

## Sedentary Lifestyle and Nutritional Status Among Adolescents: A Cross-Sectional Study in Bogor City

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### ARTICLES

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### ABSTRACT

Nutritional problems in Indonesia remain unresolved, especially among adolescents who experience the triple burden of malnutrition, namely undernutrition, overweight, and micronutrient deficiency. Adolescents in Indonesia are increasingly adopting a sedentary lifestyle, which is characterized by prolonged screen time and low levels of daily physical activity. The objective of this study was to analyze the relationship between a sedentary lifestyle and nutritional status among adolescents at Al-Ghazaly High School in Bogor City. This observational cross-sectional study involved 50 adolescents aged 15 – 18 years selected through purposive sampling based on inclusion and exclusion criteria. Primary data on subject characteristics and sedentary lifestyles were collected using the 7 Days-Adolescent Sedentary Activity Questionnaire (ASAQ) while nutritional status was assessed based on anthropometric measurements using BMI/A z-scores. Spearman's correlation was used for data analysis. The findings indicated that the subjects were categorized as having a moderate level of sedentary behavior with the highest average daily time spent on sedentary activities involving the use of computers or mobile phones for gaming, social media, and other similar activities (295 minutes/day). The majority of subjects had a normal nutritional status. Based on the correlation analysis, there was no significant relationship between sedentary lifestyle and nutritional status ( $p = 0.756$ ), indicating a very weak positive correlation ( $r = 0.045$ ). To promote better health, it is recommended that adolescents engage in active breaks between classes and limit excessive use of mobile phones. Future researchers should use a larger sample size and include other variables such as nutritional knowledge and family characteristics.

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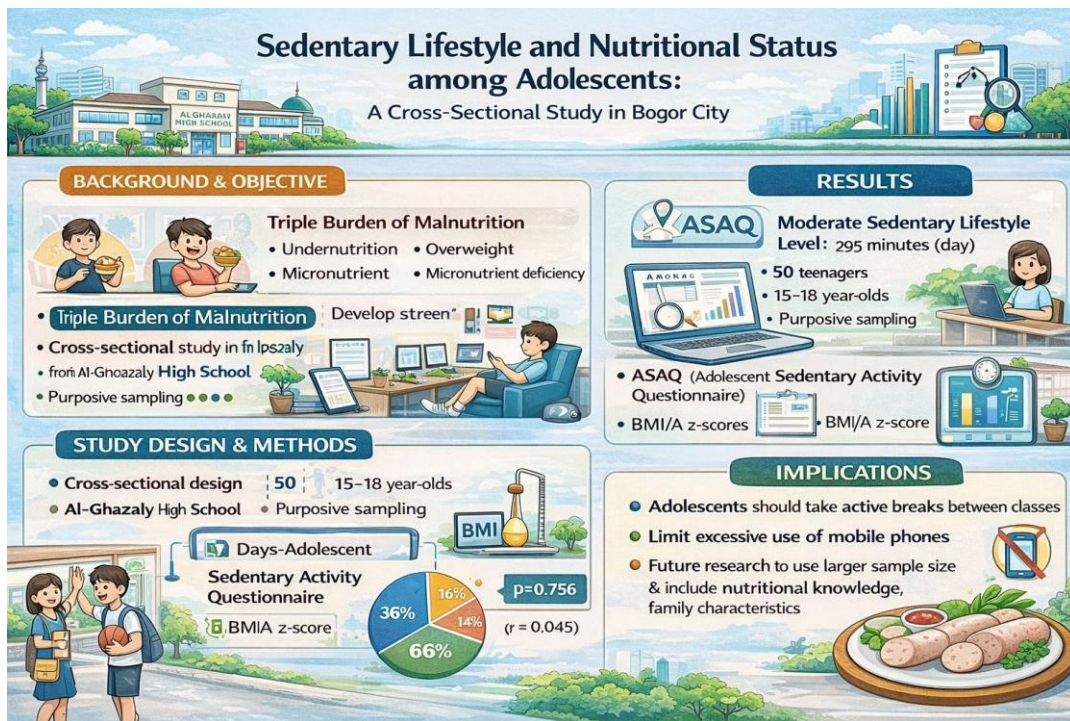


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#### Key Messages:

- Understanding how sedentary lifestyle influences nutritional status helps address this triple burden more effectively.
- This study provides localized data for Bogor City, which can support evidence-based interventions in schools, community health centers and local government programs.

