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Research Article/Özgün Araştırma

Face anthropometry of Turkish population

Türk popülasyonunda yüz antropometrisi

Işık TUNCER[1]

[1]Department of Anatomy, Meram Faculty of Medicine, Necmettin Erbakan University, 42080, Konya-Turkey

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Abstract

Aim: Analysis of facial anthropometry of modern Turkish population is important for cosmetic or reconstructive facial surgeries. In this study, it is aimed to make multiple measurements of the face in the Turkish population.

Materials and Methods: In this study, the measurements were performed on 93 Turkish adult individuals (54 males, 39 females). 13 direct facial anthropometric measurements were performed. A total set of anthropometric data was collected for each gender.

Results: Statistically significant differences were found between Turkish male and Turkish female individuals. All values except forehead height were found to be higher in males than females. Ear length was found to be higher than nose length in both males and females. Mouth width value was found to be greater than left eye fissure length and nose width values in both genders.

Conclusion: In the study, statistically significant differences were found in head and face regions between both genders when facial norms were applied for Turkish adults.

Keywords: Face; Morphometry; Adult; Gender.

Öz

Amaç: Modern Türk nüfusun yüz antropometrisinin analizi kozmetik veya rekonstrüktif yüz cerrahileri için önemlidir. Bu çalışmada, Türk populasyonunda, yüzün çoklu ölçümlerinin yapılması amaçlanmıştır.

Gereç ve Yöntem: Bu çalışmadaki ölçümler 93 yetişkin (54 erkek, 39 kadın) Türk üzerinde yapılmıştır. Her cinsiyet için tam bir set antropometrik data toplanmıştır.

Bulgular: Erkek ve kadın Türk bireyler arasında istatistiksel olarak anlamlı olan farklılıklara rastlandı. Alın yüksekliği hariç tüm değerler erkeklerde kadınlardan daha yüksek olarak bulundu. Hem kadınlarda hem de erkeklerde kulak uzunluğu burun uzunluğundan daha yüksek bulundu. Hem erkeklerde hem de kadınlarda ağız genişliği sol göz fisür uzunluğu ve burun genişliğinden daha fazla bulundu.

Sonuç: Bu çalışma, Türk yetişkinlerin yüz normları da uygulandığında cinsiyetler arasında, kafa ve yüz bölgelerinde istatistiksel olarak anlamlı farklılıklar bulunduğunu göstermektedir.

Anahtar Kelimeler: Yüz; Morfometri; Yetişkin; Cinsiyet.

Yazışma Adresi/Address for Correspondence: Işık TUNCER, Department of Anatomy, Meram Faculty of Medicine, Necmettin Erbakan University, 42080, Konya-Turkey, E-mail: ituncer42@gmail.com

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Introduction

Whenever a facial surgery is planned, quantitative evaluation of facial morphology with the help of anthropometric measurements is crucial for surgeons, both in reconstructive surgery after travma and oncological resections and also in an aesthetic procedure. By the time this study was conducted, various disciplines such as pediatrics, medical genetics, orthodontics and craniofacial surgery often used anthropometric measurements of the face in clinical assessment, diagnosis and reconstruction planning. Moreover, facial anthropometric values were also used to study the differences among various ethnic or racial groups.[1,5] The facial morphology explains some variations among populations of different ethnic backgrounds. Suggesting a single standard method for all ethnic groups is not accurate as it may lead to aesthetically unacceptable results. For this reason, specific facial norms must be available for each ethnic group. However, those data are incomplete or not available for many ethnic groups, and the differences among different ethnic groups have not been sufficiently studied so far.

Centuries ago, ancient Greeks were the first to perform such measurements of the human face. Greek sculptor Polycleitus described the ideal proportions of the human face in the 5th century BC,[6] and introduced canons that evolved to the neoclassical canons of the face. Those explanations are still being used today as a starting point for facial operations. In a previous study, however, it has been demonstrated that those neoclassical facial canons are not valid in the majority of modern Greeks.[7]

Some studies have showed normative data of facial measurements in North American, Caucasians, Africans, Americans,[2] Koreans[8] and also in other ethnic groups.[3,4] However, the normative values of the Greek face could not be determined sufficiently although the Greeks were the first to make the measurements of the human face. In a multi-center study,[5] professor Leslie Gabriel Farkas (1915-2008), known for modern facial anthropometry, and his colleagues studied the craniofacial characteristics of 25 ethnic groups, including the Greeks. But in their study, a limited number[9] of parameters were examined in a relatively small number of Greek participants (30 males and 30 females).

