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CORRELATION BETWEEN BODY MASS INDEX AND INTRAOCULAR PRESSURE AT PRIMASATYA HUSADA CITRA HOSPITAL, SURABAYA

Titiek Ernawati [1)], Rofiqi Rofiq [2)], Okky Imanuel Samatha [2)], Lani Diana [2)]

ABSTRACT

Background: *Obesity currently becomes a significant general medical issue globally with the increasing prevalence in most countries. In some studies, an increase in body mass index above normal values has been suggested as an independent risk factor associated with increased intraocular pressure, which can progress to glaucoma.* ***Objective:*** *To analyze the relationship between body mass index and intraocular pressure.* ***Material and Method:*** *The design of this study was cross-sectional with a observational analytic approach, which was conducted during the period September-October 2021, at Primasatya Husada Citra Hospital, Surabaya. The statistical analyses were done using SPSS 22.0. P value of 0.05 or less was considered statistically significant.* ***Result:*** *The investigation of 100 patients revealed a significant difference in intraocular pressure in both right and left eyes between subjects with normal, overweight, and obese. This study also found a positive correlation between BMI and intra-ocular pressure of the right eyes and left eyes.* ***Conclusion:*** *Our findings indicate a statistically significant correlation between rising BMI and elevated intraocular pressure. Increased intraocular pressure is correlated with increasing BMI.*

Key Words: *Body mass index, intraocular pressure, glaucoma*

ABSTRAK

Latar Belakang: Obesitas saat ini menjadi masalah medis umum yang signifikan secara global dengan prevalensi yang terus meningkat pada sebagian besar negara. Dalam beberapa penelitian, meningkatnya indeks massa tubuh diatas ambang normal telah dilaporkan menjadi factor resiko independent yang berhubungan dengan peningkatan tekanan intraokular, yang dapat berkembang menjadi glaukoma. **Objektif:** untuk menganalisis hubungan antara indeks massa tubuh dan tekanan intraokular. **Material dan Metode:** Desain penelitian ini adalah potong lintang dengan pendekatan analitik observasi, yang dilaksanakan pada September – Oktober 2021, di Rumah Sakit Primasatya Husada Citra, Surabaya. Analisis statistik dilakukan dengan menggunakan SPSS 22.0. Nilai P 0.05 atau kurang dianggap signifikan secara statistik. **Hasil:** Penelitian terhadap 100 subjek ini menemukan perbedaan tekanan intraokular yang

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signifikan pada kedua mata kanan dan kiri antara subjek dengan IMT normal, kelebihan berat badan, dan obesitas. Penelitian ini juga menemukan korelasi yang positif antara IMT dan tekanan intraokular mata kanan dan mata kiri. **Kesimpulan:** Hasil kami menunjukkan bahwa ada hubungan yang signifikan secara statistic antara IMT dan tekanan intraokular. Peningkatan IMT berhubungan dengan peningkatan tekanan intraokular.

Kata Kunci: Indeks Massa Tubuh, tekanan intraokular, *glaucoma*

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1)Departemen Ilmu Keseha tan Mata, Fakultas Kedokteran, Universitas Katolik Widya Mandala Surabaya. 2) Fakultas Kedokteran, Universitas Katolik Widya Mandala Surabaya. Corresponding author: titiek@ukwms.ac.id / +628123006365

INTRODUCTION

Obesity is a serious problem that affects most of the adult population, as well as around 30% of school-age children and adolescents.(1) Obesity currently becomes a major public health problem globally with the increasing prevalence in most countries.(2) In Indonesia, overweight and obese populations are increasing every year.(3) Body Mass Index (BMI) is often used to classify obesity. BMI less than 18.5 is referred to underweight, 18.5 – 24.9 is normal, more than 25 is overweight, and ≥30 is obesity.(4) Obesity is not only a risk factor for chronic diseases such as diabetes mellitus, hypertension, cardiovascular disease, stroke, and sleep apnea syndrome, but also for increased intraocular pressure (IOP).(2) Increased intraocular pressure in obese patients has been reported in several previous studies.(2,5–10) The effect of an increase in BMI on intraocular pressure is thought to be due to an increase in intraorbital fat tissue, leading to an increase in episcleral venous pressure and subsequently a decrease in aqueous outflow.(8) Increased IOP may progress to progressive glaucoma causing damage to the optic nerve, characterized by gradual loss of visual field to irreversible total loss of vision. This study aimed to evaluate the relationship between BMI and IOP at Primasatya Husada Citra Hospital, Surabaya, Indonesia.

METHOD

This research was conducted in a cross-sectional study with a observational analytic approach. The study sample was outpatients at Eye Polyclinic Primasatya Husada Citra Hospital, Surabaya from September – October 2021 who met the inclusion and exclusion criteria. The inclusion criteria were outpatients at Eye Polyclinic Primasatya Husada Citra Hospital who were willing to take part in the study, had normal/high-normal blood pressure (systolic < 139 mmHg, diastolic < 89 mmHg), and an age range of 20-60 years. Patients with history of glaucoma, history of hypertension or cardiovascular drug consumption, taking of steroid, had eye surgery, smoker (has smoked >100

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cigarettes in his life and currently smokes ciggaretes), alcoholic (more than once a month consuming alcohol), history of Chronic Kidney Disease (CKD), and severe myopia (>6 D) were among the exclusion criteria. The samples of this study were taken through consecutive sampling technique.

