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ORIGINAL ARTICLE

Impacts of Screen Time on Motor Ability and Mental Health of Children: A Case of Indonesia

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ABSTRACT

Background. Gadgets have become a common phenomenon for children in all countries. Excessive use of gadgets hurts children's development, both physically and mentally. **Objectives.** This study aims to reveal the pattern of gadget use in children and its impact on their motor skills and mental health. **Methods.** The participants were 355 children aged 12-15 years in Surabaya, consisting of 47.6% males and 52.4% females. A questionnaire was used to reveal the pattern of screen time and children's mental health by MHQol. Meanwhile, the Barrow Motor Ability test measured children's motor skills. Regression analysis was used to test the impact of one variable on another variable, and ANOVA was used to test differences between data groups. **Results.** The study's results proved that students' average screen time duration was 5.9 hours/day. Females' screen time access was higher than that of males. Gadget use was correlated with children's motor abilities, a beta coefficient of -0.116 and an F value of 4.839 ($p<0.05$). The frequency and duration of screen time also significantly affect children's mental health, with beta coefficients of -0.118 and -0.167, respectively, and an F value of 8.226 ($p<0.05$). **Conclusion.** The higher the duration of gadget use, the lower their motor skills. The higher the frequency and duration of using gadgets, the worse the child's mental health. Males' mental health is better than that of females.

INTRODUCTION

The screen time phenomenon, such as using smartphones and tablets, has become a lifestyle for most children in Indonesia. Data released by BPS in 2021 shows that most children aged 5 years and over have accessed the internet for social media, with the percentage reaching 88.99% (1). In addition to social media, 66.13% accessed it to get news, and 63.08% to access entertainment. According to the data, 98.70% of children accessed the internet using smartphones, and the rest used laptops and desktop computers. Related to the use of gadgets, there is a crucial thing that needs to be considered, namely, the amount of time spent staring at the screen, often called screen time.

This problem is not unique to Indonesia; it also occurs in almost all countries, considering the internet is a global phenomenon. For example, in Hong Kong, China, more than 92% of households use internet services (2). The study also found that 92% of students have smartphones for online communication and interaction in social activities. Children aged 10-14 years spend 20-50 hours per week or 2.8-7.1 hours daily using the

internet. This condition continues to increase, from 25.4% in 2007 to 42.0% in 2017. The research also reported that around 80% of students use the internet to play online games.

The internet is necessary for conveying information, including learning for children (3). Children can learn inside and outside the classroom through information, media, and online technology platforms. However, it is important to remember that the increasing accessibility of screen media means that children are exposed to screens from an early age (4). Parents give their children screen time for various purposes. One of these purposes is to regulate the child's behavior, such as when a child is angry, cranky, or exhibiting other maladaptive behavior. These habits eventually carry over into adolescence. As a result, gadgets are excessively used, which then impacts their development and behavior.

Research shows that excessive gadget use hurts players' and viewers' cognitive, mental, and social development (5-7), such as antisocial, neurotic, impulsive, and uninterested in other activities. Maladaptive behavior, often referred to as "gaming disorder," has been included in the list of mental disorders issued by the American Psychiatric Association in 2013 and the WHO in 2020. In addition, excessive screen time habits are contrary to the spirit of sports, especially in the context of a healthy lifestyle promoting physical activity and fitness to maintain quality of life (8-10). According to international recommendations, in many countries, screen time is limited to a maximum of 2 hours to avoid sedentary behavior and reduce the threat of non-communicable diseases (10-12).

The world of children is essentially a world for playing. Self-expression and social interaction occur through physical expression and play (13-16). Thus, the basic needs of children are to move and play. They are indeed in a period of growth and development characterized by the stage of physical exploration and the formation of various basic movements needed to meet the physical and movement needs in the next development phase. Development during childhood is a crucial phase and plays a major role as an investment in their future. The need for movement through play has a comprehensive value for forming children's identity in the future. This means that insufficient movement and play experience in children will have an unfavorable effect on the child's future. The development of physical, mental, and social capacities will move in inadequate conditions.

