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Sexual dimorphism using facial anthropometry and odontometry amongst adults in Okun ethnic group of Kogi State, Nigeria

A. Alabi, J.M. Mayowa, A.S. Alabi, J.A. Owa, Y.E Owa, O.A. Fagbemi and A.M. Ayoola

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Authors and affiliations

1Dr. ALABI Adeola, Affiliation: Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Ilorin Nigeria. E-mail address: alabi.a@unilorin.edu.ng
*[2]MAYOWA Juwon Mercy, Affiliation: University of Ilorin, Kwara state, Nigeria. E-mail address: juwonmercy65@gmail.com.
3Professor ALABI Ade Stephen, Affiliation: University of Ilorin, Kwara state, Nigeria, E-mail address: alabi.as@unilorin.edu.ng. ORCID: 0000-0002-9750-2319
4Dr. OWA Joshua Abidemi, Affiliation: Department of Paediatrics, Federal Teaching Hospital, Lokoja, Kogi State, Nigeria. E-mail address: owajabidemi@gmail.com. Phone number: +2348038377907
5Dr OWA Yetunde Elizabeth, Affiliation: Department of Ophthalmology, Federal Teaching Hospital, Lokoja, Kogi State, Nigeria. E-mail address: yetty2011@gmail.com. Phone number: +2348039090698. ORCID number:0009000526710662
6Dr. FAGBEMI Oluwaseyi Ajibola, Affiliation: Department of Human Anatomy, Federal University Lokoja. Email address: seyikizz@gmail.com. Phone number: +2348050800016. ORCID number: 0009-0003-6217-0419
7 Dr. AYOOLA Abosede Mary, Affiliation: Lead City University, Department of Anatomy, College of Medicine. E-mail address: ayoola.abosede@lcu.edu.ng
****Corresponding author:*** MAYOWA Juwon Mercy

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Authors and Affliations
1Dr. ALABI Adeola, Affiliation: Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Ilorin Nigeria. E-mail address: alabi.a@unilorin.edu.ng
[2]MAYOWA Juwon Mercy, Affiliation: University of Ilorin, Kwara state, Nigeria. E-mail address: juwonmercy65@gmail.com.
3Professor ALABI Ade Stephen, Affiliation: University of Ilorin, Kwara state, Nigeria, E-mail address: alabi.as@unilorin.edu.ng. ORCID: 0000-0002-9750-2319
4Dr. OWA Joshua Abidemi, Affiliation: Department of Paediatrics, Federal Teaching Hospital, Lokoja, Kogi State, Nigeria. E-mail address: owajabidemi@gmail.com. Phone number: +2348038377907
5Dr OWA Yetunde Elizabeth, Affiliation: Department of Ophthalmology, Federal Teaching Hospital, Lokoja, Kogi State, Nigeria. E-mail address: yetty2011@gmail.com. Phone number: +2348039090698. ORCID number:0009000526710662
6Dr. FAGBEMI Oluwaseyi Ajibola, Affiliation: Department of Human Anatomy, Federal University Lokoja. Email address: seyikizz@gmail.com. Phone number: +2348050800016. ORCID number: 0009-0003-6217-0419
7 Dr. AYOOLA Abosede Mary, Affiliation: Lead City University, Department of Anatomy, College of Medicine. E-mail address: ayoola.abosede@lcu.edu.ng

ABSTRACT

The aim of this study is to provide a comprehensive understanding of sexual dimorphism in adults in Okun ethnic group in Kogi state. The study employed a mixed-methods approach, combining both quantitative and qualitative data collection and analysis methods. A sample of 400 adults aged between 18-65 were randomly selected from Okun ethnic group in Kogi state with equal numbers of males and females. Facial anthropometry was used to measure various facial features such as facial height(FH) and width(FW), nasal height(NH) and width(NW), diagonal length of mandible, facial index while Odontometry was used to measure the maxillary Inter-canine width, Left and Right mesiodistal width of canine, first Inter-premolar width and the Mandibular Inter-canine width, Left and Right mesiodistal width of canine, first Inter-premolar width. The parameters above were measured using digital sliding vernier caliper. Facial index was calculated from the parameters of the facial height and facial width and the results were statistically analyzed. The result of the study showed that the predominant facial type was the Eury-prosopic type with a significant variation to sexual dimorphism. The Facial height, Facial width, Nasal height, Nasal width, Maxillary inter-premolar width, Maxillary inter-canine width, Mandibular inter-canine width showed no association with sex and hence, can't be used in determination of the sex of an individual. Only the Diagonal length of mandible, Maxillary left canine mesiodistal width, Maxillary right canine mesiodistal width, Mandibular left canine mesiodistal width, Mandibular right canine mesiodistal width and the Mandibular inter-premolar width were associated with sex. Hence, the Maxillary and Mandibular canines, the Diagonal length of the mandible and the Mandibular inter-premolar width hold potential as a supplementary tool in personality identification of crime suspects in unknown identity.

Keywords: *Sexual dimorphism, Facial anthropology, Odontometry, Forensic anthropology, Gender differences.*

INTRODUCTION:

Facial anthropology involves the study of facial features, including bones and soft tissues, to understand variations among populations. Variability in facial shapes among individuals is a crucial phenotype in humans, serving as a distinctive identifier for each person. The facial structure, encompassing the skull, intricate soft tissue differences, and skin color, collectively contribute to the unique appearance of the face and impact how it is perceived by others(Candramila *et al.,* 2014). Facial dimensions serve as markers for a person's races, ethnicity, and gender. Facial appearance exhibits variation across regions due to diverse parameters. Understanding facial parameters can also be utilized in reconstructive efforts and identifying individuals for investigating crimes (Shanmukha *et al.,* 2021). There is a number of relative facial parameters, which capture differences in shapes, rather than in general sizes, and are usually considered to demonstrate more or less universal sexually dimorphic tendencies. Women, on average, have a larger relative height of the forehead (Bigoni *et al.*, 2010), smaller relative heights of the lower face, and mandible (Tanikawa *et al.*, 2016), and lower relative nasal width (Tanikawa *et al.,* 2016). Nasal height and width can be used as a supportive parameter to determine the gender of the subject (Shah and Chavada, 2019). Previous studies have reported racial differences and geographical variation in Nasal height along with importance in gender differentiation. Present study reported difference in male and female, the nasal height of female was significantly low than that of males which indicates females of Bhavanagar city has shorter nose than males (Shah and Chavada, 2019). The difference in Nasal height may be due to difference in stature also as reported by previous studies (Ngeow *et al.,* 2009). Holton *et al.,* 2016, also found difference male and female nasal height in relation to sitting height. Vidya *et al.,* 2012, also reported Nasal height as an independent variable for gender determination. According to Scendoni *et al.,* 2023, Nasal width as well as nasal height are configured as predictors of sexual dimorphism. Females also tend to have a lower NW than that of males, as well as a higher NH. According to Sharma *et al.,* 2015, The diagonal length of the mandible was 79.77 ± 4.68 mm in adult males and 73.83 ± 4.84 mm in females, as compared with 8.32 ± 0.52 cm in males and 7.92 ± 0.46 cm in females observed by (Ongkana and Sudwan, 2009), in the Thai population. In both studies, the diagonal length is significantly greater in males as compared with the females. In these studies, the difference in the values might be due to different population groups included in these studies. After an anthropometric study on the mandible, (Kanwar *et al.,* 2021) said the gender differences in mean values of diagonal length of male and female were statistically highly significant.

One of the facial parameters, which has attracted a special attention of anthropologists and behavioral scientists today, is the facial width-to-height ratio (fWHR), defined as the ratio of the bizygomatic width to the upper facial height which is measured from Nasion to Gnathion (Stirrat and Perrett, 2010). This measurement is purported to offer an index of mid-face robustness that exhibits sexual dimorphism, with men generally having a larger fWHR than women, on average (Weston *et al.,* 2004). This ratio is defined as the bizygomatic width divided by the upper facial height, measured from Nasion to Prosthion or their soft-tissue approximations (Stirrat & Perrett, 2010; Tanikawa *et al.,* 2016). According to Martin-Saller's scale, facial phenotypes are classified into 5; hyperleptoprosopic, leptoprosopic, mesoprosopic, euryprosopic and hyper- euryprosopic (Jeremi`c *et al.,* 2013). The facial type of an individual has been reported to be influenced by sex, ethnicity and race, genetic, socio-economic and nutritional factors (Omotosho *et al.,* 2011). These prosopic indexes have been reported by several investigators to vary between males and females in different populations (Jeremi`c *et al.,* 2013). Omotosho *et al.,* 2011, found significantly ($P < 0.001$) lower values in facial height, breadth and index in females than males. The dominant facial type among the Serbian population was leptoprosopic with an incidence of 81.71% (76.66% males and 87.05% females). Few of the populace were of the mesoprosopic and hyperleptoprosopic facial types (Jeremi ´c *et al.,* 2013). However, in (Torres-Restrepo *et al.,* 2014) mesoprosopic and leptoprosopic facial types were the most predominant facial type, with a percentage of 47.9% each. Leptoprosopic have been shown to be the most predominant facial type identified among Africans. Mesoproscopic facial type was the most prevalent (51.3%), and the Hyperleptoprosopic type was the least prevalent (2.7%) in the male group. Among females also) is the most common facial form among females The long face (Hypereuryprosopic facial type) was the most prevalent (36.3 %), and Hyperleptoprosopic type was the least prevalent (2.7%) in the female group (Palagiri *et al.,* 2020). According to (Maalman *et al.,* 2019) The dominant facial type among the study participants was hyperleptoprosopic. As high as 153 out of the 185 Sisaala participants (73 males and 80 females) representing 83% and 145 out of the 202 Dagaaba participants (71 males and 74 females) representing 72% of the Dagaaba participants were found to have hyperleptoprosic. According to Gopinath *et al.,* 2021, the most common shape of face in males and females is mesoprosopic followed by euryprosopic. In children and Adolescents, it was shown that hyperleptoprosopic face was the commonest type in both males and females, though there was a difference in the patterns of distribution of the various types of face in both sexes. The other types of faces in the minority were seen in a higher proportion among females compared to the males (Okwesili *et al.*, 2019). While the extent of sexual dimorphism in fWHR is a subject of debate, some studies have failed to find significant differences (Geniole *et al.,* 2015; Robertson & Kingsley, 2018), whereas others indicate that men generally have higher fWHR than women (Geniole *et al.,* 2015). However, despite widespread research on fWHR, many global populations have yet to be thoroughly investigated in international literature. Notably, craniological data from Russian anthropologists during the Soviet period, encompassing diverse Middle Asian and Siberian populations, challenge the assumption that fWHR is consistently higher in males. For instance, among the Buryat population of Southern Siberia, female skulls were generally found to have higher fWHR than male skulls (Rostovtseva *et al.,* 2020).

Odontometry, on the other hand, focuses on dental characteristics. Odontometry involves the examination and measurement of tooth size. In non-living populations, teeth are essential for determining sex as they typically withstand damages and serve as valuable sources of information regarding dimorphism (Carlos *et al.,* 2012). Teeth are also useful in reconstructive identification and it is possible to obtain reasonable quantities of information concerning race, stature, and sex from them (Prabhu and Acharya, 2009). development of various crown diameters, related indices, equation algorithms, and measurement methods for sex estimation across diverse populations (Liu *et al.,* 2021).