## GRAPHICAL ABSTRACT



## INTRODUCTION

Nutritional issues in Indonesia, especially among adolescents, continue to be a persistent challenge, marked by the Triple Burden of Malnutrition, which includes undernutrition, overnutrition, and micronutrient deficiencies (1). Among these, overweight and obesity are the conditions most strongly associated with a sedentary lifestyle (2). This is caused by changes in dietary patterns, such as overeating, consuming unhealthy processed foods, and a lack of physical activity, which are often related to social and economic changes (1).

The 2023 Indonesian Health Survey found that the prevalence of malnutrition among adolescents in Indonesia was 6.6%, overweight 8.8%, and obesity 3.3% (3). This national trend is also reflected at the provincial level. In West Java, the prevalence of underweight among adolescents aged 16-18 reached 6.3%, while overweight and obesity stood at 8.9% and 4.2%, respectively (4). Nutritional problems in West Java are highest among the 16-18 age group, with underweight in Cirebon City (11.79%), overweight in Depok City (18.13%), and obesity in Kuningan (10.4%) (4). Bogor City ranks 23rd in terms of underweight (3.22%), 18th in overnutrition (8.93%), and 15th in obesity (3.5%) (4).

Adolescence, defined as the age range of 10–18 years, is a critical and vulnerable period for the occurrence of nutritional problems (1). This vulnerability arises from increased nutrient requirements needed to support rapid growth and development. Moreover, changes in lifestyle habits and dietary patterns play a significant role in determining whether these nutritional needs are adequately met (1). In today's context, technological advances bring various benefits, such as ease of access to information, communication, and entertainment. However, excessive use of technology can increase sedentary behavior, a lifestyle lacking in activity that negatively impacts health (5). The lifestyle of adolescents in Indonesia tends to be sedentary, with a significant increase in screen time and a decline in physical activity (6). According to the Indonesian Health Survey, the prevalence of insufficient physical activity among people aged  $\geq 10$  years in Indonesia is 37.4%, with West Java at 33.7%. Specifically, the prevalence of insufficient physical activity in the 15-19 year age group is 50.4% (3). The problem of overweight and obesity is often related to a lack of physical activity in daily life (7). Al-Ghazaly High School was selected as it represents a population at high risk of sedentary behavior among its students from our preliminary study. Therefore, based on this context, the researchers aimed to further investigate the relationship between sedentary behavior and nutritional status among adolescents in Al-Ghazaly High School, Bogor City.

## METHODS

This observational, cross-sectional study was conducted at Al-Ghazaly High School in Bogor City from September 2024 to June 2025. Subjects were selected using a purposive sampling technique. Inclusion criteria were adolescents aged 15-18 years, able to communicate well and read and write, who had signed an informed consent form and owned a mobile phone with internet access. Exclusion criteria included adolescents on a diet or who were ill. Dropout criteria included adolescents who discontinued the study midway and those who did not complete the ASAQ questionnaire. The number of subjects was determined using the Lemeshow (1997) formula, yielding a minimum sample size of 47 based on 16% prevalence of adolescent obesity in Bogor Tengah, a 95% confidence level and 10% margin of error. A total of 60 participants were initially recruited, with 10 dropouts, resulting in 50 subjects included in the final analysis.

Primary data was collected through direct interviews with the subjects to determine their characteristics (gender, age, and pocket money). The sedentary lifestyle variable was collected by completing a Google Form independently for 7 consecutive days and monitoring daily at school and by Whatsapp. This hybrid approach was employed to minimize incomplete data, as subjects might forget to record their activities. The form was required to be completed at the end of each day after all activities had been performed. The instrument used was based on the Adolescent Sedentary Activity Questionnaire (ASAQ). The enumerator first explained the procedure for the ASAQ questionnaire. Respondents filled in the hours for each activity listed. The ASAQ questionnaire was divided into two components: weekdays and weekends. Based on the total daily time reported, the subjects' sedentary lifestyle was then categorized into three levels: low ( $\leq 2$  hours/day), moderate (3-4 hours/day), and high ( $\geq 5$  hours/day) (8). Furthermore, researchers monitored the completion of the Google Form by creating a WhatsApp group. Data not completed for more than one day was considered dropped out. Nutritional status variables were obtained through direct anthropometric measurements, including height and weight. Height was measured with a Microtoice (accurate to 0.1 cm), and weight was measured with a digital scale (accurate to 0.1 kg). Height and weight measurements were used to calculate BMI, which was then converted into a BMI-for-Age (BMI/A) z-score using WHO AnthroPlus and classified into normal, underweight, or overweight and obese categories.

