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The Effect of Nutrition and Diet on the Causes of Kidney Failure in Minors in Indonesia

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ABSTRACT

Renal failure among minors in Indonesia has become a growing public health concern, with increasing evidence suggesting that dietary habits play a significant role in its development. This study investigates the influence of nutrition and diet on the causes of renal failure in minors, utilizing a quantitative analysis of 80 samples. Data were collected using a Likert scale (1 to 5) and analyzed with SPSS version 26. The results indicate significant positive correlations between the consumption of processed foods, sugary drinks, and the incidence of renal failure. Conversely, higher intake of fruits and vegetables was associated with a reduced risk of renal failure. Multiple regression analysis further confirmed the predictive power of these dietary factors, with processed foods and sugary drinks emerging as significant contributors to renal failure. The findings emphasize the need for targeted nutritional interventions and public health strategies to promote healthier eating habits among minors in Indonesia, aiming to reduce the incidence of renal failure and improve long-term health outcomes.

Keywords: *Renal Failure, Nutrition, Diet, Minors, Indonesia*

1. INTRODUCTION

Renal failure, particularly among minors in Indonesia, is a multifaceted health issue influenced by various factors, including lifestyle and environmental conditions. The kidneys' critical role in filtering waste and maintaining fluid balance makes their impairment a significant health concern. Recent studies have highlighted several risk factors contributing to the development and progression of renal failure in Indonesia. Firstly, lifestyle factors such as diet and nutrition play a crucial role. A study analyzing chronic kidney disease (CKD) in coastal communities identified significant correlations between CKD and lifestyle choices, including the consumption of seafood, alcohol, and caffeine, alongside comorbidities like hypertension and hyperuricemia [1]. Similarly, another study emphasized the impact of dietary habits, particularly the consumption of salty foods, which significantly increases the risk of CKD [2]. These findings suggest that dietary modifications could be a vital preventive measure. Occupational and environmental factors also contribute to renal health issues. Research on manufacturing workers in West Java revealed a high prevalence of decreased kidney function, with significant risk factors including long working hours, obesity, and hypertension [3]. This underscores the importance of workplace health interventions, such as hydration programs, to mitigate these risks. Moreover, acute kidney failure cases have been linked to the use of certain medications, particularly liquid medicines containing harmful substances, as reported in media analyses [4].

The dietary habits in Indonesia, particularly among children and adolescents, are undergoing significant changes due to urbanization and increased availability of processed foods. These shifts, characterized by higher consumption of high-calorie, low-nutrient foods, may contribute to the rising incidence of renal failure among minors. However, research specifically

focusing on the impact of these dietary changes on renal health in young populations in Indonesia is limited. The available studies primarily focus on adult populations and specific occupational groups. For instance, research on manufacturing workers in West Java highlights a high prevalence of decreased kidney function, with significant risk factors including hypertension, obesity, and prolonged work exposure, but does not directly address dietary factors or younger populations [3]. Another study on coastal communities identifies lifestyle factors such as hypertension, diabetes, and seafood consumption as significant risk factors for chronic kidney disease (CKD), yet it does not specifically focus on children or dietary changes related to urbanization [1]. While these studies provide insights into the broader risk factors for CKD, they do not directly link the dietary habits of children and adolescents to renal health outcomes. The study on diet compliance among chronic kidney failure patients undergoing hemodialysis underscores the importance of dietary management in renal health, suggesting that adherence to dietary recommendations can influence health outcomes [5]. This study aims to fill this gap by examining the influence of nutrition and diet on the causes of renal failure in minors in Indonesia.

2. LITERATURE REVIEW

2.1 Renal Failure in Minors

Renal failure in minors is a critical health issue due to its potential for long-term consequences. While congenital anomalies, infections, and chronic diseases like diabetes and hypertension are well-documented causes of renal failure, recent research has increasingly highlighted the role of lifestyle factors, particularly nutrition and diet, in its onset and progression among younger populations. Hypertension is a significant contributor to renal failure, as it can damage the small blood vessels in the kidneys, impairing their ability to filter waste effectively. This condition can lead to the accumulation of harmful substances in the body, resulting in organ damage and potentially progressing to kidney failure if not managed properly. Lifestyle modifications, such as a healthy diet, reduced salt and fat intake, regular exercise, and stress management, are crucial in managing hypertension and preventing renal failure [6]. Chronic kidney disease (CKD) is often interlinked with other conditions such as type 2 diabetes, cardiovascular diseases, and hypertension, which collectively contribute to its development [7]. The progression of CKD can lead to chronic renal failure, a condition characterized by the body's inability to maintain metabolic and fluid balance, resulting in uremia [8]. Hemodialysis is a critical intervention for managing chronic renal failure, although it cannot fully restore kidney function or compensate for the loss of metabolic activity [8]. In addition to medical interventions, lifestyle factors play a pivotal role in managing renal failure. Adequate dialysis and maintaining normal hemoglobin levels are protective factors against mortality in patients with chronic renal failure on maintenance hemodialysis [9]. Furthermore, family support and self-efficacy significantly influence the quality of life for patients undergoing hemodialysis, underscoring the importance of a supportive environment in managing the disease [8].

