



Contribution to the Assessment of Nasal Dimensions in Facial Profile among a Moroccan Population: Cross-Sectional Descriptive Study

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Abstract

INTRODUCTION: Nasal anthropometry plays a pivotal role in assessing nasal size and shape within the context of overall craniofacial structure. However, defining the ideal nasal aesthetic remains complex. Anthropometric variations in nasal morphology across populations, shaped by environmental adaptations, contribute to diverse perceptions of facial harmony among different ethnic groups. **AIM:** To define average nasal values in a harmonious Moroccan population; to explore differences between female and male noses; to establish the ideal ratio between nasal height and width. **METHODS:** This descriptive cross-sectional study utilized digital photographs of patients from the dento-facial orthopedic service at the IBN ROCHD University Hospital in Casablanca. Convenience sampling was employed, involving 51 subjects selected by an expert panel. **RESULTS:** Average values for nasal measurements were as follows: width of nasal root (14.8 ± 2.93 mm), width of nose (33.8 ± 4.43 mm), nasal protrusion (19.8 ± 2.23 mm), length of nasal bridge (42.9 ± 5.51 mm), nasal height (49.6 ± 4.85 mm), nasolabial angle ($98.1^\circ \pm 12.5^\circ$), nasofrontal angle ($143^\circ \pm 16.4^\circ$), nasofacial angle ($34.9^\circ \pm 3.78^\circ$), nasal projection angle ($73^\circ \pm 7.54^\circ$), and nasal index (68.5 ± 7.38). Statistically significant differences based on gender were observed in width of the nose, length of nasal bridge, nasal height and nasal projection angle. The “leptorhine” nose type is the most common within our sample. **CONCLUSION:** Findings underscore the distinct variations in nasal morphology between sexes and highlight the prevalence of specific nose types within our study population.

Subject Areas

Anthropometry, Dentistry, Orthodontics

Keywords

Nasal Anthropometry, Orthodontics, Moroccan Population

1. Introduction

Soft tissue profile evaluation has historically been used as a roadmap to aid orthodontists in aligning facial profile characteristics with either jaw or dental adjustments [1]. It holds a crucial role in the planning of orthodontic treatments.

Facial harmony relies on the relationship between soft tissues and their proportions [2], with a special focus on the nose due to its central and prominent position on the face [3] [4]. Thus, nasal anthropometry plays a crucial role in assessing the size and shape of the nose as an individual feature and in balance with the overall craniofacial structure [5].

However, defining the ideal nasal aesthetic remains complex: factors such as sexual dimorphism, ethnic origin, and overall facial balance significantly influence the perception of nasal shape and dimensions [6] [7].

Historically, the nose has evolved in response to environmental conditions, showing adaptations in various populations based on temperature and humidity [8]. This anthropometric diversity explains varying perceptions of facial harmony across different ethnic groups.

It's notable that much of the available anthropometric data is based on predominantly Caucasian populations [9] [10]. Therefore, studies comparing nasal measurements against established Caucasian aesthetic standards may not be universally applicable, underscoring the necessity to establish average values for diverse ethnic backgrounds [10] [11]. Such insights are valuable for fields, such as aesthetic surgery, anthropology, and orthodontics.

Our study's primary objective was to define average nasal values in a harmonious Moroccan population. The secondary objective was to explore differences between female and male noses, and establish the ideal ratio between nasal height and width.

2. Materials and Methods

This is a descriptive cross-sectional study of digital photographs of patients consulting the dento-facial orthopedic service within the Dental Consultation and Treatment Center of the IBN ROCHD University Hospital in Casablanca.

2.1. Sampling Methodology

The study was conducted between April 2023 and July 2023 and the sample was made up of 51 subjects. It was constituted by convenience sampling. A total of 73 subjects meeting the inclusion and exclusion criteria, and who consulted during the study period, were selected. Subsequently, their photographs were submitted for assessment by an independent panel of experts, who selected 51 subjects.

