



ORIGINAL RESEARCH ARTICLE

Effects of female hair braiding on selected facial Anthropometrics

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Abstract

Objective: Effects of heavy hair braiding on facial anthropometrics have raised concerns in recent times. These concerns arise from the potential impact on cultural practices and the implications for physical appearance and self-perception. This study aimed to investigate the effects of braiding on the soft anthropometrics in face and head among students in Alex Ekwueme Federal University Ndufu Alike, Ebonyi State, Nigeria.

Materials and methods: A total of 503 healthy participants, aged 19 to 25 years, were randomly recruited from an institution. Measurements of total facial length and face width were taken. A structured questionnaire was used, that contain anatomical, theatrical, and socio-psychological questions to evaluate the effects of braiding on the face and head. Participants responded using a Likert scale.

Results: Mesocephalic shape was the commonest classification of the skulls based on cephalic indices. Relationship between age and facial parameters of the study population showed significant positive correlation ($r = 0.17$, $p < 0.05$). Majority of respondents agreed that face type/facial structure determines the type of braid ($n = 138$) and braid can pull the forehead backward ($n = 102$).

Conclusion: This study will contribute to understanding the influence of braiding on facial and head anthropometrics among Nigerian students. This information can inform discussions on cultural practices and their implications for physical appearance and self-perception.

Keywords: braiding, anthropometrics, facial measurements, hair treatment



Introduction

The practice of braiding hair has a long-standing history in various cultures around the world, including Nigeria (Jenkins, 2019; Ngandu-Kalenga Greensword, 2022; Nyela, 2021). Braids are not only a form of self-expression but also hold cultural and social significance (Lukate, 2022). There is limited information about the effects of braiding of hairs, shape of the face, and cephalic forms from some selected anthropometrics among the younger population in southeastern part of Nigeria. However, the knowledge of hair braiding and its effects among female adolescents in Keffi, Nigeria is known (Okoro et al., 2021). Hair, one of the important and widely shared human features which appear in different forms, parts of the body, and at different stages of life has been trending (Omotoso, 2018; Rajan-Rankin, 2021). Nigerian women experienced clinical and psychological distress upon their hair grooming practices from the relaxed hair and that of natural hair (Ayanlowo & OtofanoWei, 2023). Understanding these effects is crucial as it can shed light on the implications for cultural practices, physical appearance, and self-perception (O'Brien-Richardson, 2019; Rajan-Rankin, 2021; Vlahaki, 2021). This study stands to investigate the effects of braiding on facial and head anthropometrics among Nigerian students, providing valuable insights into this understudied area. Methodically, the present study used the Likert scale questionnaire for anatomical and theatrical questions while facial variables were obtained through direct measurements using digital Vernier caliper, as reported elsewhere (Nguyen, 2020).

Braiding is an ancient practice that involves interweaving strands of hair to create various patterns and styles. It has been an integral part of African culture for centuries, serving as a means of artistic expression, cultural identification, and social communication (Dixon, 2005). In Nigeria, braiding styles are diverse and often reflect ethnic traditions, religious affiliations, and individual preferences (Ayanlowo & OtofanoWei, 2023).

Facial and head anthropometrics play a crucial role in assessing physical characteristics, determining facial proportions, and understanding the variations in facial features among individuals (Gupta et al., 2019). Anthropometric measurements, such as head circumference, face width, and face length, provide objective data that can be used to examine the effects of external factors, such as braiding, on facial structures (Zhang et al., 2022). Despite the cultural significance and widespread practice of braiding in Nigeria, there is a paucity of scientific research investigating its potential effects on facial and head anthropometrics among Nigerian students.

The practice of braiding involves exerting tension on the hair and scalp, which may potentially affect facial and head soft tissue anthropometrics (Mbilishaka, 2021; Shkarin et al., 2019). However, the extent and nature of these effects remain largely unknown. This knowledge gap presents a significant research problem, as it hinders our understanding of the implications of braiding on physical appearance and self-perception among Nigerian students. It is crucial to address



this research problem to provide evidence-based insights into the potential consequences of braiding on soft tissue anthropometrics, as reported previously (A. Shakir *et al.*, 2022).

