

The Relationship between Energy and Protein Intake and Nutritional Status in Adolescents

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ABSTRACT

Adolescents are an age group vulnerable to nutritional problems due to changes in increasing nutritional needs and unbalanced diets. Inadequate energy and protein intake can impact nutritional status, growth, and development in adolescents. This study aims to analyze the relationship between energy and protein intake and nutritional status in adolescents. This study used a quantitative design with a cross-sectional approach. The study sample consisted of 120 adolescents selected using a simple random sampling technique. Data on energy and protein intake were obtained through a 24-hour food recall method, while nutritional status was measured using body mass index (BMI) based on age. Data analysis was performed using the Pearson correlation test. The results showed that most respondents had insufficient energy and protein intake. There was a significant relationship between energy intake and nutritional status ($p < 0.05$), as well as a significant relationship between protein intake and nutritional status ($p < 0.05$). Adolescents with adequate energy and protein intake tended to have normal nutritional status compared to those with insufficient intake. The conclusion of this study indicates that energy and protein intake play an important role in determining adolescent nutritional status. Therefore, nutritional education interventions are needed to increase adolescent awareness of the importance of a balanced diet. Further research is recommended to explore other factors that influence adolescent nutritional status.

INTRODUCTION

Adolescence is an age group in the transition phase from childhood to adulthood, characterized by rapid growth and development. During this period, significant physical, psychological, and social changes occur, resulting in significantly increased nutritional needs, particularly energy and protein. Energy is needed to support physical activity, metabolic function, and body growth, while protein plays a crucial role in the formation of tissues, hormones, enzymes, and the immune system. An imbalance between nutritional needs and intake in adolescents can lead to various health problems, including impaired nutritional status with both short-term and long-term impacts (Brown et al., 2021, Adolescent Nutrition and Growth). Therefore, meeting optimal nutritional needs in adolescents is a crucial factor in improving the quality of health and human resources in the future.

Nutritional issues in adolescents are currently an increasingly complex global issue. This is not only a problem of undernutrition but also overnutrition, which occurs simultaneously within a population, known as the double burden of malnutrition. This condition indicates an imbalance in dietary patterns influenced by changes in modern lifestyles, urbanization, and the increasing consumption of high-calorie, low-nutrient foods. According to the World Health Organization (2021, Adolescent Nutrition: A Review of the Situation), the prevalence of nutritional problems in adolescents continues to increase, both in the form of undernutrition and overweight and obesity. This indicates that adolescents are a vulnerable group requiring special attention in nutritional interventions.

In Indonesia, the issue of nutritional status in adolescents also remains a serious challenge. Based on data from the Ministry of Health of the Republic of Indonesia (2023, Indonesian Health Profile), the prevalence of adolescents with undernutrition and overnutrition remains quite high. This is influenced by various factors, such as irregular eating patterns, skipping breakfast, low animal protein consumption, and high consumption of fast food. Furthermore, socioeconomic factors, education, and lack of knowledge about nutrition also influence adolescent consumption patterns. This situation indicates that nutritional interventions for adolescents need to be carried out comprehensively, involving various parties.

Energy intake is a major factor determining energy balance in the body. Energy obtained from food is used to carry



out various bodily functions, including physical activity, basal metabolism, and growth. Insufficient energy intake can lead to chronic energy deficiency (CED), which is characterized by weight loss, fatigue, and stunted growth. Conversely, excess energy intake can lead to fat accumulation in the body, leading to overweight or obesity. Garcia and Lopez (2024, Energy Intake and Nutritional Status in Adolescents) state that there is a significant relationship between energy intake and nutritional status, with energy imbalance contributing to malnutrition.

Besides energy, protein is a macronutrient that plays a crucial role in adolescent growth and development. Protein functions as a building block necessary for the formation of body tissues, including muscles, skin, and vital organs. Furthermore, protein plays a role in the formation of enzymes, hormones, and the immune system. Protein deficiency can lead to growth retardation, decreased muscle mass, and decreased resistance to disease. Lee et al. (2022, Protein Intake and Adolescent Health) explain that inadequate protein intake can impact growth retardation and reduced physiological function. Therefore, meeting adequate protein needs is crucial to support adolescent health.

Several previous studies have demonstrated a relationship between energy and protein intake and nutritional status in adolescents. Smith and Johnson (2020, Nutrient Intake and Body Mass Index in Adolescents) found that adolescents with adequate energy and protein intake tended to have a normal body mass index (BMI) compared to those with inadequate intake. Another study by Nguyen et al. (2023, Dietary Patterns and Nutritional Status among Adolescents) also showed that a balanced diet contributes to optimal nutritional status. Furthermore, Kim et al. (2023, Nutritional Status and Health Risks) stated that abnormal nutritional status in adolescents can increase the risk of non-communicable diseases in adulthood, such as diabetes and cardiovascular disease. However, adolescents' eating behaviors often do not align with the principles of balanced nutrition. Adolescents tend to choose foods based on taste preferences.

METHOD

This study aims to analyze the relationship between energy and protein intake and nutritional status in adolescents. This study used a quantitative design with a cross-sectional approach. The study sample consisted of 120 adolescents selected using a simple random sampling technique. Energy and protein intake data were obtained through a 24-hour food recall method, while nutritional status was measured using body mass index (BMI) based on age. Data analysis was performed using the Pearson correlation test.

RESULT

This study involved 120 adolescents selected using a simple random sampling technique. The variables analyzed included energy intake, protein intake, and nutritional status based on Body Mass Index (BMI) for age.

