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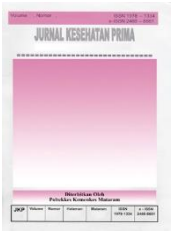

Relationship Between Urid Acid Levels with Fasting Blood Sugar

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Abstract
Uric acid is the end product of purine catabolism in the human body. The cause of increased uric acid levels is influenced by various factors including alcohol, genetics, hypothyroidism, obesity, and a diet high in purines. Diabetes is a chronic metabolic disease characterized by increased blood sugar, which is caused by an imbalance between blood supply and the need to increase glucose in cells to make it available for cell metabolism and growth. The decrease or absence of insulin makes glucose stuck in the blood and causes blood sugar to increase, while cells lack glucose which is needed for cell survival and function. The purpose if this study is to determine the relationship between blood uric acid and fasting blood sugar levels in the Academic Community of the Bengkulu Ministry of Health Polytechnic. The design of this study was observational with a cross-sectional design. This research was conducted on May 8-19, 2023. Sampling in this research will be conducted at the Bengkulu Ministry of Health Polytechnic. Data collection techniques use secondary data. The data collected was then processed and analyzed using Univariate analysis to find out the average frequency distribution of each variable and a data normality test was performed between uric acid levels and fasting blood sugar levels, and bivariate analysis using the Pearson correlation test. Results: There was no significant relationship between uric acid levels and fasting blood sugar levels (p=-0.051). There is no relationship between uric acid levels in males and females with fasting blood sugar levels (p=0.872) and (p=0.470). Conclusion: There is no significant relationship between uric acid levels and fasting blood sugar levels.

Keywords: Urid Acid Levels; Fasting Blood Sugar Levels

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder caused by the pancreas not producing enough insulin or the body's inability to use the insulin it produces effectively (Ministry of Health, 2014). The International Diabetes Federation (2015) states that the insulin hormone regulates blood glucose levels. The pancreas produces this hormone. If there is a deficiency of the insulin hormone in the body, it can cause hyperglycemia (Kusumasari *et al.*, 2021, Mitsch *et al.*, 2023)

Data from the World Health Organization (WHO) states that there are 422 million people in the world suffering from diabetes mellitus or an increase of around 8.5% in the adult population and it is estimated that there are 2.2 million deaths with a percentage due to diabetes mellitus that occurs before the age of 70 years. especially in countries with low and middle economic status. It is estimated that it will continue to increase by around 600 million people in 2035 (Kemenkes RI, 2018).

Type 2 Diabetes Mellitus is a metabolic disorder characterized by an increase in blood sugar due to decreased insulin secretion by pancreatic beta cells or impaired insulin function (insulin resistance). The relationship between uric acid and type 2 Diabetes Mellitus is caused by insulin resistance, where uric acid

increases sodium reabsorption in the kidney tubules, as a result, the ability of the kidneys to excrete sodium and uric acid increases (Dilworth *et al.*, 2021).

Gout is a metabolic disease characterized by a buildup of painful uric acid in the joints, very often found in the upper leg, ankle, and midfoot. Gout disease is also called gout disease. Gout is a metabolic disease characterized by a buildup of uric acid which causes pain in the joints. Increased uric acid levels can be influenced by various risk factors, namely a diet high in purines, decreased glomerular filtration, administration of diuretic drugs, overproduction resulting from primary defects in the purine-saving pathway, alcoholic beverages, exercise or physical activity, and medications that can inhibit uric acid excretion by the kidneys (Abbas *et al.*, 2023). Hyperuresa is an increase in uric acid in the blood that exceeds normal values. This occurs due to excess uric acid formation inhibition of excretion or a combination of both (Pertiwi and Wande, N, Mulyantari, 2019). High levels of uric acid can cause crystallization in joints and blood vessels so that it can inhibit insulin resistance, and if insulin resistance is inhibited it can cause a person's blood sugar levels to increase (Suhariati, 2019)

The results of research in the laboratory of Central Bengkulu Hospital found that uric acid levels in people with diabetes mellitus increased by an average of 1.02 mg/dl from the normal value. Uric acid levels in people with diabetes mellitus increased by 22.46% from normal values (Jais *et al.*, 2021). The results of research in Sivagangai found that serum uric acid levels of diabetics were very high and significantly related. A significant correlation was seen between serum uric acid and BMI and WHR. Uric acid is significantly increased in the diabetic population and the average value of serum uric acid levels is higher at longer duration of diabetes, hypertension, dyslipidemia, and central obesity which is a component of metabolic syndrome (Kalyani *et al.*, 2020). However, the results of Boleu et al's (2018) research in North Halmahera, Statistically, there is no significant relationship between uric acid levels. This suggests that the results are not consistent with the correlation between uric acid and blood sugar in various places. Various confounding factors such as BMI, purine diet, ethnicity, alcohol consumption, age, gender, and comorbid conditions can affect the results of this study.