Theatrically, it contributes to the existing body of knowledge by filling the gap in scientific literature concerning the effects of braiding on facial and head anthropometrics (Larsson, 2020). There are findings of the potential changes in facial structures caused by braiding (Dixon, 2005), shedding light on the impact of this cultural practice on physical appearance and self-perception among Nigerian students. Practically, there is a relationship between braiding as a hairstyle choice and women occupation (Karl *et al.*, 2022). Understanding the potential effects of braiding on facial and head anthropometrics help individuals make informed decisions regarding their hairstyles and enable hairstylists to provide appropriate recommendations and guidance to their clients (Lewis *et al.*, 2021). Educational programs and public health initiatives can focus on promoting healthy hair practices to minimizing potential negative effects from braiding of hairs in younger population. The purpose of this study is to look at how hair braiding affects the soft anthropometrics of the head and face in Nigerian students.

Materials and methods

Study materials

By multi-stage recruitment, five hundred and three healthy participants were recruited from Alex Ekwueme Federal University Ndufu Alike, Ebonyi State. Braiding's anatomical, dramatic, sociopsychological, and cultural importance were among the anthropometrics that were employed. Additionally, braiding preferences, opinions of braiding from others, self-worth, and braiding confidence were all taken into consideration.

Methods

Anthropometrics

Age: The age of the participants was determined by their date of birth and the date of the study

Head length: Measurement was taken from the top of the head (vertex) to the bottom of the chin (menton) when standing upright and looking straight ahead. It provides insight into the vertical dimension of the head.

Head width: The widest point of the head, usually above the ears and was measured

Upper facial length: Measurement was taken from a point between the eyebrows (glabella) or the hairline to the base of the nose (subnasale).

Lower facial length: Measurement was taken from the subnasale to the bottom of the chin. This measurement helps in assessing the lower part of the face and its proportions.



Total facial length (Figure 1): The total facial length was measured from the nasion to the gnathion

Face width: Measured from the distance between two points on the face, usually at the right and left zygomatic arches (cheekbones).

