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Nasal Morphometry and Its Relationship with Palpebral Fissure Shape Across Nationalities: An Anthropometric Study

Morfometría Nasal y su Relación con la Forma de la Fisura Palpebral en Distintas Nacionalidades: Un Estudio Antropométrico

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SUMMARY: Although both nasal indices and palpebral fissure parameters have been individually studied across populations, little is known about their interrelationship, which may be of importance in aesthetic, forensic, and surgical contexts. This study aimed to investigate nasal morphometry and its relation to palpebral fissure dimensions across eight nationalities. A cross-sectional study was conducted among 240 healthy students (30 per nationality, aged 18-25). Nasal height and width were measured using vernier callipers; palpebral fissure dimensions were measured using a ruler. Statistical analysis was conducted using SPSS, employing ANOVA and Spearman's correlation tests. The mean nasal index across the sample was 74.9 + 13.2, with 67.9 % mesorrhine, 26.3 % platyrrhine and 5.8 % leptorrhine. Filipinos had significantly higher NI (85.9 + 7.2; $p<0.001$), placing them predominantly in the platyrrhine category. A weak but significant negative correlation was found between nasal index and left palpebral fissure length ($r=-0.145$, $p=0.025$). No significant correlations were observed for other palpebral dimensions. The findings reveal a subtle but meaningful interrelationship between nasal structure and ocular morphology, with implications for population-specific morphometric standards in clinical and aesthetic interventions.

KEY WORDS: Nasal Morphometry; Palpebral Fissure; Anthropometry.

INTRODUCTION

Facial morphometry reflects a complex interplay of genetic and environmental factors and is a key focus in anthropology, forensic science and clinical practice (Laland, 2008). Among all the different features of the face, the eyes and nose contribute distinctly towards the facial image, which shapes both the aesthetic perception and cultural identity. Under the domain of plastic surgery, forensic science, and anthropological research, these features have gathered attention for their significance in both clinical and reconstruction settings (Uzun & Özdemir *et al*., 2014).

The shape of the nose gives a hint about one's nationality, race, age, and sex (Broer *et al*., 2014). Nasal morphometry, the quantitative study of nasal dimensions, uses parameters such as nasal width and height to calculate the nasal index (NI) (Jasuja *et al*., 2023). This is a key indicator used to classify nose types such as leptorrhine, mesorrhine, and platyrrhine, each with a nasal index of <60, 60-80, and >80, respectively (Furtado, 2016). This classification system, introduced by Topinard in the late 19th century, remains foundational in both medical and anthropological analyses (Deulkar *et al*., 2023). Studies such as those shown by Farkas *et al*. (2005) have stated how the nasal morphology varies significantly across different countries, with broader and shorter noses more common in tropical regions (platyrrhine) and narrower, higher noses in colder regions (leptorrhine)- are interpreted as adaptations to climate.

Beyond the biological perspectives, the cultural nuances frame how these traits are perceived and changed. Maassarani *et al*. (2023) noted that Gulf patients prefer a rise in the nasal dorsum, while patients in other regions like Turkey or Lebanon may be more in favour of tip projection, revealing minute regional differences in nasal beauty. Similarly, Schwitzer *et al*. (2015), demonstrated reduced postoperative satisfaction among non-Caucasian women who had received rhinoplasty, highlighting racial sensitivity as an important factor in cosmetic surgery.

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Parallel to the nasal analysis is the palpebral fissure, which is the elliptical space between the open eyelids. Palpebral fissure parameters (height, width and inclination) are essential in clinical and forensic contexts (Vasanthakumar *et al*., 2013). Understanding the diversity of these parameters across ethnicities is crucial in improving surgical outcomes and enhancing forensic and anthropological analysis.

Previous studies report variability in palpebral dimensions by somatotype, gender and head position (Nishioka *et al*., 2019; Karaketir *et al*., 2024). Such findings reiterate the need for population-specific anthropometric standards in planning facial surgeries. This knowledge will then allow the surgeons to make precise modifications while respecting the natural relationships between facial parameters.

