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Correlation Of HbA1c Leveles With Urine Ketone Levels In Patient With Diabetes Melitus In RSUD Haji Surabaya East Java province

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ABSTRACT
Diabetes is a chronic metabolism disease which characterized by increased blood glucose caused by the pancreas not producing enough insulin for the body or the body experiencing insulin resistance. The recommended examination to control glicaemic blood glucose in patient with diabetes is HbA1c. The fat metabolism caused when body have no enough glucose to process. The fat metabolism can caused ketone bodies enhacement and detected in blood or urine. Purpose of the research is to know the correlation of HbA1c levels with urine ketones levels in patient with diabetes melitus. This research is an correlational study with cross sectional case study, data of HbA1c collected by secondary data and data of urine ketons collected by data primer. The research was carried out at Laboratory in RSUD Haji Surabaya East Java Province on March-April 2024. The results showed there is no a significant correlational between HbA1c levels with urine ketone levels in patient with diabetes melitus (p=0,371). Even though there is no a significant correlational, for patient with diabetes melitus should manage the diet, do insulin intake routinely and suggested to do examination for urine ketone regurally to control the risk of complications.

Keywords: Diabetes Melitus; HbA1c; Urine Ketone

INTRODUCTION
Diabetes mellitus is a chronic disease caused when the pancreas gland cannot produce insulin or when the body's cells cannot respond effectively to insulin followed by metabolic disorders that cause high blood sugar levels ((WHO, 2019)). Diabetes mellitus is divided into four types, namely, type 1 diabetes mellitus (occurs due to a lack of the hormone insulin), type 2 diabetes mellitus (occurs when the body is resistant to the hormone insulin (gestational diabetes) occurs during the 2nd or 3rd trimester of pregnancy) and other types of diabetes.

In patients with diabetes mellitus, the sugar in the blood will increase. Blood glucose is sugar in the blood formed from carbohydrates in food and stored as glycogen in the liver and skeletal muscles. Insulin and glucagon are hormones that affect glucose levels. In addition, the examination recommended by the American Diabetes Association/ADA as a supporting examination to diagnose Diabetes Mellitus is HbA1c. HbA1c examination describes the average plasma glucose level for 8-12 weeks (Kandou et al., n.d.).

When the body does not have enough glucose to be used as an energy source, the body will use fat as an energy source becoming acetone compounds. The result of this breakdown will produce ketones which if it occurs continuously will cause the detection of ketones in the urine also called ketonuria in the compound of ketone bodies (Zuwannita, n.d.).

Metabolic ketoacidosis is an acute complication of diabetes mellitus

characterized by elevated blood glucose levels (300-400 mg/dL) accompanied by symptoms of acidosis along with positive (+) ketone levels in the urine and blood. (PERKENI, n.d.). Therefore, monitoring ketone bodies in the blood and urine is important especially for people with uncontrolled diabetes mellitus. (Mardiana et al., 2014).

RESEARCH METHOD

This type of research is an correlational study aimed to know the correlation of HbA1c levels with urinary ketone levels in patients with diabetes mellitus, using a cross-sectional approach. This research was conducted at the RSUD Haji Provinsi Jawa Timur from March 25 to April 25, 2024.

In this study, data collection techniques used primary data from the results of urine ketone examination in patients with diabetes mellitus at the RSUD Haji Provinsi Jawa Timur. The sample population used was all patients who performed HbA1c checks. The study population was 350 patients. The research sample is patients with HbA1c results above 8% who are willing to be respondents. At the time of the study, 50 people were obtained who had HbA1c results above 8% and were willing to become research respondents.

The data analysis technique used to determine the correlation between HbA1c levels and urine ketone levels in patients with diabetes mellitus will be processed using the nonparametric SPSS program, namely the spearman test because the data is ordinal scale

RESULT AND DISCUSSION

This study aims to determine the correlation between HbA1c levels and urine ketone levels in patients with diabetes mellitus. The sample used in examination of HbA1c is whole blood examined using the Cobass 6000 enzymatic method expressed in units of mg/dL on an ordinal measuring scale. Examination of urine ketone levels using the dipstick method expressed by units of measurement on an ordinal measuring scale.

Examination of urine ketone levels were carried out on patients with diabetes mellitus who had HbA1c levels above 8% with a total of 50 samples

Frequency Distribution of Diabetes Mellitus Respondents Based on Gender

All respondents in this study were diabetes mellitus patients with HbA1c levels above 8% who were not differentiated by gender. Data on the characteristics of research respondents based on gender can be seen in table 1 below.

