Effect of Eating Habits During Fasting Versus After Fasting on Biometric Parameters and Intra Ocular Pressure

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ABSTRACT

Purpose: To compare the effect of eating habits during fasting versus three months after fasting on biometric parameters and intra ocular pressure.

Methodology: A Prospective observational study was done Superior University, Lahore. By using non-probability convenient sampling, 158 healthy participants who had no history of ocular or systemic diseases and a normal ocular status aged 20-30 years were included. Ocular parameters comprised intraocular pressure, axial length, anterior chamber depth, and central corneal thickness were measured by using standardized instruments. Each measurement was made twice, once during the Ramadan fast and once three-month after Ramadan. The data was analyzed by using SPSS version 27 and p-value < 0.05 was considered statistically significant.

Result: In this study 158 individuals were enrolled among those 61 (39%) were male and 97 (61%) were female with mean age of 24.5 & SD ± 2.6. The difference of IOP between both measurements was significant (during Ramadan: RE=13.9, LE=14.2 however 3-month post Ramadan: RE & LE=14.9) as the p-value was < 0.001. In contrast, biometric parameters including CCT, ACD, and AXL did not show any significant alteration between two observations because the p-value was > 0.05.

Conclusion: Fasting significantly lowers intraocular pressure, but it has no effect on biometric measurements (CCT, ACD, and AXL). Therefore, fasting has no effect on the structural integrity of the eye, but it does change the dynamics of ocular pressure.

Keywords: Intraocular Pressure, Anterior Chamber Depth, Ocular Physiology, Visual Health, Post-Fasting, Hydration Status

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INTRODUCTION

Ramadan fasting between sunrise and sunset for the whole month of Ramadan is exceptional in that it habitually involves withholding food and water from sunrise to sunset for 29–30 uninterrupted days with a nocturnal feeding respite.[1] This acute change in meal timing, drinking habit, and sleep-wake cycle induces systemic physiologic adaptation that is expressed in cardiometabolic risk factors such as blood glucose, lipid profile, body weight, and blood pressure. Contemporary reports of intermittent fasting (IF) therapy and Ramadan-fasting experiments all consistently report results of beneficial change in weight and heterogeneous effects on glycemia, lipid profile, and blood pressure but with differing extent according to protocol, baseline, and duration.[2]

Fasting also changes sleep pattern (wakefulness and sleep delayed during morning hours), activity, and caffeine consumption. These are all capable, in their own way, of altering the circadian rhythm of IOP and affecting ocular surface and anterior-segment parameters through dehydration, osmolar stress, and biomechanical mechanisms (e.g., central corneal thickness, (CCT).[3] Many clinical trials conducted during Ramadan have investigated whether IOP differs in the fasting versus post-fasting state, and whether the "fasting state" itself has effects that can be discerned independent of measurement time. The findings are not consistent with populations and protocols and range from zero loss in IOP in normal adults, diurnal pattern change, and possible susceptibility in glaucoma. To this point, the current thesis aims to determine if pre-fasting/post-fasting (i.e., pre-dawn/sunset meal intake during the fast versus following rehydration and refeeding measurements) differentially affects biometric parameters and IOP and how such changes relate to presumptive mechanisms of hydration status, circadian rhythm, and anterior-segment biomechanics.[4]

The IOP is intraocular fluid pressure controlled by aqueous humor dynamics of drainage and formation and episcleral venous pressure.[5] It's an important clinical measure because elevated values or excessive day-to-day fluctuation are risk factors for glaucomatous optic neuropathy. In the fasting state, the IOP can fluctuate with the fluctuation in the hydration and vascular tone and its measured value can be greatly influenced by the concomitant fluctuation in the corneal characteristics and circadian rhythm as well; therefore, its interpretation in the fasting and post-fast fed state needs correction for these physiological modifiers.[6]

