



The Association of Dietary Behaviors and Fluid Intake with Symptoms of Decreased Renal Function among Nursing Students at Horizon Indonesia University

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Abstract: Decreased renal function is not only observed in older adults but can also occur in younger individuals as a result of unhealthy lifestyle behaviors. Unhealthy dietary behaviours, including high protein intake, junk food and caffeine consumption, along with inadequate fluid intake, may be associated with symptoms of decreased renal function among university students. This study aimed to examine the association between high protein intake, caffeine consumption, junk food consumption, and daily fluid intake with symptoms of decreased renal function among health science students at Horizon Indonesia University. This study employed a quantitative analytical design with a cross-sectional approach. A total of 300 students were selected using accidental sampling. Data were collected using a questionnaire and analyzed using the Chi-square test. A significant association was observed between high protein intake ($p = 0.037$), caffeine consumption ($p = 0.007$), junk food consumption ($p = 0.003$), and daily fluid intake ($p = 0.001$) with symptoms of decreased renal function. In conclusion, dietary patterns and drinking habits were significantly associated with symptoms of decreased renal function among health science students. These findings highlight the importance of promoting healthy dietary patterns and adequate fluid intake through nutrition education and preventive health programs to support renal health among university students.

Keywords: caffeine, fluid intake, high protein, junk food, renal function

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INTRODUCTION

The kidneys are vital organs that play a crucial role in maintaining body homeostasis through filtration, reabsorption, and secretion processes, as well as regulating fluid balance, electrolytes, and blood pressure. In addition, the kidneys produce hormones that regulate erythropoiesis and bone metabolism; therefore, impaired renal function can lead to systemic health consequences (Budi Susilo et al., 2023). The kidneys receive approximately 20–25% of total cardiac output, making renal function highly influenced by lifestyle and daily dietary habits (Ardiza et al., 2024).

Daily fluid intake, especially water, is a critical factor in maintaining kidney function. Chronic inadequate fluid consumption can lead to dehydration, resulting in reduced renal blood flow and impaired filtration processes (Suban & Luh Widani, 2024). Lewis (2017) states that prolonged insufficient mineral water consumption may lead to severe dehydration, thereby reducing renal perfusion and impairing kidney function. Meanwhile, Munandar (2016) at Dr. Moewardi Hospital demonstrates a significant association between mineral water intake of less than 2,000 ml per day and the occurrence of chronic kidney disease (CKD).

Healthy dietary patterns have a substantial negative impact on kidney function. Previous studies have demonstrated associations between specific dietary patterns and renal dysfunction. High protein intake is one of the factors associated with impaired renal function. Excessive protein consumption may induce glomerular hyperfiltration, which over time can accelerate the decline in glomerular filtration rate (Maleky & Ahmadi, 2025). Ekaputri (2022) also reported a strong relationship between protein intake and the progression of chronic kidney failure, which is consistent with the findings of Firmansyah (2022) regarding the significant influence of protein intake on CKD development.

According to the World Health Organization (WHO), CKD is among the ten leading causes of death worldwide. The global prevalence of CKD continues to increase, with more than 380 million cases estimated to occur across Southeast Asia, the Mediterranean region, the Middle East, and Africa. In the United States, CKD has become a major public health concern, with approximately 8 million cases and 600,000 related deaths reported (Yora Nopriani & Ani Rafikah, 2025). Data from the Indonesian Health Survey (2023) indicate that 0.20% of 114,619 individuals aged 15–24 years and older were diagnosed with CKD by physicians. West Java reported the highest number of CKD cases in Indonesia, totaling 131,846 cases. Furthermore, data from the Central Statistics Agency (BPS) of Karawang Regency (2022) recorded 5,291 dialysis procedures performed in healthcare facilities, reflecting the high demand for renal replacement therapy due to impaired kidney function. The high number of cases implies that adolescents and young adults tend to favor fast food products high in sugar, salt, and fat due to their more appealing taste compared to natural or minimally processed foods.

This food preference is supported by the findings of Puspita and Adriyanto (2019), revealing that adolescent dietary patterns exceeded the recommended daily intake limits for sugar, salt, and fat by 130.6%, 86%, and 65.7%, respectively. Such consumption patterns may increase the risk of metabolic disorders and organ dysfunction, including renal impairment. Furthermore, the consumption of junk food or ultra-processed foods (UPFs) may elevate the risk of CKD due to their high content of sodium, phosphate, saturated fats, sugars, and food additives, which can adversely

affect blood pressure, metabolic processes, and inflammatory responses (Sullivan et al., 2023). It can be concluded that prolonged exposure to such dietary patterns can significantly increase renal workload.

