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Dietary non-compliance among Indonesian patients with diabetes and kidney disease: A focus on risk-associated eating behaviors

Ketidakpatuhan terhadap pola makan pada pasien diabetes dan penyakit ginjal di Indonesia: Fokus pada perilaku makan yang berisiko

Ismi Irfiyanti Fachruddin[1*], Andi Hardianti[2]

[1] Bachelor's Degree Program in Family Welfare Education, Faculty of Engineering, Makassar State University, Makassar City, South Sulawesi, Indonesia. E-mail: ismi.irfiyanti.fachruddin@unm.ac.id
[2] Bachelor's Degree Program in Family Welfare Education, Faculty of Engineering, Makassar State University, Makassar City, South Sulawesi, Indonesia. E-mail: andi.hardianti@unm.ac.id

***Correspondence Author:**
Bachelor's Degree Program in Family Welfare Education, Faculty of Engineering, Makassar State University, Jalan Daeng Tata Raya Parang Tambung, Mannuruki, Kec. Tamalate, Makassar City, South Sulawesi, 90224, Indonesia.
E-mail: ismi.irfiyanti.fachruddin@unm.ac.id

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Abstract

Chronic illnesses, such as diabetes mellitus (DM), hypertension, and chronic kidney disease (CKD), are increasingly prevalent in Indonesia, partly due to poor dietary habits. This study aimed to analyze the association between risky food consumption and the occurrence of hypertension and CKD in individuals with diabetes and to explore the factors influencing unhealthy food choices. This cross-sectional study used data from the 2023 Indonesian Health Survey. The analysis included 14,935 adults diagnosed with diabetes mellitus, of whom 143 were identified as having both hypertension and CKD. Stratified random sampling was applied based on census blocks. Data were collected through structured interviews and health assessments of dietary patterns and a history of chronic illness. Chi-square tests and logistic regression were performed to assess the associations, with $p < 0.05$ considered significant. Hypertension was significantly associated with CKD (OR, 2.16; 95% CI: 1.68–2.77; $p < 0.001$). Risky dietary patterns, particularly high intakes of salty foods, processed meats, and sugary beverages, were significantly associated with hypertension. The major drivers of unhealthy food consumption include taste, affordability, and lack of health awareness. Risky food intake contributes to hypertension and CKD in patients with diabetes. Targeted public health interventions are required to improve dietary behavior and raise awareness.

Keywords: Diabetes Mellitus, Hypertension, Chronic Kidney Disease, Dietary Behavior

Abstrak

Penyakit kronis seperti diabetes melitus (DM), hipertensi, dan penyakit ginjal kronis (PGK) semakin meningkat di Indonesia, yang sebagian dipicu oleh pola makan yang tidak sehat. Penelitian ini bertujuan untuk menganalisis hubungan antara konsumsi makanan berisiko dengan kejadian hipertensi dan PGK pada individu dengan diabetes, serta mengeksplorasi faktor-faktor yang memengaruhi perilaku konsumsi makanan tidak sehat. Penelitian ini menggunakan desain potong lintang dengan data dari Survei Kesehatan Indonesia 2023. Analisis mencakup 14.935 orang dewasa dengan diagnosis DM, di mana 143 di antaranya mengalami hipertensi dan PGK. Pengambilan sampel dilakukan secara acak bertingkat berdasarkan blok sensus. Data dikumpulkan melalui wawancara terstruktur dan asesmen kesehatan yang mencakup pola makan dan riwayat penyakit kronis. Analisis dilakukan menggunakan uji chi-square dan regresi logistik dengan tingkat signifikansi $p < 0.05$. Hipertensi memiliki hubungan signifikan dengan PGK (OR = 2.16; 95% CI: 1.68–2.77; $p < 0.001$). Pola makan berisiko seperti konsumsi tinggi makanan asin, olahan, dan manis secara signifikan berhubungan dengan hipertensi. Faktor utama konsumsi makanan tidak sehat meliputi rasa, keterjangkauan, dan kurangnya kesadaran kesehatan. Konsumsi

makanan berisiko berkontribusi terhadap hipertensi dan PGK pada pasien diabetes. Intervensi kesehatan masyarakat yang terarah diperlukan untuk meningkatkan perilaku makan dan kesadaran gizi.

