Relationship Between Renal Function Test Serum and Lipid Profile in Patients with Diabetes Mellitus

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Relationship Between Renal Function Test Serum and Lipid Profile in Patients with Diabetes Mellitus

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Abstract. The prevalence of diabetes mellitus in the world is increasing. Hyperglycemia in diabetes mellitus can increase the risk of complications in various organs, one of which is chronic renal failure. Diabetic patients with chronic renal failure have an increased risk of cardiovascular disease 10 times higher. Cardiovascular disease is closely related to lipid profile results, one of which is triglycerides as an index of cardiovascular disease risk. In chronic renal failure a decline in kidney function is chronic resulting in glomerular filtration rate falling by more than 50% and will increase the levels of BUN and creatinine in the blood. Levels of BUN and creatinine serum is used as a parameter of kidney function tests. This study aims to determine the relationship between serum BUN and creatinine levels against serum triglyceride levels in patients with diabetes mellitus. This was an observational analytic study with cross sectional design. A sample of 50 was taken selectively at Aisyiyah Siti Fatimah Tulangan Hospital in January 2016 - March 2018. The average BUN was 28.59 mg/dL, the creatinine averaged 2.02 mg/dL and the triglyceride averaged 287.96 mg/dL. Multiple linear regression test results showed significant relationship between BUN with Triglyceride serum (b = -3.73; p = 0.048) and creatinine with Triglyceride serum (b = 83.18; p = 0.002). Based on the results, it is found that there is a significant relationship between BUN and creatinine serum against serum triglyceride in diabetes mellitus patients.

1. Introduction

The development of increasingly advanced technology causes change of lifestyle to be a lot easier and more practical. Unhealthy lifestyles such as excessive and undesirable food consumption and lack of exercise are bad for health and can cause various diseases, both infectious and non-infectious diseases. One of the diseases caused by unhealthy lifestyle is Diabetes Mellitus (DM). Diabetes Mellitus is a complex metabolic disorder characterized by chronic hyperglycemia and is caused by abnormalities of insulin secretion, insulin work, or both. Insulin is a hormone produced by the pancreas. [1] There are two types of diabetes mellitus, namely type 1 and type 2 diabetes. Type 1 diabetes is called an insulin dependent, which characterized by a lack of insulin production. While type 2 diabetes is called a non-dependent insulin caused by less effective of insulin work of the body. As many as 90% of diabetics are type 2 diabetes. [2] The World Health Organization predicts that the number of people with diabetes mellitus in Indonesia will increase from 8.4 million in 2000 to about 21.3 million people in 2030. The prevalence of diabetes mellitus in the world is 415 million people and the number is expected to increase to 642 million people in 2040. The majority of diabetics are between 40 and 59 years of age, and 80% of them live in some low and middle income countries. [3] In Indonesia the number of diabetics each year has increased. According to Riskesdas data (2013), the number of