This panel comprised a dento-facial orthopedics professor from the Dental Medicine Faculty of Casablanca, a maxillofacial surgeon, and an orthodontist from the Dental Consultation and Treatment Center of Casablanca.

Patient's selection was based on an evaluation sheet using the 5-point Likert scale, where "5" represents the highest score and "1" the lowest score. Only subjects with an average score above 3, and independently selected by all 3 jury members, were chosen.

The inclusion criteria were as follows: Moroccan men and women, aged between 18 and 60 and presenting a harmonious profile according to an expert jury.

Patients with craniofacial syndrome and/or with a history of craniofacial trauma, pregnant women, patients with metabolic disorders, patients who are still in the growth phase, patients who received facial fillers or injections, patients who undergone or were undergoing orthopedic and/or functional treatment, orthodontic treatment, plastic or orthognathic surgery or rhinoplasty, were excluded.

Through a form, the following elements were collected for each participant: Name and surname, gender, age according to the following four intervals: (18 - 30), (31 - 40), (41 - 50), (51 - 60) and measurement variables. Ethnicity was self-defined as Moroccan.

2.2. Parameters and Studied Variables

Two full face photos of each participant, one frontal and the other lateral at rest, were taken using a Panasonic Lumix FZ300 bridge camera. To ensure reproducible data, the same parameters were respected when taking all the images: an automatic "portrait" mode, a focal length of 55 mm and a distance of 1.5 m between the participant and the operator. The head was positioned so as to have a Frankfurt plane parallel to the ground. A ruler was used as a reference for enlargement measurement and was held between the fingers and under the chin.

On each frontal and lateral photograph, we marked the following points identified in **Figure 1** and **Figure 2**:



Figure 1. Reference points of the nose on a frontal photo.



Figure 2. Reference points of the nose on a profile photo.

- Pronasal (pn): the most anterior midline point of the nasal tip.
- Subnasal (sn): the junction point of the inferior border of the nasal septum and the cutaneous part of the upper lip located on the mid-sagittal plane.
- Glabella (g): the most anterior point of the ophryaic line (eyebrow line).
- Nasion (n): the most backward point of the nasion notch.
- Upper labial point (ls): the most anterior point of the upper lip.
- Cutaneous pogonion (pog c): the most anterior point of the chin image.
- Alar (al): The most lateral point of the nose wing.
- Maxillofrontal (mf): is the superficial landmark located in the lower third of the nasal root slope, on the line connecting the inner canthus and the sellion.

Then, for the variables, we measured on the frontal photos:

- Nasal width: Distance between the right and left nasal wings.
- Width of the nasal bridge: Distance between the right and left maxillofrontal points.

On the profile photos, we measured the following variables:

- Nasal tip protrusion: Distance between the subnasal and pronasal points.
- Length of the nasal bridge: Distance between the nasion and pronasal points.
- Nasal height: Distance between the nasion and subnasal points.
- Nasolabial angle: Angle between the pronasal, subnasal, and upper labial points.
- Nasofrontal angle: Angle between the pronasal, nasion, and glabella points.
- Nasofacial angle: Angle between the line drawn along the nasal dorsum and the line connecting the glabella and chin at the cutaneous pogonion point.
- Nasal projection angle: Angle between the line drawn along the nasal dorsum and the line connecting the pronasal and subnasal points.

Finally, we calculated the nasal index using the following equation: Nasal index = Nasal width \times 100/Nasal height.

The measurements were carried out using the “ImageJ” software.

2.3. Statistical Analysis

Statistical analysis was performed using SPSS 24 software. The comparison of mean values according to gender was conducted using the Student's t-test for single samples. The Mann-Whitney U test was employed when the Student's t-test was not applicable. A significance level of 0.05 was set for statistical results.

2.4. Ethical Considerations

Informed consent was drafted and provided to participants. All participants provided written consent to participate in this study after explanation and discussion of the study's objectives and the anonymous and confidential nature of the use of patients' personal data.