Kata Kunci: Diabetes Mellitus, Hipertensi, Penyakit Ginjal Kronis, Konsumsi Makanan Berisiko

Introduction

Chronic kidney disease (CKD) among patients with diabetes mellitus (DM) poses a formidable public health challenge in Indonesia, correlating with an increase in the diabetic and hypertensive population. Recent analyses of national health survey data indicate that individuals with type 2 diabetes exhibit a 2.48-fold increased risk of developing CKD compared with non-diabetics (Simanjuntak & Wahyono, 2021). Hypertension, which affects a significant proportion of patients with diabetes, is a critical risk factor that accelerates the progression of CKD. The prevalence of CKD in Indonesia has escalated to approximately 3.8% as of 2018, complicating the healthcare landscape, as it has become a substantial burden on the health system (Hustrini et al., 2022).

Hyperglycemia-induced glomerular damage in diabetes increases blood pressure (Aljabri, 2019). Hypertension further impairs renal function, creating a vicious cycle and elevating the risk of cardiovascular disease (Jankowski et al., 2021), severely affecting the kidneys and overall health.

The management of hypertension in patients with diabetes is critical for preserving renal function, particularly in the Indonesian healthcare context. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs) are frequently prescribed for their Reno protective effects, which include reducing proteinuria and slowing the progression of chronic kidney disease (CKD) (Wang et al., 2018). However, despite its efficacy, undertreatment remains a pressing concern, compounded by issues such as inadequate healthcare access and awareness of the disease (Ibrahim et al., 2016).

Dietary habits significantly affect the prevalence of chronic diseases, including hypertension and diabetes, particularly in Indonesia, where high salt intake combined with low consumption of fruits and vegetables is prevalent (Pathak & Dass, 2015). The transition towards unhealthy diets characterized by processed foods increases the risk of metabolic syndromes, exacerbating hypertension (Yao et al., 2021). Evidence suggests that a Mediterranean diet can lower the risks associated with type 2 diabetes and hypertension, although such dietary patterns are not widely adopted in Indonesia (Wang et al., 2022).

Dietary patterns also influence BMI and waist circumference, which are key predictors of hypertension and other chronic diseases (Coşoreanu et al., 2024). Adherence to a DASH diet lowers blood pressure, improves glycemic control, and reduces the risk of cardiovascular disease (Soltani et al., 2016). This underscores the need for dietary guidelines to promote healthy eating habits and combat chronic diseases.

In addition to hypertension, the effects of diet on diabetes and CKD are noteworthy. High-carbohydrate diets, particularly those rich in refined sugars and low in fiber, have been linked to the development of insulin resistance and type 2 diabetes (Nouri et al., 2023). Furthermore, dietary inflammatory indices have been shown to correlate with metabolic syndrome components, indicating that pro-inflammatory diets can exacerbate chronic conditions such as diabetes and cardiovascular diseases (H.-Y. Kim et al., 2018; Phillips et al., 2019). The consumption of nutrient-dense foods, such as fruits, vegetables, and whole grains, has been associated with lower inflammation and improved metabolic health, suggesting that dietary choices play a crucial role in disease prevention (Kim & Kim, 2022).

Health literacy plays a critical role in the dietary choices of patients with chronic diseases. Individuals with low health literacy often struggle to access, interpret, and apply nutritional information effectively, which hinders their ability to make informed food choices. This is particularly concerning in chronic disease management, where understanding nutrition labels and dietary guidelines is crucial for adherence to prescribed dietary interventions (Cash et al., 2014; Hakami et al., 2018). For instance, studies have shown

that improved comprehension of nutrition labels correlates with healthier dietary practices, which are vital for managing conditions, such as diabetes and hypertension (Hakami et al., 2018). Furthermore, health literacy not only influences dietary choices but also impacts overall health outcomes, suggesting that enhancing health literacy could lead to better disease management (Poureslami et al., 2016).

Emotional, cultural, and socioeconomic factors significantly affect food choices in patients with chronic conditions. Stress and depression trigger unhealthy eating behaviors such as high consumption of sugar and fat (Dalmazo et al., 2019; Kumela et al., 2019), creating a cycle that worsens health and emotions.

