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Abstract

Background The aim of this study was to establish normative quantitative anthropometric measurements of the Persian woman's face and assess differences from established North American White women's measurements.

Methods Standard photographs (frontal, left lateral, and base views) of 107 Persian women volunteers (both parents of Persian ancestry) between the ages of 18 and 40 were digitally acquired. Twenty-six standard anthropometric measurements were obtained using Adobe Photoshop. The results were compared with those previously published for North American White women using an unpaired t test with differences being considered significant if $p < 0.05$.

Results A statistically significant difference was found between Persian women and North American White women in 18 of 26 anthropometric measurements.

Conclusion The anthropometric differences between Persian women and North American White women reflect fundamental differences in the osseochondrous scaffold and soft tissue covering of the face. These differences partially account for the disharmony and loss of ethnic identity that occurs when surgery is planned using classical canons. For patients wishing to maintain their ethnic features following aesthetic surgery, access to ethnicity-specific normative anthropometric data will help guide the surgeon to achieve this goal.

Level of Evidence III This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors at www.springer.com/00266

Keywords Persian face · Persian women · Osseochondrous scaffold

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Introduction

It has been recognized for some time that facial beauty is directly influenced by harmonious facial proportions. While this is an intuitive statement for most aesthetic surgeons, today we have the objective data to support these conceptual frameworks. Farkas [1] and others provide us with the anthropometric data used most frequently to determine ideal facial proportions. This work was derived from detailed analysis of North American White populations. Many of these ideals have naturally found their way into the majority of our facial plastic surgery texts and help

guide us during preoperative aesthetic and reconstructive consultation.

Today, as interest in cosmetic surgery increases, the field has seen an increasing number of procedures performed on members of other races and ethnicities in the United States. Many do not necessarily wish to lose their ethnic identities but simply hope to enhance their beauty by bringing features that are out of proportion back toward proportions that are naturally enhancing. Though they often do not speak in such terms, they do specify that they do not want to have the "operated look" or that they wish to preserve their ethnic features. The problem is that most plastic surgery textbooks devote several introductory chapters on the ideal facial proportions that are derived mainly from neoclassical canons and population studies that focused on North American White or European subjects. The surgical application of these standards on people of other racial and ethnic backgrounds can lead to discordant features and loss of identity, potentially leaving the patient with an unnatural appearance that by any standard is not aesthetically pleasing. The concept of a single aesthetic standard of beauty is no longer adequate.

Many authors have recognized the need for ethnicity-specific anthropometric data and the importance of establishing quantitative and qualitative norms for each of these populations, as evidenced by studies in African American, Hispanic, and Asian groups [2–6]. As expected, the findings in these groups were distinct from Caucasian standards. Persian women have been recognized both nationally and internationally as one of the largest group of users of facial plastic surgery, especially rhinoplasty. To date, there are only a few studies on analysis of the Persian face [7, 8], and these studies have data on only a few features with their numbers diluted between men and women. There are no comprehensive population-based anthropometric studies in the literature on Persian Americans. Therefore, during facial analysis, they are often compared with Caucasian norms despite potential differences in facial proportions. In addition, interracial mixing leads to new facial proportions.

This study compares the facial proportions and measured anthropometric values between Persian women (PW) and published values for North American White women (NAWW). Highlighting potential differences between these groups will potentially help aesthetic surgeons understand the nuances of this ethnic group and guide preoperative planning.

Materials and Methods

Demographic data, including age and parental heritage, were obtained from Persian women volunteers. A requirement for inclusion was that both parents were of Persian ancestry. History of trauma, surgery, or craniofacial syndromes excluded volunteers from the study. Only subjects between the ages of 18 and 40 years were chosen to minimize the effects of aging on facial proportions. One hundred seven PW volunteers comprised the final study group. Informed consent was obtained as approved by the Institutional Review Board of the University of California Irvine. They were digitally photographed using the Canon EOS digital camera with a 100-mm macro lens (Canon U.S.A., Lake Success, NY, USA). Photographs were obtained in frontal, left lateral, and base views (Fig. 1).

