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The relationship between gadget use and sleep patterns and the incidence of obesity in adolescents

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Abstract

Background: Adolescent obesity is an increasing public health problem influenced by lifestyle factors such as gadget use and sleep patterns. Excessive gadget use may promote sedentary behavior, while insufficient sleep can disrupt metabolic processes and increase the risk of weight gain among adolescents.

Purpose: to analyze the relationship between gadget use, sleep patterns, and the incidence of obesity among adolescents.

Method: This study employed a descriptive correlational design with a cross-sectional approach. The population consisted of all students in grades 7–9 at MTs Darul Ihsan and SMP Muhammadiyah 3 Samarinda. A total sampling technique was used, involving 152 respondents. Data were collected through anthropometric measurements to determine obesity status based on Body Mass Index (BMI) and self-administered questionnaires to assess gadget use duration and sleep patterns. Data analysis included univariate and bivariate analyzes using the Pearson Chi-Square test.

Results: The majority of respondents were 13 years old (43.4%) and female (73.7%). Most adolescents had a high duration of gadget use (67.8%), and 50.7% experienced insufficient sleep duration (< 8 hours per day). Based on BMI measurements, 32.2% of respondents were classified as obese. Bivariate analysis showed no statistically significant relationship between gadget use and obesity (p -value = 0.075; OR = 2.020; 95% CI = 0.814–1.643). However, a statistically significant association was found between sleep patterns and obesity (p -value = 0.013; OR = 2.426; 95% CI = 0.756–1.833). Adolescents with insufficient sleep had approximately 2.4 times higher odds of being obese compared to those with normal sleep duration.

Conclusion: Sleep patterns are significantly associated with obesity among adolescents, whereas gadget use does not show a statistically significant relationship. Since adolescent obesity is a multifactorial condition, comprehensive prevention strategies involving schools, healthcare providers, and families are necessary to promote healthy sleep habits and balanced lifestyles.

Keywords: Adolescents; Gadget Use; Obesity; Sleep Patterns.

INTRODUCTION

Adolescent obesity is a growing public health problem globally and nationally and poses a serious challenge in various urban areas in Indonesia. Global data shows that by 2022, more than 390 million children and adolescents aged 5–19 years will be overweight, with approximately 160 million of them classified as obese (World Health Organization, 2024). The prevalence of adolescent obesity has

risen sharply from 2% in 1990 to 8% in 2022 and is projected to continue rising to 15.6% by 2030 (Sahoo, Sahoo, Choudhury, Sofi, Kumar, & Bhadoria, 2015). This condition has far-reaching implications because obesity in adolescence not only increases the risk of non-communicable diseases in adulthood but also contributes to increased overall morbidity and mortality.

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In Indonesia, the Basic Health Research results show that the prevalence of overweight and obesity in adolescents aged 15–18 years reaches 31%, with a higher figure in East Kalimantan Province, at 37% (Febriyanto, Murti, & Fertilita, 2023). Samarinda City is recorded as one of the areas with a relatively high prevalence of adolescent obesity, at 9.03%, and the Pasundan Community Health Center working area is reported to have the highest obesity cases among students, especially at SMP Muhammadiyah 3 and MTs Darul Ihsan (Humairoh & Nugroho, 2021). This condition is supported by the results of a preliminary study that shows a fairly high proportion of students with overweight and obesity status, especially at MTs Darul Ihsan, where the majority of students fall into the obesity category level I and II. This fact confirms that adolescent obesity in Samarinda is a real problem that requires serious attention and treatment (Miratunnisa, Satriani, & Amiruddin, 2024).

Obesity is a multifactorial condition influenced by an imbalance between energy intake and expenditure, partly due to sedentary behavior and lifestyle changes (Popkin & Ng, 2022). In adolescents, technological advances and increased gadget use are increasingly prominent risk factors. Indonesia is among the top five countries with the highest number of gadget users in the world, and most teenagers spend hours each day in front of screens playing games, accessing social media, and other digital entertainment (Aisyah & Wijayani, 2023). High-intensity gadget use contributes to reduced physical activity and increased consumption of unhealthy foods (Setiawati & Wiwin, 2021), which can ultimately increase the risk of obesity (Alawiyah & Ernawati, 2021). Several studies have shown that gadget use lasting more than two hours per day, up to eight hours per day, is associated with a higher proportion of obesity in adolescents (Marques, 2023).