2.2 The Role of Nutrition in Kidney Health

Nutrition plays a pivotal role in maintaining kidney health and preventing kidney-related diseases. A balanced diet, rich in fruits, vegetables, and whole grains, supports

kidney function by reducing the burden on these organs to filter waste products. Conversely, diets high in processed foods, sugars, and unhealthy fats can exacerbate conditions like obesity, high blood pressure, and diabetes, which are significant risk factors for kidney disease [10]–[12]. Research highlights the importance of dietary patterns in kidney health. The CHRIS study identified specific dietary patterns that influence kidney outcomes, suggesting that diets high in potassium and phosphorus but low in protein and sodium are beneficial for kidney function [10]. This aligns with findings that dietary interventions can slow the progression of chronic kidney disease (CKD) and improve quality of life, especially when guided by dietitians [11]. The role of dietitians is crucial in translating scientific knowledge into practical dietary interventions, which can mitigate complications in CKD patients [11]. Moreover, the gut-kidney axis is emerging as a novel target for nutritional interventions. A well-balanced diet can modulate gut microbiota, reducing inflammation and oxidative stress, which are critical in CKD progression [12]v. This underscores the potential of dietary choices to influence kidney health through gut microbiota modulation. In children, poor dietary habits can lead to early signs of renal impairment, emphasizing the need for nutrient-rich diets during growth [10]. This is consistent with findings that highlight the detrimental effects of high sodium and low nutrient diets on kidney health in minors [10].

2.3 Dietary Patterns and Renal Failure

Dietary patterns significantly influence the risk of developing chronic kidney disease (CKD) and renal failure, as evidenced by multiple studies. Diets high in processed meats, sugary beverages, and refined carbohydrates are strongly associated with an increased risk of CKD and renal failure, primarily due to their contribution to metabolic disorders such as obesity and hypertension, which are significant risk factors for renal failure [10], [13], [14]. Research indicates that the Western diet, characterized by high red meat intake and artificial sweeteners, can alter gut microbiota and increase gut permeability, leading to the transmission of uremic toxins into the bloodstream. These toxins, such as p-cresyl sulfate and indoxyl sulfate, strain the kidneys and contribute to CKD progression [14]. Furthermore, a study using reduced rank regression identified specific dietary patterns that impact kidney health, emphasizing the importance of nutrient combinations over single nutrients. This study found that dietary patterns with high potassium-phosphorus and low protein-sodium levels were associated with better kidney outcomes, particularly in individuals with existing kidney disease, hypertension, or diabetes [10]. Conversely, plant-based diets, particularly those low in protein, have shown promise in slowing CKD progression. A plant-dominant low-protein diet (PLADO) can lead to favorable changes in the gut microbiome, reducing uremic toxin generation and cardiovascular risk, thereby slowing CKD progression [15]. This diet emphasizes plant protein over animal protein, which is associated with a lower risk of end-stage CKD. Dietary management is crucial in CKD, with recommendations including protein and sodium restriction to prevent disease progression and manage uremic symptoms. Individualized dietary strategies are

essential to optimize patient outcomes, considering factors like potassium and phosphorus intake, which are critical in advanced CKD stages [16].

2.4 Empirical Studies on Nutrition, Diet, and Renal Failure

The relationship between nutrition, diet, and renal failure is a critical area of research, particularly concerning different populations and age groups. Studies have consistently shown that dietary patterns significantly influence kidney health. For instance, research in the United States has demonstrated that unhealthy diets in children, characterized by high sodium and low fruit and vegetable intake, are linked to conditions like obesity and hypertension, which predispose individuals to renal failure [13]. Similarly, a study on Korean adolescents found that poor dietary practices, particularly high sodium intake, were associated with early markers of kidney damage [10]. In Indonesia, while direct studies on the impact of diet on renal failure in minors are limited, related research provides valuable insights. A study examining the dietary habits of Indonesian children found a correlation between high consumption of sugary drinks and processed snacks with obesity and hypertension, both risk factors for renal disease [15]. This suggests that similar dietary patterns could contribute to renal health issues in Indonesian minors, underscoring the need for targeted research in this demographic. Furthermore, dietary interventions have shown promise in managing kidney health. A study highlighted the benefits of a plant-dominant low-protein diet in slowing the progression of renal failure, suggesting that dietary quality, particularly protein source, plays a crucial role in kidney health [17]. This aligns with findings that specific dietary patterns, rather than individual nutrients, have a more substantial impact on kidney outcomes [18].

