
THE DESCRIPTION OF BLOOD SERUM CREATININE LEVELS IN OUTPATIENT TYPE 2 DIABETES MELLITUS PATIENTS AT KASIH BUNDA CIMAHU HOSPITAL

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Abstract

Diabetes Mellitus represents a cluster of metabolic disorders marked by elevated blood sugar levels resulting from irregularities in the secretion of insulin, its functioning, or a combination of both. Creatinine is a substance produced by the endogenous metabolism of skeletal muscles, which is excreted in the urine after glomerular filtration, and is not reabsorbed or secreted by the renal tubules. This descriptive research aims to find out the picture of serum creatinine levels in people with Type 2 Diabetes Mellitus. The sampling technique used accidental sampling, a sample taken from people with Type 2 Diabetes Mellitus who came to the laboratory and measured their creatinine levels. The population in this study was 458 people calculated from the average patients for 3 months from January 2022 to March 2022. For samples taken based on the calculation formula with the slovin method, 82 samples were obtained. Serum creatinine levels of people with Type 2 Diabetes Mellitus at Kasih Bunda Cimahi Hospital were 50 people (61.0%) had high creatinine levels and 32 people (39.0%) had normal creatinine levels. Based on the characteristics of the age group, high serum creatinine levels were obtained dominated in the age group of 51-65 years, namely 51.2%, based on gender characteristics higher creatinine levels were found in people with Type 2 Diabetes Mellitus with the female sex, namely 62.5% than in men, based on the characteristics of long-suffering obtained results that high creatinine levels were found in the old group suffering from Diabetes Mellitus Type 2 diving 6-10 years that is 72%.

Keywords: Diabetes Mellitus, Creatinine

Introduction

Diabetes Mellitus represents a group of metabolic disorders characterized by hyperglycemia that occurs due to abnormalities in insulin secretion, insulin action, or possibly both. Chronic hyperglycemia in Diabetes Mellitus is associated with long-term damage, dysfunction, or failure of several organs. The World Health Organization (WHO) previously formulated that Diabetes Mellitus cannot be delineated with a concise and definitive answer, but in general, it can be attributed to and caused by a combination of factors that are relative to absolute insulin deficiency and disturbances in insulin features (Punasari, 2004).

According to the World Health Organization (WHO), the number of Diabetes Mellitus patients in Indonesia ranks as the fourth largest in the world after the United States, India, and China. WHO predicts a significant increase in the number of individuals with Diabetes Mellitus in the forthcoming years. WHO forecasts a rise in the number of Diabetes patients in Indonesia from 8.4 million in the year 2000 to approximately 21.3 million by the year 2030.

Hyperglycemia will lead to the occurrence of various chronic complications that can affect different organs such as the eyes, kidneys, nerves, and blood vessels. Diabetic Nephropathy is a condition where the kidneys experience reduced function and damage to the blood filtration membrane due to high blood glucose levels.

The condition of Diabetic Nephropathy is kidney damage found in 35-45% of Diabetes Mellitus patients, particularly in Type 2 Diabetes Mellitus (Mahara, 2016). Creatinine is a substance produced by the endogenous metabolism of skeletal muscles, which is excreted in urine after glomerular filtration and is neither reabsorbed nor secreted by the renal tubules. The high or low levels of creatinine in the blood are used as a significant indicator of whether an individual is experiencing renal functional impairment.

The examination of creatinine is a specific assessment and one of the indicators to determine the presence of renal disturbances, as creatinine levels are not influenced by protein consumption, and the excretory concentration in plasma and urine remains relatively constant over 24 hours (Padma, Gusti Ayu Putu, 2010).

The examination of blood creatinine levels is one of the parameters used to assess renal function in Diabetes Mellitus patients. Individuals with Diabetes, especially those with impaired or compromised kidneys, experience an increase in creatinine levels.

Creatinine levels indicate complications of Type 2 Diabetes Mellitus. Creatinine levels can be examined using enzymatic methods, and an elevation in serum creatinine levels indicates a decrease in kidney function (Doa, 2016). The normal range of creatinine is 0.7-1.3 mg/dL in males and 0.6-1.1 mg/dL in females. A twofold increase in creatinine levels indicates a 50% decrease in kidney function, and a threefold increase in serum creatinine levels indicates a 75% decrease in kidney function (Astrid A. Alfanso, 2016).

