

CORRELATION BETWEEN GLYCATED HEMOGLOBIN (HbA1c) LEVELS AND FASTING BLOOD GLUCOSE LEVELS IN PATIENTS WITH DIABETES MELLITUS IN JAMBI CITY

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ABSTRACT

Background: Diabetes Mellitus (DM) is a chronic disease of metabolic disorder characterized by blood sugar levels that increase from normal limits. It is necessary to prevent diabetes with control by monitoring metabolic status. The method that can be used in controlling blood sugar in patients with diabetes mellitus by measuring Hemoglobin-glycation (HbA1c). HbA1c measurement is the most accurate way to determine high blood sugar levels over the past 2 - 3 months. HbA1c is an examination to assess the risk of tissue damage caused by high sugar levels. The aimed of this study is to analyze the correlation between HbA1c levels and blood sugar levels in patients with diabetes mellitus.

Method: This study used descriptive methods with an analytical descriptive study with a cross-sectional among of 100 samples, based on the criteria of respondents who checked HbA1c and fasting blood sugar. Data analysis used the Speartam correlation test which was previously carried out by the Kolmogorov-Smirnov normality test.

Result: The results of this study showed that the average HbA1c level was 3.9% while the average fasting blood sugar level was 82 mg/dl. There is a significant correlation between HbA1c concentration and fasting blood sugar with $p(0.000) < (0.05)$. According to the test results, the value $r = 0.666$ means the correlation is very strong (0.51-0.75).

Conclusion: In conclusion, there is a strong correlation between HbA1c levels and fasting blood sugar level, the correlation happens to be positive, meaning there is a one-way relationship if HbA1c levels increases (High), fasting blood sugar levels will also increase (High). If the HbA1c levels is reduced (low), then the fasting blood sugar level is also reduced (low), and if the HbA1c level is normal, the blood sugar level is also normal.

Keywords: HbA1c; Diabetes Mellitus; Fasting Bood Sugar

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by blood sugar levels that are higher than normal. This cause of elevated blood sugar levels is the basis for classifying diabetes into types 1, 2, and gestational diabetes. The International Diabetes Federation (IDF) estimated that at least 463 million individuals among aged 20-79 in worldwide suffered from DM in 2019, it is equivalent to a prevalence rate of 9.3% from the total population in the same age group. From based on gender, the IDF projected a DM prevalence of 9% in females and 9.65% in males in 2019. The prevalence of DM is anticipated to rise with increasing age,

reaching 19.9% or 111.2 million individuals from aged 66-79. The figures are predicted to continue increasing to 578 million in 2030 and 700 million in 2045 (Kemenkes RI, 2020).

The World Health Organization (WHO) anticipates a rise in number of type 2 DM cases in Indonesia from 8.4 million in 2000 to approximately 21.3 million in 2030. The incidence of DM is increasing in both developed and developing nations. Based on national prevalence data, DM ranks fourth among chronic diseases in Indonesia, with DM being the most prevalent chronic disease in Indonesia (Kemenkes RI, 2018). The national prevalence of DM according to Riskesdas 2018 for individuals aged >15 years is 2.0%.

In Riskesdas 2018, the incidence of DM in the Jambi Province increase from 1.2% in 2013 to 1.4% in 2018. Cases of DM at RSUD H. Abdul Manap continue to increase, with outpatient visits totaling 3,374 and inpatient admissions numbering 290 in 2021. In 2022, outpatient visits rise to 4,230, and inpatient admissions increased to 457.

The Sustainable Development Goals (SDGs) set indicators aimed at reducing premature mortality, including DM, by one-third of Indonesia's population by 2030. The effort to achieve this objective statement needs a control measures through the monitoring of metabolic status. There is a method that can be used to control blood sugar levels in diabetics through measuring hemoglobin A1c (HbA1c). Measuring HbA1c is the most accurate way to assess the degree of hyperglycemia over the past 2-3 months. It serves as a test to evaluate the risk of tissue damage resulting from high sugar levels (Ramadhan, 2015). HbA1c levels can monitor blood sugar levels because they are not influenced by daily sugar fluctuations (Hardjoeno, 2006). The testing fo HbA1c levels can provide information on a patient's glycemic control over the previous 2-3 months and can be used in conjunction with regular blood sugar testing to adjust diabetes management.

Many studies have been performed on HbA1c, some have correlated HbA1c levels with blood sugar levels. Research by Hartini (2017) at RSUD. Abdul Wahab Syahrani Samarinda demonstrated a correlation between HbA1c levels and fasting and post-meal blood sugar levels, with 45.3% of respondents having high average levels, 53.7% normal and 1.0 % short. The increase in HbA1c levels will affect fasting and post-meal blood sugar levels. A study by Pusedikasari (2014) at Muhammadiyah Palembang Hospital showed that as post-meal blood sugar levels increased, HbA1c levels also increased, with an average of 59% for male patients and 41% for female patients. A study by Arifatunhidjah (2017) at Ambarawa Semarang General Hospital indicated a significant correlation between HbA1c levels and blood sugar levels, with higher blood sugar levels corresponding to higher HbA1c levels.

