



Research Article

THE RELATIONSHIP BETWEEN BLOOD GLUCOSE LEVELS AND UREA LEVELS IN TYPE II DIABETES MELITUS PATIENTS AT KELAPA DUA PUBLIC HEALTH CENTER

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ABSTRACT

Type II diabetes mellitus is a chronic metabolic disease that can lead to complications, including impaired renal function. One of the initial parameters to assess these disorders is ureum level. In general, elevated blood urea levels in patients with type II diabetes mellitus can serve as an indicator of disease progression. One available supporting test is the urea test, which serves as an early indicator of decreased kidney function as a chronic complication of diabetes mellitus. This study aims to determine the relationship between fasting blood glucose levels and ureum levels in type II diabetes mellitus patients at Kelapa Dua Public Health Center. This study used analytic method with cross-sectional design. There were 32 people who were selected by purposive sampling and met the inclusion criteria. Blood glucose examination using the POCT method and ureum using the urease-GLDH method. Data analysis using the Spearman correlation test. Findings most respondents were female, totaling 23 people (71.9%) and most were aged between 51 and 60 years old, totaling 16 people (50.0%). Spearman correlation test showed a significant relationship between blood glucose levels and ureum levels ($p = 0,001$).

ABSTRAK

Diabetes mellitus tipe II adalah penyakit metabolik kronis yang dapat menyebabkan komplikasi, termasuk gangguan fungsi ginjal. Salah satu parameter awal untuk menilai gangguan ini adalah kadar ureum. Secara umum, peningkatan kadar urea darah pada pasien diabetes melitus tipe II dapat berfungsi sebagai indikator perkembangan penyakit. Salah satu pemeriksaan pendukung yang tersedia adalah tes urea, yang berfungsi sebagai indikator awal penurunan fungsi ginjal sebagai komplikasi kronis diabetes melitus. Studi ini bertujuan untuk menentukan hubungan antara kadar glukosa darah puasa dan kadar ureum pada pasien diabetes mellitus tipe II di Pusat Kesehatan Masyarakat Kelapa Dua. Studi ini menggunakan metode analitik dengan desain cross-sectional. Ada 32 orang yang dipilih melalui sampling purposif dan memenuhi kriteria inklusi. Pemeriksaan glukosa darah menggunakan metode POCT dan ureum menggunakan metode urease-GLDH. Analisis data menggunakan uji korelasi Spearman. Temuan menunjukkan bahwa sebagian besar responden adalah perempuan, sebanyak 23 orang (71,9%), dan sebagian besar berusia antara 51 dan 60 tahun, sebanyak 16 orang (50,0%). Uji korelasi Spearman menunjukkan hubungan yang signifikan antara kadar glukosa darah dan kadar ureum ($p = 0,001$).

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INTRODUCTION

Non-communicable diseases remain a global public health concern, with incidence rates continuing to show an increasing trend from year to year. This is evidenced by the International Diabetes Federation report in 2021, making Indonesia rank fifth among countries with the highest prevalence of diabetes mellitus worldwide ([International Diabetes Federation, 2017, 2021](#)). Diabetes mellitus is a metabolic disorder characterized by elevated blood glucose levels over a prolonged period. The majority of cases are type II diabetes mellitus, accounting for 85–95% of the global population ([Adri et al., 2020](#); [Febrinasari et al., 2020](#)). In Banten Province, the prevalence of diabetes mellitus increased from 1.3% in 2013 to 2.2% in 2018 (Ministry of Health, 2019). In 2023, out of a total population of 3,309,365 in Tangerang Regency, 52,014 individuals were diagnosed with diabetes mellitus ([Tangerang District Health Office, 2023](#); [BPS Tangerang, 2024](#)).

The condition of diabetes mellitus can be identified through fasting blood glucose examination in serum or plasma with levels exceeding 126 mg/dL ([PERKENI, 2019](#)). Uncontrolled elevated blood glucose levels can lead to chronic complications, one of which is kidney damage or diabetic nephropathy ([Febrinasari et al., 2020](#)). In general, increased blood urea levels in patients with type II diabetes mellitus can serve as an indicator of disease progression. A condition in which blood urea levels exceed normal values is referred to as uremia ([Heriansyah, 2019](#)).

A study conducted by [Sirivole et al. \(2017\)](#) in India examined urea levels in 50 patients with diabetes mellitus and 25 control subjects. The average blood urea level in diabetic patients was 58.84 mg/dL, whereas in healthy controls it was only 25.36 mg/dL. These findings indicate that urea levels in diabetic patients are higher than in non-diabetic controls. These findings confirm that patients with diabetes mellitus tend to have higher average urea levels than controls.