Marin *et al.*, (2017) says "sex determination using dental features is primarily based on comparison of tooth dimensions in male and female". Variation in tooth size indicating sexual dimorphism, along with the precision of odontometric sex prediction, has been observed to differ across regions. The factors contributing to sexual dimorphism in teeth differ from those in craniofacial bones. The facial skeleton, including the mandible, displays sexual dimorphism either directly or indirectly as a result of hormonal influences and muscle activity. However, teeth are less affected by hormonal influences (Oettle *et al.,* 2009). Various morphometric studies have extensively explored sexual dimorphism through linear measurements such as width, length, and diagonal measurements of teeth, as well as assessments of occlusal surface areas, among others (Yoo *et al.,* 2016).

In this study, tooth size (maximum mesiodistal and buccolingual dimensions) was measured for all the permanent teeth of the maxillary and mandibular arches, except the incisors, second premolar and molars. According to (Thapar *et al.,* 2012) The sex classification accuracy of the odontometric measurements ranged from 61.5 to 76%, with combination of maxillary and mandibular teeth giving better accuracy. According to (Thapar *et al.*,2012) significant sexual dimorphism was observed in the BL dimension of the maxillary canine, MD and BL dimensions of the mandibular canine, the BL dimension of the maxillary and mandibular first molar, the MD dimension of the maxillary second molar and BL and MD dimensions of the mandibular second molar (P\0.001). The First Premolars showed significant correlation between the sibling pairs mesiodistally as well as buccolingually which establishes the existence of dimorphism amongst these teeth (Sharma *et al.,* 2014). In addition, (Shankar *et al.,* 2013) considered the diagonal measurements also as a predictor variable in determining sex and it was applicable in deriving the discriminant functions. (Anuthama *et al.,* 2011) also discovered that MD (mesiodistal) and BL (buccolingual) crown diameters were found to have statistically significant differences between both the sexes in all teeth and this finding was similar to other studies conducted in various populations. According to (Alabi *et al.,* 2022), there was a significant difference in the Maxillary inter-canine width, Maxillary inter-premolar width, Maxillary left and right canine mesiodistal widths between males and females.

Almugla *et al.,* (2023) found out that The MD width of both the right and the left maxillary canines was significantly greater in males than in females. Inter-canine distance has been reported to be a useful parameter in gender differentiation, as the eruption of canines and growth in the width of both the jaws, including the width of the dental arches, are completed before the adolescent growth changes, and the inter-canine distance does not increase after 12 years of age. The method of gender prediction by means of canine indices is beneficial as it is economical, does not require complex equipment, involves simple mathematical calculation, and is convenient for the analysis of large samples (Litha *et al.,* 2017). Gender prediction using the standard canine index in (Yousef *et al.,* 2022) was more accurate in males compared to female counterparts; however, an overall accuracy of prediction was closer to 59% for both the right and left canines.

The maxillary first premolar holds significant importance in taxonomic classification due to its distinctive features. Notably, its asymmetry is attributed to the pronounced mesial marginal developmental groove and depression, resulting in a concave mesial outline in contrast to the distal outline. (Bailey and Lynch, 2005) conducted an evaluation of the shape of mandibular premolars in Neanderthals and modern humans. Their findings revealed a higher classification accuracy in modern humans, reaching 98.1%, compared to Neanderthals, where the accuracy was only 65%. Forensic odontology plays a crucial role in gender identification when only the deceased body's remains are present, with forensic odontologists being pivotal in this process (Litha *et al.,* 2017).

MATERIALS AND METHOD:

The study population was derived from the total population of the individuals of Okun ethnic group in Kogi state, Nigeria. The subjects comprised both males and females of Okun ethnicity. The sample size is composed of 400 subjects segregated into 2 groups, (200 males and 200 females) aged between 18-65 years, all of which were normal subjects. These subjects were selected at random. Prior and informed consent were obtained from each of the subjects.

According to Martin-Saller's scale (1957), classification of face used in this study can be divided into 5

1. Hyperleptoprosopic (very long face): facial index above 93%
2. Leptoprosopic (long face): facial index between 88 and 92.9%
3. Mesoprosopic (round face): facial index between 84 and 87.9%
4. Euryprosopic (broad face): facial index between 79 and 83.9%
5. Hypereuryprosopic (very broad face): facial index below 78.9%

Statistical analysis: The statistical package for social sciences (SPSS) version 27.0, student t-test comparison was used to determine group differences, Pearson's correlation and regression analysis were used to analyze the data. $P< 0.05$ was considered significant.

Ethical consideration

Informed written consent in form of questionnaire was obtained from the subjects and the study protocol approved by the ethical review committee of the University of Ilorin (ethical number: UERC/ASN/2024/2760).

RESULTS:

Table 1: *The mean and standard deviation (S.D) and test of mean difference in the facial parameters of males and females Okun population.*

Variables	MALE Mean±S.D	Min	Max	FEMALE Mean±S.D	Min	Max	T-TEST t-test value	p-value	Inf.
Age	26.56±11.18	18	65	29.38±12.96	18	65	-2.329	**0.020**	**S**
Facial height (mm)	128.07±7.79	111.90	148.80	122.86±7.19	100.40	141.20	6.945	**<0.001**	**S**
Facial width (mm)	108.90±6.87	92.20	137.30	106.71±8.60	82.60	128.90	2.801	**0.005**	**S**
Nasal height (mm)	62.75±5.26	51.30	82.40	61.21±5.43	46.60	79.80	2.879	**0.004**	**S**
Nasal width (mm)	42.91±4.55	31.2	58.40	40.97±3.86	30.50	50.30	4.586	<**0.001**	**S**
Diagonal length of mandible (mm)	97.30±7.38	61.80	124.40	92.04±6.30	76.00	122.80	7.672	**<0.001**	**S**
Facial Index	85.22±5.94	70.50	104.50	87±5.93	69.00	98.60	-2.878	**0.04**	**S**

Note: *S.D= Standard deviation, Inf= inference, NS= Not significant, S=Significant*