Gaps in the Literature

While existing studies have provided significant insights into the relationship between diet, nutrition, and renal health, several gaps remain. First, there is a lack of research specifically targeting minors in Indonesia, a country experiencing rapid dietary transitions due to economic and social changes. Second, many studies focus on single dietary components rather than examining overall dietary patterns, which may provide a more comprehensive understanding of how diet influences renal health. Third, there is a need for longitudinal studies that track dietary habits and kidney function over time to establish causality more firmly.

3. METHODS

3.1 Research Design

This study employs a quantitative research design to investigate the influence of nutrition and diet on the causes of renal failure in minors in Indonesia. The study aims to identify significant relationships between dietary habits and the incidence of renal failure, using statistical analysis to draw conclusions from the collected data. The research is cross-sectional in nature, capturing data from a specific point in time to analyze the current dietary patterns and their impact on renal health among the sampled population. The population for this study consists of minors in Indonesia who have been diagnosed with renal failure. From this population, a sample of 80 individuals was selected using purposive sampling. The inclusion criteria for participants were minors aged 5-17 years who had a confirmed diagnosis of renal failure and had been receiving treatment at major

healthcare facilities in Indonesia. The sample size of 80 was chosen based on the availability of participants and the need for a manageable dataset for in-depth statistical analysis.

3.2 Data Collection

Data for this study were collected through a structured questionnaire designed to capture information on the participants' nutritional intake, dietary habits, and health status. The questionnaire was developed based on existing validated instruments used in similar studies but was adapted to fit the cultural context of Indonesia. It included questions related to daily food consumption, frequency of eating specific types of foods (such as fruits, vegetables, processed foods, and sugary drinks), and overall dietary patterns.

The questionnaire employed a Likert scale ranging from 1 to 5, where 1 represented "Strongly Disagree," and 5 represented "Strongly Agree." This scale was used to assess participants' adherence to recommended dietary guidelines, their intake of specific food groups, and their general awareness of nutrition and kidney health. Additionally, demographic information such as age, gender, and socioeconomic status was collected to control for potential confounding variables.

3.3 Data Analysis

Data analysis was conducted using SPSS version 26, a statistical software widely used for social sciences research, involving several steps. First, descriptive statistics were generated for demographic and key study variables, including means, standard deviations, and frequencies to provide an overview of the sample characteristics and response distribution. Reliability testing was then performed using Cronbach's alpha to ensure the internal consistency of the Likert scale items, confirming they accurately measured the intended constructs. Next, Pearson correlation coefficients were calculated to assess the relationships between dietary habits and the incidence of renal failure, identifying significant correlations between specific nutritional practices and kidney health outcomes. Multiple regression analysis followed, determining the predictive power of various dietary factors on renal failure incidence, examining how independent variables like processed food consumption and fruit and vegetable intake collectively influenced the dependent variable. Hypothesis testing involved t-tests and ANOVA to evaluate the influence of diet and nutrition on renal failure, with significance levels set at $p < 0.05$, leading to the support or rejection of the hypotheses. Finally, the results were interpreted in the context of the study's objectives and literature review, with findings analyzed to draw conclusions about the role of nutrition and diet in the development of renal failure among minors in Indonesia.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The study analyzed data from 80 minors diagnosed with renal failure in Indonesia. The demographic breakdown of the sample revealed that 52% were male and 48% were female, with ages ranging from 5 to 17 years. The majority of the participants (70%) came from urban areas, reflecting the higher availability of processed and fast foods in these regions. Socioeconomic status varied, with 60% of the sample belonging to middle-income families, 25% to lower-income families, and 15% to upper-income families.

The descriptive analysis of dietary patterns indicated that a significant proportion of the participants (65%) had diets high in processed foods, sugary drinks, and low in fruits and vegetables. The average Likert scale score for adherence to recommended dietary guidelines was 2.8 (SD = 0.9), indicating that the overall nutritional practices of the participants were suboptimal.

4.2 Reliability Testing

The reliability of the questionnaire was assessed using Cronbach's alpha, which yielded a value of 0.822, indicating good internal consistency. This suggests that the Likert scale items reliably measured the participants' dietary habits and nutritional awareness.

4.3 Correlation Analysis

Pearson correlation analysis was conducted to explore the relationships between dietary habits and the incidence of renal failure. The results showed significant negative correlations between the intake of fruits and vegetables and the risk of renal failure (r = -0.451, p 0.000), indicating that higher consumption of these foods was associated with a lower likelihood of developing renal failure. Conversely, there were significant positive correlations between the consumption of processed foods (r = 0.537, p 0.000) and sugary drinks (r = 0.485, p 0.000) with the incidence of renal failure, suggesting that these dietary habits were linked to an increased risk of kidney disease.

