THE OVERVIEW OF RANDOM BLOOD GLUCOSE LEVELS IN CATARACT SURGERY PATIENTS AT HERMINA ARCAMANIK HOSPITAL

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Abstract

Cataract is a visual impairment that can be caused by various factors, one of which is elevated blood glucose levels. This study employs a descriptive observational method to understand the overview of random blood glucose levels in cataract surgery patients at Hermina Arcamanik Hospital. The obtained data includes the results of random blood glucose level tests in patients undergoing cataract surgery at Hermina Arcamanik Hospital, totaling 46 patients. From the overview of random blood glucose levels in cataract surgery patients at Hermina Arcamanik Hospital, the average blood sugar level was 114.72 mg/dL, with a median of 96.00 mg/dL and a standard deviation (SD) of 54.312. The lowest blood sugar level recorded was 62 mg/dL, and the highest was 284 mg/dL. Out of the 46 cataract patients, 39 patients (84.8%) had normal blood sugar levels, while 7 patients (15.2%) had abnormal blood sugar levels. Based on the conducted research, it can be concluded that out of the 46 cataract patients, 7 patients (15.2%) had abnormal blood sugar levels, and 39 patients (84.8%) had normal blood sugar levels.

Keywords: blood sugar, cataract, random blood glucose level

Introduction

Cataract is a significant ocular health issue worldwide. Approximately 65 million people globally live wiht this visual impairment (Williams et al., 2020). it is often found in patients aged 40 and above. Cataracts occur when the normally clear eye lens becomes cloudy, resulting in decreased vision up or blindness (Maedel et al., 2021). Although the complete mechanism of cataract formation is not yet comprehended, several studies have identified various risk factors contributing to cataract development, including genetics, age, gender excessive sunlight exposure, smoking habits, and a history of diabetes (Barnard, 2023; Campagna et al., 2019; Sari et al., 2018).

Diabetes melitus (DM) is one of the significant risk factors in the development of cataracts. Diabetes is a chronic condition characterized by elevated blood glucose levels. High blood glucose levels can damage blood vessels and body tissues, including the eye lens (Safitri et al., 2021; Siregar et al., 2020). The reference range for blood glucose levels in serum/plasma is 70-110 mg/dL, with a two-hour postprandial blood sugar level of ≤140 mg/dL, and a Random Blood Glucose (RBG) level of ≤110 mg/dL. Elevated blood glucose levels are typically due to several factors, including the consumption of high-fat foods, simple carbohydrates, and processed foods, along with low physical activity and exercise, all of which are associated with an increase in blood sugar levels (Siregar et al., 2020). When blood glucose levels are elevated, glucose molecules can combine with proteins in glycation process, produces advanced glycation end products (AGEs). It can disrupt the protein structure of the eye lens, leading to the accumulation of substances that can block the lens, reduce its transparency, and elasticity. Moreover, high blood glucose levels can also trigger the formation of reactive oxygen species (ROS) in the eye lens, causing oxidative stress. This buildup of free radicals can damage lens cells, which can also result in damage to blood vessels in the eyes (diabetic retinopathy), causing a decrease in the supply of nutrients and oxygen to the lens (Budnar et al., 2022).

Studying the relationship between blood glucose and cataracts holds significant implications, especially given the rising prevalence of diabetes worldwide. By comprehending this connection, we can pinpoint more effective preventive and management measures, as well as gain deeper insights into the role of metabolic factors in eye health. The correlation between blood glucose levels and the development of cataracts has been a primary focal point in medical research. Research findings indicate the presence of various risk factors for cataract incidence, with diabetes mellitus showing an odds ratio (OR) of 3.850. Furthermore, the study identified the most influential risk factor for cataract occurrence as diabetes mellitus (Sudrajat et al., 2021).

This study aims to examine the overview of random blood glucose levels in patients undergoing cataract surgery at Hermina Arcamanik Hospital. This study exhibits an observational approach on the entire population of 46 cataract patients who have undergone surgery at Hermina Arcamanik Hospital.

Methods

This study employs a descriptive observational research design. This study was conducted in April 2023 at the Laboratory of Hermina Arcamanik Hospital in Bandung. The study's population comprises patients undergoing cataract surgery at Hermina Arcamanik Hospital, with data collected from January 2023. The sample of this researsch is Random Blood Glucose (RBG) examinations result of 46 individuals who underwent cataract surgery at Hermina Arcamanik Hospital.

