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Association Between Gadget Use, Energy and Protein Intake, and Nutritional Status: A Cross-Sectional Study Among Senior High School Adolescents in Porong

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ABSTRACT

Indonesia ranks fourth globally in internet users, with over 100 million smartphone users recorded in 2018, raising concerns about the impact of widespread gadget use on adolescents' lifestyle and nutritional health. This study aims to analyze the association between gadget use, energy and protein intake, and nutritional status among senior high school students in Porong.

A descriptive-analytic study with a cross-sectional design was conducted at SMAN 1 Porong from September 2023 to February 2024, involving 60 tenth-grade students selected through simple random sampling. Data were collected using a validated gadget use questionnaire, anthropometric measurements (BMI), and a 2x24-hour dietary recall. Data were analyzed using SPSS, applying univariate and Spearman correlation tests.

The results showed a significant correlation between gadget use duration and nutritional status ($p = 0.002$), while no significant relationships were found between energy intake ($p = 0.439$) or protein intake ($p = 0.859$) and nutritional status. Future research is recommended to involve larger sample sizes, adopt longitudinal designs, and include additional variables such as physical activity, sleep quality, and mental health to better understand the determinants of adolescent nutritional status.

INTRODUCTION

The use of gadgets, as part of technological development, offers various advantages—not only for communication but also as a source of information. Nowadays, people can access information and communicate both verbally and visually without being limited by distance or time; even individuals in different islands or countries can be reached simply through a mobile phone[1]. Nutritional status in adolescents is influenced by adequate intake of energy and protein, which are essential for growth and development. An imbalance in these nutrients may lead to undernutrition or overnutrition, affecting long-term health outcomes[2].

According to the Ministry of Communication and Information, Indonesia ranks fourth globally in total internet users, after the United States. The number of smartphone users in Indonesia is rapidly increasing in 2018, digital marketing research institutions estimated that the number of active users would exceed 100 million. This widespread use of digital devices, particularly among adolescents, raises concerns about its potential impact on lifestyle and health. Based on the 2023 Indonesia

Nutritional Status Survey (SKI 2023), the prevalence of underweight (thin and severely thin) among adolescents was 7.6%, while the prevalence of overweight was 12.1%, and obesity was 4.1%. These data indicate that nutritional problems among adolescents in Indonesia include both undernutrition and overnutrition, which require serious attention[3].

Gadget addiction in children and adolescents can disrupt growth and development[4]. Although frequent feature updates can support creativity and access to information, excessive gadget use also reduces physical activity and social interaction[5]. It can lead to low productivity[6] and a tendency to prioritize the virtual world over real life[7]. When combined with unhealthy eating habits—such as the frequent consumption of fried foods, sugary drinks, and high-fat meals[8]—this behavior may contribute to irregular eating patterns[9], reduced awareness while eating[10], and increased exposure to unhealthy food content[11]. These factors are linked to overnutrition or obesity and may increase the risk of degenerative diseases[12]. Lifestyle differences among adolescents contribute to varying nutritional statuses[7], and the rising screen time illustrates the strong influence of gadgets on adolescent nutrition[13].

Based on a preliminary study conducted at SMAN 1 Porong involving 16 respondents, the results showed that 3 students (18.75%) were underweight, 4 students (25%) had normal nutritional status, 2 students (12.5%) were overweight, and 7 students (43.75%) were obese based on BMI classification. These findings indicate a significant nutritional issue. However, there is still limited research examining the combined relationship between gadget use, energy and protein intake, and nutritional status among adolescents, especially in local school settings. Most existing studies tend to assess these variables separately. Therefore, this study aims to analyze the association between gadget use, energy and protein intake, and nutritional status among senior high school adolescents in SMAN 1 Porong to help fill this research gap and provide data for future nutrition interventions.

MATERIALS AND METHODS

This research was conducted at SMAN 1 Porong using a descriptive-analytic method with a cross-sectional design, carried out from September 2023 to February 2024. The purpose of this design was to provide a brief overview and to explore potential associations between variables without establishing causality. The study population included all 10th-grade students at SMAN 1 Porong, and a total of 60 students were selected using a simple random sampling technique. The data collection involved three instruments: (1) a questionnaire to assess the duration of gadget use, (2) anthropometric measurements (weight and height) to determine nutritional status using Body Mass Index (BMI) and (3) a 2x24-hour dietary recall to assess energy and protein intake. The dietary recall

was conducted on one weekday and one weekend day to capture typical dietary variations. The questionnaire on gadget use had undergone prior validity testing.

All data were analyzed using SPSS software. Univariate analysis was used to describe the characteristics and distribution of each variable in frequency tables. Bivariate analysis using the Spearman correlation test was conducted to determine the relationship between gadget use duration, energy and protein intake, and nutritional status. This study was conducted with approval from the relevant school authorities, and ethical considerations were addressed by obtaining informed consent from all participants before data collection.

