# The Effect of Short-Term Fasting on Ocular Biometry

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## Abstract:

**Introduction:** Islamic religious fasting is an action that inhibits its believers from consuming any food or drink and sometimes fasting can also be observed on Mondays or Thursdays. Ocular biometry parameters which include axial length, anterior chamber angle and depth play significant role in determining the refractive power of the eye as well as in certain ocular conditions. **Objective:** The purpose of the study was to identify the effect of short-term fasting to the ocular biometry. **Method***:* This prospective study included 37 healthy participants with a mean age of 22.51 ± 0.77 years old. The measurements were done on a day with non-fasting state (at 8.00 a.m. and 4.00 p.m.) and one week later during the fasting period (at 8.00 a.m. and 4.00 a.m.). Anterior chamber and angle were measured using Pentacam HR (Oculus, Germany) while axial length was measured using A-scan (Tomey AL-3000). **Result:** The results indicated no significant changes between short-term fasting and non-fasting state with all the variables ($p > 0.05$). Similarly, no significant changes were noted during diurnal fluctuations with all the parameters ($p > 0.05$). **Conclusion:** There is no issue of reliability of the ocular biometric data when patients undergo short-term fasting state.

**Keywords:** ocular biometry, axial length, anterior chamber depth, anterior chamber angle, Islamic religious fasting

## Introduction:

Islamic religious fasting is an action which inhibits people from consuming any food or drink. Period of fasting varied based on country or geographical locations on earth. The onset of fasting is from dawn to sunset. Fasting is not only observed in the month of Ramadhan, but it can also be observed weekly on Mondays and Thursdays. The type of food intake during fasting is similar with non-fasting day (Nowroozzadeh et al., 2012). In the morning before the sunrise, people usually take a considerable amount of food to maintain their appetite during the day and break their fast at sunset with some amount of food (Nowroozzadeh et al., 2012). This will alter the physiological system in the body (Iqbal et al., 2019). Fasting in the month of Ramadhan causes many physiological, biochemical, and metabolic changes in the body, for example the blood count and cholesterol level may change significantly. The cholesterol level and blood count show positive impact on people who are fasting (Baser, Cengiz et al., 2014). In addition, people who are fasting can reduce their body mass index (BMI) to the preferable number (Nickla, Wildsoet & Wallman, 1998).

Ocular biometry is the test that measures the shape and size of the eyeusing an ultrasound wave that penetrates into the eye and translates it into an image or data. The measurement of axial length is defined as the length from the anterior cornea to the inner limiting membrane of the eye while the anterior chamber is the distance between the posterior surface of the cornea to the front surface of the crystalline lens (Kayikçioğlu & Güler, 2000). The eye can be divided into two segments, the anterior and posterior parts. The anterior part is from the cornea up to the crystalline lens that includes anterior chamber, posterior chamber and iris while the posterior part comprises of vitreous humour, retina, choroid, fundus and optic disc (Kayikçioğlu et al., 2000).

Fasting can induce certain changes in the ocular shape. Past study showed that by fasting in Ramadhan, there were some parameters for example axial length and anterior chamber depth that changed significantly and the change induced disapproving alterations of other ocular measurements (Heravian et al., 2015). People who fasts have shown to have an increase intraocular lense (IOL) power measurement compared to when they are measured in a non-fasting state (Nowroozzadeh et al., 2012).

## Materials and Methods:

The participants of the study were recruited among the International Islamic University Malaysia (IIUM) Kuantan students. The data was collected from 37 subjects, aged 20 to 25 years. The subjects were recruited among IIUM students regardless of their gender and the method of sampling used was via convenient sampling.

Subjects were given an explanation about the study and all the procedures that would take place. Informed consent was obtained from each subject before they were included in the study. Nevertheless, only the participants who fulfilled the criteria were enrolled in this study. The inclusion criteria of the study were:

i. University students of IIUM Kuantan to ensure compliance.

ii. Both male and female students with age between 19 and 25 years. Read, Collins and Iskander (2008) suggest that age have an effect on ocular biometry measurement.

