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Associations Between Digital Lifestyle, Social Factors, and Adolescent Obesity: A Case-Control Study in Tasikmalaya Regency, Indonesia

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ABSTRACT

The rising prevalence of overweight and obesity today is associated with various factors, including digital behaviors and the social environment. This study examines the relationships between screen time, sleep duration, attitudes, physical activity, average gaming time, and the number of gaming peers with the incidence of obesity among adolescents. This study is a matched case-control study design. The study population comprises adolescents aged 16–18, encompassing both case and control groups. The case population includes adolescents with obesity in Leuwisari District, while the control population comprises non-obese adolescents from the same location. Case samples were determined based on data from the AUSREM Program, identifying 42 obese adolescents. Meanwhile, the control sample consists of non-obese adolescents selected purposively with a 1:1 matching ratio to the case group, ensuring comparable characteristics. Consequently, the total sample size for this study amounts to 84 participants. Data collection was conducted through questionnaires. Data analysis for screen time, sleep duration, attitudes, and physical activity used the McNemar test. Meanwhile, Pearson correlation was applied to measure the correlation between average gaming time and the number of gaming friends. The results indicate that variables significantly associated with adolescent obesity include screen time (OR=6.33, p=0.000), sleep duration (OR=4.25, p=0.004), Adolescents' attitudes toward obesity (OR=8.17, p=0.004), physical activity (OR=6.00, p=0.004), average gaming time (r=0.624, p = 0.012), and number of gaming friends (r=0.509, p = 0.000).

Key Messages:

- Screen time is a contributing factor to adolescent obesity, acting as a trigger for unhealthy eating habits, decreased physical activity, and sleep disturbances.
- Adolescents with negative attitudes towards obesity have a higher risk of becoming obese, while peer influence in gaming exacerbates sedentary behavior.
- A multidimensional approach involving various family, school, and community stakeholders is necessary to implement effective interventions for preventing adolescent obesity.

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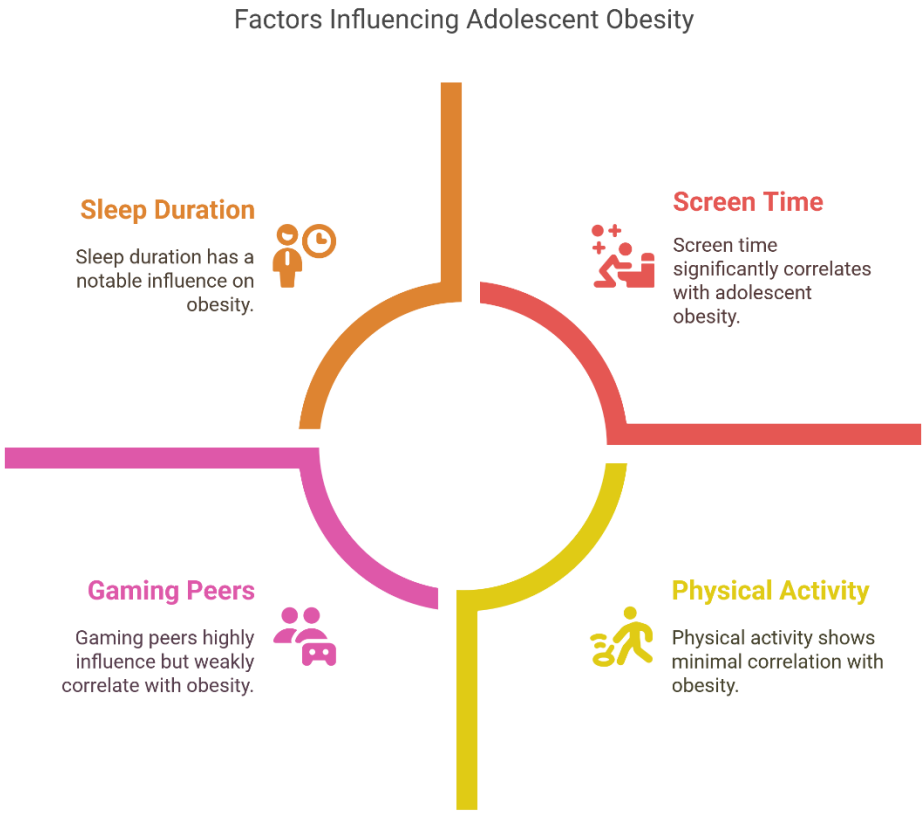
GRAPHICAL ABSTRACT



INTRODUCTION

Adolescent obesity has become a significant public health issue worldwide. According to data from the World Health Organization (WHO), the prevalence of obesity among children and adolescents has sharply increased over recent decades. In 2016, more than 340 million children and adolescents aged 5 to 19 years globally were classified as overweight or obese. This rise is particularly evident in low- and middle-income countries, where obesity is developing alongside changes in dietary patterns and lifestyle, including increased consumption of high-calorie foods, reduced intake of fruits and vegetables, and decreased physical activity(1). Behavioral and lifestyle changes among adolescents, such as the increased use of digital devices, have been associated with the rising prevalence of obesity. In the Asia-Pacific region, including Indonesia, childhood and adolescent obesity is estimated to have reached alarming proportions. In 2016, the World Health Organization (WHO) reported obesity prevalence in several Asian countries, including Indonesia, showing a continuous increase, although still lower compared to some high-income countries (1).