Despite these advances, a significant gap remains while both nasal and ocular morphometrics are independently well-characterised; the relationship between these two key facial features remains largely unexplored. This study seeks to fill that void by investigating nasal morphometry and its relationship to palpebral fissure shape among different nationalities.

Therefore, this study aimed to 1. Compare nasal morphometry across eight nationalities, and 2. Examine potential correlation between nasal morphometry and palpebral fissure dimensions, thereby addressing the limited evidence on their interrelationship.

MATERIAL AND METHOD

Study Design and Ethics

This cross-sectional study was conducted on 240 students (aged 18-25) from Gulf Medical University, Ajman, UAE. Ethical Approval was obtained by the Institutional Review Board (IRB-COM-STD-17-JULY-2024), and written informed consent was obtained from all participants.

Study Population

Participants represented eight nationalities (30 healthy individuals per group, total n=240). Both sexes were included.

Exclusion criteria: Candidates with severe facial deformities, individuals of mixed ethnic backgrounds, and those who had undergone prior nasal or intraocular surgical procedures were excluded from the study.

Standardise Measurement Procedures

All facial measurements were recorded under standard conditions, using direct anthropometry for precision. Subjects were seated upright with their head in a natural resting position and their eyes fixed on a distant target to prevent variation due to the mobility of facial muscles.

The palpebral fissure measurements were taken with a ruler to measure palpebral fissure height and width bilaterally. Eye measurements were obtained while subjects fixed their gaze on a distant point. The measurements were recorded in cm. (Fig. 1A-1B).

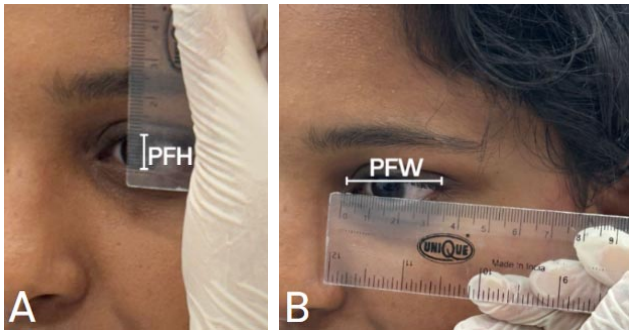

Fig. 1A. PFH being measured, Fig. 1B. PFW being measured. (PFH-palpebral fissure height, PFW- palpebral fissure width).

Nasal height (nasion to subnasale) and nasal width (alae to alae) were measured using a digital vernier caliper (accuracy 0.01mm). Palpebral fissure length (endocanthion to exocanthion) and height (upper to lower lid margin at the pupil center) were measured bilaterally with a transparent ruler.

For the outer borders of the nostrils, the measurements were recorded in mm/inches (Fig. 2A-2B).

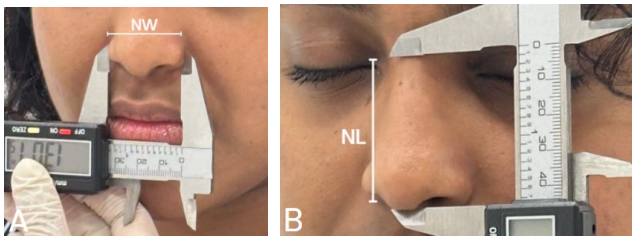

Fig. 2A. NW being measured, Fig. 2B. NL being measured. (NL-nasal length, NW- nasal width).

From these values, the nasal index (NI) was calculated using the standard formula: NI = (Nasal Width/Nasal Height) × 100. Based on the calculated nasal index, the subjects were divided into three types: Leptorrhine, with a value of less than 60 %; Mesorrhine, between 60 and 80 %; and Platyrrhine, with a value greater than 80 %.

To minimise observer bias, two independent investigators recorded each measurement twice. The average of the two values was used for analysis. Interobserver agreement was not statistically assessed and is acknowledged as a study limitation.

