Morphometric analysis of nasal shapes and angles in young adults

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KEYWORDS
Female;
Male;
Anthropometry;
Nose

Abstract

Introduction: The size, angle, shape and type of nose are a signature indicating race, age and sex.
Objective: Describe and compare nasal angles, nose types, nostril models, and nasal profiles in young Turkish males and females.
Methods: The study group consisted of university students, 56 males and 59 females. Nasal measurements were obtained from all subjects, using anthropometric methods.
Results: The nose types of females and males were 78% and 70% narrow nose, respectively. The means of females’ nasofrontal, nasal tip, nasolabial, and alar slope angles were 133.16° ± 8.88°; 77.91° ± 9.80°; 98.91° ± 10.01°; and 80.89° ± 8.33°, respectively. The means of males’ nasofrontal, nasal tip, nasolabial, and alar slope angles were 123.85° ± 13.23°; 82.16° ± 9.98°; 97.91° ± 8.78°; and 85.98° ± 8.72°, respectively.
Conclusion: The average values of the nose in this population may be used as a guide to plan corrective esthetic-cosmetic surgery and for burn scars of the nose.

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Morfométrica análise de nasais formas e ângulos em adultos jovens

Resumo

Introdução: O tamanho, os ângulos, a forma e o tipo do nariz humano são uma assinatura que indica raça, idade e sex.
Objetivo: Descrivar e comparar os ângulos nasais, tipos de nariz, modelos de narina e perfis nasais em homens e mulheres jovens turcos.

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Introdução

O nariz possui uma série de funções vitais. Filtre, aquece, e humedece o ar inalado; é a primeira linha de defesa contra alérgenos inalados; atua como um órgão olfatório e reflete a ressonância de fala. Condições como a hipertrofia septal e turbinar podem afetar a geometria nasal e, consequentemente, produzir distúrbios na palatina e aumentar a resistência ao ar. Por século, os antropólogos e cirurgiões têm tentado entender o conceito de beleza facial. A estética da beleza facial é baseada em propriedades simétricas e balanço proporcional. As descrições quantitativas são usadas no planejamento cirúrgico. O formato do nariz é um indicador de herança, raça, idade e sexos.2,3 Parâmetros antropométricos variam com a idade, raça, e áreas de cultura, e autores acreditam que transitam para normações que podem ser usadas como referenciais.4 A forma e proporção do nariz também podem indicar beleza ou atração, porque elas são vistas no centro da face.5 O conhecimento do formato único da face, e proporções da face humana, são essenciais para cirurgiões que realizam reconstrução ou restauração do nariz.6

Determinar tipos de nariz, modelos de nariz, medidas de nariz e ângulos de nariz proporcionam uma base para o estudo de anormalidades ou para a correção de danos. Exemplos incluem a alteração de pontos, o assentamento de cicatrizes, e outras alterações.7-9 A estética facial é uma questão importante, e vários autores sugerem que a estética do nariz é fundamental para o procedimento cirúrgico.

Este estudo teve o objetivo de descrever diferenças nas medidas do nariz, tipos de nariz, modelos de nariz e ângulos de nariz em estudantes do ensino médio masculino e feminino, e comparar com os estudos encontrados na literatura.

Métodos: Grupo de estudo consistiu de 56 jovens do sexo masculino e 59 do sexo feminino, que eram estudantes da Universidade. Medidas nasais foram obtidas de todas as disciplinas, através de métodos antropométricos.

Resultados: Tipos de nariz de fêmeas e machos foram encontrados na maioria parte 78% e 70% nariz estreito, respectivamente. Os meios de nasofrontal das fêmeas, ponta nasal, nasolabial e ângulos de inclinação alar foram 133,16 ± 8,88; 77,91 ± 9,80; 98,91 ± 10,01 e 80,89 ± 8,33; respectivamente. Os meios de nasofrontal dos machos, a ponta nasal, nasolabial e ângulos de inclinação alar foram 123,85 ± 13,23; 82,16 ± 9,98; 97,91 ± 8,78 e 85,98 ± 8,72; respectivamente.