diabetics in Indonesia is estimated to reach 2.6 million people, and East Java is placed second for the highest number of diabetics in Indonesia. [4]. Patients with diabeties mellitus are not able to absorb glucose properly, so the glucose remains in the blood circulation (hyperglycemia). This can cause damage to body tissues, causing health problems and life-threatening complications. High levels of glucose can consistently lead to some serious diseases that affect the heart and blood vessels, eyes, kidneys and nerves. Diabetes is a major cause of cardiovascular disease, blindness, kidney failure and leg amputation of the lower leg. Cardiovascular disease is the most severe macrovascular complications found in patients with diabetes mellitus. More than one-third of diabetics are at risk for microangiopathic complications, namely retinopathy, nephropathy and neuropathy. Diabetic nephropathy is characterized by hypertension, proteinuria and decreased renal function. This is the main cause of chronic kidney disease. [5] Factors that affect the occurrence of diabetic nephropathy include uncontrolled hyperglycemia, hypertension, male sex, smoking and dyslipidemia. [6] Most of the lipids in the human body and food consist of triglycerides. Triglycerides (TG) or triacylglycerol (TAG) are the main carriers of dietary fat throughout the bloodstream. Triglycerides consist of one glycerol molecule attached to three fatty acids. Triglycerides with cholesterol form blood fats. Most TG contains Very Low Density Lipoproteins (VLDL) and chylomicrons. Triglycerides in blood plasma can be derived either from fat in the diet or made in the body from other energy sources, such as carbohydrates. Some of the calories in the food we eat are not immediately used for energy but converted into triglycerides and stored in fat cells. When the body needs energy and there is not enough energy in the food then triglycerides will be released from the fat cells and metabolized. [7,8] Kidney plays an important role in various body metabolism, such as: excretion, maintaining water and electrolytes balance. The presence of impaired renal function due to renal failure may affect the disposal of Non Protein Nitrogen (NPN). NPN is the remains of the body's metabolic products, such as nucleic acids, amino acids and proteins. Substances of excretion are urea, creatinine and uric acid. Ureum is the end-product of protein catabolism and amino acids produced by the liver and is distributed through intracellular and extracellular fluids into the blood. The blood urea nitrogen (BUN) content can be converted to ureum by multiplying 2.14 mg / dL urea. [9] Creatinine is the product of creatin decomposition. Creatine is synthesized in the liver and is present in almost all skeletal muscles. Creatinine is a metabolic product that has a larger molecule than urea and is unconfortable to the tubular membrane, so creatinine that is filtered by the glomerulus will be excreted into the urine. [10,11] In the state of renal dysfunction, the creatinine filtration capacity is reduced so that the creatinine in the blood will increase. At the stage of chronic kidney disease, there will be a gradual decrease the function of progressive nephron, characterized by elevated serum urea and creatinine levels. [12] In a previous study it was found that there was a relationship between lipid profile with serum creatinine and uric acid associated with the risk of diabetes mellitus in cardiovascular disease. [13] However, studies of serum BUN and creatinine with triglyceride levels are rare, so research needs to be done on the relationship of renal function tests (serum BUN and creatinine) with lipid profiles (triglycerides) in patients with diabetes mellitus.

2. Experimental Method

This type of research is observational analytics. The research design was used cross sectional study. The research was conducted at Aisyiyah Siti Fatimah Tulangan Hospital in January 2016 until March 2018. A sample of 50 was taken by selective sampling. Types of data collected were secondary data resulting from examining BUN, creatinine, and triglycerides serum in patients with diabetes mellitus. BUN serum is analyzed by using enzymatic-UV kinetic method, while creatinine serum is analyzed by using Jaffe method, and triglyceride serum is analyzed by using enzymatic-colorimetric method on photometer. Data were analyzed statistically with multiple linear regression analysis using SPSS program version 22.

3. Results and Discussion

Characteristics of subjects were seen by age and sex. Table 1 shows that from 50 subjects, 26% of patients with diabetes mellitus were 40 to 50 years old, 40% were 51 to 60 years old, 26% were 61 to 70 years old, and 8% were 71 to 80 years old; with male gender patients amount to 30% and female at 70%. Patients with diabetes mellitus with normal serum BUN level of 56%, while for high serum BUN rate of 44%. Serum creatinine levels of both male and female have different normal values. In this study, the normal serum creatinine level was 8%, the serum creatinine level was low at 6%, while the high serum creatinine level was 16%. Serum creatinine levels of women with diabetes mellitus with normal category of 24%, low category 2%, and high category of 44%. Table 1 also showed serum triglyceride levels in patients with normal diabetes mellitus by 36%, and a high of 64%.

Table 1. Characteristics of research subjects

Characteristics	Criteria	n	%
Age	40-50 years old	13	26.0
	51-60 years old	20	40.0
	61-70 years old	13	26.0
	71-80 years old	4	8.0
Gender	Male	15	30.0
	Female	35	70.0
BUN Serum	Normal (5-20 mg/dl)	28	56.0
	High (>20 mg/dl)	22	44.0
Creatinin Serum			
Male	Normal (0.9 – 1.3 mg/dl)	4	8.0
	Low (<0.9 mg/dl)	3	6.0
	High (>1.3 mg/dl)	8	16.0
Female	Normal (0.6 – 1.1 mg/dl)	12	24.0
	Low (<0.6 mg/dl)	1	2.0
	High (>1.1 mg/dl)	22	44.0
Triglyserides Serum	Normal (≤200 mg/dl)	18	36.0
	High (>200mg/dl)	32	64.0

Table 2. Multiple linear regression analysis of the relationship between BUN and creatinine against triglycerides serum in patients with diabetes mellitus.

