

RELATIONSHIP BETWEEN GLYCIZED HEMOGLOBIN (HbA1c) AND SERUM GLUTAMIC OXALOACETIC TRANSAMINASE (SGOT) ENZYME ACTIVITY IN PATIENTS TYPE 2 DIABETES MELLITUS

Sindi Yulia Putri¹, Aminahtun Latifah^{1,2*}, Wuni Sri Lestari^{1,2}

¹Departement of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Jambi

²PUI-PK, Politeknik Kesehatan Kementerian Kesehatan Jambi, Jambi, Indonesia

*Corresponding author: tifa.chemistry@gmail.com

ABSTRACT

Background: Diabetes Mellitus (DM) is a complex metabolic disorder marked by persistent hyperglycemia—an elevation of blood glucose levels that surpasses normal limits. One effective method to monitor the long-term glycemic control in individuals with DM is through the assessment of Glycated Hemoglobin (HbA1c). This study seeks to explore the intriguing relationship between HbA1c values and Serum Glutamic Oxaloacetic Transaminase (SGOT) enzyme activity in patients with type 2 DM. Notably, SGOT serves as a crucial marker for liver cell damage.

Method: This study conducted a cross-sectional exploration focused on a diverse population of patients with type 2 DM aged 18 and older, who met specific inclusion criteria. Data collection was carried out in 2024, with data analysis using the Pearson and Spearman correlation tests.

Result: The results reveal an average HbA1c value of 7.8% alongside an average SGOT enzyme activity of 19.9 U/L. Data analysis yielded a significance value of 0.626 ($p > 0.05$), indicating no meaningful relationship between HbA1c levels and SGOT enzyme activity in patients with type 2 diabetes mellitus. This intriguing finding suggests that an elevation in HbA1c levels does not automatically lead to heightened SGOT enzyme activity, implying that not all individuals with type 2 diabetes suffer from liver dysfunction.

Conclusion: This finding implies that an increase in HbA1c levels does not necessarily correspond to an increase in SGOT enzyme activity, meaning that not all patients with type 2 diabetes experience impaired liver function. Given these insights, it is crucial for patients with type 2 diabetes to monitor their blood glucose and HbA1c levels regularly.

Keywords: Type 2 Diabetes Mellitus, HbA1c, SGOT

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder caused by high blood glucose levels. When the body does not use the hormone insulin normally, it will cause blood glucose levels to exceed the normal value limit (World Health Organization, 2019). Indonesia occupies the fifth position of DM cases worldwide with 19.46 million sufferers, an increase of 81.8% compared to 2019 (IDF, 2021). According to data from the Jambi Provincial Health Office, it was recorded that in 2022, in Jambi Province, there were 45,641 people with DM. Meanwhile, in Jambi City, there were 13,623 people with diabetes (Dinas Kesehatan Jambi, 2022).

Among the health centers in Jambi City, the Pakuan Baru Community Health Center ranks 2nd in DM cases, with 925 patients.

DM is a chronic metabolic disease in the form of a persistent increase in blood glucose or hyperglycemia. The cause of the increase in blood glucose levels is the basis for grouping types of DM. DM can be divided into several types, including type 1 DM, type 2 DM, and gestational diabetes (Ministry of Health, 2020). DM is often known as the silent killer. This is due to the condition of chronic hyperglycemia, which can cause long-term damage, organ damage, especially to the eyes, kidneys, nerves, liver, and blood vessels (Inayatillah, 2016).

According to the American Diabetes Association (ADA), HbA1c examination provides a reliable measurement in chronic hyperglycemia conditions and is well related to the risk of long-term complications of diabetes; the higher the HbA1c in people with DM, the more at risk of complications (ADA, 2018). Continuous increases in blood glucose can cause auto-oxidation of glucose, protein glycation, and activity of the polio metabolic pathway, which further accelerates the formation of Reactive Oxygen Species (ROS) or the formation of oxidative stress. The presence of oxidative stress causes free radicals in the body to increase. These free radicals can damage various body tissues, one of which is liver cells (Mohamed, J., et al, 2016).

