Original Article

Ocular biometry characteristics in cataract surgery candidates: A cross-sectional study

Alireza Jamali [1], Taghi Naghdi [1], Mohsen Hosseini Abardeh [2], Mojgan Jamalzehi [3], Maedeh Khalajzadeh [4], Moslem Kamangar [4], Niloofar Tehranchi [1] and Payam Nabovati [1]

[1] *Rehabilitation Research Center, Department of Optometry, School of Rehabilitation Sciences, Iran University of Medical Sciences, Tehran, Iran*

[2] *Department of Optometry, School of Paramedicine Sciences, Mashhad University of Medical Sciences, Mashhad, Iran*

[3] *Iranshahr University of Medical Sciences, Iranshahr, Iran*

[4] *Department of Optometry, School of Rehabilitation Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

ABSTRACT

Background: This study was conducted to investigate ocular biometry parameters in cataract surgery candidates in northern Tehran, Iran using OA-2000 biometry device.

Methods: In this cross-sectional study, values of ocular biometry parameters, including axial length (AL), anterior chamber depth (ACD), mean corneal curvature (mean K), lens thickness (LT), corneal astigmatism (CA), and white-to-white (WTW) of 818 eyes with cataracts, were measured using the OA-2000 biometry device (Tomey, Nagoya, Japan). The participants were divided into six age subgroups, in 10-year intervals. Finally, the values of the biometry parameters were calculated, and the trend of changes was examined for both age and sex subgroups.

Results: The mean± standard deviation (SD) of age of the participants was 63.82 ± 13.25 years. Mean ± SD of biometry parameters were as follows: AL, 23.36 ± 1.55 mm; ACD, 3.09 ± 0.40 mm; LT, 4.45 ± 0.55 mm; mean K, 44.51 ± 1.72 D; CA, 1.06 ± 0.94 D; and WTW, 11.81 ± 0.45 mm. Most of the parameters showed significant age-related changes in the total population. There was an increase in LT ($P < 0.001$) and mean K ($P = 0.001$), as well as a decrease in AL ($P < 0.001$) and ACD ($P < 0.001$) with age. Moreover, AL had a negative negligible correlation with LT ($r = -0.24$, $P < 0.001$) and mean K ($r = -026$, $P < 0.001$), as well as a weak positive correlation with ACD ($r = 0.44$, $P < 0.001$).

Conclusions: Our study revealed that the mean values of most biometric parameters varied across age and sex subgroups. Moreover, most of the parameters showed significant age-related changes in the total population.

KEY WORDS

ocular biometry, cataract, axial length, anterior chamber depth, keratometry, lens thickness, corneal astigmatism, white to white

INTRODUCTION

As reported by the World Health Organization in 2017, cataract is the most common cause of blindness and the second major cause of visual impairment worldwide [1]. Ocular biometry parameters, which are basic elements in planning for cataract surgery, include axial length (AL), anterior chamber depth (ACD), corneal curvature, and

Correspondence: Taghi Naghdi, MSc, Rehabilitation Research Center, Department of Optometry, School of Rehabilitation Sciences, Iran University of Medical Sciences, Tehran, Iran. E-mail: naghditaghi@gmail.com . ORCID iD: https://orcid.org/0000-0002-0226-5374

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white-to-white (WTW) [2]. Accordingly, appropriate implanted intraocular lens (IOL) power selection results in an acceptable uncorrected distance visual acuity, with greater patient satisfaction [3]. Different formulas have been recommended for the calculation of IOL power, all of which require specific biometric data and constants [4]. Consequently, identifying the distribution of ocular biometric parameters can facilitate appropriate IOL power selection and improve surgical outcomes. Additionally, knowing the trend of biometric parameters across age subgroups could help predict changes in refractive errors more accurately, as refractive errors occur due to imbalances in ocular biometric parameters [5]. Therefore, a biometric parameter database reflecting the healthy population could help predict refractive errors in the community and facilitate further planning. Previous studies have characterized the ocular biometric values of various communities. These parameters differ according to age, sex, and racial background [6-11].

Additionally, swept-source optical coherent tomography such as OA-2000 enables faster scanning than other biometry devices and can penetrate dense cataracts better than partial coherence interferometry devices [12]. Currently a handful of studies have described the range of biometric parameters using new accurate technologies [5, 7, 8, 13-15].

