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Nasofacial anthropometric evaluation of a sample of Pakistani children: A community-based study

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Abstract

Introduction: Harmony in facial morphology is created by a delicate balance between nose-chin and lip spatial relationship. Nasal proportions and dimensions have always be pivotal in creating / affecting facial aesthetics and nasal index assessment pre-post extraction, expansion, distraction and orthognathic surgery has re-enforced its significance in orthodontics. . Aim of this study is to evaluate the nasal and facial indices in Pakistani children that will help to identify the variation in type of nose and face among them.

Methodology: This cross-sectional study was conducted at various schools of Lahore, Pakistan with age range 3-14 years. Data was collected by taking nasal and facial measurements with digital vernier caliper and geometric divider to the nearest 1mm. Data was entered and analyzed for description using SPSS version-25. One- sample t-test was applied to test the significance of the variables. Post-stratification Pearson correlation test was used between facial and nasal index.

Results: The means of nasal height, nasal width, nasal index, face height, face width, facial index of total sample (N) were found to be 53.08±5.56 mm, 28.84±3.67 mm, 54.41±6.34 mm,106.25±9.02 mm, 118.07±9.28 mm and 89.95±6.91 respectively. Frequent nose type found was hyperleptorrhine and face type was hyperleptoprosopic in both genders.

Conclusions: Statistically significant negative correlation was found between nasal and facial index in both genders (r= -0.102 females and r= -0.237 in males).

Keywords: Anthropometry, Ethnicity, Facial Esthetics, Facial Index, Nasal Index.

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Introduction

Anthropometry comes from a Greek word "Anthropos" which means human and "metron" which means measure. Anthropometry as attributed by WHO is an inexpensive and noninvasive technique for estimating human body indices.[1,2] Anthropometric assessment of facial measures has been point of importance for long in growth studies and orthodontics, but remained under utilized for some time, till the advent of 3-D assessments.[2] In recent past anthrpometric assessment have re-gained popularity.

Human growth and development is affected by many factors: age, gender, cultural, racial, socioeconomic, biological, geological, geographical, environmental and nutritional.[3-5] The understanding of variability (absolute and relative) physical measurements and proportions is critical to research human growth, variation and medico logical documentation.[6] Human ethnicity variations have been distinguished through the nasal index.[7] Cleft lip and palate patients have been benefited through primary rhinoplasty based upon facial and /or nasal index. Nasal Index has been used to assess Impact of reconstructive nasal septoplasty on nasal

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growth. It has a diagnostic importance in dysmorphic syndromes as well.[8] Facial index is important parameter in gender assessment, genetic counseling and reconstructive surgeries for orthodontists.[5,9]

Facial Coherence in orthodontics is determined by nose-lip-chin balance.[10]Nose with a central position in the face, plays a major role in facial esthetics.[11] As facial esthetics has been found to be an important determinant of self and social perceptions, Orthodontist assess face before treatment by means of observation, photography, cephalometric tracing, or direct measurements.[10]

Naso-facial harmony / dis-harmony direct orthodontist to decided between extraction and non-extraction Distraction and orthognathic surgeries, and revision surgeries. Naso-facial assessment is also helpful for plastic and reconstructive surgeons, maxillofacial and cosmetic surgeons, traumatic injuries and secondary deformities in cleft lip and palate patients in Pakistan.[5] The aim of this study is to determine the frequency of types of face and nose using the nasal and facial indices in Pakistani children that will help to identify the variation in type of nose and face among them.

Methodology

This cross-sectional study was conducted over the period of 3 months after the approval of Ethical Committee of Sharif Medical & Dental College (No.SMDC/SMRC/228-21).

Sample size calculated through open Epi Calculator on all Primary & Middle School student age between 3-14 years in Schools of Lahore. (n=1082)

Prior permission was taken from the principals of schools of various areas of Lahore, Pakistan. Inclusion Criteria: School children (boys & girls) with age range 3-14 years of Pakistani origin were included in the study. Exclusion Criteria: Children with a history of craniofacial surgery, facial trauma, congenital craniofacial anomalies (such as cleft lip) and children who were under orthodontic treatment or had orthodontic treatment in the past were excluded. Individuals with physical impairment, scarring of face, craniofacial trauma, and facial edema. Patients with endocrine disorders were also excluded from the study.