The photographs were taken with a ruler in place which was then used for calibration to digitally resize the images so that life-size measurements could be taken using Adobe Photoshop CS2 (Adobe Systems Inc., San Jose, CA, USA). Twenty-six standard anthropometric measurements were obtained. The measurements included nasofrontal angle, nasolabial angle, nasofacial angle, nose height

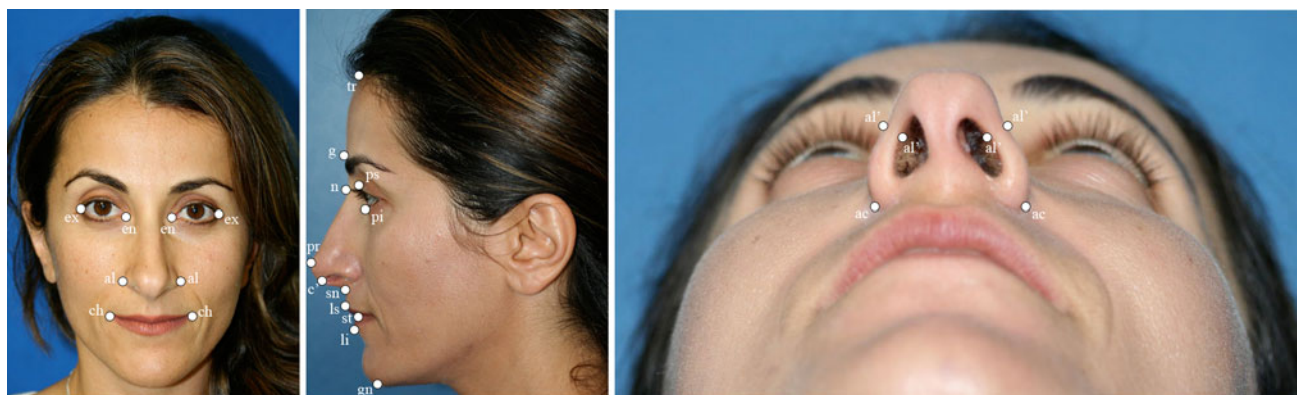**Fig. 1** Frontal (**a**), left lateral (**b**), and base (**c**) views of the face. *n* nasion, *sn* subnasale, *pr* pronasale, *al* alare, *al'* alar rim, *tr* trichion, *g* glabella, *st* stomion, *gn* gnathion, *ch* cheilion, *c'* top of columella,

ls labarale superioris, *li* labarale inferioris, *ps* palpebrae superioris, *pi* palpebrae inferioris, *ex* exocanthion, *en* endocanthion, *ac* alar facial groove

(nasion-subnasale), nose dorsal length (nasion-pronasale), columella length (subnasale-top of columella), tip protrusion (subnasal-pronasale), nose width (alare–alare), nose base diameter (alar facial groove–alar facial groove), right alar thickness (inner–outer alar rim), left alar thickness, forehead height I (trichion-glabella), forehead height II (trichion-nasion), upper-face height (nasion-stomion), midface height (glabella-subnasale), lower-face height (subnasale-gnathion), mouth width (cheilion–cheilion), upper-lip height (subnasale-stomion), upper-vermilion thickness (labrale superioris-stomion), lower-vermilion thickness (labrale inferioris-stomion), eye fissure height (palpebrae superioris-palpebrae inferioris), right eye fissure width (exocanthion-endocanthion), intercanthal distance (endocanthion–endocanthion), left eye fissure width, right canthal tilt, and left canthal tilt. Two investigators (AS and JPP) obtained the measurements, each taking the same 13 measurements on all subjects. The results were compared with those previously published for NAWW using an unpaired t test. The previously published study also took anthropometric measurements. Differences were considered statistically significant if the chance of a type I error was less than 5% ($p < 0.05$).

Results

A statistically significant difference was found between PW and NAWW in 18 anthropometric measurements. There was no significant difference in the remaining 8 measurements (Table 1). Linear measurements are reported in millimeters and angles are expressed in degrees.

The average PW face has very different anthropometric measurements than that of NAWW face. The nasofrontal and nasofacial angles are larger in PW. For ease of picturing the differences between the PW and the NAWW faces, the differences will be separated into horizontal thirds. In the upper third, PW have a shorter forehead (trichion to glabella), a smaller eye fissure height, a smaller eye fissure width, and less of an antimongoloid slant to the eyes. In the middle third, PW have a shorter columella, a wider nose, a wider nasal base, and thinner ala. In the lower third, PW have a smaller lower face height, a thinner upper vermilion, and a narrower mouth. The anthropometric measurement differences between PW and NAWW reflect variance in the osseochondrous scaffold and soft tissue covering.