The current study aimed to report values of biometric parameters using a non-contact high-resolution optical biometric device (OA-2000, Tomey, Nagoya, Japan) in a large population of cataract surgery candidates from the north of Tehran, Iran. Moreover, we determined the trend of these parameters in age subgroups, and sought to identify sex-related differences.

METHODS

In this cross-sectional study, 818 eyes of 818 cataract surgery candidates, resided in Tehran were evaluated between May 2015 and October 2019 at the Bina-Afarin Private Ophthalmology Clinic in Tehran, Iran. This study complied with the tenets of the Declaration of Helsinki in obtaining and using participants' information. Written informed consent was obtained from all participants. This study was reviewed and approved by the ethical committee of Iran University of Medical Sciences (approval code IR.IUMS.REC.1399.480).

All apparently healthy subjects > 30 years of age who were deemed appropriate candidates for cataract surgery by the cornea fellowship-trained ophthalmologist were included. Exclusion criteria were: a history of anterior or posterior segment diseases; a history of intraocular surgery; intraocular pressure ≥ 22 mmHg; secondary cataracts, such as post-traumatic or drug-induced cataract; dense cataracts requiring ultrasound biometry; and systemic diseases, such as hypertension or diabetes mellitus. In bilateral cataracts, only data from the eye for which cataract surgery was planned first were used for analysis.

The participants were divided, based on their ages, into six age subgroups with 10-year intervals, as follows: 30–40-old, 41–50-old, 51–60-old, 61–70-old, 71–80-old, and ≥ 81 years. For all participants, eye examinations, including corrected distance visual acuity (in logarithm of the minimum angle of resolution [logMAR] notation at 4 m), refraction (objective refraction using Topcon [Topcon, KR 8900, Topcon Corp., Tokyo, Japan], followed by subjective refraction), slit lamp examination (Haag-Streit model BM-900; Haag-Streit, Köniz, Switzerland), and ocular biometry using a non-contact high-resolution optical biometric device (OA-2000, Tomey, Nagoya, Japan) were performed. Following corrected distance visual acuity measurement and refraction by an optometrist, the cornea fellowship-trained ophthalmologist performed slit lamp examination and made the decision regarding the need for cataract surgery.

Subsequently, the same optometrist measured the biometry parameters for all cataract surgery candidates, including AL, ACD, lens thickness (LT), corneal power, and WTW distance. AL was defined as the distance of the corneal endothelium from the retinal pigmented epithelium. The ACD was defined as the distance of the posterior corneal surface from the anterior crystalline lens surface. LT was defined as the distance between the anterior and posterior surface from the lens. WTW was defined as the distance between the borders of the corneal limbus in the horizontal meridian. In addition to these parameters, corneal power, both flat meridian (K1) and steep meridian (K2), were recorded, and mean keratometry (mean K) was reported. Corneal astigmatism (CA) was calculated as the absolute difference between K1 and K2. These data, obtained from 818 eyes, were analyzed.

Statistical analyses were performed using IBM SPSS Statistics for Windows (version 25.0; IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was used to evaluate the normality of data distributions. Differences among the six age subgroups were assessed using one-way analysis of variance (ANOVA) followed by the LSD post-hoc test for comparison between age subgroups. In addition, the sex-differences in each parameter were evaluated using an independent *t*-test. Spearman's rank correlation (to evaluate parameters with a non-normal distribution), or, Pearson's product-moment correlation (to evaluate parameters with a normal distribution), was performed. Statistical significance was set at $P < 0.05$.

RESULTS

In this study, 818 eyes, with a mean ± standard deviation (SD) age of 63.82 ± 13.25 years (age range: 30-98 years), were included. Of these, 44.1% (361) eyes were from men. Testing the normality of distribution of all parameters using the Kolmogorov–Smirnov test indicated that only ACD was not normally distributed in the total population or in the sex groups.

