

RESEARCH ARTICLE

## Facial Anthropometry and Intelligence Quotient among Students in some Nigerian Lower Education Institution in Kano

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### Abstract

**Background:** Anthropometry is the study of measuring the human body in terms of bone, muscle, and adipose (fat) tissue dimensions. There is a scarcity of reference data on the relationship between facial anthropometry and Intelligence Quotient among primary school students in Fagge, Kano State.

**Objectives:** This study was designed to find the relationship between facial anthropometry and Intelligence Quotient (IQ) among primary school students in Fagge, Kano State.

**Method:** The study was conducted on 389 primary schools pupils in Fagge local government Kano. The subject consists of males and female whose face were measured using anthropometric method. The relationship between facial anthropometry with Intelligence Quotient was assessed using person correlation.

**Results:** The result of the study indicated that there was no statistically significant relation between facial anthropometry and IQ at  $p < 0.05$ . Also males were represented more on all the Intelligence Quotient score groupings than females. A T-test of male and female study variables showed evidence of sexual dimorphism in all variables with the males having higher values than the females.

**Conclusion:** The study concluded that there is no relationship between facial anthropometry and Intelligence Quotient.

**Keyword:** Pupils, Primary School, IQ, Facial Anthropometry

### INTRODUCTION

The ability to accurately assess another person's intelligence has a place in everyday social interaction and should have important evolutionary implications (Umar *et al.*, 2019a). Intelligence is defined as the set of cognitive or intellectual abilities required to acquire knowledge and apply that knowledge effectively to solve problems with a

well-defined goal and structure (Martinich, 1995). It is more than just book learning, a narrow academic skill, or test taking smart; rather, it reflects a broader and deeper capability for comprehending, catching on, making sense of things, or determining what to do (Neisser *et al.*, 1996; Umar *et al.*, 2019a). Individuals differ in their ability to comprehend complex ideas, adapt effectively to their surroundings, learn from experience, engage in various forms of reasoning and overcome obstacles through thought (Hiser and Francis, 2000; Umar *et al.*, 2021). Humans can

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experience and think because they have intelligence (Tirri, and Nokelainen, 2007; 2012; Umar et al., 2021). An Intelligence Quotient, or IQ, is a score derived from one of several different standardized intelligence tests. The scoring of modern IQ tests, such as the Wechsler Adult Intelligence Scale, is now based on standard scoring of the subject's rank order on the test item content, with the median score set to 100 and a standard deviation of 15, though not all tests adhere to that standard deviation of 15 IQ points (Markus et al., 2009). IQ scores are associated with morbidity and mortality, parental social status, and, to a lesser extent, parental IQ (Jokela et al., 2009; Gudaji et al., 2017). It has been observed that the average IQ is steadily increasing year after year and all over the world (tendency known as the Flynn Effect) (Flynn, 2007). The IQ score is the criterion for assessing and judging individual students' academic achievement and learning outcomes in studies (Anees et al., 2013; Umar et al., 2021).

Anthropometry is the study of measuring the human body in terms of bone, muscle, and adipose (fat) tissue dimensions. (Umar et al., 2019b). It encompasses a wide range of human body measurements. This includes weight, stature (standing height), recumbent length, skinfold thicknesses, circumferences (head, waist, limb, etc.), limb lengths, and breadths (shoulder, wrist, etc.) (Umar et al., 2019b). Some researchers have discovered a strong link between general cognitive ability and academic achievement. Others have reported that prenatal and early nutrition are linked to brain structure, behavior and intelligence (Lucas, 2005; Umar et al., 2019a). According to a recent study by Umar et al., (2019), there is a gender gap in educational outcomes (Umar et al., 2019a). Fergusson and Horwood (1997) showed that despite similar cognitive test scores, boys perform worse in school assessments than girls. Factors such as age, gender, race, and ethnicity all have an impact on the appearance of the face, which is the most variable part of the human body (Choe et al., 2004). Obtaining measurements of the soft tissues of the face is important in terms of achieving aesthetic criteria (Özdemir et al., 2007). One of the most important aspects of facial sexual dimorphism is the area of the face between the two eyes (Samal et al., 2007). In contrast to several sexually dimorphic facial characteristics such as large jawbones, prominent cheekbones, and longer faces in general, can be attributed to testosterone activities (Verdonck et al., 1999). The feminine 'full lips' of females with a distinctive high, reddish vermilion zone are considered a marker of high oestrogens to testosterone ratio (Penton-Voak and Perrett, 2000).

