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Analyzing Macro-Nutrient Intake and Nutritional Status of Adolescent Girls in Manado

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ABSTRACT

The nutritional status is directly influenced by macronutrient intake, with imbalances potentially leading to nutritional issues. This study aimed to analyze the correlation between macronutrient intake and the nutritional status of female students at State Senior High School (SSHS) 9 Manado. Employing an analytic survey with a cross-sectional design, the research was conducted from February to June 2023 at SSHS 9 Manado, involving students from grades X and XI, totaling 100 samples. Research instruments included a 24-hour food recall form, a microtoise for height measurement, and a digital scale for weight measurement. The correlation between variables was tested using the Spearman Rank correlation test. Findings revealed that a majority of respondents exhibited deficits in carbohydrate, protein, and fat intake, despite maintaining a normal nutritional status of 81%. However, statistical analysis indicated no significant relationship between carbohydrate, protein, and fat intake and the nutritional status of female students. Consequently, it was concluded that there was no significant correlation between macronutrient intake and the nutritional status of female students at SSHS 9 Manado.

Keywords: *Female Adolescent; Macronutrients intake; Nutrittional Status*

INTRODUCTION

Nutritional status stands as a crucial factor that can significantly impact an individual's health. Optimal nutritional status ensures that the body receives adequate nutrients for efficient utilization, thereby facilitating physical growth, brain development, cognitive abilities, and maintaining overall health at optimal levels (Indrati and Gardjito, 2014). Data from the Basic Health Research in 2018 revealed the prevalence of overweight adolescents in Indonesia, with 11.2% in the age group of 13-15 years and 11.3% in the age group of 16-18 years. In the city of Manado, the prevalence of overweight adolescents in the age group of 13-15 years was 17.4%, and in the age group of 16-18 years, it was 12.7% (Kementrian Kesehatan RI, 2018).

Optimal nutritional status is essential across all age ranges, including adolescence. Adolescence is a period characterized by rapid physical and psychological growth and development. Particularly for adolescent girls, this stage represents a preparatory phase for future motherhood, underscoring the critical importance of achieving optimal nutritional status to prevent potential nutritional issues. Adequate nutrition in school-age children is vital to mitigate the risk of nutritional deficiencies. Poor nutrition in school-age children can result in reduced energy levels, leading to fatigue during activities, increased susceptibility to diseases, and hindrance to academic performance. Nutritional status can significantly impact the risk of developing metabolic syndromes such as hypertension, diabetes mellitus, and others (Sartika et al., 2022).

The nutritional status of adolescents is directly influenced by the intake of macronutrients. Insufficient intake of macronutrients, particularly carbohydrates, can lead to reduced energy reserves, resulting in suboptimal physical activity, fatigue, decreased productivity, and potential impairment of bodily reactions (Sitasari et al., 2022). Research conducted by Rorimpandei et al. (2020) using a

cross-sectional study design indicated a significant relationship between macronutrient intake and the nutritional status of adolescents. This finding is consistent with the study by Mulalinda et al. (2019) conducted among junior high school students.

State Senior High School (SSHS) 9 Manado is one of the prestigious schools in Manado City, with a student population of 2,174 as of January 2023. An initial survey revealed the presence of two canteens offering a variety of food items, ranging from snacks to heavy meals, most of which are high-energy foods. This study aims to analyze the relationship between macronutrient intake and the nutritional status of female students at SSHS 9 Manado.

METHODS

This study was carried out between February and June 2023, with a focus on female students in grades X and XI at SSHS 9 Manado. An analytical survey method combined with a cross-sectional study strategy was used in the research. Using stratified random sampling, which was calculated using the Lemeshow algorithm, 100 teenage girls made up the sample.

A 24-hour food recall questionnaire was used to gather data on macronutrient intake. A SECA brand scale with a precision of 0.1 kg was used to measure weight, and an SECA brand stadiometer with a precision of 0.1 cm was used to measure height. The Body Mass Index (BMI) was computed, and standard deviations were used. Accuracy was ensured by conducting weight measurements on a level, well-lit surface; mistakes were minimized by taking height measurements in a similar setting. Prior to performing the univariate and bivariate analytic procedures, the data were first coded and cleaned for the statistical analysis. The significance was assessed in this study using the Spearman Rank test in bivariate analysis ($p<0.05$). Data statistical analyses in this study utilized a computerized statistical tool.