Cultural and regional dietary practices significantly influence health outcomes, particularly hypertension and chronic kidney disease (CKD), among Indonesian patients with diabetes. High sodium intake and reliance on processed foods are prevalent owing to cultural norms and socioeconomic constraints, which limit access to nutritious food options (Oddo et al., 2019). Consequently, individuals often resort to cheaper and less healthy alternatives, exacerbating their health issues. Understanding these dietary habits is crucial, as they are linked not only to individual patient care, but also to broader public health initiatives aimed at preventing the progression of diabetes, hypertension, and CKD (Fenta et al., 2023).

Health literacy plays an essential role in this context, as individuals must comprehend nutrition labels and make informed dietary choices to manage their conditions effectively. Enhancing health literacy can empower patients to select healthier foods, ultimately aiding in the better management of chronic diseases and reducing the public health burden associated with dietary non-compliance (Yamaoka et al., 2020). Therefore, this study aimed to identify risk-associated eating behaviors to inform targeted health interventions that address both individual and community-level dietary practices.

Methods

This cross-sectional study gathered data at a specific time to assess the correlation between the prevalence of hypertension and chronic kidney disease (CKD) in individuals with diabetes mellitus (DM). This study utilized data from the 2023 Indonesian Health Survey, an integrated survey incorporating elements of the 2018 Basic Health Research (Riskesdas) and the 2021-2022 Indonesian Toddler Nutritional Status Survey (SSGI). The survey covered all of Indonesia.

Data analysis for this study was conducted in 2024. The 14,935 patients with diabetes mellitus registered in 2023 constituted the research population for this study. Of these, 143 had both hypertension and chronic kidney disease (CKD), 112 had CKD, and 5,448 had hypertension alone. Individuals diagnosed with diabetes mellitus (DM) were included in the study, whereas those who did not submit all their survey data were excluded. As this study included data from the Indonesian Health Survey, the Association of Indonesian Public Health Higher Education Institutions (AIPTKMI) evaluated the questionnaire's validity and reliability. Sampling was performed using stratified and systematic sampling techniques. Census blocks were initially chosen proportionately to size (PPS) according to the number of households documented in the 2020 Population Census (SP2020). The chosen blocks were categorized as urban or rural and considered proximity to healthcare facilities. In the second phase, homes were chosen based on the presence of toddlers and the educational attainment of the family head.

The data collection process encompassed systematic interviews and health assessments, including information on age, sex, history of chronic illness, dietary habits, and motivations for choosing high-risk foods. Data processing was performed utilizing SPSS the Statistical Package for the Social Sciences (SPSS) software. The data processing included data cleaning to rectify missing or erroneous data, data transformation to classify variables in accordance with the study methodology, and descriptive data presentation using frequency distributions and percentages to delineate respondent characteristics.

This study utilized an analytical model that incorporated descriptive analysis to illustrate the sample history of chronic illnesses (hypertension and CKD), high-risk eating habits, and motivations for high-risk food intake. Bivariate analysis was used to investigate the correlations among the variables.

A chi-square test was conducted to examine the relationship between hypertension and kidney failure, with a significance level of p = 0.05, and 95% CI. The types of food surveyed included those considered risky for developing degenerative diseases, such as sweet foods, sugary drinks, salty foods, fatty, cholesterol-rich, or fried foods, processed meat, chicken, or fish with preservatives, flavor enhancers, soft drinks or carbonated beverages, energy drinks, instant noodles, and other instant foods. Consumption habits were categorized into two groups: at least three times a month and never consumed.

In addition, logistic regression analysis was conducted to examine the association between dietary patterns and hypertension incidence.

Subsequently, a chi-square test was conducted to examine the reasons for consuming risky foods, with answer options including good taste, easy availability, low cost, and lack of awareness of dangers and risks.

Result and Discussion

The results of the bivariate analysis (Table 1) demonstrated a statistically significant association between hypertension and the presence of chronic kidney disease (CKD) in individuals with diabetes mellitus. Among respondents with hypertension, 2.6% had CKD, whereas only 1.2% of those without hypertension had CKD. The odds ratio (OR) for developing CKD among individuals with hypertension was 2.16 (95% CI: 1.68–2.77; p < 0.001), indicating that individuals with diabetes and hypertension were more than twice as likely to have chronic kidney disease compared to those without hypertension.

