

Correlation of the Duration of Type 2 Diabetes Mellitus and Creatinine Levels

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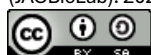
ABSTRACT

Creatinine examination can function as an indicator of the course of DM disease that has the potential to experience kidney failure and as a control of kidney function in patients with DM who have experienced complications of kidney failure. A study has been conducted to determine the relationship between the duration of patients with type 2 DM and creatinine levels. Type 2 DM patients were obtained from those diagnosed with type 2 DM from 6 months to 4 years. Data were processed using linear regression and Spearman's relationship test. With linear regression between the duration of Type 2 DM and the average creatinine level, the equation of the line $Y = 1.7176X - 0.534$ was obtained with R^2 of 0.8309. This means that the determination of the duration of Type 2 Diabetes mellitus on creatinine levels is 83.09%. From the Spearman test, it was found that starting from 1 year, two years to 3-4 years of suffering from type 2 DM, a significant relationship began to appear between the duration of suffering from DM and creatinine levels. This was also confirmed by a drastic increase in the average creatinine level from the second to the third year, which was 211%. This shows that the longer suffering from Type 2 DM, the greater the relationship with the increase in creatinine levels. The level of relationship from one year of suffering from Type 2 DM with the increase in creatinine is also getting stronger.

Keywords: Type 2 diabetes mellitus, Creatinine

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INTRODUCTION

The International Diabetes Federation (IDF) in its 10th edition atlas at the end of 2021 there were 537 million people and this number is estimated to continue to increase to around 643 million people in 2030, then in 2045 it is estimated to reach 783 million people.¹ According to the International Federation of Diabetes (IDF), the number of diabetes sufferers in Indonesia is estimated to reach 28.57 million people in 2045. Diabetes mellitus not only affects adults but also children and adolescents aged 19 years, where the number of diabetes sufferers in this group also increases every year, it is estimated that more than 1.2 million children experience type 1 diabetes mellitus.² The 10th edition of the atlas states that in Indonesia, the estimated number of adults aged 20-79 with diabetes is 19,465. Meanwhile, the total adult population aged 20-79 is 179,720,500. Therefore, if we can conclude from these two figures, the prevalence of diabetes in those aged 20-79 is 10.65, meaning 1 in 9 people has diabetes [1].

In accordance with this, the 2018 Basic Health Research (Riskesdas) showed a significant increase in the prevalence of type 2 diabetes mellitus, namely 6.9% in 2013 to 8.5% in 2018. And the prevalence of diabetes in Indonesia is estimated to increase from 9.19% in 2020 to 16.09% in 2045, in 2021 Indonesia will be in 5th position in the world with the number of diabetes sufferers as many as 19.47 million people [3].

Blood creatinine levels are one of the parameters used to assess kidney function in people with diabetes, as plasma concentrations and urinary excretion are relatively constant over a 24-hour period. Creatinine is excreted by the kidneys through a combination of filtration and secretion, and its concentration in plasma remains relatively constant from day to day. Higher-than-normal levels indicate impaired kidney function, which leads to elevated creatinine levels [4]. Therefore, creatinine testing can serve as an indicator of the progression of diabetes mellitus (DM) that can potentially lead to kidney failure and as a kidney function monitor in patients with diabetes who are already experiencing complications of kidney failure. Normal creatinine levels in men are 0.7–1.3 mg/dL, while in women they are 0.6–1.1 mg/dL [5].

Based on previous research conducted by Veronika Riani Woli [6] in Sidorejo City, Jabung District, Malang Province, there is information that sufferers of type 2 diabetes mellitus for 1-5 years have higher creatinine levels compared to sufferers who have suffered for less than one year.

Research conducted by Dinda Ayu Janeta [7], on the relationship between duration of Type 2 DM with Creatinine shows that the average duration of type 2 DM patients was 12 years with the longest group of 11-15 years and the least long group of >20 years. The average serum creatinine level was 1.41 mg/dl with the lowest level of 0.76 mg/dl and the highest level of 3.53 mg/dl. The results of the Spearman correlation test showed a significant relationship between the duration of type 2 DM and serum creatinine levels with a moderate level of relationship and a positive pattern of 0.001 ($p < 0.05$) with an r value = 0.530.