The processing and analysis were performed using Microsoft Excel and Statistical Program for Social Sciences (SPSS) 26 for Windows. The statistical analysis used was a univariate descriptive test to describe the characteristics of the subjects. Data normality was evaluated using the Shapiro–Wilk test, as the distribution was non-normal, Spearman's correlation test was used for the bivariate analysis with  $p < 0,05$ .

## RESULTS

Subject characteristics include sex, age, and distribution of pocket money distribution. The following table shows the distribution of subject characteristics.

Table 1. Characteristic subjects

Variables	Frequency (n,%)
<b>Sex</b>	
Men	19 (38)
Women	31 (62)
Total	50 (100)
<b>Age (years old)</b>	
15	6 (12)
16	20 (40)
17	22 (44)
18	2 (4)
Total	50 (100)
Median (Q1-Q3)	16 ( 16 -17) years old
<b>Pocket money(Rp.)</b>	
<20.000	21 (42)
20.000 – 30.000	19 (38)
>30.000	10 (20)
Median (Q1-Q3)	Rp 25,000 (20,000-30,000)

Sex is a characteristic that provides a general overview of the biological differences inherent in men and women. Subjects were both female and male within a specific age range. Table 1 shows that there were more female subjects than male subjects. Of the total respondents, 31 (62.0%) were female, and 19 (38.0%) were male. Age in this study is a characteristic that provides an overview of the subjects' age range. Table 1 shows that the majority of subjects were in the 16- and 17-year-old age groups, with percentages of 40.0% and 44.0%, respectively. The 15-year-old age group comprised 6 individuals (12.0%), while the 18-year-old age group comprised 2 individuals (4.0%). Pocket money is a subject characteristic that provides an overview of the range of basic daily needs of the subjects in this study. Subjects' pocket money is used to meet daily needs such as food, transportation, and other non-food items. Table 1 shows that the majority of subjects' pocket money is <20,000 rupiah, or 21 individuals (42.0%). Meanwhile, 19 individuals (38.0%) have pocket money between 20,000 and 30,000 rupiah, and 10 individuals (20.0%) have pocket money above 30,000 rupiah.

### Sedentary lifestyle

A sedentary lifestyle reflects daily activities. Physical activity was measured using the ASAQ questionnaire via Google Forms for 7 days, covering 6 school days and 1 holiday.

Table 2. Sedentary lifestyle

Sedentary lifestyle	Frequency (%)
Low ( $\leq 2$ hours)	23(46)
Moderate (3-4 hours)	27 (54)
High ( $\geq 5$ hours)	0
Median (Q1-Q3)	2,07 (1,67-2,44) hour

A sedentary lifestyle can be categorized as low, moderate, or high. Low is  $\leq 2$  hours/day, moderate is 3-4 hours/day, and high is  $\geq 5$  hours/day (8). Table 2 shows that most subjects have a moderate sedentary lifestyle (27 subjects, 54.0%), while the low category consists of 23 subjects (46.0%), and no subjects are in the high sedentary category.

Table 3. Frequency distribution based on sedentary activities

Type of activity	Average time spent/day (SD) (minute)
Watching television	81.00 (52.51)
Watching video/DVD/Film	133.70 (68.74)
Using computer/HP for playing games, social media, etc.	295.00 (98.19)
Learning with electronic devices	92.00 (56.79)
Courses	50.60 (48.34)
Read the book	80.10 (46.82)
Using transportation	123.20 (68.27)
Sitting by doing hobbies	112.60 (62.73)
Relaxing	222.60 (96.23)
Playing musical instruments	46.30 (53.30)
Go to mosque/ church	76.80 (89.72)

Table 3 shows that the highest average duration for sedentary activities was using a computer/laptop/cellphone for gaming and social media (295.00 minutes). Furthermore, other activities, such as sitting and relaxing while chatting or engaging in other leisure activities, averaged 222.60 minutes, and watching videos/DVDs/films averaged 133.70 minutes. Other activities, such as driving, hobbies while sitting, and watching television, also averaged 80-123 minutes. The activity with the shortest duration was playing a musical instrument, averaging 46.30 minutes.