Tables 1-3 show the demographic characteristics of study participants, and the values of biometric parameters in the total population, and across the six age subgroups and sexes. The mean AL in the total population was 23.36 ± 1.55 mm, which was longer in men than in women ($P = 0.001$) (Table 1). Moreover, the difference in AL between the six age subgroups was significant ($P < 0.001$) (Table 2). With increasing age, the mean AL became shorter in men ($P < 0.001$) (Table 3). A negative negligible correlation was found between AL and age in the total population (r = -0.26, $P < 0.001$) (Table 4).

The mean of ACD and LT in total population were 3.09 ± 0.40 and 4.45 ± 0.55 mm, respectively, with a significantly shallower ACD ($P = 0.001$), and non-significantly thicker LT ($P = 0.072$) in women (Table 1). For both these parameters, the difference between the six age subgroups was significant (both $P < 0.001$) (Table 2). ACD and LT parameters showed regular changes with increasing age (LT increased and ACD decreased with age) in the total population and in women (all $P < 0.001$). Men > 81 years old had a lower LT than the 71-80-year age group, but this difference was not significant ($P = 0.43$). ACD (r = -0.35, $P < 0.001$) and LT (r = 0.36, $P < 0.001$) were found to be weakly correlated with age. A weak positive and negligible negative correlation of AL elongation with ACD deepening (r = 0.44, $P < 0.001$) and LT thinning (r = -0.24, $P < 0.001$) was identified. A moderate inverse correlation between LT and ACD (r = -0.69, $P < 0.001$) was found (Table 4).

The mean of mean K and CA in total population were 44.51 ± 1.72 D and 1.06 ± 0.94 D, respectively. We observed statistically significantly steeper corneas in women ($P < 0.001$). On the other hand, men had a higher mean CA than women but was not significant ($P = 0.053$) (Table 1). Older individuals had steeper corneas ($P = 0.001$). However, despite significant differences among the six age subgroups ($P < 0.001$), changes in mean K were not regular with increasing age (Table 2 and 3). AL was found to be negatively correlated with mean K (r= -0.26, $P < 0.001$) and positively correlated with CA (r= 0.11, $P < 0.001$), although the extent of this correlation was negligible (Table 4).

Finally, the mean WTM in total population was 11.81 ± 0.45, and no significant sex-differences were found ($P = 0.053$) (Table 1). Pearson's product-moment correlation showed that older participants had smaller WTW values, with a negligible negative correlation (r = -0.19, $P < 0.001$). Furthermore, a positive, negligible correlation was found between the WTW values (r = 0.21, $P < 0.001$) and AL (Table 4).

DISCUSSION

In this cross-sectional study, we aimed to provide biometric data for the healthy population in northern Tehran, Iran, using the OA-2000, and found that the mean values of most biometric parameters differed across different age subgroups and the sexes.

Swept-source optical coherent tomography (OA-2000, 3000, and IOL Master 700) facilitates faster scanning than other biometry devices (such as IOL-Master 500) [12]. Both the OA-2000 and IOL-master 700 can penetrate dense cataracts better than partial coherence interferometry devices (IOL-master 500, Carl Zeiss, Oberkochen, Germany) and low coherence reflectometry devices (Lenstar, Haag-Streit) [12]. Few studies have described the range of these parameters in different populations using new accurate technologies for the measurement of ocular biometry parameters [5, 7, 8, 13-15].

Table 1. Demographic and biometric parameters in total population and each sex group

Parameters	Total (n = 818)	Male (n = 361)	Female (n = 457)	*P*-value*
Age (y) , Mean ± SD (Range)	63.82 ± 13.25 (30.0 to 98.0)	63.26 ± 14.45 (31.0 to 97.0)	64.26 ± 12.21 (30.0 to 98.0)	0.282
AL (mm), Mean ± SD (Range)	23.36 ± 1.55 (18.27 to 34.05)	23.57 ± 1.63 (18.27 to 34.05)	23.20 ± 1.47 (18.54 to 33.89)	**0.001**
ACD (mm), Mean ± SD (Range)	3.09 ± 0.40 (2.01 to 4.85)	3.14 ± 0.42 (2.08 to 4.85)	3.05 ± 0.38 (2.01 to 4.61)	**0.001**
LT (mm), Mean ± SD (Range)	4.45 ± 0.55 (0.70 to 7.49)	4.38 ± 0.62 (0.70 to 5.46)	4.50 ± 0.49 (2.03 to 7.49)	0.072
Mean K (D), Mean ± SD (Range)	44.51 ± 1.72 (39.71 to 60.04)	44.26 ± 1.60 (39.71 to 52.44)	44.71 ± 1.78 (40.94 to 60.04)	**< 0.001**
CA (D), Mean ± SD (Range)	1.06 ± 0.94 (0.00 to 7.81)	1.07 ± 0.96 (0.00 to 6.39)	1.04 ± 0.92 (0.00 to 7.81)	0.053
WTW (mm), Mean ± SD (Range)	11.81 ± 0.45 (8.26 to 13.83)	11.85 ± 0.46 (8.26 to 13.83)	11.79 ± 0.44 (8.96 to 13.03)	0.053

