A Descriptive Study on Energy Intake, Nutrition Knowledge, and Nutritional Status Among Adolescents at SMKN 1 Kademangan, Blitar Regency

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ABSTRACT

Adolescents are vulnerable to nutritional problems due to imbalanced energy intake and limited nutritional knowledge, which can affect their nutritional status. This descriptive quantitative study aimed to assess energy intake, nutrition knowledge, and nutritional status among adolescents at SMKN 1 Kademangan, Blitar Regency. A total of 71 students were selected through proportional random sampling. Data were collected using validated questionnaires, two 24-hour dietary recalls, and anthropometric measurements. Energy intake was analyzed using NutriSurvey and NutriCal, and nutritional status was determined using BMI-for-age (BMI/A) based on WHO standards. The results showed that 91.5% of respondents had normal nutritional status, 7.0% were overweight, and 1.4% were obese. In terms of nutrition knowledge, 62% had good knowledge, 35.2% moderate, and 2.8% poor. Meanwhile, 85.8% of respondents experienced varying levels of energy intake deficits (40.8% severe, 22.5% moderate, 22.5% mild), and only 14.1% had normal energy intake. Despite the high prevalence of energy deficits, most respondents maintained a normal BMI-for-age. This suggests that other factors may influence nutritional outcomes. Strengthening nutrition education and promoting healthy eating behaviors are recommended to support adolescent health.

INTRODUCTION

Energy is a fundamental requirement of the human body, derived from the intake of macronutrients such as carbohydrates, proteins, and fats, which play a vital role in supporting physical activity and growth particularly during adolescence, a period of rapid physical and psychological development[1–3]. Adequate nutritional knowledge among adolescents is essential to guide appropriate food choices based on physiological needs, thereby helping to prevent nutritional imbalances such as undernutrition or overnutrition[4–6]. A lack of nutritional awareness often leads to unbalanced diets, which can negatively affect adolescents' nutritional status, ranging from undernutrition and overnutrition to obesity conditions that may impair long-term health outcomes and academic performance[7,8].

Various factors influence adolescent nutritional status, including limited nutritional knowledge that causes adolescents to select foods based on taste or current trends, often neglecting nutritional value[9–11]. Additionally, irregular eating habits, frequent consumption of energy-dense fast food, and low levels of physical activity contribute to imbalances between energy intake and expenditure[12,13]. Social determinants such as peer influence, media exposure, and insufficient nutrition education at

home or school further exacerbate these problems[10]. Consequently, many adolescents experience chronic energy deficiency, anemia, or obesity, which can adversely impact their overall health and productivity[14,15].

According to the 2018 Riskesdas data, the nutritional status based on BMI-for-age (BMI/A) in East Java indicated that 10.3% of adolescents aged 16–18 years were categorized as either underweight or obese, with 6.8% falling into these extremes[16]. The prevalence of severely underweight adolescents was 1.1%, while 11.4% of female adolescents were classified as obese. In Blitar Regency specifically, 1.79% of adolescents were underweight, and 7.57% were overweight or obese[17].

Several studies have investigated the relationship between energy intake, nutrition knowledge, and adolescent nutritional status, there remains a scarcity of research focusing on these variables among vocational high school students (SMK) in Blitar Regency. This lack of local evidence presents a research gap that must be addressed to develop context-specific and targeted nutritional interventions. Moreover, vocational students often exhibit distinct patterns in physical activity and dietary behavior compared to general high school students, making them a unique population for nutritional assessment. Therefore, this study aims to examine the energy intake, nutrition knowledge, and nutritional status of adolescents at SMKN 1 Kademangan, Blitar Regency.

MATERIALS AND METHODS

This study is a quantitative descriptive research that aims to assess the energy intake, nutrition knowledge, and nutritional status of adolescents at SMKN 1 Kademangan, Blitar Regency. The research was conducted from October 2021 to May 2022 at SMKN 1 Kademangan, after obtaining official research approval from the school and relevant institutions. The population of this study included all students at SMKN 1 Kademangan, totaling 581 individuals, while a sample of 71 students was selected using proportional random sampling.

