

Distribution of Corneal Parameters among Malawian Young Adults

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Abstract

Background: Corneal parameters differ according to ethnic group. Specific ethnic group reference values are useful for clinical diagnosis and management of corneal abnormalities, and during contact lens fitting. There are no reference values for the Malawian population.

Purpose: To assess the distribution of corneal parameters (diameter and curvature) and the effect of age and sex among Malawian young adults.

Method: 57 subjects (28 males and females) aged between 17 and 42 years were selected through random sampling method. The corneal diameter was measured using a millimeter ruler. While a keratometer (baush and lomb) was used measure the anterior radius of curvature.

Results: Our study found no correlation between corneal diameter and age. The mean difference in corneal diameters between genders was not statistically significant. There was no correlation between corneal curvature and age. The mean difference in corneal curvature between genders was statistically significant.

Keywords: Corneal Parameters; Corneal Diameter; Anterior Radius of Curvature; Contact Lens; Cornea

Abbreviations

SD: Standard Deviation; OD: Right Eye; OSL: Left Eye; HVID: Horizontal Visible Iris Diameter; VVID: Visible Iris Diameter; HARC: Horizontal Anterior Radius of Curvature; VARC: Vertical Anterior Radius of Curvature

Introduction

The cornea represents the most anterior optical surface of the eye and contributes 60 percent of the total power of the human eye [1]. It functions as a refractive surface and forms a protective barrier for the internal components of the eye. It is characterized by transparency and defined topography. Subtle changes to the cornea's topography has the potential to considerably cause reduction in vision [2]. Ocular surface pathologies have been known to alter the topography of the cornea and result in visual reduction [3]. The corneal topography is also affected by race and ethnicity [2,4,5].

Anterior corneal parameters such as corneal diameter and corneal curvature are key to diagnosis and management of corneal diseases [6,7]. They are also used to determine the size of contact-lens during SCL fitting [8]. Lack of data on corneal parameters may be a hindering factor towards both diagnosis and management of corneal diseases and contact lens practice.

Various devices, ranging from simple millimeter ruler to sophisticated instrument, are used to measure different anterior corneal parameters [9]. The choice of instrument is dependent on availability and differs from practitioner to practitioner. Different studies

have reported corneal parameters measured with different devices [10-12]. However, most of these instruments are expensive and may not be affordable to practitioners in developing nations.

Different Corneal parameters for different population groups have been reported by other authors [2,4,5,13-15]. To the best of our knowledge, there is no data on corneal parameters for the Malawian population. This could lead to wrong diagnosis and improper management of corneal conditions and also hinder the practice of contact lens as practitioners use reference values of other population groups. Therefore, this study aimed at assessing the distribution of anterior corneal curvature and corneal diameter among Malawian young adults we also assessed the effect of age and sex on the two corneal parameters.

Materials and Methods

This cross-sectional correlation study was conducted among Mzuzu University students of Malawian national. The study adhered to the guidelines of the declaration of Helsinki and Approval to conduct the study was granted by the faculty of health sciences research committee.

Informed consent was obtained from all subjects and confidentiality was ensured. The anonymity of subjects was maintained by using codes for identification. No subject was harmed during the study.

The study employed simple random sampling technique to select 57 subjects between the age of 17 and 42 years. As an inclusion criterion, all Subjects were examined under the slit-lamp to rule out the presence of corneal abnormalities. Subjects with a history of ocular surgery, ocular trauma and contact lens wear were excluded from the study.

Procedures

A millimeter ruler was used to measure for corneal diameter by measuring the Visible Iris Diameter (VID) [10,11,16] while a well calibrated Bausch and Lomb keratometer was used to measure Anterior Radius of curvature (ARC) [16,17]. Vertical and horizontal Measurements were taken for each variable.

The measurements were done on both eyes of each subject. Each variable was measured three times by three different investigators and the average was recorded as a final value.

Results

The data were statistically analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. Correlations between the corneal parameters and age were analyzed using Pearson correlation coefficient test. Histograms were used to illustrate the relationship between the corneal parameters and sex. Differences between genders were analyzed using independent t-test and the value of $p < 0.05$ was considered statistically significant.