Independent variable	b	t	P
BUN (mg/dL)	-3.73	-2.027	0.048
Creatinin (mg/dL)	83.18	3.264	0.002
t table	= 1.678		
R	= 0.530		
R-square	= 0.280		
Adj. R-square	= 0.250		
F	= 9.159		
Sig. F	= 0.000		
F table	= 3.200		

There was significantly different regarding coefficient regression between BUN with triglyceride serum (b=-3.73, p=0.048). The decreasing of BUN serum level of 1 mg/dL may increase triglyceride serum levels in patients due to diabetes mellitus of 3.73 mg/dL. There was significantly different regarding coefficient regression between creatinine with triglyceride serum (b= 83.18, p=0.002). The

decreasing of creatinine serum level of 1 mg/dL may increase triglyceride serum levels in patients due to diabetes mellitus of 83.18 mg/dL. Based on table 2 it is known that R-Square value is 0.280 or 28.0%. This means that serum triglyceride levels are influenced by variable BUN and creatinine serum with a percentage of 28.0%, whereas 72.0% is influenced by other factors not investigated. BUN and creatinine serum levels have a simultaneous effect on triglyceride serum levels in patients with diabetes mellitus. This is evidenced by the statistical results of the value of F arithmetic is 9.159 (sig F = 0.000), so F arithmetic > F table (9.159> 3200). Table 2 also shows an relationship between BUN and triglycerides serum. Evident from the statistic that is t value for BUN variable equal to 2.027 (p = 0.048), so t count> t table (2.027> 1.678), but t value is negative which show the opposite relationship between serum BUN with serum triglyceride. Serum creatinine also has an relationship with triglycerides serum seen from t value for creatinine variable of 3.264 (p = 0.002), so t count > t table (3.264> 1.678), and t value is positive which shows a positive relationship between creatinine serum with triglycerides serum in patients with diabetes mellitus. In general, dyslipidemia is a condition that is also experienced by patients with diabetes mellitus. Diabetes mellitus patients have higher lipid profile levels than patients without diabetes mellitus one of them is triglyceride (TG). TG levels increase due to an increase in the number of particles Very Low Density Lipoprotein (VLDL) and I ntermediate Density Lipoprotein (IDL) in the blood circulation. [14] The main determinant of hypertriglyceridemia is the overproduction of VLDL-TG in the blood circulation in patients with diabetes mellitus. This results in the accumulation of fat in hepatocytes and insulin resistance, [15] resulting in increased glucose levels in the blood. This is consistent with studies in Thailand showing a positive relationship between TG, HbA1c, and glucose levels [16]. One of the renal function tests is creatinine. Creatinine has a relatively constant concentration from day to day. When creatinine levels greater than normal values indicate impaired renal function. [17] Rapid decline in kidney function occurs in patients with diabetes mellitus. [18] Creatinine levels increased more in patients with diabetes mellitus. [19]. Another renal function test is Bood Urea Nitrogen (BUN). BUN is a normal waste product of normal metabolism that is excreted by the kidneys and is a residual product of protein breakdown. In cases of kidney function disorder, BUN is not excreted normally by the kidneys so it accumulates in the body and causes the levels of urea in the blood to become elevated. [20] BUN is also one of the laboratory tests to confirm hypertriglyceridemia. [21] Based on the results of the study showed a statistically negative relationship between BUN with triglycerides. The higher serum TG levels, the lower the serum BUN level. BUN levels are influenced by non-renal factors such as diet. Decreased levels of BUN can be caused by dietary protein, liver disease, and sickle cell anemia. [22]

4. Conclusion

BUN serum has a negative relationship with triglycerides serum in patients with diabetes mellitus, therefore a decrease in BUN serum may increase triglycerides serum. In the other hand, creatinine serum has a positive relationship with triglycerides serum, thus the increase in creatinine serum can also increase triglycerides serum in patients with diabetes mellitus at Aisyiyah Siti Fatimah Tulangan Hospital.

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