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Relationship between gadget usage duration and sleep pattern in children aged 3-5 years in Pucang Sewu Village Surabaya

Nabil Fauzi Barmen [1,*], Pudji Lestari [2], Yunias Setiawati [3] and Ivan Rahmatullah [2]

[1] *Medical Program, Faculty of Medicine, Universitas Airlanaga, Surabaya, Indonesia.*
[2] *Department of Public Health and Preventive Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.*
[3] *Department of Psychiatry, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.*

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Abstract

Background: Sleep plays a vital role in supporting optimal functioning during childhood, including health, development, cognition, and behavior. Increased screen time duration has been associated with sleep disturbances in early childhood. The prevalence of sleep pattern disturbances among children aged 3–5 years is relatively high, ranging from 20% to 45% in Western countries and even higher in several Asian populations. Data from Statistics Indonesia indicate that 35.57% of young children in Indonesia access the internet, and 39.71% use mobile phones.

Objective: To analyze the relationship between gadget usage duration and sleep pattern in children aged 3–5 years in Pucang Sewu Village, Surabaya.

Methods: This study was conducted with an observational analytical design with a cross-sectional approach. The sample in this study were children aged 3-5 years, the sampling technique was consecutive sampling with a sample size of 63 children. The research instrument was a questionnaire on the gadget usage duration and the sleep disturbance scale for children (SDSC) given to parents of the sample. Data analysis used the Chi-Square test using SPSS (Statistical Package for the Social Sciences) for windows.

Results: The Chi-Square test shows a p value of 0.032 (<0,05), which means there is a relationship between gadget usage duration and sleep pattern in children aged 3-5 years.

Conclusion: Limiting the gadget usage duration to no more than 1 hour needs to be done to reduce the risk of sleep disorders.

Keywords: Gadget Usage Duration; Sleep Pattern; Toddler; Early Childhood Development

1. Introduction

The first five years of a child's life represent a critical period for growth and development, contributing significantly to future learning abilities, as well as social and emotional skills [1]. The age range of 3 to 5 years is characterized by a child's efforts to develop independence and socialization. By the age of three, children begin to acquire fundamental skills that form the basis for knowledge building and cognitive development [2].

In recent years, gadget use has extended beyond adults to include early childhood-aged children. According to the March 2024 National Socio-Economic Survey by Statistics Indonesia, 35.57% of children in early childhood accessed the internet, and 39.71% used mobile phones in Indonesia [3].

* Corresponding author: Nabil Fauzi Barmen

Prolonged screen time has been linked to sleep disturbances in early childhood [4]. Several mechanisms have been identified by which gadgets may contribute to such disturbances [5], including the displacement of sleep time [6], adverse effects on emotional and mental well-being [7], and the suppression of melatonin secretion caused by exposure to blue light emitted from gadget screens [8].

Sleep plays a vital role in supporting optimal functioning during childhood, including health, development, cognition, and behavior [5]. Disruptions in sleep quality or duration may lead to emotional or behavioral problems, such as anxiety, depression, and attention-deficit/hyperactivity disorder [5]. Impaired sleep can also negatively affect both mental and physical functioning [5].

The prevalence of sleep disturbances among children aged 3 to 5 years is relatively high, ranging from 20% to 45% in Western countries, and even higher in several Asian countries [9]. Studies conducted in Indonesia have also reported a high prevalence of sleep disorders in this age group, with 58.5% of children aged 4 to 5 years in Padang City [10] and 79.8% of children aged 3 to 6 years in Semarang City experiencing sleep disturbances [11].

To reduce the risk of negative outcomes such as disrupted sleep pattern in early childhood, limiting gadget usage duration to a maximum of one hour per day—as recommended by the WHO [12]—is essential.

Pucang Sewu Village, located in the heart of Surabaya City, was chosen for its blend of central urban and long-established residential communities, providing a more diverse urban population compared to newer suburban areas. Through this study, it is expected that valuable information can be obtained regarding the relationship between gadget usage duration and sleep pattern in children aged 3 to 5 years in the region.

2. Material and methods

2.1. Study Design

This study used an analytical observational design with a cross-sectional approach to assess the relationship between gadget usage duration and sleep pattern in children aged 3 to 5 years in Pucang Sewu Village, Surabaya.