The relationship of serum creatinine in Diabetes Mellitus patients is such that Diabetes Mellitus is associated with high blood levels (hyperglycemia), which leads to damaged blood vessel walls, resulting in blockages that give rise to microvascular complications, one of which is Diabetic Nephropathy. This condition can also play a role in the formation of atherosclerosis, causing blood flow disturbances that can hinder the filtration process in the glomerulus and lead to decreased kidney function, marked by elevated blood creatinine levels (Yunisrah, 2019).

The aim of this research is to determine the serum creatinine levels in Type 2 Diabetes Mellitus patients receiving outpatient care at RSUD Kasih Bunda Cimahi and to observe creatinine levels in Type 2 Diabetes Mellitus patients based on age groups, gender, and duration of suffering. Diabetes Mellitus (DM) is a metabolic disorder characterized by an elevation in blood glucose levels (Sacher and McPherson, 2004).

Diabetes Mellitus is a condition in which elevated blood glucose levels are caused by the pancreas failing to produce insulin or by the occurrence of insulin resistance (Aveonita, 2015). Diabetes Mellitus is a syndrome characterized by the disruption of carbohydrate, fat, and protein metabolism due to reduced insulin secretion or decreased insulin tissue sensitivity (Guyton & Hall, 2007).

Patients with Diabetes Mellitus are characterized by fasting blood glucose levels ≥ 126 mg/dL and 2 hours after a meal ≥ 200 mg/dL. Diabetes Mellitus can occur when the pancreas does not produce sufficient insulin or when the produced insulin cannot be effectively utilized. Polydipsia, polyuria, polyphagia, numbness, and weight loss are classical symptoms of this disease (PERKENI, 2015).

Hyperglycemia is the initial cause of the onset of diabetes. In the early stage, hyperglycemia places an individual in a pre-diabetic condition. If it becomes severe, diabetes will develop. Pre-diabetes is a condition where blood sugar levels are higher than normal but not high enough to be considered diabetes. This state can be referred to as borderline diabetes. Most people with pre-diabetes do not show symptoms. In individuals with pre-diabetes, the balance between glucose and insulin is disrupted (Sasongkowati, 2014).

Blood glucose levels rise when consuming carbohydrates. Through the process of digestion, glucose is taken up into the circulatory system. As blood glucose levels increase, it triggers the pancreas to release the hormone insulin. Insulin enables body cells to absorb glucose from the blood vessels, allowing these cells to use it as an energy reserve. Insulin acts like a key to open the door into the blood. The role of insulin, working in conjunction with other hormones, is to maintain blood glucose stability. Diabetes arises when the pancreas does not produce enough insulin or when the body becomes resistant to the effects of insulin.

The resulting impact is that glucose cannot enter cells and accumulates in the bloodstream. Gradually, high blood glucose levels can damage the eyes, nerve tissues, and blood vessels, as well as increase the risk of heart and kidney diseases, posing a threat to the circulatory system. Early diagnosis and control of blood glucose levels are crucial in preventing these health problems (Kingham, 2009).

The primary cause of an individual experiencing chronic kidney failure, necessitating hemolysis (dialysis) treatment, is due to diabetes and high blood pressure. If both conditions are well-controlled through regular treatment, kidney disease can be prevented or slowed down as early as possible. Chronic kidney disease can also increase the risk of

cardiovascular diseases (heart and blood vessel diseases), which ultimately constitute the leading cause of death for individuals with kidney failure (Arsono, 2005)

Creatinine is the end product of creatine metabolism found in skeletal muscles. In skeletal muscles, creatine is reversibly bound to phosphate in the form of phosphocreatine, which serves as an energy storage compound. A small portion of creatine serves no useful function and is transported by the blood to the kidneys (Sacher, 2004). The normal range of serum creatinine levels in men is 0.7-1.3mg/dL, while in women, it is 0.6-1.1 mg/dL. An increase in creatinine levels indicates a decrease in kidney function. If kidney disease reaches an advanced stage and the kidneys no longer function, serum creatinine levels increase, and creatinine clearance tests decrease (<15%), which is referred to as kidney failure (Ayuni Sri Putu et al., 2014).

Creatinine Levels in Diabetes Patients Based on Characteristics

A. Age

The decline in kidney function is influenced by age. In advanced age, the glomerular filtration rate decreases. Regeneration of new nephrons by the kidneys is not possible, so when kidney damage or aging processes occur, nephron loss takes place. The number of functioning nephrons decreases by 10% every 10 years at the age of 40, and at the age of 80, only 40% of nephrons function properly. However, this varies slightly from 10-15% in each individual. Individuals over 45 years of age are more susceptible to diabetes.