Conclusão: Os valores médios do nariz nesta população podem ser usados como um marcador de orientação para planejar a cirurgia correctiva nos aestheticcosmetics, cicatrizes de queimadura do nariz.

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Materiais e métodos

O estudo atual foi realizado com 115 estudantes (59 fêmeas e 56 machos) estudantes da Universidade, com 18-40 anos de idade, selecionados de maneira aleatória, totalizando 115 estudantes (59 fêmeas e 56 machos). Estes indivíduos não tinham nenhum histórico de doença nasal, nor facial, nor facial, or nose. For the Ethics Committee of University Clinical Research (Ethics Committee Number: 569), all objects were recorded and described. The data were obtained from 115 healthy volunteers, with precision of 0.1 kg (Seca, Mod 220, Hamburg, Germany), without shoes, barefoot, and with as few clothes as possible. Body height was measured in anatomic position. The body weight was measured using a Seca scale (Seca, Mod 220, Hamburg, Germany), with precision of 0.5 cm. The mean body weight and height of the male subjects were 77.34 kg (53.40–112.20 kg) and 177.02 cm (163.00–194.00 cm), respectively. The mean body weight and height of the female subjects were 59.32 kg (36.40–86.00 kg) and 164.83 cm (150–182 cm), respectively.

Anthropometric measurements were obtained from all included subjects, using standard anthropometric methods and instruments described in literature. The measurements of angles were calculated in degrees (°), and were performed by the same researcher under normal anatomic position and in the Frankfurt horizontal plane (FH). Assessment of the position of the nose, by judging the relationship of the upper and the lower edges of the ear to the eye brow level and the ala level, respectively, requires maintaining the subject’s head in the FH, which is defined by a line connecting the orbit (the lowest point of the infraorbital margin) and the porion (point at the upper edge of the auditory meatus) or tragion (landmark on the upper edge of the tragus), maintained horizontal with the help of a commercial angle meter. The data were analyzed using the SPSS, version 18.0 for Windows. Differences between male and female values were tested by Student’s t-test for normally distributed variables, and by the Mann–Whitney U test for variables that were not normally distributed. Fisher’s exact test was used to assess the relationship between types of nose, according to sex. The significance level was defined as p < 0.05. Values were expressed as mean ± standard deviation (SD).
Morphometric nasal analysis in young adults

Figure 1  Facial and nasal soft tissue landmarks. (A) Facial soft tissue landmarks of glabella (g), nasion (n), pronasale (prn), subnasale (sn), labiale superius (ls) and angles of nasofrontal (nfa), nasal tip (nta), and nasolabial (nla) were demonstrated on lateral view. (B) Facial soft tissue landmarks of alare (al), pronasale (prn) and alar slope angle (asa) were demonstrated on basal view.

(n), the point in the midline of both the nasal root and the nasofrontal suture. Subnasale (sn), the midpoint of the columnella base. Pronasale (prn), the most prominent point on the nasal tip. Glabella (g), the mid-point between the eyebrows. Labiale superius, the midpoint of the upper vermilion line, and the alare (al), the point where the nasal blade (ala nasi) extends farthest, are shown in Fig. 1A and B.

In the present study, the following parameters were measured and noted: nasofrontal angle; glabella–nasion–pronasale (g-n-prn), nasal tip angle; nasion–pronasale–subnasale (n-prn–sn), nosalabial angle; pronasale–subnasale–labiale superius (prn–sn–ls) and alar slope angle; alare–pronasale–alar (al–prn–al), width of the nose; alare–alar (al–al), total nose length; and nasion–subnasale (n–sn). These are shown in Fig. 1A and B.

