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RESEACH ARTICLE

Age-Related Variations in Nasofacial Anthropometry, Height, Weight and Body Mass Index among Hausa Adult in Kano State, Nigeria

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Abstract

Background: It is documented that people are fairly accurate at judging weight using facial appearance alone. There are changes in the facial soft tissues in accordance with nutritional status of an individual which may lead to variation in body proportion. The aim of this study was to find the effect of age on nasofacial anthropometry and body mass index among adults of Hausa ethnic group in Kano State, which could be beneficial in various fields such as forensic science, dietetics, security, plastic/cosmetics surgery, orthodontics and ergonomics. **Methods:** The study was a cross-sectional design which involved 481 participants (271 females and 210 males). Ethical approval was obtained from ministry of Health Kano state and College of Health Sciences, Bayero University Kano. The facial height, facial width, nasal height, nasal width, body height and weight were measured in accordance with established literature. Statistical analyses carried out included descriptive statistics and one-way analysis of variance (ANOVA) with Benforroni post-hoc test using IBM SPSS version 23. **Results:** Significant differences were observed between early (18-24 years), middle (25-34 years) and late adults (35-40 years) groups in body height, facial height and facial width was statistically significant and the late adult indicated the highest mean value however the significant difference between the middle and late adults were not statistically significance. The three experimental age groups indicating statistically significant differences ($p < 0.001$) in body weight, body mass index and nasal width with the late adult age group indicated higher mean value in all the parameters. In nasal height statistically significant difference ($p = 0.015$) was found only between early and late adult age groups. The facial and nasal indices showed no significant statistical difference however late adult age groups were reported with highest mean value. **Conclusion:** This study revealed a strong relationship between age and several anthropometric parameters, including facial height, facial width, nasal width, body height, body weight, and BMI ($p < 0.001$). Conversely, nasal height, facial index ($p = 0.209$), and nasal index ($p = 0.155$) demonstrated weak associations with age among the Hausa adult population of Kano State, Nigeria

Keywords: Age, anthropometry, body mass index (BMI), Hausa, nasofacial.

INTRODUCTION

Ageing is a progressive biological process that changes the harmony and symmetry of the face, affecting smooth facial contours and thereby influencing an individual's physical attractiveness, self-esteem and social interaction (Laughter *et al.,* 2023*;* Swift *et al.,* 2021; Reilly *et al.,* 2015). A broad spectrum of changes occurs in facial anatomy with age. Both Extrinsic factors such as lifestyle or environmental influences and intrinsic factors such as

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development and genetic factors, contribute to these changes; facial skeleton remodeling, fat pad repositioning, volume increase or atrophy, skin weakening and the thinning and loss of muscle tone result in a flabby or drooping appearance known as the "ageing face" (Coleman & Grover, 2006; Swift *et al.,* 2021). The first signs of facial ageing typically appear between 20 and 30 years old. These signs appear earlier in females than males (Bishara *et al.,* 1994). There are changes in the facial soft tissues in accordance with nutritional status of an individual which may lead to variation in body proportion. Facial Index (FI), has been defined as the ratio between nasion-gnathion height and bizygomatic width multiplied by one hundred. Facial morphology is the difference types of facial appearance that are classified according to the ranges in facial (proscopic) index which are: Hyper euryproscopic (Very broad), euryproscopic (broad), mesoproscopic (round), leptoproscopic (long), hyper leptoproscopic (very long) faces (Bannister *et al.,* 2000). Nasal index has defined as the ratio of right-left alars of nose length to nasion-sub-nasale height multiplied by one hundred. The nasal index is classified into leptorrhine, mesorrhine and platyrhine (Oladipo *et al.,* 2007). In the recent decades there is an increased in the body weight in every population (Hausa is not exempted) due to the environmental factors such as fat-enriched diet and sedentary lifestyle which are the great prevalence of obesity, diabetes mellitus and cardiovascular diseases (Kahn *et al.,* 2006). It has been observed that the most apparent facial changes are secondary to the ageing processes. Ageing skin needs volume to be added usually with autologous fat; laser ablation of seborrhoeic and actinic keratosis, and laser resurfacing to remove minor wrinkles (Ilankovan, 2013). Attenuation of rhytids caused by muscle contraction can be treated with chemical denervation using botulinum toxin. The effect is mostly along the procerus, glabella, and areas affected by crow's feet. It is possible to use this technique to redistribute muscle action along the nose, upper lip, chin, and lower border of the mandible and neck (Baldwin *et al.,* 2022). The treatment also counteracts the unopposed muscle action in patients who have had a stroke. Eyelids require blepharoplasty with preservation of fat along the lower lid. Two factors intrinsic and extrinsic are considered in this context. Intrinsic ageing is caused by internal biological factors, whereas extrinsic ageing is caused by environmental influences (Albert *et al*., 2011).