In the logic of development, ages 12-15 have passed the basic movement stage and entered the specialization stage (16). In this phase, there is a significant change in height. In males, it starts at age 11, peaks at age 13, and ends at age 18. In females, it starts at age 9, peaks at 11, and ends at age 16. They are ready to perform technical and tactical skills in certain sports, including in competition (17, 18). Based on Piaget's theory of cognitive development, people over the age of 11 enter the formal operational stage, which is characterized by the ability to think more logically and abstractly in ideal ways (19-21). They are also able to think deductively through the formulation of abstract hypotheses. The ability to think abstractly and scientifically has developed, although there is often immature consideration in attitudes and behavior.

In many cases, cognitive functions at that age cannot control emotional impulses that manifest in instinctive desires (20, 22, 23). As a result, many behaviors are maladaptive and even risky for one's development (24). In the context of using internet technology, including gadgets, the negative impacts resulting from excessive use are difficult to avoid.

From a gender perspective, women spend more time in front of their mobile phones daily than men (25), such as texting, emailing, and using social media sites, which are the most time-consuming activities. Some smartphone users exhibit problematic behaviors similar to substance use disorders. Smartphone addiction includes a variety of impulse control problems. This type of behavioral disorder has been medically accepted as a form of addiction. Smartphone addiction is often caused by excessive internet use. The leading cause is not the phone's function, but the games, applications, and online world it offers.

Based on motor development theory, 12-15-year-olds have entered the specialization stage, where mastery and motor skills begin to form (15, 16). In addition, there is an interaction between mental conditions and motor skills in influencing individual development (20, 21). This study aims to reveal the screen time pattern in children aged 12-15 years and its impact on their motor development and mental health. The results of this study are expected to provide a scientific

explanation of the impact of screen time on children's motor development and mental health.

MATERIALS AND METHODS

Study Design. This study uses a cross-sectional study method, observational research that analyzes data from a population at one point in time, including group differences, to confirm the influence of maturation (26, 27). This study was ex post facto because changes in the measured variables had occurred previously without intervention or manipulation.

Participants. The respondents of this study were children aged 12-15 years (M = 13.86; SD = 0.80), totaling 355 people in Surabaya. They are in urban areas with middle to upper economic status. The sample was taken by proportionally random sampling considering gender, 47.6% male and 52.4% female. With these criteria, the participants in this study were representative of the population.

Procedure and Instruments. Data collection was conducted using test and questionnaire methods to reveal the studied variables. A questionnaire was used to reveal screen time patterns, designed in such a way as to obtain data on screen time duration, time patterns, and forms of activities (4, 28). To measure children's motor skills, the Barrow Motor Ability Test is used, which consists of the standing broad jump, zig-zag running, and medicine ball putting (29). The instrument has a validity of 0.63-0.94 and a test-retest reliability of 0.92. Mental health variables were measured using the Mental Health Quality of Life Questionnaire – MHQoL (30). The questionnaire revealed several dimensions of mental health, such as self-image, independence, mood, relationships with others, and hopes for the future. The instrument has a validity of 0.489-0.717 and a Cronbach's Alpha reliability of 0.85. Thus, both instruments have adequate validity and reliability and have met the criteria.

To carry out the data collection process, a team was formed consisting of researchers assisted by final-year students who had taken research methodology courses. They were given brief training related to the research objectives, research targets, instruments used, and how to collect data. After ensuring that they understood and were skilled in using the instruments, the data collection process in the field was scheduled. The randomly selected sample students were gathered in an adequate place. In the first stage, they were given a brief explanation of the research objectives and what they had to do. In the second stage, the data collection team guided them to fill out a screen time and mental health questionnaire for about 20 minutes. In the third stage, they took a motor ability test: a standing broad jump, medicine ball put, and zig-zag run. The three test items were carried out simultaneously according to established procedures. All sample data was carefully recorded and validated to ensure its truth and accuracy.

Data Analysis. The validated data is then subjected to statistical analysis. Regression analysis is used to test the impact of one variable on another variable, and ANOVA is used to test the differences between data groups (31, 32). Multiple linear regression is a statistical technique that uses multiple independent variables to predict the outcome of a dependent variable. The purpose of multiple linear regression is to model the linear relationship between the independent variables and the dependent variable. Meanwhile, ANOVA is a statistical formula that compares variances between different group means.