Kelapa Dua Public Health Center plays a crucial role as a healthcare facility responsible for improving services for diabetes mellitus patients, with the aim of reducing morbidity, disability, and mortality associated with the condition in Tangerang Regency. One of the supporting examinations available is the urea test, which serves as an early indicator of declining kidney function as a chronic complication of diabetes mellitus. Based on this background, this study aims to determine the frequency distribution of blood glucose and urea levels in type II diabetes mellitus patients based on gender and age, as well as to analyze the relationship between blood glucose levels and urea levels in type II diabetes mellitus patients at Kelapa Dua Public Health Center, as an effort to better understand and prevent kidney complications.

MATERIALS AND METHODS

Instruments, Materials, and Samples

The study sample consisted of patients with type II diabetes mellitus who routinely received treatment at Kelapa Dua Public Health Center from March to April 2025. A total of 32 respondents were selected using purposive sampling based on the following inclusion criteria: patients diagnosed with type II diabetes mellitus, having complete demographic data (age and sex) in medical records, aged 41–70 years, having fasted for 8–10 hours prior to examination, and willing to participate by providing informed consent. The exclusion criterion was patients with a history of chronic kidney disease unrelated to diabetes.

The materials used in this study included alcohol swabs, serum and capillary blood samples, and urea reagent kits. Fasting blood glucose levels were measured using an SD Codefree glucometer with test strips, while urea levels were measured using a Mindray BS-240Pro chemistry analyzer with a photometric method.

Blood sample collection consisted of capillary blood for glucose testing and venous blood for urea examination. Venous blood samples were centrifuged to obtain serum, which was subsequently analyzed in the laboratory ([Nugraha, 2022](#); [Farida Anwari, 2023](#)). The results of blood glucose and urea measurements were displayed in mg/dL.

The reference values used were ≥ 126 mg/dL for fasting blood glucose ([PERKENI, 2019](#)) and 15–40 mg/dL for urea ([Dwiardianingrum et al., 2023](#)). The relationship between variables was analyzed using Pearson correlation for normally distributed data or Spearman correlation for non-normally distributed data, with statistical analysis performed using SPSS software ([Kurnia et al., 2023](#)).

RESULT AND DISCUSSION

1. Frequency distribution of type II diabetes mellitus patients at Kelapa Dua Public Health Center
This study examines the frequency distribution of patients with type II diabetes mellitus at Kelapa Dua Public Health Center

Table 1. Frequency distribution of patients with type II diabetes mellitus at Kelapa Dua Public Health Center

Category	Frequency (n)	Percentage (%)
Sex		
Male	9	28.1
Female	23	71.9
Age		
41-50 years	4	12.5
51-60 years	16	50.0
61-70 years	7	21.9
71-80 years	5	15.6
Duration of diabetes		
< 5 years	12	37.5
≥ 5 years	20	62.5
Total	32	100

2. Fasting blood glucose levels in patients with type II diabetes mellitus

Table 2. Distribution of fasting blood glucose levels among patients with type II diabetes mellitus

Category	Fasting blood glucose level			
	Normal		High	
	N	%	N	%
Sex				
Male	2	6.2	7	21.9
Female	9	28.1	14	43.8
Total	11	34.3	21	65.7
Age				
41-50	1	3.1	3	9.4
51-60	6	18.8	10	31.2
61-70	1	3.1	6	18.8
71-80	3	9.4	2	6.2
Total	11	34.4	21	65.6

3. Urea levels in patients with type II diabetes mellitus

Table 3. Frequency distribution of fasting blood glucose levels in patients with type II diabetes mellitus

Category	Fasting blood glucose level			
	Normal		High	
	N	%	N	%
Sex				
Male	7	21.9	2	6.2
Female	16	50.0	7	21.9
Total	23	71.9	9	28.1
Age				
41-50	3	9.4	1	3.1

51-60	11	34.4	5	15.6
61-70	4	12.5	3	9.4
71-80	5	15.6	0	0.0
Total	23	71.9	9	28.1

4. Relationship between fasting blood glucose levels and urea levels in patients with type II diabetes mellitus

Table 4. Correlation analysis between fasting blood glucose and urea levels in patients with type II diabetes mellitus

Variable	Fasting blood glucose level		
	Correlation's Coefficient	Sig (2-tailed)	N
Urea Levels	0.555	0.001	32

Based on Table 1, the age distribution of respondents shows that the majority were in the 51–60 years age group, accounting for 50.0%. In terms of sex distribution, most respondents were female, totaling 23 individuals (71.9%). The findings also indicate that most patients with type II diabetes mellitus who had elevated blood glucose and urea levels were within the 51–60 years age group.