2.2. Data Source and Patient Selection

Primary data were collected using questionnaires administered to the parents of respondents in Pucang Sewu Village, Surabaya, Indonesia, between July 2023 and April 2025.

The study population consisted of children aged 3 to 5 years in Pucang Sewu Village, Surabaya. A consecutive sampling technique was used to recruit participants. A total of 63 respondents were included in the study.

2.3. Sample Size Calculation

The minimum sample size was calculated using Slovin's formula:

$$n = \frac{N}{1 + Ne^2}$$

n = sample size

N = population size

e = standard error (10%)

$$n = \frac{168}{1 + 168\ (0.1)^2}$$

n = 63

Thus, the total sample in this study consisted of 63 children aged 3 to 5 years.

2.4. Inclusion and Exclusion Criteria

The following criteria were used to determine the eligibility of patient records for inclusion in this study:

2.4.1. Inclusion Criteria

- Children aged 3 to 5 years
- Having been cared for by their parents for at least 6 months
- Willingness to participate in the study

2.4.2. Exclusion Criteria

- Parents who did not live with their child

2.5. Data Collection

The research instrument was a questionnaire on the gadget usage duration and the sleep disturbance scale for children (SDSC) given to parents of the sample. The study examined the following variables:

2.5.1. Independent Variable

- Gadget usage duration

***2.5.2.** Dependent Variable*

- Sleep Pattern

2.6. Data Analysis and Presentation

The collected data were analyzed using SPSS for windows and Microsoft Excel software. The findings of the analysis were presented in tabular format to illustrate the distribution of the observed variables within the study population.

3. Results

3.1. Respondent Characteristics

Table 1 Demographic Characteristics of Respondents in Pucang Sewu Village, Surabaya

No	Characteristics	Frequency (N)	Percentage (%)
1	Child's Age (months)		
	36-47 months	41	65.08
	48-59 months	22	34.92
2	Mother's Age (years)		
	<20	1	1.58
	20-29	18	28.57
	30-39	35	55.55
	40-49	8	12.72
	50-59	1	1.58
3	Mother's Educational Level		
	Primary School	10	15.87
	Junior High School	7	11.11
	Senior High School/Equivalent	32	50.80
	Diploma	4	6.35

	Bachelor's Degree	10	15.87
4	Mother's Occupation		
	Healthcare Worker	1	1.58
	Entrepreneur	16	25.40
	Private Employee	5	7.94
	Housewife	40	63.50
	Teacher	1	1.58

Table 1 shows that the most common age group among children was 36–47 months, comprising 41 children (65.08%), while the least common was 48–59 months with 22 children (34.92%). The most frequent mother's age group was 30–39 years, reported in 35 mothers (55.55%), while the lowest frequencies were observed in the <20 and 50–59 years age groups, each with 1 mother (1.58%). Regarding mother's education, the highest frequency was among those with a senior high school or equivalent education, totaling 32 mothers (50.80%), whereas the lowest frequencies were among those with only primary school education or a bachelor's degree, each accounting for 10 mothers (15.87%). In terms of occupation, the majority of mothers were housewives (40 mothers, 63.50%), while the lowest frequencies were among healthcare workers and teachers, with only 1 mother (1.58%) in each category.

Table 2 Gadget Usage Duration Among Children Aged 3–5 Years in Pucang Sewu Village, Surabaya

Gadget Usage Duration	**Frequency (N)**	**Percentage (%)**
Normal (≤1 hour/day)	32	50.80
Prolonged (>1 hour/day)	31	49.20

Table 2 demonstrates that 32 children (50.80%) had a normal gadget usage duration, whereas 31 children (49.20%) were exposed to prolonged gadget use.

Table 3 Sleep Pattern of Children Aged 3–5 Years in Pucang Sewu Village, Surabaya

Sleep Pattern	**Frequency (N)**	**Percentage (%)**
No Disturbance	33	52.38
Disturbed	30	47.62

Table 3 shows that 33 children (52.38%) did not experience sleep disturbances, while 30 children (47.62%) experienced sleep disturbances.

