



## The Effect of Obesity, Smoking Habits, and Hypertension on the Risk of Chronic Kidney Disease: A Case Control Study

Rea Ariyanti<sup>1✉</sup>, Eka P. Rahayu<sup>2</sup>

<sup>1,2</sup>Public Health, Faculty of Public Health, Universitas Mulawarman, Samarinda, Indonesia

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### Abstrak

*Chronic Kidney Disease (CKD)* merupakan masalah kesehatan masyarakat global dengan prevalensi dan insidensi gagal ginjal yang meningkat. Sekitar 1 dari 10 populasi global mengalami gagal ginjal kronis pada stadium tertentu. Terdapat beberapa faktor risiko yang diduga dapat meningkatkan kejadian chronic kidney disease seperti obesitas, kebiasaan merokok, dan hipertensi. Penelitian ini bertujuan untuk mengetahui pengaruh obesitas, kebiasaan merokok, dan hipertensi terhadap risiko kejadian chronic kidney disease. Desain penelitian adalah case control. Penelitian dilaksanakan di Rumah Sakit Panti Nirmala Malang dengan jumlah sampel sebanyak 286 responden, terdiri dari 143 kelompok kasus dan 143 kontrol. Analisis data menggunakan chi-square test. Hasil penelitian menunjukkan status hipertensi ( $p=0.014$ ) memiliki pengaruh yang signifikan terhadap kejadian chronic kidney disease, sedangkan variabel lain seperti obesitas ( $p=0.122$ ) dan kebiasaan merokok ( $p=0.077$ ) dan tidak terbukti berpengaruh dalam menyebabkan chronic kidney disease. Pada kelompok kasus, diketahui bahwa lebih dari setengah responden menyatakan memiliki kebiasaan merokok dan menderita hipertensi. Direkomendasikan kepada masyarakat untuk melakukan cek kesehatan secara berkala dan mengubah gaya hidup dengan tidak merokok dan senantiasa mengontrol tekanan darah agar tetap normal.

### Abstract

*Chronic Kidney Disease (CKD)* is a global public health problem with increasing prevalence and incidence of kidney failure. About 1 in 10 of the global population experiences chronic kidney failure at some stage. There are several risk factors that are thought to increase the incidence of chronic kidney disease, such as obesity, smoking habits and hypertension. This study aims to determine the influence of obesity, smoking habits and hypertension on the risk of chronic kidney disease. The research design is case control. The research was carried out at Panti Nirmala Hospital Malang with a sample size of 286 respondents, consisting of 143 case groups and 143 controls. Data analysis used the chi-square test. The results of the study showed that hypertension status ( $p=0.014$ ) had a significant influence on the incidence of chronic kidney disease, while other variables such as obesity ( $p=0.122$ ) and smoking habits ( $p=0.077$ ) were not proven to have an influence in causing chronic kidney disease. In the case group, it was discovered that more than half of the respondents stated that they had a smoking habit and suffered from hypertension. It is recommended that people carry out regular health checks and change their lifestyle by not smoking and always controlling their blood pressure to keep it normal.

## INTRODUCTION

In the last three decades, the pattern of disease incidence has changed. This is marked by a change in the pattern of disease and death, which was previously dominated by infectious diseases, shifting to non-communicable diseases or non-communicable diseases. Based on data from the World Health Organization (WHO) in 2022, it is known that 74% of deaths in the world or around 41 million people each year are caused by non-communicable diseases (PTM), of which around 17 million people die before the age of 70 due to PTM and 86% die prematurely. This occurs in low and middle-income countries (WHO, 2022). In Indonesia, this is not much different, where currently Indonesia is facing a double burden of disease, namely the burden of infectious diseases that has not been fully overcome, coupled with the burden of non-communicable diseases which continues to increase every year. The results of Basic Health Research in 2018 show that the prevalence of non-communicable diseases has increased compared to the results of Basic Health Research in 2013, namely from 2% increasing to 3.8% in 2018 (Kemenkes RI, 2023).

CKD is defined as kidney damage and/or a decrease in the Glomerular Filtration Rate (GFR) of less than 60ml/min/1.73m<sup>2</sup> for at least 3 months. CKD initially shows no signs and symptoms but can be progressive. The increasing trend in CKD is thought to be related to lifestyle patterns, one of which is smoking behavior. Since 2013, the prevalence of smoking in adolescents (10-18 years) has continued to increase, namely 7.2% (Riskesdas 2013), 8.8% (Sirkesnas

2016) and 9.1% (Riskesdas 2018). The Ministry of Health's Balitbangkes released the latest data from the 2019 Global Youth Tobacco Survey (GYTS), showing that 40.6% of students in Indonesia aged 13-15 years, 2 out of 3 boys and almost 1 out of 5 girls have used tobacco products. In addition, 19.2% of students currently smoke and of these, 60.6% are not even prevented from buying cigarettes because of their age, and two-thirds of them can buy cigarettes at retail. GYTS data also shows that almost 7 out of 10 students have seen cigarette advertisements or promotions on television or at sales points in the last 30 days, and a third of students feel they have seen advertisements on the internet or social media (Kemenkes RI, 2023; Ladesvita & Mulyani, 2021).