Data Analysis

The data were analysed using the SPSS software. Normality of distributions was tested using the Shapiro-Wilk test, and homogeneity of variances was assessed with Levene's test. One-way ANOVA with Bonferroni post-hoc correction was applied to compare nasal indices across nationalities. Spearmann's correlation coefficient was used to assess relationships between nasal indices and palpebral fissure parameters. Statistical significance was set at $p<0.05$.

RESULTS

This study included a total of 240 participants from eight different nationalities, with 30 participants in each group. The average nasal index across the entire sample was 74.89 ± 13.20 (Table I), indicating that most participants had the mesorrhine type of nose. A breakdown of nasal types showed that 67.9 % of participants were mesorrhine, 26.3 % were platyrrhine, and 5.8 % were leptorrhine.

The descriptive statistics revealed variation in nasal index across nationalities (Table I). The Philippines had the highest mean NI at 85.99 ± 7.20, indicating a predominantly platyrrhine nasal type. In contrast, participants from the UAE exhibited narrower nasal features (67.86 ± 7.96) bordering on the leptorrhine type. Other nationalities, including India, Egypt, Pakistan, Iraq, Syria and Kuwait, fell within the mesorrhine range with minor intergroup differences.

Comparative Analysis across Nationalities:

A one-way ANOVA test confirmed a statistically significant difference in nasal index among the eight nationalities ($p <0.001$) (Table II). Subsequently, the Post Hoc (Bonferroni) Testing indicated that the Filipino participants had significantly higher nasal index values (Table III) compared to several other groups, particularly Iraqis, Kuwaitis, Syrians, and UAE nationals.

No statistically significant differences were observed among other nationalities (Egypt vs. India, Iraq vs. Kuwait, and Syria *vs.* UAE).

Correlation between Nasal Index and Palpebral Fissure

The Spearman's correlation test was conducted to examine the relationship between the Nasal Index and different Palpebral Fissure (PF) measurements (Table IV).

A weak but statistically significant negative correlation was found between the nasal index and left palpebral fissure length ($r= -0.145$, $p= 0.025$), suggesting that a higher nasal index (broader nose) was associated with a slightly shorter left PF length.

No significant correlations were found between nasal index and other PF parameters, including left PF width, right PF length, and right PF width ($p > 0.05$).

Table I. Descriptive statistics of nasal index across eight nationalities.

	N	Mean	Standard Deviation	Standard Error	95 % CI for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Egypt	30	76.17	20.07	3.66	68.68	83.67	56.26	165.56
India	30	77.47	7.80	1.42	74.56	80.39	64.75	99.35
Iraq	30	73.89	20.34	3.71	66.30	81.49	61.35	176.92
Kuwait	30	71.32	10.30	1.88	67.47	75.17	41.87	86.79
Pakistan	30	74.63	8.98	1.64	71.28	77.99	59.66	98.64
Philippines	30	85.99	7.19	1.31	83.30	88.68	75.00	102.10
Syria	30	71.77	6.69	1.22	69.27	74.27	56.68	88.50
UAE	30	67.85	7.95	1.45	64.88	70.83	55.84	85.55
Total	240	74.89	13.20	.85	73.21	76.57	41.87	176.9

Table II. Comparison of nasal indices within and between groups. (df- degree of freedom).

Source of Variation	Sum of Squares	df	Mean Square	Significance Value (p)
Between Groups	6136.46	7	876.638	.000
Within Groups	35522.37	232	153.114	-
Total	41658.84	239	-	-

Table III. Comparison between the mean differences in nasal indices between the nationalities.

Nationality		Mean Difference	Significance Value (p)
Iraq		-12.10	0.005
Kuwait		-14.67	0.000
Pakistan	Philippines	-11.35	0.013
Syria		-14.22	0.000
UAE		-18.13	0.000

Table IV. Correlation between the nasal index and the different palpebral fissure parameters.