Measurement procedures and precautionary steps were explained verbally to each participant and consent was obtained. Each child has seated on a chair, in relaxed natural head position (NHP). Data was collected by taking facial measurements with the help of digital vernier caliper and geometric divider to the nearest 1mm. Data was collected by two orthodontics faculty members and two trained post-graduate residents. Two house-officers helped in coordination and management in the field. All measurements along with demographic data were recorded in a predesigned proforma.

Following landmarks were identified on the children's faces during extraoral examination as provided by Farkas et al. [12]

Landmark	Description
NHP:	Natural head position is standardized and reproducible position, of the head in an upright posture, the eyes focused on the point in the distance at eye level, which implies that the visual axis is horizontal.
Nasion (N):	The point in the midline of both the nasal root and the naso-frontal suture.
Gnathion (Gn):	The midpoint on the lower border of the mandible.
Zygion (zy):	Width of the face measured between the most lateral points of the zygomatic bone (cheek bone).
Subnasale (Sn):	The midpoint of the angle at the columella base where the lower border of the nasal septum and the surface of the upper lip meet.
Alare (al):	The most lateral point on each alar contour.

PIC-I: Landmarks

Landmark	Description
Facial length	Measured as a straight distance between nasion (n) and gnathion (gn),
Facial width	Measured as the distance between zygion (zy) and zygion (zy).
Nasal height	Measured as the distance between nasion (n) and subnasale (sn)
Nasal width	Measured as the interalar distance (ala-ala).
Facial index (FI)	The ratio of facial length/height to the maximum width of face multiplied by 100.
Nasal index (NI)	The ratio of nasal width to the nasal height multiplied by 100.(nasal parameter)

PIC-II: Facial measurements (mm)

According to Naini[13], the classification of anatomical face and nose type is as follows:

- Hypereuryprosopic (very broad, short face) ≤78.9
- Euryprosopic (broad, short face) 79.0–83.9
- Mesoprosopic (normoprosopic: average face) 84.0–87.9
- Leptoprosopic (tall, narrow face) 88.0–92.9
- Hyperleptoprosopic (very tall, narrow face) ≥93.0

PIC-III: Face type Facial index (Naini[13])

- Hyperleptorrhine (excessively tall and narrow) ≤54.9
- Leptorrhine (tall and narrow) 55.0–69.9
- Mesorrhine (medium) 70.0–84.9
- Platyrrhine (broad and flat) 85.0–99.9
- Hyperplatyrrhine (excessively broad and flat) ≥100.0

PIC-IV: Nose type Nasal index

Statistical analysis:

The data was entered and analyzed using Statistical Package for Social Sciences (SPSS) software version 23. Basic descriptive statistics i.e. mean, standard deviation (SD), were calculated for all parameters. Frequency and percentage of nose and face type was calculated and compared in both genders using chi-square test. Data was stratified for age & gender. Further analysis was done to test the significance of the variables by using one- sample t-test (for gender). Correlation between facial and nasal index was also determined using Pearson correlation test. P value <0.05 was considered to be statistically significant.

Result

Mean age of 1082 children observed in this study was 8.40±2.98 years, including 536 males & 546 females. Comparison of mean nasal and facial parameters between both genders was found to be significant (Table-I). Most frequent nose type found in this study was hyperleptorrhine and face type was hyperleptoprosopic, in both genders which were found statistically significant in males (Table-II).

Comparison of nasofacial parameters in different age groups was statistically significant except for facial index (Table-III). Post-Hoc Tukey's test for nasofacial parameters in different age groups is shown in Table-IV. Negative correlation was found between facial and nasal index, which was statistically significant (Table V).

Nasal Parameters	Females n=546	Males n=536	*p*-value	Facial Parameters	Females n=546	Males n=536	*p*-value
Nasal Height	53.26± 5.64 n=180	52.90 ± 5.48 n=170	0.000*	Facial Height	105.41± 8.99 n=180	107.10± 8.98 n=170	0.000*
Nasal Width	28.59±3.58 n=190	29.10± 3.76 n=234	0.000*	Facial Width	117.21± 9.13 n=190	118.94± 9.36 n=234	0.000*
Nasal Index	53.89± 5.88 n=176	54.95±6.75 n=132	0.000*	Facial Index	89.86± 7.40 n=176	90.04 ± 6.36 n=132	0.000*