The study assessed 114 eyes of 57 subjects including 29 males and 28 females aged between 17 and 42 yrs.

The average horizontal visible iris diameter (HVID) was 11.26 mm (0.596) in the right eye and 11.19 mm (0.573) in the left eye. While the average vertical visible iris diameter (VVID) was 10.21 mm (0.579) and 10.18 mm (0.566) in the right and left eye respectively. The average Horizontal Anterior Radius of Curvature (HARC) was 7.75 mm (SD = 0.36) in the right eye and 7.77 mm (SD = 0.363) in the left eye. While the average Vertical Anterior Radius of Curvature (VARC) was 7.63 mm (SD = 0.355) in the right eye and 7.61 mm (SD = 0.353) in the left eye.

Correlation between horizontal visible iris diameter and age

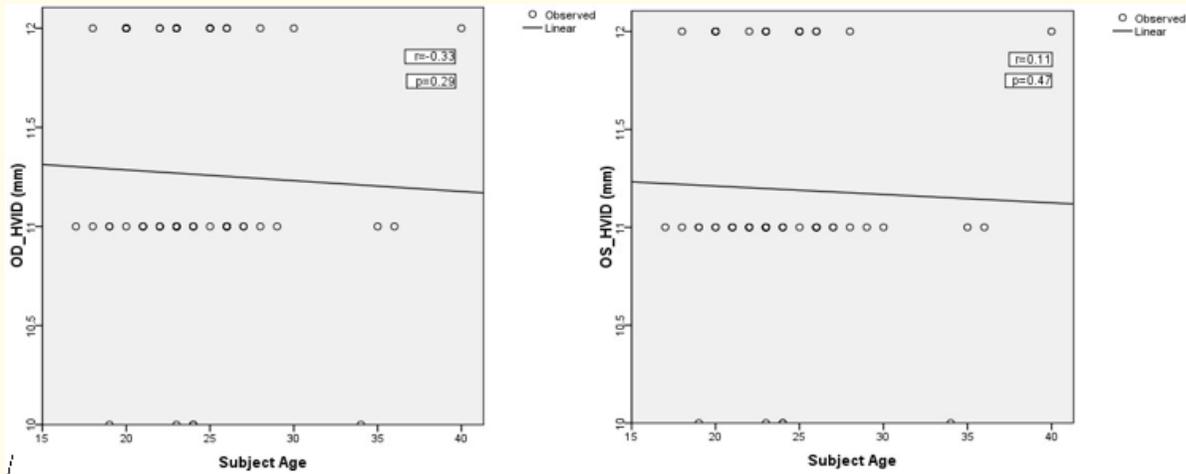


Figure 1: Correlation between HVID and age.

There was no correlation between horizontal visible iris diameter and age in both the right eye ($r = -0.33$, $p = 0.29$) and left eye ($r = 0.11$, $p = 0.47$).