There is a scarcity of data on the relationship between facial anthropometry and Intelligence Quotient among primary school students in Fagge, Kano State. The purpose of this study was to collect reference data for facial anthropometry and Intelligence Quotient among school-aged children in Kano state's Fagge local government area.

## MATERIALS AND METHODS

**Study Area:** The research was carried out in Fagge local government area in Kano State, Nigeria, which is part of the larger are of Kano metropolis. Its headquarters are in the Waje suburb. It has a land area of 21 km<sup>2</sup> and a population of 198,828 people according to the 2006 census.

**Sample Size Estimation:** The sample size was calculated to be 386  $[(1.962 \times 0.5 \times 0.5) / 0.052]$ , using the formula:  $n = Z^2PQ/d^2$  (Naing et al., 2006).

$$n = Z^2PQ/d^2$$

Where n = Minimum sample size as Standard Normal Deviation with ( $\pm 1.96$ , CI (95%)

z = normal distribution tabled value (1.96)

d = detection level or Standard error 5% (0.05)

p = 50% of the total population

Q = 1-P (1-0.5=0.5)

**Study Design and Subject Selection:** Some primary schools were chosen at random using a simple random sampling technique. Prior to the sampling, the population were divided into homogeneous groups based on the sex of the subjects, from which the sampling unit of 389, who met the inclusion criteria and was made up of both males and females, were selected.

**Inclusion Criteria:** All male and female Fagge primary school students were eligible to participate in the study.

**Exclusion Criteria:** Students with disabilities, head deformities, and ages below or above the study's target age were excluded from the study.

## Demographic Data Collection

During the course of this study, the following interments were used:

1. Questionnaire
2. Sliding Vernier Caliper.
3. Cotton
4. Methanol Sprit

**Facial Anthropometry**

The vernier caliper was used to take measurements of facial parameters in order to determine a factor unit, such as special facial height, forehead height, nose length, lower face height, special upper face height, inter ocular distance, nasal width, upper face width, lower face width, mouth height, mouth width, orbital width, orbital length, and biocular width (Umar et al., 2019b).

**Intelligence Quotient Test:** The subject's intelligence quotient (IQ) was assessed using (IQ) test questions, which required the subject to respond to ten sets of questions. The questionnaire includes spaces for bio data such as age, tribe, sex, school, class, and result, as well as a set of ten intelligence questions designed by IQtestexpert.com. The questions were graded and recorded (Umar et al., 2021).

**Facial Linear Distances Measurement**

The facial linear distances were calculated by measuring the distance between two anatomical landmarks (Umar et al., 2019b). The facial linear distances are shown in the table 1 below **adopted from** Umar et al., (2019b).

**Table: 1 Facial Linear Distances**

S/no:	Facial Linear Distance	Landmark
1	Special facial height	en-gn
2	Forehead height	tr-n
3	Nose length	n-sn
4	Lower face height	sn-gn
5	Special upper face height	g-sn
6	Inter ocular distance	en-en
7	Nasal width	al-al
8	Upper face width	zy-zy
9	Lower face width	go-go
10	Mouth height	ls-li
11	Mouth width	ch-ch
12	Orbital width	ex-en
13	Orbital length	ps-pi
14	Biocular width	ex-ex

**Ethical Approvals**

The management of the Faculty of Basic Medical Science, Yusuf Maitama Sule University's Kano granted the ethical approval. After being fully informed about the study, participants were asked to sign an information consent form prior to the data collection.

**Statistical Analysis:** The data was presented as Mean ± Standard Deviation using the SPSS version 20.0. To

determine the difference between the means, an independent t-test was used. The Pearson correlation method was used to determine the strength of the relationship between the variables. At p0.05, the level of significance was deemed acceptable.