Data from study samples were collected based on medical record, BMI measurement results and IOP measurements. The history of patients such as glaucoma, hypertension, drug consumption, eye surgery, smoker, and alcoholic was taken through a questionnaire based on patient's interview with the research team. BMI was calculated based on the BMI formula = body weight (kg) / height^2 (m^2), and intraocular pressure was measured using Canon TX – 20P non-Contact Tonometers.

The normal distribution of variables was examined using Shapiro-Wilk test. Differences between BMI groups were analyzed using an analysis of variance for normally distributed and the Kruskal-Wallis test for non-normally distributed variables. Pearson correlation and regression analysis were performed to assess the co-relationship between BMI and IOP. The statistical analyses were done using SPSS 22.0. P value of 0.05 or less was regarded statistically significant. This study was approved by the Health Research Ethics Commission of Medical Faculty Widya Mandala Catholic University based on WHO-CIOMS International Ethical Guidelines for Health-related Research Involving Humans

RESULT

Table 1. Baseline characteristics of the sample

Characteristics	Mean ± SD	N (%)
Age (years old)	35.74 ± 11.80	
- 20 - 30		42 (42%)
- 31 - 40		27 (27%)
- 41 - 50		15 (15%)
- 51 - 60		16 (16%)
Sex		
- Male		34 (34%)
- Female		66 (66%)
Blood pressure		
- Systolic blood pressure (mmHg)	119.80 ± 9.84	
- Diastolic blood pressure (mmHg)	76.40 ± 9.84	
Indeks Massa Tubuh		
- Normoweight		52 (52%)
- Overweight		32 (32%)
- Obese		16 (16%)

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Table 2. Statistical comparison using Kruskal-Wallis test

BMI	IOP right eye	P	IOP left eye	p
Normoweight	15.31 ± 2.90		15.17 ± 2.65	
Overweight	17.63 ± 3.34	0.000	17.38 ± 3.33	0.000
Obese	18.69 ± 2.34		18.86 ± 1.94	

* IOP Intraocular Pressure

Table 3. Correlation between BMI and Ocular pressure using Pearson correlation coefficient.

Ocular pressure	BMI	
	r-value	P-value
Right IOP	0.366	0.000
Left IOP	0.421	0.000

* IOP Intraocular Pressure

The sample of this study was 100 patients, including 34 men and 66 women. The mean age of this study subjects was 35.74 ± 11.80. Subjects with normal, overweight, and obese BMI were 52 (52%), 32 (32%), and 16 (16%), respectively. None of the study subjects were underweight. Table 1 illustrates the demographic characteristics of the study subjects.

The intraocular pressure of this study showed a significant difference in both eyes between three groups. (Kruskal-Wallis, P = 0.000). The mean intra-ocular pressure in the right and left eyes in each group and the statistical analysis are shown in Table 2.

We also found a positive correlation between BMI and intra-ocular pressure of the right eyes (Pearson Correlation Coefficient, R = 0.366, P = 0.000) and left eyes intraocular pressure (Pearson Correlation Coefficient, R = 0.421, P = 0.000) (Table 3).

DISCUSSION

The mean age of this study subjects was 35.74 ± 11.80. It is slightly higher than the study results of Mendala et al. which showed a mean age of 33.27 ± 7.33. (5) This is also lower than the research of Panon et al., showing the mean age of 47.00 ± 14.00.(2) The majority of this study subjects aged 20 – 30 years (42%). This result is consistent with the study conducted by Mendala et al., showing the predominant age of 20 – 30 years (43.5%).(5) However, Zafar et al. demonstrated the predominant age of 45 – 54 (22.7%) years in his study.(9)

Our study aimed to analyze the relationship between BMI and intraocular pressure at Eye Polyclinic Primasatya Husada Citra Hospital, Surabaya. We found that the mean intraocular pressure of the normoweight group was lower than the the overweight and obese group. The statistical analysis of the mean intraocular pressure differences of the three groups (normoweight, overweight, obese) showed

a significant difference both in the right and left eyes (Table 2, Kruskal-Wallis, P = 0.000). Mendala et al. showed similar results with a significant difference in mean intraocular pressure in the obese, overweight and normoweight groups (Kruskal-Wallis test, P = 0.007 in the right eyes, P = 0.0018 in left eyes).(5) The analysis of the relationship between BMI and intraocular pressure in this study with Pearson's correlation coefficient showed a positive and statistically significant relationship both in the right eyes and left eyes (Table 3). It suggests that a higher BMI is connected with a higher intraocular pressure. These findings are consistent with Kumar et al study which demonstrated a positive and statistically significant correlation between BMI and intraocular pressure. (r = 0.31, P = 0.001).(11)

The effect of an increase in BMI on intraocular pressure is thought to be due to an increase in intraorbital fat tissue, leading to an increase in episcleral venous pressure and subsequently a decrease in aqueous outflow. Consequently, decreased aqueous outflow leads to increased resistance to episcleral venous outflow.(8)

A study by Flammer *et al* was emphasized that the element of vascular dysregulation, in which BMI is a one of the factor, was the major risk factor for glaucoma.(12) Vascular dysregulation can cause to local vasospasms and abnormal autoregulation of blood flow in the ocular tissues, choroid, and optic nerve head.(10) This theory may explain why BMI will increase IOP but not always increase the risk of glaucoma.(10)

CONCLUSION

The association between increased BMI and intraocular pressure was statistically significant. We found that the higher the BMI, the higher the intraocular pressure in both eyes. Therefore, we strongly encourage everyone to lead a healthy life such as exercising regularly, eating healthy foods, quitting smoking, and maintaining weight. Further studies with larger samples using Goldmann applanation as the golden standard to measure intra-ocular pressure are warrant.

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