Since there is no systematic study available on the field of morphometric measurements of the face in Turkish population, it is a desirable task to conduct this study. It may bring some useful information for forensic odontologists, plastic surgeons and the forensic experts, which means it may be useful for cosmetic correction purpose and also for identification

Materials and Methods

The type of the study

This is a cross-sectional study in which multiple measurements of the face of young Turkish males and females are performed to provide a complete facial anthropometric profile of the population and compare its facial morphology with previous studies.

The population and the sample of the study

The study was conducted in 2019. A total of 93 volunteer adults (54 males and 39 females) were studied. The principles outlined in the Declaration of Helsinki were followed and also informed consent was obtained (2019/1956). Adults and all their four grandparents examined in this study were of Turkish origin. These individuals had normal body mass index and no history of facial reconstructive or aesthetic operations and no apparent facial anomalies. The power analysis was performed apriori by using measurements, and minimum sample size was determined as 85 for 90% power. Therefore, our sample size met the requirements of the power analysis. The subjects were selected randomly using computer aided randomization.

Data collection

The measurements used in the study were selected to examine the morphologic characteristics of the craniofacial complex and conducted according to the standard procedure described by Farkas.[10] Thirty-one measurements were performed for each individual. General anthropometric

instruments[11] were the tools for these measurements. Surface landmarks (Table 1)[11] were marked on the face of each individual before the measurements were obtained. Each measurement was taken twice by the same observer and the calculated mean value was used. The measurements performed were shown in Table 1, 2, 3 and 4.

Table 1. Analyzed Anthropometric Landmarks 11

Anthropometric Landmarks
Gonion (go) The most lateral point on the mandibular angle close to the bony gonion
Gnathion (gn) The lowest median landmark on the lower border of the mandible
Trichion (tr) The point on the hairline in the midline of the forehead
Nasion (n) The point in the midline of both the nasal root and the nasofrontal suture
Glabella (g) The most prominent midline point between the eyebrows
Endocanthion (en) The point at the iner commissure of the eye fissure
Exocanthion (ex) The point at the outer commissure of the eye fissure
Alare (al) The most lateral point on each alar contour
Subnasale (sn) The midpoint of the columella base at the apex of the angle where the lower border of the nasal septum and the surface of the upper lip meet
Cheilion (ch) The point located at each labial commissure
Superaurale (sa) The highest point on the free margin of the auricle
Subaurale (sba) The lowest point on the free margin of the ear lobe
Tragion (t) The notch on the upper margin of the tragus

13 direct facial anthropometric measurements were performed. Vertical measurements were special head height (v-en), special face height (en-gn), forehead height II (tr-n), nose length (n-sn), lower face height (sn-gn), height of calvaria (v-tr), forehead height I (tr-g), special upper face height (g-sn), ear length (sa-sba). Horizontal measurements were nose width (al-al), left eye fissure length (ex-en), intercanthal distance (en-en), and mouth width (ch-ch).

Statistical analysis

The descriptive statistics were presented as mean±standard deviation (min–max) for normally distributed variables. The normality assumption was checked by Kolmogorov-Smirnov test. Independent sample Student t-test was used for comparing data and landmark distances according to gender. Pearson Correlation Coefficient analysis was used to determine the relations between the measurements. Intraclass Correlation Coefficients (ICC) values were calculated since the measurements were performed twice by the researcher. The statistical analyses were performed by IBM SPSS V.20 (IBM Inc, Chicago, IL, USA). $p<0.05$ value was considered as statistically significant result.

Results

The mean age of the volunteers was 19.26±1.03 in males and 18.95±1.34 in females. Anthropometric analysis results obtained by examining the Turkish individuals in city of Konya were presented in Table 2. Results of facial anthropometric measurements for all individuals were summarized by gender in Table 3. All the measurements were given in millimeters. Face measurements were compared between the genders using Student t-test.

Correlation coefficient was performed to show the correlation between two variables. Data obtained from this were presented in Table 4. Intra-observer agreement value was found high and acceptable, and calculated as 0.913.

Discussion

In some practices that involve facial aesthetics, the clinicians must understand the unique and detailed morphology of their patient's ethnic group before applying any treatment.[12] There are many patients that want to preserve their specific ethnic facial features during reconstructive and aesthetic applications. Data on face norms are of great importance. In the absence of these norms, there are some risks as misdiagnosing, incorrect treatment planning and unplesant surgical outcome in patients of different

ethnic origins. Furthermore, facial norms may also be used as a guide to understand the differences in facial profiles among different ethnic groups.