Every participant was provided with an elaborate briefing concerning the essence, aims, and potential advantages of the study, alongside the affirmation that their involvement was entirely optional. They were assured that all gathered data and details would be handled confidentially and utilized solely for research objectives. Furthermore, participants expressed their agreement by endorsing an informed consent document. This investigation obtained ethical clearance and sanction under reference number KEPK/01/09/292/2023, guaranteeing adherence to ethical protocols and emphasizing the dedication to preserving the authenticity and confidentiality of participant information throughout the research undertaking.

RESULTS AND DISCUSSION

Sample Characteristics, Macro-Nutrient Intake, and Nutritional Status Overview

Table 1 provides a comprehensive overview of the age distribution among the research participants, ranging from 15 to 17 years old. Notably, the majority of respondents, comprising 42 individuals, fell within the 16-year-old age bracket, indicating a significant presence in this age group. Following closely, there were 41 respondents aged 15 years old, highlighting a substantial representation within this demographic. Additionally, 16-year-old respondents accounted for 16 individuals, while those aged 14 were notably the minority, represented by only one respondent.

Furthermore, the table elucidates an equal distribution of respondents across grades X and XI, with each constituting 50% of the total respondents. This depiction underscores the balanced representation of participants from different age groups and grades, ensuring a diverse and representative sample for the research study.

Table 1. Sample Characteristics Analysis

Category		Frequency
Grade	X	50
	XI	50
Age (years old)	14	1
	15	41
	16	42
	17	16

The respondents in this study spanned the age range of 14 to 17 years, with the majority being 16 years old, comprising 42% of the sample, while the youngest respondent was aged 14, representing only one respondent. According to Minister of Health Regulation No. 25 of 2014, this age range falls within the adolescent category. Adolescence marks a transitional period from childhood to adulthood, during which the nutritional needs increase as individuals enter prepubertal and pubertal stages. Particularly for adolescent girls, meeting the Recommended Dietary Allowance (RDA) and maintaining a balanced diet during this phase is crucial not only for growth but also for preparing for future reproductive roles (Sulaiman et al., 2022).

The macronutrient intake of respondents was assessed using a 24-hour food recall for two non-consecutive days. **Table 2** illustrates the breakdown of respondents' carbohydrate intake, revealing that 78% had a severe deficit, 9% had a moderate deficit, 4% had a mild deficit, 8% had a normal intake, and 1% exceeded their requirements. Regarding protein intake, 58% of respondents had a severe deficit, 11% had a moderate deficit, 12% had a mild deficit, 15% had a normal intake, and 4% exceeded their requirements. As for fat intake, 65% of respondents had a severe deficit, 12% had a moderate deficit, 10% had a mild deficit, 11% had a normal intake, and 2% exceeded their requirements. These findings provide a comprehensive insight into the macronutrient intake patterns among the respondents, highlighting substantial deficits across all three macronutrients, particularly in carbohydrate intake, which may have significant implications for their nutritional status and overall health.

Table 2. Distribution of respondents based on macro-nutrient intake

Macro-Nutrient Intake	Frequency
Carbohydrate Intake	
Severe Deficit	78
Moderate Deficit	9
Mild Deficit	4
Normal	8
Exceeded	1

Macro-Nutrient Intake	Frequency
Protein Intake	
Severe Deficit	58
Moderate Deficit	11
Mild Deficit	12
Normal	15
Exceeded	4
Fat Intake	
Severe Deficit	65
Moderate Deficit	12
Mild Deficit	10
Normal	11
Exceeded	2

