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Implementation of Health Education Regarding Health Status and Nutrition for Adolescents to Increase Knowledge and Awareness of Kidney Failure Prevention

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ABSTRACT

Chronic Kidney Disease is recently become health concern because the incidence was increasing annually. Incidence of kidney failure among adolescents and young adults increased from 5,490 in 1990 to 9,560 in 2019. The aim of this activity was to give information for students at junior high school about health status and educate them about health education regarding nutrition and food habit consumption daily to prevent kidney failure. This activity included examine health status, lecture method then followed by discussion, and simulation. From the health status examination, we found that 80.5% of students were categorized as normal, 11.5% overweight, and 8.0% underweight with BMI 19.8 ± 2.3. From knowledge questionnaire, initially at pre- test examination we found knowledge 58,2 ± 10,4, and after educated at post-test we found knowledge 84,7 ± 8,6. It was indicated there was increase knowledge. It was hoped, by the increasing knowledge will increase awareness, and applicating in daily food and drink consumption.

Keyword: Nutrition Education, Adolescents, Prevent, Kidney Failure

ABSTRAK

Penyakit Ginjal Kronis baru-baru ini menjadi perhatian kesehatan karena insidennya meningkat setiap tahunnya. Insiden kasus gagal ginjal di kalangan remaja dan dewasa muda meningkat dari 5.490 pada tahun 1990 menjadi 9.560 pada tahun 2019T. Tujuan dari kegiatan ini adalah memberikan informasi bagi siswa di sekolah menengah pertama tentang status kesehatan dan mendidik mereka tentang pendidikan kesehatan mengenai gizi dan konsumsi kebiasaan makan sehari-hari untuk mencegah gagal ginjal. Kegiatan ini termasuk memeriksa status kesehatan, metode ceramah kemudian diikuti dengan diskusi, dan simulasi. Dari pemeriksaan status kesehatan, kami menemukan bahwa 80,5% siswa dikategorikan normal, 11,5% kelebihan berat badan, dan 8,0% kekurangan berat badan dengan BMI 19,8 ± 2,3. Dari kuesioner pengetahuan, awalnya pada pemeriksaan pre-test kami menemukan pengetahuan 58,2 ± 10,4, dan setelah diedukasi pada post test kami menemukan pengetahuan 84,7 ± 8,6. Ini menunjukkan peningkatan pengetahuan. Diharapkan, dengan meningkatnya pengetahuan akan meningkatkan kesadaran, kemudian diaplikaskan dalam konsumsi makanan dan minuman sehari-hari.

Keyword: Pendidikan Gizi, Remaja, Pencegahan, Gagal Ginjal

1. Introduction

Chronic kidney disease (CKD) is one of the major non-communicable diseases (NCDs) and represents an increasing global public health challenge. According to the most recent **Global Burden of Disease Study 2023 (GBD 2023), CKD continues to contribute substantially to global morbidity and mortality, with the overall burden increasing markedly between 1990 and 2023. The persistence of CKD as a major cause of disability and premature mortality highlights the need for effective prevention strategies, including

interventions targeting modifiable risk factors from an early age [1]. Although CKD is more common among adults and older populations, exposure to unhealthy dietary patterns and other metabolic risk factors during adolescence may contribute to an increased risk of chronic disease later in life[1,2] .

In Indonesia, more recent national data are available from the Survei Kesehatan Indonesia (SKI) 2023, which replaced the previous national SKIas an important source of population health information. Based on SKI 2023, the prevalence of CKD based on a doctor's diagnosis among the Indonesian population aged ≥15 years was 0.18%, corresponding to an estimated 638,178 individuals . In North Sumatra Province, the prevalence was 0.17%, with an estimated weighted number of 33,884 individuals [3]. Although these diagnosis-based estimates are lower than the 0.38% prevalence reported in SKI 2018, the difference should not necessarily be interpreted as a reduction in the true burden of CKD because CKD is frequently asymptomatic and may remain undiagnosed, particularly during its early stages[3,4]. Recent evidence from Indonesia also indicates that the burden of CKD may be underestimated when estimates rely primarily on previously diagnosed cases, emphasizing the importance of early detection and prevention[4].

