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The Correlation between Glucose and Lipid Biomarkers Variations with Biometric Characteristics and Intraocular Pressure Changes during Ramadan Fasting

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ABSTRACT

Introduction: Changes in eating and sleeping habits during fasting influence various physiological parameters, thereby leading to impact on the ocular system. The present study aimed to assess the correlation between variations of glucose and lipid biomarkers with the biometric properties and intraocular pressure changes associated with Ramadan fasting.

Methods: This study was conducted on100 healthy fasting volunteers. In total, 89 participants completed the course of the study based on the inclusion and exclusion criteria. Right-eye ocular axial length and anterior chamber depth were measured using the IOL Master (Carl Zeiss Meditec, Jena, Germany). Afterwards, the intraocular pressure of the right eye was measured using a non-contact tonometer (Topcon, Computerized Tonometer CT-1/CT-1P, Tokyo, Japan).Blood samples were obtained from the participants, and the concentrations of the biomarkers, including fasting blood sugar, triglyceride, cholesterol, high-density lipoprotein, and low-density lipoprotein were measured using the Hitachi 717 analyzer (Hitachi, Tokyo, Japan). All the assessments were performed one week before and after Ramadan.

Results: Among 89 healthy Muslims who completed the study, 51 were male (mean age: 35.51±8.94 years), and 38 were female (mean age: 34.26±9.41 years). No significant correlations were observed between changes in axial length with variations of glucose, and lipid biomarkers in the fasting individuals. Furthermore, only an insignificant correlation was denoted between the anterior chamber depth and high-density lipoprotein changes during Ramadan. The findings also revealed only an insignificant association between intraocular pressure and cholesterol changes in healthy fasting individuals.

Conclusion: According to the results, changes in the ocular parameters in Ramadan fasting are probably independent of the variation levels of glucose and lipid biomarkers.

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Introduction

Ramadan is one the holiest months in the Islamic calendar. Fasting during Ramadan is one of the pillars of Islam. Every year, millions of healthy Muslims abstain from eating and drinking from dawn until dusk during this month. Since the Islamic calendar is based on the lunar months, it retrogrades about two weeks every year, and Ramadan may coincide with a different season each year. Moreover, the length of fasting may vary depending on the geographical location of the country (1-3).

During Ramadan, the frequency and

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quantity of nutrition, sleep, and physical activity decrease (4). Fasting individuals consume only two main meals, which are Sahur and If tar. Additionally, dietary habits also change during this month, and the proportion of carbohydrate, fat, and protein intake may vary compared to the other times of year (4). Changes in the number and time of meals while fasting influence various physiological parameters, thereby leading to impact on the ocular system. Reduced insulin, increased glucagon and cortisol, and changes in the lipid profile, melatonin, and electrolytes have been well-documented in fasting individuals (5-8).

The hypothesis of the current research was that the biometric and intraocular pressure (IOP) parameters alter as the glucose and lipid biomarker levels change during fasting. Therefore, the present study aimed to assess the correlation between variations of glucose and lipid biomarkers with biometric properties and intraocular pressure changes following Ramadan fasting.

Material and methods

This study was conducted on 100 healthy volunteers aged 20-50 years in Mashhad, Iran. The subjects decided to fast for a minimum of 20 days during Ramadan. The assessments were performed one week before and after Ramadan during June-July 2015.

The exclusion criteria were the history of systemic and ocular diseases, ocular surgery, and use of specific medications. In total, 89 subjects (51 males and 38 females) were enrolled in the study.

Written informed consent was obtained from the participants prior to the examinations. The experiments were carried out in accordance with the tenets of the Declaration of Helsinki, and the study protocol was approved by the Research Ethics Committee of Mashhad University of Medical Sciences (grant number: 940149).

Ocular axial length (AL) and anterior chamber depth (ACD) were measured using the IOL Masternon-contact optical biometer (Carl Zeiss Meditec, Jena, Germany) (9). Right-eye biometric measurements were performed by a single skilled optometrist at 04:00-06:00 PM. Following that, the IOP of the right eye was measured using a non-contact tonometer (Topcon, Computerized Tonometer CT-1/CT-1P, Hasunuma-cho, Itabashi UK, Tokyo, Japan) by an experienced optometrist. The mean values obtained from the three measurements were recorded for statistical analysis.

Blood samples were obtained from the brachial vein in both phases with a minimum of 12 hours of fasting and collected by a single physician in the morning (8:00-10:00 AM). Concentrations of the biomarkers, including fasting blood sugar (FBS), triglyceride, cholesterol, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) were measured using the Hitachi 717 analyzer (Hitachi, Tokyo, Japan).

Data analysis was performed in SPSS version 16 (SPSS Inc, Chicago, IL, USA), and the correlations between the parameters were evaluated using the Pearson's correlation-coefficient at the significance level of 0.05.

Results

Among 89 healthy Muslims who participated in the study, 51 were male (57.3%; mean age: 35.51±8.94 years), and 38 were female (42.7%; mean age: 34.26±9.41 years). All the measurements were performed one week before and one week after Ramadan, and the changes in the ocular parameters, glucose, and lipid biomarkers were assessed. No significant correlations were observed between the changes in the AL and variations of glucose, and lipid biomarkers in the fasting individuals during Ramadan (Table 1).

