

Description of Urea and Creatinine Levels in Patients with Chronic Kidney Disease at Anutaputa General Hospital, Palu, 2024

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ARTICLE INFO	ABSTRACT
<p>Article History:</p> <p>Received Accepted Published online</p>	<p><i>Chronic Kidney Disease (CKD) is defined as the presence of abnormalities either structurally or functionally of the kidneys, which occurs for at least three months, which has an impact on health. The prevalence rate of chronic kidney disease diagnosed by doctors in the population ≥ 15 years in Indonesia in 2018 reached 0.38% of the Indonesian population. One way to establish a diagnosis of CKD is by assessing or measuring serum urea and creatinine levels, because both compounds can be used to assess kidney function. The description of urea and creatinine in chronic kidney disease patients at Anutapura Regional Hospital, Palu in 2024 is known. This study was descriptive study with a cross-sectional approach with secondary data as a reference. The sampling technique used total sampling. Each data is described by univariate analysis using the SPSS program. The distribution of chronic kidney disease sufferers obtained that female gender is the most sufferers, namely 37 people (60.7%), and male as many as 24 people (39.3%). The highest age is 56-65 years as many as 19 people (31.1%), followed by 36-45 years and 46-55 years as many as 15 people (24.6%), then 26-35 years as many as 7 people (11.5%), and the lowest age > 65 years as many as 5 people (8.2%). The most comorbid is hypertension as many as 32 people (52.5%), followed by without hypertension and diabetes mellitus as many as 16 people (26.2%), then with hypertension and diabetes mellitus as many as 9 people (14.8%) and the lowest diabetes mellitus as many as 4 people (6.6%). The distribution of urea levels obtained the highest average urea levels in males, namely 186.54 mg / dL while women were 152.51 mg / dL. The age with the highest average urea level is 36-45 years old, which is 178.73 mg/dL, followed by 56-65 years old, which is 169.84 mg/dL, and 46-55 years old, which is 163.07 mg/dL, then 26-35 years old, which is 160.00 mg/dL, and the lowest is in those aged > 65 years, which is 129.20 mg/dL. Comorbidities with the highest average urea level are diabetes mellitus, which is 221.50 mg/dL, followed by without hypertension and diabetes mellitus, which is 168.56 mg/dL, then hypertension, which is 160.91 mg/dL, and the lowest in those with hypertension and diabetes mellitus, which is 154.22 mg/dL. The distribution of creatinine levels obtained the highest average creatinine levels in males, which is 12.60 mg/dL, while in females it is 9.06 mg/dL. The age with the highest average creatinine levels is 36-45 years of age, which is 14.48 mg/dL, followed by 26-35 years of age, which is 11.23 mg/dL, and 46-55 years of age,</i></p>
<p>Keywords: Chronic Kidney Disease; Urea; Creatinine;</p> <p>This is an open access article under the  CC-BY-SA license.</p>	

	<p>which is 10.34 mg/dL, then 56-65 years of age, which is 8.50 mg/dL, and the lowest in > 65 years of age, which is 5.06mg/dL. The comorbidity with the highest average creatinine level was hypertension, which was 11.10 mg/dL, followed by those with hypertension and diabetes mellitus, which was 10.84 mg/dL, then diabetes mellitus, which was 10.29 mg/dL, and the lowest was without hypertension and diabetes mellitus, which was 8.98 mg/dL. The most cases of chronic kidney disease were found in women, aged 56-65 years and comorbid hypertension. The highest average urea levels were found in men, aged 36-45 years and comorbid diabetes mellitus. The highest average urea levels were found in men, aged 36-45 years and comorbid hypertension.</p>
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INTRODUCTION

Chronic kidney disease (CKD) is defined as the presence of abnormalities in the structure or function of the kidneys that persist for at least three months and have an impact on health.¹ According to the 2018 Basic Health Research (Riskesdas), the prevalence of chronic kidney disease diagnosed by physicians among individuals aged ≥ 15 years in Indonesia reached 0.38% of the population in 2018, showing an increase from the 2013 Riskesdas report (0.2%). Central Sulawesi Province ranked fourth highest in Indonesia, with an incidence rate of 0.52% of its population.²

One of the methods to establish a diagnosis of CKD is by assessing or measuring serum urea and creatinine levels, as these two compounds can be used to evaluate kidney function. Creatinine is the end product of metabolism formed from the breakdown of creatine phosphate in muscles, and its clearance is carried out by the kidneys. Meanwhile, urea is a nitrogen-containing compound formed in the liver as the final product of protein metabolism and the urea cycle.³

MATERIAL AND METHOD

Research Design

This study employed a descriptive observational design with a cross-sectional approach. The purpose of this design was to describe the levels of urea and creatinine in patients diagnosed with chronic kidney disease (CKD) without manipulating any variables. The data were obtained from the results of laboratory

examinations recorded in the hospital's medical records

Time and Place of Research

This research was conducted at Anutapura General Hospital, Palu, Central Sulawesi. The study took place from January to June 2024, covering the stages of data collection, processing and analysis.