As one ages, a decrease in kidney function follows. This is due to the loss of some nephrons after the age of 40, leading to imperfect creatinine filtration and an increase in blood creatinine levels.

B. Gender

Serum creatinine concentration reflects muscle mass; creatinine levels are higher in males than in females. The total daily excretion of creatinine is normally around 14-26 mg/kg/day in males and 11-20 mg/kg/day in females. Males are more prone to terminal kidney failure than females, as seen in the percentage of terminal kidney failure among diabetes mellitus patients, where males outnumber females.

C. Duration of Suffering

Several studies indicate that type 2 diabetes mellitus patients who are newly diagnosed generally have been suffering from diabetes mellitus for less than 4-7 years before the diagnosis is established. At the time of diagnosis, 25% have retinopathy, 9% have neuropathy, and 8% have nephropathy.

The longer the duration of diabetes mellitus, the higher the risk of terminal kidney failure. This is often observed in patients with Diabetes Mellitus over a period of >5 years. Prolonged diabetes leads to kidney damage, which can result in severe kidney failure. However, it takes about 5-10 years for kidney damage to become a significant issue.

The examination of blood creatinine is a crucial parameter in determining kidney function. Serum creatinine examination greatly assists in formulating therapy decisions for patients with kidney function disorders. The high or low levels of creatinine in the blood serve as an important indicator in determining whether an individual with kidney function impairment requires hemodialysis or not (Alfanzo, 2016).

Several methods commonly used for serum creatinine examination are as follows:

- A. Jaffe Reaction: The basis of this method is that creatinine in an alkaline environment reacts with picric acid to form a yellow-orange compound. Photometer equipment is used.
- B. Kinetic: This method's foundation is relatively similar; however, it requires only one reading in the measurement. Autoanalyzer equipment is utilized.
- C. Enzymatic Blood: The basis of this method is that the substrate compound in the sample reacts with enzymes to form a substrate compound. Photometer equipment is used.

Method

This type of examination is descriptive. It is a research type aimed at observing the Profile of Serum Creatinine Levels in Type 2 Diabetes use a sample drawn from that population. Conclusions drawn from studying the sample will be applied to the population. To ensure the sample represents the population, determining the sample size used in this study is based on the Slovin method proposed by Husein Umar, which is:

n = Sample size
 N = Population Size
 e2 = Tolerable Error Rate in Selecting Sample Members (the error rate in this sampling is 10%)
 Population N = 458, assuming the error rate (e) = 10%. Therefore, the required sample size for this research is as follows:

Mellitus patients who are outpatient visitors at Kasih Bunda Hospital in Cimahi. The population is a generalization area consisting of off to 82.

$$n = \frac{N}{1+N(e)^2} = \frac{458}{1+458(0.1)^2} = 82,07 \text{ Rounded}$$

objects or subjects with specific qualities and characteristics determined by the researcher for study and subsequent conclusion drawing. The population in this research consists of Type 2 Diabetes Mellitus outpatient patients who visit the Laboratory of Kasih Bunda Hospital for periodic blood serum creatinine testing. The population size in this research is 458 individuals, calculated from the average number of patients over a 3-month period from January 2022 to March 2022.

The sample is a portion of the quantity and characteristics possessed by that population. When the population is large and the researcher cannot possibly study all individuals within the population, perhaps due to limitations in funding, resources, and time, the researcher can to determine the sample size with a 10% error rate, 82 outpatient Type 2 Diabetes Mellitus patients visiting the laboratory at Kasih Bunda Hospital for blood serum creatinine level testing are required.

The sampling technique employed is accidental sampling, which involves selecting samples from Type 2 Diabetes Mellitus patients who come to the laboratory and measuring their creatinine levels.

The data used in this study consists of Primary and Secondary data. Primary data are acquired directly by the researcher through the direct examination of blood serum creatinine levels in outpatient Type 2 Diabetes Mellitus patients. Secondary data are obtained and documented by other parties. In this study, Secondary data involve examining the history of the duration of Diabetes Mellitus and diagnosing complications associated with Type 2 Diabetes Mellitus. The method employed for Serum Creatinine Examination is based on the Kinetic Method.