Apart from smoking behavior, the trend of increasing the incidence of CKD is also accompanied by an increase in the population in Indonesia who tend to be overweight or even obese from year to year. Overweight increased from 8.6% in 2007 to 13.6% in 2018, obese increased from 10.5% in 2007 to 21.8% in 2018 (Kemenkes RI, 2023). Body size is one of the factors that influences the basal metabolic rate (BMR), that is, individuals with a larger body size have more tissue so that the BMR in these individuals is higher compared to normal individuals. The kidneys respond to this with a hyperfiltration mechanism to meet the body's metabolic needs. The next mechanism that can cause hyperfiltration is through a renal compensation mechanism due to a reduction in the number of nephrons that function adequately. The kidneys also have to work harder to filter blood more than normal to meet metabolic needs due to increased body weight. This increased function can damage the kidneys

and increase the risk of CKD in the long term (Slamet, 2021; Tangkere et al., 2023).

Apart from the increasing trend in smoking behavior, the incidence of hypertension is also increasing every year. In Indonesia with a population of 270.2 million people, the prevalence of hypertension continues to increase from 27.8 percent in 2013 to 34.1 percent in 2018. This is also supported by the theory which states that hypertension and CKD are closely related to the relationship between cause and overlapping consequences. Hypertension that occurs for a long time will cause the resistance of the afferent arterioles to change by narrowing the afferents due to the changed microvascular structure. As a result, glomerular ischemia occurs and so does the inflammatory response which ends in the release of inflammatory mediators, also endothelin, which then activates intrarenal angiotensin II and increases matrix production and deposits in the glomerular microvasculature and ends in the condition of nephrosclerosis as a result of hypertension (Nugraha et al., 2023; Gultom & Sudaryo, 2023).

Seeing that the incidence rate tends to increase, it is important to know the risk factors for chronic kidney disease such as smoking habits, obesity and hypertension, so that later prevention can be carried out by avoiding risk factors or controlling these risk factors. The number of ckd sufferers in malang city is currently predicted to reach more than 2,500 people, and it is estimated that this number will continue to increase as the number of diabetes mellitus cases increases. Treatment for ckd patients can be provided in hospital hemodialysis units that have capacity and dialysis service units. One of the hospitals in malang that treats ckd patients is panti nirmala hospital. Panti nirmala hospital is one of the private

hospitals in malang city. Based on existing medical record data, CKD is included in the top 10 most common diseases treated at this hospital. This research has the potential to provide insight into related research in accordance with the research objective, namely to determine the influence of smoking habits, obesity and hypertension on the incidence of chronic kidney disease at panti nirmala hospital, malang city.

## METHOD

Analytical observational research design, with a case control study design. This research was conducted at panti nirmala hospital, malang city, using secondary data obtained from medical records of chronic kidney disease patients at panti nirmala hospital who visited in january 2017 - december 2019. The population of this study was all patients at panti nirmala hospital, city of malang. Poor. The minimum sample size was calculated using sample size 2.2b software with two-sided difference hypothesis test calculations from lammeshow. In calculating the sample size, a minimum sample size of 146 respondents was obtained with a sample size ratio between case and control of 1:1, where the sample consisted of 143 respondents as the case group and 143 respondents as the control group, so the total sample size was 286 respondents. Sampling was carried out using a probability sampling technique, namely simple random sampling. The data obtained were analyzed statistically using univariate analysis to explain the frequency distribution and bivariate analysis using the chi square test.

RESULTS AND DISCUSSION

Data are presented in frequencies and percentages based on variable categories. Univariate analysis was used to identify the frequency distribution of respondent characteristics and bivariate analysis was used to identify the influence of independent variables (obesity, smoking

habits, and hypertension) on the dependent variable (chronic kidney disease) with the chi-square test using SPSS 22.0 (IBM Corporation, NY, USA). This research has received ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Brawijaya University, Ethical Clearance Number 74/EC/KEPK/03/2020.

Table 1. Frequency Distribution of Respondents Based on Respondent Characteristics and Variables studied

Karakteristik Variabel		Controll		Case	
		N	(%)	N	(%)
Sex	▪ Woman	85	59,4	46	32,2
	▪ Man	58	40,6	97	67,8
Age	▪ <60 age	97	67,8	47	32,9
	▪ ≥60 age	46	32,2	96	67,1
Obesity	▪ No Obesity	116	81,1	104	72,7
	▪ Obesity	27	18,9	39	27,3
Smoking Habits	▪ No Smoking Habits	104	72,7	89	62,2
	▪ Smoking Habits	39	27,3	54	37,8
Hypertension	▪ No Hypertension	63	44,1	42	29,4
	▪ Hypertension	80	55,9	101	70,6

Based on table 5.1, it can be seen that the proportion of respondents who were male was greater in the case group at 67.8% compared to 40.6% in the control group. The proportion of respondents aged ≥60 years was greater in the case group at 67.1% compared to the control group at 32.2%. The proportion of respondents who were obese was greater in the case group at

27.3% compared to the control group at 18.9%. The proportion of respondents who had a smoking habit was greater in the case group at 37.8% compared to the control group at 27.3% and the proportion of respondents who had hypertension was greater in the case group at 70.6% compared to the case group at 55. 9%.