The exclusion criteria were:

i. History of ocular trauma, surgery or significant underlying of ocular pathology. Chakraborty et al. (2011) suggest that the axial length have relationship with posterior part of the eye.

ii. Systemic disease. Nowroozadeh et al. (2011) suggest that patient with any systemic disease should be excluded.

iii. Pregnant woman and lactating mother.

iv. Smokers.

v. Full time contact lens wearer.

vi. Subject without clear cornea. Tan et al. (2011) stated that subject must not have ocular media abnormalities.

Anterior chamber angle and depth were measured using Pentacam HR (Oculus, Germany) as shown in Figure 1. Subjects were asked to sit and were instructed to place their chin on the chinrest and rest their forehead against the forehead strap. The patients were asked to fixate straight ahead on the fixation target (blue circular ring). The room lights were switched off and to obtain a reflex-free image, the cover cloth was placed over the subjects head and the Pentacam. Subjects were asked to look straight, fixate on the light emitted from the center, and refrain from blinking during the scanning process. The image was taken automatically. For Pentacam, only measurements with 'OK' status were included in this study.

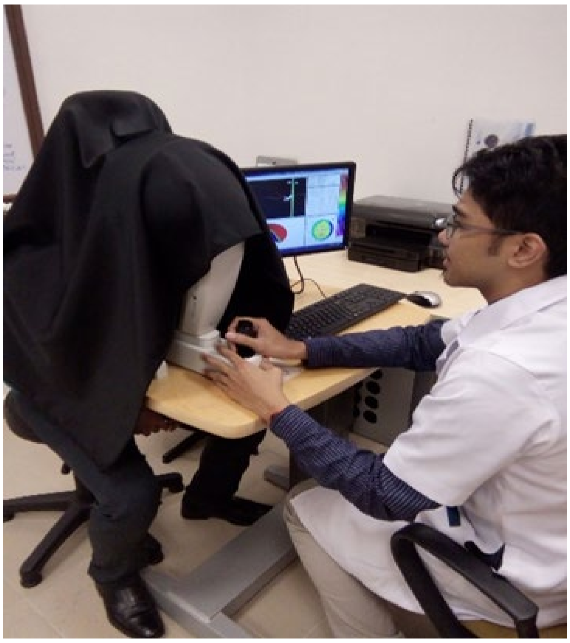

Figure 1: Anterior chamber angle and depth measurement

Axial length measurement was measured after the subject went through Pentacam examination as depicted in Figure 2.

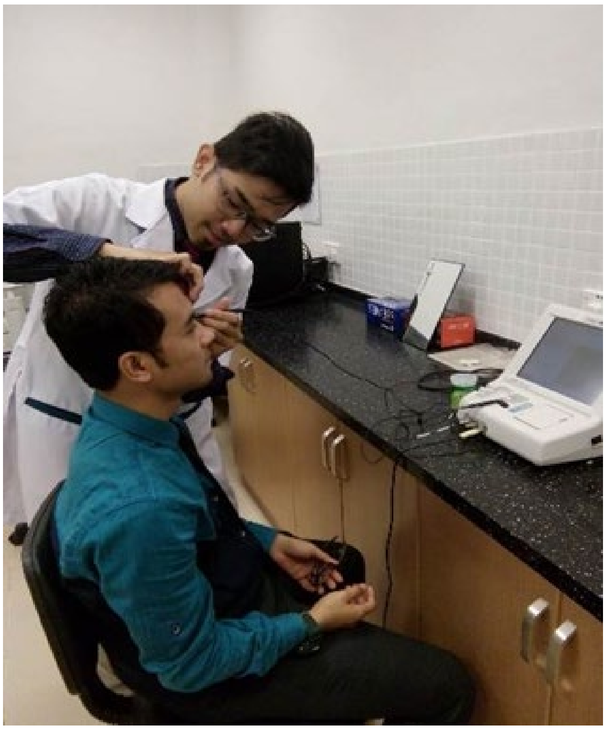

Figure 2: Axial length measurement

Subjects were asked to sit and were explained about the purpose of the test and the aim of the study again. The probe was cleaned off with alcohol swab first and rinsed with saline solution to keep it sterile. Subjects were instilled with anaesthetic (Alcaine 0.5%, Propacaine Hydrocloride). Then, they were asked to look forward straight and fixate a target. The probe was placed perpendicularly and touched gently at the center of the cornea. Five best readings were recorded and an average of them was taken as the final value.