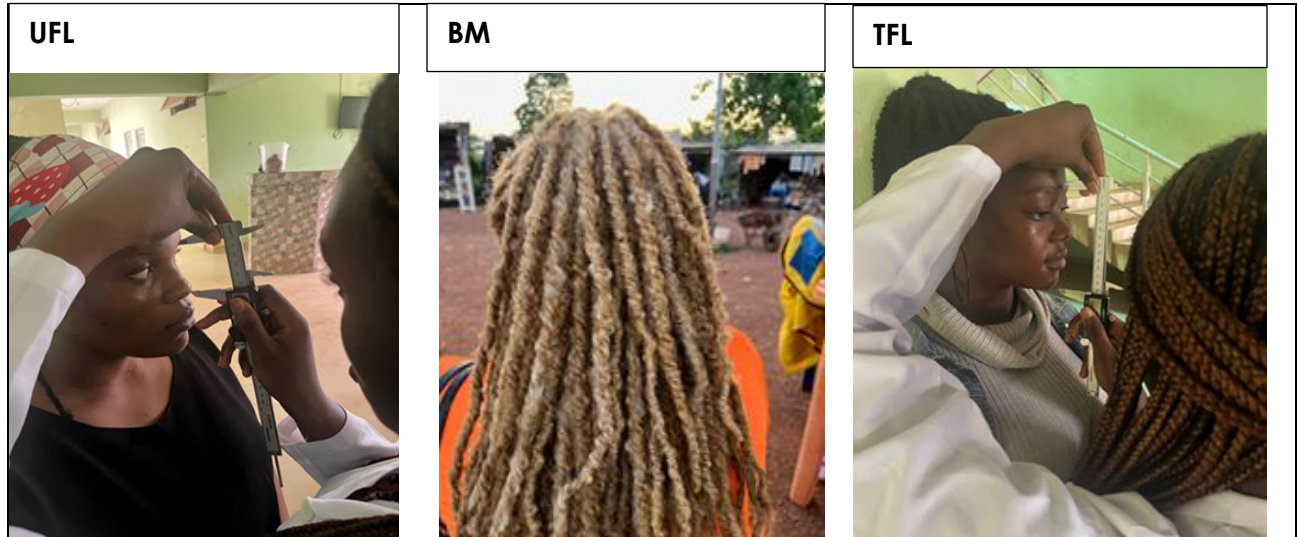


Figure 1: Total facial (TFL), upper facial lengths (UFL), and braiding measurements (BM) of subject participations

Weight: The weight of the participants was measured using a digital scale

Height: The height of the participants was measured using a stadiometer

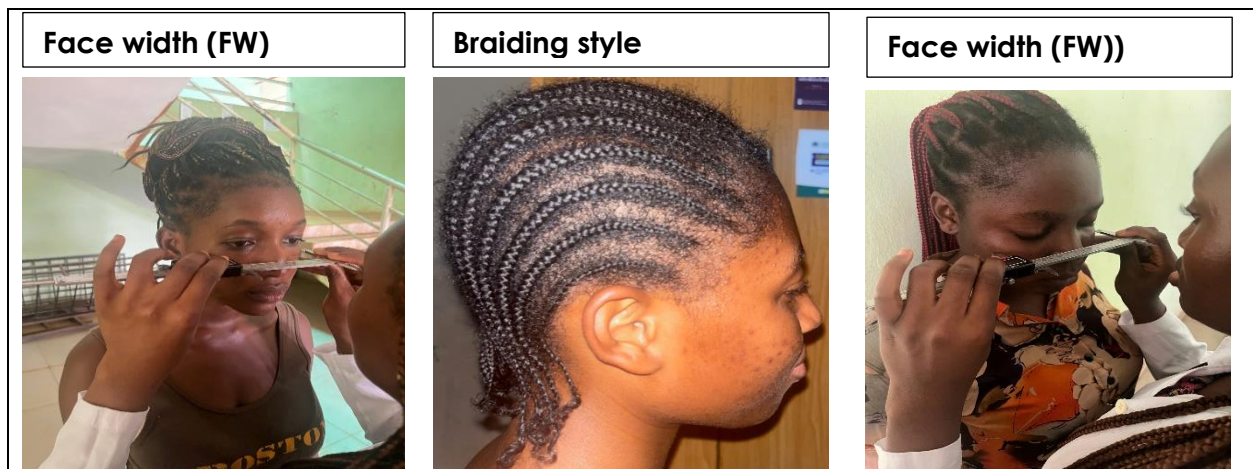


Figure 2: Measurements of different soft facial anthropometrics in different braiding hairs

Anthropometric indices

BMI: The BMI was calculated using the following formula: $BMI = \text{weight (kg)} / \text{height (m)}^2$

Cephalic Index: The cephalic index is a measure of the shape of the head. It is calculated by dividing the head length by the head width and multiplying by 100.



Prosopic Index: Maximum Cranial Length Maximum Bizygomatic Width×100

Facial Types: The facial types were categorized based on the cephalic and prosopic indices (Figure 2).

Questionnaire

Questionnaire was structured into: Anatomical questions: These questions were related to the anatomical effects of braiding on the face and head. Theatrical questions: These questions were related to the theatrical effects of braiding on the face and head. Socio-psychological questions: These questions were related to the socio-psychological effects of braiding on the face and head, and A: Agreed, SA: Strongly agreed, D: Disagreed, and SD: Strongly disagreed Provide the questionnaire as an appendix.

Criteria

Inclusion criteria: Participants must be Igbos, between the ages of 19 and 25, and must have a head of hair that is long enough to be braided while exclusion criteria were: Participants who were experiencing hair loss, have any scalp conditions that could be aggravated by braiding, and allergies to hair products.