Nasal Index = \[\text{width of the nose(al-al) \times 100} / \text{total nose length(n-sn)}\]

According to the index, the nose is divided into seven types (Olivier classification). These are: overly narrow nose (X–39.99), very narrow nose (40.00–54.99), narrow nose (55.00–69.99), medium nose (70.00–84.99), broad nose (85.00–99.99), very broad nose (100.00–114.99), and overly broad nose (115.00–X).

Table 2  Number and percentage of individuals among various nose types of young Turkish females and males.

<table>
<thead>
<tr>
<th>Nose types</th>
<th>Females</th>
<th>Males</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very narrow nose</td>
<td>6 (10%)</td>
<td>2 (3%)</td>
<td>8 (7%)</td>
</tr>
<tr>
<td>Narrow nose (55–69.9)</td>
<td>46 (78%)</td>
<td>39 (70%)</td>
<td>85 (74%)</td>
</tr>
<tr>
<td>Medium nose (70–84.9)</td>
<td>7 (12%)</td>
<td>14 (25%)</td>
<td>21 (18%)</td>
</tr>
<tr>
<td>Broad nose (85–99.9)</td>
<td>0 (0%)</td>
<td>1 (2%)</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

According to gender, nose type variability was determined \((\chi^2 = 4.61; \ p < 0.01)\).

Results

The means of females’ nasofrontal angle, nasal tip angle; nasolabial angle and alar slope angle were \(133.16 \pm 8.88\); \(77.91 \pm 9.80\); \(98.91 \pm 10.01\) and \(80.89 \pm 8.33\), respectively. The means of males’ nasofrontal angle, nasal tip angle; nasolabial angle, and alar slope angle were \(123.85 \pm 13.23\); \(82.16 \pm 9.98\); and \(97.91 \pm 8.78\) respectively (Table 1). There were statistically significant differences between the mean values of the nasofrontal angle, nasal tip angle and alar slope angle (\(\chi^2 < 0.05\)).

Nose types were calculated based on the number and percentage of nose types by gender. For females, there were six (10%) with very narrow nose, 46 (78%) with narrow nose, seven (12%) with medium nose. For males, there were two (3%) with very narrow nose, 39 (70%) with narrow nose, 14 (25%) with medium nose and one (2%) with broad nose. According to gender, nose type variability was determined \((\chi^2 = 4.61; \ p < 0.01)\).

For all individuals (males and females), there were eight (7%) with very narrow nose, 85 (74%) with narrow nose, 21 (18%) with medium nose and one (1%) with broad nose (Table 2).

Measurement and evaluation of the wings of the nose typological findings as a result of the way the nostrils, in both males and females as a result of separate reviews have identified five different nostril models. 

Nostril models of females:

1. Wide blunt nasal base, parallel to the ala of the nose, narrow oval nostril.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Females (X \pm SD) (\text{°})</th>
<th>Med (\text{°}) (\text{min-max})</th>
<th>Males (X \pm SD) (\text{°})</th>
<th>Med (\text{°}) (\text{min-max})</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasofrontal angle</td>
<td>133.16 ± 8.88</td>
<td>133.00 (114–148)</td>
<td>123.85 ± 13.23</td>
<td>122.50 (83–150)</td>
<td>0.001a</td>
</tr>
<tr>
<td>Nasalip angle</td>
<td>77.91 ± 9.80</td>
<td>77.50 (60–105)</td>
<td>82.16 ± 9.98</td>
<td>81.25 (66–113)</td>
<td>0.02a</td>
</tr>
<tr>
<td>Nasolabial angle</td>
<td>98.91 ± 10.01</td>
<td>100 (75–126)</td>
<td>97.91 ± 8.78</td>
<td>97.50 (80–124)</td>
<td>0.57d</td>
</tr>
<tr>
<td>Alar slope angle</td>
<td>80.89 ± 8.33</td>
<td>80 (62.50–112.50)</td>
<td>85.98 ± 8.72</td>
<td>87.50 (64–102.50)</td>
<td>0.001a</td>
</tr>
</tbody>
</table>

a  Significant.

b  Non-significant.
II Narrow blunt nasal base, parallel to the ala of the nose, triangular nostril.
III Wide sharp nasal base, round nostril.
IV Wide blunt nasal base, parallel to the ala of the nose, long and large nostril.
V Wide sharp nasal base, parallel to the nasolabial groove, wide oval nostril (Fig. 2).