Correlation between vertical visible iris diameter and age

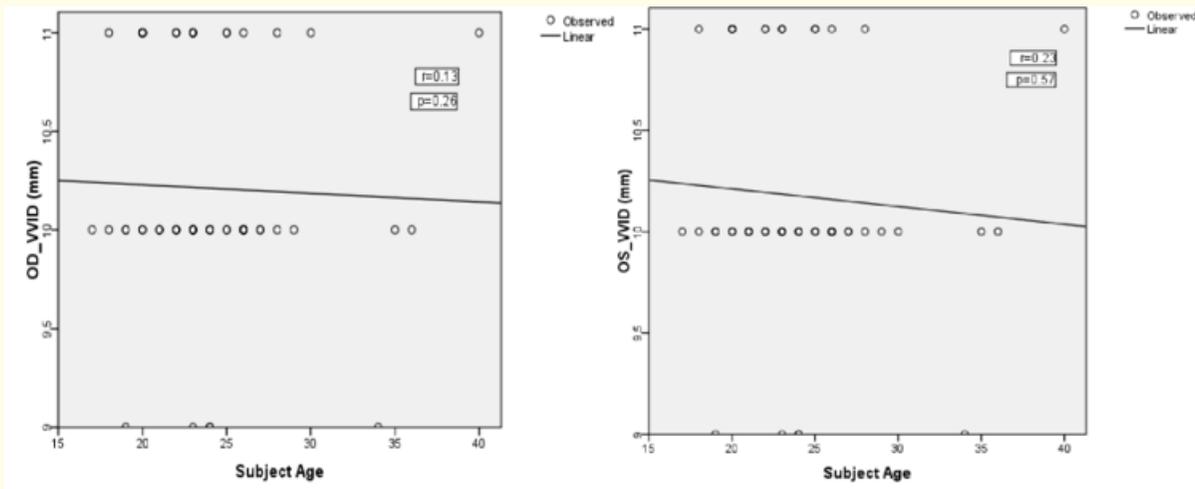


Figure 2: Correlation between VVID and age.

There was no correlation between age and vertical visible iris diameter in both the right eye ($r = 0.13$, $p = 0.26$) and the left eye ($r = 0.23$, $p = 0.57$).

Correlation between horizontal anterior radius of curvature and age

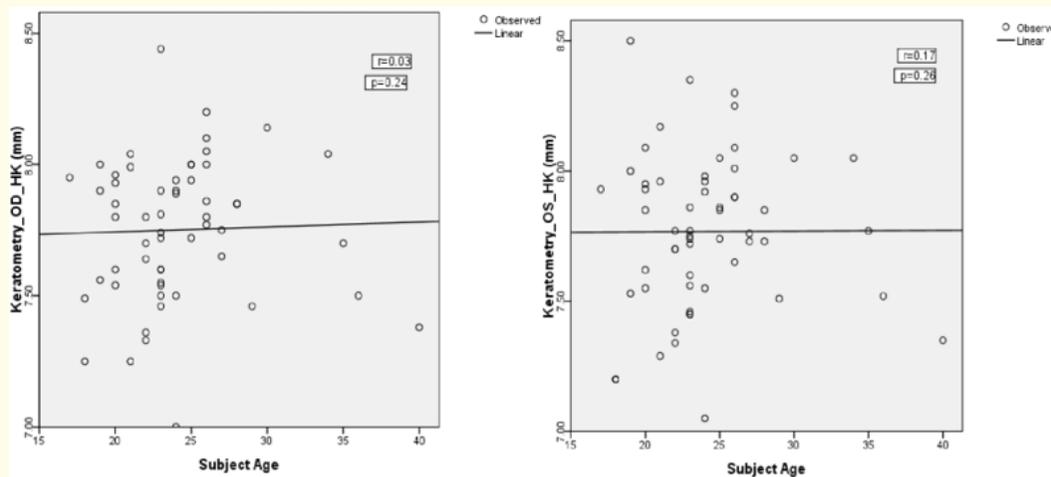


Figure 3: Correlations between HARC and age.

There was no correlation between the horizontal anterior radius of curvature and age for both the right eye ($r = 0.03$, $p = 0.24$) and left eye ($r = 0.17$, $p = 0.26$).