3.2. Analysis of Study Results

Table 4 Chi-Square Test and Crosstabulation Results on the Relationship Between Gadget Usage Duration and Sleep Pattern Among Children Aged 3–5 Years in Pucang Sewu Village, Surabaya

Gadget Usage Duration	**Sleep Pattern**		**Total**	**p**
	Disturbed	No Disturbance		
	f	f	f	
Prolonged	19	12	31	0.032
Normal	11	21	32	
Total	30	33	63	

The crosstabulation results in Table 4 show that among the 31 children with prolonged gadget use, 19 experienced sleep disturbances and 12 did not. Among the 32 children with normal gadget use duration, 11 experienced sleep disturbances and 21 did not. The Chi-square test yielded a p-value of 0.032 ($p < 0.05$), indicating a statistically significant relationship between gadget usage duration and sleep pattern among children aged 3–5 years in Pucang Sewu Village, Surabaya.

4. Discussions

4.1. Gadget Usage Duration

The recommended gadget usage duration for children aged 3 to 5 years is no more than one hour per day, according to the World Health Organization [12]. Excessive gadget usage duration may result in various health issues in children, such as eye strain, headaches, balance disturbances, obesity, and sleep disorders [13].

Variations in gadget usage duration among children may be influenced by several factors. The family is one of the contributing factors to prolonged gadget use in children [14]. Parental roles in supervision and caregiving are crucial in managing children's gadget usage [15].

Based on the findings of this study, 50.8% of the participants had a gadget usage duration of ≤ 1 hour per day. This result is consistent with the study by Setianingsih et al. [16], which also reported a greater proportion of children with low gadget usage compared to those with high usage. A similarity between the present study and the study by Setianingsih et al. [16] is the predominance of mothers who are housewives. Housewives generally have more time at home compared to those with occupations requiring them to work outside the home, which allows them to fulfill their roles as supervisors and caregivers more effectively.

Early childhood have not yet developed the ability to regulate and control their own behavior; therefore, parental supervision is essential to prevent excessive gadget use [17]. A lack of attention and supervision from parents due to their busy schedules may lead children to turn to their parents' gadgets for entertainment [18]. According to Lani et al. [19], parents who are preoccupied with work tend to give gadgets to their children. Similarly, Marsal and Hidayati [20] stated that parents may provide gadgets to their children for various reasons, including to avoid interruptions while working. Although housewives typically spend more time at home with their children, they are still responsible for household chores. This aligns with the findings of Irmayanti [21], who noted that domestic responsibilities are among the factors that hinder parents from supervising their children's gadget use effectively.

A study conducted by Lani et al. [19] found that 83.2% of children aged 3 to 5 years had a gadget usage duration of more than one hour per day. The study assessed parental attitudes toward gadget use exceeding one hour per day and found that some parents agreed that gadgets are appropriate play tools for early childhood [19]. Such supportive parental attitudes toward extended gadget use may contribute to children exceeding the recommended usage limits set by the World Health Organization [12].

Several factors may influence parental attitudes toward supervising their children's gadget use, including parental age and educational background. Parental age is one of the factors affecting parenting styles and communication with children. In this study, the majority of parents were in the 30–39-year age group. Older parents are generally believed to possess greater parenting experience [22]. According to Monalisa et al. [22], 69% of parents aged 30 to 40 years were reported to provide effective parenting to their children.

Parental education level is an important factor that influences the quality of supervision and caregiving. This is in line with the findings of Arifah [23], Maryam [24], and Soetjiningsih [25], who stated that the higher the educational level of parents, the more knowledge they tend to have regarding appropriate parenting practices. Many parents have introduced gadgets to their children without fully understanding the potential negative impacts of excessive gadget use [26]. Excessive gadget usage duration among children may be attributed to a lack of parental control and supervision [17]. Poor supervision has been linked to lower levels of parental education [27]. This is also supported by Irmayanti [21], who emphasized that parental education—particularly the mother's—plays a significant role in monitoring gadget use in toddlers.

A study conducted by Zhao et al. [28] in China reported that 78.6% of children aged 3 to 4 years had a gadget usage duration of more than one hour per day. The study also found that significant increases in screen time were observed in older children. In our study, children aged 3 to 4 years accounted for a greater proportion (65.08%) compared to those aged 4 to 5 years. At the age of three, children begin to develop foundational skills necessary for knowledge

acquisition and cognitive processing [2]. According to Keith Osborn and Benjamin S. Bloom as cited in Mutiah [29], by the age of four, a child's brain reaches approximately 50% of its adult size and continues to grow by an additional 30% by the age of eight. This is consistent with the findings of Regina and Hidayat [30], who stated that early childhood is marked by rapid development, high curiosity, and the greatest potential for learning.