Table 2. The Mean, SD, Minimum and Maximum of the Face Anthropometric Measurements in Our Population: Women (n: 39), Men (n: 54)

Parameter	n	Mean	SD	Minimum	Maximum
age	93	19,12	1,17	17,00	24,00
v-en	93	101,67	24,43	74,20	311,40
en-gn	93	115,27	8,88	96,20	147,00
tr-n	93	65,33	7,54	49,00	89,00
n-sn	93	55,80	3,97	43,70	65,00
sn-gn	93	66,21	8,16	44,80	83,80
v-tr	93	36,80	10,67	15,20	63,40
tr-g	93	59,61	7,10	44,00	84,90
g-sn	93	58,03	3,98	48,30	68,00
sa-sba	93	60,45	4,14	50,00	71,40
ex-en	93	33,58	5,10	3,00	63,50
en-en	93	32,59	3,58	15,40	39,90
al-al	93	34,16	2,74	28,20	41,60
ch-ch	93	47,51	4,00	38,80	57,70

Table 3. Face Anthropometric Measurements According to Sex (Results are given in mm)

Parameter	Male		Female			
	n	mean±SD	n	mean±SD	t	*p*
Age	54	19.26 ± 1.03	39	18.95 ± 1.34	1.21	0.229
v-en	54	105.56 ± 31.02	39	96.39 ± 7.92	2.06	0.043
en-gn	54	120.06 ± 7.70	39	108.78 ± 5.71	8.07	<0.001
tr-n	54	65.45 ± 7.28	39	65.18 ± 7.98	0.16	0.871
n-sn	54	56.44 ± 4.31	39	54.94 ± 3.33	1.89	0.062
sn-gn	54	70.49 ± 6.64	39	60.40 ± 6.25	7.44	<0.001
v-tr	54	38.90 ± 11.05	39	33.97 ± 9.56	2.29	0.024
tr-g	54	59.37 ± 6.94	39	59.95 ± 7.40	-0.38	0.707
g-sn	54	58.89 ± 4.17	39	56.87 ± 3.43	2.54	0.012
sa-sba	54	61.65 ± 3.85	39	58.84 ± 4.03	3.37	0.001
ex-en	54	34.21 ± 4.58	39	32.74 ± 5.69	1.33	0.187
en-en	54	33.16 ± 3.00	39	31.83 ± 4.17	1.69	0.095
al-al	54	35.46 ± 2.48	39	32.40 ± 2.04	6.50	<0.001
ch-ch	54	48.73 ± 3.91	39	45.86 ± 3.56	3.66	<0.001

* Significant at p<0,05 level according to Student t-test

Direk et al.[13] showed in their study that there was a significant difference between inner canthal distance and age. Besides, in a study conducted on Indians, there was a significant increase in the inner canthal distance after the age of 45.[14] The inner canthal distance also had some similarities with different studies on Turkish people.[15-18] Therefore, inner canthal distance in Turkish people is considered in narrow categories. American, Bulgarian, Macedonian, Azerbaijani, German and Greek women are also in the same category. But Persian women tend to have very narrow inner canthal distance.[15,19,20]

Direk et al.[13] did not found a significant difference between interpupillar distance and age in their study. But other studies on Turkish people showed a greater interpupillar distance.[15,16,21] In our opinion, the different results were caused by the measurement technique. When it is compared to others, Americans have lower interpupillar distance.[19,22]

Table 4. Correlation Cofficients (R) between the Face Anthropometric Measurements

	age	v-en	en-gn	tr-n	n-sn	sn-gn	v-tr	tr-g	g-sn	sa-sba	ex-en	en-en	al-al
Age													
v-en	0.194												
en-gn	0.117	0.169											
tr-n	-0.112	0.065	0.085										
n-sn	0.124	0.186	0.333*	0.245*									
sn-gn	0.112	0.185	0.682**	0.063	0.286								
v-tr	0.361	0.291*	0.096	-0.299*	0.023	0.024							
tr-g	-0.111	0.016	0.019	0.832**	0.142	0.116	-0.309*						
g-sn	0.120	0.139	0.431**	0.233*	0.830**	0.282*	0.087	0.089					
sa-sba	0.169	0.045	0.362	0.123	0.234*	0.302*	0.042	0.111	0.211*				
ex-en	0.095	0.088	0.261	0.058	-0.247*	0.114	0.087	0.052	-0.155	-0.035			
en-en	0.208	0.041	0.202	0.030	0.353*	0.084	-0.083	-0.088	0.268*	0.133	-0.144		
al-al	0.111	0.077	0.351*	-0.062	0.145	0.380*	0.322*	-0.114	0.244*	0.209	0.118	0.075	
ch-ch	0.181	0.176	0.284	0.059	-0.063	0.212	0.261*	-0.027	0.104	0.166	0.237*	-0.146	0.377*