Table 1. The relationship between hypertension and chronic kidney disease in individuals with diabetes mellitus

Hypertension	Chronic kidney disease		Total (%)	Nilai OR 95% CI	p-value
	Yes (%)	No (%)			
Yes	143 (2.6)	5448 (97.4)	5591 (37.4)	2.16 (1.68-2.77)	0.000
No	112 (1.2)	9232 (98.8)	9344 (62.6)		
Total	255 (1.7)	14680 (98.3)			

Table 2 presents the frequency of risky food consumption habits divided into two categories: individuals who consumed these foods three or more times per month and those who never consumed them at all. Most participants frequently consumed sweet foods (70.6%), sugary drinks (69.9%), salty foods (76.9%), and fatty or fried foods (81.8%), while a smaller percentage (18.2 %–30.1 %) reported never consuming these items. Processed meat or fish with preservatives were regularly consumed by 66.4% of the respondents, with 33.6% avoiding them entirely. Flavor enhancers had the highest frequency of consumption, with 83.9% of the participants using them regularly, while only 16.1% never consumed them. In contrast, soft drinks and carbonated beverages were consumed by 21.7% of the individuals three or more times per month, with 78.3% abstaining. Energy drinks had the lowest frequency of consumption, with only 13.3% of the participants consuming them regularly and 86.7% avoiding them. Lastly, 54.4% of the participants frequently consumed instant noodles or other instant foods, whereas 44.1% never consumed them. Overall, the data highlighted a high prevalence of risky food consumption habits, especially for sweet, salty, and processed foods, with fewer participants regularly consuming soft, energetic, and instant foods.

Table 2. Risky Food Consumption Habit

Food Consumption Habit	Frequency	
	≥ 3 times per month (%)	Never (%)
Sweet foods	102 (70.6)	41 (28)
Sugary drinks	100 (69.9)	43 (30.1)
Salty foods	110 (76.9)	33 (23.1)
Fatty/cholesterol-rich/fried foods	117 (81.8)	26 (18.2)
Processed meat/chicken/fish with preservatives	95 (66.4)	48 (33.6)

Flavour enhancers	120 (83.9)	23 (16.1)
Soft drinks/carbonated beverages	31 (21.7)	112 (78.3)
Energy drinks	19 (13.3)	124 (86.7)
Instant noodles, or other instant foods	79 (54.4)	64 (44.1)

Table 3. Logistic Regression Analysis of Dietary Patterns Associated with Hypertension Risk

	B	S.E.	Wald	df	p-value	OR	95% CI	
							Min	Max
Sugary drinks	0.150	0.062	5.868	1	0.015	1.162	1.029	1.312
Salty food	0.364	0.054	45.682	1	0.000	1.439	1.295	1.599
Processed meat/chicken/fish with preservatives	0.132	0.038	12.135	1	0.000	1.141	1.059	1.228
Energy drinks	0.214	0.054	15.701	1	0.000	1.239	1.114	1.378
Instant noodles, or other instant foods	0.201	0.040	24.569	1	0.000	1.222	1.129	1.323

Table 3 presents the results of the stepwise logistic regression analysis, which revealed that several dietary patterns were significantly associated with the likelihood of developing hypertension. The final model (Step 5) revealed that consumption of salty foods ($p < 0.001$; OR = 1.439; 95% CI, 1.295–1.599), energy drinks ($p < 0.001$; OR = 1.239; 95% CI: 1.114–1.378), instant noodles ($p < 0.001$; OR = 1.222; 95% CI: 1.129–1.323), processed foods with wet preservatives ($p < 0.001$; OR = 1.141; 95% CI: 1.059–1.228), and sugar-sweetened beverages ($p = 0.015$; OR = 1.162; 95% CI: 1.029–1.312) significantly increased the risk of developing hypertension. These findings suggest that a high dietary intake of sodium, preservatives, and added sugars contributes to the elevated blood pressure.

As presented in Table 4, the primary reason for consuming potentially high-risk foods was palatability. "Good taste" emerged as the most frequently cited factor across various food categories, particularly flavor enhancers (111 out of 120 respondents), salty foods (99 out of 110), and sweet foods (96 out of 102). Moreover, ease of access was a significant contributing factor, notably in the consumption of fatty and cholesterol-rich fried foods (102 out of 117) and instant noodles or other instant food products (70 out of 79). These findings suggest that sensory appeal and availability are key drivers of unhealthy food consumption. An interesting finding was the relatively high proportion of people consuming processed meat/chicken/fish with preservatives (40 out of 95) and instant noodles (47 out of 79) owing to a lack of awareness, suggesting potential gaps in public knowledge about their health risks, where cost considerations are somewhat more evident.