The results of the study in Bangladesh found that serum uric acid levels were negatively related to fasting blood glucose levels. The prevalence of diabetes decreases with increasing serum uric acid concentrations. Serum uric acid levels are high in healthy individuals but decreased in prediabetic and diabetic individuals with increased concentrations of fasting blood glucose levels. More research is needed to examine the reliability of the use of SUA to predict diabetes (Haque *et al.*, 2019).

Various research results prove that there is a relationship between uric acid levels and blood sugar levels (Abbas *et al.*, 2023; Jais *et al.*, 2021; Ume Farwa *et al.*, 2023; Husen and Ratnaningtyas, 2023). Other studies have also examined the relationship between blood sugar levels and uric acid, the higher the blood glucose level, the lower the uric acid level (Dai *et al.*, 2020; Simanullang *et al.*, 2019). However, the results of different studies show a correlation in the same direction, the increase in glucose levels in the blood is related to uric acid, considering that these 2 substances both circulate in the blood and the side effects caused will have an impact that aggravates the condition (Saktiningsih and Sulistyowati, 2017). An analysis of the relationship between uric acid and blood cave levels is still needed. The Bengkulu Ministry of Health Poltekkes routinely conducts medical check-ups (MCU) every year but has never been analyzed to determine the relationship between uric acid levels and fasting blood sugar levels based on Medical Check-Up data so that nine can be used for more effective and

efficient intervention strategies. The relationship between uric acid levels and fluctuating blood sugar levels among academic staff of the Ministry of Health, Bengkulu Polytechnic is not well understood. This study aims to determine the Relationship Between Uric Acid Levels and Flashing Blood Sugar in Academic Citizenship of the Ministry of Health, Bengkulu Polytechnic. Understanding this relationship is crucial due to the potential health implications for academic staff. High uric acid levels have been associated with various health problems, including diabetes and cardiovascular disease. Identifying any correlation between uric acid levels and blood sugar fluctuations could provide insights into preventive measures and health management strategies for this group. This research is undertaken to investigate whether there is a significant relationship between uric acid levels and fluctuating blood sugar among academic staff at Bengkulu Polytechnic. The findings could inform health promotion initiatives and personalized health interventions aimed at reducing the risk of diabetes and other metabolic disorders in this population.

METHOD

This study uses a cross-sectional approach. The population is the entire academic community of the Bengkulu Ministry of Health Polytechnic, totaling 221 people. The number of samples, namely 66 people, was calculated using the linear regression correlation formula with inclusion criteria, namely the entire Academic Community of the Bengkulu Ministry of Health Poltekkes who attended Medical Check Up and were willing to become respondents. The exclusion criteria were the Academic Community of the Bengkulu Ministry of Health Poltekkes who carried out study assignments, and medical check-up data that had been lost. Sampling is purposive sampling. The analysis used consisted of univariate analysis of the average frequency distribution of each variable and data normality between uric acid levels and fasting blood sugar levels. and bivariate using a coefficient correlation test.

RESULT AND DISCUSSION

The results of analysis and hypothesis testing can be presented in the form of graphs or tables to clarify verbally. Tables and figures can use the numbers 1,2,3, and so on. The maximum number of tables and figures is 5. Table titles are above, while image titles are below.

Table 1. Characteristics of uric acid and fasting blood sugar levels

Variable	Frequency		Statistics	
	n	%	Min-Max	$\bar{x}$±SD
Age (Years)				
≥45 years	26	39.4	24-62	43±8.2
<45 years	40	60.6	18-38.8	57±7.9
Body Mass Index (BMI)				
Obesity	37	56.1		
Overweight	15	22.7	-	-
Normal	14	12.1		
Education				
S2&S3	30	45.5	-	-
D3, D4&S1	36	54.5		
Type of Employment				
Teacher	29	43.9		
Staff	37	56.1	-	-
Gender				
Male	31	47	-	-
Female	35	53		

Table 1 Characteristics of the Academic Community of the Bengkulu Ministry of Health Poltekkes, most of the academic community is <45 years old as much as 59.1%. Most of the academic community is obese nutritional status of as much as 56.1%. Most of the most recent educational academic communities, namely D3, D4 & S1 as much as 54.5%. From the data obtained by the academic community, the majority are female, 53%. Most of the types of staff academic skills of education staff are 56.1%.

