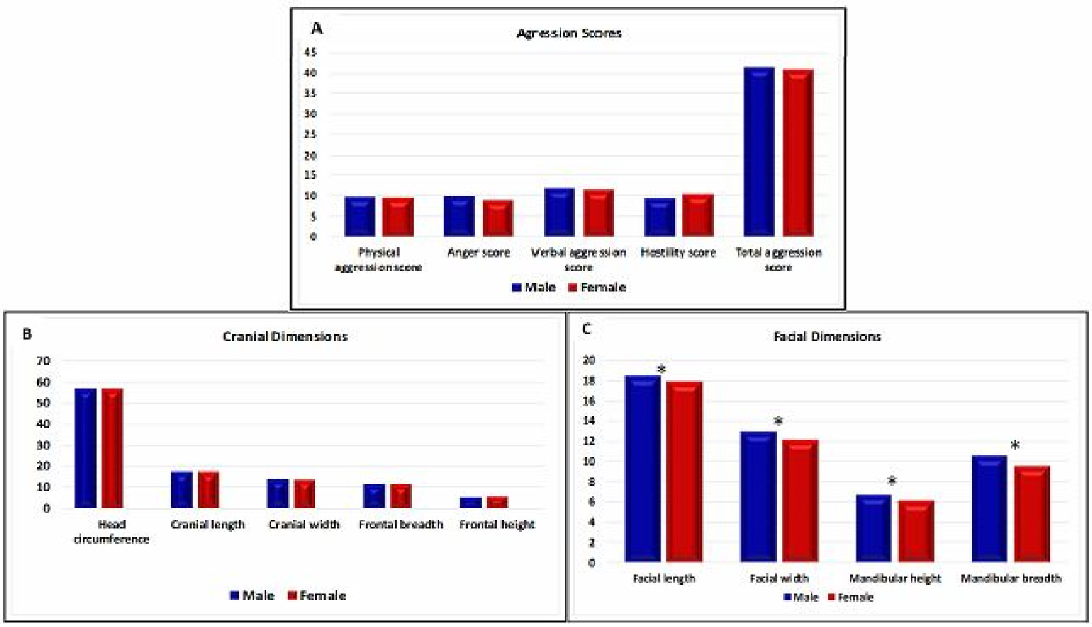

Fig. (13): Comparison between aggressive males and aggressive females regarding (A) aggression scores (B) cranial dimensions, and (C) facial dimensions. * Statistically significant at P value < 0.05.

Comparison between nonaggressive males and females

Regarding the aggression and anger scores, males in the nonaggressive group had significantly greater total aggression scores than females in the same group (p = 0.029); however, no significant difference was reported in the other scores. Concerning cranial dimensions, males in the nonaggressive group had significantly shorter head circumferences and frontal heights than females in the same group (p = 0.023 and 0.004 respectively); however, no significant differences were detected in the other cranial dimensions. With respect to facial dimensions, males in the nonaggressive group had significantly greater facial width and mandibular breadth than females in the same group (p < 0.001) but no significant difference was observed in the other facial dimensions (Figure 14).