**RESULTS**

**Descriptive Statistic of Age and Facial Anthropometry**

The minimum and maximum age of female subjects were 8 and 14 years respectively, while the minimum and maximum age of male subject were 8 and 15 years respectively. It was observed that there is higher mean value in upper face width (zy-zy), which was observed to have the highest mean value score of 110.98 ± 51.56, while orbital length (ps-pi) has the lowest mean value score of 15.45 ± 1.83 (Table 2).

**Descriptive Statistic of Intelligence Quotient**

Table 3 and Figure 1 show the frequency distribution of pupil's intelligence quotient after the administration of IQ test. It was discovered that students with low Intelligence Quotient are about 27.50 percent, those with average Intelligence Quotient are about 45.20 percent and those with high Intelligence Quotient scores are 27.20 percent.

**Sexual Dimorphism in Intelligence Quotient and Facial Anthropometry**

Table 4 displays the independent sample t-test for the variable's sexual dimorphism. There is a significant difference in sexual dimorphism in all the facial anthropometry variables except special facial height (en-gn) and Intelligence Quotient that their values recorded were significant.

**Relationship Between Intelligence Quotient and Facial Anthropometry**

Table 5 shows the relationship between Intelligence Quotient and Facial Anthropometry in the subjects. There was no significant relationship between Intelligence Quotient and facial anthropometry variables.

**TABLE 2 Descriptive Statistic of Facial Anthropometry**

Variable	Minimum	Maximum	Mean±SD
en-gn	71	100	85.98±6.57
tr-n	30	89	52.22±5.63
n-sn	28	73	36.67±3.51
sn-gn	33.00	62.00	47.95±4.91
g-sn	44	83	54.83±4.39
en-en	22	36	27.86±2.39

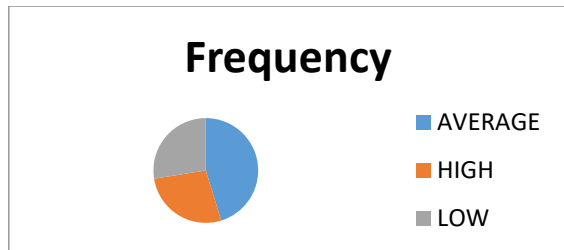
al-al	23	40	30.53±3.14
zy-zy	10.00	117.00	110.98±51.56
go-go	18	95.48	37.72±4.34
ls-li	12.00	30.00	21.96±3.41
ch-ch	24	98	42.13±4.63
ex-en	20.00	28.94	35.30±14.53
ps-pi	10.00	21.00	15.45±1.83
ex-ex	43.00	110.00	93.66±4.85

N=389 en-gn=Special facial height; tr-n= Forehead height; n-sn= Nose length; Sn-gn= Lower face height; g-sn= Special upper face height; en-en= Inter ocular distance; al-al= Nasal width; zy-zy=Upper face width; go-go= Lower facial width; ls-li= Mouth height; ch-ch= Mouth width; ex-en= Orbital width; ps-pi= orbital length; ex-ex = Biocular width

**TABLE 3 Frequency of Intelligence Quotient.**

Variables	Frequency(N)	Percent (%)
Average	176	45.20
High	106	27.20
Low	107	27.50

N=389



**Figure 1 Frequency of Intelligent Quotient**

**TABLE 4 Sexual Dimorphism in Intelligent Quotient and Facial Anthropometry**

Variable	Female	Male	t-value	p-value
en-gn	85.07±6.39	86.88±6.63	-2.740	0.006
tr-n	52.75±5.57	51.69±5.66	1.862	0.630
n-sn	36.79±3.85	36.56±3.13	0.645	0.520
sn-gn	47.82±4.90	48.07±4.93	-0.497	0.619
g-sn	54.96±4.92	54.70±3.88	0.586	0.558
al-al	30.23±3.18	30.84±3.07	-	0.058
			1.903	
zy-zy	113.31±72.89	108.65±4.49	0.891	0.375
go-go	58.38±6.85	92.90±4.93	0.998	0.319
ls-li	21.74±3.63	22.18±3.17	-1.272	0.204
ch-ch	41.86±5.43	42.41±3.67	-1.169	0.244
ex-en	42.48±20.58	28.16±3.44	0.972	0.334
ps-pi	15.55±15.56	15.36±15.36	1.041	0.299
ex-ex	93.34±93.34	93.98±93.98	-1.293	0.197
IQ	1.83±0.78	1.99±0.75	2.036	0.042