RESULTS

Table 1. Age Frequency Distribution of Class X Students of SMAN 1 Porong in 2024

Age (Years)	n	%
15	21	35
16	36	60
17	3	5
Total	**60**	**100**

Source: Primary Data 2024

Table 1 shows the age distribution of Class X students at SMAN 1 Porong in 2024. The majority of students were 16 years old, accounting for 60% (36 students) of the total sample. This was followed by students aged 15 years at 35% (21 students), while the smallest proportion was 17-year-olds, making up only 5% (3 students). These results indicate that most participants were in the typical age range for tenth-grade students, suggesting an appropriate age group for studying adolescent nutritional behavior.

Table 2. Gender Frequency Distribution of Class X Students at SMAN 1 Porong in 2024

Gender	n	%
Man	25	41.7
Woman	35	58.3
Total	**60**	**100**

Source: Primary Data 2024

Table 2 presents the gender distribution of Class X students at SMAN 1 Porong in 2024. The majority of participants were female, totaling 35 students (58.3%), while male students made up 41.7% (25 students). This indicates that female students made up the majority of respondents in this study.

Table 3. Frequency Distribution of Length of Gadget Use Duration among Class X Students at SMAN 1 Porong in 2024

Duration	n	%
1-2 Hours Normal	2	3.3
2-4 Hours Tall	30	50
>4 Hours Very high	28	46.7
Total	**60**	**100**

Source: Primary Data 2024

Table 3 shows the distribution of gadget usage duration among Class X students at SMAN 1 Porong in 2024. The majority of students (50%) reported using gadgets for 2–4 hours per day, categorized as high usage. Meanwhile, 46.7% used gadgets for more than 4 hours daily, which falls into the very high usage category. Only a small portion (3.3%) used gadgets for 1–2 hours per day. These findings indicate that most students spend a significant amount of time on gadgets, with nearly all exceeding the recommended duration for healthy screen time.

Table 4. Frequency Distribution of Energy Intake of Class X Students at SMAN 1 Porong in 2024

Energy Intake	n	%
Severe level of deficit	33	55
Moderate level deficit	4	6.7
Mild level deficit	5	8.3
Normal	16	26.7
Excess	2	3.3
Total	**60**	**100**

Source: Primary Data 2024

Table 4 presents the distribution of energy intake among Class X students at SMAN 1 Porong in 2024. More than half of the respondents (55%) experienced a severe energy deficit, while 6.7% and 8.3% had moderate and mild deficits, respectively. Only 26.7% of students had normal energy intake, and a small proportion (3.3%) showed excessive intake. These results suggest that the majority of students were not meeting their daily energy needs, which may negatively impact their growth, development, and overall nutritional status.

Table 5. Frequency Distribution of Protein Intake of Class X Students of SMAN 1 Porong in 2024

Protein Intake	n	%
Severe level of deficit	29	48.3
Moderate level deficit	4	6.7
Mild level deficit	7	11.7
Normal	16	26.7
Excess	4	6,7
Total	**60**	**100**

Source: Primary Data 2024

Table 5 presents the distribution of protein intake among Class X students at SMAN 1 Porong in 2024. Nearly half of the respondents (48.3%) experienced a severe protein deficit, followed by 6.7% with moderate deficits and 11.7% with mild deficits. Meanwhile, 26.7% had normal protein intake, and 6.7% showed excessive intake. These findings indicate that inadequate protein consumption was prevalent among the students, which may affect their immune function, muscle development, and overall nutritional status.

Table 6. Frequency Distribution of Nutritional Status for Class X Female Students of SMAN 1 Porong in 2024

Nutritional status	n	%
Severely Underweight	3	5
Underweight	1	1.7
Normal	40	66.7
Overweight	11	18.3
Obese	5	8.3
Total	**60**	**100**

Source: Primary Data 2024

Table 6 presents the nutritional status distribution of Class X female students at SMAN 1 Porong in 2024. The majority of respondents (66.7%) had a normal nutritional status. However, 18.3% were classified as overweight and 8.3% as obese, indicating a considerable proportion with excess body weight. On the other end, 5% were severely underweight and 1.7% were underweight. These findings reflect a double burden of malnutrition among the students, where both undernutrition and overnutrition coexist and may require targeted nutrition education and interventions.