The liver is an organ of the body that functions in neutralizing toxic substances that enter the body, as well as being the target of increased concentrations of free radicals. The concentration of free radicals that are not balanced with antioxidants can cause oxidative stress in the body. Oxidative stress in hyperglycemic conditions causes hepatic cell death (Mohamed, J., et al, 2016). Therefore, it is necessary to examine the liver function of patients with DM to determine abnormalities in the liver organ, which is a complication of DM disease, one of which is the examination of Serum Glutamic Oxaloacetic Transaminase (SGOT) activity. 30% SGOT is found in the cytoplasm of liver cells, and 70% is found in the mitochondria of liver cells. The high activity of SGOT is directly related to the amount of cell damage (Rosida, 2016).

Based on previous research conducted (Reza & Rachmawati, 2017), there is a significant difference in SGOT activity between DM subjects and those without DM. Likewise, research (Shahwan et al., 2019) states that there is a substantial relationship between DM patients (HbA1c > 7) who are not well controlled and SGOT. Research conducted by Kuswarini, S (2022) also states that more than 50% of DM patients experience an increase in

SGOT enzyme activity. Meanwhile, research conducted by (SH, 2019) stated that higher SGOT activity was found in DM patients but no statistically observed relationship between increased SGOT activity and HbA1c. Based on the above problems, researchers are interested in researching the relationship between HbA1c values and SGOT enzyme activity in patients with type 2 DM.

METHODS

This study conducted a cross-sectional exploration focused on a diverse population of patients with type 2 diabetes mellitus (DM). The population for this study includes all patients with type 2 DM at Pakuan Baru Health Center, Jambi City, aged 18 and older, who met specific inclusion criteria. To ensure the integrity of our findings, we excluded individuals with a history of hepatitis A, B, or C, as well as those struggling with alcoholism or taking medications known to elevate liver enzyme levels. These medications included various antibiotics, such as ampicillin and carbenicillin; antihypertensives like methyldopa and guanethidine; narcotics and specific vitamins such as folic acid, pyridoxine, and vitamin A. By carefully defining our participant criteria, we aimed to enhance the reliability and relevance of our research outcomes.

HbA1c testing and SGOT enzyme activity assessments were expertly performed using the Afilas-10 (PT. BODITECH MED INDONESIA) and the Dialab Autolyser (Austria) ensuring precise and reliable results for optimal health insights.

RESULTS AND DISCUSSION

This study was conducted on patients with type 2 diabetes, with a total of 35 respondents. Respondents were then grouped based on respondent characteristics. An

overview of the characteristics of the respondents can be seen in the table below (Table 1).

Table 1. Respondent Characteristics

Characteristics	Frequency	Percentage
Gender		
Man	10	28.6 %
Woman	25	71.4 %
Age		
36-45	1	2.9 %
46-55	5	14.3 %
56-65	20	57.1 %
>65	9	25.7%
Long Suffering		
< 5 years	18	51.4 %
> 5 years	17	48.6 %
Total	35	100 %

The measurement results of HbA1C and SGOT are shown in Table 2.

Table 2. The Relationship Between HbA1c Values and SGOT Enzyme Activity in Patients with Type 2 Diabetes

Variabel	Mean	Median	SD	Min	Max	Sig.
HbA1c	7.8	6.800	2.369	4.4	15.0	0.626
SGOT	19.9	16.00	8.769	9	50	0.626

The results of this study indicated that most respondents were diagnosed with type 2 diabetes mellitus (DM) at the age of 5. The longer a person lives with diabetes, the more it contributes to the decline in pancreatic beta cell function, increasing the risk of DM-related complications (Simatupang, 2017).