Spearman's rho		Nasal Index	Left PF Length	Left PF Width	Right PF Length	Right PF Width
Nasal Index	r	1.000	-.145*	-.032	-.117	-.037
	Sig. (2-tailed)	.	.025	.627	.071	.567
Left PF	r	-.145*	1.000	.292**	.759**	.285**
	Sig. (2-tailed)	.025	.	.000	.000	.000
Left PF	r	-.032	.292**	1.000	.275**	.848**
	Sig. (2-tailed)	.627	.000	.	.000	.000
Right PF	r	-.117	.759**	.275**	1.000	.233**
	Sig. (2-tailed)	.071	.000	.000	.	.000
Right PF	r	-.037	.285**	.848**	.233**	1.000
	Sig. (2-tailed)	.567	.000	.000	.000	.

r- correlation coefficient, N- total sample size, PF- Palpebral Fissure.*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Interrelationships among Palpebral Fissure Measurements

Strong bilateral symmetry was observed between corresponding PF measurements. Left and right PF lengths showed a strong positive correlation ($r = 0.759$, $p < 0.001$), as did left and right PF widths ($r = 0.848$, $p < 0.001$). Additionally, left PF width correlated moderately with both left and right PF lengths ($r = 0.292$ and $r = 0.275$, $p < 0.001$). These findings reflect a high degree of internal consistency and anatomical symmetry in ocular parameters.

DISCUSSION

The eyes and nose are two well-studied organs in plastic surgery and are recognised for their high inter-ethnic variability (Alsarraf *et al*., 2020; Hohman *et al*., 2025). In this study, we examined the potential correlation between nasal morphometry and palpebral fissure dimensions across a sample of 240 individuals from eight nationalities.

Our findings show that there are statistically significant differences in nasal indices among different nationalities, with the Philippines showing the most notable differences. The most common nose type found in the Philippines group was the platyrrhine, characterised by a high nasal index (NI=85.99). This significantly differed from other nationalities, such as UAE and Kuwait, which had lower average indices within the mesorrhine range. Although extensive research on nasal morphology among Filipinos is ongoing, this trend aligns with observations among Southeast Asian populations, who tend to have broader nasal bases, possibly as an adaptation to climate and as part of evolutionary processes (Zaidi *et al*., 2017). The nasal type most often associated with Asians is mesorrhine, but all three nose types can be seen within the same geographic area (Patel & Moxham, 2019). Despite limited literature specifically on the nasal index of the Filipino population, existing anthropological and morphological studies have examined the nasal features of various Filipino tribes more broadly (Barrows *et al*., 1910). These studies reveal diversity in nasal morphology among Filipinos, with some groups exhibiting broad, flat noses characteristic of the platyrrhine type, while others have medium-sized noses consistent with the mesorrhine category. This variability may be due to the Philippines' ethnolinguistic diversity and historical intermixing among different ancestral groups. The current study's findings, which place the mean nasal index within the platyrrhine range, align with previous observations, particularly among certain lowland and coastal populations (Terry *et al*., 1946). In this way, our data fills a gap in existing datasets and highlights the importance of population-specific baselines for both surgical and diagnostic purposes.

Our study also showed statistically significant negative correlations between nasal index and left palpebral fissure length, with r= -0.145, p=0.025. This indicates that broader nasal structures may be linked to shorter eye fissures. Highlighting this subtle correlation suggests that this area remains largely underexplored. Previous research by Farkas *et al*. (2005) has observed proportional relationships among craniofacial features, but few studies have directly examined this specific link (Deutsch *et al*., 2012).

We further observed no significant correlation between the nasal index and other palpebral fissure parameters, including the right PF length and bilateral PF widths. This may suggest that the association between nose and eye morphology is selective rather than uniformly distributed across all ocular measurements. These findings are presented with slight contrast to the work of Karaketir *et al*. (2024) who identified correlations between somatotype and periocular parameters. Although

somatotype can influence several facial areas simultaneously, our focus on the nasal index provides a more targeted measure, and the limited correlations observed highlight the complexity and independence of some facial features.