Abbreviations: n, number; y, years; D, diopter; AL, axial length; ACD, anterior chamber depth; LT, lens thickness; K, keratometry; CA, corneal astigmatism; WTW, white-to-white; SD, standard deviation.* Independent sample t test for comparison between sex groups; *P*-value < 0.05 is shown in bold.

Table 2. Biometric parameters in each age subgroup and statistical significance of differences among six age subgroups

Parameters / Age Subgroups	30-40 (n = 55)	41-50 (n = 79)	51-60 (n = 152)	61-70 (n = 281)	71-80 (n = 182)	> 81 (n = 69)	*P*-value
AL (mm), Mean ± SD (Range)	24.47 ± 2.12 (20.68 to 33.50)	23.94 ± 1.97 (18.54 to 33.89)	23.52 ± 2.16 (19.50 to 34.05)	23.22 ± 0.97 (18.27 to 30.46)	23.13 ± 1.68 (21.03 to 33.63)	22.65 ± 0.95 (21.05 to 24.88)	**< 0.001***
ACD (mm), Mean ± SD (Range)	3.35 ± 0.37 (2.50 to 4.24)	3.30 ± 0.46 (2.17 to 4.85)	3.18 ± 0.41 (2.27 to 4.55)	3.07 ± 0.39 (2.08 to 4.52)	2.93 ± 0.28 (2.01 to 4.00)	2.88 ± 0.37 (2.08 to 3.87)	**< 0.001****
LT (mm), Mean ± SD (Range)	3.62 ± 0.92 (0.70 to 4.47)	4.09 ± 0.56 (2.03 to 5.16)	4.37 ± 0.68 (1.82 to 7.49)	4.50 ± 0.41 (3.39 to 5.69)	4.62 ± 0.35 (3.76 to 5.46)	4.65 ± 0.46 (3.55 to 5.38)	**< 0.001***
Mean K (D), Mean ± SD (Range)	43.96 ± 1.31 (40.72 to 46.36)	44.39 ± 2.62 (39.71 to 60.04)	44.38 ± 1.71 (41.15 to 49.35)	44.51 ± 1.48 (40.42 to 50.33)	44.61 ± 1.65 (40.94 to 49.53)	45.10 ± 1.66 (42.16 to 48.91)	**0.001***
CA (D), Mean ± SD (Range)	1.48 ± 1.30 (0.00 to 6.20)	1.28 ± 1.16 (0.00 to 6.39)	1.16 ± 1.12 (0.00 to 7.81)	0.94 ± 0.79 (0.00 to 5.98)	0.92 ± 0.72 (0.00 to 3.53)	1.06 ± 0.78 (0.00 to 4.25)	**0.001***
WTW (mm), Mean ± SD (Range)	12.00 ± 0.38 (11.00 to 12.80)	11.91 ± 0.41 (11.00 to 13.83)	11.85 ± 0.37 (11.00 to 12.85)	11.77 ± 0.45 (8.96 to 13.00)	11.80 ± 0.38 (10.80 to 13.13)	11.66 ± 0.73 (8.26 to 13.03)	**< 0.001***

Abbreviations: mm, millimeter; D, diopter; AL, axial length; ACD, anterior chamber depth; LT, lens thickness; K, keratometry; CA, corneal astigmatism; WTW, white-to-white; SD, standard deviation. *One-way ANOVA test; **Kruskal-Wallis test; *P*-value < 0.05 is shown in bold.

