Asian Journal of Research and Reports in Ophthalmology

3(4): 52-57, 2020; Article no.AJRROP.62429

Relationship between Body Mass Index and Intraocular Pressure: Correlational Study

P. Thenmozhi[1*] and T. Bhuvaneshwari[1]

[1]Saveetha College of Nursing, SIMATS, Chennai, Tamil Nadu, India.

Authors' contributions

This work was carried out in collaboration between both authors. Author PT designed the study, wrote the protocol, performed the statistical analysis and wrote the first draft of the manuscript. Author TB reviewed the related literatures, collected the data and analyzed of the data. Both authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Iman Mohammed Magdy Eissa, Cairo University, Egypt.
(2) Dr. Achyut Narain Pandey, Veer Chandra Singh Garhwali Govt. Institute of Medical Science & Research (VCSGGMC), India.
(3) Dr. Panagiotis Tsikripis, University of Athens, Greece.
Reviewers:
(1) Hadjadj Soumia, University of Kasdi Merbah, Algeria.
(2) Dennis, Amaechi, Veritas University, Nigeria.
Complete Peer review History: http://www.sdiarticle4.com/review-history/62429

Original Research Article

Received 02 September 2020
Accepted 07 November 2020
Published 28 November 2020

ABSTRACT

Introduction: Obesity is the most serious public health problem. Obesity is one of the major modifiable risk factors for the increased intraocular pressure and glaucomatous progression. Hence the study was conducted with the aimed to correlate the body mass index with intraocular pressure among patients attending ophthalmic OPD.
Materials and Methods: Correlational design was employed with 60 samples who matched the inclusion criteria were selected by convenience sampling technique. Demographic variables were collected by using multiple choice questionnaires followed by Height and weight was checked to calculate body mass index. Based on that samples were characterized the level of obesity. Intraocular pressure measured and recorded. The data were tabulated and analyzed by descriptive and inferential statistics.
Results: The finding of the study reveals that there is a significant positive correlation between the body mass index and intraocular pressure.
Conclusion: Obesity related glaucomatous progression may be prevented in the initial stage itself

**Corresponding author: E-mail: thenmozhi.sethu@gmail.com;*

by controlling the weight through modification in life style, dietary pattern, exercise, and lipid lowering agents and periodical ophthalmic examination especially measuring the intraocular pressure.

Keywords: Body mass index; glaucomatous progression; intraocular Pressure; obesity; ophthalmic.

1. INTRODUCTION

Obesity is the most serious public health problem which causes severe and serious illness. The worldwide prevalence of obesity nearly tripled between 1975 and 2016. In 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of these over 650 million adults were obese [1]. Obesity is the major risk factor for many systemic diseases like hypertension and diabetes. It has been linked to a multitude of health conditions including diabetes, hypertension, ischaemic stroke and heart disease, different types of cancers, osteoarthritis, and reproductive conditions [2]. Hypertension [3] and diabetes mellitus [4] are very common in obese patients and are established risk factors for increased intraocular pressure (IOP). It is also risk for eye diseases like glaucoma, cataract, age related macular degeneration [5]. Increased IOP is the most important modifiable risk factor for the development and progression of glaucomatous optic neuropathy and glaucoma progression [6]. Obesity results in an increase in IOP, it is because of an excessive intra-orbital fat tissue this causes increase in an episcleral venous pressure which decreases aqueous outflow, obesity also increases blood viscosity through increasing red blood cell, hemoglobin and hematocrit, and this causes resistance to aqueous outflow through episcleral vein [7]. Glaucoma is usually classified into several categories with commonest and most epidemic one being primary open angle glaucoma (POAG) [7]. POAG can be induced due to multiple factors such as changes in IOP, body mass index (BMI) and diabetes…etc. [8]. The development and progression of open angle glaucoma have been linked with increase in IOP [9]. Previous studies have found proven an association between the IOP and BMI [10,11]. A recent review concluded that there is an association between higher BMI and higher IOP in adults [12]. Hence the present study was conducted with aim to correlate the BMI with IOP.