Changes in facial shape can easily be identified and may indicate either weight gain or weight loss. It was reported that for every 10 cm increase in body height, there is significant increase in some facial dimensions such as facial height, nasal root breadth, and nasal breadth as well as significant decrease in other variables such as bigonial breadth (Zhuang *et al.,* 2010). BMI plays a dominant role in the alteration of soft tissue thickness (Kotrashetti & Mallapur, 2016). It is believed that the prediction of obesity in young and middle-aged individuals is more accurate than the prediction of obesity in elderly individuals due to the association of regional fat deposits in the face with both BMI and waist circumference (Lee & Kim, 2014). Body mass index (BMI) is a major contributing factor in accurately determining differences in facial soft tissue thicknesses between individuals. Facial dimensions in young adults are significantly associated with health, as measured by episodes of respiratory infections, use of antibiotics, and high blood pressure (Coetzee *et al.,* 2009). Consequently, studies in facial recognition now demand a consideration of the different BMI categories when estimating soft tissues thicknesses (Dong *et al.,* 2012).

The role of facial dimensions in the perception of weight has a longstanding history, and since there are increasing incidences of unidentified segment of mutilated human body resulting from automobile crash, insurgency and banditry in northern Nigeria, however there is still dearth of data that relate facial dimension with stature, a study such as this which provides variables from which important body traits such as age and BMI can be predicted. Therefore, this study aims to determine the effect of age on nasofacial anthropometric parameters, height, weight, and body mass index among categories of adults of the Hausa ethnic group in Kano State, Nigeria.

METHODOLOGY

Study Setting

The study was conducted among five local government areas (Bebeji, Doguwa, Karaye, Tudun Wada and Wudil) from Kano south Senatorial district selected a using simple random sampling technique, as there are 16 local governments in the district.

Study Population

A total of 481 adult participants (210 males and 271 females) were recruited after obtaining their signed informed consent. The minimum sample size for the study was calculated using the formula developed by Cochran (1977) as 384 subjects. Ethical approval for this study was obtained from committee on ethics Kano state Ministry of Health, Kano (MOH/Off/797/T.I/1967). Informed consent was also obtained from the participants.

Age Categorization

The adults within the age of 18 to 39 years are physically, socially and emotionally functioning group than their younger or older counterparts. The current study classified the adults (within the age of 18 to 40 years) into three groups; Early Adult (18-24 years), Middle Adult (25-34 years) and Late Adult (35-40 years) (Smith *et al.,* 2013). From about the age of 40 years, humans usually begin to underdo slow changes in height and general body stature as a result of age-related alterations in the bones, spinal discs, muscles, posture and overall physical activities (Mitchell *et al.,* 2012).

Collection of Socio-demographic and Anthropometry Data

Socio-demographic data which includes: sex, age, local government of origin and ethnic group of parents and grandparents of each participant were recorded. The facial height and width were measured to the nearest 0.01cm using spreading caliper as distance between nasion to gnathion and from right to the left zygions respectively (Ernest *et al.,* 2018). The nasal height and width were measured to the nearest 0.01mm using digital vernier caliper as a distance between nasion to subnasale and from right to the left alars nose respectively (Anas & Saleh, 2014). The body height was measured to the nearest 0.01cm using stadiometer as a vertical distance between sole of the foot to vertex of the head. The body weight was measured to the nearest 0.01Kg using the weighing scale on the stadiometer when the subjects were standing at ease barefooted and wearing light clothes.