Correlation between vertical anterior radius of curvature and age

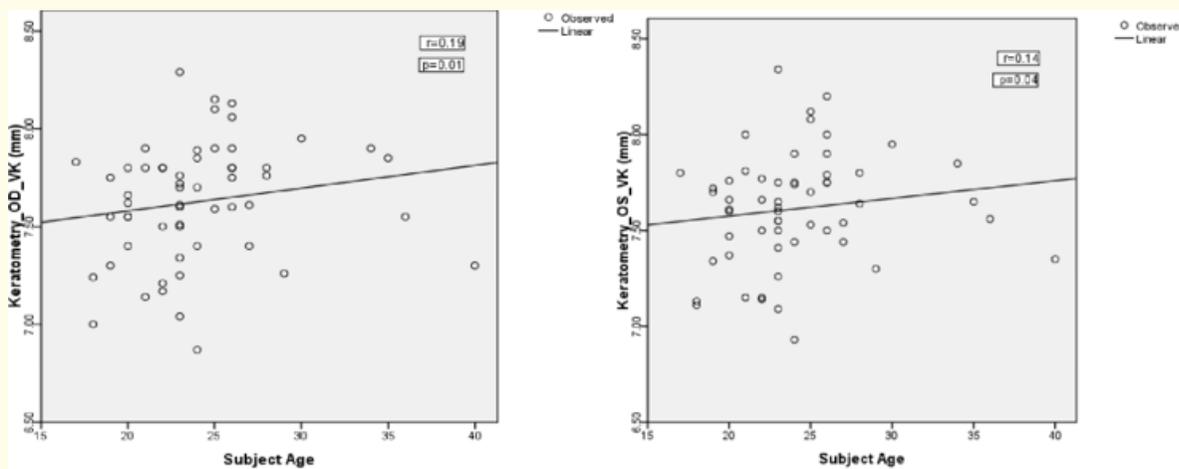


Figure 4: Correlation between VARC and age.

There was no correlation between vertical anterior radius of curvature and age for both the right eye ($r = 0.19$, $p = 0.01$) and left eye ($r = 0.14$, $p = 0.04$).