The prevalence of obesity among adolescents in Indonesia has been increasing. According to data from the Global School-based Student Health Survey, the prevalence of adolescent obesity in Indonesia reached 15.7% in 2015. Meanwhile, data from the 2018 Basic Health Research (Riset Kesehatan Dasar) reported the prevalence of teenage obesity in Indonesia at 21%, which is higher compared to the prevalence rates in 2007 (10.3%) and 2013 (15.4%)(2). Additionally, data from the 2023 Indonesian Health Survey indicate that the prevalence of overweight and obesity reaches approximately 19.7% among children aged 5 to 12 years and 16% among those aged 13 to 15 years (3). This trend is also observed in West Java Province, which is among the regions with a relatively high adolescent obesity rate. During two periods of the Indonesian Demographic and Health Survey (SDKI) from 2013 to 2018, obesity among adolescents aged 13–15 increased by 2.69%, while those aged 16-18 experienced a 3.11% increase during the same period. The prevalence of obesity among school-aged children and adolescents in Tasikmalaya Regency surged significantly in 2022, with 447 and 548 reported cases, respectively, compared to the previous year. The Adolescent Age Program (AUSREM) analysis in Tasikmalaya Regency indicates a

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significant rise in obesity cases among adolescents, increasing from 561 cases in 2022 to 1,526 cases in 2023. The highest number of cases was reported among senior high school students, totaling 225 cases. Additionally, the Leuwisari Public Health Center recorded the highest incidence, with 52 cases among senior high school students(4-6).

Changes in dietary patterns and physical inactivity drive the increase in adolescent obesity cases in several regions(7, 8). Excessive use of digital devices and video games has become a significant factor contributing to the rising number of obesity cases among adolescents in these areas(9). Adolescent obesity can have severe short and long-term impacts. In the short term, obese adolescents are at risk of psychological disorders such as depression and anxiety, and have a higher likelihood of experiencing bullying at school (10, 11). Physically, obesity can cause breathing difficulties, hypertension, and musculoskeletal problems (12, 13). In the long term, obesity during adolescence increases the likelihood of developing non-communicable diseases such as type 2 diabetes, cardiovascular diseases, and stroke in adulthood (14, 15). Several risk factors contribute to adolescent obesity, including unhealthy lifestyle behaviors such as poor eating habits, lack of physical activity, and excessive digital media use (9, 16). Data show that adolescents who spend more time in front of screens tend to have poor dietary habits, such as consuming high-calorie, low-nutrient foods (1). Furthermore, socio-economic factors also influence the risk of obesity. Adolescents from low-income families or those with parents having low educational levels are more vulnerable to obesity (17).

Previous studies have revealed that high screen time is closely associated with increased body mass index (BMI) and unhealthy eating patterns (9, 16). Chang et al. (2023) stated that children aged 2 to 6 years with prolonged screen time have a significantly higher risk of obesity. Additionally, the study identified that insufficient sleep and excessive screen time are independent factors contributing to overweight and obesity in children (18). On the other hand, short sleep duration has been linked to increased appetite-regulating hormones, which contribute to weight gain (19). Additionally, a lack of physical activity has been a significant risk factor in various studies (7, 8). Meanwhile, research conducted by Chen et al. (2024) has demonstrated that adolescents' attitudes toward obesity are strongly influenced by their awareness, with a lack of understanding about the health risks associated with obesity playing a significant role (20).

Recent studies, such as those conducted by Caner and Evgin (2021), have begun to explore more specifically the impact of digital behaviors, such as playing digital games, on obesity risk. Their research, which involved 856 adolescents in the Mediterranean region of Turkey, demonstrated that digital gaming is a significant determinant of eating behaviors that increase the risk of adolescent obesity (21). Additionally, a meta-analysis conducted by Mokhtar (2024) confirmed a growing tendency for obesity among children and adolescents who suffer from internet addiction or gaming disorders (22).

Most of these studies have been conducted in developed countries and urban settings, which do not fully reflect conditions in semi-urban or rural areas of developing countries such as Indonesia. Therefore, there is a significant research gap that needs to be addressed, particularly the lack of studies that integrate digital factors (screen time and gaming duration), physiological factors (sleep duration and physical activity), psychosocial factors (attitudes toward obesity), and social factors (number of gaming friends). This gap is especially evident in local contexts, such as Leuwisari District, a rural area with distinct cultural characteristics, technological access, and social environments that influence adolescent lifestyles. The novelty of this study lies in its holistic and contextual approach to assessing the influence of digital lifestyles and social environments on adolescent obesity status. This research not only examines individual variables such as screen time and sleep duration but also considers digital social interactions such as gaming duration and the number of gaming friends, aspects that have not been widely explored in the local Indonesian context, particularly in Leuwisari District, Tasikmalaya Regency.

Preliminary information indicates that smartphone ownership among adolescents in Leuwisari is relatively high, with most using their devices to access social media or play games. The rapid advancement of digital technology has led to an increase in sedentary behavior, as online activities such as browsing social media and gaming have become integral parts of their daily lives. Almost all adolescents in this region have social media accounts and engage in gaming, strengthening their connection to the digital environment. Additionally, local characteristics suggest that the social climate, particularly peer

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interactions, plays a role in driving high usage of digital devices. The combination of social environmental factors and exposure to digital media may contribute to shaping adolescent behavioral patterns, particularly their tendency toward sedentary behavior.

Adolescent obesity is an increasing health issue globally, including in Indonesia, with significant negative impacts. Therefore, it is essential to identify factors contributing to teenage obesity, particularly in the context of increasing digital technology use that influences adolescents' lifestyle behaviors. This study aims to understand better how factors such as screen time, sleep duration, physical activity, and adolescents' attitudes toward obesity affect their health status. The findings of this research can serve as a foundation for formulating more effective policies for the prevention and control of adolescent obesity, as well as supporting more targeted and evidence-based interventions. Although previous studies have examined the relationship between screen time, sleep duration, and obesity, this study will explore the association between digital behavior factors and social environment with adolescent obesity, especially in Leuwisari Sub-district, Tasikmalaya Regency.

This study aims to examine the relationship between several factors, namely screen time, sleep duration, adolescents' attitudes toward obesity, physical activity, average gaming time, and the number of gaming friends, and obesity status among adolescents. The primary focus is to identify the extent to which digital lifestyle and social environment influence adolescent obesity status.