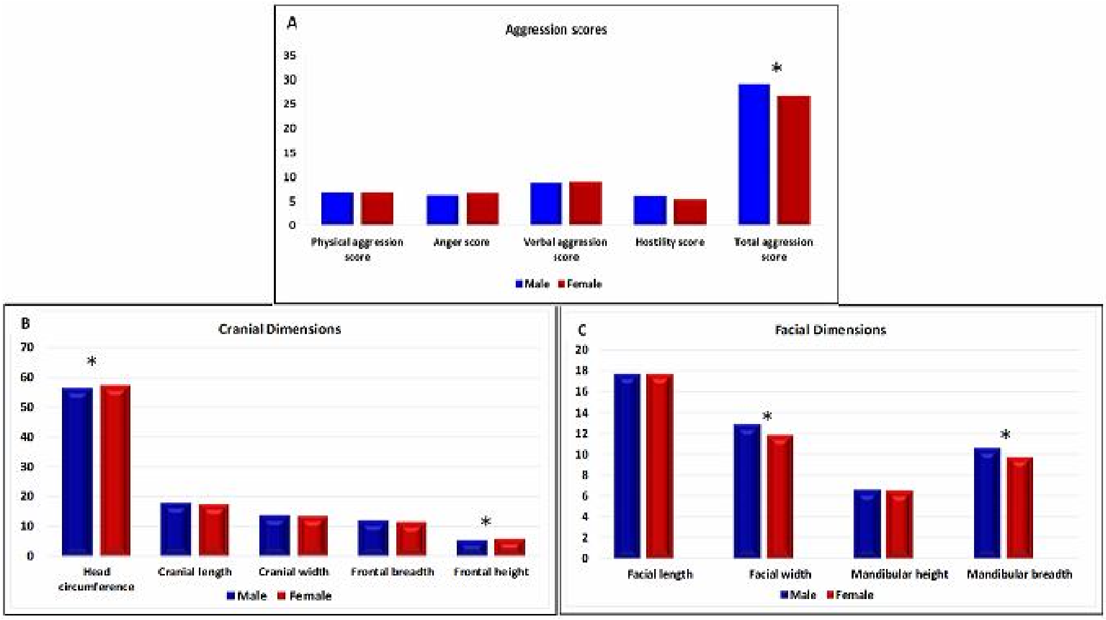

Fig. (14): Comparison between nonaggressive males and nonaggressive females regarding (A) aggression and anger scores (B) cranial dimensions, and (C) facial dimensions. * Statistically significant at P value < 0.05.

Discussion

The relationship between craniofacial traits and aggression has been an interesting topic for researchers from various disciplines, including anthropology, psychology, and forensic science. This study aimed to conduct a comprehensive examination of craniofacial parameters and their associations with aggressive behavior among Egyptian adults. Using a case–control multi-parametric approach, various craniofacial measurements were analyzed alongside behavioral assessments to elucidate any potential correlations.

In the current study, the participants in the aggressive group were significantly older than those in the nonaggressive group were. In contrast to our findings, a study including

658 13- to 17-year-old high school students (321 boys and 337 girls) from Greece who completed the aggression questionnaire revealed that the physical aggression score decreased with age (Tsorbatzoudis, et al., 2013).

Additionally, in a (Khan, 2006) study from Pakistan, 100 subjects were included, comprising 50 males and 50 females, with each gender group consisting of 25 teenagers and 25 middle-aged individuals. The teenage group comprised college students aged 13-18 years, while the middle-aged group comprised individuals with different occupations and aged 40-50 years. A questionnaire prepared from the Personality Research Form was used, and the results showed that the teenage group showed more aggression.

The disagreement between our findings and those of other studies may be because older people may experience more life stressors, such as financial difficulties, work overload, and family concerns, all of which may contribute to an increase in aggressive behavior. In addition, older people have different life experiences than younger people, including a greater likelihood of being exposed to violence, traumatic events, or other risk factors for aggressive behavior (Salleh, 2008).

In this study, it was found that residency played a role in aggression with urban inhabitants showing a significantly greater incidence of aggression. Our results are supported by those of an Indian study by (Sidhu *et al.*, 2019), which assessed the aggression levels of 695 senior secondary school students aged 12 to 20 years using the Buss and Perry Aggression Score. When comparing young people living in urban areas to those living in rural areas, they discovered a significant correlation between verbal aggression, hostility, and overall aggression. According to some theories, the high score for aggression in urban populations may have resulted from factors such as parental work, loneliness, increased internet and social media addiction, and fewer interactions with friends and parents, all of which increased feelings of frustration and increased engagement in violent and aggressive behaviors.

In the present study, among males, the total aggression score was positively correlated with both head circumference and cranial width. Additionally, we found that physical aggression scores were positively correlated with facial length among males, while anger and verbal aggression scores were positively correlated with frontal height and cranial width respectively. However, in females, we found that the total aggression score was positively correlated with cranial length and facial width. Moreover, the physical aggression score was positively correlated with frontal height, while the hostility score was positively correlated with cranial width.