Distribution of horizontal visible iris diameter (HVID) according to sex

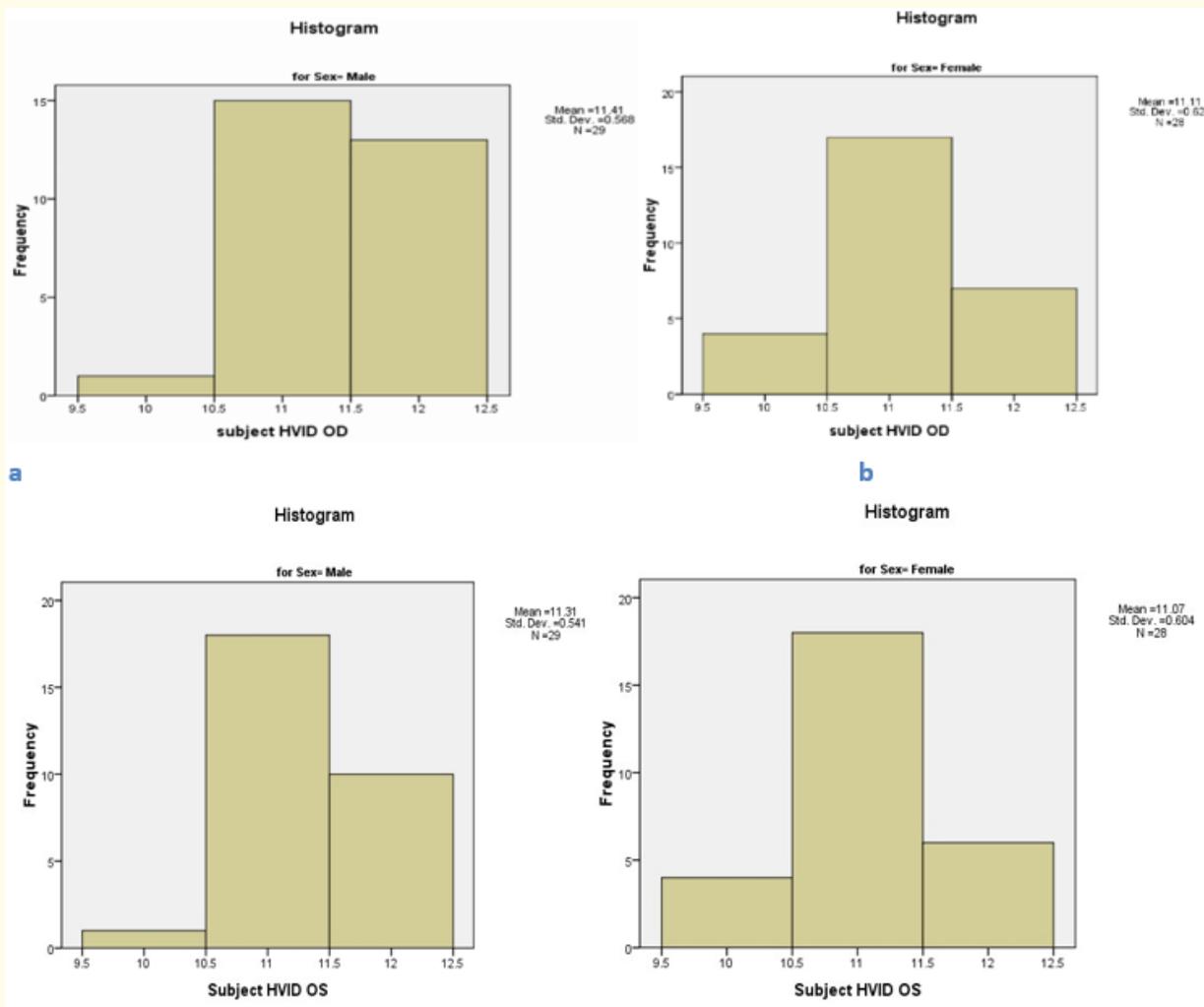


Figure 5: Distribution of corneal diameter according to sex.

The average HVID among males was 11.41 mm (SD = 0.568) in the right eye and 11.31 (SD = 0.541) in the left eye.

While, among females it was 11.11mm (SD = 0.629) in the right eye and 11.07 (SD = 0.604) in the left eye.

The mean difference between gender was not statistically significant for both the right eye ($p = 0.06$) and the left eye ($p = 0.12$).