METHODS

This study adopts an observational design utilizing a case-control framework. The case group comprises adolescents with obesity, while the control group comprises adolescents without obesity. The study population consists of adolescents aged 16–18, comprising both case and control populations. The case population includes adolescents diagnosed with obesity in Leuwisari District, based on data from the AUSREM Program. The control population consists of non-obese adolescents from the exact location. Case samples were determined using data from the AUSREM Program report from Leuwisari Public Health Center in 2023, identifying 42 obese adolescents. The control sample consists of non-obese adolescents selected purposively at a 1:1 ratio. Inclusion criteria for the control sample include matching gender and age with the case group and attending the same school. The total sample size was determined using the total sampling method, resulting in 84 participants.

Data collection instrument

Data in this study were collected using questionnaires. The screen time variable, average gaming time, and number of gaming peers were measured using a screen time duration questionnaire. This questionnaire includes questions that describe respondents' habits in using electronic devices, such as watching TV, playing computer games, gaming, or watching videos on mobile phones. Respondents provide answers regarding the duration of device usage in minutes per day. The questions in this instrument refer to the Questionnaire for Screen Time of Adolescents. The sleep duration variable was measured using the standard Pittsburgh Sleep Quality Index (PSQI) questionnaire, which contains questions regarding the time needed to fall asleep at night within 24 hours. The adolescents' attitudes toward obesity were assessed through a questionnaire containing statements about respondents' perceptions of obesity risk factors and prevention, using a Likert scale from 1 to 4. The physical activity variable was measured using the Physical Activity Level (PAL) questionnaire, which evaluates an individual's level of physical activity within the previous 24 hours.

The data collection process begins with an explanation provided to potential respondents regarding the study. After obtaining their consent, data is collected by distributing questionnaires directly to respondents or conducting interviews. The questionnaire or interviews are completed individually to ensure each respondent's privacy. Additionally, weight and height measurements are taken using an electronic step scale and a stadiometer to calculate the Body Mass Index (BMI).

Data Analysis

The data collected was subjected to statistical analysis to explore potential relationships. Screen time, sleep duration, adolescents' attitudes toward obesity, and physical activity were tested using the McNemar test. In contrast, average gaming time and number of online gaming peers were assessed using

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Pearson correlation. Screen time was categorized into high and low based on the median value (565) derived from the sample data. Sleep duration was classified into insufficient (<8.5 hours/day) and adequate (>8.5 hours/day), following the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Physical activity was divided into light (PAL = 1.40–1.69) and moderate-to-vigorous (PAL = 1.7–2.40), based on the Physical Activity Level (PAL) questionnaire. Adolescents' attitudes toward obesity were measured using a questionnaire evaluating their perspectives on obesity risk factors and prevention, with responses on a Likert scale from 1 to 4 (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). Based on the mean value (18.11), attitudes were classified into adequate (<11.81) and good (>11.81). The researcher developed the attitude questionnaire based on relevant theoretical foundations. The McNemar test was applied to analyze relationships between screen time, sleep duration, adolescents' attitudes toward obesity, and physical activity with adolescent obesity. Meanwhile, correlations between average gaming time and number of gaming peers were assessed using Pearson's correlation. The analysis used Epi Info 7, with decision-making criteria based on p-value, correlation coefficient (r), and Odds Ratio (OR) to determine risk levels. A significance level (α) of 5% was applied.

Ethical Considerations

The research committee approved the ethical considerations for this study under the approval number: KEPK/UMP/125/VI/204.

RESULTS

The number of respondents included in this study was 42 obese adolescents whose nutritional status had been validated. Nutritional status was validated by assessing anthropometric measurements of weight and height to calculate Body Mass Index (BMI). The analysis showed that the respondent characteristics based on gender in both case and control groups consisted predominantly of females (76.2%) compared to males (23.8%). The mean BMI of obese adolescents was 30.14, whereas non-obese adolescents had a mean BMI of 20.18. The average screen time among obese adolescents was 702.57 minutes per day, compared to 527.28 minutes per day in non-obese adolescents. Additionally, the average sleep duration of obese adolescents was lower (6.91 hours/day) than that of non-obese adolescents (8.03 hours/day). Furthermore, the average Physical Activity Level (PAL) of obese adolescents tended to be lower (1.67) compared to non-obese adolescents (2.10). Characteristics of the respondents are shown in Table 1.

Table 1. Respondent Characteristics

Characteristics	Obesity					
	Cases		Control		Total	
	n	%	n	%	n	%
Gender						
Female	32	76.2	32	76.2	64	76.2
Male	10	23.8	10	23,8	20	23.8
Screen time						
High	29	69.0	16	38.1	45	53.6
Low	13	31.0	26	61.9	39	46.4
Sleep Duration						
Short	31	73.8	18	42.9	49	58.3
Adequate	11	26.2	24	57.1	35	41.7
Attitude						
Moderate	28	66.7	14	33.3	42	50.0
Good	14	33.7	28	66.7	42	50.0
Physical Activity						
Light	29	69.0	13	31.0	42	50.0
Moderate-Heavy	13	31.0	29	69.0	42	50.0

Based on the analysis results, we can observe the following comparison between obese adolescents (cases) and non-obese adolescents (controls): The proportion of adolescents with high screen time was

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higher in the obese group, at 69.0%, compared to just 38.1% in the non-obese group. Regarding sleep duration characteristics, a higher proportion of short sleep duration was found in obese adolescents (73.8%) than in non-obese adolescents (42.9%). For attitude characteristics, the proportion of obese adolescents with a moderate attitude was higher (66.7%), whereas it was lower in non-obese adolescents (33.3%). Furthermore, based on physical activity characteristics, the proportion of obese adolescents engaging in light physical activity tended to be higher (69.0%) than that of non-obese adolescents (31.0%). Each independent variable was then tested using bivariate analysis. The statistical test results can be seen in Table 2 below:

Table 2. Results of Bivariate Analysis

Variable	Control		Discordance (%)	X^2	p	OR	95%CI
	E+	E-					
Screen time							
High	10	19	15.95	11.63	0.0006	6.33	1.87-21.40
Low	3	10					
Sleep Duration							
Short	7	17	14.49	8.04	0.004	4.25	1.43-12.63
Adequate	4	14					
Attitude							
Moderate	9	19	18.57	8.17	0.004	8,17	1.42-10.18
Good	5	9					
Physical Activity							
Light	9	18	17.14	10.71	0.001	6,000	1.76-20.36
Moderate-Heavy	3	12					

X^2= Chi Square; OR= Odds Ratio; *=Significant; E- = Unexposed to risk factors; p = p-value; CI= Confidence Interval; E+ = Exposed to risk factors

Evidence indicates a significant association between screen time and adolescent obesity (p = 0.0006). Adolescents with high screen time have a 6.33 times greater risk of obesity compared to those with low screen time. The discordant value was 15.95%, meaning that approximately 15.95% of pairs between obese and non-obese adolescents differ in their screen time levels. This value indicates a moderate level of discordance, implying that some pairs exhibit differences in screen time exposure between the two groups. A significant association was also found between sleep duration and adolescent obesity (p = 0.004). Adolescents with short sleep duration have a 4.25 times higher risk of obesity compared to those with adequate sleep duration. The discordant value for sleep duration was 14.5%, indicating that pairs differ in sleep duration between obese and non-obese adolescents. This suggests that sleep duration may be a related factor, given the considerable discordance between the two groups.

Adolescents' attitudes were categorized into two groups: moderate and reasonable. Attitudes were classified as mild if the score was below 11.81, and good if the score was equal to or above 11.81. The bivariate analysis results demonstrated a significant association between adolescents' attitudes toward obesity and adolescent obesity (p = 0.004). Adolescents with a moderate attitude had an 8.17 times higher risk of obesity compared to those with a good attitude. The discordant value was 18.57%, indicating that 18.57% of pairs differed in attitude between obese and non-obese adolescents. There was also a significant relationship between physical activity and adolescent obesity (p = 0.001). Adolescents with light physical activity had a 6.00 times higher risk of obesity compared to those engaging in moderate to heavy physical activity. The discordant value was approximately 17.14%, meaning that 17.14% of pairs differed in physical activity levels between obese and non-obese adolescents. This indicates a moderate difference in physical activity levels associated with obesity.

Table 3. The Relationship Between Average Time Spent Playing Games and Number of Friends with Adolescent Body Mass Index (BMI)

Variabel	*Pearson Correlation*	Signifikansi
Average time spent playing online games	0.624	0.012
Number of friends	0.509	0.000

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According to Table 3, the average time spent playing games has a significance value of 0.012. This indicates that it is correlated with Body Mass Index (BMI), which has a correlation coefficient of 0.624. With a correlation of 0.624, the relationship between average time spent playing games and BMI falls into the moderate category. This means there is a significant association between the two variables, such that changes in gaming time considerably affect BMI. Therefore, the average time spent playing games is a factor that significantly influences an individual's BMI, and this relationship is strong enough to be considered in the analysis of factors contributing to increased BMI. This positive correlation indicates that the longer the time spent playing games, the higher the individual's BMI.

The variable representing the number of friends who play games has a significance value of 0.000, indicating that this variable is correlated with Body Mass Index (BMI), with a correlation coefficient of 0.509. A Pearson correlation coefficient of 0.509 shows a moderate relationship between the number of friends who play games and BMI. This positive correlation means that the more friends an individual has who play games, the higher their BMI tends to be. Although this relationship is not very strong, the number of friends playing games can influence increased BMI. This association reflects a social pattern where having more friends who play games may be related to more intensive gaming habits, which can ultimately contribute to increased BMI or obesity.

DISCUSSION

Adolescence is a transitional phase in individual development that connects childhood and adulthood. Generally, this phase spans the age range of 10 to 19 years. Significant dynamic changes in biological, psychological, and social aspects characterize it. During this period, adolescents undergo a process of identity formation and exploration of their roles within the social environment, which contributes to character development and maturation(23). During this period, adolescents face various issues, such as lifestyle or dietary habits, that can affect their nutritional status. Nutritional needs tend to increase significantly due to the accelerated growth and development of the body. Unhealthy lifestyles, such as poor eating habits, can trigger various dietary problems, including nutrient deficiencies or excesses, which impact adolescents' overall health and well-being. On the other hand, the development of digital technology today also contributes to adolescent health. Throughout their development, adolescents are exposed to various problems that may negatively affect their growth and development (24-26).

The study results revealed a significant link between screen time and adolescent obesity. Those with high screen time are at a greater risk of becoming obese, with an odds ratio of 6.33 when compared to their peers who spend less time in front of screens. Screen time refers to the amount of time spent using electronic devices with screens, such as televisions, smartphones, tablets, and computers (27, 28). A study conducted by Haghjoo et al. in 2022 using a meta-analytic approach demonstrated that high screen time is positively associated with an increased risk of overweight and obesity in adolescents. Adolescents with the highest screen time had a 1.27 times greater likelihood of being overweight or obese compared to those with the lowest screen time (OR = 1.273; 95% CI = 1.166–1.390; P < 0.001) (29).