Table 2: *Facial type distribution and test of association with sex.*

Sex	Facial type Hyper-Lepto prosopic	Lepto prosopic	Meso prosopic	Eury prosopic	Hyper-Eury prosopic	Test of association Df	X^2 value	p value	Inf
Male (%)	20 (5.0%)	45 (11.3%)	48 (12.0%)	62 (15.5%)	25 (6.3%)	4	10.355	**0.035**	**S**
Female (%)	35 (8.8%)	51 (12.8%)	55 (13.8%)	43 (10.8%)	16 (4.0%)				
Total (%)	55 (13.8%)	96 (24.0%)	103 (25.8%)	105 (26.3%)	41 (10.3%)				

Note: Df= Degree of freedom, X^2= Chi-square, Inf= Inference, S= Significant

In table 1 above, the age has a negative significant mean difference between males and females. The mean difference in the Facial height, Facial width, Nasal height, Nasal width and Diagonal length of the mandible were all positively significant with $p<0.001$, $p=0.005$, $p=0.004$, $p<0.001$, $p<0.001$ respectively while the facial index was negatively significant($p=0.04$). The mean S.D of males were FH (128.07±7.79), FW(108.90±6.87), NH(62.75±5.26), NW(42.91±4.55), DL of mandible(97.30±7.38), FI(85.22±5.94) and that of females are FH (122.86±7.19), FW(106.71±8.60), NH(61.21±5.43), NW(40.97±3.86), DL of mandible (92.04±6.30) and FI (87±5.93).

In table 2 above, the pre-dominant facial type in the males was Eury-Prosopic(15.5%), followed by Meso-prosopic(12.0%), Lepto-prosopic(11.3%), Hyper- Euryprosopic(6.3%) and the least type was Hyper-Leptoprosopic(5.0%). For females, the least dominant is Hyper-Euryprosopic(4.0%), followed by Hyper-Leptoprosopic(8.8%), Eury-prosopic(10.8%), Lepto-prosopic(12.8%) and the most dominant facial type is Meso-prosopic. The table explained that there's significant variation (P= 0.035) among facial type of both sexes depicting that Sexual dimorphism occurs in Facial type Anthropology that was determined with the Facial index.

Table 3: *Facial parameters and test of relationship with sex.*

Variables	X^2	df	P- value	Inf.
Facial height	241.800	232	0.316	NS
Facial width	194.476	199	0.577	NS
Nasal height	182.738	174	0.310	NS
Nasal width	145.881	153	0.646	NS
Diagonal length of mandible	246.971	205	**0.024**	**S**

Note: df= Degree of freedom, X^2= Chi-square, Inf= Inference, S= Significant

In table 3 above, shows that in this study, there's no significant relationship with the Facial height, Facial width, Nasal height and Nasal width because $p>0.05$ but the Diagonal length of mandible has a positive relationship with sex ($p=0.024$).

Table 4: *The mean and standard deviation (S.D) and test of mean difference in the Odontometric parameters of males and females Okun population*

	MALE			FEMALE			T-TEST		
Variables	Mean±S.D	Min	Max	Mean±S.D	Min	Max	t-test value	p-value	Inf.
Maxillary inter-canine width(mm)	38.12±3.09	31.50	48.30	38.86±3.72	30.20	54.30	-2.185	**0.029**	**S**
Maxillary Left canine Mesiodistal width(mm)	7.41±0.80	1.80	9.90	7.0±0.80	2.10	10.10	5.313	**<0.001**	**S**
Maxillary right canine mesiodistal width (mm)	7.10±0.82	2.00	9.80	6.86±0.87	1.90	8.90	2.848	**0.005**	**S**
Maxillary inter-premolar width(mm)	45.29±3.56	36.90	59.20	46.49±3.82	35.80	62.10	-3.240	**0.001**	**S**
Mandibular inter-canine width(mm)	30.26±3.21	20.90	42.70	31.87±3.57	11.50	42.50	-4.739	**<0.001**	**S**
Mandibular left canine mesiodistal width(mm)	6.76±0.80	2.50	9.70	6.76±1.00	2.10	13.80	0.562	0.574	NS
Mandibular right canine mesiodistal width(mm)	6.60±0.78	1.90	9.70	6.66±0.96	1.80	12.40	-0.627	0.531	NS
Mandibular inter-premolar width(mm)	38.03±3.73	29.70	54.30	40.44±4.12	18.40	51.80	-6.117	**<0.001**	**S**

Note: *S.D= Standard deviation, Inf= inference, NS= Not significant, S=Significant*

In table 4, the mean difference was examined based on gender to see if there's any significant difference in the Odontometric parameters. The Maxillary inter-canine width, Maxillary inter-premolar width, Mandibular inter-canine width and Mandibular inter-premolar width all came out negatively significant unlike Maxillary left canine mesiodistal width and Maxillary right canine mesiodistal width which out positively significant($p<0.001$, $p=0.005$, $p<0.001$ respectively). There was no significant difference between the Mandibular left canine mesiodistal width and the Mandibular right canine mesiodistal width.

The Mean±S.D of the Odontometric parameters in the **Females** are Maxillary inter-canine width(38.86±3.72), Maxillary left canine mesiodistal width (7.0±0.80), Maxillary right canine mesiodistal width(6.86±0.87), Maxillary inter-premolar width(46.49±3.82), Mandibular inter-canine width(31.87±3.57), Mandibular left canine mesiodistal width(6.76±1.00), Mandibular right canine mesiodistal width(6.66±0.96), Mandibular inter-premolar width(40.44±4.12). While that of **Males** are Maxillary inter-canine width(38.12±3.09) Maxillary left canine mesiodistal width(7.41±0.80), Maxillary right canine mesiodistal width(7.10±0.82), Maxillary inter-premolar width(45.29±3.56), Mandibular inter-canine width(30.26±3.21), Mandibular left canine mesiodistal width(6.76±0.80), Mandibular right canine mesiodistal width(6.60±0.78) and Mandibular inter-premolar width(38.03±3.73).