The current study demonstrated a strong correlation between the measurements of the left and right palpebral fissure lengths and widths. This finding is expected, as the two sides of the human body typically exhibit a high degree of symmetry due to inherent biological processes during development. As Lindauer noted, this symmetry naturally develops from human growth and development, although perfect bilateral symmetry is rarely observed (Lindauer, 1998). Furthermore, minor facial asymmetries, including differences in the palpebral fissure, are common and do not necessarily indicate any abnormality (Simmons *et al*., 2004). The strong correlation in our data supports the general principle of bilateral symmetry in facial anatomy, while recognising the natural variation among individuals.

Our study also identified notable sexual dimorphism in nasal dimensions, with males exhibiting significantly higher nasal widths and nasal index values as compared to their female counterparts. These findings are consistent with the works of several other studies (Saadeh *et al*., 2024; Premraj *et al*., 2025). Within the palpebral fissure dimensions, our data showed that males had slightly larger measurements, which is consistent with studies conducted on Malaysian South Indian adults, where sexual dimorphism was reported in all palpebral parameters (Patil *et al*., 2011).

Our research findings align with studies supporting population-specific standards. Aesthetic preferences and functional needs vary across populations, which emphasises the importance of personalised treatment plans in medical and cosmetic surgery contexts. This is consistent with previous calls to move away from generalised norms in surgical planning (Schwitzer *et al*., 2015; Karaketir *et al*., 2024). Its relevance is particularly marked in surgical procedures requiring precise measurements, as operations like rhinoplasty and blepharoplasty depend heavily on measurement accuracy to ensure successful outcomes.

LIMITATION

One limitation of the study is the uneven male-to-female ratio across the nationality groups, which could show gender-related differences rather than population-specific traits. For future research, we recommend increasing the sample size and ensuring it is more representative to strengthen the generalizability of the findings.

CONCLUSION

This study examined the nasal morphometry and its correlation with the palpebral fissure parameters across individuals from eight nationalities. Our findings show statistically significant differences in nasal indices among the nationalities. The Philippines stands out for having the highest variation in nasal index, predominantly falling into the platyrrhine category. A weak but significant negative correlation was found between the left palpebral length and nasal indices. There is a strong correlation between the left PF measurements and right PF measurements, reflecting strong bilateral facial symmetry.

These results provide new data on the relationship between nasal morphometry and palpebral fissure dimensions and underscore the importance of considering ethnicity and gender in aesthetic and reconstructive surgical planning. Overall, our study stresses the importance of anthropometric diversity and highlights the need for ongoing research with larger, representative populations and advanced anthropometric techniques to better understand the subtleties of facial morphology.

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RESUMEN: Si bien tanto los índices nasales como los parámetros de la fisura palpebral se han estudiado individualmente en diversas poblaciones, se sabe poco sobre su interrelación, la cual puede ser importante en contextos estéticos, forenses y quirúrgicos. Este estudio tuvo como objetivo investigar la morfometría nasal y su relación con las dimensiones de la fisura palpebral en ocho nacionalidades. Se realizó un estudio transversal con 240 estudiantes sanos (30 por nacionalidad, de 18 a 25 años). La altura y el ancho nasal se midieron con un calibrador Vernier; las dimensiones de la fisura palpebral se midieron con una regla. Se realizó un análisis estadístico utilizando SPSS, empleando ANOVA y pruebas de correlación de Spearman. El índice nasal promedio en la muestra fue de 74,9 ± 13,2, con un 67,9 % de mesorrinos, un 26,3 % de platirrinos y un 5,8 % de leptorrinos. Los filipinos presentaron un índice nasal significativamente mayor (85,9 ± 7,2; $p < 0,001$), lo que los sitúa predominantemente en la categoría de platirrinos. Se encontró una correlación negativa débil pero significativa entre el índice nasal y la longitud de la fisura palpebral izquierda ($r = -0,145$, $p = 0,025$). No se observaron correlaciones significativas para otras dimensiones palpebrales. Los hallazgos revelan una interrelación sutil pero significativa entre la estructura nasal y la morfología ocular, con implicaciones para los estándares morfométricos específicos de la población en intervenciones clínicas y estéticas.

PALABRAS CLAVE: Morfometría nasal; Fisura palpebral; Antropometría.

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