3. Results

The results of intra-observer reproducibility (**Table 1**) were calculated using the intra-class correlation coefficient, which showed a value greater than 0.7, considered acceptable.

Table 1. Results of intra-observer reproducibility.

	ICC
Width of the nasal root	0.992
Width of the nose	0.984
Nasal protrusion	0.990
Length of the nasal bridge	0.976
Nasal height	0.986
Nasolabial angle	0.998
Nasofrontal angle	0.990
Nasofacial angle	0.965
Nasal projection angle	0.989
Nasal index	0.971

ICC. intra-class correlation coefficient.

Table 2 outlines the demographic characteristics of the study sample.

Table 2. Distribution of Juries by gender and age.

	Sample	n	%
Gender	Female	31	60.8
	Male	20	39.2
Age	18 - 30 years old	46	90.17
	31 - 40 years old	4	7.84
	41 - 50 years old	0	0
	51 - 60 years old	1	1.99

Average values are presented in **Table 3** providing an overview of the entire sample, the dispersion (standard deviation), and the confidence interval.

Table 3. Average nose dimensions.

	M	SD
Width of the nasal root	14.8 mm	2.93
Width of the nose	33.8 mm	4.43
Nasal protrusion	19.8 mm	2.23
Length of the nasal bridge	42.9 mm	5.51
Nasal height	49.6 mm	4.85
Nasolabial angle	98.1°	12.5
Nasofrontal angle	143°	16.4
Nasofacial angle	34.9°	3.78
Nasal projection angle	73.0°	7.54
Nasal index	68.5	7.38

M. Mean; **SD.** Standard deviation.

The average value in millimeters for the width of the nasal root is (14.8 ± 2.93), for the width of the nose is (33.8 ± 4.43), for nasal protrusion is (19.8 ± 2.23), for the length of the nasal bridge is (42.9 ± 5.51), and for nasal height is (49.6 ± 4.85).

The average value in degrees for the nasolabial angle is (98.1 ± 12.5), for the nasofrontal angle is (143 ± 16.4), for the nasofacial angle is (34.9 ± 3.78), and for the nasal projection angle is (73 ± 7.54).

The average value of the nasal index is 68.5 ± 7.38 .

Table 4. Comparison of average nose dimensions based on gender.

	M (SD)		P-Value
	F	H	
Width of the nasal root	15.1 mm (3.19)	14.3 mm (2.50)	0.378
Width of the nose	32.8 mm (3.24)	35.4 mm (5.54)	0.036*
Nasal protrusion	19.6 mm (2.20)	20.3 mm (2.25)	0.260
Length of the nasal bridge	40.1 mm (4.47)	47.4 mm (3.79)	<0.001*
Nasal height	47.1 mm (4.21)	53.3 mm (3.07)	<0.001*
Nasolabial angle	99.4° (10.59)	96.0° (15.11)	0.342
Nasofrontal angle	141.4° (47.81)	144.8° (24.60)	0.554
Nasofacial angle	35.6° (3.21)	33.7° (4.35)	0.079
Nasal projection angle	75.0° (7.69)	70.0° (6.37)	0.020*
Nasal index	69.8 (5.81)	66.5 (9.11)	0.158

M. Mean; **SD.** Standard deviation.

*Statistically significant difference ($P < 0.05$).

The statistical comparison of the dimensions based on the gender (**Table 4**) showed a statistically significant difference in:

- The mean width of the nose in women (32.8 mm) and men (35.4 mm).
- The mean length of the nasal bridge between women (40.1 mm) and men (47.4 mm).
- The mean nasal height between women (47.1 mm) and men (53.3 mm).
- The mean nasal projection angle between women (75.0°) and men (70.0°).

4. Discussion

Understanding nasal anthropometry is essential for comprehending nasal and overall facial aesthetics. Therefore, establishing ideal average values for various nasal parameters within each population is fundamental [12].