### Nutritional status

Nutritional status in this study is assessed using the BMI/Age index because the subjects are adolescents. The following table shows the distribution of characteristic subject based on nutritional status.

Table 4. Characteristic subject based on nutritional status

Classification	Frequency (%)
Severe acute malnutrition	0
Underweight	1 (2)
Normal	38 (76)
Overweight	11 (22)
Obese	0
Total	50 (100)

Table 4 presents the distribution of subjects, with the majority 38 subjects (76.0%), classified as having normal nutritional status. In contrast 11 subjects (22%) were categorized as overweight. Only 1 subject (2.0%) was identified as underweight.

### The Relationship between Sedentary Lifestyle and Nutritional Status

Table 5. Relationship between sedentary lifestyle and nutritional status

Sedentary lifestyle	Nutritional status										<i>p</i> -value*	<i>r</i>
	Severe acute malnutrition		Underweight		Normal		Overweight		Obese			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Low ( $\leq 2$ hours)	0	0	1	2,0	17	34,0	5	10,0	0	0		
Moderate (3-4 hours)	0	0	0	0	21	42,0	6	12,0	0	0	0,756	0,045
High ( $\geq 5$ hours)	0	0	0	0	0	0	0	0	0	0		
Total	0	0	1	2,0	38	76,0	11	22,0	0	0		

Table 5 shows that among the overweight subjects, 6 (12.0%) exhibited moderate sedentary behavior, while 5 (10.0%) had low sedentary behavior. However, the majority of subjects with a moderate lifestyle had normal nutritional status (42.0%). Analysis using the Spearman Rank test showed no significant relationship ( $p=0.756$ ;  $p>0.05$ ) between sedentary lifestyle and nutritional status in adolescents at Al-Ghazaly High School, Bogor City. The correlation value of 0.045 indicates a very weak positive relationship.

## DISCUSSION

The higher proportion of subjects in this study indicates that female subjects outnumbered males, which reflects the general classroom composition at Al-Ghazaly High School where female students are more prevalent. Adolescents aged 12–21 years generally experience significant physical and psychological development, including the development of self-identity (9). Findings from subject interviews revealed that the amount of pocket money is influenced by several factors, such as whether students are driven to school by their parents or bring meals from home. Additionally, students who live farther from school tend to receive more pocket money to cover transportation expenses, particularly when using public transport. These differences in financial allowance may influence adolescents' daily food choices and, consequently, their overall nutrient intake adequacy (10).

Adolescence, defined as the age range of 10–18 years, is a critical and vulnerable period for the occurrence of nutritional problems. This vulnerability arises from increased nutrient requirements needed to support rapid growth and development. Moreover, changes in lifestyle habits and dietary patterns play a significant role in determining whether these nutritional needs are adequately met. These factors can influence both the risk of undernutrition and overnutrition among adolescents. Consistent with previous research (11), which involved 90 respondents aged 15–18 years, the majority (58 individuals or 64.4%) were also found to have normal nutritional status.

The main findings of the study showed that the majority of subjects classified as overweight had moderate sedentary behavior (22.0%). However, the majority of subjects with a moderate lifestyle had a normal nutritional status (76.0%), while those with an underweight lifestyle had an underweight status (2.0%). Analysis

using the Spearman Rank test showed no significant relationship ( $p=0.756$ ;  $p>0.05$ ) between sedentary lifestyle and nutritional status in adolescents at Al-Ghazaly High School in Bogor City. The correlation value of 0.045 indicates a tendency for a positive relationship with a very low level of correlation. The lower level of sedentary lifestyle increased risk of overweight. The absence of a significant association in the results may be explained by several factors, including limited variability in sedentary behavior due to the lack of participants in the high sedentary category, the relatively small sample size, and the likelihood that nutritional status was affected by other unmeasured variables.