Gadgets can cause children to lose track of time and use them continuously, as they offer a wide range of entertainment. Studies by Oliemat et al. [31] and Kabali et al. [32] reported that most children use gadgets primarily to play games and watch videos on platforms such as YouTube and Netflix.

In addition to the abundance of entertainment content, gadgets are also easy for children to use. Kabali et al. [32] found that most children were able to operate gadgets with minimal parental assistance. Similarly, Oliemat et al. [31] found that nearly all children had basic operational skills, while only some demonstrated more advanced abilities such as downloading games, understanding gameplay rules, and independently selecting and playing videos.

Although gadgets are relatively easy for children to use, parental assistance remains essential. According to Lani et al. [19], parental support in helping children operate gadgets is considered a negative parental attitude, as it may unintentionally promote the development of gadget-related skills, thereby contributing to gadget usage duration exceeding one hour per day.

4.2. Sleep Pattern

Sleep pattern refer to the model, form, or structure of sleep that remains relatively consistent over time. They include sleep and wake schedules, sleep rhythm, daily sleep frequency, the ability to maintain sleep, and overall sleep satisfaction [33]. Maintaining healthy sleep pattern in children is an important responsibility for parents.

This study found that 30 children (47.62%) aged 3 to 5 years experienced sleep disturbances. This figure is relatively high and warrants attention, particularly in relation to early childhood health. Similar findings have been reported in other cities across Indonesia. For instance, a study by Isnaini [10] in Padang City reported that 58.5% of children aged 4 to 5 years experienced sleep disturbances, while Zahara [11] found a prevalence of 79.8% among children aged 3 to 6 years in Semarang City. These findings are consistent with Liu et al. [9], who reported that Asian countries have a higher prevalence of sleep disturbances in children aged 3 to 6 years compared to Western countries, where prevalence rates range from 20% to 45%. The prevalence of sleep disturbances may vary across regions due to multiple contributing factors, including cultural, environmental, familial, and individual influences [9]. Owens [34] emphasized that sleep is a multifactorial phenomenon, and sleep disturbances in children result from complex interactions among biological, psychological, developmental, and social factors, including influences from family, environment, and culture.

Sociocultural factors that vary across regions—such as political and economic conditions, as well as ideological beliefs regarding social values and parenting—can influence sleep pattern in multiple ways. These include differences in sleeping arrangements and sleep schedules, school start times, academic demands, and societal perceptions of the meaning and value of sleep [34].

Environmental factors also play a role in the development of sleep disturbances among children. Elements such as noise, uncomfortable room temperature (too hot or too cold), poor ventilation, and inadequate sleeping arrangements can significantly affect a child's sleep quality [35].

Family-related factors are another key influence on children's sleep pattern. These include parenting style, parent-child relationships, parental education level, parental occupation, bedtime regulation, and co-sleeping practices [36]. Co-sleeping has been associated with reduced sleep duration in children, as children tend to adopt their parents' sleep pattern [37]. The practice of co-sleeping may be influenced by household circumstances such as the number of siblings, availability of sleeping space, and cultural norms [38]. Parental regulation of children's sleep schedules—including nap times—can also affect overall sleep pattern. Daytime naps may reduce the child's need for nighttime sleep, potentially leading to delayed bedtimes and sleep disturbances [39]. Excessive napping may further delay sleep onset at night and contribute to sleep-related problems in children [40].

Individual factors such as genetics, sleep habits, physical health, mental well-being (e.g., anxiety or fearfulness, or stress from the home environment), physical activity, and screen time can all influence children's sleep pattern [41].

Sleep disturbances can result in a range of health consequences in children, including physical, neurocognitive, emotional, and behavioral impacts [42]. Disrupted sleep may particularly interfere with a child's growth and

development, as growth hormone (GH) becomes more active during sleep [43]. Approximately 75% of GH secretion occurs during sleep, which plays a critical role in stimulating bone and tissue growth and regulating metabolism in children [44]. Several studies have reported a correlation between insufficient sleep and obesity in preschool-aged children [45][46]. Inadequate sleep duration and poor sleep quality have also been associated with impairments in attention, intelligence, and academic performance [47][48]. Sleep contributes significantly to brain development, which in turn affects emotional regulation and behavior [49]. Furthermore, disturbed sleep in children has been linked to depression, anxiety, aggression, and attention-deficit/hyperactivity disorder (ADHD) in multiple studies [50][51].

