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Correlation Between Body Mass Index and Intraocular Pressure at Eye Clinic Mangusada Hospital, Bali



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ABSTRACT

Introduction: Imbalance in consumption and activities has been a major serious health problem nowadays and tends to become obesity. In some studies, obesity has been associated with increasing intraocular pressure, which is a risk factor for glaucoma.

Aim: This study aims to analyze the correlation between body mass index (BMI) and intraocular pressure in Eye Clinic at Mangusada Regional Hospital.

Method: This was a cross-sectional study held in Eye Clinic at Mangusada Hospital in May 2020. Inclusion criteria were people aged between 20 – 55 years old, with normal blood pressure (systolic < 139 mmHg, diastolic < 89 mmHg). The exclusion criteria were people who had history of cardiovascular diseases, diagnosed glaucoma before, had contraindication to tonometry use, consumes drug affecting cardiovascular system, and had family history of

cardiovascular, kidney, liver, and lungs diseases. Body weight was measured with body scale, body height was measured with height meter, BMI was calculated with formula of body weight in kilogram divided by square of body height in meter, blood pressure was measured by Scanner Tensimeter and intraocular pressure was measured with rebound tonometer I-care TA01i. Data was analyzed using Kruskal-Wallis and Mann Whitney Test with $p < 0.05$ as level of significance.

Results: The study of 85 subjects found significant difference in intraocular pressure in normoweight, overweight, and obesity subjects. This study also found significant difference in intraocular pressure between normoweight and obesity subjects.

Conclusion: Intraocular pressure simultaneously increases with the increasing of BMI.

Keywords: body mass index, intraocular pressure, glaucoma

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INTRODUCTION

Modern lifestyle problems such as more consumption and lack of activities have become new health problems in the world, mostly in developing countries, such as in Indonesia. Data from Ministry of Health of Indonesia Republic shows that this trend continued to increase in 1880, the rate became 2011.⁵ million in 2013 and reaching 13.6 million in 2018, as well as an obese population which was 14.8 million in 2013 became 21.8 million in habitants.^{1,2} This trend was common nowadays because of unhealthy lifestyles and lack of physical activity are very often found in our daily lives. This pattern of life, called the sedentary lifestyle increases mortality, cardiovascular disease, diabetes mellitus, obesity, high blood pressure, and increases the risk of cancer.³ Eye health problems such as glaucoma, which is the second leading cause of blindness in Indonesia, has a risk factor of increased intraocular pressure.^{4,5} Increasing intraocular pressure is the only factor that can be controlled in the development of glaucoma as well as the progression of glaucoma.

This intraocular pressure found can be influenced by personal body mass index (BMI).⁶ In a study conducted at Eye Polyclinic Mangusada Hospital, we want to report the characteristics of BMI and the patient's normative intraocular pressure with the aim of knowing the relationship between BMI and intraocular pressure.

METHOD

This research is observational analytic with cross-sectional study design. This study has received ethical approval from Research Ethics Committee of Mangusada Hospital. The study sample was outpatients in Eye Polyclinic Mangusada Hospital, Badung from 1st until 31st May 2020 who met the inclusion and exclusion criteria. The inclusion criteria were 20 - 55 years old with normal blood pressure (systolic <139 mm Hg, diastolic <89 mm Hg). Meanwhile the exclusion criteria were patients who had cardiovascular diseases, history of glaucoma, had contraindications to the tonometry and intraocular pressure measurement, history of

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cardiovascular drug consumption, and had family history related to cardiovascular, kidney, liver and lung diseases. Body weight and height were calculated by measuring weight (kg) and height (m), BMI was calculated based on the BMI formula = body weight (kg) / height² (m²), blood pressure in the sitting position with a BPBIO320 Tensimeter Scanner and intraocular pressure obtained by semi-contact I-Care TA01i tonometer.

Bivariate data analysis was performed by SPSS software version 26. The correlation between BMI and intraocular pressure was performed using Kruskal-Wallis and Mann Whitney Test. Kruskal-Wallis is used to compare intraocular pressure between three categories of BMI, namely normoweight (BMI 18.5 - 24.9), overweight (BMI 25-26.9), and obesity (BMI > 27). The Mann Whitney Test is used to compare intraocular pressure between two categories of BMI (normoweight and overweight, normoweight and obesity, and overweight and obesity).