### Statistical Analysis

All data were analysed using SPSS computer program for Windows (version 12.1.1). The normality of the data was determined using the Kolmogorov and Smirnov method. All data that passed the normality test were subjected to paired sample t-test while those data that did not pass the normality test were analysed using Wilcoxon signed-rank test. Measurements of the non-fasting days were compared with those at the same hour (8.00 am and 4.00 pm) during the fasting days. The measurements at 8.00 am and 4.00 pm during the fasting day were also compared to observe the effect of fasting as it progressed. A p-value of 0.05 or less was considered statistically significant.

## Results:

The mean age of the participants (n = 37) was 22.51 ± 0.77 years (21–24 years). Eighteen males and 19 females had participated in this study.

### Comparison between fasting and non-fasting

In Table 1, comparison of measurements between fasting and non-fasting periods at 8.00 am revealed no significant values for mean different in axial length (p=0.590), anterior chamber angle (p=0.674) and anterior chamber depth (p=0.351). Similarly, at 4.00 pm, the measurements were found to be not statistically significant for mean different of axial length (p=0.757), anterior chamber angle (p=0.518) and anterior chamber depth (p=0.757) respectively.

### Comparison between morning and evening

As shown in Table 2, during fasting period, the diurnal variation was observed but there was no statistical difference between morning and evening in the fasting states for axial length (p=0.549), anterior chamber angle (p=0.126) and anterior chamber depth (p=0.100). In the non-fasting measurements, the diurnal variation was not statistically significant in the measurements of axial length (p=0.681), anterior chamber angle (p= 0.674), anterior chamber depth (p=0.351).

Table 1: Comparison of axial length, anterior chamber angle and anterior chamber depth between fasting and non-fasting

| | Ocular biometry | Mean diff ± SD or Median (CI) | *p* (significant value) |
|---|---|---|---|
| 8.00 AM | Axial length (mm) | 0.0315 ± 0.337 | 0.590 |
| | Anterior chamber angle (mm) | 0.000 (-0.138, 0.071) | 0.674 |
| | Anterior chamber depth (mm) | -0.500 (-3.059, 1.024) | 0.351 |
| 4.00 PM | Axial length (mm) | 0.023 ± 0.338 | 0.757 |
| | Anterior chamber angle (mm) | -0.010 ± 0.317 | 0.518 |
| | Anterior chamber depth (mm) | -0.294 ± 5.496 | 0.757 |

Table 2: Comparison of axial length, anterior chamber angle and anterior chamber depth between morning and evening.

| | Ocular biometry | Median (CI) | $p$ (significant value) |
|---|---|---|---|
| Fasting | Axial length (mm) | 0.005 (-0.098, 0.024) | 0.549 |
| | Anterior chamber angle (mm) | 0.000 (-0.009, 0.059) | 0.126 |
| | Anterior chamber depth (mm) | 0.750 (-0.164,2.182) | 0.100 |
| Non-fasting | Axial length (mm) | 0.005 (-0.177,0.119) | 0.681 |
| | Anterior chamber angle (mm) | -0.020 (-0.045,0.053) | 0.674 |
| | Anterior chamber depth (mm) | 0.900 (-1.360,1.931) | 0.351 |

## Discussion:

Ocular biometric measurements remain the most important factors responsible for post-operative refractive error. The ocular biometric could be from the cornea, anterior chamber depth, lens thickness, central corneal thickness, and axial length (Yeu, 2019). In our present study, the effect of fasting was compared to see whether it can affect the ocular biometry and in turn will affect the refractive status (Zhang et al., 2018). We focused on these factors to uncover the causes for possible intraocular lens or refractive power measurement change during short-term fasting. In the study done by Norrby (2008), the error calculation of anterior chamber depth in cataract surgery may lead to the error in prediction of the intraocular power thus affecting the refractive error calculation.