4.3. The Relationship Between Gadget Usage Duration and Sleep Pattern in Children Aged 3 to 5 Years

This study found a significant relationship between gadget usage duration and sleep pattern in children aged 3 to 5 years. The findings revealed that gadget usage exceeding the WHO [12]-recommended screen time limit of one hour per day was associated with an increased risk of sleep disturbances in children. This result is consistent with the study by Zhu et al. [52], which reported that longer gadget usage duration was linked to a higher risk of sleep problems. Similarly, Hiltunen et al. [53] found that increased screen time was associated with delayed sleep onset and reduced sleep duration. Lan et al. [54] also reported that screen time had an impact on sleep duration and was associated with circadian rhythm misalignment.

The World Health Organization recommends limiting gadget usage to no more than one hour per day for children under the age of five [12]. Exceeding this threshold has been associated with an increased risk of sleep disturbances in children. A study by Zhu et al. [52] found that the risk of sleep problems begins to rise when screen time surpasses the one-hour daily limit.

Screen time may disrupt sleep pattern through several mechanisms. First, exposure to light from electronic devices can suppress melatonin production. Second, inappropriate content—such as violent media—can influence children's behavior and emotional state. Third, screen time may displace time that should otherwise be allocated for sleep. Parents who allow excessive or poorly regulated gadget use are also less likely to enforce sleep routines and proper sleep hygiene practices [55].

Melatonin is a hormone that regulates the body's circadian rhythm, including the sleep–wake cycle. Its synthesis and secretion occur in the pineal gland, are stimulated by darkness, and inhibited by light exposure. Light signals received through the retina are transmitted to the pineal gland via the suprachiasmatic nucleus (SCN) located in the hypothalamus [56]. Blue light emitted from screens—wavelengths in the range of 460–480 nm—has been shown to suppress melatonin production [8].

Individual characteristics, such as previous light exposure, ethnicity, and age, may influence the degree of melatonin suppression [57][58][59][60]. A study among university students found that just two hours of screen use resulted in a 1.1-hour delay in the circadian phase [61]. Moreover, Higuchi et al. [62] found that melatonin sensitivity to light in children was nearly twice as high as in adults.

The content accessed through gadgets also plays a role in influencing children's sleep pattern. A study by Garrison et al. [7] found that exposure to violent media content was associated with an increased incidence of sleep disturbances in children. Similarly, Paavonen et al. [63] reported that viewing adult television programs was linked to a higher risk of sleep problems among children. Certain types of content—such as violent, frightening, or highly stimulating games—can lead to increased arousal levels in children, which may serve as a mediator for sleep disturbances [6][64].

The ease of gadget use, combined with the absence of defined start and end times, may result in sleep displacement [5]. Children may delay their bedtime to prolong gadget use, which in turn leads to a later sleep onset and reduced total sleep duration [6].

Unsupervised gadget use in children can lead to excessive screen time. Parental involvement is crucial in managing gadget use, including setting clear rules regarding allowable content, limiting daily screen time, avoiding the placement of gadgets in the child's bedroom, and providing alternative activities that promote physical and social engagement [65].

This study is subject to several limitations. As a cross-sectional study, it captures data at a single point in time, which restricts the ability to determine causality; therefore, the relationship identified cannot be interpreted as causal. Furthermore, data collection relied solely on self-reported questionnaires through interviews with respondents, without validation through direct observation or cross-checking, making the findings susceptible to recall bias and the accuracy of respondents' reporting.

5. Conclusion

A total of 32 children (50.80%) had a normal gadget usage duration, while 31 children (49.20%) were exposed to prolonged gadget use. Additionally, 33 children (52.38%) did not experience sleep disturbances, whereas 30 children (47.62%) did. The analysis demonstrated a relationship between gadget usage duration and sleep pattern among children aged 3–5 years. Therefore, limiting the gadget usage duration to no more than one hour per day, as recommended by the World Health Organization (WHO) [12], is essential to reduce the risk of sleep disturbances in early childhood.

Compliance with ethical standards

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Disclosure of Conflict of interest

The authors declare no conflicts of interest.

Statement of ethical approval

Ethical approval was received from Ethics Committee of Universitas Airlangga (Approval No. 44/EC/KEPK/FKUA/2024).

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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