In addition to gadget use, sleep patterns are also a significant factor contributing to obesity. Chronic sleep deprivation can disrupt the regulation of hormones that control appetite and metabolism, increasing insulin resistance and triggering weight gain (Chaput, Gray, Poitras, Carson, Gruber, Olds, & Tremblay, 2016). Previous research has shown that adolescents who sleep less than eight hours per night have a significantly higher risk of

overweight and obesity compared to those who get enough sleep (Matricciani, Paquet, Dumuid, Lushington, & Olds, 2022; Bani & Herlina, 2022). Initial interviews with students at both schools indicated that excessive gadget use often disrupts sleep, although most students are unaware of the long-term impact on health (Suryati, Dormina, & Irwandi, 2024).

RESEARCH METHOD

This study employed a quantitative descriptive correlational design with a cross-sectional approach. The cross-sectional design was selected to examine the relationship between gadget use, sleep patterns, and obesity among adolescents at a single point in time. This design allows for the identification of associations between variables without conducting long-term follow-up. Data collection was conducted simultaneously for all variables among students at MTs Darul Ihsan and SMP Muhammadiyah 3 Samarinda within a predetermined period.

The study population consisted of all students in grades VII–IX at SMP Muhammadiyah 3 Samarinda (92 students) and MTs Darul Ihsan Samarinda (121 students), with a total population of 213 students. A total sampling technique was applied, in which all members of the population who met the inclusion criteria were eligible to participate. During data collection, only 152 students were available and met the criteria to be included as respondents. The reduction in sample size occurred due to student absences related to illness and school activities, such as class meetings. Despite this reduction, the sample remains representative of the population.

Inclusion criteria included students enrolled at MTs Darul Ihsan and SMP Muhammadiyah 3 Samarinda, willingness to participate in the study, absence of chronic or infectious illness, not undergoing a special diet, and ability to communicate effectively. Exclusion criteria were students who refused to participate or were in emergency health conditions at the time of data collection. The study was conducted at MTs Darul Ihsan and SMP Muhammadiyah 3 Samarinda, East Kalimantan, Indonesia. These schools were selected due to their high prevalence of adolescent obesity based on local health screening data and their accessibility for data collection. Data collection was carried out in

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December 2025, taking into account the academic schedule and availability of students. Measurements included questionnaire administration and anthropometric assessments conducted during school hours.

The dependent variable in this study was obesity status, while the independent variables were gadget use and sleep patterns. Obesity was determined using Body Mass Index (BMI), calculated from measured body weight and height, and categorized according to standard BMI classifications (Kurdanti et al., 2019). Gadget use was assessed based on daily duration and intensity of use, categorized into normal use (1–2 hours/day) and high use (>4 hours/day). Sleep patterns were evaluated based on sleep duration, categorized as insufficient (<8 hours/day) or normal (8–9 hours/day).

Data were collected using self-administered questionnaires and anthropometric measurements. The questionnaire was developed by the researcher based on relevant literature and previous studies and consisted of three sections: demographic characteristics, gadget use, and sleep patterns. Gadget use was measured using 10 questionnaire items assessing daily duration and types of activities performed using gadgets. Sleep patterns were assessed using 10 questionnaire items evaluating sleep duration, bedtime habits, and sleep quality.

Anthropometric measurements included body weight and height, measured using a digital scale and a stadiometer, respectively. BMI was calculated using the formula: $BMI = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$ dan Data Collection Procedure. Data collection was conducted systematically through questionnaire distribution and physical measurements. Students who met the inclusion criteria were provided with an explanation of the study objectives and procedures before giving informed consent. Questionnaires were completed by the students under supervision to ensure accuracy and completeness. Body weight and height measurements were taken using standardized procedures. In addition, limited observation was conducted to support data accuracy, particularly related to students' gadget use behavior during school activities.

Data analysis was performed using computer-based statistical software. Univariate analysis was conducted to describe the demographic characteristics and distribution of each study variable using frequency and percentage tables. Bivariate analysis was performed to examine the relationship between gadget use and obesity, as well as between sleep patterns and obesity. The Pearson Chi-Square test was used due to the categorical nature of the variables. Statistical significance was determined at a p-value of less than 0.05.

