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Correlation between screen time and physical activity to students' physical fitness

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Abstract: The development of electronic media may increase screen time (ST) duration, cause students to develop sedentary habits, and decrease their physical activity (PA). Lately, this has been thought to be the cause of the problem of low physical fitness (PF) among students. This study aimed to analyze the correlation between screen time, physical activity, and students' physical fitness. The design of this study was correlational, with a total of 88 subjects in grades 4 and 5 at Primary Laboratoy School (Labschool) Unesa 1. The sampling technique was simple random sampling. Nusantara students' physical fitness test (TKPN) was employed to assessed physical fitness, screen time-based sedentary behaviour questionnaire to assessed sedentary behaviour, and physical activity questionnaires for older children to assessed physical activity level. Data were collected in alignment with the physical education schedule for each class. Multinomial logistic regression was employed for data analysis. Findings revealed a significant simultaneous correlation among sedentary time (ST), physical activity (PA), and physical fitness (PF) ($p = 0.017$). However, partial analysis indicated no significant correlation between ST and PF ($p = 0.517$), while PA demonstrated a significant correlation with PF ($p = 0.013$). The results of the descriptive analysis showed that 73.9% of participants had very poor levels of physical fitness, and 43.18% of participants had low physical activity levels, with an average daily screen time duration of 3.03 hours. Participants accessed electronic media mostly to play games on smartphones, with an average of 2.28 hours. This study concluded that screen time was not directly affecting physical fitness but could reduce physical activity and student fitness. Despite screen time having no direct impact on physical fitness, this study recommends continuing to monitor screen time duration and increasing physical activity levels to mitigate potential risks associated with excessive screen use.

Keywords: screen time, physical activity, physical fitness, elementary school

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INTRODUCTION

The rapid development of electronic media has given rise to various problems, especially the high duration of screen time (ST) (B, 2023). All elements of society have experienced an increase in screen time, including elementary school students (Hedderson et al., 2023). The high screen time duration reduces students' physical activities (PA) (Almaqhawi & Albarqi, 2022). A high duration of screen time increases sedentary time, which may impact health if it is not balanced with physical activity (Park et al., 2020). For elementary school students, conducting regular physical activity can improve their fitness and learning achievement (Chabibi Arif et al., 2021). However, as students get older, their physical activity decreases (Farooq et al., 2020). If students do not maintain their physical activity, it may increase the risk of diabetes, obesity, and mental health problems (Hanifah et al., 2023).

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Stuart (2021) pointed out that physical activity has an important influence on children's overall health and well-being. Physical activity also has a positive correlation with increasing students' physical fitness (PF) (Gea-García et al., 2020). Meanwhile, students with good physical fitness tend to experience increased cognitive levels, self-control, and self-resilience (Sibbick et al., 2024). However, in current reality, many students have poor physical fitness, especially elementary school students (Lu et al., 2022). Based on observations with physical education teachers at the school, It was found that students' physical fitness levels were still relatively low, which may be caused by a preference for playing on smartphones rather than engaging in physical activities. This problem mainly occurs in grades 4, 5, and 6. We also found that instead of joining extracurricular activities, students tended to play games on their smartphones. Previous preliminary studies stated that most students exercise only once a week with an average duration of 15-30 minutes and engage in screen time of more than 3 hours daily. These results did not follow WHO's recommendations for ages 5 – 17 years with daily PA for 60 minutes daily, muscle strengthening exercise 3 days a week, and a maximum duration of screen time < 2 hours a day (WHO, 2020).