Screen time contributes to adolescent obesity through several key mechanisms, including increased exposure to unhealthy foods, reduced physical activity, disrupted sleep, and excessive food consumption during screen-related activities. Screen time, especially smartphone use, often leads to exposure to advertisements for food and beverages that influence adolescents' perceptions, encouraging unhealthy food choices or poor dietary patterns. Eating while watching screens or playing games frequently results in unintentional overeating among adolescents. This behavior also contributes to reduced energy expenditure and metabolic disturbances. Excessive screen time, particularly during nighttime, can disrupt sleep duration, affecting hormones that regulate appetite, ultimately leading to increased calorie intake (30).

In this study, sleep duration was associated with the incidence of obesity in adolescents. Adolescents with insufficient sleep duration had a 4.25 times higher risk of obesity compared to those with adequate sleep duration. Sleeping less than 8 hours is linked to a higher prevalence of central obesity (31). Insufficient sleep duration in adolescents is linked to obesity, as it affects hormones that regulate appetite, energy metabolism, and glucose levels, including melatonin, cortisol, leptin, and ghrelin. When adolescents

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experience inadequate or poor-quality sleep, their risk of higher caloric intake, insulin resistance, abdominal obesity, and reduced physical activity increases. These factors collectively contribute to the development of obesity in this age group (32, 33). Short sleep duration in adolescents contributes to obesity by influencing hormones that regulate appetite, energy metabolism, and glucose regulation. Key hormones involved include melatonin, cortisol, leptin, and ghrelin. When adolescents do not get enough sleep or experience poor-quality sleep, they face a higher risk of increased calorie intake, insulin resistance, abdominal obesity, and decreased physical activity. All of these factors contribute to obesity in adolescents(34). Adequate sleep duration is essential for adolescent growth and development. Quality sleep also supports brain development, emotional regulation, and learning ability. The National Sleep Foundation recommends a sleep duration of 8 to 10 hours per night for adolescents aged 14 to 17 years. This duration is considered optimal to support adolescents' physical, mental, and cognitive health (35).

Adolescents' attitudes toward obesity, based on study results, show a significant association. Adolescents with a moderate attitude have an 8.17 times higher risk of obesity compared to those with a positive attitude. Adolescents' attitudes toward obesity can influence behaviors related to diet, physical activity, and acceptance of body weight status. Based on the study's findings, adolescents exhibit moderate attitudes toward obesity, which are reflected in five interconnected key characteristics. First, while there is an intellectual recognition of the importance of obesity prevention, this understanding has not been fully internalized, which limits its influence on behavior change. Adolescents, especially those who are already obese, often underestimate the urgency of addressing obesity, thinking it is a condition that does not need immediate attention or intervention. Some specific misconceptions about obesity still exist, particularly concerning the role of physical activity in its development. Alarmingly, 23.8% of obese individuals believe that a lack of physical activity does not contribute to obesity. This highlights significant gaps in their understanding of the condition's associated risk factors. Fourth, low commitment to preventive behavioral change is reflected in inconsistencies in adopting healthy lifestyle practices, despite adolescents cognitively understanding the solutions. This lack of commitment hinders sustainable efforts to maintain a healthier lifestyle. Finally, these patterns culminate in an attitude-behavior gap, where agreement with obesity prevention strategies fails to translate into sustained implementation in adolescents' daily lives. While they may acknowledge the importance of preventive measures, these behaviors are often not consistently practiced, preventing long-term change.

The study was conducted by Ayran & Karaca (2023) in Turkey; it was demonstrated that awareness of obesity and attitudes toward nutrition are significantly related to adolescents' weight status. Adolescents with low awareness of obesity and negative attitudes toward healthy eating tend to have a higher risk of obesity or overweight. Conversely, adolescents with positive attitudes toward healthy eating exhibit greater awareness of obesity. Those with positive attitudes are more capable of recognizing signs of obesity and understanding its dangers compared to adolescents with negative or indifferent attitudes toward healthy eating(36). Another study conducted by Özer et al. (2024) reported that adolescents with positive attitudes toward physical activity tend to have a normal body weight status. Conversely, those with negative attitudes toward physical activity are more likely to be overweight or obese. This positive attitude can motivate adolescents to adopt healthier behaviors, such as regulating their diet and physical activity and paying closer attention to their body weight.(37).

In this study, physical activity showed a significant association with adolescent obesity. Adolescents engaging in light physical activity had a 6.00 times higher risk of obesity compared to those with moderate to vigorous physical activity. These results are consistent with a study conducted by Kedir et al. in 2022, which identified physical inactivity as a significant predictor of overweight and obesity in adolescents. Less physically active adolescents were found to have a higher risk of obesity(38). Additionally, a study by Kim and Munro in 2021 showed an inverse relationship between physical activity and adolescent obesity. Adolescents who engaged more frequently in physical activities and sports had a lower risk of obesity. Physical activity helps regulate body weight through biological mechanisms such as increased calorie burning, enhanced metabolism, and reduced fat accumulation. Physical activity or sports participation can improve body composition by increasing muscle mass and reducing body fat. Additionally, engaging in physical activity can boost self-confidence, improve body image, and reduce stress, which may

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promote healthier eating behaviors and a more active lifestyle (39, 40). Generally, adolescents who engage in low physical activity are often associated with sedentary behaviors such as prolonged television watching and mobile phone use. These conditions can increase the risk of obesity in adolescents(1).

Based on research findings, the playing time of online games demonstrates a positive correlation between the average time spent playing games and the number of friends, with the incidence of obesity among adolescents. The current technological development has both positive and negative impacts on public health. One of the adverse effects on adolescents stemming from this technological advancement is online gaming. Online gaming has now become an inseparable part of adolescents' lives. Most adolescents spend a significant amount of time on online gaming platforms. This trend has skyrocketed alongside technological progress and increased access to faster internet connections. Beyond the direct impact of screen time, peer relationships also play a crucial role in shaping adolescents' digital behaviors. Research indicates that adolescents typically have friends both at school and at home. Most maintain 2 to 3 close friends for social interactions. The influence of peers is also noticeable in online gaming activities. Data shows that 15.1% of adolescents are frequently invited to play online games, 33.3% are occasionally asked, and 14.3% report being rarely invited. This evidence suggests that peers can significantly impact adolescents' engagement in digital activities like online gaming.