At the level of the anterior segment, with Scheimpflug photography and OCT, changes in CCT, anterior chamber depth/volume, corneal and lens density, and peripapillary microvasculature have been studied during fasting. In normals, some reports describe minimal but statistically significant decrease in CCT and modest difference in IOP between the two states of non-fasting and fasting; others describe very minor changes.[7] These, whilst within physiological overall range, influence applanation tonometry readings (which are correlated with CCT) and thus clinical interpretation of IOP for fasting and post-fasting readings.[8]

METHODOLOGY

A Prospective observational study was done at Superior University, Lahore. By using non-probability convenient sampling, 158 healthy participants who had no history of ocular or systemic diseases and a normal ocular status aged 20-30 years were included. Individuals were excluded from the study if they had any systemic or ocular pathology (cataract, endothelial dystrophy and pseudo exfoliation syndrome), a history of ocular surgery (refractive surgery, crosslinking, etc.), use of ocular drops or contact lenses, smoked, consumed alcohol. Approval for the study was granted by the Ethical review board of College of Ophthalmogy and Allied Vision Sciences.

All participants underwent a full ophthalmological examination, including refraction, best corrected visual acuity, biomicroscopy evaluation of anterior segment and fundus. Ocular parameters comprised intraocular pressure measured by using applanation tonometer and axial length, anterior chamber depth, and central corneal thickness were measured by using standardized IOL master. Each measurement was made twice, once during the Ramadan fast and once three-month after Ramadan. The data was analyzed by using SPSS version 27 and p-value < 0.05 was considered statistically significant. Confidence level was 90%, with 5% of precision level. Standard deviation was 1.22 with mean (I) of 13.80 and mean (II) 13.60.

RESULTS:

In this study 158 individuals were enrolled among those 61 (39%) were male and 97 (61%) were female with mean age of 24.5 & SD ± 2.6. The difference of IOP between both measurements was significant (during Ramadan: RE=13.9, LE=14.2 however 3-month post Ramadan: RE & LE=14.9) as the p-value was < 0.001. The average intraocular pressure (IOP) readings for the right eye (LE) and left eye (RE) taken both during and after fasting. After fasting, the right eye's mean intraocular pressure (IOP) rose from 13.9 ± 2.6 mmHg to 14.9 ± 2.4 mmHg. Similarly, after fasting, the left eye's mean intraocular pressure (IOP) increased from 14.2 ± 2.6 mmHg to 14.9 ± 2.4 mmHg. The statistical significance of the changes between the fasting and post-fasting periods is indicated by the p-value (<0.001). These results imply that fasting may temporarily lower intraocular pressure (IOP) Physiological changes in the dynamics of ocular fluid, metabolism, or hydration levels during fasting and subsequent refeeding may be the cause of these discrepancies. In contrast, biometric parameters including CCT, ACD, and AXL did not show any significant alteration between two observations because the p-value was > 0.05. the biometric measurements of the right and left eyes, including axial length (AXL), anterior chamber depth (ACD), and central corneal thickness (CCT), taken during and after fasting. With p-values of 0.145 and 0.080, respectively, the mean CCT for the right eye was 523.3 ± 32.8 µm before and 523.2 ± 32.8 µm after the fast. The mean CCT for the left eye was 524.9 ± 33.1 µm during and 524.7 ± 33.2 µm after fasting. The mean ACD for both eyes did not differ significantly between the fasting and post-fasting conditions (RE: 3.48 ± 0.26 mm vs. 3.47 ± 0.26 mm, p = 1.00; LE: 3.52 ± 0.36 mm vs. 3.51 ± 0.36 mm, p = 0.896). Furthermore, there was no change in the mean axial length (LE: 23.55 ± 1.02 mm vs. 23.53 ± 1.02 mm, p = 0.502; RE: 23.59 ± 0.98 mm vs. 23.57 ± 0.98 mm, p = 0.719). These findings imply that corneal thickness, anterior chamber depth, and axial length remain stable during fasting and post-fasting, indicating that fasting has no discernible impact on ocular biometrics.