The findings of this study align with those of previous studies that emphasized the role of hypertension in CKD progression. For instance, a systematic review indicated that poorly controlled diabetes and hypertension significantly increase the risk of developing CKD (Shiferaw et al., 2020). Additionally, a meta-analysis focusing on Ethiopian patients with diabetes revealed that age, duration of diabetes duration were significantly associated with CKD prevalence (Shiferaw et al., 2020). These findings suggest that managing blood pressure and glycemic control is crucial for preventing CKD in patients with diabetes.

Table 4. Reason for consuming risky food

Reason for consuming risky food	Reasons for consuming risky food							
	Good taste		Easy availability		Cheaper		Lack of awareness	
	Yes	No	Yes	No	Yes	No	Yes	No
Sweet food (n=102)	96	6	89	13	70	32	38	64
Sugary drinks (n=100)	94	6	86	14	68	32	39	61
Salty foods (n=110)	99	11	92	18	77	33	42	68
Fatty/cholesterol-rich/fried foods (n=117)	105	12	100	17	83	34	43	74
Processed meat/chicken/fish with preservatives	90	5	85	10	69	26	40	55

(n=95)								
Flavour enhancers (n=120)	111	9	103	17	84	36	43	77
Soft drinks/carbonated beverages (n=31)	30	1	31	0	26	5	17	14
Energy drinks (n=19)	18	1	19	0	16	3	12	7
Instant noodles, or other instant foods (n=79)	75	4	70	9	58	21	32	47

Moreover, the relationship between hypertension and CKD is complicated by the presence of other comorbidities. For example, a study conducted in Ghana reported a high prevalence of CKD (74%) in patients with both diabetes and hypertension, suggesting that the interplay between these conditions can lead to more severe renal impairment (Ephraim et al., 2015). Similarly, a study from Nigeria has highlighted that hypertension and diabetes remain the leading causes of CKD, with an increasing prevalence of hypertension in both urban and rural communities (Akpan & Ekrikpo, 2015). This trend necessitates a comprehensive approach to patient education and lifestyle modifications to mitigate the risks associated with chronic conditions.

The implications of these findings extend beyond individual patient care and include the development of public health strategies. Increasing awareness of the risks of hypertension and diabetes in relation to CKD is essential for early detection and intervention. A study from Ethiopia emphasized the importance of screening and educating patients about CKD risk factors, which can lead to improved health outcomes (Kumela et al., 2019). Furthermore, understanding the biochemical and clinical characteristics of CKD in patients with hypertension can lead to better management practices and therapeutic interventions (Baaj et al., 2020).

Stepwise logistic regression analysis revealed that certain dietary patterns, particularly those high in sodium and preservatives, significantly increased the risk of developing hypertension. Specifically, the consumption of salty foods, energy drinks, instant noodles, processed foods with wet preservatives, and sugar-sweetened beverages was notably associated with an increased risk of hypertension ($p < 0.001$). This aligns with the existing literature, indicating that excessive sodium intake is directly correlated with elevated blood pressure and the incidence of hypertension in various populations. Notably, studies conducted in Japan have highlighted the detrimental impact of high-sodium consumption from processed foods on health outcomes (Takase et al., 2015). Evidence from other regions, including findings related to dietary patterns linked to hypertension, suggests that there is indeed a connection between salty processed foods and the risk of hypertension (Gbadamosi & Tlou, 2020).

In Indonesia, a similar dietary trend has been observed, characterized by rising consumption of processed and ultra-processed foods, which are often laden with high salt and sugar contents. Research indicates that Indonesian dietary habits have shifted towards greater consumption of these foods, coinciding with increasing rates of obesity and hypertension. Local studies have corroborated the association between high salt intake from processed foods and hypertension risk, suggesting that the population faces significant public health challenges owing to poor dietary choices (Nardocci et al., 2020; Stamler et al., 2018). These findings underscore the need for dietary awareness and highlight the urgency of public health interventions targeting dietary modifications in Indonesia to mitigate the epidemic.