Population and Sample

The population in this study consisted of all patients diagnosed with chronic kidney disease (CKD) who underwent treatment at Anutapura General Hospital, Palu, during 2024. The sample was selected using purposive sampling technique, including patients with complete data on serum urea and creatinine levels available in the laboratory records. Exclusion criteria included patients with incomplete data or other conditions affecting urea and creatinine levels.

Data Presentation

The data were processed and presented in tabular and descriptive form. Urea and creatinine levels were expressed as mean, minimum, and maximum values, while the distribution of respondents was displayed in frequency tables according to age, sex and disease stage. The results were then analyzed and interpreted descriptively to illustrate the profile of urea and creatinine levels among CKD patients.

RESULTS AND DISCUSSIONS

Table 1. Distribution of Chronic Kidney Disease Based on Gender, Age, and Comorbidities

Characteristic	n	%
Gender		
Male	24	39.3%
Female	37	60.7%
Age		
26-35	7	11.5%
36-45	15	24.6%
46-55	15	24.6%
56-65	19	31.1%
>65	5	8.2%
Comorbidities		
Hypertension (HT)	32	52.5%
Diabetes Mellitus (DM)	4	6.6%
Both HT and DM	9	14.8%
Without HT and DM	16	26.2%

From the table above, it can be seen that the frequency distribution of patients based on gender shows a predominance of female patients, totaling 37 individuals (60.7%), compared to 24 male patients (39.3%).

Based on age distribution, the most dominant group was patients aged 56–65 years, totaling 19 individuals (31.1%), followed by those aged 36–45 years and 46–55 years, each totaling 15 individuals (24.6%). The smallest age group was patients aged over 65 years, with 5 individuals (8.2%).

Regarding comorbidities, the most common condition among CKD patients was hypertension, found in 32 individuals (52.5%), followed by patients without hypertension or diabetes mellitus, totaling 16 individuals (26.2%). The least common comorbidity was diabetes mellitus alone, found in 4 individuals (6.6%).

Table 2. Distribution of Urea Levels Based on Gender, Age, and Comorbidities Among Patients with Chronic Kidney Disease

Characteristic	Urea (mg/dL)		
	Min	Max	Mean
Gender			
Male	61	319	186.54
Female	76	327	152.51
Age (Years)			
26-35	86	327	160.00
36-45	78	316	178.73
46-55	94	319	163.07
56-65	76	293	169.84
>65	61	167	129.20
Comorbidities			
Hypertension (HT)	32	52.5	160.91
Diabetes Mellitus (DM)	4	6.6	221.50
Both HT and DM	9	14.8	154.22
Without HT and DM	16	26.2	168.56

From the table above, it can be seen that all samples showed urea levels exceeding the normal range.

The average urea level based on gender showed that male patients had an average value of 186.54 mg/dL, while female patients had an average of 152.51 mg/dL. These results indicate that male patients had higher urea levels compared to female patients.

The average urea level based on age category showed that the highest urea levels were found in the 36–45 years age group, with an average of 178.73 mg/dL, followed by the 56–65 years age group with 169.84 mg/dL. Meanwhile, the lowest urea levels were observed in the >65 years age group.

Table 3. Distribution of Creatinine Levels Based on Gender, Age, and Comorbidities Among Patients with Chronic Kidney Disease

Characteristic	Creatinine (mg/dL)		
	Min	Max	Mean

Gender			
Male	1.8	32.97	12.60
Female	3.52	49.00	9.06
Age (Years)			
26-35	4.52	26.92	11.23
36-45	4.34	32.97	14.48
46-55	2.45	49.00	10.34
56-65	3.70	31.23	8.50
>65	1.18	6.65	5.06
Comorbidities			
Hypertension (HT)	1.18	32.97	11.10
Diabetes Mellitus (DM)	44.82	21.11	10.29
Both HT and DM	2.45	29.88	10.84
Without HT and DM	3.52	49.00	8.98

From the table above, it can be seen that all samples showed creatinine levels exceeding the normal range.