RESULTS

Screen Time. Based on the duration of screen time, children use time in various ways, from only 1 hour to 20 hours per day. On average, they spend 5.9 hours per day. If this number is multiplied by 7 days a week, they use time to access gadgets for 41.3 hours/week. Viewed from a gender perspective (Table 1), girls' access is higher (M = 6.3 ± 2.9) compared to boys (M = 5.4 ± 3.2).

The variance analysis shows a significant difference in the duration of gadget use between boys and girls, with an F value of 7.261 at a significance of <0.01 (Table 2). Girls spend more time accessing gadgets than boys. Access to gadgets is mostly (70.7%) done at night, the rest in the evening (21.1%), during the afternoon (7.3%), and in the morning, 0.8% (Figure 1). There is a strong indication that night is the most comfortable time for gadgets.

What kind of activities do children do related to using the gadget? Empirical data shows that as many as 91.5% of gadgets are used for social media and playing games, and only 8.5% use them for learning and working purposes (Figure 2). The use of gadgets in children has also been proven to affect their play. Empirical facts show that only 13.2% of them play purely in the

physical field area, as many as 22.5% of them play purely using the screen, and as many as 64.2% play using a combination of physical field and screen media.

Table 1. Means and standard deviations of screen time access for male and female.

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Male	169	5.4438	3.16201	0.24323	1.00	20.00
Female	186	6.3172	2.94479	0.21592	2.00	17.00
Total	355	5.9014	3.07696	0.16331	1.00	20.00

Table 2. Analysis of Variance in Screen Time between Male and Female.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	67.548	1	67.548	7.261	0.007
Within Groups	3284.001	353	9.303		
Total	3351.549	354			

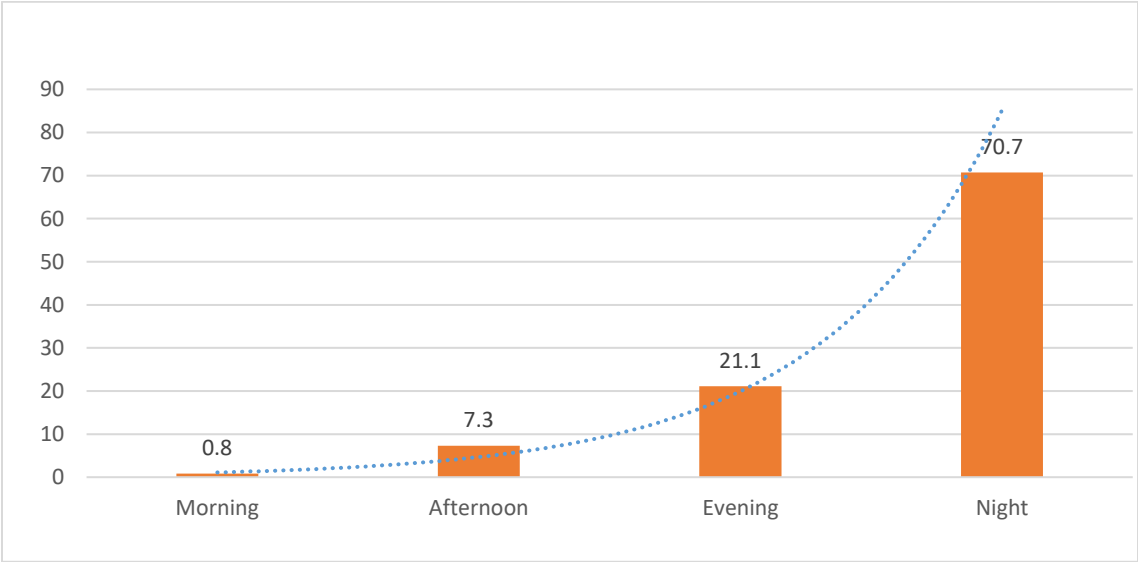

Figure 1. Respondents' use of gadgets based on time allocation (%).