The research findings reveal that the majority of respondents have deficient macronutrient intake. The results from the food recall indicate that the most commonly consumed carbohydrate sources are rice and noodles. On average, the respondents' carbohydrate intake is 166.65 grams per day. Based on the Recommended Dietary Allowance (RDA) for females aged 13-15 years and 16-18 years, which is 300 grams per day, it is evident that the average carbohydrate intake of the respondents falls below the RDA. With a minimum intake of 70.60 grams per day and a maximum intake of 366.65 grams per day, there is still room for improvement to meet the recommended intake. Consuming an excess of macronutrients can lead to obesity and increase the risk of non-communicable diseases such as heart disease, hypertension, diabetes mellitus, and stroke, while inadequate consumption may result in malnutrition. Balanced and nutritious food consumption, aligned with individual nutritional needs and guided by the principles of balanced nutrition, can enhance the immune system and reduce the risk of infection. A study conducted at the University of Sam Ratulangi found that most respondents had low carbohydrate, fat, and protein intake (Mawitjere et al., 2021). This result suggests that despite their advanced knowledge in health sciences, individuals may still struggle to implement healthy dietary habits, emphasizing the importance of targeted nutritional education and behavior change interventions.

The average protein intake of the respondents is 44.94 grams per day, with a minimum intake of 12.20 grams per day and a maximum intake of 105.15 grams per day. This average intake remains below the RDA for females aged 13-15 years and 16-18 years, which is 65 grams per day. The food recall results indicate that respondents consume animal-based protein more frequently than plant-based protein. Protein plays a crucial role in the body's metabolism, as it contributes to approximately 10%-15% of the total energy required by the body (Adriani and Wirjatmadi, 2016). Thus, ensuring an adequate protein intake is essential for optimal bodily functions and overall health (Afifah et al., 2022).

The average fat intake of the respondents was 42.53 grams per day, still below the Recommended Dietary Allowance (RDA) for females aged 13-15 years and 16-18 years, which is 70 grams per day. The minimum fat intake of the respondents was 11.10 grams, while the maximum intake was 110.20 grams. The average fat

intake of the respondents reflects the research findings indicating that the majority of respondents' fat intake falls into the deficit category. It is recommended that fat consumption does not exceed the total energy required (Afifah et al., 2022). However, fats provide a greater energy yield compared to carbohydrates and proteins, with 1 gram of fat equaling 9 calories. Despite being higher in energy density, fats are an essential macronutrient required for various physiological functions, including hormone production, insulation, and the absorption of fat-soluble vitamins. Therefore, while it is crucial to monitor fat intake to maintain a balanced diet, it is equally important to ensure an adequate intake to support overall health and well-being.

Nutritional status is typically assessed through the measurement of height and weight, with calculations based on the Body Mass Index (BMI) formula and reference tables outlined in Minister of Health Regulation No. 2 of 2020. This comprehensive evaluation provides insights into individuals' overall health and well-being. **Table 3** succinctly summarizes our findings, revealing that over 50% of respondents displayed normal nutritional status, comprising a significant 81% of the total. Additionally, 3% were underweight, while 10% were overweight, and 6% fell into the obese category. These statistics underscore the complex interplay between dietary habits, lifestyle factors, and health outcomes among our study population.

Table 3. Distribution of respondents based on nutritional status

Nutritional Status	Frequency
Underweight	3
Normal	81
Overweight	6
Obese	10
Total	100

Nutritional status, as defined by the balance of nutrients necessary for bodily metabolism processes, was predominantly normal among our respondents, with over 50% demonstrating optimal nutritional status, as noted by Sitasari et al. (2022). Optimal nutritional status, crucial for physical growth, brain development, and overall health, was evident in 81% of respondents (Dhini, 2023). However, 10% were classified as overweight and 6% as obese, indicative of excess nutrient intake surpassing recommended levels. Conversely, undernutrition, characterized by a lack of essential nutrient intake, was observed in a minority of respondents, aligning with Ardiansyah et al. (2022) findings.

The Relationship between Macro-Nutrient Intake and Nutritional Status

Statistical analysis utilizing Spearman Rank correlation tests revealed intriguing insights into the relationship between macronutrient intake and nutritional status. Specifically, the analysis demonstrated that for carbohydrate intake and nutritional status, the obtained p-value was > 0.05 (0.132), indicating a lack of significant correlation between carbohydrate intake and nutritional status. Similarly, the statistical assessment for protein intake and nutritional status yielded a p-value > 0.05 (0.176), suggesting no discernible relationship between protein intake and

respondents' nutritional status. Additionally, the analysis concerning fat intake and nutritional status returned a p-value > 0.05 (0.277), further reinforcing the absence of a significant relationship between these variables.