2. MATERIALS AND METHODS

Non-experimental - correlational research design was adopted to conduct the present study after obtaining formal permission from the opthal OPD of Saveetha Medical College and Hospital in Tamilnadu, India with 60 samples. The investigators selected the samples according to convenient of the investigators and met the inclusion criteria were selected by using non probability convenience sampling technique. The inclusion criteria were both male and female patients with the age group between 20 – 60 years, BMI was ≥25 kg/m2, intraocular pressure more than 22 mm of Hg, and patients having any underlying ophthalmic pathologies, or the presence of neurological, and endocrine disorders were excluded from the study. The tool used for the study was questionnaire related to demographic variables, digital scale, stadiometer and Tonometer. Demographic variables were collected by interview method by using multiple choice questionnaires. Followed by height and weight was checked by using standardized and calibrated digital scale and stadiometer. The BMI was calculated by using the formula BMI = kg/m^2 where kg is weight in kilograms and m^2 is height in metres squared and classified the obesity according to the World Health Organization Guidelines [13]. The participants were classified as underweight (<18.5 kg/m2), normal weight (18.5–24.9 kg/m2), pre-obesity (25–29.9 kg/m2), and obese (≥30 kg/m2). Intraocular pressure was measured by applanation tonometer. They were assured about their confidentiality and anonymity throughout the study. The collected data prepared for analysis using Microsoft excel and were analysed by using descriptive and inferential statistics. SPSS 16 version of the software was employed for the determination of Pearson's correlation coefficient to correlate the body mass index with intraocular pressure. P values less than 0.05 were considered statistically significant.

3. RESULTS

The findings of the current study reveal that the majority of the samples were in the age group of 40-50 years and 52% were male, 47% were completed graduation, 70% were non-vegetarian, 33% were having a history of diabetes mellitus and 23% had hypertension (Table 1).

Table 1. Frequency and percentage distribution of demographic variables of patients attending opthal OPD

Demographic Variables	Frequency	%
Age in Years		
20 – 30	13	21.7
30 – 40	23	38.3
40 – 50	24	40
Gender		
Male	31	51.7
Female	29	48.3
Educational Status		
Primary school	16	26.7
Secondary school	16	26.7
Graduation	28	46.6
Dietary Pattern		
Vegetarian	18	30.0
Non-vegetarian	42	70.0
Occupation		
Government	23	38.3
Private	37	61.7
Unemployed	-	-
Presence of Diabetes Mellitus		
Yes	20	33.3
No	40	66.7
Presence of Hypertension		
Yes	14	23.3
No	46	76.7

Out of 60 samples, 10 (16.67%) were in pre obesity, 5 (8.33%) were in class I obesity, 39(65%) were in class II obesity, and 6 (10%) were in class III obesity as depicted in Table 2.

The below Table 3 shows that, most of them 41(68.33%) had IOP and 19(31.67%) had IOP above normal.

The Table 4 shows the mean score of IOP was 23.19±1.92 and the mean score of BMI was 31.84±2.01. The calculated Karl Pearson's Correlation value was R = 0.42 which clearly infers that there is a statistically significant positive correlation between IOP and BMI.