Table 1. Frequency Distribution of Diabetes Mellitus Respondents Based on Gender

No.	Age	Frequency	Presentation
1.	Man	24	48%
2.	Woman	26	52%
	Total	50	100%

Based on the data in the table that has been presented, the distribution of respondents based on gender shows that the majority of respondents in this study were respondents with female gender as many as 26 people or 52% while respondents with male gender were 24 people or 48%.

Respondent Characteristic Based on Age

Data on the characteristics of research respondents based on age are presented in table 2 below.

Table 2 Frequency Distribution of Diabetes Mellitus Respondents Based on Age

No.	Age	Frequen	Presentation
1.	26-45 years (Adults)	5	10%
2.	46-59 years (Pre-elderly	24	48%
3.	>60 years (Elderly)	21	42%
	Total	50	100%

The data in table 2 shows that the age distribution of respondents in diabetes mellitus patients is mostly aged 46-59 years

(pre-elderly) with a percentage of 48%, respondents aged 26-45 years (adults) as much as 10% and age> 60 years (elderly) as much as 42%.

Overview of HbA1c Level Results in Respondents

An overview of the results of HbA1c levels in respondents with diabetes mellitus patients can be seen in the following table 3 below.

Table 3 Overview of HbA1c Level Results in Respondents

	N	Average	Lowest	Highest
HbA1c	50	10,5%	8,2%	15,5%

Based on data from table 3, the lowest level of HbA1c was 8.2%, the highest level was 15.5% and the average level of HbA1c was 10.5%.

Distribution of Urine Ketone Results in Respondents

The distribution of urine ketone results in respondents with diabetes mellitus can be seen in table 4 below.

Table 4 Distribution of Urine Ketone Results in Respondents

Keton	N	Presentation
Normal (0 mg/dL)	42	84%
Abnormal (> 0 mg/dL)	8	16%
Total	50	100%

Based on table 4, the results of normal urine ketone examination in patients with diabetes mellitus who became respondents were 42 (84%) respondents and patients with diabetes mellitus with ketone levels exceeding normal limits amounted to 8 (16%) respondents.

Statistical Analysis

Data from the examination of HbA1c and urine ketone levels were analyzed using statistical tests to determine whether or not there was a relationship or correlation

Table 5 Statistical Analysis

Variabel	**Sig.**	**Correlation Coefficient**
HbA1c Keton Urin	0,371	0,129

From the table above, the statistical test results obtained a correlation value of 0.371 which means the sig value < $\alpha = 0.05$ so that Ho is accepted and Hi is rejected, which means that in this study there is no significant relationship between HbA1c levels and urine ketone levels.

Based on research that has been conducted, 48% of research respondents are male and 53% of respondents are female. According to Sukmaningsih W. R, 2016 women are more at risk of DM disease because of a greater body mass index and the syndrome of the menstrual cycle causing fat accumulation resulting in inhibition of glucose intake into cells due to hormonal processes that are occurring. In this study, the majority of respondents who had Diabetes Mellitus were in the age range of 46-59 years (pre-elderly). According to Rudi et al., 2017, individuals in the pre-elderly age range have a higher probability of about 1.4 times having impaired blood sugar levels.

Urine ketone examination is performed qualitatively using urine strips that are read visually. Not all patients with diabetes mellitus found ketones in the urine. This is influenced by the insulin system which inhibits ketogenesis by stimulating acetyl CoA carboxylase. Determined Kemenkes, diabetes mellitus is a chronic disease caused by the patient's body failure to use insulin effectively followed by metabolic disorders of carbohydrates, lipids, and proteins resulting in increased blood sugar levels. Too high glucose levels and lack of the hormone insulin in people with diabetes mellitus cause the body to use fat as a source of energy. Ketones will be formed when the body lacks carbohydrates and lacks glucose for energy. The metabolic use of fatty acids by the liver if it occurs continuously will produce ketone bodies that can be detected in the urine. If the body continues to use ketones as energy, it will cause an emergency, namely ketoacidosis which is very dangerous. (Analis et al., n.d.).

CONCLUSION AND RECOMMENDATION

Based on the results of this study, it can be concluded that there is no correlation between HbA1c levels and urine ketones in patients with diabetes mellitus at Haji Surabaya Hospital where the sig result is $0.371 < \alpha = 0.05$, meaning there is no significant relationship.

For the community, especially people with diabetes mellitus, they should always maintain sugar levels by regular control, taking medication according to the doctor's recommendations and doing physical activity so that blood sugar remains controlled. For further researchers, it is hoped that a wider sample will be sought by paying attention to the time of checking the patient's blood sugar, the use of insulin as a patient treatment followed by checking blood ketone levels as well as pH levels in the patient's blood so that it is expected to show a correlation between HbA1c levels and urine ketone levels in patients with diabetes mellitus.

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