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Original Article

Anthropometric measurements of the orbital contour and canthal distance in young Turkish

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ABSTRACT

Introduction: This study is aimed to define the mean values of the different anthropometric measurements of right and left orbits and giving the average of the basic measurements of the soft orbital tissues in young Turkish and compare the obtained measurements between women and men.

Materials and methods: 115 students (59 female and 56 male) from Yasar Dogu School of Physical Education and Sport of Ondokuz Mayis University participated in the study. The age of participants were ranging between 18 and 30 years. 12 measurements were done, 3 for general body measurement and 9 for orbit contour region. The parameters of measurements are the intercanthal width (en-en), the biocular width (ex-ex), interpupillary distance (p-p), palpebral fissure width right-left (ex-en/r-l), height of the orbit right-left (os-oi/r-l), palpebral fissure height right-left (ps-pi/r-l).

Results: The mean values of en-en, ex-ex, p-p, ex-en/r-l, os-oi/r-l, and ps-pi/r-l in males the mean values were, 28.68 ± 3.61 mm, 96.43 ± 11.90 mm, 61.73 ± 3.77 mm, 36.02 ± 2.71 mm/35.63 ± 2.79 mm, 35.19 ± 4.37 mm/35.13 ± 4.49 mm, 10.06 ± 1.74 mm/10.30 ± 1.90 mm, respectively. However, in females were 27.84 ± 2.90 mm, 95.08 ± 9.85 mm, 58.99 ± 3.22 mm, 35.01 ± 2.27 mm/34.66 ± 2.28 mm,35.15 ± 3.64 mm/35.79 ± 3.70 mm, 10.31 ± 1.43 mm/10.37 ± 1.73 mm, respectively.

Discussion: The results indicate that the measurements were higher in males than in females ($p < 0.001$). The normative anthropometric data presented in this study would be useful for clinical interpretation of periocular pathology and serve as reference values when planning aesthetic and posttraumatic surgical interventions.

1. Introduction

Anthropometry is a science which is concerned with measurements of physical size and shape of human body. The measurements are taken from body surface landmarks; such as angles, circumference, lengths and widths, using simple instruments.[1]

During the fifth century B.C.; the Greek sculptor Polycleitus detailed the ideal proportions of the human body in his

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Canon.[2] Subsequently, in Renaissance, artists and scholars, including Leonardo da Vinci, Bergmuller, Dürer and Elsholts, have investigated and developed the rules for facial proportions.[1,3,4] The science of anthropometry has been introduced into clinical practice in the past several decades of the late nineteenth century.[1,3]

Craniofacial anthropometric parameters provide important information about optimal facial harmony in clinical practice.[5] These parameters are used for early diagnosis of the syndromic conditions and congenital or acquired orbital or facial deformities, for planning surgical operations and evaluating the result of plastic surgery.[6] Raschke et al[7] reported that the anthropometric measurements presented may be of help to surgeons, to confirm the estimations performed intraoperatively, postoperatively and to objectify the risk of postoperative distortion. In addition, orbital parametric values guide the manufacture of spectacle frames and lenses.[8] Anthropometric parameters exhibit differences with age, sex and ethnic background and several authors have undertaken to document normative values which may serve as reference index for different populations.[6] Moreover statistical data about the anthropometric measurements in a population are useful for forensic scientists.[6,9]

The present study is a comparative study and investigated the anthropometrics measurements of orbit in males and females. The purpose of the study is to provide normative data that could be used for clinical assessment, craniofacial surgery and anthropologic evaluation for the index population.

2. Material and methods

2.1. Subjects

This is the observational descriptive cross sectional Study, carried out on 115 students (59 women and 56 men) from Yasar Dogu School of Physical Education and Sport of Ondokuz Mayis University. The age of participants were ranging between 18 and 30 years. The criteria of selection include those with no evidence of congenital face anomalies or previous eye surgeries.

The study was approved by the Ethical Committee of the University and the participants were consented to all procedures.

Student's height, weight and body mass index (BMI) were measured by a height and weight measuring instrument is (Seca 220 Mod Hamburg, Germany; 0.5 cm) and a scale (Seca 220 Mod Hamburg, Germany; 0.1 kg Max: 200 kg).

