*Original Research*

# An Overview of Serum Creatinine Levels Among Active Smokers in Suli Village, Salahutu Subdistrict

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**Abstract**

Smoking is one of the risk factors that may affect kidney health due to exposure to various toxic substances contained in cigarette smoke, including nicotine, carbon monoxide, and heavy metals such as lead (Pb). Continuous exposure to these substances may induce oxidative stress, endothelial dysfunction, hemodynamic changes, and vascular damage, potentially affecting renal perfusion and reducing the glomerular filtration rate. Serum creatinine is one of the laboratory parameters used to assess kidney function and may provide an initial indication of potential filtration impairment. This study aimed to describe serum creatinine levels among active smokers in Suli Village, Salahutu District. This descriptive study involved 20 active smokers selected using purposive sampling based on predetermined inclusion and exclusion criteria. Serum creatinine levels were examined using the Jaffe method with a BA-200 Biosystems Chemistry Analyzer. The results showed that 15 respondents (75%) had serum creatinine levels within the normal range, while 5 respondents (25%) had serum creatinine levels above the normal range. Abnormally elevated creatinine levels were found among respondents who were older, had smoked for more than 5 years, consumed a higher number of cigarettes, and had inadequate water intake. The findings indicate that most active smokers had serum creatinine levels within the normal range; however, 25% of respondents had elevated creatinine levels that warrant attention. These findings highlight the importance of education regarding the impact of smoking on kidney health and the need for regular kidney function monitoring, particularly among smokers with long-term and high-intensity smoking habits.

**Keywords:** serum creatinine; active smokers; kidney function; smoking; renal health.

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## INTRODUCTION

Smoking is a major risk factor for chronic diseases and remains a significant global and national public health concern (Okinu Rahim et al., 2024). In addition to its well-established effects on the respiratory and cardiovascular systems, smoking may adversely affect kidney function (Setyawan, 2019; Xia et al., 2017). Cigarette smoke contains numerous toxic substances, including nicotine, carbon monoxide, cadmium, arsenic, and lead, which may promote oxidative stress, systemic inflammation, endothelial dysfunction, and renal vasoconstriction (Rosita & Mustika, 2019). Prolonged and intensive exposure to these substances may impair renal hemodynamics and contribute to progressive kidney damage(Xia et al., 2017).

Chronic kidney disease (CKD) is a progressive condition that often remains asymptomatic during its early stages, highlighting the importance of early detection among individuals at risk (Shlipak et al., 2021). Serum creatinine is a commonly used laboratory biomarker for assessing renal filtration function. As a metabolic end product primarily excreted by the kidneys, increased serum creatinine levels may indicate impaired renal filtration, although they can also be influenced by factors such as age, muscle mass, hydration status, and lifestyle (Ávila et al., 2025).

One of the harmful components of cigarette smoke is lead (Pb), which has nephrotoxic properties and may adversely affect renal tissue following prolonged exposure (Mortada et al., 2004). Long-term exposure to toxic substances may contribute to structural and functional kidney damage, potentially reflected by changes in serum creatinine levels (EL-Safty et al., 2004). However, elevated serum creatinine is not consistently observed in all smokers and may vary according to smoking duration and intensity, as well as individual and lifestyle-related factors(Halimi et al., 2000). Therefore, assessing serum creatinine levels among active smokers may provide an initial indication of renal health in this population(Farah et al., 2023).

Suli Village, Salahutu District, is a community where active smoking remains prevalent, yet data regarding serum creatinine levels among local smokers are limited. This study therefore aimed to describe serum creatinine levels among active smokers in Suli Village, Salahutu District, providing baseline information to support public awareness, smoking cessation efforts, and preventive strategies for maintaining kidney health.