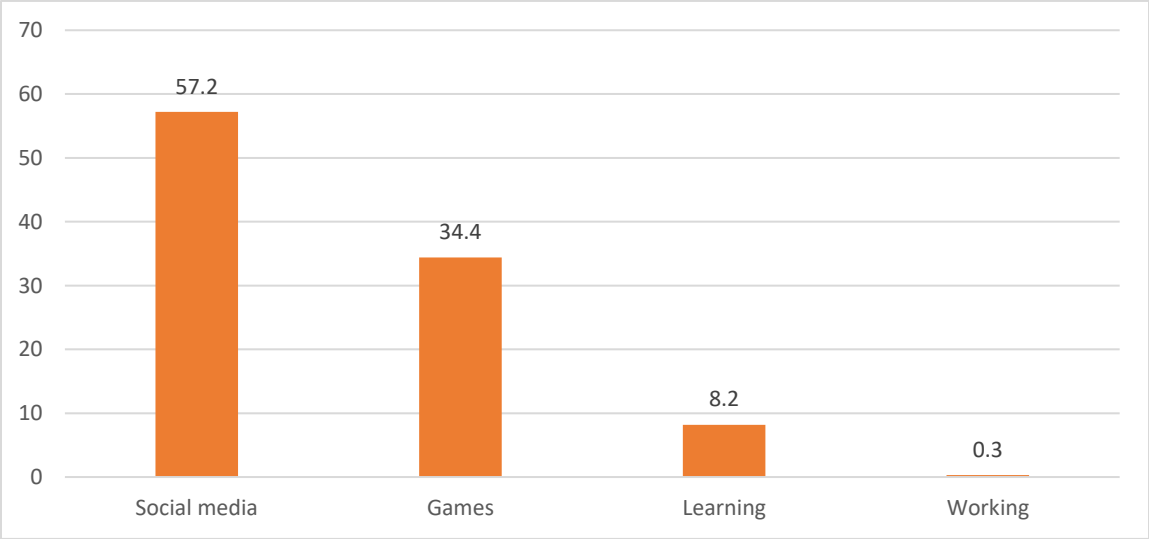

Figure 2. Respondents' use of gadgets based on their purpose (%).

Impacts of Gadgets on Children's Motor Ability. Further analysis was conducted to test the effect of gadgets on students' motor ability. The regression analysis results showed that gadget use hurt children's motor ability with a beta coefficient of -0.116 and an F value of 4.839 at a significance of <0.05 (Table 3). This means that the higher the duration of gadget use, the lower their motor ability.

It should be noted that children's motor abilities are a composite score that includes lower limb strength (standing broad jump), agility (zig-zag run), and upper limb strength (medicine ball put). When a deeper analysis is conducted by conducting a correlation test, screen time significantly correlates with lower limb strength, with a correlation coefficient of -0.144 at a significance of <0.01 (Table 4). However, screen time does not correlate directly with agility and upper limb strength. This fact is understandable and rational because when an individual's activities are mostly sitting or passive, the part of the body most affected is the lower extremities, in this case, leg strength.

Table 3. Impacts of screen time on children's motor ability.

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	2.810	0.083		33.793	0.000
Duration_sc	-0.027	0.012	-0.116	-2.200	0.028

Table 4. Correlations between screen time and motor ability components.

	1	2	3	4
1. Duration of screen time	1	-0.144**	0.102	-0.092
		0.006	0.054	0.084
2. Standing broad jump		1	-0.721**	0.664**
			0.000	0.000
3. Zig-zag run			1	-0.625**
				0.000
4. Medicine ball put				1

**: Correlation is significant at the 0.01 level (2-tailed); *: Correlation is significant at the 0.05 level (2-tailed).

However, it is also important to remember that lower limb strength is related to other motor abilities.

This is evidenced by the results of the correlation analysis between standing broad jump scores and zig-zag run scores (r=-0.721; p<0.01) and medicine ball put (r=0.664; p<0.01). The stronger the lower limb, the better a person's agility, and the stronger the upper limb. The opposite also occurs.