Nutrition is closely related to kidney health and is an important component of CKD prevention. Dietary patterns can influence kidney health directly and indirectly through their effects on blood pressure, obesity, diabetes, cardiovascular health, and metabolic function [1,5]. High consumption of sodium-rich foods can contribute to elevated blood pressure, which is an important risk factor for kidney damage, while excessive consumption of added sugars and energy-dense foods may increase the risk of obesity and metabolic disorders that can subsequently affect kidney function [5,6]. In addition, increasing evidence suggests that consumption of ultra-processed foods (UPFs) may be associated with adverse kidney outcomes. A 2024 systematic review and dose-response meta-analysis involving more than 500,000 participants found that high UPF consumption was associated with a higher risk of CKD, with the highest intake category associated with an approximately 18% greater risk compared with the lowest intake category; each 10% increase in the proportion of UPF in the diet was also associated with a 7% higher risk of CKD [7]. Another 2024 systematic review and meta-analysis of cohort studies involving 219,132 participants reported that individuals with the highest UPF consumption had a 25% higher risk of incident CKD than those with the lowest consumption [8]. More recent evidence involving 786,216 participants also found that greater UPF consumption was associated with an increased risk of declining renal function [9].

The potential relationship between nutrition and kidney health is particularly relevant during adolescence. Adolescents are increasingly exposed to foods and beverages that are high in sodium, added sugars, unhealthy fats, and other characteristics commonly associated with poor dietary quality. Dietary habits established during adolescence may persist into adulthood and may contribute to the development of obesity, hypertension, diabetes, and other metabolic conditions that are important risk factors for CKD [5,6]. Therefore, nutrition education during adolescence should not only focus on preventing malnutrition and obesity but should also introduce the concept that healthy dietary choices can contribute to maintaining kidney health over the life course.

School-based nutrition education represents an important strategy for promoting healthy dietary behaviors among adolescents because schools provide a structured environment in which health information can be delivered to a large number of young people. A 2024 systematic review of school-based nutrition interventions found that school-centered programs can improve dietary habits, food preferences, nutrition-related knowledge, and lifestyle behaviors among school children and adolescents [10]. Furthermore, umbrella review in 2024 synthesizing 17 reviews and 347 unique primary studies found that multi-component school-based interventions were generally effective in improving adolescents' knowledge and behaviors related to healthy eating. Interventions were more likely to be effective when nutrition education was supported by changes in the school environment and involvement of parents or the wider community [4,11]. A 2024 quasi-experimental study also demonstrated improvements in nutrition knowledge, attitudes, and diet quality following a nutrition education intervention among school-going adolescents [12].

SKI (2023) representing of 0.33 % of totally CKD cases reported are adult population [3]. In Medan City, hospital data recently indicate a rising trend, examples by 357 CKD patients recorded at RSUP H. Adam Malik Medan in 2022 to 858 CKD patients in 2023[3].

Based on these, preventive nutrition education targeting junior young people as high school students is critical in promoting health- conscious behavior through school based strategies to improve students' dietary knowledge [5,7] dan behavior practices related balanced nutrition consumption to maintain healthy body and avoid some diseases mainly kidney disease as kidney failure/ CKD. Therefore, this program aimed to improve junior high school students' knowledge and awareness of balanced nutrition for reducing the risk of disease in the future mainly kidney failure.

2. Methods

To prevent kidney failure and ensure a productive young generation, we must prepare healthy and qualified young people early on to achieve the Golden Indonesia 2045 vision. There were some activities necessary to carry out;

2.1 At initial phase

Team coordinate with school administrators to determine schedules of this activity and number of participants that involved. Then team prepared educational modules on balanced nutrition and module of kidney failure prevention for promoting.