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RESEARCH RESULTS

Table 1. Frequency Distribution of Respondents of MTS Darul Ihsan (N=77)

Variable	Results
Age (Mean±SD) (Range) (Years)	(13.4±1.08) (12-16)
12	17/22.1
13	29/37.7
14	15/19.5
15	15/19.5
16	1/1.3
Gender (n/%)	
Man	0/0
Woman	77/100
Class (n/%)	
7A	26/33.8
7B	20/26.0
9A	18/23.4
9B	13/16.9
Gadget Usage Duration (n/%)	
Tall	55/71.4
Normal	22/28.6
Sleep Patterns Duration (n/%)	
Not enough	41/53.2
Normal	36/46.8
Nutritional Status (n/%)	
Underweight	21/27.3
Normal	30/39.0
Overweight	11/14.3
Obesity I	9/11.7
Obesity II	6/7.8
Obesity Incidents (n/%)	
Obesity	25/32.5
Not Obese	52/67.5

Table 1 shows that the average age of respondents and standard deviation is (13.4±1.08) with an age range of 12-16 years. The majority were female, namely 77 respondents (100%). The majority of respondents were in class 7A, namely 25 (33.8%), with the majority using gadgets for a long duration, namely 55 (71.4%). Based on sleep patterns, the majority of respondents did not get enough sleep, namely 41 (53.2%), with the majority of respondents having a normal nutritional status, namely 30 (39.0%), and the majority of respondents were not obese, namely 52 (67.5%).

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Table 2. Frequency Distribution of Respondents of JHS Muhammadiyah 3 (N=75)

Variable	Results
Age (Mean±SD) (Range) (Years)	(13.4±0.817) (12-15)
12	8/10.7
13	37/49.3
14	24/32.0
15	6/8.0
Gender (n/%)	
Man	0/0
Woman	75/100
Class (n/%)	
7A	17/22.7
7B	21/28.0
8A	16/21.3
8B	21/28.0
Gadget Usage Duration (n/%)	
Tall	48/64.0
Normal	27/36.0
Sleep Patterns Duration (n/%)	
Not enough	36/48.0
Normal	39/52.0
Nutritional Status (n/%)	
Underweight	33/44.0
Normal	19/25.0
Overweight	2/2.7
Obesity I	19/25.3
Obesity II	2/2.7
Obesity Incidents (n/%)	
Obesity	24/32.0
Not Obese	51/68.0

Table 2 shows that the average age of respondents and standard deviation is (13.4±0.817) with an age range of 12-15 years. The majority of respondents were female, namely 75 (100%), with the majority being in classes 7B and 8B, both of which had 21 respondents (28.0%). Based on gadget usage duration, the majority of respondents had a tall stature, namely 48 (64.0%) and normal sleep patterns duration, namely 39 (52.0%), with the majority having a normal nutritional status and obesity 1, namely 19 respondents (25.3%) and the majority not obese, namely 51 (68.0%).

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Table 3. Chi Square Test of Gadget Use on Obesity Incidence

Variable	Obesity Variable		p-value	OR
	Obesity (n=49)	Not Obese (n=103)		
Duration Use Gadget (n/%)				
Tall	38/36.9	65/69.8	0.075	2,020 (1.643-0.814)
Normal	11/22.4	38/77.6		
Duration Sleep (n/%)				
Not enough	32/41.6	45/58.4	0.013	2,426 (1.833-0.756)
Normal	17/22.7	58/77.3		

Based on the results of the crosstab analysis in Table 3.15, there were 103 respondents with a high gadget usage duration, with 38 respondents (36.9%) being obese and 65 respondents (69.8%) not being obese, while in the normal gadget usage duration category there were 49 respondents, 11 respondents (22.4%) being obese and 38 respondents (77.6%) not being obese. In terms of proportion, the incidence of obesity was higher in the high gadget usage duration group, but the statistical test results showed a p-value of 0.075 ($p > 0.05$) so there was no significant relationship between the duration of gadget usage and the incidence of obesity. The Odds Ratio (OR) value of 2.020 indicates that respondents with a high gadget usage duration have approximately twice the chance of experiencing obesity compared to normal gadget usage duration, but because the OR Confidence Interval crosses 1, the duration of gadget usage cannot be stated as a dominant factor and is likely influenced by other factors such as diet and