The objective of our study was to determine average values considered ideal for certain nasal parameters within a Moroccan population exhibiting harmonious facial profiles. Secondly, we aimed to define differences between female and male noses and establish the optimal ratio between nasal height and width.

Regarding nasal root width, our study found an average of 14.8 (± 2.93). Several studies have shown values higher than those in our study. For instance, a study conducted in India by BHANDARI and *et al.* in 2021 [13] on a sample of 500 subjects aimed to measure various linear parameters of Indian faces, reported an average value of 21 mm (± 2.6) for nasal root width.

Another study conducted by EZIYI and *et al.* in 2022 on a sub-Saharan population of 678 Nigerian adults [14], showed an average value of 19.87 mm (± 0.30).

Concerning nasal width, it averages 33.8 mm (± 4.43) in our study. In comparison with literature data, a study conducted in Iraq by FARHAN and *et al.* in 2021 [15] and another in Turkey by BAGHERI and *et al.* in 2023 [16] found respective values of 32.5 mm (± 4.5) and 33.23 mm (± 2.8). In contrast, EZIYI and *et al.* in reported a wider nasal base, measured at 40.04 mm (± 0.23).

Nasal protrusion is averaging 19.8 mm (± 2.23) in our study. Consistent with our findings, a study by DIOUF and *et al.* in Senegal in 2014 [17], involving 138 subjects from Senegal and Morocco showed an average of 20.23 mm (± 2.5). Similarly, BHANDARI and *et al.* found an average protrusion of 18.56 mm (± 1.88) in an Indian population [13].

In contrast, OZDEMIR and UZUN in 2015 [18] on a total of 115 young Turkish adults reported higher values than ours, with a nasal protrusion average of 22.81 mm (± 3.02). While EZIYI and *et al.* [14] showed lower values 15.96 mm (± 0.27).

For nasal bridge length, it averages 42.9 mm (± 5.51) in our study. Similarly, BAGHERI and *et al.* [16] showed a mean length of 42.84 mm (± 4.36) among Turks.

EZIYI and *et al.* [14] found a lower average of 38.17 mm (± 0.41) among Nigerian adults and FARHAN and *et al.* [15] reported a higher mean of 48.1 mm (± 6.2) among Iraqis.

Nasal height averages 49.6 mm (± 4.85) in our study. Aligned with our findings,

DIOUF and *et al.* [17] showed an average of 49.7 mm (± 3.96) among Moroccans in their study. Similarly, BAGHERI and *et al.* [16] found an average of 49.72 mm (± 2.91) among Turks. Eziyi and *et al.* [14] reported an average of 42.73 mm (± 0.39). Lastly, FARHAN and *et al.* [15] demonstrated an average of 54.4 mm (± 5.9).

For nasolabial angle, it averages 98.1° (± 12.5) in our study. According to a study by ARMIJO and *et al.* in 2012 [19] aiming to define the ideal nasolabial angle in 10 men and 10 women undergoing rhinoplasty, results showed that angles ranging between 93.4° and 98.5° in men, and between 95.5° and 100.1° in women, were aesthetically preferable. Our findings fall within these ranges (96° (± 15.11) for men, 99.4° (± 10.59) for women), aligning with the ideal values from this study.

Compared to a Saudi Arabian population, AL-QATTAN and *et al.* in 2012 [20] reported a more open angle among Saudis (117.58°) compared to our study. BAGHERI and [16] showed an average angle of 87.72° (± 9.2) among Turks. And EZIYI and *et al.* [14] found a narrower angle among adults from the Yoruba tribe in Nigeria, with an average of 85.61° (± 0.97).

As for the nasofrontal angle, it is averaging 134° (± 16.4) according to our study. An open nasofrontal angle can give the impression that the nose is longer, as the nasal root appears higher or poorly defined [21]. POWELL and HUMPHREY [22] suggested that the ideal nasofrontal angle should fall between 115 and 130 degrees. This range does not encompass the value found in our study (134° (± 16.4)). However, in line with our results, studies conducted by BAGHERI and *et al.* [16] and by EZIYI and *et al.* [14] showed values similar to ours: 132.33° (± 5.97) and 132.55° (± 0.54), respectively.