Table 2. Overview of Uric Acid Levels

Uric acid (mg/dl)	Frequency		Statistics	
	n	%	Min-Max	$\bar{x}$±SD
Male				
High >7 mg/dl	9	13.6	4 - 8.3	5.7±24.2
Normal (3.4 -7 mg/dl)	22	33.3		
Female				
High >5.7 mg/dl	13	19.7	3 - 7.6	3.2±25.6
Normal (2.4-5.7mg/dl)	22	33.3		

Based on Table 2, it can be seen that on average most of those who have high uric acid levels are female with a percentage of 19.7%, the average uric acid is 3.2 mg/dl, the lowest is 3 mg/dl while the highest uric acid level is 7.6 mg/dl. Whereas normal uric acid levels have the same number, namely 22 people between males and females with a percentage of 33.3%. The average uric acid level for males is 5.7 mg/dl, the lowest is 4.0 mg/dl while the highest is 8.3 mg/dl. Women are susceptible to obesity and type 2 diabetes because their activity is smaller than that of men, so they take less glucose, and they are susceptible to obesity and hyperglycemia (Purlinda and Widodo, 2020). Uric acid levels will increase as men age and women increase after menopause (Farizal *et al.*, 2019; Wu *et al.*, 2022).

Table 3. Overview of Fasting Blood Sugar Levels

Fasting Blood Sugar Levels (mg/dl)	Frequency		Statistics	
	n	%	Min-Mak	$\bar{x}$±SD
High >126 mg/dl	6	9.1	54-338	101.6±37.7
Normal ≤126 mg/dl	60	90.9		

Based on Table 3, it can be seen that most of the levels of the academic community have normal fasting blood sugar levels with a percentage of 90.3%. While those who have high fasting sugar levels with a percentage of 9.1%. The average fasting blood sugar level in the academic community is 101.6 mg/dl, with the lowest being 54 mg/dl and the highest being 338 mg/dl.

The results of the Pearson correlation statistical test between uric acid levels in men with fasting blood sugar levels showed that there was no significant relationship between uric acid levels and fasting blood sugar levels (p-value 0.872) and uric acid levels in women with fasting blood sugar levels showed that there was no significant relationship between uric acid levels and fasting blood sugar levels (p=0.4). The results of statistical tests between uric acid and fasting blood sugar levels showed that there was no significant relationship between uric acid levels and fasting blood sugar levels (p-value 0.686).

Table 4 Relationship between Uric Acid Levels and Fasting Blood Sugar Levels

Variable	*p-value*	*Coefficient correlation (r)*
Male uric acid levels with fasting blood sugar levels	0.872	-0.30
Female uric acid levels with fasting blood sugar levels	0.470	0.126
Uric acid levels with fasting blood sugar levels	0.686	-0.051

The direction of the relationship has an interpretation. If the (r) value is positive, that is, it is directly proportional and if the (r) value is negative, it is inversely proportional. The results showed that the value of r = -0.051 and uric acid levels in men with fasting blood sugar levels showed a value of r = -0.30 so it can be concluded that the results of uric acid levels with blood sugar levels have a negative interpretation indicating the greater the value of uric acid levels. urate, the smaller the value of uric blood sugar levels. Meanwhile, uric acid levels in women with fasting

blood sugar levels have a positive interpretation indicating that the greater the uric acid level, the greater the fasting blood sugar level.

The meaning of the closeness of the relationship between uric acid levels and fasting blood sugar levels is r = 0.051 indicating that there is no relationship or the relationship is very weak. Based on the results of the Pearson correlation test conducted on the academic community of the Bengkulu Ministry of Health Poltekkes, a correlation coefficient was obtained (r = -0.051) so the correlation results were obtained with a negative pattern with a weak degree of closeness or no relationship, where the correlation value with a negative pattern indicates a greater value of acid levels urates, the smaller the value of fasting blood sugar levels. The correlation coefficient (r) for male uric acid levels with fasting blood sugar levels showed results (r = -0.30) which showed a negative correlation pattern with a moderate level of severity, where the correlation value with a negative pattern showed a greater value of uric acid levels the smaller the value of fasting blood sugar levels and female uric acid levels with fasting blood sugar levels obtained results (r = 0.126) so correlation results were obtained with a positive pattern with a weak degree of closeness or no relationship, where the correlation value with a positive pattern showed that the greater the value of uric acid levels, the greater the value fasting blood sugar levels.

The results of statistical tests on the academic community of the Bengkulu Ministry of Health Poltekkes showed that there was no significant relationship between uric acid levels and fasting blood sugar levels (p-value 0.681) and (r = -0.051). This is in line with research conducted by Suhariati (2019) who found out about the relationship between uric acid levels in serum and serum blood glucose levels in Type 2 Diabetes Mellitus patients at the Gatot Subroto Clinic Laboratory in Medan in 2018, which a weak and insignificant correlation shown with a value of r = 0.14 (Suhariati, 2019). However, the results of the study found a significant negative relationship between uric acid and blood sugar levels (Dai *et al.*, 2020).

