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Philtral Column and Nostril Shape Morphology and Their Association among Isoko Adults in Delta State, Nigeria

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ABSTRACT

Aim: The goal of this study is to characterise philtral column and nostril shape morphology among Isoko adults in Delta State, Nigeria; and to determine their association and gender-related variation.

Materials and Methods: A descriptive cross-sectional study design was employed, involving 200 healthy male and female Isoko participants aged 18–80 years, selected using cluster sampling. Ethical approval was obtained, and informed consent was secured from all participants. Philtral length and width were measured directly with a digital vernier caliper, while philtral column type and nostril shape were classified from standardised facial photographs. Statistical analysis was performed using the Statistical Package for the Social Sciences, version 25, with significance set at $p < 0.05$.

Results: The parallel philtral type (38.0%) and the teardrop nostril shape (68.0%) were the most common. A significant association was found between philtral type and nostril shape ($p < 0.001$), with parallel philtra co-occurring mainly with teardrop nostrils (93.4%) and flat philtra with round nostrils (73.0%). Philtral type was significantly associated with sex ($p = 0.032$). Males had significantly greater philtral length (15.62 ± 1.95 mm) and width (13.99 ± 1.25 mm) than females (13.61 ± 1.93 mm and 13.21 ± 1.08 mm) with $p < 0.001$.

Conclusion: The study reveals clear morphological patterns in the philtrum and nostrils of the Isoko population, a strong association between the two features, and notable gender differences in philtral type and dimensions.

INTRODUCTION

The human face is a critical marker of individual identity, ethnic heritage and developmental status, and facial morphology plays an important role in social interaction, clinical assessment and forensic identification (Sforza *et al.*, 2009). Among the structures that define facial proportion and aesthetics, the philtrum and nostrils occupy an important position within the upper lip-nose complex (Abdulrasheed and Eneye, 2013).

The philtrum is the vertical groove extending from the base of the nose to the upper vermilion border, bounded laterally by the philtral columns (Mori *et al.*,

2005). The four known types of philtral column are: triangular, parallel, concave and flat (Mori *et al.*, 2005). The flat type is a recognised diagnostic criterion in dysmorphology, including fetal alcohol spectrum disorders (Astley and Clarren, 2001). The nostril shape morphology is categorized into four types which include teardrop, round, triangular and rectangular (Abdulrasheed and Eneye, 2013); which likewise varies across ethnic groups and is influenced by genetic, developmental and environmental factors (Etoz *et al.*, 2008), with direct relevance to facial aesthetics and to reconstructive and forensic practice (Porter and Olson, 2001; Kishi *et al.*, 2012).

African populations exhibit facial characteristics, including broader nasal bases and distinct philtral

configurations, that differ from those of other populations (Omotoso *et al.*, 2011), and Nigeria’s ethnic diversity produces further variation in facial morphology (Iloanusi *et al.*, 2022). Reference standards used in clinical and forensic practice are frequently derived from non-African populations and may not represent Nigerian ethnic groups (Adeiza *et al.*, 2022), which can lead to normal anatomical variation being misinterpreted as pathological (Osaguona *et al.*, 2022).

Previous Nigerian studies have largely examined general nasal parameters across ethnic groups (Anibor *et al.*, 2011; Eboh, 2011; Oladipo *et al.*, 2009), with little attention to philtral column and nostril shape morphology, particularly among the Isoko. This study therefore sought to characterise philtral column and nostril shape morphology among Isoko adults, examine the association between the two, and determine gender-related variation.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted among adult male and female Isoko subjects at Ozoro in Delta State, Nigeria. Approval for commencement of the study was obtained from the Research and Ethics Committee, Department of Human Anatomy and Cell Biology, Delta State University, Abraka, and informed consent was obtained from each participant prior to data collection.

