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Original research

Investigation of the effects of Islamic fasting on ocular parameters

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Abstract

Purpose: To investigate the effects of religious fasting during the month of Ramadan on intraocular pressure (IOP), refractive error, corneal tomography and biomechanics, ocular biometry, and tear film layer properties.

Methods: This prospective study was carried out one week before and in the last week of Ramadan. Ninety-four eyes of 94 healthy adult volunteers (54 males and 40 females) with a mean ± SD age of 35.12 ± 9.07 were enrolled in this study. Patients with any systemic disorder, ocular disease, or a history of previous surgery were excluded. Corneal tomography and biomechanics, ocular biometry, IOP, refractive error, and tear break up time (TBUT) were evaluated in non-fasting and fasting periods by the Pentacam (Oculus), Corvis ST (Oculus), IOL Master (Carl Zeiss), computerized tonometer (Topcon CT-1/CT-1P), auto kerato-refractometer (Topcon KR-1), and Keratograph 5M (Oculus), respectively.

Results: There was no significant difference in the central corneal thickness (CCT) between the study groups ($P = 0.123$) using the Pentacam while the Corvis ST showed a significant difference in all participants ($P < 0.0001$). Moreover, the peak distance (distance of the two surrounding peaks of the cornea at the highest concavity) of male and female participants showed a significant difference between the fasting and non-fasting groups ($P = 0.002$). The anterior chamber depth (ACD) using the Pentacam decreased in the male group ($P = 0.004$) in the fasting period. During the fasting period, computerized tonometer showed a decrease in IOP only in males in comparison to the non-fasting group ($P = 0.018$) while the Corvis ST showed decreased IOP in all participants ($P < 0.0001$). The steep keratometry (K2) in the corneal posterior surface appeared to be different in males between the study groups ($P = 0.034$). We were unable to show any significant difference in other ocular parameters between fasting and non-fasting periods.

Conclusion: This study showed that ACD, IOP, CCT, and peak distance were different between fasting and non-fasting groups while no difference was observed in other ocular parameters. Interpretations of these significant differences should be considered in the clinical setting.

Keywords: Fasting; Intraocular pressure; Ocular parameters; Corneal tomography

Conflict of interest: The authors have no conflicts of interest.

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Introduction

The Muslim population of the world is expected to increase by about 35% in the next 20 years, rising from 1.6 billion in 2010 to 2.2 billion by 2030, according to new population projections by the Pew Research Center's Forum on Religion and Public Life.[1]

The month of Ramadan is the ninth month of the Islamic calendar, and fasting during this month is one of the five pillars of Islam, so it is strictly observed worldwide by millions of Muslims. Fasting is obligatory for healthy adult Muslims unless they have an acceptable excuse, such as menstruating women, sick and traveling people, or pregnant and lactating women who are exempt and permitted to postpone their fasting to a suitable time when it does not interfere with their maternal responsibilities.[2] Muslims fast during the daylight hours from dawn to dusk, when they abstain from foods, drinks, and smoke. They are permitted to eat and drink only after the sunset, the so-called breaking-of-fast meal, until the pre-dawn meal which defines the beginning of the new fasting period. However, they have two main meals as explained above, and they are allowed to eat and drink from the sunset to sunrise.[3] The amount of food and fluid intake shows a noticeable change as a result of fasting during the day and eating period.[4–6]

People who fast are subjected to significant changes in their normal feeding, sleeping, and behavioral patterns. There are only a few reports in the literature regarding the effects of Ramadan fasting on the ocular parameters, but most of them investigated intraocular pressure (IOP) and tear parameters.[3,4,7–12]

Kayikçioglu et al. found that religious fasting did not affect the tear break up time (TBUT) values in healthy individuals.[10] Moreover, some authors have concluded that the total daily intake of nutrients is not related to higher myopia.[9,11] Assadi et al. reported that Islamic Ramadan fasting did not markedly affect physiological IOP, refractive error, or visual acuity in healthy volunteers.[7]

Every year, many Muslims fast during Ramadan, and the majority of them are concerned about the impact of fasting on ocular health. Although various studies have been carried out so far,[3–12] most of these studies evaluated limited ocular parameters in a small number of patients. Therefore, we designed a comprehensive study to investigate the effects of fasting on different ocular parameters.

Methods

This case–control study was performed in Mashhad, Iran in Ramadan 2015 (7 June to 5 July). The study was performed in two phases: the first phase was carried out one week before Ramadan, and the second phase was conducted in the last week of Ramadan. One hundred subjects who intended to fast during Ramadan were recruited. All selected patients received information about the study and consented to undergoing additional examinations before and 3 weeks after fasting. The Institutional Review Board and the Ethics Committee of Mashhad University of Medical Sciences approved the study and ensured its protocol followed the tenets of the Declaration of Helsinki. Healthy adults aged 20–50 years old who intended to fast during Ramadan for at least 20 days were included in the study. Blood pressure was measured in the afternoon for all participants one week before the study using a digital sphygmomanometer. In addition, blood samples were taken in the morning for biochemistry tests using the Hitachi 717 analyzer (Japan) and lipid profile measurements. Then individuals with abnormal test results, underlying disease like diabetes, hypertension, etc., and people who took certain medications were excluded from the study. The patients with any systemic disorder, ocular pathology, and/or previous surgery were also excluded from the study. We also excluded subjects who did not participate in the second phase such as women who had their menstrual cycle in the second phase. All participants were evaluated carefully by an experienced ophthalmologist (MR.S.) and underwent complete ophthalmic examinations. All measurements were done by a single experienced optometrist in fasting and non-fasting periods.

In order to avoid the experimental error rate, only the data of one eye (right eye) was used in this study. All measurements were done in a consistent way based on the manufacturer's instructions. The manufacturers' representatives calibrated the devices every 6 months routinely.

Since Ramadan varies in duration from 12 to 17 h a day in different years, it should be mentioned that our study was conducted in the summer which is almost the longest span of fasting compared to any other season.[4–6] All measurements were performed between 03:00 and 06:00 p.m. in fasting and non-fasting periods; therefore, the measurement time was 2–3 h and at least 10 h after a meal in the non-fasting and fasting group, respectively.

Our study population was 94 subjects (54 males and 40 females).

The test sequence was as follows:

TBUT: Measurement of the TBUT was done by the Keratograph 5M (Oculus, type 77000, Germany). The Keratograph 5M evaluates the tear film using infrared light and non-invasive keratograph break-up time (NIKBUT) can be examined carefully and documented easily. The infrared light used in the Keratograph 5M is invisible to the human eye and produces no glare during the examination and no reflex tearing. The repeatability and methodology of the Keratograph 5M have been evaluated and approved in previous studies.[13]

Refractive error measurement: The participants underwent cyclorefraction using an auto kerato-refractometer (Topcon KR-1, Hasunma-cho, Itabashi-UK, Tokyo, Japan). Two doses of cyclopentolate 1% drops were administered 5 min apart, and refraction was checked 30 min after the second instillation. If the pupil responded to penlight stimulation after 30 min, the examiner waited for an additional 10 min before performing cycloplegic refraction. The auto kerato-refractometer measured the refractive error three times, and the average of these three measurements was used to calculate the in spherical equivalent (SE).

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