Definition of the Landmarks

Nasion: is the innermost point in the midline between forehead and nose.

Gnathion: is the lowest point on the lower border of the chin in the midline.

Zygion: is the most lateral point on the zygomatic arch.

Subnasale: is the junction in the midline between the lower border of the septum and the cutaneous portion of the upper lip.

Alars nose: is the most external points on the wing of the nose.

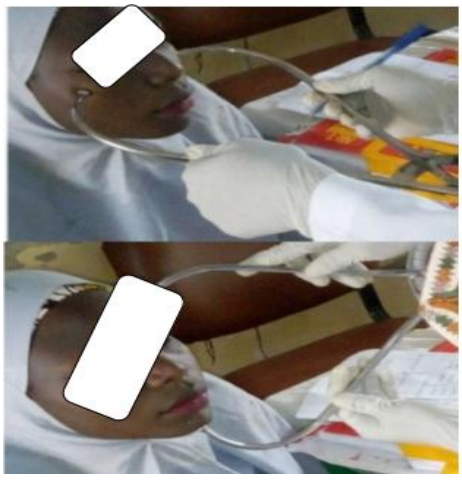

Plate I: Measurement of Facial Height and Width

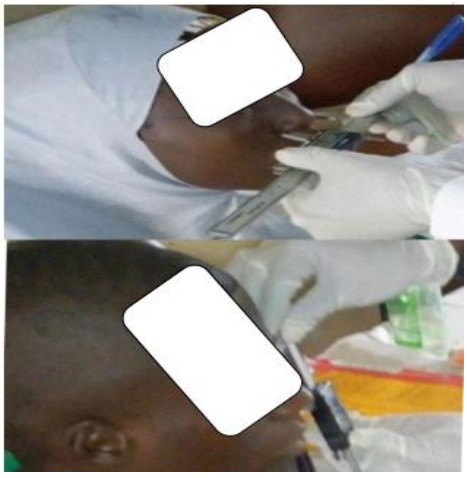

Plate II: Measurement of Nasal Width and Height

Derived Indices

$$\text{Body Mass Index (BMI)} = \frac{\text{weight (kg)}}{\text{height (m}^2\text{)}}$$

$$\text{Facial Index (FI)} = \frac{\text{Facial height}}{\text{Facial width}} \times 100 \text{ (Praveen } \textit{et al.,} \text{ 2013)}$$

$$\text{Nasal Index (NI)} = \frac{\text{Nasal width}}{\text{Nasal height}} \times 100 \text{ (Oladipo } \textit{et al.,} \text{ 2008)}$$

Statistical analyses

The data collected were analyzed using IBM Corporation Statistical Package for Service Solution (SPSS) version 23 and expressed as mean ± standard deviation to determine descriptive statistics. One-way ANOVA was used to evaluate relationship between age groups and nasofacial dimensions. Bonferroni post Hoc multiple comparisons test was used to evaluate significant differences within the age groups. The level of significance was declared as $p<0.05$.

RESULTS

Table 1 shows the descriptive statistics of the current study with a total of 481 participants from Hausa ethnic group were included for this study, 271 were females and 210 were males. The ages of the participants ranged between 18 to 40 years, with mean of 26.22 (±6.38) years. The average height of the female and male participants was 159.97 (±5.40) cm and 168.06 (±6.11) cm also had an average weight of 55.30 (±10.07) Kg and 62.02 (±8.97) Kg respectively. It was found that the body mass index of the study population ranged from 15.31 to 35.20 Kg/m^2, with the average of 21.59 (±3.67) Kg/m^2 and 21.95 (±2.95) Kg/m^2 in females and males respectively. The average facial height in females were 10.13 (±0.57) cm and 10.71 (±0.60) cm in males, while the mean value of facial width were 10.74 (±0.62) cm and 11.26 (±0.69) cm in females and males respectively. The average nasal width/height were found to be 36.96 (±3.32) mm/44.35 (±4.79) mm and 41.72 (±3.54) mm/46.53 (±4.70) mm in females and males respectively. Moreover, the participants had a facial index ranged between 73.91 to 117.65, while females possessed the average of 94.51 (±6.69) and males had 95.38 (±6.96). Also, the nasal index ranged between 62.59 to 113.41 with the mean value of 83.93 (±8.80) and 90.26 (±9.20) in female and male participants respectively.