RESULTS

Table 1: Gender distribution of the studied sample

Gender	Frequency	Percentage (%)
Male	95	47.5
Female	105	52.5
Total	200	100

Table 1 shows the gender distribution of the sample, with 95 males (47.5%) and 105 females (52.5%).

Table 2: Philtral types of the studied sample

Philtral type	Frequency	Percentage (%)
Concave	55	27.5
Parallel	76	38.0
Triangular	32	16.0
Flat	37	18.5
Total	200	100

Table 2 shows that the parallel philtral type was the most prevalent (38.0%), followed by concave (27.5%) and flat (18.5%), while the triangular type was the least prevalent (16.0%).

A total of 200 participants (95 males and 105 females) were selected using cluster sampling, with sample size determined using Araoye’s (2004) formula. Inclusion criteria were adults of Isoko origin (both parents and grandparents) with no visible facial deformity, who gave informed consent. Exclusion criteria were individuals of non-Isoko origin and those with a history of facial trauma, surgery or congenital facial abnormality.

Data were collected in the month of June, 2026 using a structured data sheet, a digital sliding vernier caliper and a flexible ruler. Philtral length and width were obtained by direct measurement, while philtral column type (concave, parallel, triangular or flat (Astley and Clarren, 2001) and nostril shape (teardrop, round, rectangular or triangular (Abdulrasheed and Eneye, 2013) were classified from standardised frontal photographs.

The Statistical Package for the Social Sciences (SPSS), version 25 was used to analyse the data. The chi-square test was used for the categorical variables (philtral type, nostril shape and sex), with Fisher’s Exact Test and Monte Carlo simulation used to verify results where more than 20% of cells had expected counts below 5. The independent-samples t-test was used for the continuous variables (philtral length and width). A p-value of less than 0.05 was deemed statistically significant.



Figure 1: Pictures of philtral shape classification. (1) triangular (2) parallel (3) concave (4) flat (Abdulrasheed and Eneye, 2013).

Table 3: Nostril shapes of the studied sample

Nostril shape	Frequency	Percentage (%)
Teardrop	136	68.0
Round	47	23.5
Rectangular	13	6.5
Triangular	4	2.0
Total	200	100

As seen in Table 3, the teardrop nostril shape was the most prevalent (68.0%), followed by round (23.5%) and rectangular (6.5%), while the triangular shape was the least prevalent (2.0%).

Table 4: Descriptive statistics of parameters

Parameter	N	Minimum	Maximum	Mean $\pm$ SD
Age (years)	200	18	80	33.78 $\pm$ 11.22
Philtral length (mm)	200	9.00	21.00	14.57 $\pm$ 2.18
Philtral width (mm)	200	10.43	16.50	13.58 $\pm$ 1.23

Table 4 showed that participants ranged in age from 18 to 80 years (33.78 $\pm$ 11.22 years). Philtral length ranged from 9 to 21 mm (mean 14.57 $\pm$ 2.18 mm) and philtral width from 10.43 to 16.50 mm (mean 13.58 $\pm$ 1.23 mm).

Table 5: Chi-square tests of association between philtral type and nostril shape

Test	Value	df	p-value
Pearson Chi-Square	108.09	9	<0.001*
Likelihood Ratio	117.13	9	<0.001*
Fisher's Exact Test	108.27	—	<0.001*
Linear-by-Linear Association	20.31	1	<0.001*
N of Valid Cases	200		

* p value is statistically significant.

Table 5 revealed a significant association between philtral type and nostril shape ($\chi^2(9, N = 200) = 108.09, p < 0.001$), with a significant linear-by-linear trend. Fifty percent of cells had an expected count below 5 (minimum expected count = 0.64); Fisher's Exact Test and Monte Carlo simulation confirmed the association at $p < 0.001$.