Impacts of Gadgets on Children's Mental Health. The subsequent analysis related to gadgets' influence on mental health was conducted. Based on descriptive analysis (Table 5), data were obtained that of the eight aspects of children's mental health, the aspect of hope for the future had the highest average (M = 4.52 ± 0.77), and the aspect of mood had the lowest average (M = 2.84 ± 1.09). Based on the descriptive data, a regression analysis was then carried out.

Table 5. Descriptive analysis of screen time, frequency, and mental health aspects.

Variables	Minimum	Maximum	Mean	Std. Deviation
Duration of screen time	1.00	20.00	5.9014	3.07696
Frequency	1.00	5.00	3.6563	1.31277
Mental Health				
Self-image	1.00	5.00	3.7099	0.96714
Independent	1.00	5.00	3.5493	1.07342
Mood	1.00	5.00	2.8394	1.09163
Relationship	1.00	5.00	4.3127	0.88025
Daily activity	1.00	5.00	3.8620	0.90547
Physical health	1.00	5.00	3.9437	0.99557
Future	1.00	5.00	4.5183	0.76769
Well-being	1.00	5.00	4.1014	1.00331

The regression analysis results show that the frequency and duration of screen time significantly affect children's mental health, with beta coefficients of -0.118 and -0.167, respectively, and an F value of 8.226 at a significance of <0.05 (Table 6). The higher the frequency and duration of using gadgets, the worse the child's mental health condition. If explored further, which mental aspects are most affected? The results of the correlation analysis show that four aspects of mental health are significantly related, namely social relations (r=-0.220), physical health (r=-0.209), daily activities (r=-0.171), and well-being or psychological well-being (r=-0.109).

Table 6. Impacts of duration and frequency of screen time on mental health.

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	4.200	0.095		44.254	0.000
Duration_sc	-0.029	0.009	-0.167	-3.192	0.002
Frequency	-0.048	0.021	-0.118	-2.266	0.024

It must be admitted that social relationships are the most impactful dimension when children spend much time using gadgets. Children become more engrossed in their gadgets than in interacting with other friends. When the child's social relationship dimension is problematic, it will be related to other aspects of mental health. The results of the correlation analysis (Table 7) prove that social relations are significantly correlated with daily activities (r=0.249), physical health (r=0.378), future hopes (r=0.303), and well-being (r=0.482). The data also proves that social relations are very closely related to well-being.

Table 7. Correlations between screen time and mental health aspects.

	1	2	3	4	5	6	7	8	9
1. Duration of ST	1	-0.011	0.028	-0.061	-0.220**	-0.171**	-0.209**	-0.042	-0.109*
2. Self-image		1	0.241**	0.023	0.303**	0.228**	0.364**	0.336**	0.371**
3. Independent			1	0.085	0.156**	0.258**	0.103	0.113*	0.124*
4. Mood				1	0.017	-0.085	0.005	-0.052	0.152**
5. Relationship					1	0.249**	0.378**	0.303**	0.482**
6. Daily activity						1	0.258**	0.180**	0.183**
7. Physical health							1	0.338**	0.526**
8. Future								1	0.361**
9. Well-being									1

**: Correlation is significant at the 0.01 level (2-tailed); *: Correlation is significant at the 0.05 level (2-tailed).

The Differences in Children's Mental Health Based on Gender. This study also attempted to examine the differences in mental health based on gender between boys and girls. Based on descriptive data analysis, the average for boys was higher in the dimensions of self-image, mood, social relations, daily activities, physical health, and well-being. Meanwhile, the strong average for girls was in the dimensions of independence and hope for the future (Table 8).

The data was then tested using ANOVA. The test results show significant differences in mental health between male and female students. The differences occur in the mood dimension with an F value of 8.209 at a significance of <0.01, in the social relations dimension with an F value of 6.006 at a significance of <0.05, in the physical health dimension with an F value of 3.941 at a significance of <0.05, and in the well-being dimension with an F value of 14.141 at a significance of <0.01 (Table 9).