Table 2 shows the effects of age on height, weight, BMI and nasofacial dimensions among the study participants. The difference observed between early adult with middle and late adults age groups in body height, facial height and facial width where significantly smaller in early adult when compared with middle and late adults age groups. There is statistically significant difference among the three age groups in body weight, nasal width and BMI, the late adult age group showed the higher mean value of 63.86 (±10.63) Kg in body weight, 40.70 (±3.94) mm in nasal width and 23.41 (±3.85) Kg/m^2 in BMI. The nasal height indicates statistically significant difference between early and late adult age groups with the early adult age group having the lower mean value of 44.63 (±4.87) mm. There is no significant difference statistically across the age groups in facial and nasal indices, however, the middle adult age group have the higher mean facial index of 95.54(±7.28) and late adult age group have the higher mean nasal index of 88.44 (±10.45).

Table 3 shows the effect of age on height, weight, BMI and nasofacial dimensions among female of the study participants. Statistically significant difference ($p = <0.001$) was found across the age groups in BMI with late adult age group indicates the higher mean value of 24.00 (±4.45) Kg/m^2, however, the difference observed in body weight between early adult age group with middle and late adult age groups is significantly higher in late adult with mean value of 61.39 (±11.16) Kg and lower in early adult with mean value of 52.80 (±8.14) Kg, but the difference in body weight between middle and late adult age groups is not statistically significant. Late adult age group showed statistically difference with early and middle adult age groups in nasal width and the mean value is significantly higher in late adult, 38.63 (±3.98) mm and lower in middle adult, 36.32 (±2.98) mm. The statistical difference between middle and late adult age groups in nasal index is significantly higher in late adult with mean value of 86.69 (±8.69) and lower in middle adult with mean value of 82.29 (±7.93) but the statistical difference between early adult is neither significant with middle nor late adult age groups. There is no statistically significant difference among the age groups in height, facial height, facial width, nasal height and facial index (See Table 3).

Table 1: Descriptive Statistics of Age, Height, Weight, Body Mass Index and Some Facial Anthropometry among the Study Participants.

	Study Population (N= 481)		Female Participants (n= 271)		Male Participants (n= 210)	
Variables	**Min-Max**	**Mean±S.D**	**Min-Max**	**Mean±S.D**	**Min-Max**	**Mean±S.D**
Age (years)	18.00-40.00	26.22±6.38	18.00-40.00	24.77±6.27	18.00-40.00	28.10±6.02
HT (cm)	138.80-187.20	163.50±6.99	138.80-178.00	159.97±5.40	153.00-187.20	168.06±6.11
WT (Kg)	38.00-97.00	58.23±10.16	38.00-97.00	55.30±10.07	42.00-96.50	62.02±8.97
FH (cm)	8.50-12.50	10.38±0.65	8.50-12.00	10.13±0.57	9.00-12.50	10.71±0.60
FW (cm)	8.50-13.50	10.97±0.70	8.50-13.40	10.74±0.62	9.00-13.50	11.26±0.69
NW (mm)	29.57-53.02	39.04±4.15	29.57-50.88	36.96±3.32	33.21-53.02	41.72±3.54
NH (mm)	34.15-67.10	45.30±4.87	34.15-67.10	44.35±4.79	37.82-63.19	46.53±4.70
BMI (Kg/m^2)	15.31-35.20	21.75±3.38	15.31-35.20	21.59±3.67	15.65-35.20	21.95±2.95
FI	73.91-117.65	94.89±6.82	73.91-117.65	94.51±6.69	76.00-115.00	95.38±6.96
NI	62.59-113.41	86.69±9.50	62.59-111.01	83.93±8.80	67.17-113.41	90.26±9.20

N = 481, Min= Minimum value, Max= Maximum Value, S.D= Standard Deviation, HT = Body Height, WT = Body Weight, FH = Facial Height, FW = Facial Width, NW = Nasal Width, NH = Nasal Height, BMI = Body Mass Index, FI = Facial Index, NI = Nasal Index

Table 2: Effect of Age on Height, weight, BMI and Nasofacial dimensions among the study participants.