Data collection involved both primary and secondary sources. Primary data were obtained directly from respondents and included personal information (name and age), a nutrition knowledge questionnaire, 2x24-hour dietary recall, and anthropometric measurements (height and weight). The nutrition knowledge questionnaire was validated by experts and its reliability was tested using Cronbach's Alpha, ensuring its suitability for data collection. Secondary data were collected from the school and included general school information and documentation of the School Health Program (UKS).

The instruments used in data collection and analysis included a digital scale, microtoise, and a food picture booklet to assist respondents in estimating portion sizes. Dietary intake was analyzed

using NutriSurvey and NutriCal software to calculate energy and nutrient intake based on the dietary recall data. Nutritional status was determined based on Body Mass Index-for-Age (BMI/A) using WHO growth reference standards. All data were analyzed descriptively, and frequency distributions and percentages were calculated using the latest version of SPSS.

RESULT

Table 1. Distribution of Frequency of Gender and Age of Respondents at SMKN 1 Kademangan, Blitar Regency

Respondent Characteristics	n	%
Gender		
Man	36	50,7
Woman	35	49,3
Age		
14-16 Years	34	47,9
17-19 Years	37	52,1
Total	**71**	**100**

Source : Primary Data, 2022

Based on Table 1, the distribution of respondents by gender at SMKN 1 Kademangan, Blitar Regency, shows that the sample was nearly evenly divided, with 36 male students (50.7%) and 35 female students (49.3%). In terms of age, the majority of respondents were between 17–19 years old, comprising 37 students (52.1%), while the remaining 34 students (47.9%) were in the 14–16 years age group. This indicates a relatively balanced representation of both gender and age groups among the respondents, which supports the generalizability of the findings within the student population.

Table 2. Distribution of Respondent Frequencies Based on Nutritional Status at SMKN 1 Kademangan, Blitar Regency

Nutritional Status	n	%
Underweight	0	0
Good Nutrition	65	91,5
Overweight	5	7,0
Obese	1	1,4
Total	**71**	**100**

Source : Primary Data, 2022

Based on Table 2, the majority of respondents at SMKN 1 Kademangan, Blitar Regency, had a normal nutritional status, with 65 students (91.5%) categorized as having good nutrition. A small proportion of respondents were classified as having overweight, with 5 students (7.0%), and 1 student (1.4%) in the Obese category. Notably, no respondents (0%) were categorized as underweight. These findings indicate that most students have an adequate nutritional status, although a small percentage may be at risk of excessive nutritional intake.

Table 3. Frequency Distribution of Respondents' Knowledge Level at SMKN 1 Kademangan, Blitar Regency

Level of Nutrition Knowledge	n	%
Good	44	62
Moderate	25	35,2
Less	2	2,8
Total	**71**	**100**

Source : Primary Data, 2022

Based on Table 3, the majority of respondents at SMKN 1 Kademangan, Blitar Regency, demonstrated a good level of nutrition knowledge, with 44 students (62%) falling into the "good" category. Additionally, 25 students (35.2%) had a moderate or "fair" level of knowledge, while only 2 students (2.8%) were categorized as having poor nutrition knowledge. These results suggest that most students possess a sufficient understanding of nutrition, although a small proportion may still require targeted education to improve their knowledge.

Table 4. Distribution of Respondents' Energy Intake Frequency at SMKN 1 Kademangan, Blitar Regency

Energy Intake	n	%
Severe Deficit	29	40,8
Moderate Deficit	16	22,5
Mild Deficit	16	22,5
Normal	10	14,1
More	0	0
Total	**71**	**100**

Source : Primary Data, 2022

Based on Table 4, most respondents at SMKN 1 Kademangan, Blitar Regency, experienced energy intake deficits, with 29 students (40.8%) in the severe deficit category, 16 students (22.5%) in the moderate deficit category, and another 16 students (22.5%) in the mild deficit category. Only 10 students (14.1%) had a normal energy intake, and none (0%) were classified as having excessive energy intake. These findings indicate that the majority of students do not meet their daily energy requirements, which could potentially affect their growth, academic performance, and overall health if not addressed properly.