In general, overweight subjects spend more time in sedentary activities than subjects with a normal nutritional status. This condition occurs because most adolescents experience lifestyle changes characterized by reduced physical activity (12). This is in line with the results of research (13), which found that all overweight subjects exhibited high sedentary behavior at 52.4%. Meanwhile, subjects with normal nutritional status accounted for 47.6%, while the moderate category was observed only among them. This suggests that the number of subjects with high levels of sedentary activity is nearly equal to the number with overweight or normal nutritional status. The correlation test results, with a  $p$ -value of 1.000, indicate no significant relationship between sedentary activity and adolescent nutritional status (13). The absence of a significant association in the results may be explained by several factors, including limited variability in sedentary behavior due to the lack of participants in the high sedentary category, the relatively small sample size, and the likelihood that nutritional status was heavily affected by other unmeasured variables, such as the subjects' specific daily caloric intake, genetic predispositions, nutritional knowledge, and family income levels.

This study's findings align with a report from the Indonesian Ministry of Health data, found the prevalence of physical inactivity in the 15–19 age group reached 50.4%. A comparable pattern was reported, indicating that adolescents who were overweight tended to exhibit higher levels of sedentary behavior compared to those with normal nutritional status (14). Adolescents who spend more than 2 hours per day engaged in sedentary activities, such as watching television or playing with gadgets, are at increased risk of higher body mass index (7). Adolescents who watch television for more than 2 hours a day are 48% more likely to be overweight than those who watch less than 1 hour a day (7). Furthermore, sedentary activities related to electronic devices often not only increase sitting time but are also associated with unhealthy food consumption patterns, such as consuming snacks high in fat and sugar. This condition exacerbates the risk of overnutrition in adolescents, especially if not balanced with regular physical activity (15).

A sedentary lifestyle, characterized by low levels of physical activity, can be minimized through several important factors, one of the main ones being increasing awareness of the importance of physical activity. When individuals, especially adolescents, understand the risks associated with an unhealthy lifestyle and minimal physical activity, they will be more motivated to increase the frequency and intensity of physical activity (16). This aligns with Maidartati *et al.*'s finding that sedentary behavior is closely related to a person's nutritional status, as it can trigger an increase in body fat, leading to an imbalance between energy intake and energy expenditure. Physical activity can increase energy expenditure by 20-50%, thus contributing to weight loss. Therefore, someone with low physical activity levels has a 4.6 times greater risk of obesity (14).

The most frequent sedentary activities undertaken by subjects were using computers/laptops/cellphones for gaming and social media. This high level of sedentary activity is due to advances in information technology, which, in turn, encourage subjects to keep up with these developments, leading them to use computers/laptops/cellphones for assignments (17). In today's digital era, the average child is exposed to gadgets, television, games, and computer screens for considerable amounts of time, which can affect nutritional status (18).

Sedentary activities such as watching television, using a computer/laptop/cellphone for assignments, taking lessons, reading novels, and attending religious services/weekend school are still relatively low. This indicates that although technology is utilized for learning, its use is still more strongly influenced by playing games or social media than by learning activities. Furthermore, subjects showed less interest in efficient and innovative activities (5). Based on interviews with subjects, other activities carried out outside the school environment, or most individuals did not engage in any activities after school and simply sat relaxing, watched movies, and used cell phones. However, subjects occasionally did work on assignments when available. Furthermore, some subjects used private vehicles and public transportation to get to school and travel outside of school.

On average, subjects had different habits for each individual, but overall, subjects often used their free time for sedentary activities. Recreational activities or hobbies can lead to sedentary behavior in a person if the hobby is classified as low physical activity or remains for a long period of time, and also when a person is influenced by geographic location (19). This is similar to the location of Al-Ghazaly High School, which is located in an urban area, so it tends to have easier access to support a sedentary lifestyle.

## CONCLUSION

The results of the study indicate that there is no significant relationship between a sedentary lifestyle and nutritional status in adolescents, with a tendency towards a positive correlation. The findings indicate a predominance of a moderate sedentary lifestyle among subjects (54%), accompanied by a generally normal nutritional status (76%). To improve overall health, adolescents are recommended to engage in active breaks between classes and limit excessive use of mobile phones, limit excessive use of mobile phones after school, and incorporate more physical activity into their daily commute and leisure time. Suggestions for future researchers include expanding the sample size and exploring variables such as family income level, nutritional knowledge, and overall physical activity to provide a more comprehensive understanding of the influences on adolescent nutritional status.

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## CONFLICTS OF INTEREST

The author declares that this research was conducted without any conflict of interest, including financial and non-financial elements related to the content and results of the research in this article.

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