	Mean ± S.D				
Variables	**Early Adult (18-24 years)**	**Middle Adult (25-34 years)**	**Late Adult (35-40 years)**	**F**	**P value**
HT (cm)	161.80±6.80[a,b]	164.51±6.85[a]	165.24±6.95[b]	10.981	<0.001
WT (Kg)	54.37±8.19[a,b]	59.82±10.30[a,c]	63.86±10.63[b,c]	33.497	<0.001
FH (cm)	10.22±0.58[a,b]	10.50±0.68[a]	10.49±0.67[b]	10.364	<0.001
FW (cm)	10.85±0.58[a,b]	11.02±0.76[a]	11.14±0.77[b]	5.925	0.003
NW (mm)	38.14±3.85[a,b]	39.26±4.31[a,c]	40.70±3.94[b,c]	12.165	<0.001
NH (mm)	44.63±4.87[b]	45.54±4.71	46.39±5.08[b]	4.267	0.015
BMI (Kg/m^2)	20.74±2.65[a,b]	22.09±3.50[a,c]	23.41±3.85[b,c]	21.697	<0.001
FI	94.44±6.58	95.54±7.28	94.39±6.14	1.568	0.209
NI	86.05±9.44	86.62±9.11	88.44±10.45	1.869	0.155

Significant at the 0.05 level. Similar superscripts indicate significant differences among the age groups. N = 481, Min= Minimum value, Max= Maximum Value, S.D= Standard Deviation, HT = Body Height, WT = Body Weight, FH = Facial Height, FW = Facial Width, NW = Nasal Width, NH = Nasal Height, BMI = Body Mass Index, FI = Facial Index, NI = Nasal Index

Table 3: Effect of Age on Height, weight, BMI and Nasofacial dimensions among Female of the study participants.

	Mean ±S.D				
Variables	**Early Adult (18-24 years)**	**Middle Adult (25-34 years)**	**Late Adult (35-40 years)**	**F**	**P value**
HT (cm)	159.73±5.75	160.30±5.01	160.06±5.03	0.319	0.727
WT (Kg)	52.80±8.14[a,b]	56.90±11.10[a]	61.39±11.16[b]	12.863	<0.001
FH (cm)	10.13±0.58	10.13±0.56	10.12±0.58	0.004	0.996
FW (cm)	10.74±0.56	10.73±0.68	10.80±0.73	0.145	0.865
NW (mm)	36.98±3.23[b]	36.32±2.98[c]	38.63±3.98[b,c]	6.290	0.002
NH (mm)	44.20±4.98	44.43±4.72	44.74±4.27	0.193	0.825
BMI (Kg/m^2)	20.67±2.84[a,b]	22.12±4.02[a,c]	24.00±4.45[b,c]	13.959	<0.001
FI	94.54±6.52	94.65±7.19	93.99±6.13	0.124	0.883
NI	84.34±9.21	82.29±7.93[c]	86.69±8.69[c]	3.528	0.031

Significant at the 0.05 level. Similar superscripts indicate significant differences among the age groups, n = 271. N = 481, Min= Minimum value, Max= Maximum Value, S.D= Standard Deviation, HT = Body Height, WT = Body Weight, FH = Facial Height, FW = Facial Width, NW = Nasal Width, NH = Nasal Height, BMI = Body Mass Index, FI = Facial Index, NI = Nasal Index

Table 4 shows the effect of age on height, weight, BMI and nasofacial dimensions among male of the study participants. The differences observed between early adult age group with middle and late adult age groups in weight, facial height and BMI were statistically significant with late adult age group having the highest weight and BMI mean value of 65.60 (±9.99) Kg and 23.00 (±3.34) Kg/m^2 respectively and the middle adult age group indicate highest average facial height with value of 10.83 (±0.59) cm. There is no significant difference statistically between the age groups in the remaining study variables. However, the late adult age group indicates highest mean value in body height, facial width, nasal width and height of 168.91 (±5.68) cm, 11.38 (±0.70) cm, 42.17 (±3.20) mm and 47.55 (±5.32) mm respectively. The mean values of facial and nasal indices are higher in middle adult age group when compared with early and late adult age groups even though, the differences are not statistically significant (as indicated in Table 4 below).