The instruments and materials used for Creatinine Examination are as follows: Instruments: Laboratory coat, Sterile nitrile gloves, Red-capped (Non-anticoagulant Vacutainer tubes), 3cc Terumo syringe, Onemade alcohol swabs, Onemade adhesive tape, Tourniquet, CoreLab centrifuge, blue tip and Yellow tip pipette tips, Sample cup, 1000µL micropipette, Easy ra Autoanalyzer instrument. Materials: Blood Serum. Reagents: The reagents used in this study are MEDICA reagents, consisting of Reagent R1 and R2.

Results and Discussion

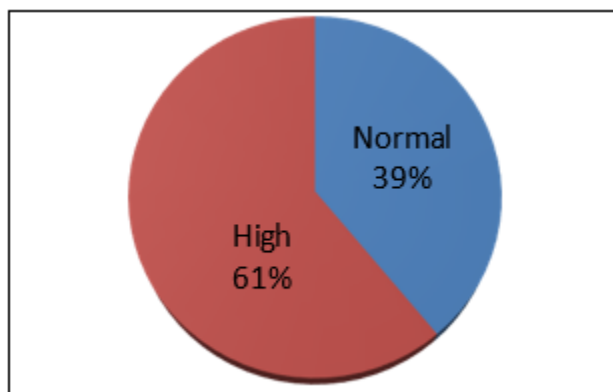
After conducting research on 82 sample patients with Type 2 Diabetes Mellitus examined at Kasih Bunda Hospital Cimahi during the period of April - May 2022, the following results were obtained:

Table 1
High and Normal Creatinine Results

Creatinine Results	Quantity	Percentage (%)
Normal	32	39.0
High	50	61.0
Total	82	100.0

Source: Processed by the author (2022)

Figure 1
Pie Chart Creatinine Level Results



Source: Processed by the author (2022)

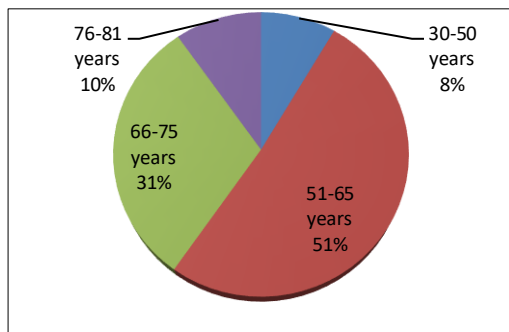
The investigation carried out at Kasih Bunda Hospital Cimahi on 82 samples of Type 2 Diabetes Mellitus patients in the months of April-May 2022 yielded creatinine levels categorized into two groups: High and Normal. Creatinine results are considered High if they exceed the normal range (0.7-1.3 mg/dL) for males and (0.6-1.1 mg/dL) for females. Based on the findings of the study, it was determined that 61.0% had elevated creatinine levels, while 39% had normal creatinine levels. This can be attributed to the dominance of patients with Diabetes Mellitus of less than 10 years in this study compared to those who have had Diabetes Mellitus for more than 10 years. Creatinine levels increase after >10 years

Table 2
The Characteristics of Type 2 Diabetes Patients Based on Age Group

Age group (Years)	Quantity	Percentage (%)
30 - 50 Years	7	8.5
51 - 65 Years	42	51.2
66 - 75 Years	25	30.5
76 - 81 Years	8	9.8
Total	82	100.0

Source: Processed by the author (2022)

Figure 2
Pie Chart The Characteristics of Type 2 Diabetes Patients Based on Age Group



Source: Processed by the author (2022)

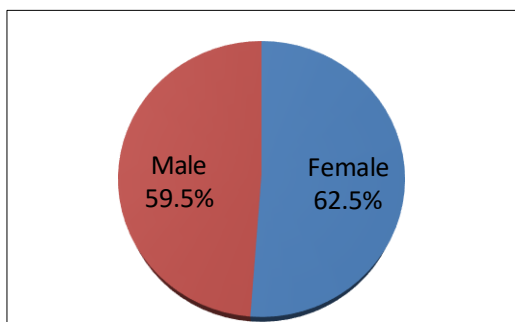
From the outcomes of the research conducted at Kasih Bunda Hospital Cimahi, it was determined that high serum creatinine levels are predominantly found within the age group of 51-65 years, accounting for 51.2% or a total of 28 individuals. This result aligns with previous studies indicating that individuals with Type 2 Diabetes Mellitus exhibit predominantly elevated creatinine levels within the age group of >45 years. The findings of this study also correspond with Nurhayati's research at RS. Bhayangkara Kota Palembang, which revealed that individuals with Type 2 Diabetes Mellitus, exhibiting high creatinine levels, are predominantly within the age group of 61-70 years, at a rate of 50%. Individuals above the age of 40 are more susceptible to Diabetes Mellitus due to the process of nephron loss that occurs after the age of 40.