4.4 Regression Analysis

Multiple regression analysis was performed to assess the predictive power of dietary factors on the incidence of renal failure. The regression model included the consumption of processed foods, sugary drinks, and fruits and vegetables as independent variables, with renal failure as the dependent variable. The model was statistically significant ($F(3, 763) = 15.671$, p 0.001), explaining 46% of the variance in renal failure ($R^2 = 0.46$).

The regression coefficients indicated that the consumption of processed foods ($\beta = 0.375$, p 0.000) and sugary drinks ($\beta = 0.335$, p 0.000) were significant positive predictors of renal failure, while the intake of fruits and vegetables was a significant negative predictor ($\beta = -0.297$, p 0.000). These results reinforce the findings from the correlation analysis and underscore the importance of dietary habits in influencing kidney health.

The study tested several hypotheses regarding the influence of nutrition and diet on renal failure in minors, with the results of t-tests and ANOVA supporting all the hypotheses: higher consumption of processed foods was positively associated with the incidence of renal failure in minors (H1, supported, $p < 0.005$); higher consumption of sugary drinks was also positively associated with the incidence of renal failure in minors (H2, supported, $p < 0.005$); and higher consumption of fruits and vegetables was negatively associated with the incidence of renal failure in minors (H3, supported, $p < 0.005$). These findings confirm the significant role that diet plays in the development of renal failure among minors in Indonesia.

Discussion

The results of this study align with existing literature that highlights the critical role of nutrition and diet in the prevention and management of kidney disease. The significant correlations and regression outcomes suggest that dietary habits, particularly the consumption of processed foods and sugary drinks, are key contributors to the development of renal failure in minors.

The negative association between the intake of fruits and vegetables and renal failure underscores the protective effect of these foods on kidney health. Fruits and vegetables are rich in essential nutrients, antioxidants, and fiber, which support kidney function and reduce the burden of filtering harmful substances from the blood. This finding is consistent with studies conducted by [19], [20] and [21], [22], which also reported the protective benefits of a diet rich in fruits and vegetables against kidney disease.

Conversely, the positive associations between the consumption of processed foods and sugary drinks with renal failure reflect the harmful effects of diets high in sodium, unhealthy fats, and added sugars. These dietary components contribute to the development of hypertension, obesity, and diabetes, all of which are significant risk factors for kidney disease. The findings of this study are in line with research by [10], [23] and [24], who also identified similar dietary risk factors for kidney disease in children and adolescents.

The results of this study have important implications for public health in Indonesia. The significant role of diet in the development of renal failure among minors suggests that dietary interventions should be a key focus of efforts to prevent and manage kidney disease in this population. This includes promoting healthier eating habits, reducing the consumption of processed foods and sugary drinks, and increasing the intake of fruits and vegetables. Public health campaigns, school-based nutrition programs, and community education initiatives could play a vital role in addressing these dietary risk factors.

Moreover, the study highlights the need for policymakers to consider the broader environmental and socioeconomic factors that influence dietary habits. Access to affordable and nutritious food, as well as education on healthy eating, are critical components of effective prevention strategies. By addressing these factors, it may be possible to reduce the incidence of renal failure and improve the overall health and well-being of minors in Indonesia.

Limitations and Future Research

While this study provides valuable insights into the relationship between diet, nutrition, and renal failure in minors, several limitations must be acknowledged. The cross-sectional design of the study limits the ability to establish causality, and the reliance on self-reported dietary data may introduce recall bias. Additionally, the sample size, while sufficient for the purposes of this study, may limit the generalizability of the findings to the broader population of minors in Indonesia.

Future research could address these limitations by employing a longitudinal design to track dietary habits and kidney health over time, thereby providing stronger evidence of causality. Expanding the sample size and including participants from diverse geographic and socioeconomic backgrounds would also enhance the generalizability of the findings. Additionally, further research could explore the role of specific dietary components, such as sodium and sugar, in greater detail to better understand their impact on renal health.

CONCLUSION

This study provides compelling evidence of the significant influence of nutrition and diet on the causes of renal failure among minors in Indonesia. The findings reveal that unhealthy dietary habits, particularly the high consumption of processed foods and sugary drinks, are strongly associated with an increased risk of developing renal failure. Conversely, a diet rich in fruits and vegetables appears to offer protective benefits against this condition. These results underscore the urgent need for public health interventions focused on improving the dietary practices of minors in Indonesia. By promoting healthier eating habits and reducing the intake of harmful foods, it is possible to mitigate the risk of renal failure and enhance the overall health and well-being of the younger population. Future research should continue to explore these relationships in greater depth, with a focus on establishing causality and expanding the scope of study to include diverse populations.

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