2.2. Anthropometric measurement

The Methodology and standardized measurements of the orbit were taken according to the landmarked points defined by Farkas.[10] The parameters of measurements are the Intercanthal Distance (ICD: en-en), Outercanthal Distance (OCD: ex-ex), Interpupillary Distance (IPD: p-p), Palpebral Fissure Width right-left (PFW: ex-en/r-l), Height of the Orbit right-left (OH: os-oi/r-l), Palpebral Fissure Height right-left (PFH: ps-pi/r-l) (Figs. 1 and 2). The parameters of measurements were taken with the head in the Frankfurt Horizontal Plane, which is defined as a line connecting the orbitale (the lowest point of the infraorbital margin) and the porion (point at the upper edge of the external auditory meatus) or tragion (landmark on the upper edge of the tragus) of the ear, the line maintained horizontal with the help of a commercial angle meter.[10] The measurements were performed while the subject is in the sitting position with the pupils fixed on the center. Measurements were performed using a digital caliper (digital vernier caliper 0–150 mm × 0.05 mm). Measurements were repeated three times by a single researcher. Each measurement was recorded on a prepared chart.

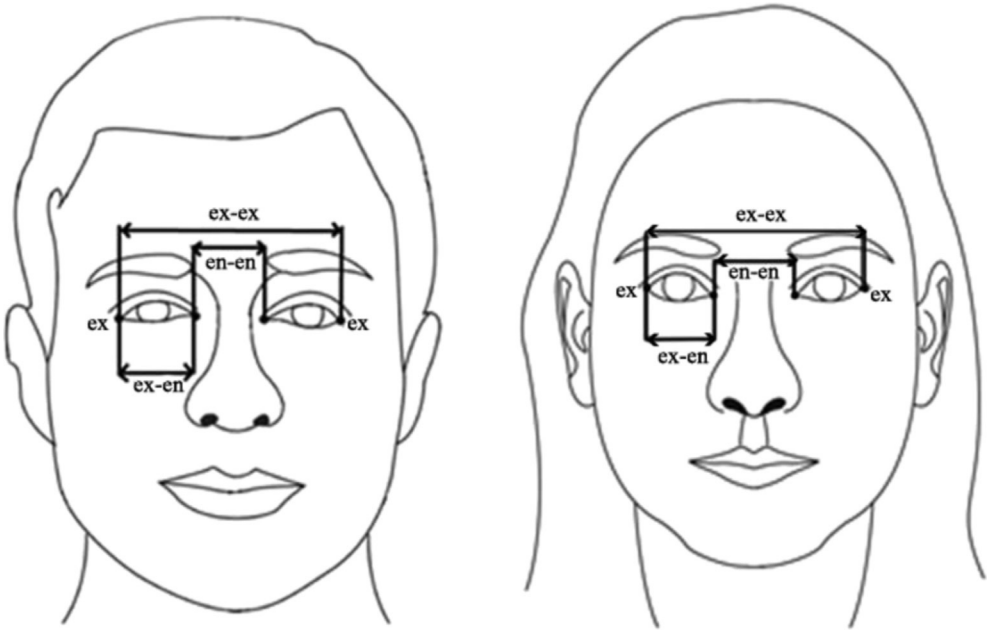

Fig. 1 – Anthropometric measurements for both women and men around the eyes; outercanthal distance (OCD: ex-ex), intercanthal distance (ICD: en-en), palpebral fissure width (PFW: ex-en).

