

Correlation Between Screen Time and Levels of Physical Activity and Health Indicators Among Adolescents at SMAN 2 Palangka Raya

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Abstract

Introduction: The high ownership of smartphones among teenagers in Central Kalimantan, supported by increasingly widespread internet penetration, indicates the intense use of digital technology in everyday life. A national survey reveals that the majority of adolescents have a screen time of more than 3 hours per day, reflecting the dominance of screen-based activities. This condition has the potential to encourage a shift from healthy lifestyles towards sedentary lifestyles. **Methods :** This study is a correlational study with a cross-sectional approach in July-August 2025 involving 151 students from SMAN 2 Palangka Raya using simple random sampling. The inclusion criteria used were students of SMAN 2 Palangka Raya aged 14-17 years who had provided informed consent. Instruments used included the Screen Time Questionnaire, International Physical Activity Questionnaire, Pittsburgh Sleep Quality Index, Patient Health Questionnaire Adolescent, BMI measurement sheet, and blood pressure recording. Then, the type of data used was ordinal, which was analyzed using Somers' d, with SPSS version 25. **Results:** There was a significant relationship between sleep quality p ($0.000 < 0.05$), d (-0.181), mental health p ($0.003 < 0.05$), d (0.199), and BMI p ($0.032 < 0.05$), d (0.161). Meanwhile, no significant relationship was found in other variables ($p > 0.05$). **Conclusion:** School-based interventions and school-parent collaboration are needed to promote balanced digital use, healthy sleep habits, and physical activity among students. This study is limited by its cross-sectional design, self-reported data, and small single-school sample, which restrict causal inference and generalizability.

Keyword: Health indicators; level of physical activity; screen time.

Received: October 22, 2025 | Revised: January 5, 7, February 8, 2026

Accepted: February 21, 2026 | Published: March 3, 2026



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Introduction

The development of digital technology has brought fundamental changes to patterns of physical activity and leisure time among adolescents. Advances in information technology, particularly the increase in mobile phone ownership and internet access, have encouraged a shift in adolescent behaviour from physical activities to sedentary screen-based activities. Data from the Badan Pusat Statistik, (2025) shows a significant increase in mobile phone ownership in Indonesia, from 38.05% in 2010 to 68.65% in 2024. This increase is in line with the increasingly widespread use of smartphones as a means of communication, entertainment, and access to information in the daily lives of adolescents.

Based on regional classification, the level of gadget ownership and use tends to be higher among adolescents living in urban areas compared to rural areas. This condition is also reflected in Central Kalimantan Province, where in 2024 mobile phone ownership reached 75.71% of the total population, indicating a relatively high penetration of digital technology in this region. Based on changes in adolescent behaviour, according to the 2025 internet penetration and internet usage behaviour survey by the Indonesian Internet Service Providers Association (APJII) among Generation Z (aged 13-28 years), smartphones/mobile phones remain the primary device with a usage rate of 82.85%, laptops (14.12%), and Smart TVs only (3.03%).

This illustrates that the younger generation relies more on smartphones as the primary means for digital activities, whether for communication, entertainment, or learning. Furthermore, the trend of smartphone/mobile phone usage based on education level shows that the highest usage is among primary school graduates (91.41%) and junior high school graduates (90.06%), while usage decreases among senior high school graduates (85.08%) and is lowest among university graduates (67.60%). Meanwhile, the types of internet entertainment content most frequently accessed by Indonesians are dominated by online short videos (30.16%), social media content (28.67%), online music (14.34%) and long videos/internet-based TV (17.61%), online game streaming (6.75%), online radio/podcasts (1.07%), and don't know/no answer (1.34%).

The high intensity of device usage, especially for consuming digital entertainment content, has the potential to increase screen time, which requires serious attention. In line with the internet penetration percentage, the latest data from Goodstats shows that young people aged 16 years and above in Indonesia spend an average of 7 hours and 22 minutes per day accessing the internet. This data is supported by findings from a national survey which noted that 24.5% to 33.8% of young people experience sedentary behaviour for ≥ 3 hours per day (Andriyani et al., 2020). With the high duration of screen time and sedentary behaviour among adolescents, it is highly likely that adolescents will tend to shift from active physical activity to a passive lifestyle.