Moreover, the convenience and availability of certain food items play crucial roles in shaping consumption patterns. This was particularly evident in the case of fatty and cholesterol-rich fried foods, where 102 of the 117 respondents indicated that accessibility influenced their choices. Instant noodles and other ready-to-eat foods also reflected this trend, with 70 of the 79 respondents citing availability as a key factor. The preference for instant foods can be attributed to modern lifestyles that prioritize time efficiency as consumers often seek quick meal solutions that fit their busy schedules (Coşoreanu et al., 2024; Toiba et al., 2023). This preference for convenience is further supported by the increasing consumption rates of instant noodles in Indonesia, which have reached significant figures, underscoring their status as a staple food in the region (Coşoreanu et al., 2024).

Cost considerations have also emerged as a factor influencing food choices, albeit to a lesser extent than taste and food availability. The economic aspect of food consumption cannot be overlooked, as many consumers may opt for cheaper processed foods because of financial constraints. This behavior is particularly pronounced in lower-income demographics, where the affordability of food items often dictates dietary choices and preferences. Studies indicate that economic factors significantly impact consumer preferences, particularly in developing countries where budget constraints are prevalent (Ajisuksmo, 2021).

These findings indicate a concerning level of awareness of the health risks associated with processed meat and instant noodle consumption. Specifically, 40 out of 95 respondents consumed processed meat with preservatives, while 47 out of 79 reported consuming instant noodles, largely because of insufficient knowledge of their potential health effects. This gap emphasizes the urgent need for enhanced public health education aimed at increasing awareness of dietary choices and their impact on health.

The literature supports the assertion that nutritional literacy plays a crucial role in dietary behavior. For instance, studies have highlighted that a lack of engagement with nutritional information such as food labels directly correlates with poorer food choices, particularly among medical students in Vietnam (M et al., 2023). Similarly, it has been demonstrated that socio-demographic factors can significantly shape dietary patterns, highlighting the necessity for tailored educational interventions targeting specific populations (Ruggieri et al., 2022). Research suggests that improving knowledge of nutrition among at-risk groups can lead to healthier dietary practices and a reduced incidence of non-communicable diseases (NCDs) (Cena & Calder, 2020; Al Rahmad, 2021).

In Indonesia, where processed foods are becoming increasingly prevalent, these findings have significant implications for public health. Targeted educational campaigns are crucial for mitigating health risks, particularly in urban areas, where convenient yet unhealthy food options are more accessible. Interventions aimed at enhancing nutritional knowledge can potentially lead to the decreased consumption of harmful processed foods and positively impact public health outcomes (Amoah et al., 2024; Chen & Li, 2024). Enhanced nutrition education should focus on integrating accurate dietary information into community health initiatives to foster a more health-conscious society.

Furthermore, the interplay between taste, convenience, and awareness of health risks suggests a complex relationship that shapes consumer behavior regarding risky foods. As individuals navigate their food choices, they often weigh the immediate gratification of taste and convenience against the long-term health implications of their dietary habits. This dynamic is particularly relevant in the context of adolescents and young adults, who may be more susceptible to peer influence and marketing strategies that promote unhealthy food options (Hale & Viner, 2016; Yunas et al., 2021).This study had several limitations that should be acknowledged. First, dietary habits and reasons for consuming risky foods were self-reported, which introduces the possibility of recall and social desirability bias. Additionally, although the initial sample size was large, the final subgroup analysis included only 143 individuals with diabetes mellitus, hypertension, and/or CKD, potentially limiting the generalizability of our findings. Finally, the assessment of motivations for risky food consumption was limited to predefined response categories, which may not fully capture the complex social, cultural, and psychological drivers of dietary behavior. These limitations highlight the need for further research using longitudinal designs and more comprehensive assessments to better understand the causal mechanisms and broader contextual influences of dietary non-compliance in populations with chronic diseases.

Conclusion

This study confirmed a significant association between hypertension and chronic kidney disease (CKD) in patients with diabetes mellitus (DM), highlighting hypertension as a major contributing factor in CKD progression. Furthermore, frequent consumption of risky foods, such as salty, sugary, and processed foods, was significantly associated with an increased risk of hypertension, which in turn exacerbated the risk of CKD. These findings directly support the original research objective of assessing the association between dietary patterns, hypertension, and CKD in individuals with diabetes.

The study also identified taste preference, ease of access, and limited health awareness as key drivers of risky food consumption. These insights underscore the urgent need for targeted public health interventions to reduce risky dietary behaviors. Future strategies should focus on improving health literacy, promoting accessible and affordable healthy foods, and implementing culturally relevant educational campaigns to mitigate the burden of diet-related chronic diseases in the country.

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