Table 3. Biometric parameters in sex groups by age subgroups, and statistical significance of differences among age subgroups by sex group

Parameters / Male Age Subgroups	30-40 (n = 31)	41-50 (n = 45)	51-60 (n = 60)	61-70 (n = 102)	71-80 (n = 91)	> 81 (n = 32)	*P*-value
AL (mm), Mean ± SD (Range)	25.10 ± 2.39 (23.36 to 33.55)	24.12 ± 1.62 (20.83 to 31.75)	23.89 ± 2.36 (20.24 to 34.05)	23.30 ± 0.94 (18.27 to 26.08)	23.13 ± 0.93 (21.03 to 25.65)	22.86 ± 1.11 (21.05 to 24.88)	**< 0.001***
ACD (mm), Mean ± SD (Range)	3.35 ± 0.36 (2.50 to 4.05)	3.31 ± 0.46 (2.27 to 4.85)	3.30 ± 0.45 (2.39 to 4.55)	3.12 ± 0.40 (2.08 to 4.52)	2.97 ± 0.31 (2.17 to 4.00)	2.96 ± 0.42 (2.08 to 3.87)	**< 0.001****
LT (mm), Mean ± SD (Range)	3.49 ± 1.27 (0.70 to 4.47)	4.07 ± 0.37 (3.62 to 4.82)	4.19 ± 0.74 (1.82 to 5.45)	4.44 ± 0.45 (3.58 to 5.35)	4.68 ± 0.34 (4.18 to 5.46)	4.53 ± 0.53 (3.55 to 5.18)	**< 0.001***
Mean K (D), Mean ± SD (Range)	43.93 ± 1.23 (40.72 to 46.36)	43.83 ± 1.87 (39.71 to 52.44)	43.99 ± 1.35 (41.39 to 46.91)	44.14 ± 1.53 (40.42 to 48.42)	44.64 ± 1.65 (41.08 to 49.53)	44.96 ± 1.69 (42.16 to 48.91)	**0.002***
CA (D), Mean ± SD (Range)	1.61 ± 1.44 (0.00 to 6.20)	1.43 ± 1.42 (0.00 to 6.39)	0.91 ± 0.61 (0.00 to 2.83)	0.92 ± 0.75 (0.0 to 4.00)	0.93 ± 0.78 (0.00 to 3.39)	1.23 ± 1.00 (0.00 to 4.25)	**0.031***
WTW (mm), Mean ± SD (Range)	12.04 ± 0.37 (11.0 to 12.80)	11.69 ± 0.48 (11.00 to 13.83)	11.93 ± 0.32 (11.40 to 12.85)	11.83 ± 0.40 (10.70 to 13.00)	11.79 ± 0.36 (10.80 to 13.30)	11.56 ± 0.91 (8.26 to 12.60)	**0.003***
Parameters / Female Age Subgroups	**30-40 (n = 24)**	**41-50 (n = 34)**	**51-60 (n = 92)**	**61-70 (n = 179)**	**71-80 (n = 91)**	**> 81 (n = 37)**	***P*-value**
AL (mm), Mean ± SD (Range)	23.66 ± 1.38 (20.68 to 27.17)	23.69 ± 2.36 (18.54 to 33.89)	23.29 ± 2.00 (19.50 to 33.70)	23.18 ± 0.98 (21.46 to 30.46)	23.13 ± 1.36 (21.22 to 33.63)	22.48 ± 0.76 (21.09 to 24.19)	**< 0.001***
ACD (mm), Mean ± SD (Range)	3.35 ± 0.38 (2.50 to 4.24)	3.30 ± 0.47 (2.17 to 4.61)	3.10 ± 0.36 (2.27 to 3.75)	3.05 ± 0.37 (2.21 to 4.05)	2.90 ± 0.25 (2.01 to 3.46)	2.81 ± 0.31 (2.09 to 3.35)	**< 0.001****
LT (mm), Mean ± SD (Range)	3.78 ± 0.20 (3.56 to 4.03)	4.10 ± 0.68 (2.03 to 5.16)	4.49 ± 0.63 (3.62 to 7.49)	4.53 ± 0.39 (3.39 to 5.69)	4.58 ± 0.36 (3.76 to 5.31)	4.74 ± 0.40 (4.02 to 5.38)	**< 0.001***
Mean K (D), Mean ± SD (Range)	44.00 ± 1.44 (41.01 to 46.08)	45.13 ± 3.25 (41.86 to 60.04)	44.64 ± 1.87 (41.15 to 49.35)	44.72 ± 1.42 (41.31 to 50.33)	44.59 ± 1.66 (40.94 to 48.57)	45.22 ± 1.64 (42.33 to 48.46)	0.195*
CA (D), Mean ± SD (Range)	1.32 ± 1.10 (0.70 to 4.22)	1.09 ± 0.64 (0.29 to 3.10)	1.32 ± 1.34 (0.00 to 7.81)	0.95 ± 0.81 (0.00 to 5.98)	0.91 ± 0.72 (0.00 to 3.53)	0.91 ± 0.50 (0.00 to 1.99)	**0.033***
WTW (mm), Mean ± SD (Range)	11.96 ± 0.41 (11.00 to 12.60)	11.85 ± 0.30 (11.33 to 12.41)	11.79 ± 0.39 (11.00 to 12.58)	11.74 ± 0.48 (8.96 to 12.80)	11.82 ± 0.40 (11.06 to 12.85)	11.74 ± 0.52 (10.90 to 13.03)	0.108*