## RESEARCH METHOD

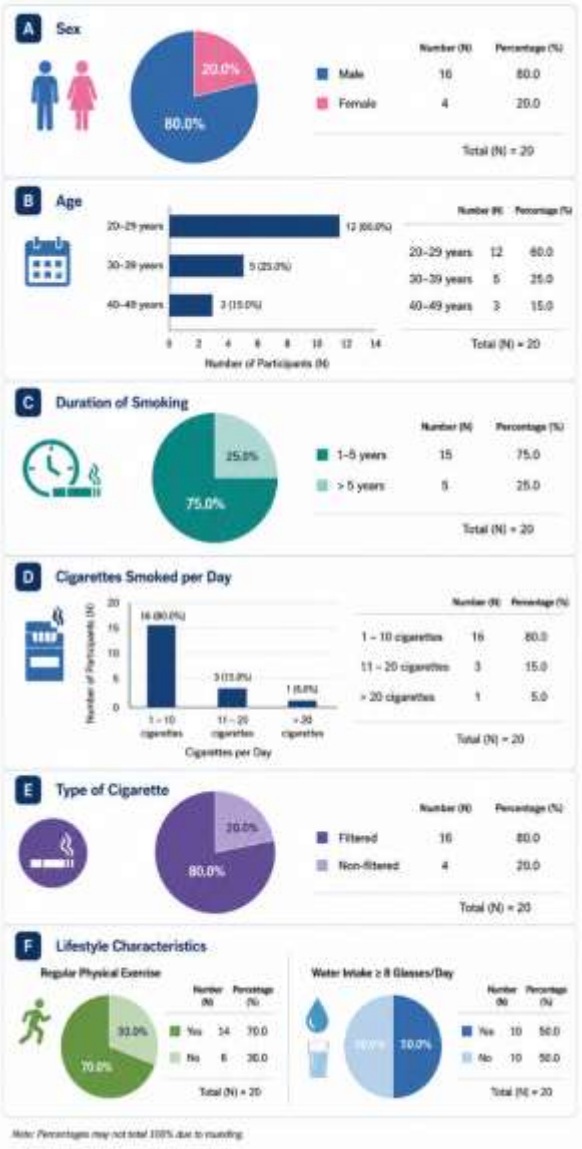
This study employed a descriptive research design with a laboratory examination approach. The study was conducted from April 10 to May 30, 2026, in Suli Village for sample collection and at the Maluku Provincial Health Laboratory for sample analysis. The study population consisted of 154 active smokers in Suli Village, with a sample of 20 participants selected using purposive sampling based on the inclusion criteria, namely being aged ≥18 years, in good health, and willing to participate as respondents. Serum creatinine levels were measured using the Jaffe method with a BA-200 Biosystems Chemistry Analyzer. The data were analyzed descriptively and presented in the form of frequency distribution tables and narrative descriptions

## RESULTS

The demographic, smoking-related, and lifestyle characteristics of the study participants are summarized in Figure 1. Among the 20 active smokers included in this study, the majority were male (80.0%, n = 16), while females represented 20.0% (n = 4). Most participants were aged 20–29 years (60.0%, n = 12), followed by those aged 30–39 years (25.0%, n = 5) and 40–49 years (15.0%, n = 3). Regarding smoking behavior, 75.0% (n = 15) had smoked for 1–5 years, whereas 25.0% (n = 5) had smoked for more than five years. Most participants smoked 1–10 cigarettes per day (80.0%, n = 16), while 15.0% (n = 3) smoked 11–20 cigarettes per day and 5.0% (n = 1) smoked more than 20 cigarettes daily. Filtered cigarettes were used by 80.0% (n = 16) of participants, whereas 20.0% (n = 4) smoked non-filtered cigarettes. Furthermore, 70.0% (n =