Figure 1. Location of SMPN 10 Medan

2.2 Implementation Phase

Figure 2. Students fill out the pre-test

Figure 3. Measuring students' weight and height

The activities included in the implementation phase were;

1. Initially, health status examination for young people at junior high school including weight and height examination using the Ministry of Health standards (2020) to determine basal metabolic index of the body.
2. Activities followed to find out respondents' knowledge by distributing questionnaires about knowledge / a pre-test to assess baseline knowledge.
3. Health promotion through presentations, videos, and interactive quizzes related to balanced nutrition, daily healthy food needs, daily water requirements, and kidney failure prevention. prevention.
4. Demonstrations of healthy daily foods and affordable.

2.3 Evaluation Phase

At this phase;

1. Evaluation was conducted to asses knowledge after education activity propered/ post test score of knowledge. Then pretest score and post score were compared to determine after education activity the knowledge of partisipant was increased or decreased
2. Feedback interviews from teacher sustainability of this program.

3. Results and Discussion

3.1Participant involved

The nutrition education program was attended by 87 eighth-grade students from SMP Negeri 10 Medan, comprising 45 males (51.7%) and 42 females (48.3%), with ages ranging from 13 to 15 years. The relatively balanced distribution of male and female participants provided representation of both sexes within the participating class cohort. Adolescence is an important period for nutrition intervention because dietary preferences, eating behaviors, and lifestyle patterns established during this stage may persist into adulthood and contribute to long-term health outcomes [11,12]. Therefore, involving junior high school students in nutrition education may provide an opportunity to establish healthy dietary practices before the accumulation of metabolic and cardiovascular risk factors associated with chronic diseases

3.2 Anthropometric measurement

Anthropometric assessment was conducted to describe the nutritional status of the participants and to provide an objective baseline for understanding their health profile. Body weight was measured in kilograms using a calibrated digital weighing scale, with participants wearing light clothing and without shoes. Height was measured in centimeters using a portable stadiometer, with participants standing upright, barefoot, with their heels together and head positioned in the Frankfurt horizontal plane. Body mass index (BMI) was subsequently calculated as body weight in kilograms divided by height in meters squared (kg/m²). Because the participants were 13–15 years old, BMI was interpreted according to age- and sex-specific BMI-for-age z-scores using the WHO 2021 Growth Reference for children and adolescents aged 5–19 years, rather than adult BMI cut-off value[3].

According to the WHO 2007 BMI-for-age classification, thinness was defined as BMI-for-age <−2 SD, severe thinness as <−3 SD, normal nutritional status as ≥−2 SD to ≤+1 SD, overweight as >+1 SD, and obesity as >+2 SD [3,4]. BMI-for-age z-scores were determined according to the participant's exact age, sex, weight, and height using the WHO 2021 reference, for example through WHO AnthroPlus or equivalent validated calculation procedures. Thus, the classification in this study was based on growth-adjusted BMI rather than fixed BMI thresholds. The results are presented in Table 1.

Table 1. Anthropometric Characteristics of Junior High School Students

Parameter	Male (n=45)	Female (n=42)	Total (n=87)
Weight (kg)	49.6 ± 8.2	47.1 ± 7.5	48.4 ± 7.9
Height (cm)	157.3 ± 6.4	155.8 ± 5.9	156.6 ± 6.2
BMI (kg/m²)	20.1 ± 2.4	19.4 ± 2.3	19.8 ± 2.3

Based on the BMI-for-age classification, 80.5% of the students were categorized as having normal nutritional status, 11.5% as overweight, and 8.0% as thin. The predominance of normal nutritional status suggests that most participants had a BMI appropriate for their age and sex at the time of assessment. However, the presence of both overweight and thinness indicates that nutritional problems can coexist within the same adolescent population, reflecting the continuing double burden of malnutrition among young people.