* significant at p<0.05 level according to Pearson Correlation Analysis
**significant at p<0.001 level according to Pearson Correlation Analysis

As Direk et al.[13] showed in their study, the palpebral fissure length reduced as the age increased. There was averagely 1.5 mm shortening between each age group. Bosch et al.[23] reported that palpebral fissure length was affected by age. While some eyelids did not change position, the palpebral fissure lengthened by 3 mm at any age between the ages of 12 and 25. It was also shown to shorten by 2.5 mm per year between the ages of 35 and 85. Direk et al.[13] compared the results of their study with the studies done by Farkas et al.[5] and Wei,[24] and found that Chinese women had a lower palpebral fissure length. This may indicate the presence of epicanthal curve found in Asian people. The results show that the values of Greek, Bulgarian and German women are closer to each other while length of palpebral fissure is longer in Azerbaijani women.

Inter-canthal width on adults was similar to the anthropometric data in the literature,[25-29] as well as three dimensional computerized data.[30] Binocular width was somewhat smaller than that reported by Pryor,[29] but similar to that from several other reports in the literature.[26-28-30]

The biggest difference (approximately 10 to 11 mm more than the data of the study presented here) was found for the data collected using the optoelectronic system.[31,32] It should be noted that the optoelectronic system collected landmark data identified by retroreflective markers positioned on the individual's face. For an exocanthion landmark, the marker was positioned on the frontozygomatic suture, a number of millimeters lateral from the actual landmark, as shown in detail by Ferrario et al.[31]

Physical and social characteristics must be taken into account in order to perform rhinoplasty in the Middle Eastern population.[33-34] The ability of CT scans in making a pre-operative plan for rhinoplasty patients is not excessive. Clinical series of CT-PNS data were used to find unique radiological features of the native Saudi nose and the results for the Saudi population were compared with the Asian community. Anthropometric data were used medically as a mean to help plastic surgeons in the examinations of the human face, or to determine whether it was normal or abnormal, beautiful or aesthetically disadvantaged, and improved or not improved.[34] This is generally

done by comparing a subject to an ideal subject.[34] However, the 3-dimensional stereoscopic location of facial structures is inconsistent between the radiological anthropometry (2 dimensions) and biometric (radiographic) anthropometry measurements.[35] But radiological advancement using 3-dimensional CT scans gives a more accurate assessment of the nasal bone and the angles of the nose. The data obtained in this study fills a gap in the research, providing reference criteria for radiological measurements of the noses of Saudi people.