Table 5. Distribution of Frequency of Nutrition Knowledge with Nutritional Status Based on BMI/U Respondents at SMKN 1 Kademangan, Blitar Regency

Nutrition Knowledge	Nutritional Status								Total	
	Underweight		Good Nutrition		Overweight		Obese			
	n	%	n	%	n	%	n	%	n	%
Good	0	0	41	57,8	2	2,8	1	1,4	44	100
Moderate	0	0	23	32,4	2	2,8	0	0	25	100
Less	0	0	1	1,4	1	1,4	0	0	2	100
Total	**0**	**0**	**65**	**91,6**	**5**	**7,0**	**1**	**1,4**	**71**	**100**

Source : Primary Data, 2022

Based on Table 5, the majority of respondents with good nutritional knowledge had a normal nutritional status (57.8%), with a small proportion categorized as overweight (2.8%) or obese (2.8%).

Among those with moderate knowledge, 32.4% had normal nutritional status, and 2.8% were categorized as overweight. Interestingly, among the two respondents with poor nutritional knowledge, half were classified as having normal nutritional status and the other half as overnutrition. These results suggest a possible association between nutritional knowledge and nutritional status, where better knowledge tends to be aligned with better nutritional outcomes. However, further statistical testing is needed to determine the significance of this relationship.

Table 6. Frequency Distribution of Energy Consumption Levels with Nutritional Status Based on BMI/U of Respondents at SMKN 1 Kaemangan, Blitar Regency

Consumption Rate	Nutritional Status								Total	
	Underweight		Good Nutrition		Overweight		Obese			
	n	%	n	%	n	%	n	%	n	%
Normal	0	0	10	14,1	0	0	0	0	10	14,1
Deficit	0	0	55	77,5	5	7,0	1	1,4	61	85,9
Total	**0**	**0**	**65**	**91,6**	**5**	**7,0**	**1**	**1,4**	**71**	**100**

Source : Primary Data, 2022

Table 6 shows the distribution of respondents based on energy intake levels and their nutritional status according to BMI-for-age. All respondents with normal energy intake (14.1%) were classified as having normal nutritional status. Among respondents with energy deficits, the majority (90.1%) had normal nutritional status, while 1.4% were categorized as obese, and 7.0% as overweight. Notably, no respondents were identified as undernourished across either group. These findings suggest that even with energy deficits, most adolescents maintained a normal nutritional status, potentially due to other influencing factors such as metabolic adaptation or variability in physical activity. Further analysis is necessary to explore these contributing factors.

DISCUSSION

Energy Intake Among Students at SMKN 1 Kademangan

The findings of this study indicate that a significant proportion of respondents experienced varying levels of energy intake deficits. Specifically, 40.8% had severe deficits, 22.5% moderate, and another 22.5% mild. Only 14.1% of respondents achieved normal energy intake, and none exceeded the recommended energy requirements. According to the Indonesian Ministry of Health Regulation No. 28/2019, adolescent boys aged 16–18 years require approximately 2,650 kcal/day, while adolescent girls need 2,100 kcal/day. Comparing this with actual intake data reveals a wide gap between recommended and consumed energy levels[18].

Despite the predominance of energy intake deficits, 91.5% of respondents maintained a normal nutritional status based on BMI-for-age (BMI/A). This paradox raises important questions about the accuracy of dietary recall, physiological compensations, and the role of other influencing factors such as body composition, metabolism, or physical activity. Similar inconsistencies have been

reported in other studies. For instance, Kim et al. (2025) observed that Korean adolescents with calorie deficits still showed stable weight due to decreased physical activity and lower basal metabolic rates[19].

One plausible explanation is the time lag between dietary intake and anthropometric change. Nutritional status, particularly BMI, reflects long-term energy balance rather than short-term consumption. Therefore, adolescents with low recent intake may still present with a normal BMI due to previous sufficient energy reserves or adaptive metabolic efficiency[20].