Statistical analysis

Statistical tests (SPSS Version 20) used to analyze the data in the tables were: Independent samples t-test to compare the means of two groups that are independent of each other (mean age of participants in Group A(19-20 years) with the mean age of participants in Group B(21-22 years), One-way ANOVA to compare the means of three or more groups (Group A, B, and C(23-25 years)), chi-square test to compare the frequencies of two or more categorical variables (frequencies of the different types of responses to the anatomical questions), and correlation to measure the strength of the relationship between two variables (age of participants and their head length) respectively.

Approval

Ethical approval letter was obtained from ethical committee of the university through the Department and Faculty research committees after oral defense of the study. Informed consent forms were served, filled, and returned before the commencement of the study.

Results

General characterization of study population (Table 1) showed: The mean age of the study population was 21.02 years, head length 19.68 cm, head width 16.80 cm, upper facial length 53.95 mm, and lower facial length 64.32 mm.

Facial indices across age groups of the study population (Table 2) were: Significant difference in facial indices between the three age groups, mean facial index for Group A (19-20 years) was 85.64, B (21-22 years) was 92.38, and C (23-25 years) was 93.12.



Table 1: General characterization of study population

Parameters	Mean±SD
Age (years)	21.02±1.33
Head Length (cm)	19.68±1.44
Head Width (cm)	16.80±1.54
Upper Facial Length (mm)	53.95±5.50
Lower Facial Length (mm)	64.32±5.28
Total Facial Length (mm)	123.16±7.08
Face Width (mm)	133.40±6.35
Weight (kg)	65.57±12.67
Height (cm)	164±0.07
BMI (kg/m ²)	24.31±4.78
Cephalic Index	85.64±7.75
Prosopic Index	92.38±4.59

Table 2: Facial indices across age groups of the study population.

Parameters	19-20 years	21-22 years	23-25 years	F-value	p-value
Age (year)	19.53±0.50	21.27±0.44	23.10±0.37	947.86	<0.001*
HL (cm)	19.77±1.42	19.53±1.49	19.87±1.31	1.21	0.29
HW (cm)	16.96±1.54	16.62±1.57	17.00±1.45	1.64	0.19
UFL (mm)	54.42±5.43	53.84±5.49	53.39±5.72	0.57	0.56
LFL (mm)	63.72±5.21	64.42±5.70	65.17±4.12	1.15	0.31
TFL (mm)	122.26±6.54	122.94±7.45	125.36±6.71	3.01	0.05
FW (mm)	132.52±5.81	133.49±6.43	134.80±6.92	1.95	0.14
Weight (kg)	56.93±8.45	66.40±9.85	65.19±13.02	73.16	<0.001*
Height (cm)	162±0.09	160±0.05	161±0.05	8.04	<0.001*
BMI	21.76±4.18	25.93±3.90	25.17±5.06	35.57	<0.001*
CI	86.07±8.54	85.28±7.09	85.80±8.01	0.26	0.76
PI	92.33±4.76	92.13±4.37	93.12±4.86	0.76	0.46

Keys: Head length (HL), head width (HW), upper facial length (UFL), lower facial length (LFL), total facial length (TFL), face width (FW), kilogram (kg), meter (m), millimeter (mm), body mass index (BMI), Cephalic index (CI), Prosopic index (PI). Group A= 19-20 years, Group B= 21-22 years, Group C= 23-25 years.