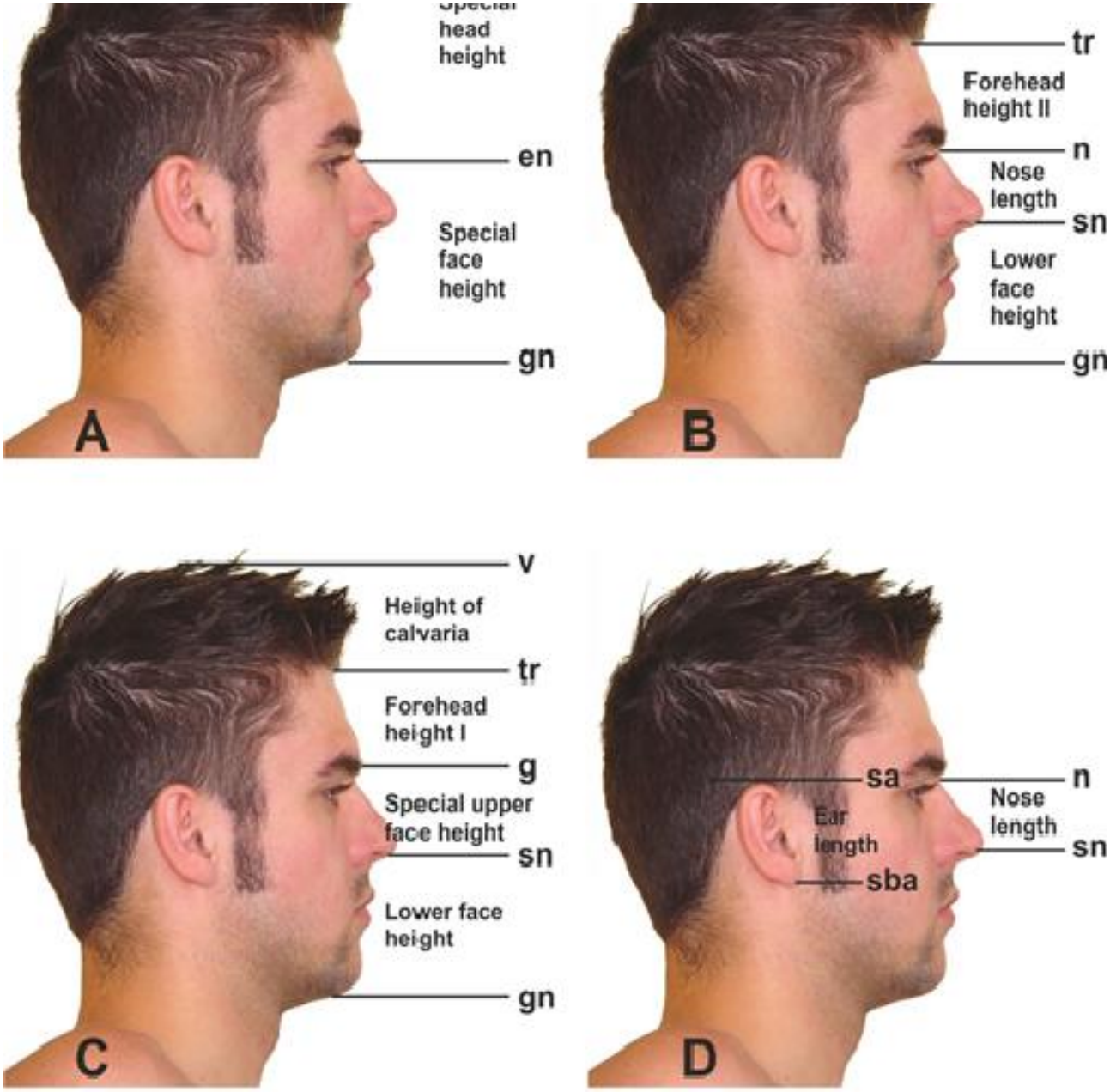

Figure 1. Vertical measurements; A; special head height [vertex-endocanthion (v-en)], special face heihgt height [endocanthion-gnathion (en-gn)], B; forehead height II [(trichion-nasion (tr-n)], nose length [nasion-subnasale (n-sn)], lower face height [(subnasale-grathion (sn-gn)], C; height of calvaria [vertex-trichion (v-tr)], forehead heihgth I [trichion-glabella [(tr-g)], special upper face height [glabella-subnasale (g-sn)], lower face height [(subnasale-gnathion (sn-gn)], D; nose length [nasion-subnasale (n-sn)], ear length [supraaurale-subaurale (sa-sba)].

As mentioned earlier, photogrammetric analysis is less reliable than the anthropometric analysis.[36,37] However, in their study, Jeffries et al.[38] photogrammetrically examined 200 African American subjects (100 males and 100 females) aged 18 to 35. Computer analysis of the photographs was implemented and the results were compared with those of Farkas.[10] They showed that African American and

white subjects had similar vertical facial proportions, but the values of horizontal proportions differed significantly. The African American nose was shorter than the white nose. The horizontal dimensions (interocular distance, nose width, mouth width and facial width) indicated many differences between races, including 97% of the study group having a nose that was wider than the interocular distance compared with 40.8% of white individuals who had a nose that was the same size as the interocular distance. Jeffries et al.[38] thought that their findings were compatible with the data in literature. But they reported that there were inherent problems with measurements.