The tools and materials utilized in this research encompass Accu-chek Star Strip Express, Safety lancets by linkfar (Blood Lancet), whole blood samples (capillary blood),

Safety lancets by linkfar (Needle), Star Strip Express (Strip), BD Alcohol Swabs (Alcohol pads), Altamed Gloves, and Infectious Waste Container.

The collected capillary blood samples are placed on a test strip containing the glucose dehydrogenase enzyme and a coenzyme in a measuring device. The test strip will direct the capillary blood to the reactive area where the conversion of glucose to gluconolactone occurs by the enzyme and coenzyme. The device will measure the direct current (DC) electric current generated by the reaction and convert it into a glucose level value in mg/dL.

Results and Discussion

Distribution of Blood Sugar Levels in Cataract Patients at Hermina Arcamanik Hospital The capillary blood sampling of 46 patients undergoing cataract surgery at Hermina Arcamanik Hospital was conducted in the morning to avoid diurnal variations. This refers to the natural fluctuations in various biological parameters that occur during the daily cycle, particularly in the changes of blood glucose levels over a 24-hour period. The result of the random blood glucose level examination in Table 1 indicates that the average blood glucose level in 46 cataract patients is 114.72 ± 54.31 mg/dL. The lowest blood glucose level recorded
was 62 mg/dL, while the highest reached 284 mg/dL.

Table 1 Random blood glucose levels in 46 cataract patients

Variable	N	Min	Max	Mean	STD
Random blood glucose level (mg/dL)	46	62	284	114.72	54.31

From these results, it can be inferred that within the studied patient population, there is a significant variation in blood glucose levels. Some patients may experience hypoglycemia, while others might have hyperglycemia. The high standard deviation also indicates a considerable heterogeneity in the patients' blood glucose response to the testing. This could suggest the presence of factors contributing to this variation, such as dietary patterns, lifestyle, or individual medical conditions.

Table 2 Random blood glucose levels distribution

Blood glucose levels	**Frequency**	**Percentage (%)**
Normal	39	84,8
Abnormal	7	15,2
Total	46	100,0

Based on the random blood glucose level examination in cataract patients presented in Table 2, it was observed that 7 patients had abnormal blood glucose levels, while 39 patients had normal blood glucose levels. This indicates that among the 46 cataract patients at Hermina Arcamanik Hospital, 15.2% of them exhibited abnormal blood glucose levels, as illustrated in Figure 1.

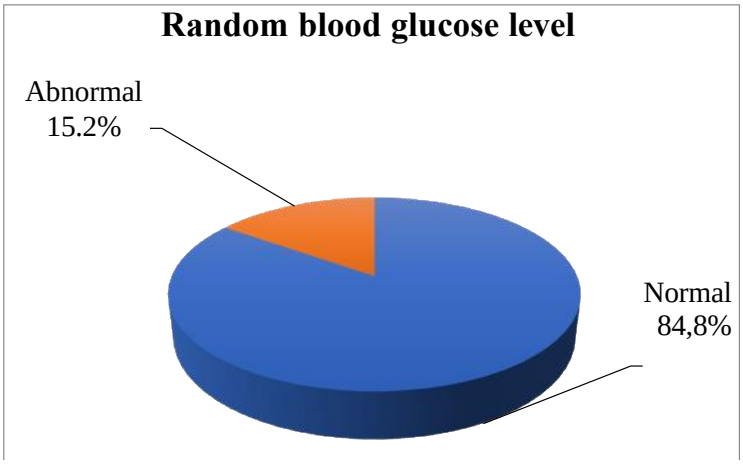

Figure 1 Random blood gluose levels distribution

This percentage illustrates the prevalence of blood glucose level issues associated with cataract conditions at Hermina Arcamanik Hospital. This could indicate a correlation between cataract conditions and blood glucose level problems. However, it's important to remember that these results only suggest a statistical relationship and do not necessarily imply a cause-and- effect relationship. The clinical implications of these findings underscore the necessity of monitoring blood glucose levels in cataract patients to prevent potential, more severe eye complications. Further studies are required to gain a deeper understanding of this relationship as well as the factors influencing the test outcomes.

Distribution of Blood Sugar Levels in Age-Related Cataract Patients at Hermina Arcamanik Hospital
The results of blood glucose level examination among 46 cataract patients at Hermina Arcamanik Hospital, based on age categories, namely at-risk age (≥ 45 years) consisting of 36 patients and non-risk age (< 45 years) totaling 3 patients are presented in Table 3. It shows that among the 36 patients in the at-risk age group, their blood glucose levels were normal, while 7 other patients had abnormal blood glucose levels. Furthermore, among the 3 patients in the non-risk age group, no patients with abnormal blood glucose levels were identified. This indicates that there are 83.7% of patients in the at-risk age group who have normal blood glucose levels, while the remaining 16.3% patients have abnormal blood glucose levels, as shown in Figure 2.