The average creatinine level based on gender showed that male patients had an average value of 12.60 mg/dL, while female patients had an average of 9.06 mg/dL. These results indicate that male patients had higher creatinine levels compared to female patients.

The average creatinine level based on age category showed that the highest creatinine level was found in the 36–45 years age group, with an average of 14.48 mg/dL, followed by the 26–35 years age group with 11.23 mg/dL. The lowest creatinine level was observed in the >65 years age group, with an average of 5.06 mg/dL.

The average creatinine level based on comorbidities showed that the highest creatinine level was found among patients with hypertension, with an average of 11.10 mg/dL, while the lowest creatinine level was found among patients without hypertension or diabetes mellitus, with an average of 8.98 mg/dL.

DISCUSSION

The frequency distribution of patients based on gender showed that the majority

were female, totaling 37 individuals (60.7%), while male patients accounted for 24 individuals (39.3%). This indicates that the number of female patients with chronic kidney disease (CKD) was higher than that of males. This finding is supported by data from the CDC, which reported that the prevalence of CKD in males (12%) was slightly lower than in females (14%), and it aligns with a study conducted by Yuliandi (2021), which also found a higher proportion of female CKD patients (56.67%) compared to males (43.33%).^{4–5}

This difference may occur because females are more frequently affected by lupus, an autoimmune disease that can attack the kidneys, as well as due to the higher incidence of urinary tract infections (UTIs) in females. The shorter anatomical structure of the female urethra facilitates bacterial infection and inflammation of the urinary tract. Recurrent infections and inflammation can cause histological changes in kidney structure and lead to impaired kidney function.⁵

The distribution of patients based on age showed that the dominant age group was 56–65 years (19 individuals, 31.1%), followed by 36–45 years and 46–55 years (15 individuals, 24.6% each), while the smallest group was >65 years (5 individuals, 8.2%). This result is consistent with a study by Nuroini (2022), which found that patients aged 46–65 years had the highest frequency of CKD cases (51.25%), and also aligns with Afriansya (2020), who reported that the 40–60 years age group represented the largest proportion of CKD patients (72%).^{6–7}

This trend can be explained by the aging process, which causes both anatomical and physiological changes in the kidneys. With age, the kidneys tend to undergo atrophy, and the cortical thickness decreases due to nephron damage, accompanied by a reduced ability of the body to regenerate damaged cells. This process typically begins around age 40, with kidney function declining progressively—up to 50% reduction by age 60.⁵

The distribution of patients based on comorbidities showed that the majority had hypertension (32 individuals, 52.5%), followed by those without hypertension or diabetes mellitus (16 individuals, 26.2%), while

the smallest group consisted of patients with diabetes mellitus only (4 individuals, 6.6%). This finding is supported by data from the Indonesian Society of Nephrology (PERNEFRI), which reported that hypertension was the most common comorbidity among CKD patients (50%).⁸ Similarly, a study by Loho (2016) found that hypertension was the most frequent comorbidity associated with CKD (83%).⁹

This condition occurs because increased extracellular pressure leads to enhanced tissue perfusion, stimulating vasoconstriction, which in turn causes increased peripheral vascular resistance and elevated blood pressure. Over time, persistent systemic arterial hypertension is transmitted to the kidneys, causing glomerular hypertension, nephrosclerosis, and progressive loss of renal function, eventually leading to chronic renal failure.¹⁰

Table 2 shows that all samples exhibited urea levels above the normal range. The average urea level by gender indicated that male patients had a mean urea level of 186.54 mg/dL, while female patients had an average of 152.51 mg/dL. This finding demonstrates that male patients had higher urea levels than female patients. This result is consistent with the study conducted by Afriansya (2020), which found that the average urea level among males (167.09 mg/dL) was higher than that among females (164.39 mg/dL).⁷

This difference may be attributed to dietary and lifestyle factors. Men tend to consume higher amounts of protein compared to women, which contributes to increased urea levels due to greater protein metabolism. Furthermore, more intense physical activity among men also influences the elevation of urea concentration, as physical exertion accelerates protein metabolism in the body.⁶

The average urea level by age group showed that the highest mean urea concentration was found among individuals aged 36–45 years (178.73 mg/dL), followed by the 56–65 years age group (169.84 mg/dL), while the lowest level occurred among those aged >65 years (129.20 mg/dL). A study published in the *Journal of Medical Laboratory* reported that individuals aged 51–60 years had the highest

proportion (50%) of elevated urea levels. Similarly, Loho (2016) reported that the prevalence of chronic kidney disease increases with age, with the 66–75 years age group having the largest proportion of cases.⁹