Table 2. Effect of obesity, smoking habits, and hypertension on the incidence of CKD

Variable	Pvalue	OR	95% CI
Obesity	0,122	1,6	0,9 – 2,8
Smoking Habits	0,077	1,6	0,9 – 2,6
Hypertension	0,014	1,9	0,2 – 0,8

Bivariate analysis uses the chi square test. The results of bivariate analysis showed that hypertension ( $P_{\text{value}} = 0.014$ ) had an influence on the incidence of CKD. Respondents with hypertension had odds of suffering from CKD 1.9 times (CI 95%; 0.2-0.8) compared to respondents who did not have hypertension. Obesity ( $P_{\text{value}} = 0.122$ ) and smoking habits ( $P_{\text{value}} = 0.077$ ) have no influence on the incidence of CKD.

In the case group, the proportion of male respondents was 67.8%. In the control group, the proportion of male respondents was 40.6%. The highest incidence and prevalence in CKD patients are men. Data derived from the Derived from the Dialysis Outcomes and Practice Patterns Study (DOPPS) show that male CKD patients tend to start dialysis earlier compared with women and generally show poorer survival rates. The lower prevalence of CKD in premenopausal women is thought to be due to the protective role of the hormone estrogen in the development of CKD (Samosir et al., 2024; Swartling et al., 2021).

In the case group, the proportion of respondents aged  $\geq 60$  years was 67.1%. In the control group, the proportion of respondents aged  $\geq 60$  years was 32.2%. Based on a report from the Center for Disease Control and Prevention (CDC) in 2019 regarding Chronic Kidney Disease in the United States, it shows that 38% of CKD patients are aged 65 years or older, 13% of CKD patients are aged 45% -64%, and 7% of CKD patients aged 18%-44% (Ariyanti & Wdijati, 2020). Age is said to have a risk of CKD because kidney function decreases with increasing age in both women and men. Among the elderly population, it is known that more than half of the subjects examined have CKD. Thus, the elderly population is considered more

susceptible to experiencing CKD than those at a young age (Hasanah et al., 2023; Liu & Ravani, 2022).

In the case group, the proportion of respondents who were obese was 27.3%. In the control group, the proportion of respondents who were obese was 18.9%. The results of this study show that obesity does not have a significant relationship with the incidence of CKD. Obesity is said to have no direct influence on the incidence of CKD, but has an influence on metabolic syndrome diseases such as DM and hypertension. This metabolic syndrome disease is related to the incidence of CKD (Prihaningtyas et al., 2020). Apart from that, the results of this study also show that smoking habits do not have a significant relationship with the incidence of CKD. In the case group, the proportion of respondents with obesity was 37.8%. In the control group, the proportion of respondents with obesity was 27.3%. Smoking habits can be a cause of CKD, but this depends on the length and frequency of a person's smoking every day (Setyawan, 2021).

In the case group, the proportion of respondents with hypertension was 70.6%. In the control group, the proportion of respondents with hypertension was 55.9%. The results of this study show that hypertension has a significant relationship with the incidence of CKD, where respondents with hypertension have odds of suffering from CKD 1.9 times (CI 95%; 0.2-0.8) compared to respondents who do not have hypertension. The results of this research are in line with the results of research conducted by Aga et al., (2024) and Burnier & Damianaki (2023) which states that there is a significant relationship between hypertension and the incidence of CKD. A person is said to have high blood

pressure (hypertension) if the systolic and/or diastolic blood pressure is above normal, namely systolic pressure above 140 mmHg and diastolic blood pressure above 90 mmHg. High blood pressure will cause damage to blood vessels and the heart's work will increase, which will affect blood distribution. Hypertension that occurs for a long time will cause the resistance of the afferent arterioles to change by narrowing the afferents due to the changed microvascular structure. As a result, glomerular ischemia occurs and so does the inflammatory response which ends in the release of inflammatory mediators, also endothelin, which then activates intrarenal angiotensin II and increases matrix production and deposits in the glomerular microvasculature and ends in the condition of nephrosclerosis as a result of hypertension (Adi Nugraha et al., 2023; Gultom & Sudaryo, 2023).

## CONCLUSION

The findings of this study strengthen the causal relationship between hypertension and CKD, where the results show that hypertension has a significant influence on the incidence of CKD. Public health initiatives to always maintain and control blood pressure by changing lifestyle by following a healthy diet such as reducing saturated fat intake, increasing fiber intake and reducing carbohydrate intake as well as carrying out regular health checks such as taking blood pressure measurements at least once a year at Posbindu Non-Communicable Diseases or Health Service Facilities. Future research can explore further the factors related to CKD, especially factors that can be intervened.

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