Table 4: Effect of Age on Height, weight, BMI and Nasofacial dimensions among Male of the study participants.

	Mean ±S.D				
Variables	**Early Adult (18-24 years)**	**Middle Adult (25-34 years)**	**Late Adult (35-40 years)**	**F**	**P value**
HT (cm)	166.92±6.53	168.31±6.02	168.91±5.68	1.579	0.209
WT (Kg)	58.25±6.98[a,b]	62.47±8.75[a]	65.60±9.99[b]	9.836	<0.001
FH (cm)	10.46±0.54[a,b]	10.83±0.59[a]	10.75±0.61[b]	7.674	0.001
FW (cm)	11.13±0.54	11.28±0.74	11.38±0.70	1.838	0.162
NW (mm)	41.00±3.77	41.92±3.53	42.17±3.20	1.784	0.171
NH (mm)	45.67±4.46	46.54±4.48	47.55±5.32	2.140	0.120
BMI (Kg/m^2)	20.90±2.12[a,b]	22.06±2.98[a]	23.00±3.34[b]	7.235	0.001
FI	94.21±6.78	96.35±7.30	94.67±6.20	2.104	0.125
NI	90.25±8.74	90.54±8.32	89.68±11.46	0.141	0.869

Significant at the 0.05 level. Similar superscripts indicate significant differences among the age groups, n = 210. N = 481, Min= Minimum value, Max= Maximum Value, S.D= Standard Deviation, HT = Body Height, WT = Body Weight, FH = Facial Height, FW = Facial Width, NW = Nasal Width, NH = Nasal Height, BMI = Body Mass Index, FI = Facial Index, NI = Nasal Index

DISCUSSION

The result in the current study showed sexual dimorphism in all the study parameters with the female having a lower mean value than the male participants. It was also found that there is a positive increase in body height, facial height and facial width however the differences are only statistically significant between early and late adult age groups (the reason could be because cessation of longitudinal bone growth after approximately 25 years of age due to the effect of growth hormones that cause fusion of epiphyseal plates), the nasal width, body weight and body mass index increase with the increase in age and the differences are statistically significant across the experimental three adult age groups, although the BMI is within normal range but there is need for dietary sensitization in elderly people to avoid the risk of obesity, similar normal range BMI of Hausa was reported by Tanko *et al.,* 2023. The difference in nasal height (NH) was only examined to be statistically significant between early and late adult age groups which could be attributed to the slow growing of the nasal cavity, this is in keeping with the study of past literature by Edelstein (1996), Pham *et al.* (2011), Gibelli *et al.*(2012), Ozkocak & Ozdemir (2018) and Mirdehghan *et al.* (2020). The facial index reported to be higher in middle age group and the difference between the groups is not statistically significant which implies that the middle adult age group of the Hausa ethnic group of Kano state have hyperleptoprosopic face, in contrast, the early and late adults possess leptoprosopic face which indicate the effect of age on facial type within the ethnic group. However, some study reported euriprosopic face type (Tanko *et al.,* 2023). The late adult age group was found to have higher nasal index (NI) however the difference between the groups is not statistically significant and indicate similar nasal type (platyrrhine) among the Hausa ethnic group in Kano state, in contrast with other study reported mesorrhine nasal type (Anas & Saleh, 2014; Tanko *et al.,* 2023), the variation could be attributed to the age of the participants. In female only facial height showed significant difference between early with middle and late adult age groups which is similar with a study in Korea but reported nasal height significant also which could be due to race and regional variations (Kim *et al.,* 2012). The demand for the analysis of facial features in the field of forensic medicine and legal practice among the Hausa ethnic group of kano state has recently increased, largely due to the high-rate immigration from the neighboring states affected by insurgency and rising incidence of crime and illegal activities. The study aimed at evaluating the relationship between the facial anthropometry and BMI with age among Hausa ethnic group of Kano state Nigeria, the findings could be applicable in forensic sciences especially in cases of personal identification of images from video surveillance systems, also in other fields such as dietetics, security, plastic/cosmetics surgery, orthodontics and ergonomics.