Abbreviations: mm, millimeter; D, diopter; AL, axial length; ACD, anterior chamber depth; LT, lens thickness; K, keratometry; CA, corneal astigmatism; WTW, white-to-white; SD, standard deviation. *One-way ANOVA test, ** Kruskal-Wallis test, *P*-value < 0.05 is shown in bold.

Table 4. Correlation between biometric parameters as well as age and each parameter in total population

Parameters		Age	AL	ACD	LT	Mean K	CA	WTW
Age	Correlation Coefficient		-0.26	-0.35	0.36	0.01	-0.12	-0.19
	*P-value**		< **0.001**	< **0.001**	< **0.001**	0.870	**0.020**	< **0.001**
AL	Correlation Coefficient	-0.26		0.44	-0.24	-0.26	0.11	0.21
	*P-value**	< **0.001**		< **0.001**	< **0.001**	< **0.001**	**0.001**	< **0.001**
ACD	Correlation Coefficient	-0.35	0.44		-0.69	-0.07	0.06	0.30
	*P-value***	< **0.001**	< **0.001**		< **0.001**	**0.043**	0.082	< **0.001**
LT	Correlation Coefficient	0.36	-0.24	-0.69		0.01	-0.12	0.00
	*P-value**	< **0.001**	< **0.001**	< **0.001**		0.870	**0.020**	0.282
Mean K	Correlation Coefficient	0.01	-0.26	-0.07	0.01		0.13	-0.36
	*P-value**	0.87	< **0.001**	**0.043**	0.870		< **0.001**	< **0.001**
CA	Correlation Coefficient	-0.12	0.11	0.06	-0.12	0.13		-0.05
	*P-value**	**0.020**	**0.001**	0.082	0.082	< **0.001**		0.127
WTW	Correlation Coefficient	-0.19	0.21	0.30	0.00	-0.36	-0.05	
	*P-value**	< **0.001**	< **0.001**	< **0.001**	0.282	< **0.001**	0.127	

Abbreviations: AL, axial length; ACD, anterior chamber depth; LT, lens thickness; K, keratometry; CA, corneal astigmatism; WTW, white-to-white; *Pearson's product-moment correlation; **Spearman's rank correlation; *P*-value < 0.05 is shown in bold.

Table 5. Summary of axial length values in the current study and published papers

Author/date	Ethnicity	Device	Number of examined eyes	Mean AL (mm)	
				Female	Male
Present study (2020)	Iranian	Swept Source	818	23.20	23.57
Wickremasinghe (2004) [15]	Mongoloid	A scan	1617	23.08	23.42
Olsen (2007) [19]	White	A scan	723	23.20	23.74
Fotedar (2010) [18]	White	PCI	1321	23.20	23.75
LIM (2010) [8]	Mongoloid	PCI	2788	23.55 (mean age- and sex-adjusted AL)	
Pan (2011) [14]	Indian	PCI	2785	23.23	23.68

Abbreviations: AL, Axial Length; mm: millimeters; PCI; Partial Coherence Interferometry.