Distribution of vertical visible iris diameter (VVID) according to sex

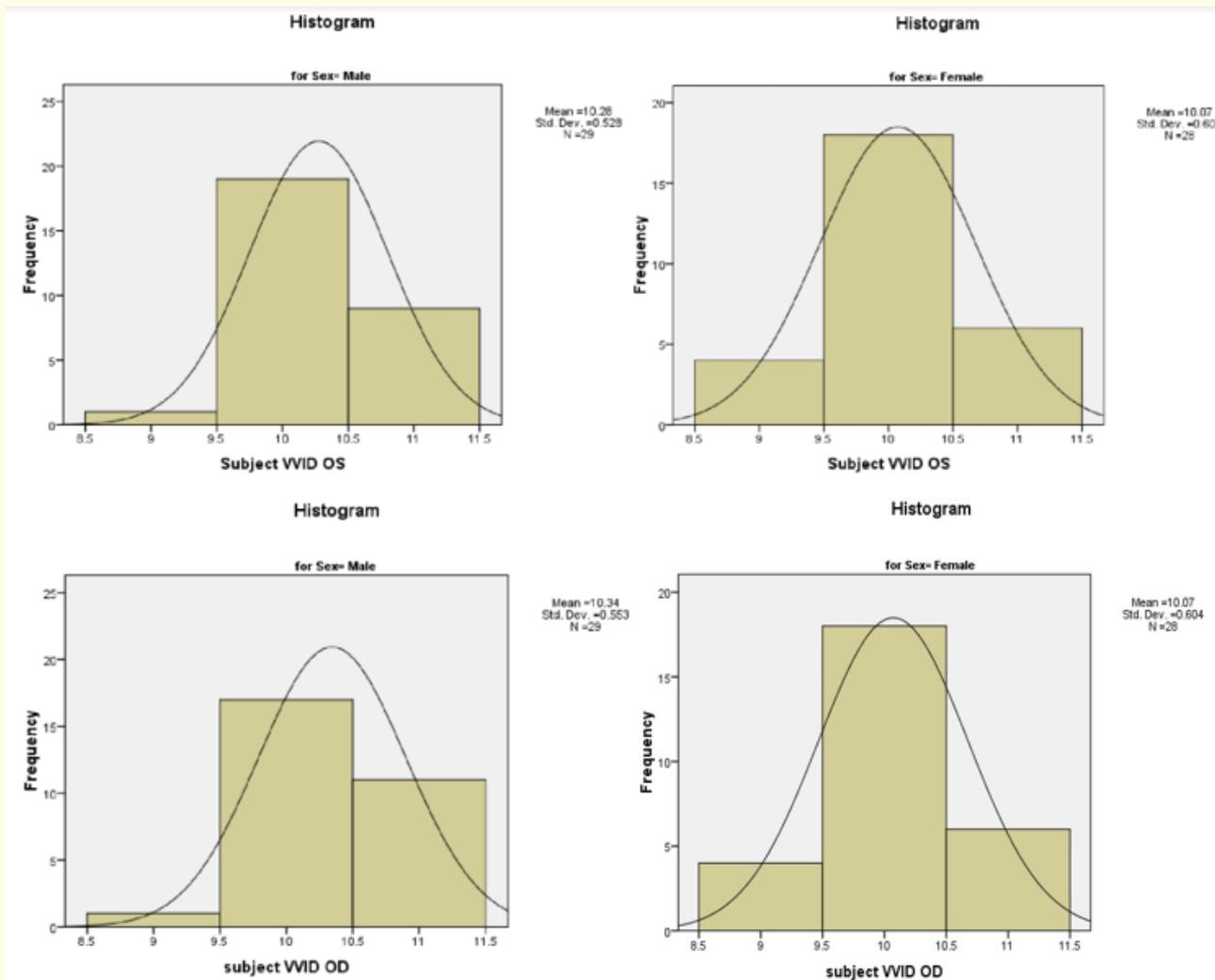


Figure 6: Distribution of VVID according to sex.

The average VVID among males was 10.34 (SD = 0.553) in the right eye and 10.28 (SD = 0.528) in the left eye. While among females it was 10.07 (SD = 0.604) in both eyes. The mean difference between gender was not statistically significant for both the right eye ($p = 0.08$) and the left eye ($p = 0.16$).