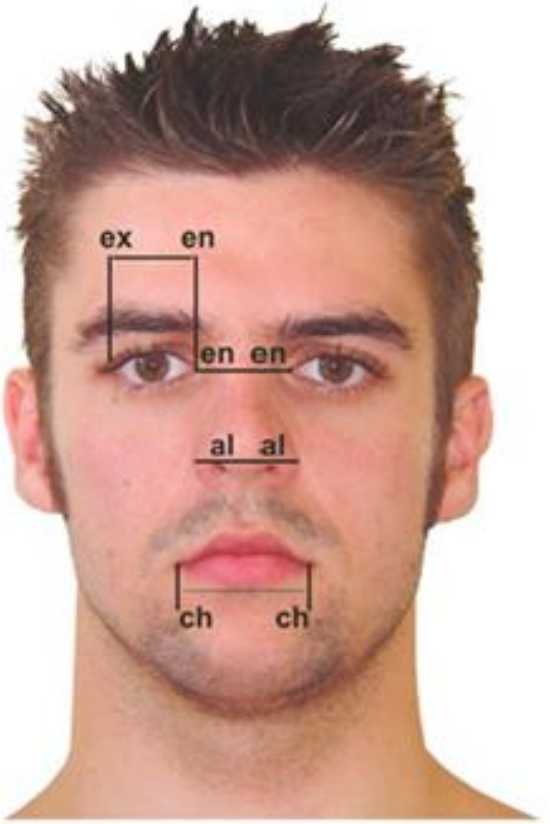

Figure 2. Horizontal measurements: right eye fissure length [exocanthion-endocantion (ex-en)], intercanthal distance [endocanthion-endocanthion (en-en)], nose width [alare-alare (al-al)], mouth width [cheilion-cheilion (ch-ch)

Surgeons usually decide the surgical method to be used in external nasal reconstruction, taking into account clinical practice experiences which have both subjective and objective factors.[39] The subjective factor of the nasal aesthetics mentioned here differs according to ethnic origin and geographical and cultural differences.

Springer et al.[40] wrote that there were gender related effects in the assessment of nasal shape. Women were more critical in assessing the appearance of their own nose in comparison to men and more critical in assessing the appearance of their own nose as opposed to the noses of other people.

Farkas et al.[5] reported that the neoclassical aesthetic standard developed during the European Renaissance is not completely suitable for Asian and African ethnic groups. Similarly, despite the fact that aesthetics of the people in different parts of China are influenced by the traditional Han culture, there are still some differences between them.

The objective factor mentioned above in external nasal reconstruction is the common application of systematic anthropometric methods to measure the soft tissue of the external nose before surgery. Pre-operative determination and surgical approach should be carried out according to the shape of face, mouth, eyes and body. It also refers to the measurement values of the normal population in the same gender and ethnic back ground as a basis to decide the degree of reconstruction and the morphology of implant and objectively guide the actual surgery.[41,42]

The differences in normative facial anthropometry show the specific facial features of ethnic groups and genders. Databases of those measurements should be available for different ethnic male and female populations. Inter individual variations which are generally mentioned in certain measurements should also be noted. Considering these specific factors may help plastic surgeons to decide for their operation approaches at some point. Certain facial features may be created or altered in either reconstructive or aesthetic surgery, and the desired result may be obtained.[9]

Bashour el al.[43,44] found that there are four most important cues determining attractiveness: averageness, sexual dimorphism, youthfulness, and symmetry. He pointed out that a surgeon planning facial cosmetic, plastic or reconstructive surgery can

potentially gain both profound comprehension and better-quality surgical results by appreciating these findings.

Bianchini et al.[45] studied face types in a South American sample aged 15 to 18. In the Brazilian population, they observed the face type as leptoprosopic (13.45%) in females and hyperleptoprosopic (27.73%) in males According to Özşahin et al.[46], Turkish face types are somewhat different from this.

Conclusion

This study shares data for pre-operative purposes and also post-operative evaluation of Turkish patients. It can be concluded that the anthropometric data obtained from this study may provide a guide in quantitative analysis of the face of Turkish for plastic and reconstructive surgery field.

Ethics Committee Approval

For this research, the Scientific Research and Publication Ethics Committee approval numbered 05.07.2019/1956 was taken from the relevant university. The study was carried out in accordance with the Helsinki Declaration of Principles. The written permissions and consent were obtained from the clinic where the research was conducted.

Informed Consent

All participants signed the Informed Consent Form and their consent was obtained.

Author Contributions

This study was prepared by a single author. Therefore, all processes such as writing, measurements, analyses and submission were carried out by this author.

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Conflict of Interest

There is no conflict of interest to declare.

Financial Disclosure

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Peer-review

Externally peer-reviewed.

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