However, the Indonesian Paediatric Association (IDAI) recommends that children aged 12-18 years should not spend more than 2 hours per day on screen time. This high duration of screen time indicates a risk of mobile phone addiction (Buctot et al., 2020). In addition, the level of mobile phone addiction in adolescents is significantly influenced by patterns of leisure time management and enjoyment of physical activity (Namlı et al., 2025). This

phenomenon is important to study because there is a tendency for adolescents to shift from active physical activities to a sedentary lifestyle due to the long duration of screen time, which affects their body mass index, sleep quality, and mental health.

Ideal health indicators in adolescents are demonstrated by optimal physical fitness, ideal body weight, good sleep quality, and stable mental health (Hosker et al., 2019). Therefore, adolescents should have a balanced lifestyle between physical activity, rest, and leisure time. According to the WHO, (2021), the recommended physical activity for children and adolescents (aged 5-17 years) to improve cardiovascular fitness, muscle strength, bone health, and metabolism, as well as reduce symptoms of anxiety and depression, is at least 60 minutes of moderate to vigorous physical activity per day. Physical activity exceeding 60 minutes at least three times a week will provide additional health benefits, including strengthening muscles and bones.

Furthermore, the Indonesian Paediatric Society or Ikatan Dokter Anak Indonesia (IDAI) recommends that children aged 12-18 years old should not spend more than 2 hours per day on screen time and recommended duration of quality sleep is 8-10 hours per day. Based on research findings, the negative impact of screen time on physical activity and overall health is now increasingly evident and has received widespread attention in various scientific studies. Among these, excessive screen time negatively impacts motor skills (Mineshita et al., 2021), increases body weight (Mukhtar et al., 2023), reduces sleep duration (Syilvani et al., 2024), interpersonal difficulties (Jusienè et al., 2025), and mental health (Santos et al., 2024).

Thus, it can be concluded that excessive screen time in adolescents not only contributes to reduced physical activity but also affects various aspects of physical, psychological, and social development. However, studies examining the relationship between these variables, particularly among adolescents in the Palangka Raya area, are still very limited. This condition indicates an important research gap that needs to be filled, considering that the characteristics of the environment, culture, and lifestyle of adolescents in this area are different from other regions. Based on previous research, studies on the impact of screen time duration on the health and physical behaviour of adolescents in Indonesia show relatively consistent findings.

Among them, (Setiawati et al., 2019) conducted a study in the city of Surabaya, which revealed that there is a significant relationship between the intensity of social media use and low levels of exercise habits among students at SMAN 6 Surabaya. In addition, similar findings were also presented by (Islami et al., 2023), which showed that sedentary behaviour and physical activity are factors that are interrelated with energy intake in 45 adolescent at SMK Negeri 1 Banjarbaru. Based on a synthesis of these empirical findings, the initial hypothesis that can be formulated in this study is that there is a significant negative relationship between screen time duration and adolescent physical activity levels, sleep quality, mental health, body mass index, and blood pressure.

Where the higher the screen time duration, the lower the level of physical activity and adolescent health indicators. Based on this hypothesis, this study has strategic benefits in the scope of health interventions in schools, both preventively and promotively. The research results can serve as an evidence base for schools in designing integrated health intervention

programmes, particularly in controlling students' screen time duration through school policies, strengthening healthy digital literacy, and developing structured physical activities in the school environment. With strong empirical evidence, schools can set more proportional limits on gadget use and sleep hygiene based on adolescent developmental needs.

Methods

This study is a correlational study with a cross-sectional approach conducted in July-August 2025 on 151 students of SMAN 2 Palangka Raya. The inclusion criteria used were students of SMAN 2 Palangka Raya aged 14-17 years who had provided informed consent. The instruments used to measure screen time duration were the Screen Time Questionnaire (STQ), physical activity levels using the Physical Activity Questionnaire for Adolescents Short Form (PAQ-A) with a Cronbach's α reliability level of 0.78–0.82 (Rahayu et al., 2022), the Pittsburgh Sleep Quality Index (PSQI) questionnaire for sleep quality with a Cronbach's α reliability coefficient of 0.74 (Setyowati & Chung, 2021), the Patient Health Questionnaire Adolescent (PHQ-A) for mental health with an instrument reliability coefficient of 0.70 (Chen et al., 2024), measurement of nutritional status indicators using a BMI measurement sheet and blood pressure indicators using blood pressure recordings. The data collection procedure for the variables of screen time duration, physical activity level, sleep quality, and mental health used self-report instruments. Meanwhile, BMI measurement was carried out manually using a tape measure and scales, then calculated using the BMI formula, which is $\text{weight (kg)} / (\text{height (m)} \times \text{height (m)})$. Blood pressure measurements were taken using a digital device, the Sinocare BA-801 sphygmomanometer. The data obtained were ordinal and analysed using Somers' d correlation test with SPSS version 25 software.