In summary, the canines are the most significant with the males having a larger mean difference than the females.

Table 5: *Odontometric parameters and test of relationship with sex.*

Variables	X^2	df	P- value	Inf.
Maxillary Inter-canine sWidth(mm)	154.754	130	0.068	NS
Maxillary Left canine Mesiodistal Width(mm)	101.810	44	**<0.001**	**S**
Maxillary Right canine Mesiodistal Width(mm)	73.251	47	**0.008**	**S**
Maxillary Inter-premolar Width(mm)	124.302	133	0.693	NS

Mandibular Inter-canine Width(mm)	150.362	131	0.118	NS
Mandibular Left canine Mesiodistal Width(mm)	63.324	46	**0.046**	**S**
Mandibular Right canine Mesiodistal Width(mm)	68.358	47	**0.023**	**S**
Mandibular Inter-premolar Width(mm)	189.029	151	**0.019**	**S**

Note: *R= Pearson's correlation value, Inf.= Inference*, *NS= Not significant, S=Significant*

In table 5 above shows that there's a positive correlation/relationship between the Maxillary right canine mesiodistal width, Maxillary left canine mesiodistal width, Mandibular left canine mesiodistal width, Mandibular right canine mesiodistal width and Mandibular Inter-premolar width ($p=0.008$, $p<0.001$, $p=0.046$, $p=0.023$ and $p=0.019$ respectively) with no relationship in the Mandibular inter-canine width, Maxillary inter-premolar width and Maxillary inter-canine width.

DISCUSSION

Some parameters of the face have been reported to be sexually dimorphic with males having higher parameters than the females. In human populations, facial heights and facial widths on average is said to be larger in men than in women(Rostovtseva *et al.,* 2020) but in this study, facial width of the females was larger than that of the males and the facial height of the males were larger than that of the females. A prior investigation focusing on facial height across communities in Nepal determined that there are disparities in upper and lower facial height proportions based on race. However, there were no notable distinctions observed between males and females. Additionally, both upper and lower facial heights showed a proportional increase with age(Baral *et al.,* 2010).

Nasal height of previous studies variates depending on the geological and racial origins. Nasal height of females was lower than that of the males (Shah and Chavad, 2019) indicating that females have shorter nose than males which was found out to be the same in this current study where the males also have a higher nasal height than the females. Nasal heights and widths have been said to be sexually dimorphic with males having higher nasal width, height and indices (Oladipo *et al.,* 2009) similar to Anibor *et al.*(2011) where males also had higher nasal width, height and index than the females which is also similar to this study where the mean nasal width and height of males are higher than that of the females. Males had mean nasal width higher than that of the females but the nasal and height of the females were higher than the males (Oladipo *et al.,* 2009).

The diagonal length of the mandible in this study for adult males was measured at 97.30±7.38mm, while for females it was 92.04±6.30mm. This contrasts with the findings of Sharma *et al.* (2016), where males had 79.77 ± 4.68 mm and females had 73.83 ± 4.84 mm. Ongkana and Sudwan (2009) findings in the Thai population resulted in males having a diagonal length of 8.32 ± 0.52 cm and females with 7.92 ± 0.46 cm. Notably, all of these studies consistently show that the diagonal length is significantly larger in males compared to females. These variations in values could be attributed to the inclusion of different population. The facial index may be an essential factor in increasing susceptibility to obstructive sleep apnea as Europrosopic facial type favors the nasal breathing mode (Kurnia *et al.,* 2012). The facial indices of males were consistently higher than those of their female counterparts at various ages contrasting with what we have in this study where the males mean have a lesser facial index compared to the females. All measured parameters showed significant sex difference confirming the existence of sexual difference in measured facial parameters possibly due to genetic, hormonal, nutrition and other related factors.

26.3% of this current study had the Eury-prosopic facial type, 25.8% had the Meso-prosopic facial type, followed by Lepto-prosopic facial type with 12.8%, then 13.8% had the Hyper-leptoprosopic type of face and 10.3% had the Hyper-euryprosopic facial type. The commonest type of face in the males was the Eury-prosopic face and in the females was the Meso-prosopic. In general, the dominant facial type was the Eury-prosopic facial type in contrast with Okwesisli *et al.* (2019) where the Hyper-leptoprosopic facial type was the commonest in both males and females. Among Sisaala and Dagaaba adults' population in Upper west region, Ghana, the predominant face shape was hyperleptoprosopic, followed by leptoprosopic facial type (Maalman *et al.,* 2019). In previous studies, it was revealed that the Igbo people in Abakaliki exhibited a leptoprosopic facial type (Maalman *et al.,* 2019). Contrastingly, among Sindhi individuals, 45% were hyperleptoprosopic, while 46% were leptoprosopic (Oladipo *et al.,* 2010). Similarly, the prevalent facial type among the three major ethnic groups in Gombe State, Nigeria, was identified as leptoprosopic (Akinlolu *et al.,* 2015). Torres-Restrepo observed mesoprosopic and leptoprosopic types as the most common with the most dominant facial type among Africans as leptoprosopic (Torres-Restrepo *et al.,* 2014). In this study, the Mesiodistal widths of Maxillary canines and Mandibular canines were sexually dimorphic which was similar to Issrani *et al.* (2020) which discovered that the mesiodistal width of mandibular canines revealed significance to sexual dimorphism. In permanent dentition, mandibular canines are known to show the greatest sex dimorphism; hence, it has become the tooth of choice for sex estimation studies. It has been considered that the mesiodistal width of mandibular canines is the simpler method for sex prediction with a better rate of accuracy (Azevedo *et al.,* 2019). Oghenemavwe *et al.* (2022) revealed that the maxillary canine exhibits the highest degree of sexual dimorphism. This phenomenon may be attributed to a biological evolutionary trend, given its historical role in aggressive functions such as defense and prey-catching in male primates. While in modern male humans these functions are now performed by the arms and fingers, it is speculated that the significant role once held by canines in evolution is still somewhat reflected in men through the presence of larger canines (Angadi *et al.,* 2013). Additionally, a study suggests that the sexual dimorphism observed in canines may be influenced by genes associated with the timing of their formation (Guatelli-Steinberg *et al.,* 2008). Inter-canine width exhibited the highest percentage of sexual dimorphism(Alabi *et al.,* 2022). Studies have found out that mandibular canines exhibited the greatest sexual dimorphism in their MD width among all teeth (Ates *et al.,* 2006; Karaman, 2006). On the contrary, no sexual dimorphism was also reported (Boaz and Gupta, 2009; Acharya and Mainali, 2007). Least variation was also reported with maxillary canines between males and females (Khan *et al.,* 2011). Maxillary central incisors and right and left canines showed a significant difference between males and females (Srivastava *et al.,* 2014) while Al-Rifaiy *et al.* (1997) reported no significant difference between males and females. This study revealed significant sexual dimorphism in the Mandibular inter-premolar width. The Maxillary inter-canine and inter-premolar width, alongside with the Mandibular inter-canine width showed no significant dimorphism in contrast with Almugla *et al,* (2023) which found significant sexual dimorphism in the Maxillary inter-canine width. A recent study on the native Saudi Arabian population found reverse gender dimorphism(Alanazi *et al.,* 2022). Gupta *et al.* (2014) reported a higher percentage of gender dimorphism with respect to maxillary ICD.