Table 7 Cross Tabulation of Length of Gadget Use with Nutritional Status of Class X Students at SMAN 1 Porong

Duration Use of gadgets	Nutritional status										Total	%	r	p
	Severely Underweight		Underweight		Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%	n	%				
1-2 hours (Normal)	0	0	0	0	1	1.7	2	3.3	2	3.3	5	8.3	0.392	0.002
2-4 hours (Tall)	0	0	0	0	11	18.3	5	11.3	1	1.7	17	28.3		
>4 hours (Very high)	3	5	1	1.7	28	46.7	4	25.3	2	3.3	38	63		
Total	**3**	**5**	**1**	**1.7**	**40**	**66.7**	**11**	**18.3**	**5**	**8.3**	**60**	**100**		

Source: Primary Data 2024

Table 7 shows the cross-tabulation between gadget use duration and nutritional status among Class X students at SMAN 1 Porong. Most students with normal nutritional status (46.7%) were in the group that used gadgets for more than 4 hours per day. However, this group also included all students who were severely underweight (5%) and underweight (1.7%), as well as a portion of those who were overweight (6.7%) and obese (3.3%). Students with moderate gadget use (2–4 hours) were mostly in the normal category (18.3%), with a few classified as overweight and obese. Interestingly, among those who used gadgets for only 1–2 hours, the proportion of overweight and obese students was relatively high (6.6%) despite the low sample size. The Spearman correlation test showed a significant negative correlation (r = -0.392, p = 0.002), indicating that as the duration of gadget use increased, nutritional status tended to decline, suggesting a potential relationship between excessive screen time and poor nutritional outcomes.

Table 8. Cross Tabulation of Energy Intake Levels with Nutritional Status for Class X Students at SMAN 1 Porong

Energy intake	Nutritional status										Total	%	r	p
	Severely Underweight		Underweight		Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%	n	%				
Level deficit heavy	0	0	1	1.7	24	40	7	11.7	1	1.7	33	55	0.102	0.439
Moderate level deficit	2	3.3	0	0	1	1.7	1	1.7	0	0	4	6,7		
Mild level deficit	0	0	0	0	5	8.3	0	0	0	0	5	8.3		
Normal	1	1.7	0	0	9	15	3	5	3	5	16	26.7		
Excess	0	0	0	0	1	1.7	0	0	1	1.7	2	3.3		
Total	**3**	**5**	**1**	**1.7**	**40**	**66.7**	**11**	**18.3**	**5**	**8.3**	**60**	**100**		

Source: Primary Data 2024

The results of the cross-tabulation between energy intake levels and nutritional status among 60 students showed that the majority of students with good nutritional status (66.7%) were mostly found in the group with normal energy intake (15%) and heavy energy deficit (40%). Among those classified as overweight (18.3%), most had a heavy energy deficit (11.7%), while students categorized as obese (8.3%) were mainly distributed in both heavy energy deficit and normal energy intake groups (1.7% and 5% respectively). A small number of students with malnutrition (5%) and severe malnutrition (1.7%) were also found, particularly in the moderate energy deficit group. Based on the spearman test, the statistical analysis yielded a p-value of 0.439 ($p > 0.05$), indicating no significant relationship between energy intake levels and nutritional status.

Table 9. Cross Tabulation of Protein Intake Levels with Nutritional Status in Class X Female Students of SMAN 1 Porong

Intake Proteins	Nutritional status										Total	%	r	p
	Severely Underweight		Underweight		Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%	n	%				
Severe level of deficit	2	3.3	0	0	20	33.3	6	10	1	1.7	29	48.3	0.023	0.859
Moderate level deficit	0	0	1	1.7	2	3.3	1	1.7	0	0	4	6,7		
Mild level deficit	0	0	0	0	3	5	2	3.3	2	3.3	7	11.7		
Normal	0	0	0	0	13	21.7	1	1.7	2	3.3	16	26.7		
Excess	1	1.7	0	0	2	3.3	1	1.7	0	0	4	6,7		
Total	**3**	**5**	**1**	**1.7**	**40**	**66.7**	**11**	**18.3**	**5**	**8.3**	**60**	**100**		

Source: Primary Data 2024

Based on the cross-tabulation results, most students with good nutritional status (66.7%) were concentrated in the group with a severe protein deficit (33.3%) and normal protein intake (21.7%). Among students with overnutrition (18.3%), the highest proportion was also found in the severe deficit group (10%). For those categorized as obese (8.3%), the distribution was more varied, with students found in both the mild protein deficit and normal intake groups (3.3%). Meanwhile, cases of malnutrition (5%) and severe malnutrition (1.7%) were mainly found in the severe and excess protein intake groups. Statistical analysis using the Chi-square test yielded a p-value of 0.859 ($p > 0.05$), indicating no significant association between protein intake levels and nutritional status in this group.

DISCUSSION

Adolescence is a period that requires more nutritional intake compared to children who do not yet have a choice about the food menu they want to consume, but when they get older a person begins to have desires and choices for the food they want to consume[5]. Food intake for teenagers, especially teenagers at SMA Negeri 1 Porong, tends to be inadequate. The availability of food in the school canteen tends to be insufficient to meet the individual needs of a student. Based on the results

of observations during research, it shows that students tend to use gadgets for a long time. The results of observations were that if they had free time and rest time, they used their time for chatting, playing games, social media such as Instagram or other entertainment platforms. So the duration of time students play gadgets at school is high. Meeting friends at school also triggers the activity of playing online games together, so that some students use their break time to play games in class with their friends[14].