Conclusion

This study concludes that age significantly affects facial height, facial width, nasal width, body height, body weight, and BMI among the Hausa ethnic group of Kano State, Nigeria. However, nasal height, facial index, and nasal index showed a weaker relationship with age.

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Conflict of interest

None declared

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Authors' Contributions:

HMN: designed the research methodology and data collection. LHA: contributed to study design and provided critical revisions. AAG: performed the data statistical analysis.

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REFERENCES

Albert, M. Sethuram, A. and Ricanek, K. (2011). *Implications of Adult Facial Ageing on Biometrics, Biometrics - Unique and Diverse Applications in Nature, Science, and Technology.* Albert, M. (Ed.), InTech 89-106

Anas, I. Y. and Saleh, M. S. (2014) Anthropometric Comparison of Nasal Indices between Hausa and Yoruba Ethnic Groups in Nigeria. *Journal of Scientific Research & Reports;* 3(3): 437-444

Baldwin, M. C., Liu, Z. J., Raffery, K. L., Keith, A., Tamasas, B., Kaiyala, K. and Heering, S. W. (2022). Boulinum toxin in the masseter muscle: Lingering effect of denervation. *The Anatomical Record;* 305(5): 1215-1230

Bannister, L. H., Williams, P. L., Berry, M. M., Collins, P., Dyson, M. and Dussek, J. E. (2000). Gray's Anatomy: The anatomical basis of medicine and surgery. 38th Ed. *New York, Churchill Livingstone.*

Bishara, S.E., Treder, J.E. and Jakobsen, J.R. (1994). Facial and dental changes in adulthood. *American Journal of Orthodontics and Dentofacial Orthopedics;* 106, 175–186.

Cochran, W. G. (1977). Sampling Techniques. Hoboken, NJ John Wiley and Sons, Inc.

Coetzee, V., Perrett, D. I. and Stephen, I. D. (2009). Facial adiposity: a cue to health? *Perception;* 38:1700–1711.

Coleman, S.R. and Grover, R. (2006). The anatomy of the aging face: Volume loss and changes in 3-dimensional topography. *Aesthetic Surgery Journal;* 26, 4–9.

Dong, Y., Huang, L., Feng, Z., Bai, S., Wu, G. and Zhao, Y. (2012). Influence of sex and body mass index on facial soft tissue thickness measurements of the northern Chinese adult population. *Forensic Science International;* 222(1–3):396-407.

Edelstein, D. R. (1996). Aging of the Normal Nose in Adults. *Laryngoscope;* 181: 1-25

Ernest, M. A., Sanu, O. O., Utomi, I. L. and Ibeabuchi, M. N. (2018). Sexual Dimorphism in Facial Soft Tissue anthropometry among young adults Nigerians. *Journal of the World Federation of Orthodontists;* 7: 94-101.

Gibelli, D., Mapelli, A., Obertovà, Z. … and Cattaneo, C. (2012). Age changes of facial measurements in European young adult males: Implications for the identification of the living. *Journal of Comparative Human Biology;* 63: 451– 458

Ilankovan, V. (2013). Anatomy of ageing face. *British Journal of Oral and Maxillofacial Surgery;* 4146: 1-8.

Kahn, S. E., Hull, R. L. and Utzschneider, K. M. (2006). Mechanism linking obesity to insulin resistance and type 2 diabetes. *Nature;* 444: 840-846.