Table 3: Face types of the study population

Facial Types	Cephalic Index categorization	
	Frequency (N)	Percentage (%)
Dolicocephalic	1	0.4
Mesocephalic	59	23.6
Brachycephalic	21	8.4
Hyperbrachycephalic	169	67.6
	Prosopic Index categorization	
Hypereuriprosopic	2	0.8
Euriprosopic	15	6.0
Mesoprosopic	49	19.6
Leptoprosopic	101	40.4
Hyperleptoprosopic	83	33.2



Table 4: Relationship between age, height, and weight with facial parameters of the study population

Facial parameters	Age		Height		Weight	
	r-value	p-value	r-value	p-value	r-value	p-value
Head length	-0.03	0.57	0.08	0.16	0.02	0.74
Head width	-0.01	0.91	0.13*	0.03	0.05	0.41
Upper facial length	-0.08	0.17	0.07	0.21	0.01	0.94
Lower facial length	0.09	0.12	0.05	0.37	0.12*	0.04*
Total facial length	0.16**	0.01*	0.18**	0.003	0.18*	0.004*
Face width	0.17**	0.01*	0.09	0.13	0.22*	<0.001*
Cephalic Index	0.02	0.74	0.07	0.25	0.03	0.62
Prosopic Index	0.02	0.66	0.13*	0.03	0.001	0.98

Keys: r=correlation value (*weak, **strong), significant at p<0.05.

Table 5: Anatomical, theatrical, and socio-psychological responses on the face and head by braiding

	A	SA	D	SD
Anatomical questions				
Face type/facial structure determines the type of braid	138	76	31	5
Braid pull the forehead backward	99	102	38	11
Braid may cause traction alopecia (hair loss) if the braids are not put in correctly	108	117	21	4
Braiding causes stress on your hair if done too tightly	82	159	8	1
Braid may cause result in hair loss	116	107	22	5
Braid can cause dryness of the face	39	29	133	49
Theatrical questions				
A braided hair enhances the beauty of the face	87	153	9	1
A braided hair serves as makeup for ladies	135	83	28	4
A braided hair ensures good clothing is worn	92	56	80	22
A braided hair attracts attention from the male	98	95	34	23
Hair braiding styles are part of theatrical makeup	141	89	19	1
Socio-psychological question				
Braiding enhances confidence among students	100	109	35	6
Braiding ensure happiness among students	99	76	65	10
Braiding boosts the ego of female	101	102	40	7
Braids define status than wigs/weeve	75	52	90	33
Braids can help promote healthy growth	102	43	81	24

Keys: A=Agreed, SA=Strongly agreed, D=Disagreed, SD=Strongly disagreed

Face types of the study population (Table 3 and Figures 2) presented: The most common face type in the study population was mesocephalic, second most common face type brachycephalic, and least common face type was dolicocephalic. Relationship between age, height and weight with facial parameters of the study population (Table 4) showed the significant positive correlation between age and all the facial parameters

Anatomical, theatrical, and socio-psychological responses on the face and head by braiding (Table 5) showed that majority of respondents agreed that face



type/facial structure determines the type of braid, braid can pull the forehead backward, cause traction alopecia (hair loss) if the braids are not put in correctly, stress on your hair if done too tightly, result in hair loss, dryness of the face, and braided hair enhances the beauty of the face. Also, the majority of respondents agreed that a braided hair serves as makeup for ladies, ensures good clothing is worn, attracts attention from the male, part of theatrical makeup, enhances confidence among students, ensure happiness among students, boosts the ego of female, define status than wigs/weeve-on, and promote healthy growth. Implications from the results in this study were; soft anthropometrics of the face and head may change with age, the most common face type in the study population was mesocephalic (medium width and height), with some effects of braiding on hairs (Figure 3).