Table 1 Anthropometric measurements of PW compared with those of NAWW

Anthropometric measurement	PW	NAWW	Mean difference	p value
Nasofrontal angle	140.98 (29.96)	134.30 (7.00)	6.68	0.003
Nasolabial angle	103.45 (13.49)	104.20 (9.80)	−0.75	0.571
Nasofacial angle	35.81 (4.24)	29.90 (3.90)	5.91	<0.001
Nose height (n-sn)	5.08 (0.43)	5.06 (0.31)	0.02	0.635
Nose dorsal length (n-pr)	4.41 (0.40)	4.47 (0.34)	−0.06	0.160
Columella length (sn-c')	0.83 (0.17)	1.15 (0.17)	−0.32	<0.001
Tip protrusion (sn-pr)	1.97 (0.18)	1.97 (0.16)	0	1
Nose width (al–al)	3.52 (0.30)	3.14 (0.20)	0.38	<0.001
Nose base diameter (ac–ac)	3.14 (0.52)	3.05 (0.22)	0.09	0.033
Right alar thickness (al'–al')	0.44 (0.08)	0.53 (0.07)	−0.09	<0.001
Left alar thickness	0.45 (0.08)	0.53 (0.07)	−0.08	<0.001
Forehead height I (tr-g)	4.63 (1.47)	5.27 (0.60)	−0.64	<0.001
Forehead height II (tr-n)	6.50 (1.98)	6.30 (0.60)	0.2	0.185
Upper face height (n-st)	7.01 (1.10)	6.94 (0.32)	0.07	0.401
Midface height (g-sn)	6.91 (0.48)	6.31 (0.44)	0.6	<0.001
Lower face height (sn-gn)	6.15 (0.48)	6.43 (0.40)	−0.28	<0.001
Mouth width (ch–ch)	4.92 (0.43)	5.02 (0.35)	−0.1	0.026
Upper lip height (sn-st)	1.90 (0.24)	2.01 (0.20)	−0.11	<0.001
Upper vermilion thickness (ls-st)	0.77 (0.14)	0.87 (0.13)	−0.1	<0.001
Lower vermilion thickness (li-st)	0.95 (0.17)	0.94 (0.15)	0.01	0.589
Eye fissure height (ps-pi)	0.92 (0.24)	1.09 (0.12)	−0.17	<0.001
Right eye fissure width (ex-en)	2.68 (0.23)	3.07 (0.12)	−0.39	<0.001
Intercanthal distance (en–en)	3.20 (0.30)	3.18 (0.23)	0.02	0.509
Left eye fissure width	2.68 (0.33)	3.07 (0.12)	−0.39	<0.001
Right canthal tilt	3.04 (2.39)	4.10 (2.20)	−1.06	<0.001
Left canthal tilt	2.71 (2.38)	4.10 (2.20)	−1.39	<0.001

Angles are measured in degrees and lengths in mm with two standard deviations indicated in parentheses

Table 2 Comparison of the PW and NAWW facial anthropometric measurements and how well they approximate four neoclassical canons (lengths in cm)

Neoclassical canons		PW	NAWW
3-section facial profile	Trichion-nasion	6.5	6.3
	Nasion-subnasale	5.08	5.06
	Subnasale-gnathion	6.15	6.43
	(upper 1/3-lower 1/3)	0.35	-0.13
Orbitonasal proportion	Alare–Alare	3.52	3.14
	Endocanthion-endocanthion	3.2	3.18
	Difference	0.32	−0.04
Orbital proportion	Endocanthion-endocanthion	3.2	3.18
	Exocanthion-endocanthion	2.68	3.07
	Difference	0.52	0.11
Naso-oral proportion	1.5 × (Alare–Alare)	5.28	4.71
	Cheilion–Cheilion	4.92	5.02
	Difference	0.36	−0.31

Some of the vertical and horizontal proportions of the face were compared with those of the White population using four neoclassical canons (Table 2). The first canon checked was the three-section facial profile, which states that the upper third of the face (trichion-nasion) should be equal to the middle third of the face (nasion-subnasale), which should be equal to the lower third of the face (subnasale-gnathion). In the PW, the lower third of the face was shorter than the upper third by 3.5 mm, while in the NAWW the lower third was longer than the upper third by 1.3 mm. The two populations deviated from the canon in opposite directions and the amount of deviation was greater in the PW.