Table-I: Comparison of Mean of Nasal and Facial Parameters in Both Genders (one-sample t-test)

Gender	Nose type	Face Type						p-value
		Hypereury prosopic %	Eury-prosopic %	Meso-prosopic %	Lepto-prosopic %	Hyperlep to prosopic %	Total	
Male	Hyper-leptorrhine	10 (1.9%)	30 (5.6%)	54 (10.0%)	84 (15.7%)	112 (20.9%)	290 (54.1%)	0.001*
	Leptorrhine	16 (3.0%)	38 (7.0%)	44 (8.2%)	72 (13.4%)	68 (12.7%)	238 (44.4%)	
	Mesorrhine	4 (0.8%)	2 (0.4%)	0 (0%)	2 (0.4%)	0 (0%)	8 (1.5%)	
	Total	30 (5.6%)	70(13.0%)	98(18.3%)	158(29.5%)	180(33.6%)	536 (100%)	
Female	Hyper-leptorrhine	12(2.1%)	44(8.1%)	62(11.4%)	92(16.9%)	118(21.6%)	328 (60.0%)	0.196
	Leptorrhine	14(2.6%)	28(5.1%)	50(9.2%)	66(12.0%)	58(10.6%)	216 (39.6%)	
	Mesorrhine	0(0%)	0(0%)	0(0%)	0(0%)	2(0.4%)	2 (0.4%)	
	Total	26(4.8%)	72(13.2%)	112(20.5%)	158(28.9%)	178(32.6%)	546 (100%)	

Table-II: Comparison of nose type and face type in both Genders (chi-square)

Nasofacial Parameter (mm)	Age Group 3-6 years n=350 Mean ± SD	Age Group 7-10 years n=424 Mean ± SD	Age Group 11-14 years n=308 Mean ± SD	*p*-value	Total Children (N=1082) Mean ± SD
Nasal Height (N-Sn)	48.58±4.86	53.91 ± 4.09	57.05 ± 4.36	0.001*	53.08±5.56
Nasal Width (Ala-Ala)	25.89±4.20	29.96± 2.24	30.66± 2.34	0.001*	28.84±3.67
Nasal Index (NI)	52.74±6.63	55.97± 5.99	54.18± 5.97	0.001*	54.41±6.34
Facial Height (N-Gn)	98.73 ±7.79	108.26± 6.27	112.03± 7.74	0.001*	106.25±9.02
Facial width (Zy-Zy)	109.76±6.66	120.16±6.97	124.63±7.61	0.001*	118.07±9.28
Facial Index (FI)	89.61±7.67	90.48±6.51	89.61±6.49	0.133	89.95±6.91

Table-III: Comparison of Nasofacial Parameters in different Age Groups using One-way ANOVA

Age Groups	Nasal Height	*p* - value	Nasal Width	*p* - value	Nasal Index	*p* – value	Face Height	*p* - value	Face Width	*p* - value	Facial Index	*p* - value
3-6 years	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.193
	11-14 years	0.000*	11-14 years	0.000*	11-14 years	0.008*	11-14 years	0.000*	11-14 years	0.000*	11-14 years	1.000
7-10 years	3-6 years	0.000*	3-6 years	0.000*	3-6 years	0.000*	3-6 years	0.000*	3-6 years	0.000*	3-6 years	0.193
	11-14 years	0.000*	11-14 years	0.006*	11-14 years	0.000*	11-14 years	0.000*	11-14 years	0.000*	11-14 years	0.217
11-14 years	3-6 years	0.000*	3-6 years	0.000*	3-6 years	0.008*	3-6 years	0.000*	3-6 years	0.000*	3-6 years	1.000
	7-10 years	0.000*	7-10 years	0.006*	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.000*	7-10 years	0.217

Table-IV: Post- Hoc Analysis with Tukey's Test for comparison of Nasofacial parameters in different age groups

Nasal Index	Facial Index			
	Females		Males	
	Correlation Coefficient	*p*-value	Correlation Coefficient	*p*-value
	-0.102**	0.017*	-0.237**	0.001*

Table-V: Correlation between Nasal & Facial Index with respect to Gender

Discussion

Nasofacial morphology is a genetic trait, which to some extent is affected by environmental factors.[3,14,15] Farkas introduced "Anthropometric measurements" based on the extensive technical study of face and head measurements in accordance to age, sex, and ethnic origin.[16] Accurate facial analysis is essential for diagnosis of genetic and acquired anomalies, for the study of normal and abnormal growth and for morphometric investigation.[16]