DISCUSSION

This study has attempted to uncover screen time patterns in children aged 12-15 years and their

impact on motor skills and mental health, including from a gender perspective. This study found empirical facts that their average screen time duration was 5.9 hours/day. This condition exceeds international recommendations on screen time use, <2 hours/day (10-12). Of course, there are concerns regarding excessive time spent on gadgets because of the negative impacts on their physical and mental development (4, 33-35).

Table 8. Means and standard deviations of mental health based on gender.

		Mean	Std. Deviation
Self-image	male	3.8107	0.98180
	female	3.6183	0.94697
	Total	3.7099	0.96714
Independent	male	3.5325	1.08581
	female	3.5645	1.06473
	Total	3.5493	1.07342
Mood	male	3.0118	1.01177
	female	2.6828	1.13967
	Total	2.8394	1.09163
Relationship	male	4.4320	0.81455
	female	4.2043	0.92484
	Total	4.3127	0.88025
Daily activity	male	3.8817	0.91167
	female	3.8441	0.90189
	Total	3.8620	0.90547
Physical health	male	4.0533	0.97138
	female	3.8441	1.00936
	Total	3.9437	0.99557
Future	male	4.4675	0.81676
	female	4.5645	0.71933
	Total	4.5183	0.76769
Well-being	male	4.3077	0.85217
	female	3.9140	1.09204
	Total	4.1014	1.00331

The research also found that females' screen time access was 0.9 hours more than that of males. This finding is in line with previous research, which stated that from a gender perspective, females spend more time in front of their phones every day compared to males (25). This also has a correlation with the level of physical activity that is done. Males tend to be busy with physical activities such as sports. Because of that, the level of participation in sports for males is higher than for females (36, 37).

In terms of time, this study found that access to gadgets was 70.7% done at night when children were in the family environment or outside school hours. This means that parents' role is important inaring for, educating, and supervising children's behavior in using gadgets (2, 28, 38). The absence of education and weak control from parents increases the risk of deviation in the use of gadgets in children. This is because children aged 12-15 are still in the process of finding their identity, and their rational considerations are often immature (10, 20, 39). In this regard, self-regulation becomes a very crucial factor. With good self-regulation, children can respond to environmental stimuli in various socially tolerable ways, be flexible in providing spontaneous reactions, and delay spontaneous reactions according to needs (40, 41). Children's ability to regulate themselves, including in using gadgets, is the basis for healthy psychosocial adjustment and is protective in the context of stress (38, 42).

From a functional perspective, the study found that 91.5% of gadgets were used for social media and playing games, while only 8.5% were used for learning and working purposes. This finding confirms BPS data from 2021, which states that most children aged 5 years and over have accessed the internet for social media, with the percentage reaching 88.99% (1). Research conducted in China also confirmed that 92% of students have smartphones for online communication and interaction in social activities, and around 80% of students use the internet to play online games (2).

Table 9. The differences in mental health between male and female.

		Sum of Squares	df	Mean Square	F	Sig.
Self-image	Between Groups	3.277	1	3.277	3.528	0.061
	Within Groups	327.839	353	0.929		
	Total	331.115	354			
Independent	Between Groups	0.091	1	0.091	0.078	0.780
	Within Groups	407.797	353	1.155		
	Total	407.887	354			
Mood	Between Groups	9.587	1	9.587	8.209	0.004
	Within Groups	412.261	353	1.168		
	Total	421.848	354			
Relationship	Between Groups	4.589	1	4.589	6.006	0.015
	Within Groups	269.704	353	0.764		
	Total	274.293	354			
Daily activity	Between Groups	0.125	1	0.125	0.152	0.697
	Within Groups	290.112	353	0.822		
	Total	290.237	354			
Physical health	Between Groups	3.874	1	3.874	3.941	0.048
	Within Groups	346.999	353	0.983		
	Total	350.873	354			
Future	Between Groups	0.834	1	0.834	1.417	0.235
	Within Groups	207.797	353	0.589		
	Total	208.631	354			
Well-being	Between Groups	13.726	1	13.726	14.141	0.000
	Within Groups	342.624	353	0.971		
	Total	356.349	354			

Based on empirical testing through regression analysis, this study found that using gadgets has been proven to hurt children's motor skills. The higher the duration of gadget use, the lower the child's motor abilities. This study's findings align with several previous studies, which state that sedentary behavior characterized by activities that involve a lot of sitting, such as the screen time phenomenon, harms children's physical condition and motor abilities (4, 15, 28, 34). Children's bodies tend to be obese, muscle strength does not grow optimally, and physical fitness is relatively low. This study found that the child's most affected limbs were the lower extremities, in this case, leg strength. Further analysis also found that lower limb strength correlated with agility and upper limb strength.