The findings of (Gülcen et al., 2021) are consistent with our findings. The authors measured craniofacial dimensions and indices in 156 female and 147 male Turkish adults aged 18 to 38 years using an altered version of the Buss-Perry questionnaire. According to the study, there was a positive correlation between the total aggression score in males and the frontal, upper facial, and total facial height-facial width indices. The study also revealed that while upper facial and total facial height–facial width indices were positively correlated with verbal aggression, frontal and upper facial indices were positively correlated with physical aggression in males. However, there was no significant correlation between craniofacial indices and anger.

The current study revealed no significant differences in aggression scores or cranial dimensions between aggressive males and aggressive females. (Gülcen et al., 2021) reported that, except for frontal height, men had greater mean values for all cranial dimensions than women did, which is in contrast to our findings. Furthermore, the same study revealed that, except for physical aggression, male students scored significantly higher than female students in every subdomain of the aggression questionnaire. The distinct nature of the study population (the Turkish population) may be the reason for this discrepancy.

A review of meta-analyses including 148 studies on gender variations in direct and indirect aggression in children and adolescents revealed that girls were more likely to favor indirect aggression, while boys were more likely to favor direct aggression (Card et al., 2008).

Testosterone commonly plays a substantial role in controlling aggression. The human testosterone/aggression complex varies in response to environmental challenges, which may have a significant impact on situation-specific aggressive behavior. A meta-analysis by (Geniole et al., 2020) revealed a correlation between aggression and baseline testosterone levels. Additionally, there was a positive correlation between aggression and increases in testosterone concentrations.

In this study, males in the aggressive group had significantly greater facial length, facial width, mandibular height, and mandibular breadth than females in the same group. In line with our study, in the (Gülcen et al., 2021) study, the mean values of facial dimensions were greater in males than in females. Furthermore, (Tuncer, 2020) conducted 13 direct facial anthropometric measurements on 93 adult Turkish participants (mean age 19.26±1.03 years for 54 males and 18.95±1.34 years for 39 females). The study found that males had greater values than females in all facial measurement except forehead height.

Sex hormones have a well-documented effect on human craniofacial morphology; this effect is most noticeable between the faces of men and women in postpubertal dimorphism (Kesterke et al., 2016; Matthews et al., 2018). The nose, forehead, lips, zygomatic region (cheeks), and mandible are typically where sex differences in human facial morphology are most noticeable (Koudelová et al., 2015; Kesterke et al., 2016; Matthews et al., 2018). Previous research has established a direct correlation between facial morphology and testosterone levels, as well as between facial morphology and behavioral and physical indicators (Whitehouse et al., 2015; Hodges-Simeon et al., 2016).

Moreover, males in the nonaggressive group had significantly greater facial width and mandibular breadth than females in the same group. In accordance with our study, an anthropometric Iranian study included 200 volunteer medical students (100 males and 100 females), aged 20–25 years, where measurements of the upper, lower, and total facial heights as well as the width of the face were taken. The total facial height and width were greater in males than in females (Dodangheh et al., 2018). Furthermore, an anthropometric study by (Pandeya and Atreya, 2018) measured the width and height of the faces of 155 students, and 72 of them demonstrated that the total facial height and width were greater in males than in females.

An Iranian study analyzed the cephalo-facial dimensions of 732 participants (366 male and 366 female) aged 18 to 20 years. They discovered that males had noticeably larger craniums than females, both in terms of length and breadth (Pouya et al., 2017). Additionally, standard photographs of the forehead region were taken of 200 young Turkish adults aged 19 to 21 years. Five groups of hairline contours were identified: round, M-shaped, rectangular, bell-shaped, and triangular. As reference points, measurements of the forehead region, including height, forehead width, and the supraorbital region were computed using these photographs. They discovered that the average frontal height of males was considerably greater than that of females (Sirinturk et al., 2017).