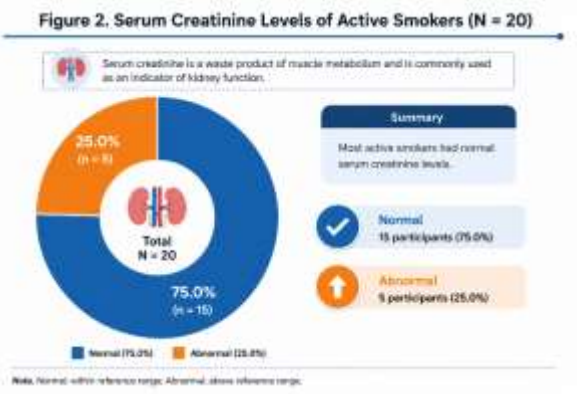
14) reported engaging in regular physical exercise, and half of the participants (50.0%, n = 10) consumed at least eight glasses of water per day.

Figure 1. Characteristics of the Study Participants (N = 20)




The distribution of serum creatinine levels among active smokers is presented in figure 2. Of the 20 participants, 15 (75.0%) had serum creatinine levels within the normal reference range, whereas 5 participants (25.0%) had elevated serum creatinine levels above the normal reference range. Overall, most participants demonstrated normal serum creatinine levels based on laboratory examination.

Figure 2. Serum Creatinine Levels of Active Smokers (N = 20)




## DISCUSSION

The study results show that the majority of respondents (75%) had serum creatinine levels within the normal range, while 25% of respondents had serum creatinine levels above the reference value. These findings suggest that not all active smokers experience kidney dysfunction detectable through serum creatinine testing. Nevertheless, the presence of a proportion of respondents with elevated creatinine levels still indicates that exposure to cigarette smoke has the potential to affect kidney function. These results are consistent with various studies reporting that smoking is associated with reduced kidney function, characterized by elevated creatinine and urea levels, the onset of albuminuria, a decrease in estimated glomerular filtration rate (eGFR), and an increased risk of chronic kidney disease and accelerated progression of kidney damage (Jain & Jaimes, 2013; Nacira et al., 2021; Oosterwijk et al., 2023).

Although most respondents still had normal serum creatinine levels, these results must be interpreted with caution. Serum creatinine is a relatively insensitive biomarker for detecting kidney injury in its early stages because its levels generally do not rise until there has been a significant decline in glomerular filtration rate. Therefore, active smokers may experience subclinical kidney damage even though their creatinine levels remain within the normal range. This condition has been demonstrated in various studies showing elevated levels of

kidney injury biomarkers, such as N-acetyl-β-D-glucosaminidase (NAG), neutrophil gelatinase-associated lipocalin (NGAL), kidney injury molecule-1 (KIM-1), total urinary protein, and microalbuminuria, before an increase in serum creatinine occurs (Farah et al., 2023; Jain & Jaimes, 2013; Tascón et al., 2022).

In this study, normal serum creatinine levels were more commonly found in the 20–29 age group. These findings suggest that the kidneys in younger individuals still possess good physiological compensatory capacity, enabling them to maintain filtration function despite exposure to cigarette smoke. Conversely, a tendency toward elevated creatinine levels was more frequently observed in older age groups. This can be explained by the progressive aging process of the kidneys, which is characterized by a decrease in glomerular filtration rate, glomerulosclerosis, tubular degeneration, interstitial fibrosis, chronic inflammation, oxidative stress, and a decline in the regenerative capacity of renal cells (Gekle, 2017; Marquez-Exposito et al., 2022; Zhang et al., 2025a). These findings are consistent with previous studies showing that advancing age is associated with increased cystatin C levels, microalbuminuria, and reduced kidney function in active smokers (Farah et al., 2023; Oosterwijk et al., 2023).

Smoking duration and intensity also show a trend supporting the cumulative effects of cigarette smoke exposure on the kidneys. Respondents with a smoking history of more than five years and higher daily cigarette consumption were more likely to have creatinine levels above the normal range. Various studies have demonstrated a dose–response relationship between smoking duration, pack-years, smoking index, and the number of cigarettes consumed per day, and increased microalbuminuria, elevated creatinine levels, decreased eGFR, and an increased risk of chronic kidney disease (Eid et al., 2022; Farah et al., 2023; Kumar et al., 2022). In fact, studies in adolescents have shown that exposure to cigarette smoke—whether active or passive, is associated with a decrease in eGFR, suggesting that the nephrotoxic effects of smoking can begin at a young age, even before clinical manifestations of kidney disease appear(García-Esquinas et al., 2013).