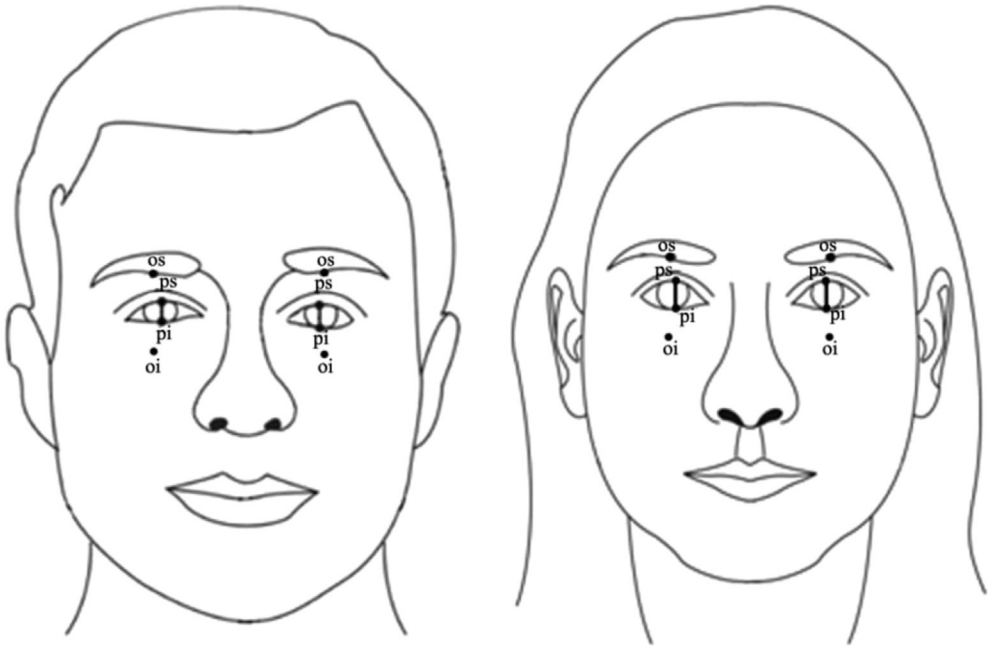

Fig. 2 – Anthropometric measurements of male and female eye; orbital height (OH: os-oi), palpebral fissure height (PFH: ps-pi).

Anthropometric measurement points are taken as follows:

- Endocanthion (en) is the point at the inner commissure of the eye fissure. This soft endocanthion is located lateral to the bony landmark that is used in cephalometry.
- Exocanthion (ex) is the point at the outer commissure of the eye fissure. The soft exocanthion is slightly medial to the bony exocanthion.
- Orbitale superius (os) in young adults is the highest point on the lower border of the eyebrow, close to the highest bony point of the upper margin of each orbit, where the bony supraorbitale landmark is located.
- Orbitale inferior (oi) is the lowest point on the lower margin of each orbit. It is identified by palpation and is identical to the bony orbitale.
- Palpebrale superior (ps) is the highest point in the mid-portion of the free margin of each upper eyelid. Palpebrale inferior (pi) is the lowest point in the mid-portion of the free margin of each lower eyelid.
- Center point of pupil (p) is determined when head is in the resting position and the eye is looking straight forward. Identification is easiest when the patient is reclining, the eye fissures are horizontal, and the eyes are gazing straight upward[10] (Fig. 2).

The data were analyzed using a Statistical Package for the Social Sciences (SPSS) (Version18). The mean values of orbital contour measurements from males and females were calculated and the statistical difference between genders were investigated. Independent Sample Test (Independent samples t-test), a parametric test, was used to determine the statistically significant difference between the measurements of males and females. In addition, Wilcoxon test was used for the comparison of left and right orbit measurements. Mean, median, standard deviation, maximum and minimum values of all measurements were determined. *P* value less than 0.05 was considered statistically significant. Data were expressed as mean ± standard deviation (X ± SD). The mean data were compared with those obtained from similar studies in the literature.

3. Result

Mean weight and height of the males was 77.34 kg (range 53.40–112.20 kg) and 177.02 cm (range 163.00–194.00 cm), respectively. Mean weight and height of the females was 59.32 kg (range 38.40–86.00 kg) and 164.83 cm (range 150–182 cm), respectively. Mean body mass indices of males and females were 24.65 kg/m^2 (range 18.92–36.51 kg/m^2) and 21.84 kg/m^2 (range 16.95–18 kg/m^2) respectively (Table 1).