4. DISCUSSION

Glaucoma is one of the leading causes of blindness which is a group of eye conditions that damage the optic nerve due to dysfunctional regulation of ocular blood flow. Evidence suggests that impaired vascular autoregulation renders the optic nerve head susceptible to decreases in ocular perfusion pressure, increases in IOP, and/or increased local metabolic demands. Ischemic damage, which likely contributes to further impairment in autoregulation, results in changes to the optic nerve head consistent with glaucoma [14]. BMI in one the risk factor closely relate with dysfunctional vascular regulation [15]. Hence the current study was conducted to correlate the body mass index with IOP with 60 samples for the period of one month as ophthalmic OPD. It is observed that 10 (16.67%) were in pre obesity, 5 (8.33%) were in class I obesity, 39 (65%) were in class II obesity, and 6 (10%) were in class III obesity. 19 (31.67%) of the 60 participants had increased IOP with the mean value of 23.19. It is also found that there is a statistically significant positive correlation of increased BMI with increases IOP. The finding of this study is consistent with the study conducted by Louisraj et al. [16], who observed that ninety-four (47%) of the 200 participants had a normal BMI, 67 (33.5%) were overweight, and 33 (16.5%) were obese and also observed that an increase in BMI being positively associated with an increase in IOP in both men and women. Similarly, study by Cohen et al. [17], conducted a retrospective cross-sectional analysis of a database from a screening center in Israel which assessed 18,575 subjects and concluded that obesity, is an

Table 2. Frequency and percentage distribution of BMI among patients attending opthal OPD

Body Mass Index	Frequency	%
Pre-Obesity (25.0–29.9)	10	16.67
Obesity Class I (30.0–34.9)	5	8.33
Obesity Class I (35.0–39.9)	39	65.00
Obesity Class II (Above 40)	6	10.00

Table 3. Frequency and percentage distribution of IOP among patients attending opthal OPD

Intraocular Pressure	Frequency	Percentage
Normal (12 – 21 mmHg)	41	68.33
Above normal (≥22 mmHg)	19	31.67

Table 4. Correlation of BMI with IOP and among patients attending opthal OPD

Variables	Mean	S.D	Karl Pearson's Correlation Value
IOP	23.19	1.92	R = 0.421
BMI	31.84	2.01	P=0.049
			df=59
			S

S – Significant, df- Degrees of freedom

independent risk factor for increasing IOP in both men and women. Albuquerque et al. [18], have conducted a study to evaluate the association between BMI and IOP among children and found that no correlation between BMI and IOP in children [18]. This finding is contrasted with current study findings, hence further study may be recommended among children. A prospective observational study conducted by Megan et al. [19], to evaluate the correlation between BMI and IOP after adjusting for risk factors and concluded that no significant correlation was found between IOP and BMI at the sitting position, whereas in supine IOP was statistically correlated with higher BMI, however the clinical significance is unknown. The current study observed the IOP while in sitting position. The findings of the study by Ajay et al. [20], revealed that IOP was positively correlated with BMI however, the clinical significance cannot be confirmed by the minor deviation in the IOP as well as BMI of the participants. Danish et al. [21], who proved that increase in BMI is strongly associated with an increase in IOP from the observation 300 patients examined in the out-patient department of Ophthalmology. It was found that BMI strongly correlated with anterior chamber depth and IOP and also, the degree of obesity was found to be a significant factor. Hence this study finding is accepts the hypothesis with the other previous study finding, however this study is recommended to measure other corneal parameters associated with glaucomatous optic neuropathy.

5. CONCLUSION

The Current study concludes that the body mass index has an impact on increased IOP. Obesity related glaucomatous progression may be prevented in the initial stage itself by controlling the weight through modification in life style, dietary pattern, exercise, and lipid lowering agents. Weight reduction measures have to be insisted by the health care personnel to the patients attending in ophthalmic OPD. Obese patients being examined the eye especially assessing the intraocular pressure along with other systemic examination as a part of routine health check-up.