Facial index has direct relationship with morphological facial height and indirect with maximum facial width, thereby emphasizing accurate assessment of the two noncontributing factors.[17] Nasal Index assessment is useful in the disciplines orthodontics, of facial aesthetics, forensic medicine, as well as reconstructive surgeries and regarded as valuable asset for researcher.[17-20]

In the field of physical anthropology, differences in cephalofacial features are reflected not only between different human races but also between humans of the same race in different regions and between different ethnic groups of the same race in the same region.[3] When the facial pattern of a patient is not determined before orthodontic treatment commences, the facial esthetics and occlusal function of the patient may be further compromised if the lower facial height (LFH) is unnecessarily increased or reduced by the mechanics used in treatment.[21,22]

Most frequent face type found in this study is Hyperleptoprosopic in both genders and the least common was hypereuryprosopic. Esa et al found similar results conducted on the population of Nigeria.[22] These results are in accordance with Mansur et al who found same face type with prevalence of 75.68% among population of Nepal.[23] Sarkodie et al and Kyei et al in their studies found the predominant facial type was hyperleptoprosopic and the least was leptoprosopic in Ghana population.[17,24] Mittal et al found Mesoprosopic as the dominant phenotype in Solan population.[16] Wai et al found leptoprosopic face type most frequent in young adults of Malaya and mesoprosopic face type of Chinese population.[2]

This present study found Hyperleptorrhine as the most frequent nose type in Pakistani school children. Whereas, different studies conducted on Indian (Khtmandu) and Nepalese medical students suggested Mesorrhine type the most common.[18,19,25] Agburum et al showed that males have the Mesorrhine nose type while females have the Platyrrhine nose type of the Nigerian adult natives.[20] Wai et al found Mesorrhine nasal type most frequent in young adults of Malaya and Chinese population.[2] Whereas Jaberi et al found frequently the Platyrrhine nose type in both genders of Iranian population.[26]

Present study concluded that comparison of all the parameters in different age groups are significant except facial index. This is in contrast with Sarkodie et al who found that facial indices for the males and females of both Bono and Ewe tribes were statistically different along with the facial height and facial width.[17] Agburum et al observed statistically significant difference between

nasal index and age among Nigerian Population.[20] Wai et al also found differences of nasal and facial index statistically significant in all three races included in their study.[2] Sudikshya et al found no significant difference in both nasal and facial index between Indian and Nepalese population.[18]
This study also concluded that facial index and nasal index have a negative and significant correlation for both genders. This inverse relation shows that both genders have Hyperleptoprosopic face (≥93.0) and Hyperleptorrhine nose (≤54.9) in a sample of Pakistani school children. However, Okiemute found positive correlation of age & facial index in a cluster of Nigerian population.[22]

Current study has its own limitations as this includes a small sample of Pakistani population, and results are regional in nature so they cannot be generalized. More extensive studies relevant to this are encouraged on broad spectrum to establish reliable nasofacial anthropometric norms, which can direct treatment planning in orthodontics as well as reconstructive surgeries.

Conclusion

- The differences of mean nasal and facial parameters were found to be significant in both genders.
- Most common nose type was hyperleptorrhine and face type was hyperletoprosopic in both genders.
- Comparison of nasofacial parameters in different age groups was statistically significant except for facial index.
- Negative correlation was found between facial and nasal index, which was statistically significant.

Ethical Approval

The study was approved by the Ethical Committee of Sharif Medical & Dental College (No.SMDC/SMRC/228-21)

Disclaimer

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Conflict of Interest

It is declared that the authors don't have any conflict of interest.

Authors' Contribution

FR: Design of the work, or the acquisition, analysis, or interpretation of data, Drafting the work, Agreement of integrity of any part of the work are appropriately investigated and resolved
FM: Design of the work, or the acquisition, analysis, or interpretation of data, Drafting the work, Final approval, Agreement of integrity of any part of the work are appropriately investigated and resolved
MN: Design of the work, or the acquisition, analysis, or interpretation of data
SA: Design of the work or the acquisition, analysis, or interpretation of data
HH: Design of the work or the acquisition, analysis, or interpretation of data
RM: Design of the work or the acquisition, analysis, or interpretation of data.

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