Nostril models were calculated based on the number and percentage of females nostril models: 17 (28.81%) model I, 17 (28.81) model II, eight (13.55%) model III, ten (16.94%) model IV and seven (11.86%) model V.

Nostril models of males:
I Middle sharp nasal base, parallel to the ala of the nose, narrow oval nostril.
II Wide sharp nasal base, parallel to the ala of the nose, wide oval nostril.
III Wide blunt nasal base, round nostril.
IV Wide blunt nasal base, parallel to the ala of the nose, narrow oval nostril.
V Middle blunt nasal base, parallel to the nasolabial groove, narrow oval nostril (Fig. 3).

The nostril models of males found were: 12 (21.42%) model I, 21 (37.50%) model II, five (8.92%) model III, 15 (26.78%) model IV, and three (5.35%) model V.

Researchers should observe the shape of the dorsum of the nose, which can be straight, concave, convex, or curved. In addition, the shape of the tip of the nose, nose wing shape and height should be examined carefully. Nose profiles of measured subjects were as follows.

Female nose profiles:
I Long nasal dorsum, high nasal root, forward sloping nasal tip, and horizontal nasal base.
II Long nasal dorsum, deep nasal root, upward sloping nasal tip, and downward sloping nasal base.
III Short nasal dorsum, middle nasal root, upward sloping nasal tip, and upward sloping nasal base.
IV Middle nasal dorsum, middle nasal root, upward sloping nasal tip, and horizontal nasal base.
V Middle nasal dorsum, middle nasal root, upward sloping nasal tip, and upward sloping nasal base (Fig. 3).

The female nose profiles found were: 16 (27.11%) profile I, ten (16.94%) profile II, seven (11.86%) profile III, 16 (27.11%) profile IV and ten (16.94%) profile V.

Male nose profiles:
I Short nasal dorsum, deep nasal root, upward sloping nasal tip, and forward/upward sloping nasal base.
II Long nasal dorsum, high nasal root, downward sloping nasal tip, and forward/upward sloping nasal base.
III Long nasal dorsum, middle nasal root, forward/downward sloping nasal tip, and horizontal nasal base.
IV Middle nasal dorsum, deep nasal root, upward sloping nasal tip, and forward/upward sloping nasal base.
V Long nasal dorsum, deep nasal root, forward/upward sloping nasal tip, and forward/upward sloping nasal base (Fig. 4).

The nose profiles of males found were: 12 (21.42%) profile I, eight (14.28%) profile II, six (10.71%) profile III, 20 (35.71%) profile IV and ten (17.85%) profile V (Fig. 5).
## Discussion

The midline area of the face is of crucial importance for the judgment of attractiveness. Lying in the middle of the face, the nasal pyramid plays a noticeable cosmetic role in the appearance of the whole face; it provides harmony and balance to the face. The appreciation of facial attractiveness, especially of the nose, depends on various factors such as gender and the individual observer.

Detailed information was not found in the literature on the comparison of nasal angles, nose types, nostril models, and nasal profile in young Turkish females and males. Standards for analysis of the Turkish male and female nasal shapes and angle measurements are lacking, especially considering that the concept of facial attractiveness is a complex assimilation of innate perceptions and cultural stereotypes.