This research offers fresh perspectives on the effects of screen time on children's growth and development, addressing the inconsistencies found in previous studies (Gastaud et al., 2023). The investigation aims to clarify the relationship between screen time and physical fitness levels in children, an area that has not been extensively explored. While, many existing studies primarily focus on adolescents, this research specifically targets elementary school students, thereby filling a significant gap in the literature. Utilizing the Nusantara Students' Physical Fitness Test (TKPN) developed by the Indonesian Ministry of Youth and Sports allows for a robust assessment of students' physical fitness levels. The urgency of this research stems from the need to understand how screen time and physical activity relate to students' physical fitness levels. The findings will serve as a valuable resource for parents, educators, and caregivers, guiding them in promoting healthier lifestyles for children in today's digital landscape. The primary aim of this study is to analyze the correlation between screen time, physical activity, and students' physical fitness. By exploring these relationships, the research seeks to provide insights that can inform educational policies and parenting strategies aimed at enhancing children's overall well-being and physical health. Although no direct causality between screen time and physical fitness is established, the study highlights the importance of monitoring screen time duration and encouraging increased physical activity to mitigate potential risks associated with excessive screen use. This approach emphasizes the need for a balanced lifestyle that integrates digital engagement with regular exercise to support optimal physical fitness among young learners.

METHODS

Design

This research employed a correlational design to analyze the correlation between screen time, physical activity, and physical fitness with multivariate and partial type correlation. Multivariate correlation is considered a type of high-level correlation that provides in-depth analysis results on three or more variables (d'Hondt et al., 2024). After analyzing multivariate data, the study continues by partially analyzing the correlation to obtain more specific analysis results. The stages of this study are determining and formulating the problem, searching for theories and literature, determining research methods, collecting, and analyzing data, and ending with a description of the results and discussion.

Subject

The subjects in this research were students in classes 4 and 5 for the 2023/2024 academic year at Labschool Unesa 1 Primary School. The population was 112 students. The sampling technique was simple random sampling. The number of samples was determined using the Slovin Formula, involving 88 students. The age range of the research subjects was 9 – 11 years.

Instrument

Nusantara Students' Physical Fitness Test (TKPN) is a test developed by the Indonesian Ministry of Youth and Sports to measure students' physical fitness (Rusdiana, 2022), employed to assess students' physical fitness. The test items from TKPN consist of body mass index, V sit and reach, 60-second sit up, 30-second squat thrust, and Pacer Test. The result of each test item was calculated based on the weight, which is the pacer test at 85%, squat thrust at 5%, sit up at 5%, and v sit and reach 5%. After obtaining points for each test item, the final fitness results could be categorized as very good (>4), good (3 – 3.9), moderate (2 – 2.9), poor (1 – 1.9), and very poor (<1).

Moreover, a screen time–based sedentary behaviour questionnaire is an instrument for measuring the duration of screen time adopted from Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) with a reliability value (>0,7) (Rey-López et al., 2012). The items measured were time spent watching television, playing games on a computer/laptop, playing games on a smartphone, accessing the internet not for studying, accessing the internet for studying and studying outside of schoolwork. Subjects were given the option to follow several time categories such as: (i) 0 min, (ii) 0-30 minutes, (iii) 30 minutes – 1 hour, (iv) 1 – 2 hours, (v) 2 – 3 hours, (vi) 3 – 4 hours, (vii) > 4 hours. The instrument norm is [(working days x 5) + (holidays x 2)] / 7.

The Physical Activity Questionnaire for Older Children was employed to measure activity levels for children aged 8 – 14 years for seven days before the test was carried out (Kowalski, et, al. 2004). This instrument has a good reliability value with a Cronbach Alpha score between 0,682 – 0,745 (Dapan et al., 2017). The test items consist of 10 questions. Item number 1 asks the type of sport or activity carried out for one week. Items numbers 2 – 8 ask for activities carried out in free time, after school, in the afternoon, and during physical education lessons. Item number 9 asks about how active students every day are. Number 10 asks about your condition in the past week. Each test item has a score of 1 – 5. In the assessment for items 1 – 9, the average is calculated and categorized as very poor (1), poor (2), moderate (3), good (4), very good (5).

Data Collection

The data was collected data in five days. On average, the physical fitness tests were conducted in about 70 minutes. For the physical fitness test, the researcher divided the test items into several posts; post one for measuring body mass index and v sit and reach; post for assessing a 60-second sit-up test and a 30-second squat thrust test; and post three for the Pacer test. The participants were divided into three groups and conducted warming-up before the test. Data on screen time and physical activity were collected within 35 minutes. The data was collected in each classroom. The researcher distributes questionnaires to the research subjects, explaining each question item and opening a question-and-answer session.