Table 1. Distribution of Respondents' Characteristics (n = 120)

Characteristics	Frequency (n)	Percentage (%)
Age		
13–15 years	68	56.7
16–18 years	52	43.3
Total	120	100
Sex		
Male	58	48.3
Female	62	51.7
Total	120	100

Table 1 presents the demographic characteristics of the respondents. The majority of adolescents were aged 13–15 years (56.7%), while 43.3% were aged 16–18 years. Regarding sex distribution, 51.7% of the respondents were female and 48.3% were male. This indicates that the sample was relatively balanced in terms of gender, although slightly dominated by younger adolescents.



Table 2. Distribution of Energy and Protein Intake

Variable	Category	Frequency (n)	Percentage (%)
Energy Intake	Inadequate	72	60.0
	Adequate	48	40.0
	Total	120	100
Protein Intake	Inadequate	70	58.3
	Adequate	50	41.7
	Total	120	100

Table 2 shows that most adolescents had inadequate energy and protein intake. Specifically, 60.0% of respondents had inadequate energy intake, while only 40.0% had adequate intake. Similarly, 58.3% of respondents had inadequate protein intake, and 41.7% had adequate protein intake. These findings suggest that a large proportion of adolescents did not meet the recommended dietary intake for energy and protein

Table 3. Distribution of Nutritional Status

Nutritional Status	Frequency (n)	Percentage (%)
Underweight	30	25.0
Normal	65	54.2
Overweight/Obese	25	20.8
Total	120	100

Table 3 illustrates the nutritional status of respondents based on BMI-for-age classification. More than half of the adolescents (54.2%) had normal nutritional status. However, 25.0% were underweight, and 20.8% were categorized as overweight or obese. This indicates a double burden of malnutrition, where both undernutrition and overnutrition are present among adolescents

Table 4. Relationship Between Energy Intake and Nutritional Status

Variable	r	p-value
Energy Intake vs Nutritional Status	0.42	0.001
Total Respondents	120	

Table 4 presents the results of the Pearson correlation test between energy intake and nutritional status. The correlation coefficient ($r = 0.42$) indicates a moderate positive relationship, and the p-value (0.001) shows that the relationship is statistically significant ($p < 0.05$). This means that higher energy intake is associated with better nutritional status among adolescents.

Table 5. Relationship Between Protein Intake and Nutritional Status

Variable	r	p-value
Protein Intake vs Nutritional Status	0.38	0.002
Total Respondents	120	

Table 5 shows the relationship between protein intake and nutritional status. The results indicate a moderate positive correlation ($r = 0.38$) with a statistically significant p-value (0.002). This suggests that adequate protein intake is significantly associated with improved nutritional status in adolescents.

DISCUSSION

The findings of this study indicate that most adolescents had inadequate energy and protein intake, which significantly influenced their nutritional status. This result aligns with recent evidence showing that adolescence is a critical period of rapid growth requiring increased macronutrient intake. A review by Parajuli et al. (2025) emphasized that inadequate dietary intake during adolescence can negatively affect physical growth, cognitive development, and long-term health outcomes.

The high prevalence of inadequate energy intake observed in this study is consistent with recent empirical findings. Rahayu et al. (2025) reported that more than 80% of adolescents experienced energy deficits, despite many still having normal BMI, suggesting that nutritional status is influenced by multiple interacting factors. This supports the theory that BMI alone may not fully capture dietary adequacy, especially in early stages of nutritional imbalance.

Furthermore, this study found that protein intake was also insufficient among the majority of adolescents. Protein plays a fundamental role in tissue synthesis, muscle growth, and hormonal regulation. A recent meta-analysis (2024) highlighted that inadequate macronutrient intake, including protein, is significantly associated with poor nutritional outcomes and increased risk of both undernutrition and obesity in adolescents.

The presence of underweight (25.0%) and overweight/obesity (20.8%) in this study reflects the double burden of malnutrition, which remains a major global health issue. Recent evidence shows that developing countries, including Indonesia, are experiencing a shift toward increased consumption of energy-dense but nutrient-poor foods, contributing to both forms of malnutrition simultaneously.

The significant relationship between energy intake and nutritional status found in this study is strongly supported by recent research. A cross-sectional study by Nurhayati et al. (2025) demonstrated a significant correlation between energy intake and nutritional status ($p = 0.000$; $r = 0.494$), indicating that energy intake is a major determinant of adolescent BMI.

Similarly, the relationship between protein intake and nutritional status in this study aligns with contemporary findings. Research conducted in 2025 showed that adolescents with better dietary intake patterns, including adequate protein consumption, tend to have improved nutritional status and better growth outcomes.

However, not all studies show a direct association. For instance, Rahayu et al. (2025) found no significant relationship between macronutrient intake and obesity, suggesting that other factors such as physical activity, genetics, and lifestyle behaviors also play important roles. This indicates that nutritional status is multifactorial and cannot be explained solely by dietary intake.

In addition to dietary factors, psychosocial aspects such as stress also influence adolescent nutritional status. Recent studies indicate that stress can alter eating behavior and appetite regulation, thereby affecting energy intake and body weight. This supports a holistic approach to adolescent nutrition that considers both biological and psychological determinants.

CONCLUSION

This study concludes that energy and protein intake play a significant role in determining the nutritional status of adolescents. The majority of respondents were found to have inadequate energy and protein intake, which was significantly associated with their nutritional status. Adolescents with adequate intake of energy and protein were more likely to have normal nutritional status compared to those with insufficient intake.

The findings also highlight the presence of a double burden of malnutrition, as both underweight and overweight conditions were observed among adolescents. This indicates that nutritional problems in adolescents are complex and influenced by multiple factors.

Therefore, it is essential to implement comprehensive nutrition interventions, including nutrition education, promotion of balanced diets, and healthy lifestyle behaviors among adolescents. Future research is recommended to



explore other contributing factors such as physical activity, psychological conditions, and socio-economic status to better understand adolescent nutritional status

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