Biologically, the link between smoking and reduced kidney function is based on robust mechanisms. Cigarette smoke contains more than a thousand chemical compounds, including nicotine, heavy metals, nitrosamines, and fine particulate matter, which can trigger oxidative stress, chronic inflammation, endothelial dysfunction, and damage to the structure of the glomeruli and renal tubules (Appolon et al., 2026; Oosterwijk et al., 2023; Zheng et al., 2020). Experimental studies have shown that nicotine can reduce renal cell viability by increasing the formation of reactive oxygen species (ROS), activating the α7nAChR receptor and the NLRP6 inflammasome, inducing endoplasmic reticulum stress, autophagy, apoptosis, and renal histopathological changes (Zhang et al., 2025a). In addition, smoking also causes renal hemodynamic disturbances, including reduced renal plasma flow, endothelial relaxation dysfunction, increased superoxide production, decreased nitric oxide bioavailability, elevated endothelin-1, and hypertension, which collectively accelerate the decline in glomerular filtration rate (Jain & Jaimes, 2013). In addition to nicotine, the cadmium content in cigarettes is also known to be nephrotoxic and is found at higher levels in active smokers. However, multivariate analysis shows that smoking status remains a stronger predictor of kidney function deterioration than cadmium levels alone (Oosterwijk et al., 2023).

This study also showed a tendency toward higher serum creatinine levels among users of unfiltered cigarettes. These findings can be considered representative of the study

population, but should be interpreted with caution. Recent evidence indicates that biomarkers of cigarette exposure, such as cotinine and NNAL, do not differ significantly between users of filtered and unfiltered cigarettes; thus, both types of cigarettes still expose users to toxic substances that can potentially damage the kidneys and cannot be considered safer (Appolon et al., 2026).

In addition to smoking habits, this study also examined lifestyle factors. Respondents who exercised regularly and had better hydration habits tended to maintain normal serum creatinine levels. Nevertheless, current scientific evidence more strongly supports the benefits of physical activity and a healthy lifestyle in slowing the aging process of the kidneys and maintaining vascular function than it does establishing a direct relationship between drinking eight glasses of water per day and creatinine levels in active smokers (Zhang et al., 2025b). Therefore, these two factors are more appropriately viewed as supporting factors in maintaining kidney health rather than as standalone protective factors.

Interpretation of serum creatinine levels must also account for non-GFR factors that can influence these values, such as muscle mass, hydration status, and systemic inflammation. Consequently, the assessment of kidney function in active smokers should not rely solely on serum creatinine levels but should be combined with other parameters, such as eGFR, albuminuria, cystatin C, and biomarkers of kidney injury, to provide a more accurate and comprehensive picture of kidney function (Farah et al., 2023)

Overall, the results of this study indicate that although the majority of active smokers in Suli Village still have serum creatinine levels within the normal range, heavier exposure to cigarette smoke, as reflected by older age, longer duration of smoking, and higher smoking intensity, shows a trend toward decreased kidney function. These findings are supported by biological and epidemiological evidence showing that chronic exposure to cigarette smoke triggers oxidative stress, inflammation, vascular dysfunction, and damage to the glomeruli and renal tubules, which can occur subclinically before eventually manifesting as elevated serum creatinine levels.

## CONCLUSION

Based on the findings of this study, it can be concluded that serum creatinine levels among active smokers in Suli Village were within the normal range in 75% of respondents, while 25% had levels above the normal range. The community is advised to reduce or quit smoking and adopt a healthy lifestyle to help prevent further deterioration of kidney function.

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