Based on prior research and the increasing incidence of DM cases, the author is interested in further exploring of the correlation between HbA1c levels and blood sugar levels in DM patients at RSUD H. Abdul Manap in Jambi City.

METHOD

The methods of this study employs an analytical descriptive research design with a cross-sectional approach. The population under investigation comprises individuals afflicted with Diabetes Mellitus (DM) who underwent assessments for HbA1c levels and fasting blood glucose levels at the Clinical Pathology Laboratory of Regional General Hospital Jambi City, spanning from October 2022 to March 2023.

The data for this study consists of secondary data, specifically from HbA1c levels and blood glucose levels of patients with diabetes mellitus who had examinations at the Clinical Pathology Laboratory of Local Hospital in Jambi City. The research data was collected from January to March 2023, with a total sample size of 100 individuals. The specimens were examined using a BioSystems BA200.

The research of this study has obtained an ethical approval from the Ethics Committee at the Jambi Ministry of Health Poltekkes.

RESULTS AND DISCUSSION

In this study, the author's research findings about respondent characteristics including demographic attributes such as gender and age. The demographic distribution by gender is presented graphically below.

Table 1. The Respondent Characteristics Based on Age

	AGE			
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-20	1	1,0	1,0	1,0
21-40	3	3,0	3,0	4,0
41-60	60	60,0	60,0	64,0
61-80	36	36,0	36,0	100,0
Total	100	100,0	100,0	

Table 2. Respondent Characteristics Based on Gender

	GENDER			
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
MALE	39	39,0	39,0	39,0
FEMALE	61	61,0	61,0	100,0
Total	100	100,0	100,0	

Table 1 shows that respondents are distributed across age groups: 1% aged 1-20 years, 3% aged 21-40 years, 60% aged 41-60 years, and 36% aged 61-80 years. The table gave detail respondent characteristics by age demonstrates the highest percentage of respondents with the 41-60 year age group. Table 2 shows a higher

Table 4. Spearman Correlation Test Results for HbA1c Levels against Fasting Blood Sugar Levels in DM Patients

Parameter	n	Mean	Median	Min-Max	SD	Correlation Coefficient	P
HbA1c	100	3,9	7,95	5,1-14,8	2,37	0,666	0,000*
KGDP	100	82	153,50	76 - 357	63,05		

*Correlation Spearman test, $p < 0.05$

The analysis in this study stay focused on the correlation between HbA1c levels and fasting blood glucose in diabetic patients. The correlation between HbA1c levels and fasting blood glucose in diabetic patients showed a significant association, characterized by a strong positive correlation. The results of this study showed that the average HbA1c level was 3.9% while the average fasting blood sugar level was 82 mg/dl. There is a significant correlation between HbA1c concentration and fasting blood sugar with $p(0.000) < (0.05)$. According to the test results, the value $r = 0.666$ means the correlation is very strong (0.51-0.75). From this, the author's findings there are consistent with studies conducted by Hartini (2017) and Arifatunhidjah (2017), who both concluded that there is a significant relationship between HbA1c levels and fasting blood glucose, shows a strong positive correlation. This indicates that as HbA1c levels increase, fasting blood sugar levels also tend to increase.

From secondary data, it was found that although HbA1c levels were within the normal range, fasting blood sugar levels were high.

proportion of female respondents (61%) compared to males (39%). The data collected from male and female DM patients is not evenly balanced.

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Table 3. Normality Test Results for HbA1c and Fasting Blood Sugar Levels in DM

Test Result	Mean	P
HbA1c Levels	8,584	0,001*
Fasting Blood Glucose Levels	169,03	0,000*

This phenomenon can be caused by many different factors, including genetics, obesity, age, blood pressure, physical activity, stress, and history of gestational diabetes (Damayanti, 2018). Additionally, high HbA1c levels associated with normal fasting blood sugar can be influenced by factors such as iron deficiency anemia, age, polycythemia vera, second trimester of pregnancy, high urea levels, excessive alcohol consumption, aplastic anemia, and prolonged use of salicylates (Arfatunhidjah, 2017).

CONCLUSION

The analysis in this study stay focused on the correlation between HbA1c levels and fasting blood glucose in diabetic patients. The correlation between HbA1c levels and fasting blood glucose in diabetic patients showed a significant association, characterized by a strong positive correlation. The results of this study showed that the average HbA1c level was 3.9% while the average fasting blood sugar level was 82 mg/dl. There is a

significant correlation between HbA1c concentration and fasting blood sugar with $p(0.000) < (0.05)$. According to the test results, the value $r = 0.666$ means the correlation is very strong (0.51-0.75). From this, the author's findings there are consistent with studies conducted by Hartini (2017) and Arifatunhidjah (2017), who both concluded that there is a significant relationship between HbA1c levels and fasting blood glucose, shows a strong positive correlation. This indicates that as HbA1c levels increase, fasting blood sugar levels also tend to increase.

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CONFLICT OF INTEREST

The author declares there is no any conflict of interest during this study.

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