### Comparison of axial length and anterior chamber depth between fasting and non-fasting states

We found that axial length has no significant effect following short term fasting. From our examination, the result between fasting and non-fasting states showed the mean axial length had no significant change. This may be due to the minimal effect of dehydration. Next, the result from the diurnal effect in the two states of the day also showed no significant result. This parameter is known to be resilient against changes even intervention was introduced (Lau et al., 2019). The variations of axial length between two non-fasting days showed significant result when they were compared between weeks or month (Chakraborty et al., 2011).

In the study done by Baser et al. (2014), the effect of anterior chamber angle gave significant result between fasting month and non-fasting month. Contradiction to that, our results show insignificant change in the morning and evening. Moreover, the result showed that the mean between morning and evening for fasting and non-fasting day is not significant which the effect of dehydration may not happen diurnally. The possible reason may be because the participants did not drink at pre-dawn, thus the effect of water loading that happens in fasting month does not happen in short-term fasting. During religious fasting month, people usually drink a lot of water before dawn to avoid the effect of dehydration, thus resulting in the anterior chamber calculation of fasting month to be deeper in the morning (Albagi and Alameen, 2014). During short-term religious fasting, people tend to not drink water as in fasting month because the effect of dehydration may not be as severe as in the fasting month. Thus the effect of water loading is fully established in long-term fasting because of the drinking effect during the pre-dawn breakfast.

Theoretically, the effect of fasting can be achieved in a month of Ramadhan, Nowroozzadeh (2012) also states that dehydration happens during fasting period can shrink the vitreous humor and decrease the axial length. Usually during Islamic religious fasting month, people tend to drink 50% more water than normal months, causing the effect of higher water loading (Kerimoglu et al., 2009). A study done by Albagi and Alameen (2014) agrees with our study that the axial length does not show any significant result between fasting and non-fasting state.

### Anterior chamber angle between fasting and non-fasting state.

The anterior chamber angle is an angle that is measured between the root of the iris and the peripheral corneal vault. It is one of very important parameter in determining the eye-threatening disease which is glaucoma. Glaucoma that commonly relates with ocular biometry is primary angle closure glaucoma (ACG). It is a condition that results to irregular structure of anterior chamber angle (Hayashi et al., 2000). Studies have proven that anterior chamber angle and changes of anterior chamber depth contributed to the ACG. Among all the parameters involved, anterior chamber angle showed the most important factor in determining ACG (Wilensky et al., 1993). A study done by Aung (2005) states that eyes with primary angle closure have are likely to have shallow anterior chamber depth (ACD), thick lens, shifted anterior lens position, small corneal diameter and radius of curvature, and short axial length.

Thus, it is significant that this parameter to be measured in our study. In the previous research works, none of them studied about the effect of anterior chamber angle. Besides, the risk of having angle closure in narrow anterior chamber depth is very high and also they also have the tendency to have glaucomatous optic neuropathy (Aung, 2015). The reason why the anterior chamber angle was not significantly reduced between fasting state and non-fasting state may be because the anterior chamber depth did not change. As stated in the study before (Kerimoglu et al., 2009), the theory of accumulation of ocular dehydration is the main factor of ocular biometric to change, it is also applied in the anterior chamber angle. Whenever the anterior chamber angle becomes narrow, the risk of having angle closure may increase (Congdon et al., 1992).

## Conclusion:

In this study we found that there was no significant change in the biometric parameters after observing the Islamic religious daily fasting. The data suggest that there is no significant different in axial length, anterior chamber depth and angle between non-fasting and daily fasting states. Thus, there is no issue in the reliability of the ocular biometric data and the measurements can be conducted while the patient is in the short-term fasting state.

## Declaration of interest:

The authors have no proprietary interest in any materials or methods described within this paper. This submission has not been published anywhere previously and it is not simultaneously being considered for any other publication.

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