The average of the nasofacial angle is 34.9° (± 3.78) according to our study. It is approximately 36° in men and 34° in women according to FURTADO and *et al.* [23]. As per Mehta and Srivastava in 2017 [24], their study conducted in India showed that the average nasofacial angle was 35.52° (± 4.8). While AL-QATTAN and *et al.* [20] reported an average nasofacial angle of 37.35° (± 5.45), which is lower than the average value found in our study.

The nasal tip projection angle averages 73° (± 7.54) according to our study. The studies conducted by FARKAS and *et al.* [12] demonstrated that the most significant differences of the nasal tip projection angle were in the mobile part of the nose (the tip).

Compared to our results, EZIYI and *et al.* [14] showed a value lower than ours, at 70.27° (± 1.03), and BAGHERI and *et al.* [16] showed an average value of 79.36° (± 10.28).

According to our study, the nasal index averages 68.5 (± 7.38).

The nasal index categorizes the nose into different types, following the classification by MARTIN AND SALLER [25]:

- Leptorhine or moderately long and narrow nose, with nasal index values between 55 and 69.9.
- Mesorhine or medium nose, with nasal index values between 70 and 84.9.

- Platyrhine or short and moderately wide nose, with nasal index values between 85 and 99.9.

In our study, the most common nasal shape among men and women was leptorrhine, or moderately long and narrow nose.

DHULQARNAIN and *et al.* in 2020 [26] showed that nigerian population had predominantly mesorrhine nose shape, while Iranians were leptorrhine.

Comparatively, Iraqi individuals [15] had a lower nasal index value than our results (60 ± 7.9) and Indians exhibited higher values (73.42 ± 7.13), with a high frequency of mesorrhine shape in men and both leptorrhine and mesorrhine shapes in women [13].

These differences in results are noteworthy as the nasal index plays a crucial role in determining sex and race for forensic investigators, as well as in plastic surgery interventions [27] [28].

Regarding differences in nasal dimensions based on gender, the results of our study showed statistically significant differences only for nasal width ($p = 0.036$), nasal bridge length ($p < 0.001$), nasal height ($p < 0.001$), and nasal projection angle ($p = 0.020$). Men exhibited greater values than women in nasal width, nasal bridge length, and nasal height. However, women had a significantly more open nasal projection angle compared to men.

In the study conducted by EZIYI and *et al.* [14] results aligned with ours: men had longer, higher, and wider noses compared to women, while women showed statistically significant prominence in nasal projection. Consistent with our findings, nasal root width and nasolabial angle were greater in women than in men, whereas nasal protrusion was more pronounced in men.

Contrarily, data from the study by BHANDARI and *et al.* [13] showed that nasal width, nasal height, and nasal bridge length were significantly reduced in females ($p < 0.01$), consistent with our study's results.

However, nasal root width was similar between sexes in their study, and nasal protrusion and nasal index were significantly higher in men compared to women, unlike our findings.

DIOUF and *et al.* [17], found agreement with our study on nasal height, nasal tip, and nasofrontal angle measurements. However, there was disagreement regarding the nasolabial angle: our study indicated a more open angle in women, whereas DIOUF and *et al.* found a more open angle in men.

It's important to note that their measurement methodology using printed photos and a protractor could introduce measurement biases into their results.

5. Conclusions

Nasal morphology is an essential component of facial balance, harmony, and proportion. The anthropometric heterogeneity among different ethnicities underscores the need to establish individualized ideal values for each population.

Based on our study, the following conclusions can be drawn:

- There is significant sexual dimorphism for the following characteristics: nose

height, width, length of the nasal bridge, and nasal tip projection angle.

- The “leptorhine” nose type is the most common within our sample.

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Conflicts of Interest

The authors declare no conflicts of interest.

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