Table 3 Blood glucose levels in age category

Age category	Blood glucose level				Total	
	Normal		Abnormal			
	N	%	N	%	N	%
High-risk	36	83.7	7	16.3	43	100.0
Low-risk	3	100.0	0	0.0	3	100.0
Total	39	84.8	7	15.2	46	100.0

These findings reveal the existence of differences in blood glucose response between the at-risk and non-risk age groups. Patients in the at-risk age group tend to have a higher likelihood of having abnormal blood glucose levels. This aligns with the understanding that the at-risk age (≥ 45 years) is a major risk factor for type 2 diabetes, which can impact blood glucose regulation. Further studies with larger sample and more detailed influencing factors could be conducted for subsequent research to provide deeper insights.

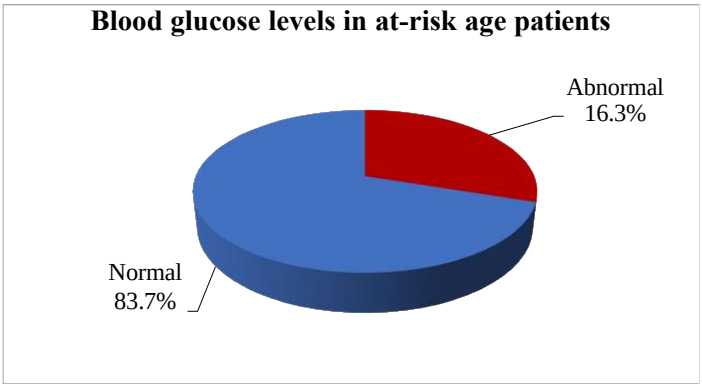

Figure 2 Random blood glucose levels distribution in at-risk age patients

Distribution of Blood Sugar Levels in Gender-Related Cataract Patients at Hermina Arcamanik Hospital

The results of blood glucose level examination among 46 cataract patients at Hermina Arcamanik Hospital, categorized by gender, are presented in Table 4. There were 31 female cataract patients and 15 male cataract patients. Table 4 indicates that out of the 31 female cataract patients, 26 patients had normal blood glucose levels, while 5 patients had abnormal blood glucose levels. Meanwhile, out of the 15 male cataract patients, 13 patients had normal blood glucose levels, and 2 patients had abnormal blood glucose levels.

Table 1 Blood glucose levels in gender category

Gender	Blood glucose level				Total	
	Normal		Abnormal			
	N	%	N	%	N	%
Female	26	83.9	5	16.1	31	100.0
Male	13	86.7	2	13.3	15	100.0
Total	39	84.8	7	15.2	46	100.0

The distribution of blood glucose levels among cataract patients based on gender is depicted in Figure 3. Among the 31 female cataract patients, 16.1% of them had abnormal blood glucose levels. Meanwhile, among the 15 male cataract patients, 13.3% of them had abnormal blood glucose levels. It is evident that there is a slight difference in the percentage of female and male patients with abnormal blood glucose levels. Although the percentage of females with abnormal blood glucose levels is slightly higher than males, this difference is not significant within this sample size. Therefore, these findings offer initial insights into the potential disparity in blood glucose response between cataract patients based on gender. Different biological and hormonal factors between males and females might contribute to this variance. However, further studies with a larger sample size and control over potential factors are necessary to gain a deeper understanding of this difference.