CONSENT

The patients who consented for willing to participate were taught about the purpose of the study and informed consent was obtained.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

ACKNOWLEDGEMENT

Authors would like to appreciate and thankful to the participants for their cooperation to complete the study successfully.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Available:https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
2. Remington PL, Brwonson RC, Wegner MV, Chronic disease epidemiology and control, American Public Health Association, Washington, DC, USA, 3rd Edition; 2010.
3. Zhao D, Cho J, Kim MH, et al. The association of blood pressure and primary open-angle glaucoma: A meta-analysis. Am J Ophthalmol. 2014;158:615–627.
4. Zhao D, Cho J, Kim MH, et al. Diabetes, fasting glucose, and the risk of glaucoma: A meta-analysis. Ophthalmology. 2015; 122:72–78.
5. Farnaz Siddiqui, Saba Alkhairy, Mazhar-ul-Hassan, Darshan Kumar. Relationship between Body Mass index and intraocular pressure in diabetic and hypertensive adults. Pak J Ophthalmol. 2016;3(1):4-8.
6. Coleman AL, Kodjebacheva G. Risk factors for glaucoma needing more attention. Open Ophthalmol J. 2009;3:38-42.
7. Xu L, Li J, Xia C, et al. Anterior chamber depth correlated with anthropometric measurement the Beijing study. Eye (Lond). 2009;23(3):632-634.
8. Foster PJ, Machin D, Wong TY, Ng TP, Kirwan JF, Johnson GJ, et al. Determinants of intraocular pressure and its association with glaucomatous optic neuropathy in Chinese Singaporeans: The Tanjong Pagar study. Investigative Ophthalmol Visual Sci. 2003;44(9):3885-91.
9. Resnikoff S, Pascolini D, Mariotti SP, Pokharel GP. Global magnitude of visual impairment caused by uncorrected refractive errors in 2004. Bull World Health Organ. 2008;86(1):63-70.
10. Mori K, Ando F, Nomura H, Sato Y, Shimokata H. Relationship between intraocular pressure and obesity in Japan. Int J Epidemiol. 2000;29(4):661-6.
11. Lee JS, Choi YR, Lee JE, Choi HY, Lee SH, Oum BS. Relationship between intraocular pressure and systemic health parameters in the Korean population. Korean J Ophthalmol. 2002; 16(1):13-9.
12. Cheung N, Wong TY. Obesity and eye diseases. Surv Ophthalmol. 2007;52(2): 180-95.
13. Available:https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi
14. Danny Moore, Alon Harris, Darrell WuDunn, Nisha Kheradiya, Brent Siesky. Dysfunctional regulation of ocular blood flow: A risk factor for glaucoma?. Clinical Ophthalmology. 2008;2(4):849–861.
15. Flammer J, Haefl iger IO, Orgul S, et al. Vascular dysregulation: A principal risk factor for glaucomatous damage? J Glaucoma. 1999;8:212–19
16. Louisraj S, Thomas PA, Nelson Jesudasan CA. Correlation between body mass index and intraocular pressure: A pilot study. TNOA J Ophthalmic Sci Res. 2018;56:8-11.
17. Cohen, Eytan, Kramer, Michal, Shochat, Tzippy, Goldberg, Elad, et al. Relationship between body mass index and intraocular pressure in men and women: A population-based study. Journal of Glaucoma. 2016; 25(5):509-513.
18. Albuquerque, Luciano Lira de, et al. The correlation between body mass index and intraocular pressure in children. Arq. Bras. Oftalmol. 2013;76(1):10-12.
19. Megan M. Geloneck, Eric L. Crowell, Erik B. Wilson, Alice Z. Chuang, Laura A. Baker, Nicholas P. Bell, Robert M. Feldman. ARVO Annual Meeting Abstract March 2012 Correlation between Body Mass Index and Intraocular Pressure. Invest. Ophthalmol. Vis. Sci. 2012;53(14): 5021.
20. Ajay Kumar, Nikhil Sharma, Anjani Rathee, Nitesh Pradhan. Comparison of body mass index and intraocular pressure. International Journal of Research in Medical Sciences. 2019;7(2): 367-371.

21. Danish Zafar, Rahil Malik, Iftikhar Ahmad, Nuzhat Rahil, Mehfooz Hussain, Nargis Noman. Co-relation between body mass index and intraocular pressure In Adults. Gomal Journal of Medical Sciences. 2010;8(1):85-88.

© 2020 Thenmozhi and Bhuvaneshwari; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/62429