Our study, the mean values of ICD, OCD, PFW/r-l, OH/r-l, PFH/r-l and IPD, in males the mean values were, 28.68 ± 3.61 mm, 96.43 ± 11.90 mm, 36.02 ± 2.71 mm/35.63 ± 2.79 mm, 35.19 ± 4.37 mm/35.13 ± 4.49 mm, 10.06 ± 1.74 mm/10.30 ± 1.90 mm, 61.73 ± 3.77 mm, respectively. However, in females were 27.84 ± 2.90 mm, 95.08 ± 9.85 mm, 35.01 ± 2.27 mm/34.66 ± 2.28 mm, 35.15 ± 3.64 mm/35.79 ± 3.70 mm, 10.31 ± 1.43 mm/10.37 ± 1.73 mm, 58.99 ± 3.22 mm, respectively (Table 2).

Table 1 – Age, height, weight and body mass index of the participants.

Measurement	Age group	Height (cm)	Weight (kg)	Body mass index (kg/m^2)
Male	18–30	177.02	77.34	24.65
Female	18–30	164.83	59.32	21.84

Table 2 – Antropometric measurement of the participants.

Measurements (mm)	ICD	OCD	PFW (r)	PFW (l)	OH (r)	OH (l)	PFH (r)	PFH (l)	IPD
Male	28.68 ± 3.61	96.43 ± 11.90	36.02 ± 2.71	35.63 ± 2.79	35.19 ± 4.37	35.13 ± 4.49	10.06 ± 1.74	10.30 ± 1.90	61.73 ± 3.77[a]
Female	27.84 ± 2.90	95.08 ± 9.85	35.01 ± 2.27	34.66 ± 2.28	35.15 ± 3.64[a]	35.79 ± 3.70[a]	10.31 ± 1.43	10.37 ± 1.73	58.99 ± 3.22[a]

Mean ± S.D.
[a] There was a statistically significant difference between both sexes ($p < 0.05$). (r): Right; (l): Left. ICD: Intercanthal Distance, OCD: Outercanthal Distance, PFW: Palpebral Fissure Width, OH: Height of the Orbit, PFH: Palpebral Fissure Height, IPD: Interpupillary Distance.

4. Discussion

The attractiveness of the face is the result of the relationship between the symmetry of its part. The aesthetic result depends on all anatomic structures. The orbitonasal area is the aesthetically sensitive area of the face, even a small difference can cause disharmony, asymmetry and disproportion. In facial surgery, determination of any unusual disproportion of the face with the help of indices is invaluable both before and after the operation. The importance of facial proportions in different races has been declared by several surgeons.[11] Indices can also be used to determine the rate of growth.[12]

Interpupillary distance is the most important parameter for measuring the distance between the eyeballs.[13] It is associated with craniofacial abnormality such as Apert's syndrome which is a congenital disorder characterized by malformations of the skull, face, hands and feet. Measurements of interpupillary distance and interorbital distance gives true measurement of the position of the ocular apparatus, unaffected by such soft tissue change.[8]

Intercanthal distance is also an important measurement in congenital or traumatic facial deformity,[8] as well as in proper mounting of spectacle lenses to eliminate unwanted prismatic effects.[13]An abnormally wide distance between the inner canthi is termed telecanthus and may be a primary telecanthus involving only soft tissue change or secondary telecanthus associated with ocular hypertelorism.[8]

Palpebral fissure height may be increased or decreased along with an increase or decrease in globe projection. Palpebral fissure height and palpebral fissure width may be shortened in traumatic telecanthus or eyelid injury. A shortened palpebral fissure width has been linked to fetal alcohol syndrome[14].

Ocular and periocular anthropometric measurements were examined by several researchers. They obtained racial and ethnic differences in relation to age and gender. In the present study we examined in both males and females the intercanthal distance (ICD), outercanthal distance (OCD), palpebral fissure width (PFW), palpebral fissure height (PFH), orbital height (OH) and interpupillary distance (IPD). We found significant differences in OH and IPD measurements between males and female. Otherwise there were no significant

Table 3 – Comparison with other studies regarding ICD, OCD and PFW (r/l).