Moreover, in a study of 400 Turkish patients aged 18-45 years, cranial CT was used to measure 14 anthropometric parameters including maximum cranial length, maximum cranial breadth, and upper facial breadth. They demonstrated that males scored higher than females on every measured item (Ekizoglu et al., 2016). Additionally, (Avci et al., 2015) measured craniofacial parameters on two-dimensional reformatted CT scans in 60 normal adults (30 males and 30 females) and reported that some craniofacial parameters, especially vertical parameters showed sex differences that began in childhood and continued in adulthood.

On the other hand, in this study males in the nonaggressive group had significantly lower head circumferences and frontal heights than females in the same group. This finding disagrees with other studies that showed that compared to females; males had increased head circumferences and frontal heights (Pouya et al., 2017; Sirinturk et al., 2017). This discrepancy might be due to gender differences in brain development or the size, shape, and functioning of brain areas, which make them less likely to engage in aggressive behavior. Other factors such as genetics and hormonal or environmental factors, may contribute to the observed disparities in cranial dimensions between males and females in the nonaggressive group.

Compared with females, nonaggressive males in the current study had significantly greater total aggression scores. Consistent with our findings, (Im et al., 2018) who analyzed young men's and women's self-reports of aggression to examine the impact of gender on aggression. Using three self-report questionnaires, they assessed 334 Korean college students (aged 18.3±1.2 years) and high school students (aged 17.7±1.3 years; 169 males, aged 18.8±0.8 years; 165 females, aged 17.7±1.3 years) using the Buss–Durkee Hostility Inventory, the Buss–Perry Aggression Questionnaire, and the Peer Conflict Scale. Men had higher scores on these questionnaires than women, and there were gender differences in the specific forms of aggression measured, such as physical aggression, rage, and overt and reactive aggression.

In line with this finding, (Zeichner et al., 2003) used the Buss-Perry Aggression Questionnaire and the Response Choice Aggression Paradigm on 84 undergraduate students (43 males and 41 females) from the US with a mean age of 19.75 years and found that males had greater aggression than females.

Furthermore, a study conducted in Germany investigated the manifestation of aggression using the Taylor aggression paradigm in 81 healthy, right-handed participants. Three experiments were each conducted on 27 participants. They discovered that at first, women exhibited less aggression than men. However, when the provocation and punishment modalities were the same, gender differences were less pronounced under longer, more severe provocation. Therefore, when faced with little provocation, women behave less aggressively. High provocation, however, has a comparable impact on reactive aggressive behavior in both males and females across a range of aggressive behaviors (Weidler et al., 2019).

Conclusion:

Craniofacial measurements were found to be correlated with various aggression subdomains of the BAQ among the Egyptian population sample. Compared with nonaggressive males, aggressive males had significantly greater cranial width and facial length, but they had significantly greater facial length, facial width, mandibular height, and mandibular breadth when compared with aggressive females. In males, the total aggression score was positively correlated with head circumference and cranial width, the physical aggression score was positively correlated with facial length, and the anger and verbal aggression scores were positively correlated with frontal height. In females, the total aggression score showed a positive correlation with cranial length and facial width, the physical aggression score was positively correlated with frontal height, and the hostility score was positively correlated with cranial width.

Recommendations

1. Effects of Age and Environment
    - This research suggests that when diagnosing and treating people who have a tendency toward aggression it is important to take into account factors such as age and residential environment (urban vs. rural) that might act as moderating factors in the diagnosis and treatment of aggression.
    - It is important for medical professionals to pay close attention to older adults residing in urban areas who may exhibit a greater propensity for aggressive behavior.
2. Craniofacial Dimensions as Aggression Indicators

    Medical professionals can consider craniofacial dimensions and indices (head circumference, cranial width, facial length, and width) as potential indicators of aggression in both males and females.
3. Craniofacial Dimensions in Aggression Risk Assessment
    - This study opens a new avenue for investigating the potential of craniofacial dimensions as a tool for risk assessment in aggressive behavior.
    - Future research can explore the feasibility of utilizing these measurements to identify individuals at risk of developing aggression.
4. Future Research Directions.
    - Large-scale studies are required to investigate the relationships between craniofacial dimensions, aggression, and gender across diverse populations.
    - Additionally, further research is needed to compare the prevalence of aggression across different age groups.

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