Table 4. The relationship between macro-nutrient intake and nutritional status

Variables	p-value	r-correlation
Carbohydrate Intake Nutritional Status	0,132	0,152
Protein Intake Nutritional Status	0,176	0,136
Fat Intake Nutritional Status	0,277	0,110

The statistical analysis, utilizing the Spearman Rank correlation test, revealed results indicating a p-value < 0.05 for carbohydrate intake concerning nutritional status (p = 0.132), signifying no significant association between macronutrient intake and the respondents' nutritional status, which aligns with the findings of Mawaddah and Muniroh (2019) among adolescent girls at high school, suggesting no correlation between carbohydrate intake and nutritional status. Similarly, the statistical analysis concerning protein intake and nutritional status yielded a p-value < 0.05 (0.176), indicating no significant relationship between protein intake and nutritional status, corroborating the findings of Attika (2015), which found no association between protein intake and nutritional status. Additionally, the statistical test conducted for fat intake and nutritional status resulted in a p-value < 0.05 (p = 0.277), indicating no significant relationship between fat intake and nutritional status, consistent with the study conducted by Parewasi et al. (2021) among adolescent girls, which found no significant association between fat intake and nutritional status.

The research findings indicate no relationship between micronutrient intake and nutritional status, attributed to the fact that macronutrient intake does not accurately reflect the respondents' nutritional status. While most respondents had deficits in macronutrient intake, they maintained a normal nutritional status. However, it's essential to recognize that the respondents' nutritional status may change in the future if the continuous deficit in macronutrient consumption persists. Factors such as the quantity, frequency, and lack of dietary variety among respondents influence their macronutrient intake. Food recall data revealed that respondents commonly consumed carbohydrate sources such as rice and noodles, yet the frequency of heavy meals was less than three times a day. Moreover, the variety of protein intake among respondents was limited, with some consuming exclusively animal protein or plant-based protein.

The research findings indicating deficits in macronutrient intake despite normal nutritional status may be attributed to the "flat slope syndrome," where overweight respondents tend to underreport their intake while underweight respondents tend to overestimate their consumption (Setyawati and Hartini, 2018). During food recall interviews, it was noted that some respondents had limited knowledge of nutrition and the nutritional content of foods, suggesting insufficient nutritional knowledge among respondents. Nutritional knowledge is considered an indirect factor

influencing nutritional status. According to Tumanggor et al. (2023), nutritional issues may arise from a lack of understanding regarding the nutritional value of various foods, ingredients, and meal options. Research by Jayanti and Novananda (2017) indicated that healthy food choices are related to balanced nutrition, and health is influenced by adolescents' nutritional knowledge.

The respondents in this study were high school girls, an age group where adolescent girls tend to be concerned about their appearance. Food recall data revealed that some respondents only consumed heavy meals twice a day, and some even only once a day. Appearance is crucial for adolescent girls, and body image can lead to eating disorders, affecting nutritional status. Besides macronutrient intake, body image is another factor influencing nutritional status, as demonstrated by the result of Ripta et al. (2023) which found a significant relationship between body image and adolescent nutritional status.

CONCLUSSION

The research conducted at SSHS 9 Manado sheds light on the macronutrient intake patterns among female students, revealing prevalent deficits in carbohydrates, proteins, and fats, despite the majority maintaining a normal nutritional status. This intriguing observation prompts a deeper investigation into the dynamics of nutritional patterns and their implications on overall health outcomes among adolescent girls in the school setting. Contrary to expectations, the analysis reveals a lack of significant correlation between macronutrient intake and the nutritional status of female students at SSHS 9 Manado. This finding challenges conventional assumptions regarding the direct relationship between nutrient intake and nutritional status, highlighting the complexity of nutritional dynamics and the multifaceted factors influencing adolescent health outcomes. Further exploration into the underlying factors contributing to this discrepancy is warranted, encompassing dietary behaviors, socioeconomic factors, and cultural influences, to elucidate a comprehensive understanding of the nutritional landscape and inform targeted interventions for promoting optimal health among adolescent girls in similar educational settings.

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