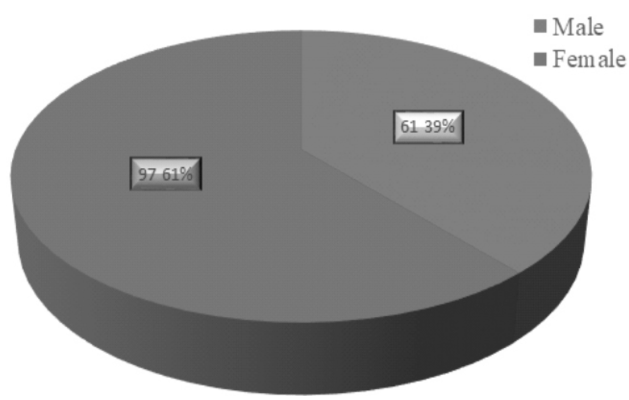


Figure I depict the pie chart representing the gender wise distribution

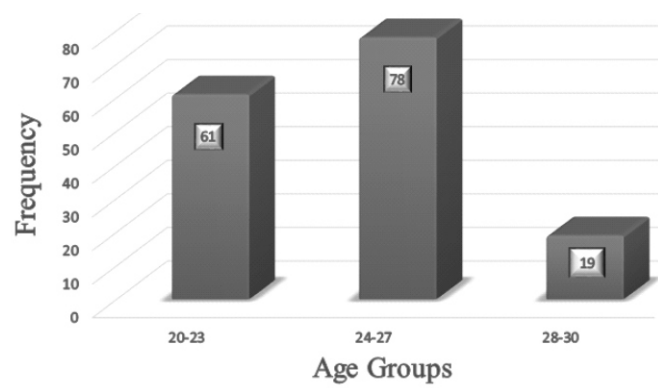


Figure-II depict the Bar chart representing the age wise distribution

IOP Measurements	Mean (mmHg)	Std	P-Value
RE (During)	13.9	3	<0.001
RE (Post)	14.9	2	
LE(During)	14.2	3	<0.001
LE(Post)	14.9	2	

Table-I: Showing the changes in IOP during fasting and post fasting

Data mentioned in above table showed the average intraocular pressure (IOP) readings for the right eye (LE) and left eye (RE) taken both during and after fasting.

Figure-III depicts the Bar chart representing the data from Table-I

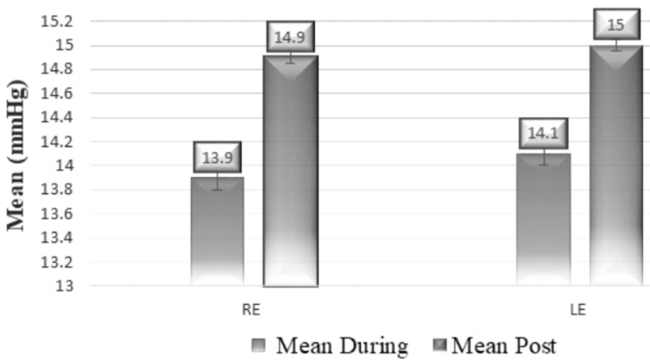


Table-II: Showing the significance of paired t-test by comparing CCT, ACD, AXL

Biometric Parameters	Mean		Std		P-Value
	During	Post	During	Post	
CCT-RE (µm)	523.3	523	32.8	33	0.145
CCT-LE (µm)	524.9	525	33.1	33	0.08
ACD-RE (mm)	3.48	3.47	0.26	0.3	0.98
ACD-LE (mm)	3.52	3.51	0.36	0.4	0.896
AXL-RE (mm)	23.59	23.6	0.98	1	0.719
AXL-LE (mm)	23.55	23.5	1.02	1	0.502

Table II compares the biometric measurements of the right and left eyes, including axial length (AXL), anterior chamber depth (ACD), and central corneal thickness (CCT), taken during and after fasting.

Figure IV shows a bar chart of CCT measurements taken during and after fasting, corresponding to the data in Table IV.