RESULT

The number of samples obtain were 85 samples, consisting of 43 males (50.6%) and 42 females (49.6%). Based on age range, the majority of samples were in the age group 20-30 years old

(43.5%), with mean of the age was 33.27 ± 7.33 years old. Based on the BMI, samples with normal weight (normoweight) was 42 samples (49.4%), 24 samples with overweight (28.2%), and 19 samples (22.4%) with obesity. Table 1 shows the general characteristics of samples in this study.

Based on statistical tests using Kruskal-Wallis which compared intraocular pressure values between the three groups, $p = 0.007$ was obtained in the right eye and $p = 0.018$ in the left eye. It shows that there is a significant difference among BMI groups both in right and left eye. Further statistical tests using Mann Whitney Test comparing intraocular pressure values between normoweight and overweight was found $p = 0.137$ ($p < 0.05$) in the right eye; $p = 0.527$ ($p < 0.05$) in the left eye. Furthermore, the comparison between normoweight and obesity was found significant with $p = 0.002$ ($p < 0.05$) in the right eye and $p = 0.04$ ($p < 0.05$) in the left eye. It shows a significant different between Intraocular pressure in normoweight group and obesity group. Meanwhile, there is no significant different found between overweight and obesity group with $p = 0.089$ ($p > 0.05$) in right eye and $p = 0.061$ ($p > 0.05$) in left eye (Table 2).

DISCUSSION

In this study we found the mean value of intraocular pressure in normoweight samples was lower than the value of intraocular pressure in overweight and obese samples (17.05 ± 2.43 mmHg in the right eye and 17.26 ± 2.1 mmHg in the left eye). The statistical analysis of this study also showed that the level of intraocular pressure in normoweight group is lower than Intraocular pressure in overweight group. It proves that increasing BMI correlated to higher level of intraocular pressure. This result is similar with research conducted by Zafar et al. (2010),⁷ that found that the level of intraocular pressure in overweight patients were higher than the intraocular pressure in patients with normal body weight.⁷ Research conducted by Louisraj et al. (2018)⁸ also has similar result with this study. The research involved sample with systemic comorbidities (35% of the total sample) such as diabetes mellitus, hypertension, and ischemic heart disease and 54% of subjects with comorbidities are overweight or obese.⁸

The effect of increased BMI on intraocular pressure is thought to be related to an increase in intraoral adipose tissue, and increased blood viscosity, which causes an increase in episclera vein pressure. This process will cause disruption to the flow of humor aqueous from anterior chamber and eventually increase intraocular pressure.⁹ Study conducted by Sacca (2005)¹⁰ states that increased

Table 1. Baseline characteristic of the sample

Characteristics	Mean $\pm$ SD	N (%)
Age (years old)	33.27 ± 7.33	
Sex		
- Male		43 (50.6%)
- Female		42 (49.4%)
Blood Pressure		
- Systolic blood pressure (mmHg)	120.12 ± 4.81	
- Diastolic blood pressure (mmHg)	80.35 ± 3.20	
Indeks Massa Tubuh		
- Normoweight		42 (49.4%)
- Overweight		24 (28.2%)
- Obesitas		19 (22.4%)

Table 2. Correlation between Intraocular Pressure and Body Mass Index (BMI)

BMI	Intraocular pressure right eye	p	Intraocular Pressure left eye	p
Normo-weight	$14,6 \pm 2,76$		$15,29 \pm 2,66$	
Over-weight	$15,62 \pm 2,71$	0.007*	$15,67 \pm 2,77$	0.0018*
Obesitas	$17,05 \pm 2,43$		$17,26 \pm 2,10$	

* $p < 0.05$

intraocular pressure is also thought to be caused by hyperleptinemia which can increase oxidative stress. In this situation, trabecular meshwork tissue degeneration can occur which can cause blockage of the aquos humor outflow and become the leading cause of increasing intraocular pressure.¹⁰

CONCLUSION

There is a significant correlation between increasing BMI and increasing intraocular pressure. The higher BMI score, the higher intraocular pressure we found on both eyes. Therefore, education should be given to the community, especially to the people with overweight and obesity about the risk of increasing intraocular pressure as the leading cause of glaucoma. Further research is needed with more sample size and precise intraocular pressure measurement with Goldmann applanation as the gold standard.

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