Results

The categorical scale for each instrument, for measuring screen time duration using the Screen Time Questionnaire (STQ), with low category classification for 1-2 hours, moderate for 3-4 hours, and severe for > 4 hours. Sleep quality category classification using the Pittsburgh Sleep Quality Index (PSQI) includes a good category with a score of 1-5 and a poor category with a score of > 5 . Then, the Body Mass Index (BMI) classification is adjusted to the Regulation of the Minister of Health of the Republic of Indonesia Number 41 of 2014, with the very thin category having a score of < 17.0 , the thin category having a score of $17- < 18.5$, the normal category having a score of $18.5-25.0$, the overweight category having a score of $> 25.0-27.0$, and the obese category with a score > 27.0 .

Physical activity levels were assessed using the International Physical Activity Questionnaire (IPAQ). The physical activity level classifications used include the light category (< 600 MET minutes/week), moderate category ($600-3000$ MET minutes/week), and vigorous category (> 3000 MET minutes/week). Mental health was classified using the Patient Health Questionnaire Adolescent (PHQ-A) instrument into the normal category with a score of 0-4, mild category with a score of 5-9, moderate category with a score of 10-14, moderately severe category with a score of 15-19, and severe category with a score of 20-27.

Additionally, the categorical criteria for blood pressure in adolescents include 90/60 hypotension, 120/80 normal, 130/85 prehypertension, and > 140/ > 90 hypertension. The frequency and percentage results of each categorical data by respondents are detailed in Table 1 below.

Table 1. Characteristic respondent

Variables	Frequency (n)	Percentage (%)
Gender		
Male	80	53.0
Female	71	47.0
Age		
14	11	7.3
15	74	49.0
16	60	39.7
17	6	4.0
Screen time duration		
Low	6	4.0
Moderate	26	17.2
Severe	119	78.8
Sleep quality		
Good	123	81.5
Poor	28	18.5
Body mass index		
Normal	74	49.0
Thin	6	4.0
Very thin	2	1.3
Overweight	16	10.6
Obese	53	35.1
Level of physical activity		
Light	12	7.9
Moderate	112	74.2
Vigorous	27	17.9
Mental health		
Normal	89	58.9
Mild	42	27.8
Moderate	11	7.3
Moderately severe	7	4.6
Severe	2	1.3
Blood pressure		
Normal	125	82.8
Hypotension	13	8.6
Prehypertension	10	6.6
Hypertension	3	2.0

Based on the prerequisite tests, namely normality and homogeneity tests, the data in both tests showed results of $p > 0.05$, so it can be concluded that the data are not normal and not homogeneous. Thus, the hypothesis test was continued using Somers' d on ordinal data. The *p-value* indicates the level of significance, while the Somers' d or *d* value indicates the correlation coefficient, which is a measure of the linear correlation between two variables. Full details are shown in table 2 below.

Table 2. Correlation result

Variables	<i>p-value</i>	<i>d</i>
Level of physical activity	0.357	0.056
Sleep quality	0.000	-0.181
Body mass index	0.032	0.161
Mental health	0.003	0.199
Blood pressure	0.582	-0.029

There is a significant relationship between screen time and sleep quality p ($0.000 < 0.05$), with d (-0.181). The results show a weak negative relationship, which means that the longer the screen time, the worse the individual's sleep quality. Then, the variable of screen time with mental health p ($0.003 < 0.05$), with d (0.199) can be interpreted as the lower the duration of screen time, the better the level of mental health in individuals. There is a significant correlation between screen time and body mass index p ($0.032 < 0.05$), with d (0.161). It can be concluded that the lower the duration of screen time, the better the body mass index of an individual. However, no significant differences were found in other health indicators ($p > 0.05$). Among them, screen time duration with level of physical activity was found to be p ($0.357 > 0.05$). And the indicator of screen time duration with blood pressure was found to be p ($0.582 > 0.05$).