MATERIALS AND METHODS

This descriptive study aimed to determine creatinine levels in patients with type 2 diabetes mellitus at Harapan Sehati Hospital. The creatinine examination method used was the Enzymatic Colorimetric method. Samples were taken using a purposive sampling method, including patients diagnosed with type 2 diabetes mellitus who met the inclusion criteria.

The study was conducted at Harapan Sehati Hospital in Bogor from October to November 2024. Inclusion criteria for this study were patients with type 2 diabetes mellitus, aged 40 years and above, and female. Exclusion criteria included patients with type 2 diabetes who were unwilling to participate, were unwell, or unable to communicate effectively.

RESULTS AND DISCUSSION

Patient data shows that the youngest patient was 41 years old, and the oldest was 78 years old. The average age of patients was 59.10 years. The data showed that the average creatinine level was 1.69 mg/dl, with the lowest creatinine level being 0.8 mg/dl and the highest creatinine level being 8.4 mg/dl. Eleven patients with type 2 diabetes had normal creatinine levels, while 19 had high creatinine levels (above 1.1 mg/dl).

Eleven patients with type 2 diabetes had a history of less than 1 year (approximately 6 months), 5 had a history of 1 year, 11 had a history of 2 years, and 3 had a history of 3-4 years.

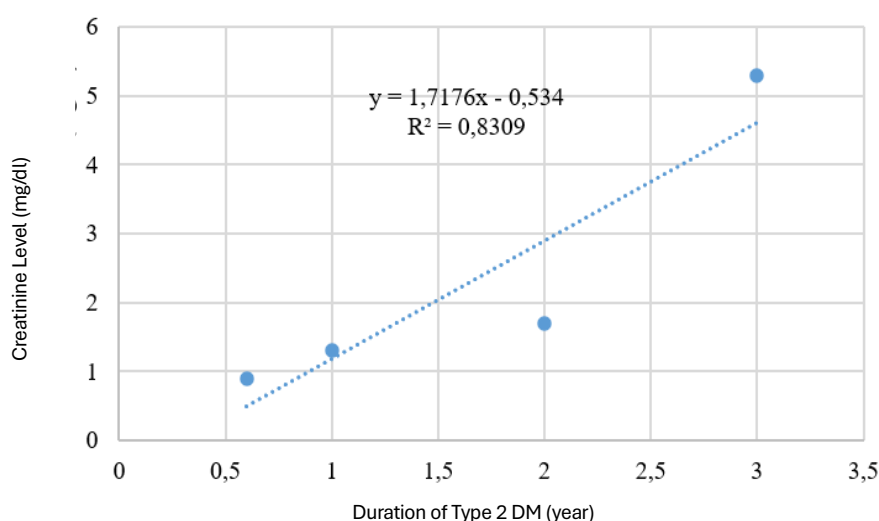


Figure 1. Correlation graph of duration of DM vs. average creatinine levels

By linear regression between the duration of Type 2 DM and the average creatinine level, the equation $Y = 1.7176X - 0.534$ was obtained with R^2 of 0.8309. This means that the determination of the duration of Type 2 Diabetes mellitus on creatinine levels is 83.09%.

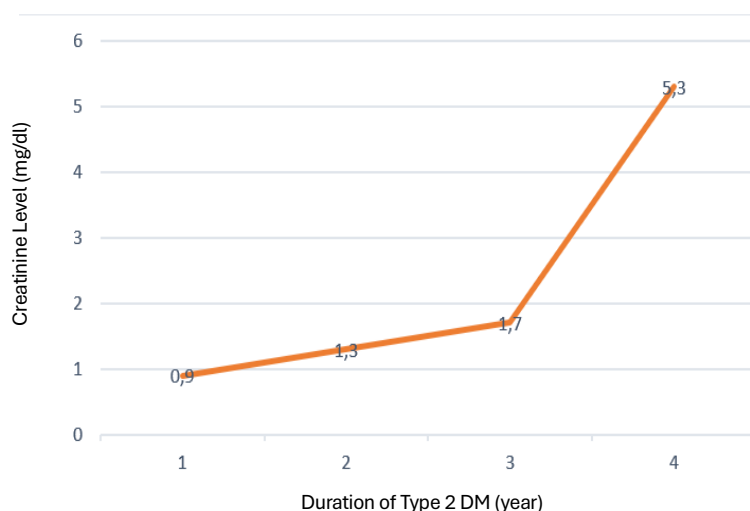


Figure 2. Graph of duration of suffering from DM vs increase in creatinine levels