Furthermore, self-reported dietary data via 24-hour recalls is inherently prone to recall bias, especially among adolescents. Underreporting or overreporting due to social desirability or memory limitations can distort the actual intake data[21]. This methodological limitation may account for the apparent mismatch between reported energy intake and measured nutritional status.

Nutritional Knowledge of Respondents

This study shows that 62% of students had good nutrition knowledge, 35.2% had moderate knowledge, and only 2.8% were categorized as having poor knowledge. Nutrition knowledge is considered a determinant of healthy eating behavior, although its direct influence on nutritional status is debated. A meta-analysis by Spronk et al. (2014) found a weak-to-moderate correlation between nutrition knowledge and dietary intake, indicating that knowledge alone may not lead to better health outcomes unless supported by enabling environments and behavioral changes[22].

In our study, most students with good knowledge also had normal nutritional status. However, a few were overweight or obese, highlighting that knowledge does not automatically translate into practice. Adolescents are often influenced by external factors such as taste preferences, peer pressure, advertising, and convenience, which may override their nutritional understanding[23].

Therefore, it is essential not only to provide knowledge but also to cultivate positive attitudes and habits, and to build school and home environments that support healthy food choices. Nutrition education that integrates behavior change models—such as the Theory of Planned Behavior or Social Cognitive Theory—has proven more effective than knowledge-based approaches alone[24].

Nutritional Status and Its Paradox

An intriguing finding from this study is that most respondents were within normal BMI/A ranges, even though a significant majority had inadequate energy intake. As noted earlier, this mismatch may result from metabolic adaptations, where the body compensates for reduced intake by lowering energy expenditure[25]. Another possibility is that some students consumed energy-dense but nutrient-poor foods, which might sustain weight without ensuring optimal nutrient adequacy.

Interestingly, none of the respondents were categorized as underweight, even though nearly 86% had an energy deficit. This suggests that the level and duration of energy deficit may not yet be sufficient to cause weight loss, or that previous nutritional surpluses have created a buffer.

Adolescents, particularly males, also tend to have a higher proportion of lean mass, which affects BMI interpretation and may mask early nutritional deficits.

There is also the possibility that physical activity levels among respondents were low, thus reducing overall energy needs. However, since this variable was not measured in the current study, future research is needed to assess physical activity alongside intake and BMI.

This study employed a descriptive cross-sectional design, which is useful for exploring prevalence and patterns but does not allow for causal inference. Furthermore, the use of BMI-for-age, while practical and WHO-recommended, does not capture body composition, such as fat distribution or lean mass. For instance, two students with the same BMI may have vastly different body fat percentages and health risks.

The use of a single school as the study setting limits generalizability. SMKN 1 Kademangan may have specific characteristics (e.g., socioeconomic background, school meal programs, regional food patterns) that do not represent the broader adolescent population. Future studies should include multiple schools with varied backgrounds to improve external validity.

Additionally, dietary assessment using 2x24-hour recall may not accurately reflect habitual intake. Including a food frequency questionnaire (FFQ) or repeated recalls over a week would offer more robust estimates. Lastly, the study did not assess micronutrient intake or dietary diversity, both of which are critical for evaluating diet quality.

This study was limited to students at SMKN 1 Kademangan, Blitar Regency, which may not represent the adolescent population in other regions or schools with different socioeconomic or cultural backgrounds. Furthermore, the cross-sectional design only captures a snapshot in time, making it difficult to establish causal relationships between energy intake, nutrition knowledge, and nutritional status. Environmental and lifestyle factors such as physical activity, sleep patterns, or psychological stress were also not assessed, which may influence nutritional outcomes.

CONCLUSION

The findings of this study indicate that most adolescents at SMKN 1 Kademangan had a normal nutritional status despite experiencing an energy deficit and having good nutritional knowledge. This suggests that factors beyond energy intake, such as physical activity and overall dietary patterns, play a role in determining adolescent nutritional status. It is recommended that continuous nutrition education and monitoring of balanced eating habits be implemented to prevent the long-term effects of energy deficiency in adolescents.

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