Young Adults, especially university students, generally exhibit unhealthy lifestyles due to dense academic demands, intensive learning activities, excessive stress, and lifestyles. These conditions often lead students to prefer fast and convenient food options such as junk food, caffeinated beverages, and high-protein foods (Nofiyanti et al., 2025). They also frequently consume caffeinated beverages such as coffee or energy drinks to combat fatigue and maintain alertness while completing academic tasks. Unfortunately, excessive caffeine consumption has been reported to increase the risk of CKD, as a study by Gao et al. (2025) found a significant association between caffeine intake from coffee and the incidence of CKD.

Within the university setting, particularly among health science students, dietary patterns such as protein intake, caffeine consumption, junk food intake, and daily drinking habits tend to differ from those of the general population. Despite health science students theoretically having better knowledge of healthy lifestyle behaviors, preliminary observations among health science students at Horizon Indonesia University revealed contrasting conditions. Initial interviews conducted with 20 health science students on October 7–8, 2025, indicated that six students frequently consumed high-protein foods such as fried chicken, eggs, and protein supplements more than four times per week. Five students reported daily consumption of caffeinated beverages to support academic activities, six students frequently consumed junk food due to convenience, and only three students reported drinking the recommended minimum of eight glasses of water per day. These consumption patterns suggest a potential risk of renal function impairment among health science students.

This study aimed to analyze the association between high protein intake, caffeine consumption, junk food consumption, and daily fluid intake with symptoms of decreased renal function among health science students at Horizon Indonesia University. Based on theoretical frameworks and previous research findings, the hypothesis of this study is that high protein intake, excessive caffeine consumption, high junk food consumption, and inadequate daily fluid intake are positively associated with an increased occurrence of symptoms of decreased renal function among health science students at Horizon Indonesia University.

METHODS

Design, Time, and Place

This study employed a quantitative method with a correlational analytic approach and a cross-sectional study design. The research was conducted from October to December 2025 at Horizon Indonesia University.

Population and Sample

The study population consisted of all first- to fourth-year health science students at Horizon Indonesia University, totaling 1,041 students. The minimum sample size calculated using Slovin's formula was 289 respondents. However, to anticipate potential incomplete data (non-response) and

to enhance the statistical power of the analysis, the sample size was rounded up to 300 respondents. The sampling technique used in this study was accidental sampling, a non-probability sampling method in which respondents encountered by the researcher and meeting the inclusion criteria were selected as study participants. This technique was chosen to facilitate respondent recruitment during the study period and was considered appropriate given field conditions and time constraints.

Inclusion criteria were active undergraduate nursing students (Bachelor of Nursing program) in years 1–4 at Horizon Indonesia University, in good health, with no history of kidney disease, and willing to participate in the study. Exclusion criteria included students from study programs other than undergraduate nursing, students who were currently ill or had a history of kidney disease, and respondents who did not complete the questionnaire fully.

Research Procedure and Instrument

Protein intake was assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), which demonstrated acceptable reliability with a Cronbach's alpha of 0.768. Caffeine consumption was measured using a modified version of the Caffeine Consumption Questionnaire (CCQ), with a Cronbach's alpha of 0.683. Junk food consumption was assessed using a Food Frequency Questionnaire (FFQ) based on the Ultra-Processed Food (UPF) category according to the NOVA classification, which showed high reliability with a Cronbach's alpha of 0.864. Daily fluid intake was measured using the Beverage Intake Questionnaire (BEVQ), which had a Cronbach's alpha of 0.710. Symptoms of decreased renal function were assessed using a self-reported symptom checklist developed by the researchers based on clinical literature on early signs of renal impairment and adapted with reference to the Kidney Disease Quality of Life–Short Form (KDQOL-SF). This instrument demonstrated high internal consistency with a Cronbach's alpha of 0.881. All research instruments underwent validity testing, with item-total correlation coefficients (r -calculated) exceeding the r -table value (0.381), indicating that all questionnaire items were valid.