Conclusion:

Facial width of the females was larger than that of the males and the facial height was larger in the males than the females. Females have a shorter nose than males because their nasal height were lesser than that of the males. Diagonal length of the mandibles was larger in the males than in the females. Most dominant facial type in this study was the Eury-prosopic type. All of these facial parameters showed no significant association with sexual dimorphism except the Diagonal length of the mandible and the Facial type.

Maxillary and Mandibular canines were sexually dimorphic while the Inter-canine and Inter-premolar widths were not sexually dimorphic except the Mandibular Inter-premolar width.

Therefore, facial anthropology and odontometry can be useful in forensic investigations, bio-archaeology, and the identification of human remain in mass disasters. It can also be used in various medical fields like Orthodontics & Maxillofacial surgeries. Knowledge of sexual dimorphism in craniofacial and dental structures can also lead to more effective medical interventions based on individual anatomical differences.

REFERENCES

Acharya, A.B., Mainali, S. (2007). Univariate sex dimorphism in the Nepalese dentition and the use of discriminant functions in gender assessment. *Forensic Sci Int* 173:47–56

Akinlolu, A. A., Akinola, B. O., Nurudeen, R. L., Kadiri, R. E., Ajao, M. S. (2015). Cephalometric study of mouth morphology among major Nigerian Tribes. *Anatomy Journal of Africa*, 4(1), 496 504.

Alabi, A.S., Haroon, O.F & Fadipe, O.O. (2022): A Cheiloscopic Study in Relation to Maxillary Odontometrics of Igbomina Ethnic Groups in Nigeria. *Human Biology Review*. 11(4): 301-316.

Alanazi, A. A., Almutair, A. M., Alhubayshi, A., Almalki, A., Naqvi, Z. A., Alassaf, A., Almulhim, B., Alghamdi, S. A., Mallineni, S. K. (2022). Morphometric Analysis of Permanent Canines: Preliminary Findings on Odontometric Gender Dimorphism. *International Journal of Environmental Research and Public Health*, 19, 2109.

Almugla, Y. M., Madiraju, G. S., Mohan, R., Abraham, S. (2023). Gender Dimorphism in Maxillary Permanent Canine Odontometrics Based on a Three-Dimensional Digital Method and Discriminant Function Analysis in the Saudi Population. *Applied Sciences*, 13, 9326. https://doi.org/10.3390/app13169326

Al-Rifaiy, M. Q., Abdullah, M. A., Ashraf, I., Khan, N. (1997). Dimorphism of mandibular and maxillary canine teeth in establishing identity. *Saudi Dental Journal*, 9, 17–20.

Angadi, P., Hemani, S., Achraya, A. (2013). Analyses of Odontometric sexual dimorphism and sex assessment accuracy on a larger sample. *Journal of Forensic and Legal Medicine*, 20, 673-677.

Anibor, E., Etetafia, M. O., Eboh, D. E. O., & Akpobasaha, O. (2011). Anthropometric study of the nasal parameters of the Isokos in Delta State of Nigeria. *Annals of Biological Research*, 2(6), 408-413. http://scholarsresearchlibrary.com/archive.html

Anuthama, K., Shankar, S., Ilayaraja, V., Kumar, G. S., Rajmohan, M., and Vignesh. (2011). Determining dental sex dimorphism in South Indians using discriminant function analysis. *Forensic Science International*, 212(1-3), 86-89.

Ates, M., Karaman, F., Iscan, M. Y., Erdem, T. L. (2006). Sexual differences in Turkish dentition. *Legal Medicine (Tokyo)*, 8, 288–92.

Azevedo, A., Pereira, M. L., Gouveia, S., Tavares, J. N., Caldas, I. M. (2019). Sex estimation using the mandibular canine index components. *Forensic Science, Medicine, and Pathology*, 15(2), 191–7. doi:10.1007/s12024-018-0051-2.

Bailey, S. E., & Lynch, J. M. (2005). Diagnostic differences in mandibular P4 shape between Neandertals and anatomically modern humans. *American Journal of Physical Anthropology, 126*(3), 268–277.