Distribution of horizontal anterior radius of curvature according to sex

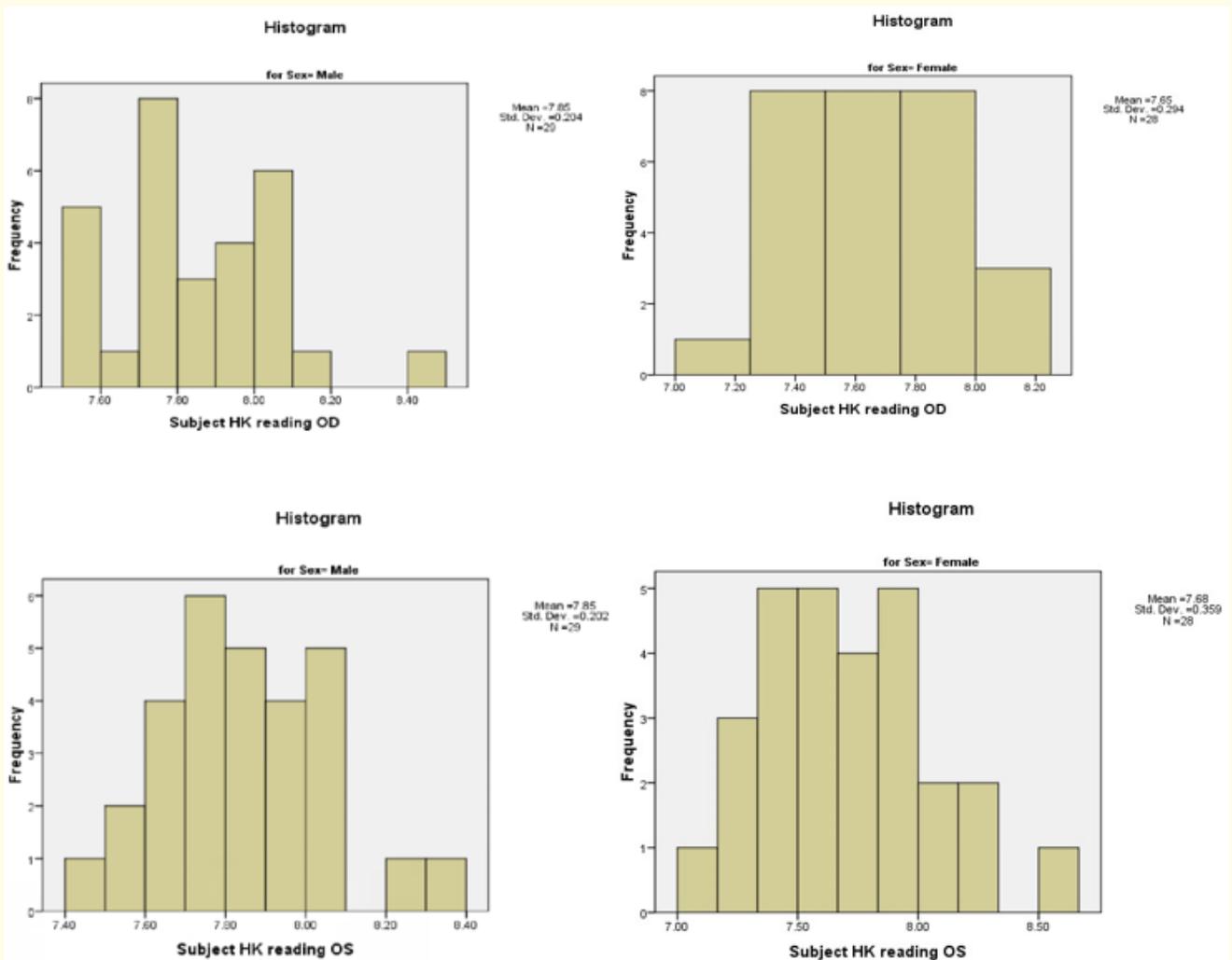


Figure 7: Distribution of anterior radius of curvature according to sex.

The average HARC among males was 7.85 mm (SD = 0.204) in the right eye and 7.85 mm (SD = 0.02) in the left eye. While among females it was 7.65 mm (SD = 0.294) in the right eye and 7.68 mm (SD = 0.359) in the left eye. The mean difference between gender was statistically significant for both the right eye ($p = 0.004$) and the left eye ($p = 0.014$).