As with other parts of the body, the external nose angles, nose shape, the head, and face development rapidly during adolescence. It is very important to know the pattern of development and timing of maturity to determine the best time for the reconstruction nasal deformities. Farkas reported that the angles of the nose essentially stop growing at the age of 12 in women and at age 14 or 15 in men, and the size and shape of the external nose is less likely change after maturity. Thus, the present study selected healthy young Turkish males and females aged between 18 and 30 years old and performed an anthropometric study to provide reliable reference data during reconstruction of secondary nasal deformity after cheiloplasty, nasal reconstruction, and repair of nasal defects and rhinoplasty in Turkish adults. This study’s results of angles were compared with the studies available in literature.

The mean result of the nasofrontal angle in the present study for females (133.16°) was smaller than Indian American (138.20°), North American White (134.30°), Korean American (136.80°), Chinese (Han) (144.04°), Croatian (139.11°), and Chinese females (139.09°). The Turkish female mean nasal tip angle value (77.91°) was greater than North American White (67.40°), and smaller than North American Chinese (78.50°), Chinese (Han) (96.16°), Croatian (84.12°), and Chinese females (83.87°). The mean result of Turkish female nasolabial angle (98.91°) was narrower than North American White (104.20°), Korean (103.43°), Japanese (99.87°), Chinese (113.51°), Western (106.52°), Chinese (Han) (103.42°), and Croatian females (109.39°); and wider than Indian American (97.20°), Korean American (92.10°), and Chinese females (97.71°). The Turkish female alar slope angle (80.89°) was smaller than Korean American (81.90°) and Chinese females (90.89°), and greater than North American White females (59.40°).

The mean result of the nasofrontal angle in the present study for males (123.85°) was smaller than Caucasians (137.30°), African American (126.90°), Chinese (Han) (138.19°), and Chinese males (137.43°). The Turkish male mean nasal tip angle value (82.16°) was greater than Caucasian (80.60°) and Croatian males (79.85°); and smaller than Chinese (Han) females (96.16°), Chinese (82.55°), and Italian (93.84°). The Turkish male mean nasolabial angle (97.91°) was narrower than Chinese (Han) (104.30°), Croatian males (105.42°), and Chinese (99.91°); and wider than African American males (83.10°). The Turkish female alar slope angle (80.89°) was wider than Italian females (74.45°). The mean of the Turkish male alar slope angle (85.98°) was smaller than Chinese males (89.07°), and larger than Italian males (75.43°) (Table 3).

In general, surgeons decide the surgical method of external nose reconstruction based on their clinical practice experience, which combines subjective and objective factors. The subjective factor of nasal esthetics varies with ethnic background and geographical and cultural