However, the observed decline in urea levels among patients aged >65 years in this study may be related to reduced muscle mass and more controlled dietary patterns, such as lower protein intake, which can influence the body's production of urea.¹¹

The average urea level based on comorbidities indicated that the highest average was found among patients with diabetes mellitus (221.50 mg/dL). Several studies have investigated the relationship between diabetes mellitus and elevated urea levels. A study conducted at Bhayangkara Hospital Palembang by Syafitri (2020) found that among 111 diabetes mellitus patients, 45.9% had elevated urea levels.¹²

This condition occurs because diabetic patients often experience hyperglycemia (high blood glucose levels), which damages blood vessel walls, leading to vascular obstruction and microvascular complications, including diabetic nephropathy. Hyperglycemia also contributes to atherosclerosis formation, resulting in narrowing of blood vessel lumens and reduced renal blood flow. Consequently, glomerular filtration becomes impaired, leading to decreased kidney function, which is clinically manifested by increased blood urea and creatinine levels.¹³

Based on Table 3 above, it can be seen that all samples showed creatinine levels exceeding the normal range.

The average creatinine level by gender indicated that male patients had a mean level of 12.60 mg/dL, while female patients had an average of 9.06 mg/dL. These results show that male patients had higher creatinine levels compared to female patients. This finding is consistent with the study conducted by Afriansya (2020), which reported that the mean creatinine level in males (11.80 mg/dL) was higher than in females (9.73 mg/dL).⁷

This difference may occur because males generally have greater muscle mass than

females. Since creatinine is a byproduct of muscle metabolism, individuals with more muscle mass tend to produce more creatinine, resulting in higher serum creatinine concentrations.¹⁴

The average creatinine level by age group showed that the highest mean level was observed among patients aged 36–45 years (14.48 mg/dL), followed by the 26–35 years age group (11.23 mg/dL), while the lowest mean level was found in the >65 years group (5.06 mg/dL). These findings are consistent with the study by Nuroini (2022), which showed that the highest average creatinine level occurred in the 40–45 years age group (4.55 mg/dL), and decreased among those aged >65 years (3.82 mg/dL).⁶

The increase in creatinine levels among the 36–45 years age group may be attributed to higher muscle mass and greater physical activity, which naturally elevate creatinine production. In contrast, the decline in creatinine levels observed in patients aged over 65 years is likely due to loss of muscle mass and reduced creatinine production associated with aging.¹⁵

The average creatinine level based on comorbidities showed that the highest mean creatinine concentration was found in patients with hypertension, with an average of 11.10 mg/dL, while the lowest mean level was observed in patients without hypertension or diabetes mellitus, with an average of 8.98 mg/dL.

This finding is consistent with a study conducted by Ruhalida Okta Amalia (2023) at Siti Khadijah Islamic Hospital, Palembang, which reported that 53% of patients with hypertension had abnormal creatinine levels.¹⁶

This condition occurs because hypertension can cause vasoconstriction (narrowing of blood vessels) in the kidneys, leading to disrupted blood and nutrient flow to renal tissues. The resulting cell damage impairs the kidneys' ability to filter waste products, causing a decline in renal function. Consequently, metabolic waste products such as creatinine accumulate in the bloodstream, resulting in elevated serum creatinine levels.

Conversely, patients without hypertension or diabetes mellitus tend to have lower creatinine levels, reflecting better kidney function. This finding reinforces that hypertension is a significant risk factor for decreased renal function.¹⁷

CONCLUSION

Based on the results of the study involving 61 samples from the hemodialysis unit and medical records in January 2025, entitled "*Description of Urea and Creatinine Levels in Patients with Chronic Kidney Disease at Anutapura General Hospital, Palu, 2024*," the following conclusions can be drawn:

1. The highest incidence of chronic kidney disease was found among female patients, particularly in the 56–65 years age group, and most commonly associated with the comorbidity of hypertension.
2. The highest average urea level was observed in male patients, within the 36–45 years age group, and among those with the comorbidity of diabetes mellitus.
3. The highest average creatinine level was observed in male patients, within the 36–45 years age group, and among those with the comorbidity of hypertension.

AUTHOR CONTRIBUTIONS

Conceptualization, K.R.I, S., A.I.M.; Methodology, K.R.I.; Validation, S., A.I.M.; Formal Analysis, K.R.I.; Investigation, K.R.I., Resources, K.R.I.; Data Curation, K.R.I.; Writing-Original Draft Preparation, K.R.I., S., and A.I.M.; Visualization, K.R.I. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declares that there is no conflict of interest.

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