

## **THE RELATIONSHIP BETWEEN SOFT DRINK CONSUMPTION AND CHRONIC KIDNEY DISEASE IN MUHAMMADIYAH PALEMBANG HOSPITAL**

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### **ABSTRACT**

Chronic kidney disease (CKD) has become one of the leading causes of death worldwide. It is one of several non-communicable diseases that have seen an associated increase in mortality over the past two decades. The causes of decreased kidney function are due to several factors, including a history of hypertension, cardiovascular history, family history of CKD, history of drinking preserved beverages, colored beverages, and other chemicals, and older age groups. Consuming soft drinks is associated with diabetes, hypertension, and kidney stones as risk factors for chronic kidney disease. This study aims to analyze the relationship between the frequency of soft drinks and chronic kidney disease at the Muhammadiyah Palembang Hospital. The sample of this study was 47 cases and 47 controls with an analytic observational research design with a case-control approach. This study used questionnaires and medical record data at the Palembang Muhammadiyah Hospital. Sampling used a consecutive sampling technique. The results showed that 61.7% of CKD patients and 55.3% of control subjects consumed soft drinks. The types of soft drinks consumed by CKD patients and control subjects were soft drinks with added sweeteners (100.0%). The results of the Pearson Chi-square test showed a value of  $p=0.644$  ( $p>0.05$ ). This study concluded that there is no relationship between the frequency of soft drinks and chronic kidney disease.

Keywords: Soda drinks, Chronic kidney disease, Case control

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## **Introduction**

Chronic kidney disease has become one of the leading causes of death worldwide. It is one of the few non-communicable diseases, apart from stroke and heart disease, that has been associated with increased mortality in recent years.<sup>1</sup> Chronic kidney disease (CKD) is a systemic disease characterized by prolonged changes in the shape, function, or both of the kidneys that impact health.<sup>2</sup> There are five stages of chronic kidney disease: stage 1, kidney damage with normal kidney function; stage 2, kidney damage with mild loss of kidney function; stage 3a, mild-moderate loss of kidney function; stage 3b, moderate-heavy loss of kidney function; stage 4 very severe loss of kidney function, and stage 5 kidney failure.<sup>3</sup>

Several factors can lead to decreased kidney function, including hypertension, heart disease, CKD in the family, consumption of preserved beverages, and older age.<sup>4</sup> Soft drinks containing high fructose can increase the excretion of calcium, oxalate, and uric acid, increasing the risk of kidney stones. Kidney stones are a risk factor for CKD.<sup>5</sup> Indonesia ranks third in sugar-sweetened beverage consumption in Southeast Asia, with 20 liters of soft drinks per person.<sup>6</sup> Indonesians consume 2.4 ml of soft drinks every day. Sales of soft drinks in Indonesia reached 944 million per liter, or 24.2% of total sales.<sup>7</sup>

Consumption of more than 1 unit (glass, bottle, or can) of sweetened soft drinks daily has a 23% greater risk of developing kidney stones than consumption of less than 1 unit per week.<sup>8</sup> Soft drinks contain phosphorus, additional color, and flavor. Dietary phosphate can affect serum phosphate and fibroblast growth factor-23 levels. Dietary soft drinks may increase dietary acid load due to their phosphorus

content, increasing the risk of kidney disease.<sup>9</sup> The fructose content in sweetened soft drinks is associated with an increased risk of kidney stones. The fructose content can increase serum urate concentration and cause kidney disease through renin production, vascular disease, and interstitial fibrosis. This situation leads to increased excretion of potassium, oxalate, and uric acid, which increases the likelihood of kidney stones.<sup>10</sup>

This study aimed to determine the relationship between the frequency of soft drink consumption and the incidence of chronic kidney disease at the Muhammadiyah Palembang Hospital.

## **Method**

This study was an analytic observational study with a case-control research design. This study was conducted in October-December 2023, with the population being chronic kidney disease patients in the Internal Medicine Poly and Hemodialysis Room of the Muhammadiyah Palembang Hospital and patients without chronic kidney disease in the Neurology and Eye Polyclinics of the Muhammadiyah Palembang Hospital. Samples were obtained from as many as 94 patients (47 cases and 47 control patients) using consecutive sampling techniques.

Inclusion criteria in case patients were chronic kidney disease patients in the Internal Medicine Poly and Hemodialysis Room at the Muhammadiyah Palembang Hospital with a minimum age of 18 years who were willing to become respondents. Exclusion criteria in case patients were patients with a history of kidney transplantation, patients with memory impairment, and pregnant women. The inclusion criteria for control patients were patients not diagnosed with chronic kidney disease at the

Muhammadiyah Palembang Hospital and had a minimum age of 18. Exclusion criteria for control patients were patients with congenital/congenital kidney disease, patients with a history of kidney surgery, and pregnant women.

The frequency of soft drinks was categorized as frequent if consumed  $\geq 1x/day$ , occasional if consumed 1-6 times per week, and rare if consumed  $< 3$  Times/month. Case subjects in this study were not differentiated based on the stage of CKD. Soft drinks consisted of 2 types: those with added sweeteners (e.g., Coca-Cola, sprite) and soft drinks with artificial sweeteners (e.g., Coca-Cola Zero Sugar).