The proportion of overweight students in this program (11.5%) should be interpreted cautiously because the sample was obtained from a single school and was not designed to represent adolescents in Medan or Indonesia. Nevertheless, the finding is consistent with the broader concern regarding increasing overweight and obesity among Indonesian populations. The 2023 Indonesian health survey reported that obesity among Indonesians aged >18 years had increased from 21.8% in 2018 to 23.4% in 2023, demonstrating the continuing importance of overweight and obesity prevention across the life course[3]. Although these national adult data cannot be directly compared with the BMI-for-age classification used in adolescents, they reinforce the importance of addressing unhealthy dietary and lifestyle behaviors before adulthood.

Nutritional status during adolescence is also relevant to future kidney health. Excess adiposity may influence kidney function through several mechanisms, including insulin resistance, activation of the renin–angiotensin–aldosterone system, inflammation, altered renal hemodynamics, and increased glomerular filtration pressure [13]. A 2024 review highlighted that obesity can affect renal health even during childhood and adolescence, with insulin resistance and altered renal hemodynamics playing important roles in the pathway linking obesity to kidney dysfunction [14,6]. Furthermore, a systematic review of longitudinal studies found that higher BMI or obesity during childhood was associated with a greater risk of kidney disease later in life in most of the included cohorts [15,7]. These findings support the importance of maintaining healthy nutritional status during adolescence as part of a life-course approach to CKD prevention.

Conversely, thinness also warrants attention because it may indicate inadequate energy or nutrient intake and may reflect poor dietary quality. Therefore, the goal of adolescent nutrition education should not be limited to preventing overweight but should promote overall nutritional adequacy and healthy dietary patterns. Balanced nutrition, appropriate portion sizes, adequate intake of fruits and vegetables, moderation of sodium and added sugars, and reduced consumption of highly processed foods are relevant not only to maintaining healthy body weight but also to reducing long-term cardiometabolic and kidney disease risks [2,6,12,13].

3.3 Knowledge Assesment

Participants' nutritional knowledge was assessed using a validated 20-item multiple-choice questionnaire covering balanced nutrition, healthy eating practices, and strategies for kidney failure prevention. The questionnaire was administered before and after the educational intervention, allowing changes in knowledge to be assessed. The results are shown in Table 2

Table 2. Comparison of Students' Knowledge Scores Before and After the Nutrition Education Program

Description	Mean Score (0–100)	SD	Result
Pre-test	58.2	±10.4	Low baseline knowledge
Post-test	84.7	±8.6	Significant improvement
Increase	+26.5 points (45.5%)	—	$p < 0.001$

The mean knowledge score increased from 58.2 ± 10.4 before the intervention to 84.7 ± 8.6 after the intervention, representing an absolute increase of 26.5 points, or approximately 45.5% relative to the baseline score. The statistically significant improvement ($p < 0.001$) indicates that the educational intervention was associated with a substantial short-term improvement in students' knowledge regarding nutrition and kidney failure prevention.

This improvement is consistent with previous evidence showing that school-based nutrition education can improve adolescents' nutrition knowledge. For example, a 2024 quasi-experimental study involving 226 school-going adolescents found that a 12-week nutrition education program consisting of mini-lectures and interactive discussions significantly improved nutrition knowledge and eating-related attitudes compared with a control group [8]. Similarly, a systematic review of school-based nutrition interventions among adolescents

found that educational interventions based on behavioral theories were generally able to improve food-related behaviors, with 11 of 12 included studies reporting favorable changes in consumption of at least two food groups [9]. More recent evidence from a 2025 quasi-experimental study also demonstrated significant improvements in nutrition knowledge and behavioral constructs following a multi-strategy intervention incorporating interactive lectures, group discussions, posters, educational videos, and songs [10].

The magnitude of improvement observed in the present program may be partly explained by the use of interactive and participatory educational strategies rather than relying exclusively on conventional lecture-based delivery. Interactive education encourages students to actively process information through discussion, questioning, visual materials, peer interaction, and practical activities. Such approaches may improve attention, facilitate retrieval and application of newly acquired information, and allow students to connect abstract nutritional concepts with familiar food choices and everyday situations. Recent evidence indicates that experiential and interactive approaches—including workshops, games, digital learning, practical activities, and other participatory methods—frequently improve nutrition knowledge, food-related skills, attitudes, and self-efficacy among children and adolescents [13,11].