Data Processing and Analysis

Data were collected using structured questionnaires and processed through several stages, including editing, coding, data entry, cleaning, and tabulation to ensure readiness for analysis. All coded data were entered and analyzed using SPSS software version 25. Data analysis was conducted quantitatively, comprising univariate analysis to describe respondent characteristics and the distribution of each variable in terms of frequencies and percentages, as well as bivariate analysis to examine the association between independent variables (high protein intake, caffeine consumption, junk food consumption, and daily fluid intake) and the dependent variable (symptoms of decreased renal function). Bivariate analysis was performed using the Chi-square (χ^2) test with a significance level of $p < 0.05$ and a 95% confidence interval. Fisher's Exact Test was applied as an alternative when expected cell counts were less than 5.

RESULTS

Based on the results of data analysis involving 300 respondents, the majority were aged 20–22 years, totaling 231 individuals (77%). In terms of sex, most respondents were female, accounting for

183 individuals (61%). Regarding cohort classification, the largest proportion of respondents belonged to the fourth cohort, with 115 individuals (38.3%), indicating that most respondents were final-year students. Based on body weight, the highest percentage was 51–60 kg, totaling 111 individuals (37%). Meanwhile, in terms of height, most respondents had a height ranging from 156–165 cm, accounting for 128 individuals (42.7%).

Table 1
Demography of Subject Characteristics Distribution

Respondents Characteristic	Frequency (n)	Percentage (%)
Age		
17-19 years	54	18.0
20-22 years	231	77.0
23-25 years	15	5.0
Gender		
Female	183	61.0
Male	117	39.0
Year of Study		
1	61	20.3
2	59	19.7
3	65	21.7
4	115	38.3
Weight		
40-50 kg	106	35.3
51-60 kg	111	37.0
61-70 kg	83	27.7
40-50 kg	106	35.3
Height		
145-155 cm	77	25.7
156-165 cm	128	42.7
166-175 cm	82	27.3
176-185 cm	13	4.3
Total	300	100

Based on the results of data analysis, the majority of respondents experienced symptoms of decreased kidney function, totaling 270 respondents (90.0%). In terms of protein intake, most respondents had a high protein intake, with 280 respondents (93.3%). Regarding caffeine consumption, almost all respondents were in the high-consumption category, with 291 respondents (97.0%). Similarly, most respondents were classified as having high junk food consumption, totaling 296 respondents (98.7%). With respect to daily fluid intake, the majority of respondents had an adequate level of fluid intake, with 272 respondents (90.7%).

The results of bivariate analysis using the Chi-square test with Fisher's Exact Test showed that high protein intake (p -value = 0.037), caffeine consumption (p -value = 0.007), junk food consumption (p -value = 0.003), and daily fluid intake (p -value = 0.001) had p -values $< \alpha = 0.05$; therefore, the null hypothesis was rejected. It can be concluded that there is a statistically significant association between high protein intake, caffeine consumption, junk food consumption, and daily fluid intake and

symptoms of decreased kidney function among health science students at Horizon University Indonesia.

Table 2

Distribution of Dietary Behaviors and Symptoms of Decreased Kidney Function

Variable	Frequency (n)	Percentage (%)
Decreased Kidney Function		
Symptoms Present	270	90.0
No Symptoms	30	10.0
Protein Intake		
Low	20	7.0
High	280	93.0
Caffein Consumption		
Low	9	3.0
High	291	97.0
Junk Food Consumption		
Low	4	1.3
High	296	98.7
Daily Fluid Intake		
Insufficient	28	9.3
Adequate	272	90.7
Total	300	100.0

The results of the Odds Ratio analysis demonstrated that students with high protein intake had a 3.4-fold higher likelihood of experiencing symptoms of decreased kidney function (OR = 3.400). Students with high caffeine consumption had an 8.154-fold higher likelihood (OR = 8.154), those with high junk food consumption had a 19.032-fold higher likelihood (OR = 19.032), and students with insufficient daily fluid intake had a 5.662-fold higher likelihood of experiencing symptoms of decreased kidney function (OR = 5.662).

Table 3

Bivariate Analysis of Dietary Behaviors with Symptoms of Decreased Kidney Function

Variable	Symptoms of Decreased Kidney Function				Total		p-value	OR
	Presence		Absence					
	n	%	n	%	n	%		
Food Rights Fulfillment								
Low	5	25.0	15	75.0	20	100	0.037*	3.400
High	25	8.9	255	91.1	280	100		
Caffeine Consumption								
Fulfilled	4	44.4	5	55.6	9	100	0.007*	8.154
Unfulfilled	25	8.9	265	91.1	291	100		
Junk Food Consumption								
Low	3	75.0	1	25.0	4	100	0.003*	19.032
High	27	8.9	269	91.9	296	100		
Daily Fluid Intake								
Insufficient	9	32.1	19	67.9	28	100	0.001*	5.662
Adequate	21	7.7	251	92.3	272	100		
Total	30	10	270	90	300	100		