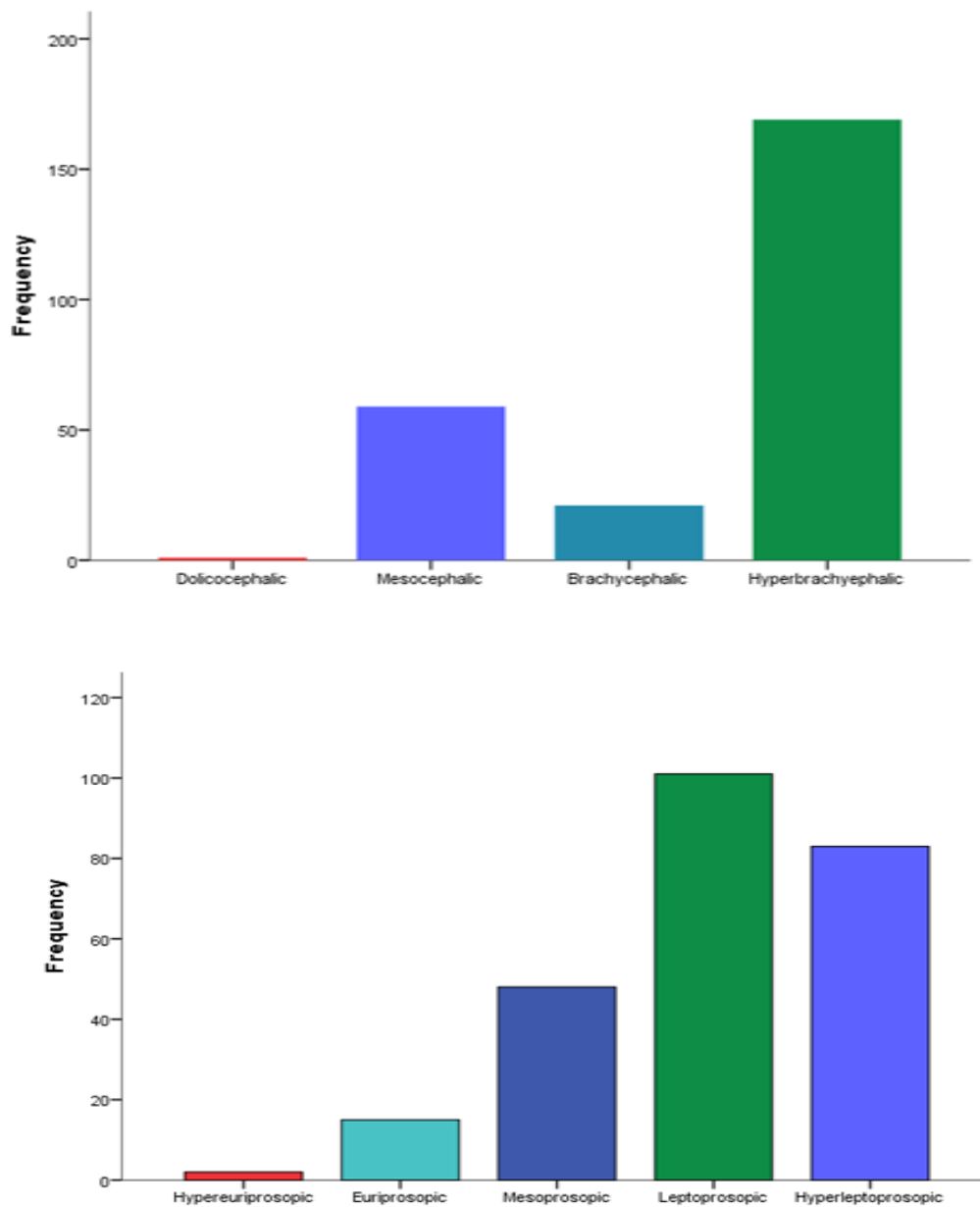


Figure 3: Cephalic and prosopic index categorizations



Also, the majority of respondents agreed that face type/facial structure determines the type of braid, suggesting that braiding styles should be chosen to complement the natural shape of the face and braided hair enhances the beauty of the face, which suggested that braiding can be a way to improve one's appearance. However, ossification of bones of the head and face occurred earlier and may not change again in adulthood.