Table 6: Cross-tabulation of philtral type by nostril shape

Philtral type / Nostril shape	Teardrop	Round	Rectangular	Triangular	Total
Concave	36 (65.5%)	19 (34.5%)	0 (0.0%)	0 (0.0%)	55 (100%)
Parallel	71 (93.4%)	0 (0.0%)	3 (3.9%)	2 (2.6%)	76 (100%)
Triangular	22 (68.8%)	1 (3.1%)	8 (25.0%)	1 (3.1%)	32 (100%)
Flat	7 (18.9%)	27 (73.0%)	2 (5.4%)	1 (2.7%)	37 (100%)
Total	136 (68.0%)	47 (23.5%)	13 (6.5%)	4 (2.0%)	200 (100%)

Table 6 shows that teardrop nostrils were most frequent among participants with parallel (93.4%) or concave (65.5%) philtra, round nostrils among those with flat philtra (73.0%), and rectangular nostrils were most strongly associated with triangular philtra (25.0%). Percentages are row percentages.

Table 7: Association between gender and philtral type

Gender	Philtral type	Frequency	Percentage (%)	p-value
Male	Parallel	60	63.2	0.032*
	Concave	23	24.2	
	Flat	12	12.6	
Female	Parallel	48	45.7	
	Concave	32	30.5	
	Flat	25	23.8	

* p value is statistically significant. Highlighted label is flagged for author verification (see text of Table 7 below) and should be cleared once confirmed.

Table 7 revealed a significant association between gender and philtral type ($\chi^2(2, N = 200) = 6.89, p = 0.032$). Males more often had the parallel type (63.2% versus 45.7%), while females more often had the concave (30.5% versus 24.2%) and flat (23.8% vs. 12.6%) types. Triangular and parallel types were combined into one category for this test because of low expected cell counts.

Table 8: Distribution of nostril shape by gender

Nostril shape	Male n (%)	Female n (%)	Total n (%)
Teardrop	69 (72.6)	67 (63.8)	136 (68.0)
Round	16 (16.8)	31 (29.5)	47 (23.5)
Rectangular	8 (8.4)	5 (4.8)	13 (6.5)
Triangular	2 (2.1)	2 (1.9)	4 (2.0)
Total	95 (100)	105 (100)	200 (100)

Table 8 shows that teardrop nostrils were the most common shape in both males (72.6%) and females (63.8%), while round nostrils were more frequent in females (29.5%) than in males (16.8%). Percentages are column percentages; no chi-square test was computed for this cross-tabulation.

Table 9: Gender differences in philtral length and width

Parameter	Gender	N	Mean $\pm$ SD	t-test	p-value
Philtral length (mm)	Male	95	15.62 $\pm$ 1.95	7.32	<0.001*
	Female	105	13.61 $\pm$ 1.93		
Philtral width (mm)	Male	95	13.99 $\pm$ 1.25	4.77	<0.001*
	Female	105	13.21 $\pm$ 1.08		

* p value is statistically significant.

Table 9 revealed that males had significantly greater philtral length and philtral width than females ($df = 198$, $p < 0.001$ for both).

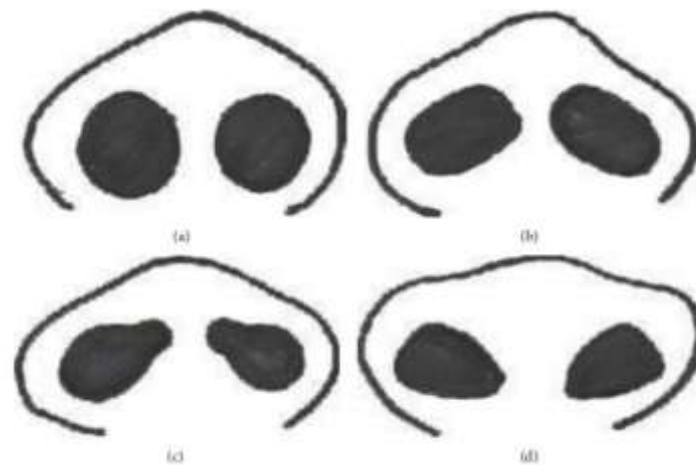


Figure 2: Diagram of nostril shape. (a) round (b) rectangular (c) teardrop (d) triangular (Abdulrasheed and Eneye, 2013).