*) p-value of Fisher's Exact Test with a significance level of $\alpha = 0.05$

DISCUSSION

Respondents Characteristic

The results of the analysis showed that the majority of respondents were aged 20–22 years (77%), which falls within the early adulthood category. During early adulthood, individuals generally exhibit physical and cognitive maturity and an adequate capacity to understand health-related information. However, this life stage is also commonly associated with lifestyle changes driven by academic demands, such as irregular eating patterns, increased fast food consumption, and higher intake of caffeinated beverages, which may potentially affect kidney health (Nofiyanti et al., 2025). Regarding sex, most respondents were female (61%). Females are generally more sensitive to changes in bodily conditions and more open to reporting health-related symptoms, which may facilitate early detection of symptoms of decreased kidney function through the questionnaire used in this study.

Most respondents belonged to the fourth cohort (38.3%), representing final-year students. Final-year students tend to experience higher academic pressure, which increases the risk of adopting unhealthy lifestyle behaviors, such as excessive caffeine consumption, frequent intake of junk food, and inadequate fluid intake. These conditions may elevate the risk of kidney function impairment at a young age (Nofiyanti et al., 2025). Based on anthropometric characteristics, most respondents had a body weight ranging from 51–60 kg and a height of 156–165 cm, indicating that the majority were within a relatively normal physical category. Nevertheless, normal anthropometric status does not necessarily reflect healthy dietary patterns or lifestyle behaviors. High protein intake, excessive consumption of caffeine and junk food, as well as insufficient daily fluid intake may still impose an additional burden on kidney function.

High Protein Intake and Symptoms of Decreased Kidney Function

The results of the bivariate analysis demonstrated a statistically significant association between high protein intake and symptoms of decreased kidney function among health science students at Horizon University Indonesia in 2025 ($p\text{-value} = 0.037 < \alpha = 0.05$). According to the Health Belief Model (HBM), this finding may be explained by low perceived susceptibility, whereby students do not consider themselves vulnerable to kidney disorders despite excessive protein consumption. In addition, perceived severity regarding the long-term impact of high protein intake remains low, as the symptoms experienced tend to be mild and not immediately apparent. Students also tended to perceive greater benefits (perceived benefits) from high protein consumption, such as increased stamina and physical endurance, compared to the benefits of limiting protein intake for kidney health. Perceived barriers, including established eating habits, environmental influences, and the popularity of high-protein diets, further reinforced this behavior. Moreover, the lack of specific education related to kidney health might contribute to minimal cues to action for regulating protein intake.

These findings are consistent with theoretical perspectives suggesting that excessive protein consumption increases the production of nitrogenous metabolic waste products, such as urea and creatinine. The accumulation of these substances requires the kidneys to work harder during filtration and excretion processes, which over time may lead to impaired kidney function (Dwi Anissa et al., 2021). Prolonged high protein intake may also induce glomerular hyperfiltration, a

compensatory mechanism in response to increased filtration workload. However, sustained hyperfiltration can ultimately result in a decline in the glomerular filtration rate and accelerate kidney damage (Rusdi et al., 2023). This risk is further exacerbated when high protein intake is not accompanied by adequate hydration, as fluid deficiency increases the burden on renal excretory function.

Caffeine Consumption and Symptoms of Decreased Kidney Function

The bivariate analysis revealed a statistically significant association between caffeine consumption and symptoms of decreased kidney function among health science students at Horizon University Indonesia in 2025 ($p\text{-value} = 0.007 < \alpha = 0.05$). From the perspective of the Health Belief Model (HBM), students tended to have low perceived susceptibility to the risks associated with caffeine consumption, as caffeine was commonly perceived as beneficial for supporting academic activities. Perceived severity was also low because the adverse effects of caffeine on kidney function were not immediately felt. Short-term benefits of caffeine consumption (perceived benefits), such as improved alertness and reduced fatigue, are perceived as more salient than the benefits of limiting caffeine intake. Perceived barriers, including academic demands and physical exhaustion, made it difficult for students to reduce caffeine consumption. Additionally, insufficient information regarding safe limits of caffeine intake contributed to a lack of cues to action for behavioral change.