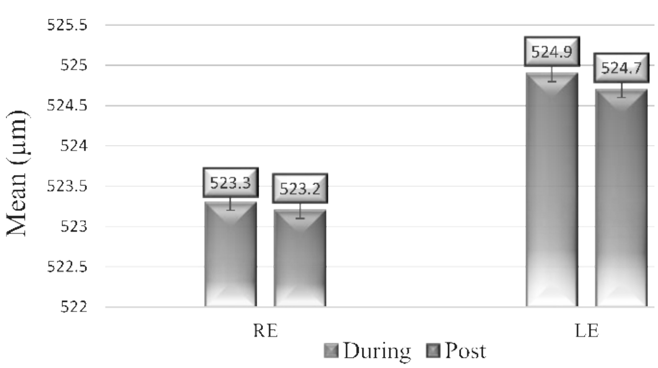


Figure V shows a bar chart of ACD measurements during and after fasting, as listed in Table IV

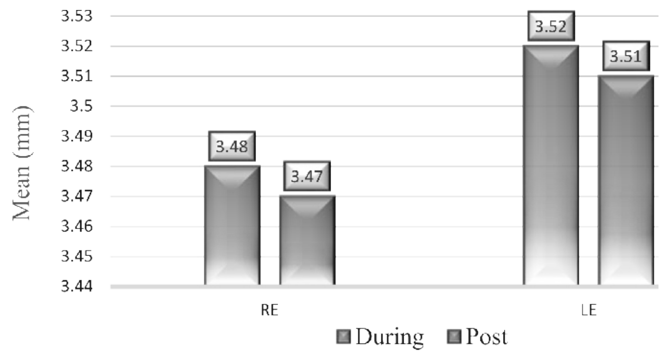
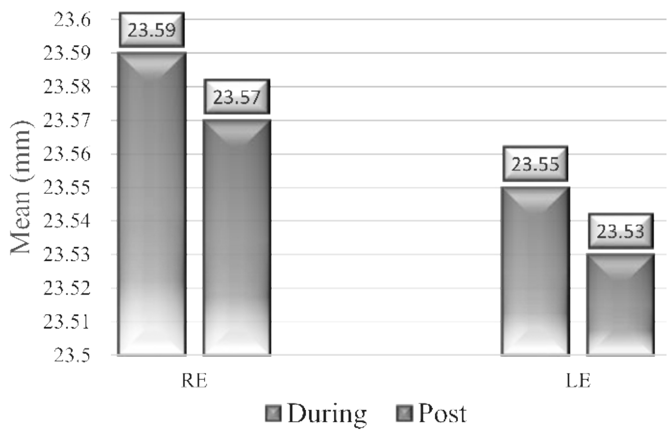


Figure VI presents AXL measurements during and after fasting, corresponding to Table IV



DISCUSSION

This research investigated how fasting and post-fasting conditions affected IOP and anterior segment measurements, including as AXL, ACD, and CCT. The findings showed only minor but persistent variations between fasting and non-fasting settings; biometric parameters like AXL, ACD, and CCT stayed relatively stable, whereas IOP values increased slightly following refeeding and rehydration.[10] Although slight differences may be due to biomechanical or hydration-related modifications, these data imply that the physiological influence of fasting on ocular parameters is minimal and unlikely to be of significant clinical importance in healthy persons.[11]

A total of 158 participants—61 men (39%) and 97 women (61%), with a mean age of 24.5 years and a standard deviation of ±2.6—participated in this study. Measurements done during and after Ramadan showed a statistically significant variation in intraocular pressure (IOP) readings. In particular, the right eye's (RE) and left eye's (LE) mean intraocular pressure (IOP) during Ramadan was 13.9 mmHg and 14.2 mmHg, respectively. Three months after Ramadan, the mean IOP in both eyes rose to 14.9 mmHg. With a p-value of less than 0.001, this difference was determined to be significant, suggesting a significant physiological variation related to the fasting period. The change in IOP during fasting and posting is in accordance with previous study of Abdullah Beyog˘lu. Yalcin Karakucuk. Ays¸egu¨l C¸ o¨mez.21 (Received: 8 July 2019 / Accepted: 20 June 2020.Ó Springer Nature B.V. 2020)