Discussion

Based on secondary data from the UK Biobank, a large-scale research database that includes health, lifestyle, genetic, and biomarker information from approximately 390,089 participants in the UK, it was reported that every additional 2 hours of screen time per day was associated with a 31% increase in the risk of death in individuals with low physical activity levels ($HR = 1.31$; $95\% CI = 1.22-1.43$) (Celis-Morales et al., 2018). These findings indicate that high screen time exposure, particularly in physically inactive individuals, contributes to an increased risk of long-term health problems. Conversely, different results were shown by a cross-sectional study conducted by (Wibowo et al., 2025) on 70 students aged 15-17 years at SMK Negeri 2 Salatiga, which found that screen time duration was not significantly associated with physical activity levels ($r = 0.082$; $p = 0.498$).

Consistent with these findings, the results of a cross-sectional study in this research also showed no significant correlation between screen time and physical activity ($p = 0.357 > 0.05$). The differences in findings between studies are thought to be influenced by differences in design characteristics and data sources, where the UK Biobank study used large-scale secondary data with a cohort design and long-term outcomes, while the Indonesian study used a cross-sectional design with a relatively small number of respondents and a teenage population. In addition, differences in age context, screen usage culture, and physical activity measurement methods also have the potential to influence the results obtained.

Thus, the results of cross-sectional studies need to be interpreted carefully and open up opportunities for longitudinal and larger sample-based studies to obtain a more comprehensive picture of the relationship between screen time and physical activity. A number of studies have shown a correlation between screen time and sleep quality in

adolescents. Cross-sectional study involving 547 adolescents with an average age of 16.66 years reported that more than half of the respondents (52%) experienced poor sleep quality based on the Pittsburgh Sleep Quality Index (PSQI) score, with an average score of 5.98 (SD = 2.70). These findings are consistent with high screen time exposure, with adolescents spending an average of 537.6 minutes (± 301.5) per day on school days and increasing to 725.5 minutes (± 339.2) per day on weekends.

Further analysis showed that screen time on weekends was significantly associated with PSQI scores ($p = 0.032$), indicating that the longer the duration of screen time on weekends, the lower the quality of sleep among adolescents (Naing et al., 2024). Similar results were also shown by secondary data analysis from the Millennium Cohort Study (MCS) involving 11,361 adolescents aged 13-15 years. This longitudinal study found that adolescents with heavy social media use (≥ 2 hours per day) were 1.38 times more likely to wake up in the middle of the night compared to light users (AOR = 1.38; 95% CI: 1.22-1.57). In addition, other types of screen time activities also showed a significant relationship, where internet use had an AOR of 1.17 (95% CI: 1.01-1.35) and gaming activities had an AOR of 1.24 (95% CI: 1.08-1.42) for night-time awakenings (Hisler et al., 2020).

These findings indicate that the impact of screen time on sleep quality, particularly night-time sleep disturbances, is influenced by the type of screen time activity undertaken. The consistency of these findings is also evident in the local context in Indonesia. A cross-sectional study of 151 students at SMAN 2 Palangka Raya showed a significant relationship between screen time duration and sleep quality ($p = 0.000 < 0.05$). The negative and weak correlation coefficient value ($d = -0.181$) indicates that an increase in screen time duration tends to be followed by a decrease in sleep quality among adolescents, although the strength of the relationship found is relatively low. Empirical evidence from various levels of analysis shows a consistent relationship between screen time duration and weight status in children and adolescents.

A summary of data from a systematic review meta-analysis reports that adolescents with the highest screen time exposure are 1.27 times more likely to be overweight or obese than those with the lowest screen time (OR = 1.27; 95% CI: 1.16-1.39) (Haghjoo et al., 2022). These findings confirm that excessive screen time exposure is a significant risk factor for weight gain in the adolescent population. In line with these findings, a secondary data analysis from the National Survey of Children's Health (NSCH) of 29,480 children and adolescents aged 10-17 years showed that individuals who spent ≥ 4 hours per day watching television or playing video games had a significantly higher risk of being overweight or obese (OR = 3.04; 95% CI: 2.10-4.40), particularly among those who did not meet daily physical activity recommendations. In addition, computer use for the same duration (≥ 4 hours per day) was also significantly associated with a 1.53-fold increase in the risk of overweight or obesity compared to lower screen time exposure (OR = 1.53; 95% CI: 1.19-1.97 (Bakour et al., 2022).

These results indicate a cumulative effect of screen time influenced by the type of sedentary activity and the individual's level of physical activity. The consistency of this relationship was also found in the local context. A cross-sectional analysis of students at SMAN 2 Palangka Raya showed a significant relationship between screen time duration and

body mass index (BMI) ($p = 0.032 < 0.05$), with a weak positive correlation coefficient ($d = 0.161$). Although the strength of the correlation was relatively low, the positive direction of the relationship indicates that an increase in screen time duration tends to be followed by an increase in BMI. Thus, it can be concluded that lower screen time duration is associated with better body mass index status in children and adolescents.