Discussion

The implications of these findings were as follows:

Face type/facial structure determines the type of braid. Study participants believed that different face types and facial structures should be taken into consideration when choosing a suitable braid style. This implies that braiding techniques need to be customized based on individual facial features to enhance the overall appearance and prevent face injuries. Shakir *et al.*, (2022) and Shakir, (2021) found that hair braiding can lead to burn injuries and face anthropometrics are important in theatrical aspect, which are more common in young African-American females. Ramírez (2018) also found that injuries caused by hair braiding along facial anthropometrics have become increasingly common in African-American girls, with injuries being significantly more frequent in summer months. Wang (2008) provides a historical perspective on hand braiding techniques in China, but does not directly address the research question on the correlation between hair braiding and facial variations. Braid can cause traction alopecia (hair loss) if the braids are not put in correctly. Participants recognized the potential risk of hair loss due to improper braiding techniques, suggesting the importance of proper braiding methods to minimize the occurrence of traction alopecia and maintain healthy hair.

El Zein *et al* (2019) reports on six cases of hair loss in African American women, which agreed to the discussions on hair loss. Mitchell *et al.*, (2021) describes a case series of six African American women with traction alopecia. Holden, (2022) discusses the role of hair stylists in screening for scarring hair loss, including Central Centrifugal Cicatricial Alopecia (CCCA), which is a common cause of hair loss in African American women. Finally, Agrawal *et al.*, (2020) reports on a new dermoscopy finding in a case of marginal traction alopecia, but this is not directly related to the incidence of traction alopecia in African American women. Overall, this present study agreed with previous authors that have provided some information on the hair type, face shape, hair loss, and diagnosis of traction alopecia in African and American women.

In our study, braiding causes stress on hair if done too tightly, suggesting that participants were aware of the potential stress that tightly braided hair can cause. This implies that braiding styles should be done with caution, ensuring that they are not overly tight to avoid putting excessive strain on the hair, which could lead to damage or hair breakage. Grunzweig & Keys, 2015 reports a case of full-thickness scalp necrosis following tight spiral braiding. Palmer, (2020) reports two



cases of scalp hematoma in children after hair braiding, suggesting that the tension placed on the scalp during the placement of tight rows of hair braids is sufficient to result in such hematomas. Ramirez *et al.*, (2018) reports that scald injuries caused by hair braiding have become increasingly common in African-American girls, with injuries significantly more frequent in summer months. Dixon & Ratliff, (2011) reports a case study of a 7-year-old boy who developed occipital pressure ulcers due to hair braids, suggesting that hair braids can be a potential risk factor for pressure-related skin damage.

Theatrical finding in the present study indicated that participants perceive hair braiding as an integral part of theatrical makeup. This implies that braiding can be used as a visual element in theatrical performances or presentations to enhance the overall aesthetic and character portrayal. Shakir *et al.*, (2022) discusses the use of scalding water in hair braiding, which can lead to burn injuries requiring hospitalization and surgical intervention. Sun *et al.*, (2021) proposes a method for generating procedural 3D hair involving braids modeled from a single-view photograph. Franklin *et al.*, (2021) discusses the history of female military hair-grooming standards and the most commonly associated scalp symptoms and disorders. This present study found that there was a significant variation in facial anthropometric parameters among different age groups. The mean head length, head width, upper facial length, lower facial length, total facial length, face width, weight, and BMI were all significantly greater in the 23-25-year age group than in the 19-20-year age group. The mean cephalic index was significantly lower in the 23-25-year age group than in the 19-20-year age group. The mean prosopic index was significantly higher in the 23-25-year age group than in the 19-20-year age group (Figure 3).

Dogru *et al.*, (2020) found that nasal root width increased with aging, while morphological and anatomical widths of the nose were increased with aging but at a lower rate in the senior group. Ma *et al.*, (2019) found that there were significant differences in periorcular anthropometry between young and middle-aged adults of Chinese Han ethnic group, with alterations in periorcular and eyelid morphologies under the effect of aging. Ogodescu *et al.*, (2021) proposed a simplified anthropometric technique to determine reference values for Romanian children and adolescents for facial parameters, and found that vertical and transversal linear parameters and some facial indices were increased in boys depending on the age group. Jilani *et al.*, (2018) reviewed existing research on craniofacial anthropometry and found that there are inter-ethnic and demic-group variations in facial measurements due to traditional and image-based anthropometric methods.