The absence of a relationship between uric acid levels and fasting blood sugar levels in this study could be caused by several factors, including the absence of a direct assessment of factors that can affect the production of uric acid levels both in purine catabolism and chronic systemic inflammatory responses due to poor metabolic control. Bad and hyperfiltration in the kidney is also one of the factors that affect the results of data analysis.

The mechanism for increasing uric acid with fasting blood sugar occurs because high uric acid can lead to crystallization in joints and blood vessels resulting in inhibited insulin resistance and an increase in blood sugar levels in the body. The results of research at Bhayangkara Palembang Hospital found high uric acid levels in people with type 2 diabetes mellitus with hypertension (. Hyperuricemia is linked to insulin resistance and dysfunction in pancreatic β-cells, which may contribute to the development of type 2 diabetes. While the direct impact of elevated uric acid (UA) levels on diabetes remains debated, there is evidence suggesting that UA could harm pancreatic β-cells. This review explores the mechanisms through which UA induces damage to β-cells, including decreased insulin secretion and cell death triggered by oxidative stress and inflammation. Additionally, UA promotes the expression of inducible nitric oxide synthase (iNOS), which further disrupts β-cell function. Thus, hyperuricemia potentially impairs β-cells, possibly predisposing individuals to diabetes. It is speculated that medications aimed at lowering UA levels could be beneficial in preventing diabetes in hyperuricemic patients (Ghasemi, 2021).

Uric acid has been identified as a marker for several metabolic and hemodynamic abnormalities. Increased serum uric acid concentration plays a role in

the occurrence of morbidity in patients with type 2 diabetes mellitus. The enzymatic effect of xanthine oxidase is to increase the production of (ROS) and uric acid. This will cause oxidative stress and lead to insulin resistance. Insulin resistance itself results in hyperinsulinemia which can increase sodium and water reabsorption including uric acid from the kidney tubules (Kusumasari *et al.*, 2021).

Chronic increase in blood sugar or what is commonly called chronic hyperglycemia that occurs in DM is caused by an effect on insulin secretion. In cells, insulin plays a role, starting from the process of metabolizing carbohydrates, fats, and proteins, to the process of forming DNA and RNA and various growth processes in cells, tissues, or organs. This series of processes and roles also occur in pancreatic beta cells, so it can be said that insulin resistance will be the basis for pancreatic beta cell dysfunction in people with diabetes mellitus (Simanullang *et al.*, 2019).

This is in line with previous studies showing that there is no specific relationship between uric acid levels and fasting blood sugar levels. There is a very weak correlation and not statistically related between uric acid levels and fasting blood sugar in type 2 DM sufferers and obesity. It can be concluded that obesity is a factor that plays an important role in the occurrence of insulin resistance and this condition of insulin resistance is the basis for the occurrence of pancreatic Beta cell dysfunction in patients with diabetes mellitus. Currently, metabolic disorders such as diabetes mellitus and obesity are often associated with increased uric acid levels and their levels can also be used as markers of inflammation or to predict metabolic and cardiovascular complications in patients with obesity and diabetes mellitus (Ume Farwa *et al.*, 2023).

In line with previous studies, it can be concluded that the indigenous ethnic community in North Halmahera has a high prevalence of hyperuricemia (50.83% for males and 69.17% for females) with an average uric acid level of 7.7 ± 2.66 mg/dl. Statistically, there is no significant relationship between uric acid levels. This shows that the results are not consistent in the correlation between uric acid and blood sugar in various places. Various confounding factors such as BMI, purine diet, ethnicity, alcohol consumption, age, gender, and comorbid conditions can affect the results of this study (Boleu *et al.*, 2018).

CONCLUSION

Most of the Characteristics of the Academic Community of the Bengkulu Ministry of Health Poltekkes are <45 years old (59.1%). Most of the academic community is obese (56.1%). last education S1 & S2 (54.5%). Female (53%). Education staff status (56.1%). The average uric acid for men is 5.7 mg/dl and for women is 3.2 mg/dl. The average fasting blood sugar level is 102 mg/dl. There was no significant relationship between uric acid levels and fasting blood sugar levels (p=0.65 r=-0.051). and there is no relationship between male uric acid levels and fasting blood levels (p=0.872 r=-0.30) there is no relationship between uric acid levels and fasting blood sugar levels in the Academic Community of the Bengkulu Ministry of Health Polytechnic. Suggestions for further research are that further research needs to be carried out by controlling factors that can affect uric acid levels and blood glucose levels.

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