In our study, the mean AL (23.36 mm) was smaller than that described by Hoffmann et al., Lim et al., Pan et al., and Hoffer et al. (23.43 mm, 23.45 mm, 23.45 mm, and 23.50 mm, respectively) [8, 14, 16, 17]. As shown in Table 5, the mean AL in men was smaller than that reported by Olsen and Fotedar, but it was also greater than that reported by Wickremasinghe. Moreover, women had a greater mean AL than reported in the Wickremasinghe study [15, 18, 19]. These differences could arise from dissimilarities in the population structure of studies or the racial background of participants.

Contrary to the results of the study by Chen et al., which found no relationship between age and AL [6], our study revealed a negative, but statistically significant correlation between age and AL, with a greater AL in younger participants. In addition, the mean AL differed significantly among the six age subgroups in the total population and in sex groups, with AL being greater in men. With increasing age, the mean AL decreased significantly in men. The same sex difference was also seen in other studies [6, 15, 18, 19], which may be explained by the fact that, in the general population, adult men are taller than women [19]. Hoffer et al. found that the mean AL in men is about 0.52 mm more than that in women, consistent with our results (0.37 mm) [16].

In the present study, the mean ACD (3.09 mm) was shallower than that reported by Hoffmann et al. and Pan et al. (3.11 mm and 3.15 mm, respectively) [14, 17]. We found a significantly shallower ACD in women, which is in agreement with the results of other studies [15, 18, 19]. Comparably, Hoffer's study also found that the mean ACD in men was about 0.16 mm deeper than in women [16]. Spearman's rank correlation showed that older participants had a shallower ACD, which can be attributed to the increase in LT due to aging [20]. Therefore, it may be concluded that aging is associated with a decrease in ACD and lens thickening. A decreased ACD may increase the risk of angle-closure glaucoma [21]. Therefore, ACD is an influential factor in determining the timing of cataract surgery. Of note, the measurement of ACD varies, depending on the measuring device, whereby ultrasound methods obtain shorter values than optical devices [22].

The mean K in our participants was 44.51 D, which is steeper than that reported by Chen et al. and Yu et al. (44.20 D and 44.29 D, respectively) [6, 11]. Moreover, similar to other studies, we found a flatter mean cornea in men than in women [8, 17]. Hoffer et al. also found a 0.50 D flatter cornea in men than in women, which is similar to the findings of our study [16]. Commonly, men have greater AL, deeper ACD, and flatter corneas than women [8], as also shown in the present study. Despite significant differences among the six age subgroups, changes in mean K with increasing age were not regular. Further, despite the trend for decreasing mean CA across age subgroups in both sexes, the mean CA was higher in the participants aged > 81 years than in those aged 70-80 years, both in the total population and in men. This finding is comparable to the results of previous studies in which there was no correlation between age and CA [6, 7]. However, a negative, negligible, but significant correlation was found between age and CA in our study.

This study provides reference values for biometric parameters among healthy cataract candidates in a relatively large population. The lack of IOL power calculation and details regarding the type of astigmatism, in addition to the cross-sectional study design, are among the limitations of this study. Furthermore, demographic and ethnic diversity in Tehran may not reflect a pure Persian racial background. A longitudinal study could also provide more robust evidence regarding changes in biometric parameters across different ages. Therefore, we recommend addressing these limitations in future studies.

CONCLUSIONS

In the present study, nearly all biometric parameters, including AL, ACD, LT, WTW, and CA, correlated with age changes. In this context, younger participants had a greater AL, deeper ACD, thinner crystalline lens, and larger WTW than older participants. Furthermore, the mean values of most biometric parameters varied across sex subgroups. These findings highlight the importance of taking patient age and sex into account when interpreting biometric data for cataract surgery.

ETHICS DECLARATIONS

Ethical approval: This study was performed in accordance with the tenets of the Declaration of Helsinki in terms of obtaining and using information, and written consent forms were obtained from all participants. The present project was reviewed and accepted by the ethical committee of Iran University of Medical Sciences (approval code IR.IUMS.REC.1399.480).
Conflict of interest: None.

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