In this present study, the most common facial type in the study population was hyperbrachycephalic, which is characterized by a short, broad head. The most common facial type in the 19-20-year age group was mesoprosopic, which is characterized by a medium-length face. The most common facial type in the 21-22-year age group was euryprosopic, which is characterized by a long, narrow



face. The most common facial type in the 23-25year age group was hypereuriprosopic, which is characterized by a very long, narrow face. This study groups were between teen age and young adults, Omotoso *et al.*, (2019) found that among Bini children in southern Nigeria, the prevalence of brachycephalic head type was high in both males and females. Gomes *et al.*, (2020) found that in a Brazilian subpopulation, brachycephalic individuals had thicker soft tissue in certain maxillary regions, while dolichocephalic individuals had thicker soft tissue in a mandibular landmark. Knigge *et al.*, (2021) found that hyperdivergent growth trajectories were associated with a higher potential risk for Class II malocclusion. Finally, Defabianis *et al.*, (2022) found that children with IC2-LoM or negative genotype, clockwise growth tendency, and skeletal class II. These findings suggest that hyperbrachycephalic facial types may be more prevalent in certain regions, and that they may be associated with certain growth patterns.

The correlation between age and facial parameters was strongest for total facial length and face width. The correlation between height and facial parameters was strongest for head width and face width. The correlation between weight and facial parameters was strongest for lower facial length and total facial length. Windhager *et al.*, (2019) found that age-related facial shape change was similar in both sexes until around age 50, at which time the female aging trajectory turned sharply. The overall magnitude of facial shape change (aging rate) was higher in women than men, especially in early postmenopause, which are found in the cluster of wrinkles/texture and ptosis/sagging are predominant factors taken into account in almost all ethnicities, albeit at various extents, reaching almost 100% in French women (Flament *et al.*, 2020, 2021). Limitations of the study showed that the study was conducted on a specific population (Nigerian students aged 19-25 years) and may not be generalizable to other populations. Additionally, the study relied on self-reported data from participants in the southern part of Nigeria, which may be subject to bias. Stansberry-Brusnahan and Collet-Klingenberg, (2010) highlights the difficulty of generalizing results from clinical trials. Identifying limitations can lead to new insights and experimental designs, emphasizes the importance of researchers earnestly pointing out limitations, and pointing to sources of bias or missing data (Bianco *et al.*, 2021; Vargas & Mancina, 2019). However, the strength of this study: measured various facial and head parameters, including head length, head width, upper and lower facial lengths, total facial length, and face width, which provides a detailed analysis of the effects of braiding on different aspects of the face and head, and derived anthropometric indices, such as the cephalic index and prosopic index, which allowed for a more nuanced analysis of the effects of braiding on the shape of the head and face.

Conclusion

The study identifies the prevalence of different face types in the population, highlights the ongoing development of facial features with age, and suggests the importance of considering facial shape when selecting braiding styles for aesthetic enhancement.



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Appendix: Part of the questionnaire for the study

S/N	Societal parameters	Questions	A	SA	DA	SDA
1	Anatomical Questionnaire	Face type /Facial structure determines type of braid				
		Braid pull the forehead backward				
		Braid can cause traction alopecia (hair loss) if the braids are not put in correctly				
		Braiding causes stress on your hair if done too tightly				
		Braid may even result in hair loss				
		Braid may cause dryness of the face				
2	Theatrical Questionnaire	A braided hair enhances the beauty of the face				
		A braided hair serves as makeup for ladies				
		A braided hair ensures good clothing is worn				
		A braided hair attracts attention from the males				
		Hair braiding styles are part of theatrical makeup				
3	Socio-psychological Questionnaire	Braiding enhances confidence amongst students				
		Braiding ensures happiness amongst students				
		Braiding boosts the ego of females				
		Braids define status than wigs/weavon				
		Braids can help promote healthy growth				