This finding is consistent with previous studies indicating that the risk of hyperglycemia and impaired kidney function increases with age due to physiological changes. Reduced insulin sensitivity makes blood glucose control more difficult, leading to chronic hyperglycemia. Prolonged hyperglycemia can result in decreased kidney function, which is reflected by increased urea levels (Dai et al., 2020; Yudestira, 2024).

The results also show that the majority of respondents had been living with diabetes mellitus for ≥5 years, totaling 20 individuals (62.5%). This duration represents a major risk factor for complications, including kidney dysfunction. Long-term exposure to high blood glucose levels can trigger oxidative stress and microvascular damage, thereby reducing renal filtration capacity (Purwandari et al., 2022). In addition, physical inactivity directly affects insulin sensitivity and blood glucose regulation. Moderate physical activity, such as walking three times per week for 30 minutes, has been shown to significantly reduce blood glucose levels (Rehmaitamalem et al., 2021).

As shown in Table 2, of the 32 respondents examined, the majority had urea levels within the normal range (15–40 mg/dL), including 7 males (21.9%) and 16 females (50.0%). The highest proportion of respondents with normal urea levels was found in the 51–60 years age group, comprising 11 individuals (34.4%) of the total sample. These findings are consistent with studies indicating that the risk of hyperglycemia and impaired kidney function increases with age due to physiological changes. Reduced insulin sensitivity leads to difficulty in controlling blood glucose levels, resulting in chronic hyperglycemia. Prolonged hyperglycemia can contribute to decreased kidney function, as reflected by elevated urea levels (Dai et al., 2020; Yudestira, 2024).

This is further supported by Saputri et al. (2025), who reported that women, particularly after menopause, have a higher risk of developing type II diabetes mellitus due to hormonal changes that affect glucose metabolism and insulin sensitivity. These changes make blood glucose regulation more difficult and increase the risk of complications.

Based on the age group distribution shown in Table 3, elevated fasting blood glucose levels were most frequently observed in respondents aged 51–60 years (31.2%). In addition, this age group also had the highest proportion of respondents with normal urea levels, accounting for 11 individuals (34.4%) of the total sample. This condition may worsen during menopause, when decreased estrogen levels and increased visceral fat lead to elevated free fatty acids that impair insulin sensitivity. As a result, glucose accumulates in the bloodstream, increasing the risk of hyperglycemia and kidney dysfunction, which may contribute to elevated urea levels.

Normality testing was performed using the Shapiro–Wilk test, which showed that both fasting blood glucose and urea data were not normally distributed. Therefore, Spearman correlation analysis was applied.

The results indicated significance values of 0.002 for fasting blood glucose and 0.000 for urea, both of which were below 0.05, confirming that the data were not normally distributed (Cahyono, 2015). The Spearman correlation test was then used to assess the relationship between fasting blood glucose and urea levels. A significance value of less than 0.05 indicates a statistically significant relationship between variables (Udin et al., 2021). As presented in Table 4, the analysis showed a significance value of 0.001 ($p < 0.05$) and

a positive correlation, indicating a statistically significant relationship between fasting blood glucose and urea levels. This means that higher fasting blood glucose levels are associated with higher urea levels. Therefore, the alternative hypothesis (H_1) is accepted.

These findings are consistent with previous studies by [Sirivole et al. \(2017\)](#) and [Jassim \(2024\)](#), which reported higher urea levels in patients with type II diabetes mellitus compared to healthy controls. Chronic hyperglycemia can increase urea levels due to damage to the microvasculature of the renal glomeruli, which play a key role in filtration. This condition may lead to complications such as diabetic nephropathy and progressive decline in kidney function ([Ramadhani et al., 2024](#)).

Thus, this study highlights the importance of optimal blood glucose control to prevent kidney damage and further complications in patients with type II diabetes mellitus. In addition, early detection through urea examination is essential to prevent more severe renal impairment.

CONCLUSION

Based on the findings of this study, the majority of respondents were women, indicating that women represent a larger proportion of patients with type II diabetes mellitus. Most respondents were in the 51–60 age group, which is considered a high-risk group for complications such as impaired kidney function. The results also showed a significant relationship between fasting blood glucose levels and urea levels ($p = 0.001$). Higher blood glucose levels were associated with an increased likelihood of elevated urea levels. This study recommends that non-diabetic communities begin adopting a healthy lifestyle as a preventative measure, and further research should examine the relationship with HbA1c levels.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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