Several earlier research that documented small drops in IOP values during Ramadan fasting are in agreement with our finding of a slightly lower IOP during fasting. According to Kamal et al. (2021) and Oltulu et al. (2016) fasting was linked to a drop in IOP. This could be because of a decrease in aqueous humor production or a decrease in episcleral venous pressure brought on by mild dehydration.[12]

Likewise, Sedaghat et al. (2017) documented slight but statistically significant drops in corneal-compensated IOP, supporting the idea that fluid restriction plays a role in the short-term decrease in IOP. A slight increase in measured IOP could result from these systemic changes that increase aqueous production or episcleral venous pressure. But, since the difference was only 1 mmHg in magnitude, it most likely reflects a typical physiological fluctuation rather than a significant clinical intervention.[13]

Between fasting and post-fasting settings, axial length, anterior chamber depth, and central corneal thickness stayed relatively unchanged.[14] These findings are consistent with earlier studies showing that ocular biometry does not exhibit detectable structural changes as a result of short-term fasting. Sedaghat et al. (2017) and Oltulu et al. (2016) reported relatively slight, non-significant CCT fluctuations, but Anam et al. (2024) reported similarly steady AL and ACD values.[15] The small difference seen in our study indicates that minor daytime dehydration during Ramadan does not significantly influence corneal hydration status in healthy adults, which is relevant given that corneal hydration contributes to CCT variability. Additionally, this consistency suggests that measurement bias associated with corneal thickness is unlikely to be the cause of IOP variations seen between fasting states.[16]

A number of related mechanisms can account for the small drop in intraocular pressure (IOP) that occurs during fasting. Limiting fluid intake causes the body's blood pressure and plasma volume to drop, which momentarily lowers blood flow to the eye and reduces the generation of aqueous humor, both of which lower intraocular pressure.[17] Additionally, fasting triggers the sympathetic nervous system, which alters blood vessel tone and ciliary body activity, both of which can have an impact on eye pressure. Lower IOP measurements can also result from modest corneal thinning and structural changes brought on by dehydration.[18] The body's plasma volume and osmolarity return to normal after fasting, restoring the balance of eye fluids and resulting in a slight increase in intraocular pressure to return to normal.[19]

Another possible explanation for the observed changes in intraocular pressure is circadian rhythm. The body's normal biological clock may be shifted during Ramadan due to changes in eating and sleeping patterns, which could affect when IOP fluctuations occur. IOP often peaks in the early morning and progressively falls throughout the day.[20] Therefore, tiny but constant fluctuations in IOP readings, irrespective of fasting itself, could result from variances in measurement timing with respect to these circadian phases. This implies that the observed variations in IOP measurements may be partially explained by changes in daily routine and biological rhythm during Ramadan.[21]

CONCLUSION

Fasting significantly lowers intraocular pressure, but it has no effect on biometric measurements (CCT, ACD, and AXL). Therefore, fasting has no effect on the structural integrity of the eye, but it does change the dynamics of ocular pressure.

RECOMMENDATIONS

Future studies should include larger and more diverse samples to enhance the applicability of the findings across different ages, genders, and ethnicities.

Participants with refractive errors or glaucoma should be incorporated to assess whether fasting produces similar or distinct effects in eyes with pre-existing conditions.

Serial measurements of intraocular pressure and biometric parameters should be conducted at multiple time points during fasting to capture short-term and long-term variations.

Conflict Of Interest: None to declare.

Ethical Approval: The study was approved by the Institutional Review Board / Ethical Review Board Reference No. SU/IRB/FAHS/25/D-1236 dated 15.03.2025, Superior University Lahore.

Authors' Contributions:

Fatima Hassan: Concept, Design, Literature research, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

Iram Riaz: Data acquisition, Data analysis, Manuscript preparation, Manuscript review.

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