These findings are consistent with existing theories suggesting that excessive caffeine intake may disrupt fluid balance and increase blood pressure through stimulation of the nervous and hormonal systems. This condition increases the workload of the kidneys in maintaining fluid and electrolyte homeostasis, which over time may impair kidney function (Reddy et al., 2024). Continuous caffeine consumption may also activate the renin–angiotensin–aldosterone system, leading to increased intraglomerular pressure due to renal vasoconstriction. According to Yusuf (2020), prolonged elevation of intraglomerular pressure may accelerate the decline in kidney function, particularly in individuals with additional risk factors such as hypertension.

Junk Food Consumption and Symptoms of Decreased Kidney Function

The results of the bivariate analysis indicated a statistically significant association between junk food consumption and symptoms of decreased kidney function among health science students at Horizon University Indonesia in 2025 ($p\text{-value} = 0.003 < \alpha = 0.05$). According to the Health Belief Model (HBM), students often did not perceive themselves as vulnerable (perceived susceptibility) to the negative effects of junk food consumption, as its impact was not immediately evident. Perceived severity was also low because kidney dysfunction developed gradually. The perceived benefits of junk food, such as convenience and palatability, outweighed the perceived benefits of maintaining a healthy diet. Perceived barriers, including time constraints and easy access to junk food, further reinforced this behavior. Moreover, limited promotion of healthy nutrition within the campus environment resulted in insufficient cues to action for reducing junk food consumption.

These findings align with theoretical evidence indicating that junk food typically contains high levels of sodium, sugar, and saturated fat. These components may elevate blood pressure and increase the burden on the kidneys in regulating fluid and electrolyte balance, thereby increasing the risk of kidney dysfunction over time (Priyadini & Puspitasari, 2024). Excessive consumption of junk

food, particularly ultra-processed foods, may also induce oxidative stress and inflammatory processes in renal tissues. According to Zhang (2024) cited in Cai et al. (2022), added phosphorus and various food additives commonly found in junk food may accelerate kidney function decline when consumed long-term. Consequently, the kidneys must work harder to filter metabolic waste products, increasing the risk of renal damage.

Daily Fluid Intake and Symptoms of Decreased Kidney Function

The bivariate analysis demonstrated a statistically significant association between daily fluid intake and symptoms of decreased kidney function among health science students at Horizon University in 2025 ($p\text{-value} = 0.001 < \alpha = 0.05$). From the Health Belief Model (HBM) perspective, students tended to have low perceived susceptibility and perceived severity regarding the risks of inadequate fluid intake, as it does not immediately cause severe symptoms. The perceived benefits of drinking water were often considered less appealing compared to other beverages. Perceived barriers, such as forgetting to drink water and demanding academic activities, contributed to persistent inadequate hydration habits. Furthermore, the lack of reminders and education regarding the importance of adequate hydration led to minimal cues to action for maintaining sufficient daily fluid intake.

These findings are consistent with theoretical explanations suggesting that insufficient fluid intake reduces renal perfusion and impairs the glomerular filtration process. Reduced renal perfusion decreases the kidney's ability to optimally filter blood, resulting in ineffective excretion of metabolic waste products (Rozi et al., 2023). Chronic inadequate hydration also leads to more concentrated urine, making it more difficult to eliminate waste substances such as urea and creatinine. According to Nurfrida et al. (2023), prolonged exposure to this condition may increase the risk of chronic kidney dysfunction due to the accumulation of metabolic waste and increased renal workload.

CONCLUSION

Based on the study results, the majority of respondents were aged 20–22 years, female, belonged to the fourth (final) cohort, had a body weight ranging from 51–60 kg, and a height ranging from 156–165 cm. In terms of kidney function, most respondents exhibited symptoms of decreased kidney function, predominantly among those with high protein intake, high caffeine consumption, high junk food consumption, and insufficient daily fluid intake. The results of bivariate analysis using the Chi-square test with Fisher's Exact Test indicated that high protein intake, caffeine consumption, junk food consumption, and daily fluid intake had $p\text{-values} < \alpha = 0.05$. It can therefore be concluded that there is a statistically significant association between high protein intake, caffeine consumption, junk food consumption, and daily fluid intake and symptoms of decreased kidney function among health science students at Horizon University Indonesia.

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Author Contribution Statement

Erlena Erlena: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, and Writing – review & editing. **Faizal Ramadhani:** Investigation, Data curation, Formal analysis, Validation, and Writing – review & editing. **Rina Vera:** Conceptualization, Methodology, Validation, Supervision, and Writing – review & editing.

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