A study conducted by Djanah et al. in 2021 indicates that the trend of online game addiction among Indonesian adolescents tends to be high. This condition is driven by easy access to technology, such as the widespread use of smartphones owned by adolescents and the availability of internet networks. Other contributing factors include peer invitations to play online games, the perception of online gaming as a way to fill leisure time, and the presence of competitive gaming trends that can enhance motivation to play. The majority of online game players in Indonesia are male adolescents aged 21 to 24 years, who are students living without parental supervision(41). Furthermore, a study conducted by Oslen et al. in 2024 demonstrated that the factor triggering adolescents to play online games is the habit of gaming after returning from school. Such a habit becomes a stimulus for adolescents to engage in gaming. Adolescents feel uncomfortable if they do not play games immediately, accompanied by a desire to achieve satisfaction through gaming. Additionally, the study also revealed that adolescents who experience conflicts with their parents regarding gaming tend to have an even stronger desire to play games (42). Adolescents who have social networks with strong family influences exhibit a higher prevalence of obesity (43). Furthermore, as adolescents age, their behavior is increasingly influenced by social environments beyond the family setting. This results in a greater impact of peer influence and community norms in shaping eating habits and physical activities that tend to be followed (44).

The habitual use of digital devices ultimately triggers digital addiction, particularly in the context of gaming. Adolescents who use the internet for more than 60 minutes in a single session are at increased risk of overweight and obesity(10). This condition leads to physical inactivity. Adolescents addicted to gaming tend to spend prolonged periods sitting while playing online games, which limits their engagement in physical activities. Extended periods of sitting while gaming and frequent eating during gameplay significantly increase the risk of obesity because these habits do not burn energy through physical activity. Excess calories consumed during gaming contribute to weight gain, making obesity one of the primary health consequences of digital addiction(45).

Obesity occurring during adolescence has both physical and psychosocial impacts. Physically, adolescent obesity increases the early risk of developing non-communicable diseases such as type 2 diabetes and cardiovascular diseases. Psychosocial consequences of obesity in adolescents include the risk of bullying, discrimination, and negative stigma. Adolescents may experience social isolation due to discrimination or feelings of shame, as well as low self-esteem resulting from frequent teasing by their peers (25, 46-48). A comprehensive understanding of the factors contributing to adolescent obesity is essential for practical prevention efforts. For adolescents, it is expected to avoid sedentary lifestyle habits and apply a diet according to the principles of balanced nutrition (49-51).

This study has limitations and potential biases related to its data collection methods. It used a survey instrument to measure participants' past conditions concerning screen time, sleep duration, physical activity, and attitudes, relying on self-reported answers, which may lead to recall bias. Additionally,

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the sample size was limited. Due to the existing limitations, future research should consider using a longitudinal study design to establish causal relationships. It would also be beneficial to use a larger sample size to improve the generalizability of the findings. Additionally, incorporating confounding variables such as dietary habits and family history would lead to a more comprehensive analysis.

Scientific implications: This study refines the bio-psycho-social framework for understanding adolescent obesity by demonstrating that it arises from various factors. These include biological factors, such as hormonal disruptions due to sleep deprivation, psychological factors like attitudes toward obesity, and social influences, including peer relationships and digital engagement. The research underscores the significance of digital addiction as a critical link between technology use and obesity risk. Excessive screen time disrupts sleep and impacts adolescents' behavior and psychosocial well-being. These findings open avenues for future research into digital behaviors as essential determinants of adolescent health issues and contribute to the existing literature on technology-related health risks.

Furthermore, these findings provide practical implications for public health, education, and policy, especially regarding the prevention of adolescent obesity. First, comprehensive lifestyle interventions should be implemented in schools and communities, with a focus on education related to time limits for device use, improved sleep, and increased physical activity. These initiatives should aim to foster sustainable health attitudes and behaviors. Second, social environment and family support are crucial in shaping adolescents' behavior. Active parental involvement in monitoring digital device use and promoting physical activity at home is essential. Training programs for parents should be developed to improve their supervisory skills. Third, regulatory measures should be implemented to limit exposure to digital content, especially unhealthy food advertisements. Policymakers should restrict fast food marketing on social media and gaming platforms to counteract the negative impact on adolescents' food choices. In addition, school-based health services should be strengthened for early detection and ongoing educational efforts, including obesity screening, nutrition counseling, and guidance on sleep hygiene and gaming risks.