Patient data shows that the youngest patient was 41 years old, and the oldest was 78. The average age was 59.10 years. The average creatinine level was 1.69 mg/dl, with the lowest creatinine level being 0.8 mg/dl and the highest creatinine level being 8.4 mg/dl. Eleven patients with type 2 diabetes had normal creatinine levels, while 19 had high creatinine levels (above 1.1 mg/dl). Eleven patients with type 2 diabetes had a history of less than 1 year (approximately 6 months), 5 patients had a history of 1 year, 11 patients had a history of 2 years, and 3-4 years had a history of 3 years.

A linear regression between the duration of Type 2 DM and the average creatinine level yielded a linear equation of $Y = 1.7176X - 0.534$, with an R^2 of 0.8309. This means that the duration of Type 2 DM determines creatinine levels by 83.09%. The Spearman test revealed that, from one year, two years, to three to four years of Type 2 DM, a significant relationship between duration of DM and creatinine levels began to emerge. This was further supported by the drastic increase in average creatinine levels from the second to the third year, amounting to 211%. This indicates that the longer the duration of Type 2 DM, the stronger the relationship with creatinine levels. The association between one year of Type 2 DM and creatinine levels also became stronger [9].

The duration of diabetes mellitus indicates how long a patient has had diabetes since the diagnosis. The duration of diabetes mellitus is associated with the risk of several complications that arise later. The main factor triggering complications in diabetes mellitus, besides duration, is the severity of the diabetes. It can be concluded that the longer a person suffers from diabetes mellitus, the more likely they are to experience various complications.

Creatinine is a waste product of muscle protein metabolism. The amount of creatine per unit of skeletal muscle mass is consistent with the rate of creatine breakdown. Therefore, plasma creatinine concentrations are very stable and are a direct reflection of skeletal muscle mass. Blood creatinine levels increase due to decreased kidney function in excreting creatinine, preventing it from being excreted in the urine. ⁸ This was seen in the sample group with type 2 diabetes mellitus, where after 3 to 5 years, the percentage increase in creatinine reached 211.76%. This indicates that complications from tissue damage due to high blood glucose levels have already led to a decline in kidney function as a filtering organ.

In this study, in patients with type 2 diabetes mellitus, high glucose levels can damage the kidney filter over time, affecting kidney function and increasing blood creatinine levels. Several factors can contribute to normal creatinine levels in type 2 diabetes patients in this study. Normal creatinine levels are generally maintained at a constant level, and levels above the normal range indicate impaired kidney function. Other factors that influence creatinine levels include blood glucose levels and the duration of type 2 diabetes. High blood glucose levels weaken and make blood vessel walls more fragile, leading to blockages in small blood vessels, resulting in microvascular complications such as nephropathy.

High creatinine levels indicate the onset of decreased kidney function, which can lead to kidney failure. This is due to the loss of some nephrons and incomplete creatinine filtration, resulting in elevated blood creatinine levels.

9 Long-term diabetes causes changes in small blood vessels that can lead to kidney damage, which can lead to severe kidney failure.

This is in line with research by Zulfian [10], who found a significant correlation between random blood sugar (GDS) and serum creatinine levels in patients with type 2 diabetes, with a p-value of 0.000. Also, research by Wahid Ullah [11] found that both serum urea and creatinine showed a strong positive correlation with glucose levels and remained statistically significant ($p < 0.01$). Similarly, blood glucose levels showed a strong correlation with kidney function test parameters. Therefore, it is concluded that serum urea and creatinine are important parameters for assessing kidney function in diabetes mellitus.

CONCLUSIONS

It was found that starting from 1 year, two years to 3-4 years of suffering from type 2 DM, a significant relationship began to appear between the duration of suffering from DM and creatinine levels. This was also confirmed by a drastic increase in the average creatinine level from the second to the third year, which was 211%. This shows that the longer suffering from Type 2 DM, the greater the relationship with the increase in creatinine levels. The level of relationship from one year of suffering from Type 2 DM with the increase in creatinine is also getting stronger.

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