Table 3
The Characteristics of Type 2 Diabetes Mellitus Patients Based on Gender

Gender	Participant
Male	42
Female	40
Total	82

Source: Processed by the author (2022)

Figure 3
Pie Chart The Characteristics of Type 2 Diabetes Mellitus Patients Based on Gender



Source: Processed by the author (2022)

Based on the research conducted on outpatient Type 2 Diabetes Mellitus patients at Kasih Bunda Hospital Cimahi, the results indicate that females experience a higher increase in creatinine levels, with a total of 25 individuals (62.5%) out of 82 respondents. The research findings revealed that higher creatinine levels are predominantly found in female patients with Type 2 Diabetes Mellitus, comprising 25 individuals (62.5%) with elevated creatinine levels and 15

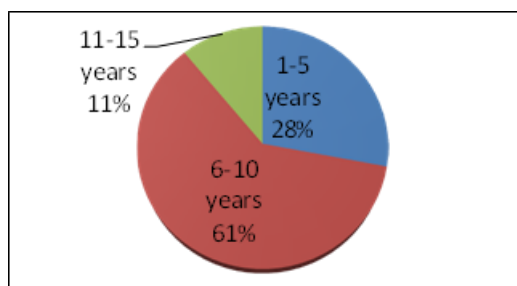
individuals (37.5%) with normal creatinine levels. In contrast, among male patients, 25 individuals (59.5%) exhibited high serum creatinine levels, while 17 individuals had normal creatinine levels.

Table 4
The Characteristics of Patients with Type 2 Diabetes Mellitus Based on Length of Suffering from Diabetes Mellitus

Duration of suffering	Quantity	Percentage (%)
1 - 5 Years	23	28.0
6 - 10 Years	50	61.0
11 - 15 Years	9	11.0
Total	82	100.0

Source: Processed by the author (2022)

Figure 4
Pie Chart The Characteristics of Patients with Type 2 Diabetes Mellitus Based on Length of Suffering from Diabetes Mellitus



Source: Processed by the author (2022)

Based on the research results conducted on serum creatinine levels in Type 2 Diabetes Mellitus patients at Kasih Bunda Hospital Cimahi, it is found that concerning the duration of suffering, elevated creatinine levels are predominantly observed in the group of patients who have been suffering from Type 2 Diabetes Mellitus for 6-10 years, amounting to 28 individuals (72%).

Conclusion and Recommendations

Conclusion

From the research conducted on outpatient Type 2 Diabetes Mellitus patients at Kasih Bunda Hospital Cimahi, involving 82 samples, the following conclusions can be drawn based on the characteristics of age groups, gender, and duration of suffering from Type 2 Diabetes Mellitus: Serum creatinine levels in Type 2 Diabetes Mellitus patients at Kasih Bunda Hospital Cimahi showed that 50 individuals (61.0%) had elevated creatinine levels, and 32 individuals (39.0%) had normal creatinine levels. Based on the characteristics of age groups, elevated creatinine levels were predominantly observed in the 51-65 age group, accounting for 51.2%. Based on gender characteristics, higher creatinine levels were more commonly found in female patients with Type 2 Diabetes Mellitus, representing 62.5% compared to males. Regarding the characteristic of duration of suffering, the results showed that elevated creatinine levels were frequently found in the group suffering from Type 2 Diabetes Mellitus for 6-10 years, at 72%.

Recommendations

1. Patients with Type 2 Diabetes Mellitus are advised to engage in sufficient physical activity or exercise and to regularly monitor their kidney function during treatment.

2. Patients are encouraged to adhere to the diet prescribed by the hospital or physician to maintain optimal blood glucose levels in Type 2 Diabetes Mellitus patients, to prevent complications to mitigate the worsening of their condition if complications arise.
3. For future researchers, it is recommended to conduct further studies that examine the profile of blood creatinine levels and their relationship with urinary creatinine levels in diabetic patients.

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