Data Analysis

This research conducted descriptive analysis to find averages and percentages of data. Multinomial logistic regression has employed to find the correlation between ST, PA, and student physical fitness, both simultaneously and partially.

RESULT AND DISCUSSION

Table 1 shows that most students have a level of PF in the very poor category (73,9%). Students have a level of PA in the low category (43,18%). Students have an average daily screen time of 3,03 hours. The majority of screen time activity was for playing games on smartphones and accessing the internet, not studying. The duration of screen time activities peaked during holidays and weekends. Table 2 shows the simultaneous significant correlation between ST PA and PF ($p<0.05$). The simultaneous contribution of ST variables and PA to physical fitness level is 26,8%. Table 3 shows

that the screen time variable and physical fitness did not correlate significantly ($p>0.05$). Meanwhile, the variables PA and PF have a significant correlation ($p<0.05$).

Our findings showed that most students had very poor physical fitness. This finding aligned with a previous study by Sunarwan et al. (2022), which found that most elementary school students have a low level of physical fitness. In addition, Akhmad et al. (2024) found that the PF condition of elementary school students is predominantly very low. Valentino & Iskandar (2020) also found that most elementary school students had very low physical fitness. According to Teich et al. (2023), several years after the COVID-19 pandemic, students' PF decreased due to a lack of PA during quarantine. Other factors influencing physical fitness are diet and nutritional requirements, sleep duration, and prolonged duration of sedentary activities (Huang et al, 2023).

Increasing physical activity during physical education lessons can maintain students' physical fitness (Greier et al., 2020). Maintaining physical activity levels can provide broad benefits, either cognitive, physiological, or social (Chabibi Arif et al., 2021). In childhood, PF is an important indicator of health that can affect physical and psychological (Raghuveer et al., 2020). Physical fitness can be improved if students do physical activities accompanied by exercises such as strength or endurance (Chikih & Anggunadi, 2023).

Table 1. Characteristics of Participants

Physical Fitness	N		Percentage
Very poor	65		73,9
Poor	22		25
Moderate	1		1,1
Good	0		0
Very good	0		0
Screen Time	Mean		
	Weekdays	Weekend	Result ± SD
Watching television	1,04	2,16	2 ± 1,19
Playing games on a laptop/computer	0,59	2,14	1,37 ± 1,10
Playing games on a smartphone	1,28	2,48	2,28 ± 1,24
Access to the Internet not for study	1,17	2,19	2,08 ± 1,12
Access the Internet for study	0,55	1,29	1,32 ± 0,52
Studying outside of schoolwork	0,45	0,5	0,48 ± 0,04
Weekly duration			20,24 ± 6,38
Daily duration			3,03 ± 0,897
Physical Activity	N		Percentage
Very low	18		20,45
Low	38		43,18
Moderate	28		31,82
High	4		4,55
Very high	0		0

Table 2. Simultaneous Analysis

Variable	R Square Nagelkerke	Sig
Screen Time Physical activity Physical fitness	0,268	0,017

Table 3. Partial Analysis

Variable	Sig.
Screen Time Physical fitness	0,517
Physical activity Physical fitness	0,013

Maintaining physical activity is one way to protect students from various types of cardiovascular disease (Luo et al., 2024). However, based on the analysis, most students engage in low physical activity levels. In line with research by Riadi & Satria (2023), the PA level of elementary school students is currently in the very low category. These results aligned with research by Farooq et al. (2020), which states that from year to year, the level of PA in children and adolescents has decreased due to a lack of supervision and concrete examples for parents to maintain physical activity. Carballo-Fazanes et al. (2020) stated that there is influence from parents, relatives, and the environment in the family, which shapes children's habits of being active in carrying out physical activities or moving. Ohgino et al. (2022) pointed out that promotion is needed regarding the importance of PA in forming healthy habits in the environment. The environment around children is influenced by electronic media, which creates bad habits of low physical activity and high screen time (Konca, 2022). Jongenelis et al. (2024) stated that there is an opportunity to improve active lifestyles through parenting from parents and families. Heredia et al. (2024) asserted that parental support and the surrounding environment significantly influence physical activity and screen time. Therefore, parents and families should understand the importance of an active lifestyle.