The study found that the average HbA1c value among patients with type 2 diabetes was 7.8%, indicating uncontrolled diabetes. The HbA1c test is the gold standard for diagnosing and assessing diabetes control. A diagnosis of diabetes can be made if the HbA1c level exceeds 6.5%. The target for HbA1c levels in diabetes management is to keep them below 7%. Testing should occur every three months, or monthly for patients with HbA1c levels above 10%, to monitor therapy effectiveness and make necessary adjustments. For patients with stable blood glucose control, HbA1c examinations are recommended at least every six months (Perkeni, 2019).

Based on the research conducted, the average SGOT enzyme activity in patients with

type 2 diabetes was found to be 19.9 U/L. This aligns with the findings of Alzahrani et al. (2017), which reported that among 25 tested samples, 3 patients (12%) exhibited increased SGOT enzyme activity. Prolonged high glucose levels (hyperglycemia) can lead to complications in type 2 diabetes.

The liver is particularly vulnerable to oxidative stress caused by hyperglycemia, which can damage liver tissue. This damage disrupts protein, carbohydrate, and lipid metabolism, leading to increased oxidative stress and triggering inflammation. Both oxidative stress and inflammatory responses act as destructive agents that worsen the pathological condition of diabetes (Pangestuningsih, M., & Rukminingsih, F., 2022).

Insulin resistance leads to a decreased sensitivity of body tissues, especially the liver, to insulin. As a result, glucose in the blood is not effectively processed into the body's cells (Guyton and Hall, 2007). The brain signals insulin-producing cells to increase insulin production, which raises insulin levels in the bloodstream. This increase in insulin also affects the synthesis of fatty acids, glycogen, and proteins in the liver. However, it should be noted that several other factors can also lead to increased SGOT enzyme levels in patients with type 2 diabetes (Kuswarini, S., 2020).

The study's findings indicated that the average SGOT enzyme activity was normal, suggesting that liver function in patients with type 2 diabetes was not impaired. Normal results in these patients may be influenced by the duration of their diabetes. Increases in SGOT enzyme activity among some individuals may occur due to factors such as the length of time they have had diabetes, their level of physical activity, or medication use.

Statistical analysis showed a P-value greater than 0.05, indicating no significant relationship between HbA1c values and SGOT enzyme activity. This finding contrasts with research by Shahwan et al. (2019), which

identified a significant association between poorly controlled type 2 diabetes (HbA1c > 7%) and SGOT enzyme activity. The lack of significant results in this study may be attributed to various other factors affecting SGOT enzyme activity, such as fatigue, poor sleep patterns, and medication use.

CONCLUSION

The research conducted offers intriguing insights into the relationship between HbA1c levels and SGOT enzyme activity in patients with type 2 diabetes mellitus (DM). The findings reveal that the average HbA1c value stands at 7.8%, accompanied by a standard deviation of 2.36%. Furthermore, the average SGOT enzyme activity in these patients is recorded at 19.9 U/L, with a standard deviation of 8.76 U/L.

Upon thorough analysis of the data, we arrive at a noteworthy conclusion: there exists no significant relationship between HbA1c values and SGOT enzyme activity in this specific population. The resulting p-value of 0.626 underscores the absence of a meaningful correlation. These findings pave the way for further exploration in understanding the complexities of diabetes management and its biochemical markers.

ACKNOWLEDGMENT

The author gratefully acknowledges the contributions of all those who supported the writing of this article

CONFLICT OF INTEREST

All authors declared that there was no conflict of interest.