DISCUSSION

The parallel philtral configuration was the most predominant type in this adult Isoko sample (38.0%), followed by concave (27.5%), flat (18.5%) and triangular (16.0%) types. This contrasts with Abdulrasheed and Eneye (2013), who found the triangular type overwhelmingly predominant (72%) among Nigerian children aged 5–6 years. The difference plausibly reflects age-related changes in facial soft tissue, as pubertal growth, subcutaneous fat redistribution and maturation of the orbicularis oris complex are likely to alter philtral column prominence and orientation from childhood to adulthood. The predominance of the parallel type is, however, directionally consistent with Mori *et al.* (2005), who reported the parallel configuration as the most common type (51.4%) in Japanese subjects. The comparatively low prevalence of flat philtra (18.5%) is of clinical relevance, since flat or poorly defined philtra are a recognised diagnostic feature of fetal alcohol spectrum disorders (Astley and Clarren, 2001; Hoyme *et al.*, 2005).

For nostril shape, the teardrop form predominated (68.0%), followed by round (23.5%), rectangular (6.5%) and triangular (2.0%) shapes. This pattern is broadly consistent with descriptions of West African nasal morphology characterised by wider nasal bases and pronounced alar flare (Anibor *et al.*, 2011; Omotoso *et al.*, 2011), which tend to appear externally as rounded or teardrop-shaped rather than sharply triangular nostril apertures. It is also consistent with the broad (platyrrhine) nasal indices reported among other Nigerian ethnic groups (Eboh, 2011; Oladipo *et al.*, 2009), although nasal index and nostril shape are

distinct measures and the correspondence should be interpreted cautiously.

A highly significant association was found between philtral type and nostril shape ($p < 0.001$), with a significant linear-by-linear trend. Parallel philtra were overwhelmingly associated with teardrop nostrils (93.4%), flat philtra with round nostrils (73.0%) and, to a lesser extent, triangular philtra with rectangular nostrils (25.0%). This coupling is plausibly explained by shared embryological origins: the intermaxillary segment gives rise to both the philtrum and the columella, while the lateral nasal processes merge with the maxillary process to form the alar base and lateral nostril borders (Som and Naidich, 2013; Rice, 2020). The insertion of the orbicularis oris and levator labii superioris alaeque nasi muscles may influence both philtral column tension and the lateral pull on the nostril sill (Gasser, 1967), so that a parallel alignment of the philtral ridges may be biomechanically linked to a broader, teardrop-shaped nostril aperture.

Philtral type also differed significantly by gender ($p = 0.032$), with males more often presenting the parallel type and females more often the concave and flat types. For nostril shape, the teardrop form predominated in both sexes, but round nostrils were more frequent in females (29.5%) than males (16.8%); this difference was descriptive only, as no formal test was computed. Males also had significantly longer and wider philtra than females ($p < 0.001$), consistent with the larger craniofacial and soft-tissue dimensions generally reported in males, which have been attributed in part to the influence of testosterone during pubertal growth (Esomonu *et al.*, 2013; Sforza *et al.*, 2009; Ferrario *et al.*, 1999). The mean philtral length in this sample (14.57 mm) falls within the

reported normative range of 13–18 mm (Zankl *et al.*, 2002), while providing population-specific baseline values for the Isoko people in Southern Nigeria.

CONCLUSION

This study has demonstrated clear morphological patterns in philtral columns and nostril shapes within the Isoko population. The parallel philtral type and the teardrop nostril shape predominated, and a statistically significant association was found between the two features. Philtral type differed significantly by gender, and males had significantly longer and wider philtra than females. These findings provide baseline anthropometric norms with potential application in reconstructive and cosmetic surgery, dysmorphology assessment and forensic facial identification among the Isoko population.

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