Furthermore, the findings showed an insignificant correlation between the changes in ACD and HDL during the holy month of Ramadan (Table 2).

Table 1. Results of Pearson's Correlation-Coefficient (r values) Regarding Changes in Axial Length, Glucose, and Lipid Biomarkers during Ramadan

	Changes in AL	P-value
Changes in FBS	0.053	0.64
Changes in Cholesterol	-0.103	0.35
Changes in Triglyceride	-0.081	0.47
Changes in HDL	-0.122	0.27
Changes in LDL	-0.040	0.72

AL: axial length; FBS: fasting blood sugar; HDL: high-density lipoprotein; LDL: low-density lipoprotein

Table 2. Results of Pearson's Correlation-Coefficient (r values) Regarding Changes in Anterior Chamber Depth, Glucose, and Lipid Biomarkers during Ramadan

	Changes in ACD	P-value
Changes in FBS	-0.044	0.69
Changes in Cholesterol	-0.104	0.35
Changes in Triglyceride	-0.005	0.96
Changes in HDL	-0.208	0.06
Changes in LDL	-0.021	0.84

ACD: anterior chamber depth, FBS: fasting blood sugar; HDL: high-density lipoprotein; LDL: low-density lipoprotein

The findings were also indicative of an insignificant correlation between IOP and cholesterol changes in the healthy fasting individuals during Ramadan (Table 3).

Table 3. Results of Pearson's Correlation-Coefficient (r values) Regarding Changes in Intraocular Pressure, Glucose, and Lipid Biomarkers during Ramadan

	Changes in IOP	P-value
Changes in FBS	-0.009	0.93
Changes in Cholesterol	-0.200	0.06
Changes in Triglyceride	-0.103	0.34
Changes in HDL	-0.021	0.84
Changes in LDL	-0.106	0.32

IOP: intraocular pressure FBS: fasting blood sugar; HDL: high-density lipoprotein; LDL: low-density lipoprotein

Discussion

The eating, drinking, and sleeping habits of Muslims change during the holy month of Ramadan, thereby influencing physiological parameters. Ramadan fasting is a great opportunity to assess the effect of reduced meal frequency on metabolism and ocular structures. The present study aimed to investigate the correlation between variations of glucose and lipid biomarkers with the changes in some ocular parameters in healthy fasting individuals during Ramadan.

Our findings showed no significant correlation between the changes in the AL, and variations of glucose, and lipid biomarkers in Ramadan fasting. To the best of our knowledge, no previous studies have evaluated the associations between the changes in glucose and lipid biomarkers with alternation of AL during Ramadan. According to the results obtained by Nowrooz Zadeh et al., the AL value significantly decreased in fasting individuals, while it returned to normal after one month. (10). In the mentioned study, this finding was explained by the dehydration associated with the phases of fasting, which could construct the vitreous hum our and consequently decrease the axial length.

In another research, Baser et al. observed a significant reduction in the AL in the evening during the fasting period (11), which was explained by the dehydration following fasting. On the other hand, some studies have evaluated the ocular biometric parameters using the IOL Master, reporting unchanged AL during the holy month of Ramadan (9, 12).

According to the results of the present study, there was an insignificant correlation between the changes in ACD and HDL during the holy month of Ramadan. To the best of our knowledge, no prior studies have assessed the correlation between glucose and variations of lipid biomarkers with the changes in ACD during Ramadan. In this regard, Nowrooz Zadeh et al. reported a significant increase in ACD during Ramadan fasting compared to the baseline measurements, which returned to normal one month after Ramadan. Moreover, they reported higher ACD in the morning compared to the evening in fasting individuals (10). According to the mentioned research, intentional drinking of large amount of fluids at the predawn meal to diminish the effects of dehydration could increase ACD and IOP in the morning, which in turn decreases these parameters in the evening due to the gradual dehydration in one day of fasting.

In another study in this regard, Shahsavan et al. assessed ACD using the IOL Master in the afternoon before and after Ramadan, stating that ACD remained unchanged during Ramadan fasting (9). Furthermore, Heravian et al. evaluated IOP during Ramadan and reported significant differences in the IOP values between pre- and post-Ramadan fasting (13.66±3.0 versus 12.06±2.3; P=0.001) (13). Dadeya et al. also investigated the effects of fating on IOP and observed significant lower IOP values at all times in a day of fasting (14), while Kerimoglu et al. reported an increment in the IOP value in the early morning, which reduced in the afternoon during the fasting period (15).

The findings of Dadeya et al. demonstrated that the depletion of stored fats in fasting individuals may diminish prostaglandin secretion, thereby leading to the reduction of IOP (14). According to the findings of the current research, there was only an insignificant correlation between the changes

in IOP and cholesterol, which is in line with the results obtained by Dadeya et al. although the difference was not considered statistically significant.

Conclusion

According to the results, there were no significant associations between the changes in the AL, ACD, and IOP with the variations in the levels of glucose and lipid biomarkers in the healthy individuals during Ramadan. Therefore, the variations in the ocular parameters variations during Ramadan fasting may be independent of the variations in the levels of glucose and lipid biomarkers.

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Conflict of interest

None declared.

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