This study also found that the frequency and duration of screen time significantly affect students' mental health. The higher the frequency and duration of using gadgets, the worse the mental health condition of children. The findings of this study strengthen previous studies, which state that excessive use of gadgets hurts their motor, emotional, and social development (4, 33-35). Children have difficulty sleeping, and emotional instability, are easily angered, and even isolate themselves and do not want to socialize. The study also found that four aspects of mental health are significantly affected: social relations, physical health, daily activities, and well-being.

From a gender perspective, there is a significant difference in mental health between males and females. Males' mental health is better than that of females. Several previous studies have shown that gender factors correlate with the prevalence of certain mental disorders, including depression, anxiety, and somatic complaints (43-45). Females are more prone to anxiety and depression than males. Meanwhile, males are more prone to problems related to alcohol, drug abuse, and antisocial behavior. The study also

found that differences in mental health between males and females occurred in the dimensions of mood, social relationships, physical health, and well-being. It is strongly suspected that these differences are caused by females' more extended use of gadgets, as found in this study. In addition, females' physical activity is also lower than that of males (36, 37). The combination of these variables may explain why females' mental health is worse than that of males. Appropriate mitigation is needed to overcome these differences as a result of common stereotypes in terms of gender, race, and socio-economic status (39, 46, 47).

CONCLUSION

Children's screen time averages 5.9 hours/day, exceeding international recommendations for screen time use of <2 hours/day. Girls have more screen time than boys. From a functional perspective, 91.5% of gadgets are used for social media and playing games, and only 8.5% use them for learning and working purposes. Gadget use was correlated with children's motor abilities. The longer the duration of gadget use, the lower their motor abilities. The most affected body part is the lower extremities, in this case, leg strength. The frequency and duration of screen time significantly affect children's mental health. The higher the frequency and duration of using gadgets, the worse their mental health condition. There are significant differences in mental health between males and females. Males' mental health is better than that of females. Differences occur in mood, social relations, physical health, and well-being.

APPLICABLE REMARKS

- Gadget use has been shown to hurt children's motor abilities. The longer the duration of gadget use, the lower their motor abilities.
- The frequency and duration of screen time significantly affect children's mental health. The higher the frequency and duration of using gadgets, the worse their mental health condition.
- There are significant differences in mental health between males and females. Males' mental health is better than that of females.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Ali Maksum, Nanik Indahwati. Acquisition of data: Nanik Indahwati, Sasmita Christine, Bayu Prakoso, Afifan Yulfadinata, Fatur Rohman. Analysis and interpretation of data: Nanik Indahwati, Ali Maksum. Drafting the manuscript: Nanik Indahwati, Ali Maksum. Critical revision of the manuscript for important intellectual content: Ali Maksum. Statistical analysis: Nanik Indahwati, Ali Maksum. Administrative, technical, and material support: Nanik Indahwati, Sasmita Christine, Bayu Prakoso. Study supervision: Nanik Indahwati.

CONFLICT OF INTEREST

This study contains no material that the authors could consider a conflict of interest.

FINANCIAL DISCLOSURE

There are no financial conflicts of interest to disclose.

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ETHICAL CONSIDERATION

The study obtained ethical approval from the Research Ethics Committee of Universitas Negeri Surabaya, decision number 2024/04. This study was conducted in accordance with the principles of the Helsinki Declaration. Before measurements, participants were given a detailed presentation about the study procedure and informed consent forms.

ROLE OF THE SPONSOR

This research received no external funding from the sponsor.

ARTIFICIAL INTELLIGENCE (AI) USE

AI tools did not create this document. The content has been created, reviewed, and edited by a human.

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