REFERENCES

- Alzahrani, S. H., Baig, M., Bashawri, J. I., Aashi, M. M., Shaibi, F. K., & Alqarni, D. A. (2019). Prevalence and Association of Elevated Liver Transaminases in Type 2 Diabetes Mellitus Patients in Jeddah, Saudi Arabia. *Cureus*, 11(7), e5166. <https://doi.org/10.7759/cureus.5166>
- American Diabetes Association, 2018. Standards of Medical Care in Diabetes -2018 ML. Matthew C. R.iddle, ed. Available at: <https://diabetesed.net/wpcontent/uploads/2017/12/2018-ADA-Standards-of-Care.pdf>
- Dinas Kesehatan Jambi, (2022). Profil Kesehatan Dinas Provinsi Jambi Tahun 2022.
- Guyton & Hall, 2007. Buku Fisiologi Kedokteran. Edisi 27. Penerbit Buku Kedokteran EGC. Jakarta.
- Hartini, S. (2016). Hubungan HbA1c Terhadap Kadar Glukosa Darah Pada Penderita Diabetes Mellitus Di RSUD. Abdul Wahab Syahrane Samarinda. *Husada Mahakam: Jurnal Kesehatan*, 4(3).
- Inayatillah, B. (2016). Pengaruh Ekstrak Daun Ketapang (*Terminalia catappa* L.) terhadap Perbaikan Kerusakan Hepatosit serta Kadar SGOT dan SGPT Mencit (*Mus musculus*) Diabetik (Doctoral dissertation, Airlangga University).
- International Diabetes Federation. (2021). IDF Diabetes Atlas, Ninth edition 2021.3235.
- Kemenkes RI. (2020). Pedoman Nasional Pelayanan Kedokteran Tata Laksana Diabetes Mellitus Tipe 2. In pusat data dan informasi kementerian kesehatan RI.
- Kuswarini, S. (2020). Analisis Risiko Kadar Enzim SGOT dan SGPT pada

- Penderita Diabetes Mellitus Tipe 2 Risk Analyses of AST and ALT levels in Patients with Diabetes Mellitus Tipe 2. *Jurnal Laboratorium Medis E-ISSN*, 2685, 8495.
- Mohamed, J., Nazratun Nafizah, A. H., Zariyantey, A. H., & Budin, S. B. (2016). Mechanisms of Diabetes-Induced Liver Damage: The role of oxidative stress and inflammation. *Sultan Qaboos University Medical Journal*, 16(2), 1 el132– el141. <https://doi.org/10.18295/squmlj.2016.16.02.002>.
- Nurhikmah, N. W. (2018). Kadar Serum Glutamic Pyruvic Transaminase (SGPT) pada Penderita Diabetes Mellitus Tipe 2 Tidak Terkontrol. *KTI Prodi DIII Stikes Insan Cendikia Medika*
- Pangestuningsih, M., & Rukminingsih, F. (2022). Gambaran fungsi hati pada pasien Diabetes Mellitus tipe 2 di salah satu Rumah Sakit Swasta di Kabupaten Demak periode Oktober-Desember 2020. *Jurnal Riset Kefarmasian Indonesia*, 4(2), 134-143.
- Perkeni. 2019. *Pengelolaan dan Pencegahan Diabetes Mellitus tipe 2 di Indonesia*. Jakarta: PB Perkeni.
- Ramadhan, N., & Marissa, N. (2015). Karakteristik penderita diabetes mellitus tipe 2 berdasarkan kadar HbA1c di puskesmas jayabaru kota Banda Aceh. *Sel*, 2(2), 49–56.
- Reza, A., & Rachmawati, B. (2017). Perbedaan kadar sgot dan sgpt antara subyek dengan dan tanpa diabetes mellitus. *Jurnal Kedokteran Diponegoro (Diponegoro Medical Journal)*, 6(2), 158-166.
- Rosida, A. (2016). Pemeriksaan laboratorium penyakit hati. *Berkala Kedokteran*, 12(1), 123-131.
- Shahwan, M. J., Khatab, A. H., Khattab, M. H., & Jairoun, A.A (2019). Association between abnormal serum hepatic enzymes, lipid levels and glycemic control in patients with type 2 diabetes mellitus. *Obsety Medicine*, 16, 100137.
- Simatupang, R. 2017. Pengaruh pendidikan kesehatan melalui media leaflet tentang diet DM terhadap pengetahuan pasien DMDI RSUD Pandan Kabupaten Tapanuli Tengah Tahun 2017. *Jurnal Ilmiah Kohesi*. vol. 1(2): 163-174.
- WHO (2019) *Classification Of Diabetes Mellitus*. In *Clinics in Laboratory Medicine* (Vol. 21, Issue 1).