Baral, P., Lobo, S. W., Menezes, R. G., Kanchan, T., Krishan, K., & Bhattacharya, S. (2010). An anthropometric study of facial height among four endogamous communities in the Sunsari district of Nepal. *Singapore Medical Journal*, 51(3), 212-215.

Bigoni, L., Velemínská, J., and Brůžek, J. (2010). Three-dimensional geometric morphometric analysis of cranio-facial sexual dimorphism in a Central European sample of known sex. *HOMO—Journal of Comparative Human Biology*, 61(2010), 16–32.

Boaz, K., Gupta, C. (2009). Dimorphism in human maxillary and mandibular canines in the establishment of gender. *Journal of Forensic Dental Sciences*, 1, 42–4.

Candramila, W., Sumarsono, S. H., Surybroto, B., Pereira, M., & Moeis, M. R. (2014). Face shape variation among Sundanese people from Western Java, Indonesia. *Hayati Journal of Biosciences*, 22(1), 34-40.

Carlos, S., Alicia, P., Laise, N. C., Luiz, F. J., Eduardo, D., & Eduardo, D. J. (2012). Sex determination in Uruguayans by odontometric analysis. *Brazilian Journal of Oral Sciences*, 11(3), 381-386.

Geniole, S. N., Denson, T. F., Dixson, B. J., Carré, J. M., McCormick, C. M. (2015). Evidence from meta-analyses of the facial width-to-height ratio as an evolved cue of threat. *PLoS ONE*, 10(doi:10.1371/journal.pone.0132726).

Gopinath, T., Ganesh, S., Subramani, V. N., Narasimhan, M. (2021). Role of facial index and odontometric parameters in the establishment of stature and gender of individuals. *J Pharm Bioall Sci*, 13, S1068-73.

Guatelli-Steinberg, D., Sciulli, P. W., Betsinger, T. K. (2008). Dental crown size and sex hormone concentrations: Another look at the development of sexual dimorphism. *American Journal of Physical Anthropology*, 137, 324–333.

Gupta, S., Chandra, A., Gupta, O. P., Verma, Y., Srivastava, S. (2014). Establishment of gender dimorphism in North Indian population by odontometric study of permanent maxillary canine. *Journal of Forensic Research*, 5, 224.

Holton, N. E., Alsamawi, A., Yokley, T. R., and Froehle, A. W. (2016). The ontogeny of nasal shape: An analysis of sexual dimorphism in a longitudinal sample. *Am J Phys Anthropol*, 160(1), 52-61.

Issrani, R., Iqbal, A., Alam, M. K., Prabhu, N. (2020). 3D CBCT Analysis of Odontometric Variables for Gender Dimorphism in Saudi Arabian Subpopulation. *Indian Journal of Forensic Medicine and Toxicology*, 14, 1873.

Jeremić, D., Kocić, S., Vulović, M., Sazdanović, M., Sazdanović, P., Jovanović, B., et al. (2013). Anthropometric study of the facial index in the population of central Serbia. *Arch. Biol. Sci*., 65(3), 219–221.

Kanwar, R., Gajbhiye, N., Dhakar, J. S., and Kanwar, I. S. (2021). Sex Determination of Dry Human Mandible Using Metrical Parameters in Mahakaushal Region of Madhya Pradesh, India: A Cross-sectional Study. *International Journal of Anatomy Radiology and Surgery*, 10(4), AO65-AO69.

Karaman, F. (2006) Use of diagonal teeth measurements in predicting gender in a Turkish population. *J Forensic Sci* 51:630–635

Khan, S. H., Hassan, G. S., Rafique, T., Hasan, M. N., Russell, M. S. (2011). Mesiodistal crown dimensions of permanent teeth in Bangladeshi population. *Bangabandhu Sheikh Mujib Medical University Journal*, 4, 81–7.

Kramer, R. S. S. (2017). Sexual dimorphism of facial width-to-height ratio in human skulls and faces: A meta-analytical approach. *Evolution and Human Behavior, 38*(3), 414–420.

Kurnia, C., Susiana, S., & Husin, W. (2012). Facial indices in Chinese ethnic students aged 20–22. *Journal of Dentistry Indonesia*, 19(1), 1–4.

Litha, Girish, H. C., Murgod, S., & Savita, J. K. (2017). Gender determination by odontometric method. *Journal of Forensic Dental Sciences, 9*(1), 44.

Liu, J., Liu, Y., Wang, J., Ge, S., Zhang, Y., Wang, X., Du, L., & He, H. (2021). Permanent Maxillary Odontometrics for Sex Estimation Based on a 3-Dimensional Digital Method. *Medical Science Monitor*, 27, e933450. https://doi.org/10.12659/MSM.933450

Maalman, R. S., Abaidoo, C. S., Darko, N. D., and Tetteh, J. (2019). Facial types and morphology: A study among Sisaala and Dagaaba adult population in the Upper West Region, Ghana. *Scientific African*, 3(2019), e000071.

Marin, V., Zeljko, D., Vera, N., Jadranka, K., & Hrvoje, B. (2017). Odontometrics: a useful method for sex determination in an archaeological skeletal population. *Journal of Archaeological Science*, 34(6), 905-913.

Ngeow, W. C., and Aljunid, S. T. (2009). Craniofacial anthropometric norms of Malaysian Indians. *Indian Journal of Dent Res*, 20(3), 313–318.

Oettlé, A. C., Pretorius, E., Steyn, M. (2009). Geometric morphometric analysis of the use of mandibular gonial eversion in sex determination. *Homo - Journal of Comparative Human Biology*, 60, 29–43.

Oghenemavwe, L. E., Oyakhire, M. O., & Onwugbufor, U. E. (2022). Sex and Stature Estimation from Odontometric Parameters of Kalabari Ethnic Group in Rivers State, Nigeria. *European Journal of Dental and Oral Health, Online First*, 2684-4443. https://doi.org/10.24018/ejdent.2022.3.2.156

Okwesili, O. R., Obikili, E. N., and Achebe, J. U. (2019). Facial index among Igbo children and adolescents in Enugu. *Biomedical Research*, 30(6), 845-850.