physical activity. There were 77 respondents with insufficient sleep duration, consisting of 32 respondents (41.6%) who were obese and 45 respondents (58.4%) who were not obese, while among the 75 respondents with normal sleep duration, there were 17 respondents (22.7%) who were obese and 58 respondents (77.3%) who were not obese. In terms of proportion, the incidence of obesity was higher in respondents with insufficient sleep duration. The results of the statistical test showed a p-value of 0.013 ($p < 0.05$), which indicates a significant relationship between sleep duration and the incidence of obesity. The Odds Ratio (OR) value of 2.426 indicates that respondents with insufficient sleep duration have approximately 2.4 times greater chance of experiencing obesity compared to respondents with normal sleep duration. Thus, sleep duration can be stated as a factor related to the incidence of obesity in adolescents.

DISCUSSION

This study found that adolescent obesity remains a prevalent issue, with approximately one-third of respondents classified as obese. The majority of respondents were in early adolescence, a critical developmental period during which lifestyle habits related to sleep, physical activity, and gadget use begin to form. At this stage, adolescents often experience biological changes in circadian rhythm and increasing autonomy over daily behaviors, which may influence obesity risk (Marmot, 2022).

The findings showed that high gadget use was common among adolescents; However, no statistically significant relationship was found

between gadget use duration and obesity. Although adolescents with high gadget use had higher odds of obesity, this relationship did not reach statistical significance. This result suggests that gadget use alone may not directly contribute to obesity but may act indirectly through other factors such as reduced physical activity and unhealthy eating behaviors. Previous studies have reported similar findings, indicating that screen time contributes to sedentary behavior but does not always independently predict obesity without the presence of additional lifestyle risk factors (Zhang, Tian, Zou, Zhang, & Pan, 2022).

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In contrast, sleep patterns showed a significant association with obesity. Adolescents with insufficient sleep were more likely to experience obesity than those with adequate sleep duration. This finding is consistent with existing literature, which suggests that short sleep duration disrupts hormonal regulation of appetite, particularly leptin and ghrelin, leading to increased hunger and higher caloric intake (Rowe, Jarrin, Noel, Ramil, & McGrath, 2021). Furthermore, insufficient sleep may cause daytime fatigue, reducing motivation for physical activity and increasing sedentary behavior, which further contributes to weight gain (Chaput & Dutil, 2016). The interaction between sleep deprivation and lifestyle behaviors highlights the multifactorial nature of adolescent obesity. Although gadget use was not significantly associated with obesity in this study, excessive gadget use may still indirectly influence sleep duration, especially when used at night (Hale & Dzierzewski, 2024). Exposure to blue light from screens can suppress melatonin production, delay sleep onset, and reduce total sleep time, thereby increasing obesity risk indirectly (Aisyah & Wijayani, 2023).

Overall, these findings emphasize the importance of adequate sleep as a protective factor against obesity among adolescents. Interventions focusing on improving sleep habits, limiting nighttime gadget use, and promoting balanced lifestyles may be effective strategies for obesity prevention (Tremblay, 2021). Schools, families, and healthcare providers should collaborate to encourage healthy sleep routines and awareness of lifestyle behaviors that influence adolescent health (Langford, Bonell, Jones, Poulou, Murphy, Waters, & Campbell, 2015).

CONCLUSION

This study examined the relationship between gadget use, sleep patterns, and the incidence of obesity among adolescents at MTs Darul Ihsan and SMP Muhammadiyah 3 Samarinda involving 152 respondents. The findings showed that the prevalence of obesity among adolescents was relatively high, with 32.2% of respondents classified as obese based on Body Mass Index (BMI) measurements. Most participants had a high duration of gadget use, and nearly half experienced insufficient

sleep duration of less than eight hours per day. Statistical analysis revealed that gadget use was not significantly associated with obesity, although adolescents with high gadget use tended to have higher odds of obesity. In contrast, sleep patterns showed a statistically significant association with obesity, where adolescents with insufficient sleep duration had approximately 2.4 times higher risk of being obese compared to those with adequate sleep. These results indicate that sleep duration plays an important role in adolescent obesity, highlighting the need for preventive strategies focusing on healthy sleep habits as part of comprehensive obesity prevention efforts among adolescents.

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