The second canon assessed was the orbitonasal proportion, which states that the intercanthal distance (en–en) should be equal to the nasal width (al-al). In PW, the nasal width was wider than the intercanthal distance by 3.2 mm while in NAWW the nose was narrower than the interocular distance by 0.4 mm. Again, the two populations skewed in opposite directions, with the NAWW coming much closer to satisfying the canon.

The third canon tested was the orbital proportion, which states that the intercanthal distance (en–en) should be equal to the horizontal eye fissure width (en-ex). In both populations the eyes were spaced closer together than 1 horizontal eye fissure width. However, the NAWW came closer to the canon (difference of 1.1 mm), while the eyes in PW were placed 5.2 mm closer together than a horizontal eye fissure width.

Lastly, the naso-oral proportion was assessed. This canon states that the nasal width should be two thirds the mouth width, or alternately stated as 1.5 times the nasal width should equal the mouth width. The absolute value of

the deviation from this canon was similar in both groups (3.6 mm in PW and 3.1 mm in NAWW). However, they deviated in opposite directions. The nose was too wide relative to the mouth in PW, while the mouth was too wide relative to the nose in NAWW.

Discussion

The neoclassical canons for ideal facial proportions were established primarily by artists of the 17th century based on European White subjects. The earliest and largest body of quantitative anthropometric measurements was also derived from North American White subjects [1]. This previously published study obtained measurements using anthropometric techniques, and the current study uses photogrammetric measurements. While the two techniques are different, both are validated and are comparable measurements [9]. This particular previous study is used for comparison because it contains the most accepted measurements for NAWW. These canons and quantitative data have established the fundamental principles of aesthetic facial analysis taught and used by the vast majority of facial plastic surgeons. However, there are inherent problems with applying canons based on exclusively White subjects to modern society comprised of heterogeneous races and ethnicities, especially with increasingly more non-White consumers of facial plastic surgery [10].

It is clear that differences exist in normative anthropometric measurements among different races and ethnicities. To date much has been written about White, African American, and Latino, and Korean facial proportions and measurements [2–6]. However, the little data available on the Persian population was limited to 20-year-old subjects [8]. That study included 50 men and 50 women and was also limited in scope because fewer features were measured.

The anthropometric measurement differences between PW and NAWW reflect variance in the osseochondrous scaffold and soft tissue covering. The nasofrontal and nasofacial angles are larger in PW. The columella is longer in NAWW, while the nose is wider in PW. The lower third of the face is longer in NAWW. The mouth is wider, upper lip longer, and upper vermilion thicker in NAWW. NAWW eyes are larger and have a slightly more mongoloid slant. The average PW face has very different anthropometric measurements than those of NAWW.

Studies suggest that while women of different ethnicities share the same definitions of beauty in some areas of the face, in other areas of the face it is the ethnic differences that yield the ethnic identity and define beauty [11]. Although the absolute value of the differences between measurements in PW and NAWW are small, when taken

together they yield a face with very distinctive proportions. These differences give rise to the potential for disharmony and loss of ethnic identity if the classical canons of facial analysis are used to plan cosmetic surgery for this ethnic group. Therefore, a single definition of beauty is inadequate for planning cosmetic surgery on people of different or multiple ethnic backgrounds.

Conclusions

To date, facial cosmetic surgeons are taught to depend on the neoclassical canons to assess and critique the face prior to surgery. This study shows that the average PW does not have the same facial proportions as the average NAWW. It is concordant with the growing body of literature affirming the limitations of facial analysis based on normative data derived from a single ethnic group. With the high demand for facial cosmetic surgery in the Persian population, ethnicity-specific facial proportions must be incorporated into analysis and surgical planning. This study provides objective, detailed, normative anthropometric data that can be used as a reference for facial analysis in the Persian population. Further work will need to be done to determine qualities and proportions that are subjectively considered beautiful on the PW face and analyze how those compare with PW and NAWW averages.

Disclosure The authors have no conflicts of interest to disclose.

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