### Table 3: Comparison of nasal angles of females and males in the present study and other races.

<table>
<thead>
<tr>
<th>Author</th>
<th>Race</th>
<th>Sex</th>
<th>n</th>
<th>NFA (°)</th>
<th>NTA (°)</th>
<th>NLA (°)</th>
<th>ASA (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhee, 2004</td>
<td>Korean</td>
<td>F</td>
<td>22</td>
<td>132.43</td>
<td>103.43</td>
<td>99.87</td>
<td>94.30</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>F</td>
<td>15</td>
<td>132.43</td>
<td>103.43</td>
<td>99.87</td>
<td>94.30</td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td>F</td>
<td>16</td>
<td>132.43</td>
<td>103.43</td>
<td>99.87</td>
<td>94.30</td>
</tr>
<tr>
<td></td>
<td>Western</td>
<td>F</td>
<td>18</td>
<td>132.43</td>
<td>103.43</td>
<td>99.87</td>
<td>94.30</td>
</tr>
<tr>
<td>Husein, 2010</td>
<td>Indian American</td>
<td>F</td>
<td>102</td>
<td>138.20</td>
<td>97.20</td>
<td>97.20</td>
<td>97.20</td>
</tr>
<tr>
<td></td>
<td>NAW</td>
<td>F</td>
<td>200</td>
<td>134.30</td>
<td>67.40</td>
<td>104.20</td>
<td>59.40</td>
</tr>
<tr>
<td>Choes KS, 2006</td>
<td>Korean American</td>
<td>F</td>
<td>72</td>
<td>136.80</td>
<td>78.50</td>
<td>92.10</td>
<td>81.90</td>
</tr>
<tr>
<td>Aung SC, 2000</td>
<td>Chinese</td>
<td>F</td>
<td>45</td>
<td>139.09</td>
<td>83.87</td>
<td>97.91</td>
<td>90.89</td>
</tr>
<tr>
<td>Dong Y, 2011</td>
<td>Chinese (Han)</td>
<td>F</td>
<td>143</td>
<td>144.04</td>
<td>96.16</td>
<td>103.42</td>
<td></td>
</tr>
<tr>
<td>Milosevic AS, 2008</td>
<td>Croatian</td>
<td>F</td>
<td>58</td>
<td>139.11</td>
<td>84.12</td>
<td>109.39</td>
<td></td>
</tr>
<tr>
<td>Sforza C, 2011</td>
<td>Italian</td>
<td>F</td>
<td>66</td>
<td>93.84</td>
<td>75.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present study</td>
<td>Turkish</td>
<td>F</td>
<td>59</td>
<td>133.16</td>
<td>77.91</td>
<td>98.91</td>
<td>80.89</td>
</tr>
<tr>
<td>Porter, 2004</td>
<td>African American</td>
<td>M</td>
<td>109</td>
<td>126.90</td>
<td>83.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nguyen and Turley, 1998</td>
<td>Caucasian</td>
<td>M</td>
<td>116</td>
<td>137.30</td>
<td>80.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aung SC, 2000</td>
<td>Chinese</td>
<td>M</td>
<td>45</td>
<td>137.43</td>
<td>82.55</td>
<td>99.91</td>
<td>89.07</td>
</tr>
<tr>
<td>Dong Y, 2011</td>
<td>Chinese (Han)</td>
<td>M</td>
<td>146</td>
<td>138.19</td>
<td>94.16</td>
<td>104.30</td>
<td></td>
</tr>
<tr>
<td>Sforza C, 2011</td>
<td>Italian</td>
<td>M</td>
<td>126</td>
<td>94.99</td>
<td>74.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present study</td>
<td>Turkish</td>
<td>M</td>
<td>56</td>
<td>123.85</td>
<td>82.16</td>
<td>97.91</td>
<td>85.98</td>
</tr>
</tbody>
</table>

n, number; NFA, nasofrontal angle; NTA, nasal tip angle; NLA, nasolabial angle; ASA, alar slope angle; NAW, North American white; F, female; M, male.
differences. Springer et al. reported that there were gender related effects with respect to the assessment of nasal shape in women as compared to men, who are more critical in assessing the appearance of their own nose as opposed to the noses of other people. Farkas et al. indicated that the neoclassical esthetic standard developed during the European Renaissance is not completely suitable for Asian and African ethnic groups. Similarly, there are still some differences between the esthetics of the people of Turkey and other countries. Whites generally have narrow or medium noses, Asians usually have medium noses, and Blacks often have wide nose. Blacks living in the Congo and Guinea have especially wide noses, with nose indexes over 100.

In the present study, narrow noses predominated: 46 (78%) females, 39 (70%) males, and 85 (74%) among all subjects. Facial analysis, using anthropometric proportions as a guide, is paramount for planning cosmetic and reconstructive facial surgery.

Conclusion

The present study shows that statistically significant differences between the mean values of the nasofrontal angle, nasal tip angle, and alar slope angle in young Turkish males and females, who had mostly narrow noses, among five different nostril models and nose profiles. The Turkish females had mostly nasal profile I and nostril model I, and the Turkish males had mostly nasal profile IV and nostril model II. Average values of the nasal angles, nose types, nostril models, and nasal profiles in this population may be used as a guide to plan corrective esthetic-cosmetic surgery and for burn scars of the nose.

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Conflicts of interest

The authors declare no conflicts of interest.

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