Kim, S. Y., Bayome, M., Park, J. H., … and Moon, H. (2012). Evaluation of the facial dimensions of young adult women with a preferred facial appearance. *Korean Journal of Orthodontics*; 45(5): 253-260

Kotrashetti, V. S. and Mallapur, M. D. (2016). Radiographic assessment of facial soft tissue thickness in South Indian population – An anthropologic study. *Journal of Forensic Legal Medicine;* 39:161–168.

Laughter, M.R., Anderson, J.B., Maymone, M.B.C. and Kroumpouzos, G. (2023). Psychology of Aesthetics: Beauty, Social Media, and Body Dysmorphic Disorder. *Clinical Dermatology;* 41, 28–32.

Lee, B. J. and Kim, J. Y. (2014). Predicting visceral obesity based on facial characteristics. BMC Complementary and Alternative Medicine; 14(248): 1-9.

Mirdehghan, N., Sharif, K., Kalia, A., Mirdehghan, M., Mirdehghan, K. and Khan, N. N. (2020). Comparison of cephalometric craniofacial features and facial photographic features for two generations of patients. *South European Journal of Orthodontics and Dentofacial Research;* 7(2):22-31

Mitchell, W. K., Williams, J., Atherton, P., Larvin, M., Lund, J. and Narici, M. (2012). Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength; a quantitative review. *Frontiers in Physiology;* 3:260

Oladipo, G., Fawehinmi, H. and Suleiman, Y. (2008). The study of Nasal Parameters (Nasal Height, Nasal Width, Nasal Index) among the Yorubas of Nigeria. *The Internet Journal of Biological Anthropology;* 3:2

Oladipo, G. S., Olabiyi, A. O., Oremosu, A. A. and Noronha, C. C. (2007). Nasal indices among major ethnic groups in southern. *Nigeria Scientific Research and Essay;* 2(1): 020-022.

Ozkocak, V. and Ozdemir, F. (2018). Age-Related Changes in the External Noses of the Anatolian Men. *Springer Nature and International Society of Aesthetic Plastic Surgery;* 1-7

Pham, D. D., Do, J. H., Ku, B., Lee, H. J., Kim, H. and Kim, J. Y. (2011). Body Mass Index and Facial Cues in Sasang Typology for Young and Elderly Persons. *Evidence-Based Complementary and Alternative Medicine;* 1-9

Praveen, K. D., Janaki C. S., Vijayaraghavan, V. and Delhi raj U. (2013). A Study on Measurement And Correlation of Cephalic And Facial Indices in Males of South Indian Population. *International Journal of Medical Research & Health Sciences;* 2(3): 439-446.

Reilly, M.J., Tomsic, J.A., Fernandez, S.J. and Davison, S.P. (2015). Effect of FacialRejuvenation Surgery on Perceived Attractiveness, Femininity, and Personality. *JAMA Facial Plastic Surgery;* 17, 202–207.

Smith, A. W., Bellizzi, K. M., Keegan, T. H.M., Zebrack, B., Chen, V. W., Neale, A. V. Ann S. Hamilton, Margarett Shnorhavorian, and Charles F. Lynch (2013). Health-Related Quality of Life of Adolescent and Young Adult Patients with Cancer in the United States: The Adolescent and Young Adult Health Outcomes and Patient Experience Study. *Journal of Clinical Oncology; 31(17) :2136-2145*

Swift, A., Liew, S.;Weinkle, S., Garcia, J.K. and Silberberg, M.B. (2021). The Facial Aging Process From the "Inside Out". *Aesthetic Surgery Journal;* 41, 1107–1119.

Tanko, M., Garba, M., Sadeeq, A. A., Peter, A. S. and Aliyu, J. (2023). Naso-Facial Indices and Body Mass Index of Yoruba and Hausa Ethnic Groups Students in Ahmadu Bello University Zaria, Aged 18 – 25 Years. *Journal of Biomedical and Applied Sciences FUD;* 2:1 ISSN: 2814-3221 (print), ISSN: 2955-0874 (online)

Zhuang, Z., Landsitte, D., Benson, S., Roberge, R. and Shaffer, R. (2010). Facial anthropometric differences among gender, ethnicity, and age groups. *Annals of Occupational Hygiene;* 54:391-402.