Supervision and modelling from parents regarding screen time are essential so that children do not exceed the recommended limits (Ozturk & Yalçin, 2021). Based on the analysis, most students have an average daily screen time duration of 3,01 hours. This result is in the high category and exceeds the recommended limit of < 2 hours per day (Chaput et al., 2020). According to Qi et al. (2023), excessive screen time is a common habit among students today. The high duration of screen time in students was not for studying but for playing games and accessing social media. High screen time activities can hinder sensorimotor development, academic results, and social-emotional competence (Muppalla et al., 2023). The high duration of students' screen time, on average, peaked during holidays or at home. The increase in the duration of screen time among students when at home and on holidays causes parents to worry (Nwankwo et al., 2019). The importance of limiting the duration of screen time and monitoring electronic media content is the responsibility of parents, teachers, and the environment around students so that they do not experience a negative impact (Hartshorne et al., 2021). It is important to set limits and educate the public about screen time duration so that health and wellness promotion continues to increase (Tadpatrikar et al., 2024).

Based on simultaneous analysis, ST, and PA are related to students' physical fitness. Research by Greier et al. (2019) showed a significant correlation between ST, PA, and students' physical fitness. According to Chen et al. (2022), students who engage in PA and ST have good physical fitness. Increasing ST duration is associated with decreased health quality (Fan, et al., 2022). This statement is based on research by Reis et al. (2024) regulating the duration of ST and PA increases in physical fitness indicators. Limiting ST and PA is associated with improved health (Martin et al., 2022). Lifestyle improvements occur if students manage these two variables (Pavan et al., 2023). Schools need to conduct interventions to reduce the risk of cardiovascular disease through programs that can increase physical fitness (Yáñez-Sepúlveda et al., 2024). Measurable and structured physical education programs enable teachers to maintain and improve students' physical fitness (Guijarro-Romero et al., 2022).

A partial screen time and physical fitness analysis showed no significant correlation. This is aligned with the research by Sivanesan et al. (2020) which stated that no correlation exists between screen time and cardiometabolic risk. Stiglic & Viner (2019) found weak evidence regarding the correlation between screen time and physical fitness. The high duration of screen time does not affect

students' physical fitness levels (Dong et al., 2021). Several cardiovascular diseases have been shown to have no significant correlation with screen time (Qiu et al., 2024). Even though screen time does not have a direct effect on physical fitness, replacing screen time with physical activity can improve health and fitness (Reis et al., 2024). Movement behaviour patterns to replace screen time as a promotion of physical activity may be associated with improved cardiometabolic health indicators (Burns, 2024).

Meanwhile, the partial analysis showed a significant correlation between PA and PF. This finding is in line with a previous study by Zymbal et al. (2022), which found a correlation between PA and PF through muscle strength. This statement was also supported by Maarif (2023), that there is a significant correlation between PA and PF. Alam et al. (2023) stated the significance of the result correlation between PA and PF. A high level of activity improves physical fitness (Azmi et al., 2021). Guijarro-Romero et al. (2022) pointed out that students who had suitable activities and were supported by the physical education program at school, which focused on increasing physical activity, also increased their physical fitness levels. Physical activity is one of the important components that can keep children fit and healthy (Supriyanto et al., 2021). Physical activity is one way to maintain a body mass index in the normal category so physical fitness can be influenced by levels of physical activity (Bai et al., 2024). Physical activity plays an important role in preventing health problems in children, both physically and mentally (Felin Fochesatto et al., 2023).

CONCLUSION

This study found a simultaneous significant correlation between screen time, physical activity, and students' physical fitness. Partial screen time analysis showed no correlation between screen time and students' physical fitness. Meanwhile, there was a significant correlation between physical activity and students' physical fitness. Further research is needed on the current habit variables of elementary school students. Through the results of this study, students are expected to be aware of the importance of their physical fitness and the variables that influence it. This study may increase awareness about limiting screen time duration and promoting an active lifestyle in the current era.

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