Oladipo, G., Gabriel, A., & Fawehinmi, H. (2009). The study of nasal parameters (nasal height, nasal width, nasal index) amongst the Yorubas of Nigeria. *Internet Journal of Biological Anthropology*, 3.

Oladipo, G. S., Isong, E. E., Okoh, P. D. (2010). Facial, nasal, maxillary, mandibular and oro-facial heights of adult Ibibios of Nigeria. *Australian Journal of Basic and Applied Sciences*, 4(12), 6306–6311.

Omotoso, D. R., Oludiran, O. O., Sakpa, C. L. (2011). Nasofacial anthropometry of adult Bini tribe in Nigeria. *Afr. J. Biomed. Res*., 14(3), 219–221.

Ongkana, N., and Sudwan, P. (2009). Gender difference in Thai mandibles using metric analysis. *Chiang Mai Med J*, 48(2), 43-48.

Palagiri, L. P., Suresh, P., and Srinivasan, K. (2020). Anthropometric Study of The Facial (Prosopic) Indices: A Proof for Gender Dimorphism. *J Dent Educ*, 13(2), 53–59.

Prabhu, S., Acharya, A.B. (2009). Odontometric sex assessment in Indians. *Forensic Sci Int* 192:129.e1–129.e5

Robertson, J. M., & Kingsley, B. E. (2018). Sexually dimorphic faciometrics in black racial groups from early adulthood to late middle age. *Evolutionary Psychology, 16*(1), 1–8. https://doi.org/10.1177/1474704918811056

Rostovtseva, V.V., Mezentseva, A.A., Windhager, S., Butovskaya, M.L. (2020). Sexual dimorphism in facial shape of modern Buryats of Southern Siberia. *Am J Hum Biol*. 2020; e23458.

Scendoni, R., Kelmendi, J., Arrais Ribeiro, I. L., Cingolani, M., De Micco, F., Cameriere, R. (2023). Anthropometric analysis of orbital and nasal parameters for sexual dimorphism: New anatomical evidences in the field of personal identification through a retrospective observational study. *PLoS ONE*, 18(5), e0284219.

Shah, S. B., and Chavada, S. (2019). Study of Nasal Height for Sexual Dimorphism in 18-30 Years age Group People in Bhavanagr City of Gujarat. Acad. *Anat. Int. 2019*;5(1), 71-73.

Shankar, S., Anuthama, K., Kruthika, M., Kumar, V. S., Ramesh, K., Jaheerdeen, A., and Yasin, M. M. (2013). Identifying sexual dimorphism in a paediatric South Indian population using stepwise discriminant function analysis. *Journal of Forensic and Legal Medicine*.

Shanmukha, V. V., Dhananjay, K., Neel, K. A. (2021). A cross-sectional study of facial index in Western Uttar Pradesh population between 18-25 years of age. *Asian Journal of Medical Sciences*, 12(6), 95-100.

Sharma, M., Gorea, R. K., and Gorea, A. (2015). A morphometric study of the human mandible in Indian populations for sex determination. *Egypt J Forensic Sci*.

Sharma, M., Gorea, R. K., Gorea, A., & Abuderman, A. (2016). A morphometric study of the human mandible in the Indian population for sex determination. *Egyptian Journal of Forensic Sciences, 6*(2), 165–169. https://doi.org/10.1016/j.ejfs.2015.01.002

Sharma, S., Dinkar, A. D., & Bedi, S. (2014). Odontometric sexual dimorphism: A sibling correlation. *Journal of Clinical and Diagnostic Research, 8*(3), 233–235.

Srivastava, R., Jyoti, B., Jha, P., Gupta, M., Devi, P., Jayaram, R. (2014). Gender determination from the mesiodistal dimension of permanent maxillary incisors and canines: An odontometric study. *Journal of Indian Academy of Oral Medicine and Radiology*, 26, 287–92.

Stirrat, M., Perrett, D.I. (2010). Valid facial cues to cooperation and trust: male facial width and trustworthiness. *Psychological science*. 2010;21(3):349– 54.

Tanikawa, C., Zere E., Takada, K. (2016). Sexual dimorphism in the facial morphology of adult humans: a three-dimensional analysis. *Homo. 2016*;67(1):23–49.

Thapar, R., Angadi, P. V., Hallikerimath, S., and Kale, A. D. (2012). Sex assessment using odontometry and cranial anthropometry: evaluation in an Indian sample. *Forensic Sci Med Pathol*, 8(1), 94-100.

Torres-Restrepo, A. M., Quintero-Monsalve, A. M., Giraldo-Mira, J. F., Rueda, Z. V., Vélez-Trujillo, N., Botero-Mariaca, P. (2014). Agreement between cranial and facial classification through clinical observation and anthropometric measurement among envigado school children. *BMC Oral Health*, 14(1), 50.

Vidya, C. S., Prashantha, B., and Gangadhar, M. R. (2012). Anthropometric Predictors for Sexual Dimorphism of Skulls of South Indian Origin. *International Journal of Scientific and Research Publications*, 2(10), 1–4.

Weston, E. M., Friday, A. E., Johnstone, R. A., Schrenk, F. (2004). Wide faces or large canines? The attractive versus the aggressive primate. *Proceedings of the Royal Society B*, 271(Suppl. 6), S416–S419. (doi:10.1098/rsbl.2004.0203).

Yoo, H. I., Yang, D. W., Lee, M. Y., et al. (2016). Morphological analysis of the occlusal surface of maxillary molars in Koreans. *Archives of Oral Biology*, 67, 15–21.

Yousef, H., Alhajj, M., and Sharma, S. (2022). Anatomy, Skin (Integument), Epidermis. *In StatPearls. StatPearls Publishing.*