Distribution of vertical anterior radius of curvature according to sex

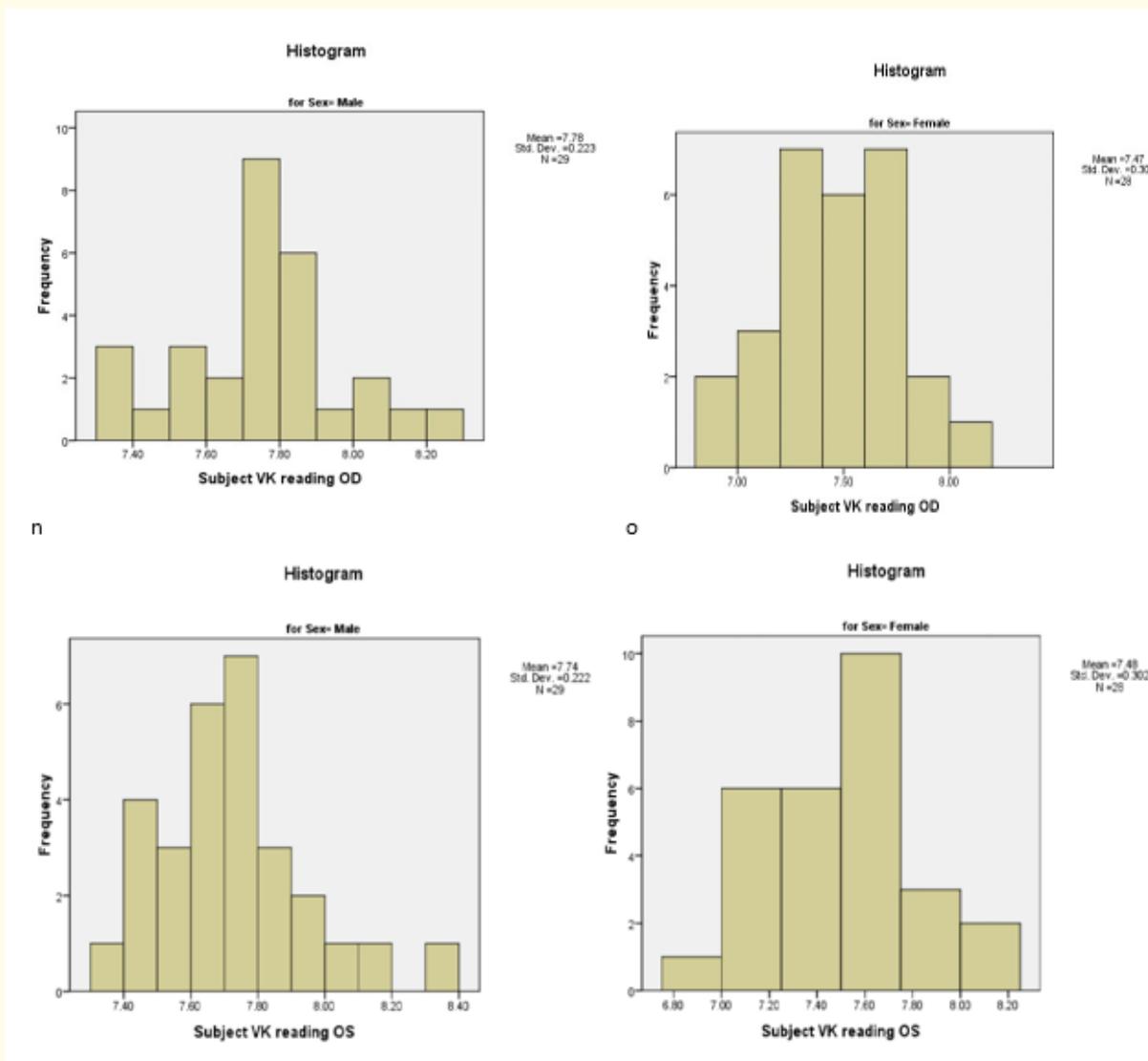


Figure 8: Distribution of VARC according to sex.

The average of VARC among males was 7.78 mm (SD = 0.223) in the right eye and 7.74 (SD = 0.222) in the left eye. While among females it was 7.47 (SD = 0.302) in the right eye and 7.48 (SD = 0.302) in the left eye. The mean difference between gender was statistically significant for both the right eye ($p = 0.0001$) and the left eye ($p = 0.0005$).

Discussion

Relationship between Corneal diameter and age

The current study found no relationship between corneal diameter and age (Figure 1-3). However previous studies [9,11,18-20] report that corneal diameter decreased with age. The variation in results could be because of different age range used. For instance, our study included a narrow age range (17 - 42) unlike other studies [9,11,18-20] which included an age range as wide as 0 - 100 yrs.

Relationship between corneal diameter and sex

This present study found a larger corneal diameter among males than females (Figure 6 and 7). This agrees with other authors [11,18,21-23]. However, it in contrast Fu., *et al.* [24] who reported a larger corneal diameter in females than in males among a population. The difference could be because the Fu study [24] recruited more female subjects (n = 1224) than males (n = 497).

Anterior corneal curvature and age

Our study found no relationship between anterior corneal curvature and age (Figure 4 and 5). This is in agreement with Eghosasere and Ebi [18,25]. However other studies [13-15,19,20] found that corneal curvature decreases with age. Our study reports different results and this could be because we employed a narrow age range (17 to 42 years). Fring [20] and raspberry [19] report that the corneal curvature is stabilized at this age. While Alqurashi., *et al.* [26] reported an increase in km values with age among a population of Saudi individuals aged 12 years and above.

Anterior corneal curvature and sex

The relationship between anterior corneal curvature and sex has been reported in the literature [4,15,22,27-30]. Our study found that the anterior corneal curvature was larger in males than females (Figure 8). This is in agreement with other authors [4,15,22,26-29].

Conclusion

Our study found no relationship between corneal diameter and age as well as between corneal curvature and age. The corneal curvature and corneal diameter were larger among males than females. We recommend a nationwide study including a wider age range to establish corneal parameters for other age groups.

Conflict of Interest

The authors report no conflict of interest.

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