Every human being needs energy to fulfill their basal energy to support the growth and development process and daily activities. Most of the food consumed will produce protein, fat and carbohydrates[15]. Energy intake at SMA Negeri 1 Porong tends to be low because they rarely eat breakfast at home and breakfast is taken during breaks at school. So that eating patterns are irregular and food intake becomes inappropriate, gadgets are compact digital tools designed to enhance accessibility and functionality. Through gadgets, work will be more practical. The important thing is how to utilize gadgets to provide a positive impact in terms of social aspects of society[16,17]. Respondents predominantly use their free time to access gadgets more than is recommended. Using smartphones to access social media and online games[18]. There is no verbal advice from parents and there are no regulations at school regarding the use of electronic devices (gadgets) so that students feel free to operate smartphones except during school hours[19].

Energy is an important part for a person to carry out daily activities. In the body of every human being, metabolic processes will occur, so that the body always has sufficient calories in terms of the intake of food consumed. Someone who has a low food intake tends to be weak because the body produces little energy, this also affects their thinking power[20]. Protein, like fat and carbohydrates, is useful as a source of energy. Protein is useful for cell growth and regeneration so that dead cells are replaced with new ones for the body's immunity. The need for protein will also increase in adolescents, because during adolescence there is still a rapid growth process in the early teenage stage[21].

Based on the results of research using the 2 x 24 hour food recall form that has been carried out, it can be seen that there are still many respondents who rarely consume protein because they consume so little food on a daily basis. The greater the frequency of a person's consumption, the greater the chance of meeting nutritional adequacy. Including energy intake which causes malnutrition, namely consuming food that is not in appropriate quantity or less than what the body needs so that nutritional quality is not maintained[19]. Protein in adolescence has an important role because there is still a lot of growth that occurs during adolescence. Protein metabolism also occurs differently for each individual. Therefore, even though students tend to have low protein intake, their nutritional status is still good. Lack of protein intake can be caused by a lack of variety in the food consumed[22].

Most respondents had good nutritional status but energy and protein intake experienced a deficit, this is because nutritional status is not always influenced by food intake alone. The student's lifestyle influences this, some consume excessive food but do not balance it with physical activity, some consume small amounts of food because they have no appetite[23]. This will affect the nutritional status of each individual which could lead to two possibilities of obesity/thinning. Basically, nutritional intake will affect a person's nutritional status, because whatever is consumed comes from food that contains nutrients, therefore the importance of sufficient animal and vegetable protein to support growth[24,25].

Based on research that has been conducted, it was found that not everyone who has normal nutritional status will have sufficient energy intake to meet their daily needs. This is because when carrying out a food recall the flat slope syndrome occurs, which means that respondents who are fat will report eating less food and vice versa.

The study is limited by its cross-sectional design, which prevents the establishment of causal relationships between gadget use, dietary intake, and nutritional status. The research was conducted at a single school with a relatively small sample size, which limits the generalizability of the findings to a broader adolescent population. Moreover, the study did not consider other influencing variables such as physical activity, sleep patterns, and mental health, which may also play a role in determining nutritional outcomes.

This study may be subject to recall bias, particularly in the assessment of energy and protein intake using the 2x24-hour dietary recall method, as participants may not accurately remember or report their food consumption. There is also a possibility of response bias in the self-reported duration of gadget use, as students may underreport or overreport their screen time based on social desirability. Additionally, observer bias may occur during anthropometric measurements if standard procedures are not consistently followed.

CONCLUSION

Based on the results of research conducted at SMAN 1 Porong, it can be concluded that the gender of 35 students (58.3%) was female compared to 25 students (41.7%) and the age of most of the respondents was 16 years old, 36 students (60%). The duration of gadget use by respondents in the high category was 3 students (46.7 %), respondents in the very high category were 28 students (46.7%) and respondents in the normal category were 2 students (3.3%). The level of energy intake of respondents in the severe deficit category was 33 students (55%). The level of protein intake of respondents in the severe deficit category was 29 students (48.5%). There is a significant relationship between the length of gadget use and nutritional status at SMA Negeri 1 Porong. There is no significant relationship between energy and protein intake and nutritional status at SMA Negeri 1 Porong.

Future studies are encouraged to involve a larger and more diverse sample across multiple schools to improve generalizability. In addition, longitudinal research designs are recommended to better understand the causal relationships between gadget use, dietary intake, and nutritional status. Including other influencing variables such as physical activity, sleep quality, and mental health may also provide a more comprehensive view of the factors affecting adolescent nutrition.

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