CONCLUSION

A complex interaction of digital lifestyle factors, social environment, and health habits influences adolescent obesity. High screen time has been shown to increase the risk of obesity through mechanisms such as exposure to unhealthy food advertisements, decreased physical activity, and disrupted sleep patterns. Insufficient sleep duration also significantly contributes to impairing the regulation of appetite hormones and glucose metabolism. Furthermore, adolescents' attitudes toward obesity play an important role, with negative or indifferent attitudes toward healthy eating associated with a higher risk of obesity. Low physical activity, especially sedentary behavior and the habit of playing online games driven by peer influence, further exacerbates the risk of obesity through inactive lifestyles and excessive calorie consumption. To address these challenges, a multidimensional approach involving various stakeholders is required. At the family and school levels, interventions should limit screen time, provide nutrition education, and promote physical activity. Digital literacy must also be incorporated into curricula to help adolescents critically filter exposure to unhealthy food advertisements. At the policy level, regulations restricting fast food advertising on digital platforms and providing accessible sports facilities for adolescents are essential. Furthermore, future studies should use a longitudinal design to establish causal relationships and involve a larger sample size to improve generalizability.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Sultana S, Rahman MM, Sigel B, Hashizume M. Associations of lifestyle risk factors with overweight or obesity among adolescents: a multicountry analysis. Elsevier BV; 2021. 742-50 p.
2. Setiyo Nugroho P, Wijayanti A, Sunarti S, Suprayitno. Obesity and Its Risk Factors Among Adolescents in Indonesia. Malaysian Journal of Medicine and Health Sciences. 2020;16:2636-9346.
3. BRIN. [Challenges and Strategies for Addressing Child and Adolescent Obesity Jakarta]: Badan Riset dan Inovasi Nasional; 2024 [cited 2025. Available from: https://brin.go.id/reviews/118905/tantangan-dan-strategi-penanganan-obesitas-pada-anak-dan-remaja.
4. Kemenkes, I BPdPKKKR. [Basic Health Research 2018]. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI; 2018.
5. Kemenkes. [Recognize Nutrition Problems Threatening Indonesian Teenagers]: Kementerian Kesehatan Indonesia; 2018 [Available from: https://sehatnegeriku.kemkes.go.id/baca/rilis-media/20180515/4025903/kenali-masalah-gizi-ancam-remaja-indonesia/.
6. Leuwisari P. [High School Health Screening Report]. Tasikmalaya 2023.
7. Silva A, Silva L, Lopes I, Francisco ACd, Neto ACdA, Monteiro MJ, et al. Association of Dietary Pattern and Physical Inactivity With Hypertension, Obesity, Diabetes, and Metabolic Syndrome. 2024.
8. Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of Adolescent Physical Activity and Inactivity Patterns. Pediatrics. 2000;105(6):e83-e.
9. Gülü M, Yagin FH, Gocer I, Yapici H, Ayyildiz E, Clemente FM, et al. Exploring obesity, physical activity, and digital game addiction levels among adolescents: A study on machine learning-based prediction of digital game addiction. 2023; Volume 14 - 2023.
10. Kavici S, Ayaz-Alkaya S. Internet addiction, social anxiety and body mass index in adolescents: A predictive correlational design. Children and Youth Services Review. 2024;160:107590.
11. Şahin N, Kırlı U. The Relationship Between Peer Bullying and Anxiety-Depression Levels in Children With Obesity. Alpha psychiatry. 2021;22(2):94-9.
12. di Palmo E, Filice E, Cavallo A, Caffarelli C, Maltoni G, Miniaci A, et al. Childhood Obesity and Respiratory Diseases: Which Link? Children (Basel, Switzerland). 2021;8(3).
13. Fortunato LM, Kruk T, Lima Júnior E. Relationship between obesity and musculoskeletal disorders: systematic review and meta-analysis. Research, Society and Development. 2021;10(13):e119101320212.
14. Ansari S, Haboubi H, Haboubi N. Adult obesity complications: challenges and clinical impact. 2020;11:2042018820934955.
15. Almuqbil M, Rabbani SI, Gilkaramenthi R, Aljawadi M, Alsanie WF, Alamri AS, et al. Non-communicable diseases in Saudi adolescents: prevalence, risk factors, and implications for public health. Frontiers in Public Health. 2025;13.
16. Kocakoğlu U, Karaoğlu N, Kutlu R. The relationship between computer game addiction and obesity in third and fourth-grade elementary school students. Gulhane Medical Journal. 2021;62(2):87-95.
17. Xiaopeng Ji, Lauren B. Covington FP, Ming Ji, Janeese A. Brownlow,. Review for "Associations between sleep and overweight/obesity in adolescents vary by race/ethnicity and socioeconomic status". National Library of Medicine. 2022.
18. Chang R-Y, Chen T-L, Yeh C-C, Chen C-H, Wang Q-W, Toung T, et al. Risk of obesity among children aged 2–6 years who had prolonged screen time in Taiwan: a nationwide cross-sectional study. 2023:165-76.