	Age	Sex	ICD (mm)	OCD (mm)	PFW (r/l) (mm)
Chinese[8]	18–60	M	35.93 ± 2.42[a]	101.57 ± 4.34[b]	
		F	35.13 ± 2.48[a]	97.91 ± 4.19[b]	
Iranian[12]	18–30	M	27.3 ± 2.7	91.8 ± 6.5	37.2 ± 1.5
		F	24.6 ± 3.5	79.8 ± 5.9	24.4 ± 3.3
Indian[12]		M	34.1 ± 2.2	98.8 ± 3.5	30.2 ± 2.0
		F	30.9 ± 2.9	97.5 ± 5.0	31.3 ± 2.2
Azerbaijan[12]		M	30.8 ± 3.5	96.2 ± 4.2	34.4 ± 1.7
		F	30.5 ± 2.2	94.2 ± 4.0	33.8 ± 1.6
Whites in UK[15]	18–25	M	32.8 ± 2.4		27.6 ± 1.9
		F	33.3 ± 2.7		26.5 ± 2.2
Indian[15]		M	31.4 ± 2.0		30.3 ± 1.7
		F	31.1 ± 2.6		28.2 ± 2.1
Chinese[15]		M	37.2 ± 1.7		28.8 ± 2.1
		F	36.4 ± 2.7		26.8 ± 2.3
Whites in USA[3]	20–39	M			26.7 ± 1.7
		F			27.2 ± 1.8
African-American[3]		M			27.5 ± 1.4
		F			27.0 ± 1.4
Han Chinese[14]	18–35	M	37.51 ± 2.92[b]	93.20 ± 3.32[b]	
		F	35.55 ± 2.75[b]	87.85 ± 3.69[b]	
Indian[16]	16–60	M	32.8 ± 1.7		32.3 ± 2.2
		F	32.7 ± 1.5		33.7 ± 1.8
Turkish	18–30	M	28.68 ± 3.61[a]	96.43 ± 11.90[a]	35.82 ± 2.74[b]
		F	27.84 ± 2.90[a]	95.08 ± 9.85[a]	34.83 ± 2.27[b]

[a] Not significantly difference. r: right; l: left.
[b] Significantly difference ($p < 0.05$).

Table 4 – Comparison with other studies regarding OH (r), OH (l) and IPD.

	Age	Sex	OH (r) (mm)	OH (l) (mm)	IPD (mm)
Han Chinese[14]	18–25	M	31.66 ± 2.34[a]	32.00 ± 2.33[a]	
		F	31.66 ± 2.39[a]	31.61 ± 2.54[a]	
Chinese[8]	18–60	M			64.59 ± 2.87[b]
		F			61.31 ± 2.59[b]
Indian[16]	16–60	M			64.2 ± 2.2
		F			63.1 ± 1.8
Turkish	18–30	M	35.19 ± 4.37[b]	35.13 ± 4.49[b]	61.73 ± 3.77[b]
		F	35.15 ± 3.64[b]	35.79 ± 3.70[b]	58.99 ± 3.22[b]

[a] Not significantly difference. r: right; l: left.
[b] Significantly difference ($p < 0.05$).

Table 5 – Comparison with other studies regarding PFW (r), PFW (l) and PFH (r), PFH (l).

	Age	Sex	PFW (r) (mm)	PFW (l) (mm)	PFH(r/l) (mm)	PFH (r) (mm)	PFH (l) (mm)
Han Chinese[14]	18–25	M	28.07 ± 1.31[b]	27.92 ± 1.39[b]		8.90 ± 0.98[b]	8.88 ± 0.94[b]
		F	26.36 ± 1.40[b]	26.11 ± 1.39[b]		9.39 ± 0.93[b]	9.36 ± 1.08[b]
Korean[17]	20–49	M	28.2 ± 3.1[b]	29.0 ± 3.0[b]		10.0 ± 1.6[b]	9.9 ± 1.6[b]
		F	26.8 ± 3.6[b]	27.6 ± 3.5[b]		10.2 ± 1.6[b]	10.0 ± 1.7[b]
Indian[16]	16–60	M			12.3 ± 1.7		
		F			11.7 ± 1.6		
Turkish	18–30	M			10.17 ± 1.81[a]	10.06 ± 1.74[a]	10.30 ± 1.90[a]
		F			10.23 ± 1.97[a]	10.31 ± 1.43[a]	10.37 ± 1.73[a]