The use of student-generated educational posters in the present program may have further reinforced learning by requiring participants to transform information into a visual message. This type of activity changes students from passive recipients of information into active participants in the learning process. The process of selecting key messages, discussing ideas with peers, and communicating health information to others may enhance comprehension and recall. Recent research on adolescent nutrition education also indicates that engaging, context-specific, and interactive strategies can improve knowledge and may support healthier food-related decision-making, although changes in actual dietary behavior require longer and more intensive follow-up [16,12].

Importantly, the improvement in knowledge should not be interpreted as evidence that the intervention has already prevented CKD or changed students' long-term dietary behavior. Knowledge is an important prerequisite for health behavior change, but it does not automatically translate into sustained behavior. Environmental factors, food availability, family practices, peer influence, socioeconomic conditions, and personal preferences can affect adolescents' ability to apply nutrition knowledge in daily life[15,17]. Therefore, the observed increase in knowledge represents an encouraging immediate outcome, while longer-term evaluation is required to determine whether the program produces sustained improvements in dietary behavior and nutritional status.

3.4 Responsiveness Respondents

Student responsiveness was demonstrated through the development of educational posters with the theme “Smart Teens without Kidney Failure.” This activity provided an opportunity for students to translate nutrition and kidney-health messages into visual communication materials. Rather than merely receiving information, students were encouraged to interpret, summarize, and communicate the health messages, thereby reinforcing the educational content through active participation.

Figure 4. Group Photo of Participants

The involvement of teachers also strengthened the potential sustainability of the intervention. Teachers were trained to integrate nutrition education into extracurricular activities or science lessons, creating an opportunity for the messages introduced during the program to be reinforced after the intervention had ended. This approach is consistent with evidence indicating that school-based nutrition programs are more likely to be effective when educational activities are integrated into the school environment and supported by teachers and other stakeholders [17,15]. However, the sustainability of these activities should be evaluated in future studies by assessing whether teachers continue implementing the materials and whether students retain the acquired knowledge over time.

3.5 Study Limitations

Several limitations should be considered when interpreting the findings. First, the sample size was relatively small, with only 87 students participating in the program. Therefore, the findings may have limited statistical precision and may not be generalizable to all junior high school students. Second, the program was conducted in only one school in Medan, and the participants may differ from students in other schools with respect to socioeconomic background, school environment, dietary practices, and access to health information. Third, the evaluation included only a short-term follow-up, with knowledge assessed immediately before and after the intervention. Consequently, it is not possible to determine whether the observed improvement in knowledge was maintained over several months. Finally, the evaluation focused primarily on nutrition knowledge rather than actual dietary behavior or clinical kidney outcomes. Increased knowledge does not necessarily result in sustained changes in food consumption, physical activity, body composition, or kidney health. Future studies should therefore use larger and more diverse samples, involve multiple schools, incorporate longer follow-up periods, and assess behavioral outcomes such as dietary intake, consumption of sugar-sweetened beverages and high-sodium foods, food choices, and other lifestyle indicators in addition to knowledge.

Overall, the findings indicate that the school-based nutrition education program was associated with a substantial improvement in students' short-term nutrition knowledge. The combination of nutrition education, interactive learning activities, student-generated posters, and teacher involvement may provide a practical approach for introducing kidney-health promotion within the school setting. Nevertheless, future studies with larger samples, control groups, longer follow-up, and behavioral outcomes are needed to determine whether improvements in knowledge can be translated into sustained healthy dietary practices and meaningful long-term kidney-health benefits.

4. Conclusion

The implementation of the Nutrition Education Program at SMP Negeri 10 Medan effectively improved students' knowledge and awareness regarding balanced nutrition and kidney failure prevention. This was recommended regular implementation. This education was recommended as preventive health education strategies against kidney failure in integrated health extracurricular activities.

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