N=389 en-gn=Special facial height; tr-n= Forehead height; n-sn= Nose length; Sn-gn= Lower face height; g-sn=Special upper face height; en-en=Inter ocular distance; al-al=Nasal width; zy-zy=Upper face width; go-go=Lower facial width; ls-li=Mouth height; ch-ch=Mouth width; ex-en=Orbita; ps-pi=Orbital length; ex-ex =Biocular width; IQ=Intelligence Quotient

**Table 5 Relationship Between Intelligence Quotient and Facial Anthropometry**

VARAIBLE	r-value	P- value
en-gn	-0.083	0.102
tr-n	0.026	0.612
n-sn	0.40	0.437
sn-gn	-0.002	0.659
g-sn	0.030	0.559
en-en	0.033	0.511
al-al	-0.099	0.510
zy-zy	0.062	0.221
go-go	-0.060	0.239
ls-li	0.065	0.203
ch-ch	0.002	0.971
ex-en	0.073	0.148
ps-pi	-0.006	0.902
ex-ex	0.032	0.528

N=389 en-gn= Special facial height; tr-n= Forehead height; n-sn= Nose length; Sn-gn= Lower face height; g-sn= Special upper face height; en-en= Inter ocular distance; al-al= Nasal width; zy-zy=Upper face width; go-go= Lower facial width; ls-li= Mouth height; ch-ch= Mouth width; ex-en= Orbital width; ps-pi= Orbital length; ex-ex = Biocular width

Correlation is significant at p<0.05

**DISCUSSION**

The current findings support the findings of Porter *et al.*, (2004), who discovered that African American males had shorter nasal length and wider alar width than white men. The mean mouth width for both genders is similar to that obtained by Ngeow and Aljunid, (2009), but lower than that observed by Farkas *et al.*, (1994). Males were found to have higher IQs than females, in which the differences in IQs were found to be statistically significant. Similarly, Iqbal *et al.*, (2021) found a significant relationship between IQ and gender difference, with males having higher IQ than females. However, Dania *et al.*, (2014) reported contradictory findings, stating that there was no significant difference in academic achievement based on students' gender. In

contrast, Adigun et al., (2015) reported that females outperformed males in terms of academic performance.

The preset investigation reveals existence of sexual dimorphism in IQs especially in the population student of lower education institutions in Kano State, Nigeria. The male population's mean IQ score is higher than the female population's, implying that male children are more brilliant than female children. There was no significant link between Intelligence Quotient and facial anthropometry. As a result, facial characteristics, as discovered by in the preset study, are not directly related to a high level of intelligence. The findings of this study are similar to those of a previous study conducted by Kleisner et al., (2014), which found no correlation between morphological traits and real intelligence as measured by an IQ test, in either men or women. Kleisner et al, have argued, however, that the faces of supposed high and low intelligence are most likely nothing more than a cultural stereotype because these morphological traits do not correlate with the subjects' true intelligence.

## CONCLUSION

Based on the findings presented above, this study concluded that there is no significant relationship between facial anthropometry and Intelligent Quotient. However, sexual dimorphism exists in Intelligence Quotient with males having more IQ than females.

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**CONFLICT OF INTREST:** None declared

## AUTHORS CONTRIBUTIONS

**Conception and design of study:** UMI, RI

**Acquisition of data:** RI

**Analysis and interpretation:** UMI, RI, JDU, AIA

**Drafting the manuscript:** UMI, JDU, UKB, ALH, UHO, AM

**Revising the manuscript critically for important** UMI, JDU, AIA

**Intellectual content:** UMI, RI, JDU

**Approval of the version of the manuscript to be published:**

UMI, JDU, AIA

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