[a] Not significantly difference. r: right; l: left.
[b] Significantly difference ($p < 0.05$).

differences in ICD, OCD, PFH and PFW measurements. Wu et al[14] reported, in Han Chinese population, that there were significant differences in ICD, OCD, PFW right, PFW left, PFH right and PFH left between males and females and distinctly there were no significant differences in OH right and OH left[14] (Table 4) and this study was in large contrast with our study. Song et al[17] compared PFW right, PFW left, OH right and OH left in Korean population and they observed that there were significant differences in all their measurements between two genders (Tables 4 and 5).

We observed that the mean results of all measurements of males were greater than the mean results of the all measurements of females except the mean result of PFH. This was similar with the study of Jayaratne et al[18] who found that ICD, OCD, and PFW were significantly larger in Chinese males than females, but the PFH did not differ between genders.[18] Our results regarding the ICD, PFW and PFH were similar with the findings of Kunjur et al,[15] Song et al[17] and Price et al[3] (Tables 3–5).

Considerable ethnic differences were apparent when we compared our findings with other available studies on young adults from other countries; the ICD of Turkish was smaller than Chinese,[18] Indian, Italian, Russian, Azerbaijani,[19] Saudi-Arabian,[20] Egyptian[19] Angolan, African-American[19]

Table 6 – Comparison with other studies regarding ICD, OCD and PFW (r/l) (Data is taken from 12th reference).

Countries[12]	Sex	N	ICD: en-en (mm)	OCD: ex-ex (mm)	PFW: ex-en (mm)
Italian	M	30	30.2	93.8	33.9
	F	30	27.6	89.5	32.7
Azerbaijani	M	30	30.8	96.2	34.4
	F	30	30.5	94.2	33.8
Iranian	M	30	27.3	91.8	37.2
	F	30	24.6	79.8	24.4
Egyptian	M	30	31.8	89	31.5
	F	30	30.9	86.3	30.8
Angolan	M	30	36.3	92.7	28.5
	F	30	36.6	87	27.1
Indian	M	30	34.1	98.8	30.2
	F	30	30.9	97.5	31.3
Russian	M	30	34.2	98.9	34.6
	F	30	32.7	94.6	34.5
Present study	M	56	28.68	96.43	35.82
	F	59	27.84	95.08	34.83

and North American[12] counterparts. On the other hand, our findings regarding ICD were larger than Iranian[19] in both sexes (Table 6).

When we compared our findings of OCD with other available studies we found that the Turkish has OCD larger than Chinese, Italian, Azerbaijani, Iranian, Egyptian, Angolan, and smaller than Indian[19] in both sexes (Table 6).

According to this study the Turkish has PFW larger than Chinese,[8] Indian, Italian, Russian, Azerbaijani, Egyptian, Angolan.[19] On the other hand, our findings regarding PFW were smaller than Iranian[19] in both sexes (Table 6).

According to our findings the Turkish has larger PFH when compared with Chinese,[14] Korean,[19] and African-American[19] in both sexes.

We compared the OH results with only one study that was reported by Wu et al[14] for Han Chinese.[14] According to this study Turkish OH was larger than Han Chinese in both sexes.

We compared our IPD results with two studies and Turkish IPD were smaller than Chinese[8] and Indians[16] (Table 5).

Age, race and gender affect the human face, according to our study and the other compared studies. Although the face measurements have no statistically significant differences in many landmarks, gender affect the measurement size. Male size is larger than the female size in most of the measurements.

5. Conclusion

In conclusion, in the present study, we have reported normative anthropometric periocular measurements for Turkish young adults. Although we couldn't find significant differences between many values, the data of the measurements are very important for evaluating the orbital area. Intercanthal width, biocular width, and eye fissure lengths were significantly larger in Turkish males than females, but the eye fissure height did not differ between genders. The normative anthropometric data presented in this study would be useful for clinical interpretation of periocular pathology and serve as reference values when planning aesthetic and posttraumatic surgical interventions.

Conflicts of interest

All authors have none to declare.

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