Empirical findings from a large-scale cross-sectional study in China involving 11,173 respondents aged 19-22 years showed an interaction between physical activity levels and screen time duration on psychological health. The analysis revealed that students with low levels of physical activity (moderate-to-vigorous physical activity/MVPA < 30 minutes per day) and high screen time exposure (> 2 hours per day) were 1.59 times more likely to experience psychological symptoms compared to the reference group with high physical activity (MVPA > 60 minutes per day) and low screen time (< 1 hour per day) (OR = 1.59; 95% CI: 1.10-2.31) (Deng et al., 2024).

These findings confirm that the combination of sedentary behaviour and low physical activity is an important determinant of vulnerability to mental health problems in young adults. The consistency of this relationship is also reflected in the findings of this cross-sectional study, which shows a significant correlation between screen time duration and mental health in adolescents ($p = 0.003 < 0.05$). Although the strength of the relationship found was relatively weak, the positive direction of the correlation ($d = 0.199$) indicates that an increase in screen time tends to be followed by a decline in mental health. Thus, these results reinforce the evidence that lower screen time is associated with better mental health in adolescent and young adult populations.

Evidence from secondary data in the form of a recent meta-analysis shows that in children and adolescents, exposure to the highest category of screen time is associated with a 15% increase in the risk of hypertension compared to the lowest category of screen time (OR = 1.15; 95% CI: 1.08-1.23; $p < 0.001$) (Farhangi et al., 2023). These findings are reinforced by an observational study of 101 adolescents using oscillometric blood pressure measurements, in which each additional hour of screen time per week was associated with a 1.18-fold increase in the odds of hypertension (OR = 1.18; 95% CI: 1.006-1.394; $p < 0.05$) (Stabouli et al., 2022). However, the results of the analysis in this study did not show a significant relationship between screen time duration and blood pressure ($p = 0.582$).

These differences in findings are likely influenced by variations in the standards and characteristics of the blood pressure measurement devices used, as well as limitations in the self-reported measurement of screen time exposure. Overall, the findings of this study indicate that screen time duration has a consistent association with several adolescent health indicators, sleep quality, body mass index status, and mental health, although no significant relationship was found with physical activity levels and blood pressure. These results indicate that the impact of screen time is multidimensional and influenced by the behavioural context that accompanies it, such as the type of screen activity, level of physical activity, and individual characteristics.

Thus, screen time should still be viewed as a relevant behavioural factor in adolescent health promotion efforts, especially in relation to sedentary behaviour and psychosocial health. School-based intervention studies need to be developed, such as healthy digital

literacy programs, screen time restrictions before bedtime, and education on sleep hygiene for students. On the other hand, collaboration between schools and parents is important in monitoring and guiding the use of digital devices so that it is more balanced with physical activity and adequate rest.

However, the interpretation of these research findings must be conducted cautiously, given several methodological limitations inherent in the cross-sectional design. Additionally, the use of self-report instruments in measuring screen time duration may introduce recall bias and exposure estimation errors, while the relatively small sample size and homogeneity of respondent characteristics may limit the generalisability of the results. Therefore, future research is recommended to use a longitudinal design with a larger sample size, objective measurement of screen time and physical activity, and more comprehensive control of confounding factors to gain a deeper understanding of the impact of screen time on health.

Conclusion

A cross-sectional study involving 151 students at SMAN 2 Palangka Raya showed that screen time duration was significantly associated with sleep quality, BMI and mental health. Subsequent research is recommended to use a longitudinal design to examine the causal relationship between high screen time duration and adolescent health indicators in greater depth. In addition, school-based intervention studies need to be developed, such as healthy digital literacy programs, screen time restrictions before bedtime, and education on sleep hygiene for students. On the other hand, collaboration between schools and parents is important in monitoring and guiding the use of digital devices so that it is more balanced with physical activity and adequate rest. The limitations of this study include the use of a cross-sectional design, which cannot explain causal relationships. In addition, data on screen time, sleep quality, and mental health were obtained through self-report questionnaires, which could potentially cause respondent perception bias. Furthermore, the limited sample size from only one school also limits the generalization of the research results.

Author's Statement

The author would like to thank all the research teams and respondents who participated in this study

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