The questionnaire had previously been validated on other populations. The results stated that the questionnaire was valid and reliable. Data analysis used the Pearson Chi-square test. This study has received ethical approval from the Bioethics, Humanities, and Islamic Medicine Committee of the Faculty of Medicine, University of Muhammadiyah Palembang No. 147/EC/KBHKKI/FK-UMP/XI/2023.

**Results**

After analyzing the data on 94 subjects, the frequency distribution of subject characteristics is shown in Table 1.

**Table 1.** Research Subject Characteristics

Characteristics	Case (N = 47)		Control (N= 47)	
	Frequency (person)	Percentage (%)	Frequency (person)	Percentage (%)
<b>Gender</b>				
Male	22	46.8	25	53.2
Female	25	53.2	22	46.8
<b>Age</b>				
<20 years old	0	0.0	0	0.0
20-29 years old	4	8.5	9	19.1
30-39 years old	5	10.6	19	40.4
40-49 years old	9	19.2	11	23.4
50-59 years old	16	34.0	6	12.8
$\geq 60$ years old	13	27.7	2	4.3
<b>Occupation</b>				
Unemployed	27	57.4	20	42.6
Employee	14	29.8	23	48.9
Self-employed	6	12.8	4	8.5
<b>Frequency of Soda Drinking</b>				
No Soda	18	38.3	21	44.7
Consuming Soda				
Seldom	14	29.8	15	31.9
Sometimes	11	23.4	7	14.9
Frequently	4	8.5	4	8.5
<b>Types of Soft Drinks</b>				
Artificial-sweetened	0	0.0	0	0.0
Sugar-sweetened	29	100.0	26	100.0

This study found an almost equal gender balance between the control and case groups. The control group was in the age range of 30-39 years (40.4%), and the case group was

50-59 years (34.0%). Regarding the frequency of soft drinks, the control group who consumed soft drinks was 55.3%, and the case group was 61.7%. Twenty-nine case subjects and 26 control subjects who consumed soft

drinks chose additional sweetener-type soft drinks (100.0%).

The relationship between the frequency of soft drink consumption and chronic kidney disease was done by combining cells for the category of rarely drinking soda and sometimes drinking soda. Data were then tested

using Pearson's test due to abnormal data distribution (Table 2). The Pearson Chi-Square test results showed no significant relationship between the frequency of soft drinks and chronic kidney disease with  $p\text{-value} = 0.644$  ( $p > 0.05$ ).

**Table 2.** Relationship between frequency of soft drink consumption and chronic kidney disease

Frequency	Chronic kidney disease				Total	p-value
	Case		Control			
	n	%	n	%		
Frequently	15	31.9	11	23.4	26	0.644
Seldom	14	29.8	15	31.9	29	
No soda	18	38.3	21	44.7	39	
Total	47	100.0	47	100.0	94	

**Discussions**

Most patients with CKD cases at the Muhammadiyah Palembang Hospital were female (Table 1). These results align with the research in Makassar and Tasikmalaya, which showed the same thing.<sup>11,12</sup> A systematic review study showed that the prevalence of CKD in Asia is higher in women.<sup>13</sup> According to the National Kidney Foundation, women are more prone to kidney failure because women are more prone to urinary tract infections due to the anatomical structure of the female urinary tract, which is shorter than men.<sup>14</sup>

This study found that the age of CKD patients was dominated in the age range of 50-59 years (Table 1). Previous research in Jakarta also found that CKD is more prevalent in the age range of 50-59 years, and in Madiun, which states that the most age is in the range of 46-65 years.<sup>8,15</sup> Aging causes changes in the renal parenchyma damaged by cellular aging and the cumulative effect of nephrotoxic agents prescribed during the patient's lifetime. Aging is also associated with other potentially

adverse lifestyle factors, such as lower levels of physical activity, obesity, and poor dietary quality that can exacerbate conditions such as insulin resistance and hypertension.<sup>16</sup>

All case and control subjects who consumed soft drinks chose sodas with added sweeteners (Table 1). Fizzy drinks with added sweeteners (fructose) have a sweet taste that is more preferred.<sup>17</sup> Fizzy drinks with artificial sweeteners are less preferred, possibly because they contain artificial sweeteners such as aspartame, which has a taste that is not identical to the sweet taste of sugar. The sweetness occurs more slowly, and there is also an aftertaste.<sup>18</sup>

This study showed no significant association between soft drink consumption and chronic kidney disease (Table 2). This result follows previous research, which states that consuming soft drinks is not a risk factor for the onset of chronic kidney disease.<sup>19</sup> The absence of a significant relationship in this study may be due to the subjects consuming soft drinks with a frequency that is not frequent so that the body can

maintain homeostasis for the kidneys. The amount of water consumed by a person can also neutralize the adverse effects on kidney health.<sup>20</sup>

### **Conclusions and Suggestions**

The incidence of chronic kidney disease in patients in this study was not associated with a history of frequent consumption of soft drinks. People should be wise in consuming soft drinks and pay attention to health conditions. Future researchers should conduct research in several locations and ensure that control patients are not diagnosed with chronic kidney disease.

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