https://doi.org/10.56303/jhnresearch.v4i2.447

19. Lin J, Jiang Y, Wang G, Meng M, Zhu Q, Mei H, et al. Associations of Short Sleep Duration With Appetite-regulating Hormones and Adipokines: A Systematic Review and Meta-analysis. Obesity Reviews. 2020;21(11).
20. Chen Y, Zhang L, Wang M, Lu B, Shen T, Gu R, et al. Insights From Multiple Stakeholders Regarding Adolescent Obesity in China: An Exploratory Qualitative Study. Inquiry: The Journal of Health Care Organization Provision and Financing. 2024;61.
21. Caner N, Evgin D. Digital Risks and Adolescents: The Relationships Between Digital Game Addiction, Emotional Eating, and Aggression. International Journal of Mental Health Nursing. 2021;30(6):1599-609.
22. Mokhtar MC, McGee R. Impact of Internet Addiction and Gaming Disorder on Body Weight in Children and Adolescents: A Systematic Review. Journal of Paediatrics and Child Health. 2024;61(2):136-47.
23. Berk LE. Development through the lifespan. Boston: Sage Publications; 2022.
24. Patton GC, Sawyer SM, Santelli JS, Ross DA, Afifi R, Allen NB, et al. Our future: a Lancet commission on adolescent health and wellbeing. The Lancet. 2016;387(10036):2423-78.
25. WHO. Obesity and overweight: World Health Organization; 2024 [cited 2025 27]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
26. Priftis N, Panagiotakos D. Screen Time and Its Health Consequences in Children and Adolescents. Children. 2023;10(10).
27. Qi J, Yan Y, Yin H. Screen time among school-aged children aged 6–14: a systematic review. Global Health Research and Policy. 2023;8(1):12.
28. OED. Oxford English Dictionary Oxford: Oxford University Press; 2025 [Available from: https://www.oed.com/dictionary/screen-time_n?tab=factsheet#1215011640.
29. Haghjoo P, Siri G, Soleimani E, Farhangi MA, Alesaeidi S. Screen time increases overweight and obesity risk among adolescents: a systematic review and dose-response meta-analysis. BMC Primary Care. 2022;23(1):161.
30. Byun D, Kim Y, Jang H, Oh H. Screen time and obesity prevalence in adolescents: an isotemporal substitution analysis. BMC Public Health. 2024;24(1):3130.
31. Lahyani Y, Adarmouch L, Sebbani M, Mansoury O, El Mouaddib H, Amine M. Impact of sociodemographic factors, sleep, physical activity, and sedentary lifestyle on central obesity in schoolchildren aged 6–12 years in Marrakech, Morocco. Heliyon. 2025;11(1):e41176.
32. Widjaja NA, Kurube CF, Ardianah E. Sleep duration and insulin resistance in obese adolescents with metabolic syndrome: is there a correlation? Acta bio-medica: Atenei Parmensis. 2023;94(4):e2023079.
33. Yıldız F, Tuğrul Aksakal MZ, Yıldız R, Baş F. The Relationship Between Sleep Quality, Sleep Duration, Social Jet Lag, and Obesity in Adolescents. Journal of clinical research in pediatric endocrinology. 2024;16(4):419-25.
34. Mosavat M, Mirsanjari M, Arabiat D, Smyth A, Whitehead L. The Role of Sleep Curtailment on Leptin Levels in Obesity and Diabetes Mellitus. Obesity facts. 2021;14(2):214-21.
35. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, et al. National Sleep Foundation's updated sleep duration recommendations: final report. Sleep health. 2015;1(4):233-43.
36. Ayran G, Karaca O. Relationship Between Obesity Awareness and Nutrition Attitude: A Sectional Study Among Secondary School Students. Galician Medical Journal. 2023;30(4):e-GMJ2023-A02.
37. Özer Ö, Uyhan O, Devrilmez E, Orhan İ, Bilgiç M, Uğurlu A, et al. The relationship between attitude toward physical activity and weight gain in children and young adolescents. 2024; Volume 12 - 2024.
38. Kedir S, Hassen K, Melaku Y, Jemal M. Determinants of overweight and/or obesity among school adolescents in Butajira Town, Southern Ethiopia. A case-control study: Public Library of Science (PLoS); 2022.
39. Kim EK, Munro T. Associations between Physical Activity and Depressive Symptoms through Obesity and School Bullying among Adolescents. International Journal of Depression and Anxiety. 2021;4(1).

https://doi.org/10.56303/jhnresearch.v4i2.447

40. Li H, Choi J, Kim A, Liu G. Association between physical activity, smartphone usage, and obesity risk among Korean adolescents: A cross-sectional study based on the 2021 Korean adolescent health behavior survey. Acta Psychologica. 2025;252:104648.
41. Djannah SN, Tentama F, Sinanto RA. Game addiction among adolescents and its health impacts. International Journal of Public Health Science. 2021;10(3):480-92.
42. Olsen M, André F, Delfin C, Håkansson A, Claesdotter-Knutsson E. Children and adolescents' self-reported gaming habits – An exploratory, cross-sectional study of gaming among 9–15-year-old school children. Emerging Trends in Drugs, Addictions, and Health. 2024;4:100058.
43. Aguirre MdJX, Andrade FCD, Aguirre MAC, Justino JR, Maciel BLL. Social Network, Food Patterns, Physical Activity, and Associations with Overweight and Obesity in Adolescents from a School in Rural Brazil. Nutrients. 2023;15(15):3305-.
44. Malobická E, Zibolenová J, Baška T, Bakalár P, Madleňák T, Štefanová E, et al. Differences in the frequency of selected risk factors of overweight and obesity in adolescents in various social environments within Slovakia. Public Health. 2025;240:203-8.
45. Aziz N, Nordin MJ, Abdulkadir SJ, Salih MMM. Digital addiction: Systematic review of computer game addiction impact on adolescent physical health. Electronics (Switzerland). 2021;10(9).
46. Hendy A, Soliman SM, Tantawi H, Salman S, Ibrahim RK, Hendy A, et al. The weight of words: investigating the role of weight stigma and body mass index in shaping children and youth's emotional experiences. Journal of Eating Disorders. 2025;13(1).
47. Julia Tong T, Mohammadnezhad M, Salem Alqahtani N, Salusalu M. Perception of students on factors contributing to overweight and obesity among high school students in Kiribati: A qualitative study. PLOS ONE. 2022;17(1):e0260900.
48. Cheon BK, Bittner JMP, Pink AE. Contributions of subjective status to eating behaviors, obesity, and metabolic health across development. Appetite. 2025;204:107735.
49. Rakhman A, Buludawa M, Hijrah H, Ariani A. The Relationship between the Intensity of Gadget Use, Eating Patterns, Mukbang Watching Habits and Changes in Eating Behavior with the Incidence of Overweight in Adolescents. J Health Nutr Res. 16 Desember 2024;3(3):221–9.
50. Rakhman A, Hamid MAbd, Nurulfuadi N, Nadila D, Aiman U. Relationship between Fast Food Consumption, Sedentary Lifestyle, and Physical Activity with Body Mass Index (BMI) among Students of Madrasah Aliyah Alkahiraat Pusat Palu Post-Covid-19 Pandemic. J Health Nutr Res. 4 April 2025;4(1):8–14.
51. Damayanti DS, Humairah AT, Darmayanti F, Isnaenil M IP, Maarif R. Relationship Between Eating Patterns, Physical Activity, and Obesity Incidence Among Madrasah Tsanawiyah (MTs) Students. J Health Nutr Res. 21 Agustus 2024;3(2):133–7

https://doi.org/10.56303/jhnresearch.v4i2.447