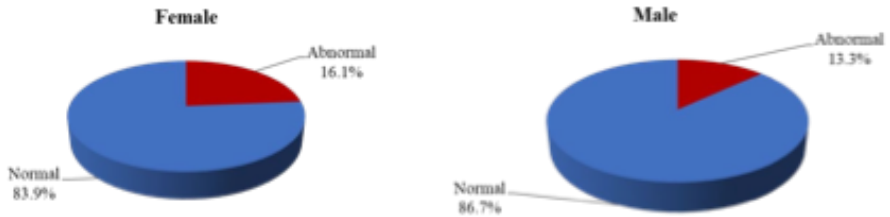

Figure 3 Random blood glucose levels distribution in gender category patients

Conclusion

Random blood glucose levels in cataract surgery patients at Hermina Arcamanik Hospital showed that out of 46 patients with cataracts, 7 patients (15.2%) had abnormal blood sugar levels, while 39 cataract patients (84.8%) had normal blood sugar levels. Based on age, the random blood glucose levels were categorized as follows: In the high-risk age category (≥ 45 years), there were 43 cataract patients, with 36 patients (83.7%) having normal blood sugar levels and 7 patients (16.3%) having abnormal blood sugar levels. In the low-risk age category (< 45 years), there were 3 cataract patients, all with normal blood sugar levels (100.0%), and none with abnormal blood sugar levels (0.0%). Based on gender, the random blood glucose levels were analyzed as follows: Out of 46 cataract patients, 31 were female cataract patients, with 26 patients (83.9%) having normal blood sugar levels and 5 patients (16.1%) having abnormal blood sugar levels. There were 15 male cataract patients, with 13 patients (86.7%) having normal blood sugar levels and 2 patients (13.3%) having abnormal blood sugar levels.

Suggestion

In order to develop a more comprehensive understanding of the relationship between blood glucose levels and cataract conditions in patients, it is advisable to conduct further research using a more detailed and inclusive approach. Expanding the sample size is essential to ensure that the resulting data represents the diversity within the cataract patient population at Hermina Arcamanik Hospital. By involving a larger number of patients, the findings obtained will be more robust and have greater potential for generalization to a broader population. Additionally, conducting a more in-depth analysis of factors that could influence blood glucose levels, such as medical history, dietary patterns, physical activity, and body mass index, is crucial. Multivariate analysis approaches can help identify independent factors contributing to abnormal blood glucose issues. Exploring these factors will not only contribute to a better understanding of the relationship between blood glucose levels and cataract conditions but also provide valuable insights into potential interventions or preventive measures. This approach will enhance the validity and applicability of the study's results.

Reference

Barnard, N. D. (Ed.). (2023). Cataract (3rd ed.). Physicians Committee for Responsible Medicine. https://nutritionguide.pcrm.org/nutritionguide/view/Nutrition_Guide_for_Clinicians/134 2016/all/Cataract

Budnar, P., Tangirala, R., Bakthisaran, R., & Rao, C. M. (2022). Protein Aggregation and Cataract: Role of Age-Related Modifications and Mutations in α-Crystallins.

Biochemistry (Moscow), 87(3), 225–241. https://doi.org/10.1134/S000629792203004X

Campagna, D., Alamo, A., Di Pino, A., Russo, C., Calogero, A. E., Purrello, F., & Polosa, R. (2019). Smoking and diabetes: dangerous liaisons and confusing relationships. Diabetology & Metabolic Syndrome, 11(1), 85. https://doi.org/10.1186/s13098-019- 0482-2

Maedel, S., Evans, J. R., Harrer-Seely, A., & Findl, O. (2021). Intraocular lens optic edge design for the prevention of posterior capsule opacification after cataract surgery. Cochrane Database of Systematic Reviews, 8.

Safitri, A. Z., Fajariyah, R. N., & Astutik, E. (2021). Risk factors of diabetes mellitus in urban communities in Indonesia (IFLS 5). J Berk Epidemiol, 9(184), 10–20473.

Sari, A. D., Masriadi, M., & Arman, A. (2018). Faktor Risiko Kejadian Katarak pada Pasien Pria Usia 40-55 Tahun Dirumah Sakit Pertamina Balikpapan. Window of Health, 1(2), 61–67. https://doi.org/10.33368/woh.v0i0.27

Siregar, R. A., Amahorseja, A. R., Adriani, A., & Andriana, J. (2020). Pemeriksaan kadar glukosa darah sewaktu, kadar asam urat dan kadar cholesterol pada masyarakat di Desa Eretan Wetan Kabupaten Indramayu Periode Februari 2020. Jurnal Comunita Servizio, 2(1), 291–300.

Sudrajat, A., Munawir, A., & Supangat, S. (2021). Pengaruh Faktor Risiko Terjadinya Katarak Terhadap Katarak Senil Pada Petani di wilayah Kerja Puskesmas Tempurejo Kabupaten Jember. Multidisciplinary Journal, 4(2), 39–46.

Williams, L. B., Prakalapakorn, S. G., Ansari, Z., & Goldhardt, R. (2020). Impact and Trends in Global Ophthalmology. Current Ophthalmology Reports, 8(3), 136–143. https://doi.org/10.1007/s40135-020-00245