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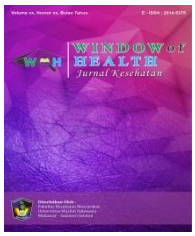

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Impact of Gadget Use on Infant and Toddler Motor and Cognitive Development in the Digital Era

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ABSTRACT

The development of digital technology has had a significant impact on various aspects of life, including child development, particularly for infants and toddlers. The use of gadgets such as smartphones, tablets, and televisions has become increasingly widespread, raising concerns about their effects on the motor and cognitive development of young children. This study aims to analyze the relationship between the duration of gadget use and motor and cognitive development in infants and toddlers aged 6 months to 5 years. The research method used is a descriptive, correlational, quantitative approach with purposive sampling, involving 150 parents of children who use gadgets. Data was collected through surveys and analyzed using Pearson correlation tests and simple linear regression. The results show a significant negative correlation between the duration of gadget use and motor development (-0.41) and cognitive development (-0.28). Children who used gadgets for longer periods showed delays in motor development, such as walking and crawling. However, the use of educational apps had a positive impact on cognitive development with a positive correlation (0.32). The study also found that age and gender did not have a significant effect on the relationship between gadget use and child development. This discussion suggests that parents should limit the duration of gadget use and prioritize physical and social activities for children to support optimal motor and cognitive development. Further research is needed to explore the impact of various types of applications on child development.

Keywords: Gadget use; motor development; cognitive development; screen time; child development

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INTRODUCTION

In this sophisticated digital era, technology has become an integral part of everyday life, influencing various aspects, from how we work, communicate to how we access information [1]. The influence of technology also extends to children's development, especially babies and toddlers. The emergence of gadgets, such as smartphones, tablets, and televisions, has brought significant changes to people's lifestyles, including among young parents who are increasingly familiar with digital devices [2]. The use of gadgets by adults has become commonplace, but this trend has also begun to affect younger age groups, even among babies in the womb. In recent years, health experts have begun to pay more attention to the impact of technology on the development of babies and toddlers [3]. Motor and cognitive development at an early age is greatly influenced by various factors, such as stimulation provided by parents, the environment, and the parenting patterns applied [4]. Technology, in this case, gadgets, is one of the factors increasingly involved in children's daily lives. Gadgets offer various educational applications that are claimed to be able to stimulate children's cognitive development, but there are also concerns that excessive use of gadgets can inhibit motor development and create dependence on these devices [5]. With the rapid development of technology, many parents rely on gadgets for their children's entertainment and education. This has raised debate among experts, whether gadgets really have a positive impact on child development, or actually have a negative impact, especially on the motor and cognitive aspects that are the foundation of children's growth and development at an early age [6]. Research on the impact of gadgets on the development of infants and toddlers shows various findings that lead to a deeper understanding of the influence of this technology [7]. Infant motor development, which includes the ability to move, control the body, and coordination between the eyes and hands, is highly dependent on physical stimulation carried out through direct interaction with the surrounding environment [8]. Physical activities, such as crawling, walking, or playing outdoors, are an important part of healthy motor development [9]. However, with the increasing amount of time spent by infants and toddlers in front of gadget screens, there is concern that these children are less involved in physical activities that stimulate their motor development [10]. Decreased active playtime and increased gadget use can contribute to delays in gross and fine motor development. Several studies have shown that infants who use gadgets too often can experience decreased ability to develop hand-eye coordination, fine motor skills, and speech skills [11].

In addition, cognitive development in infants and toddlers is also influenced by exposure to technology. At an early age, a baby's brain is very developed and ready to receive various stimuli, both from direct human interaction and from visual and auditory stimulation . Although some applications on gadgets claim to have educational benefits, the long-term impact of digital exposure on children's cognitive development is still debated. Several studies have shown that the use of gadgets can disrupt children's attention, affect sleep quality, and even reduce children's social skills because they reduce direct interaction with parents and peers [12]. However, on the other hand, there is also evidence that the

use of gadgets in a controlled and directed manner can provide benefits in terms of recognizing colors, numbers, letters, or language development [13]. For example, several interactive applications that teach language or introduce basic math and science concepts have been shown to be effective in stimulating the cognitive development of older children [6]. Therefore, it is very important to clearly understand how much influence gadgets have on the motor and cognitive development of infants and toddlers, and how best to utilize this technology without neglecting the basic needs of early childhood development. Although many studies have been conducted to assess the impact of gadgets on child development, there are several areas that still require deeper understanding [11]. One of these is the extent to which the duration and type of content accessed through gadgets affect infants' motor and cognitive development. Not all gadget use has the same effect, and this depends on many factors, such as the child's age, the type of application used, and how often the child is exposed to gadgets [14]. Although there have been studies that show the negative effects of gadgets on motor and cognitive development, the limited number of studies examining the specific relationship between gadget use and aspects of fine motor development, such as grasping, writing, or drawing skills, as well as children's social skills, is a challenge that must be overcome [1]. Most existing studies focus more on the effects of gadgets on social behavior and anxiety, but few detail how gadgets can affect children's physical and motor skills, especially in toddlers. In addition, the research is often separated between the effects of gadget use and other factors that play a role in child development, such as the quality of parental interaction or access to an environment that supports physical activity [5]. This means that there is a knowledge gap that needs to be filled to truly understand the effects of gadgets on infant and toddler growth and development, and how technology can be used wisely and appropriately to support child development. In this study, researchers will examine in depth the influence of gadgets on the motor and cognitive development of infants and toddlers [15]. Researchers will explore various aspects of development that are influenced by gadget exposure, both directly and indirectly [16]. Researchers will examine whether the duration of gadget use is associated with delays in motor or cognitive development, and whether the effects of gadgets differ between children who use them in a controlled manner and those who are more frequently exposed. The methods used in this study include a literature review of various related studies and a survey of parents regarding gadget usage habits in their children. The results of this study are expected to provide clearer insights into the influence of technology on the development of children at an early age. With a better understanding, parents and medical personnel can design more effective strategies in utilizing technology to support children's motor and cognitive development, without sacrificing other important aspects of their growth and development. Overall, this article aims to provide a clearer picture of the influence of gadgets on infants and toddlers, as well as provide useful recommendations for parents, educators, and health professionals in facing the challenges of child development in this increasingly modern digital era.

METHOD

This study uses a quantitative descriptive correlational method to analyze the effect of gadget use on the motor and cognitive development of infants and toddlers [17]. The purpose of this study was to describe the relationship between the duration of gadget use and motor and cognitive development in infants and toddlers. The quantitative method was chosen because this study focuses on measuring variables numerically and conducting statistical analysis [18]. This study was conducted in several areas of South Sulawesi, including Makassar, Bulukumba, and Sidenreng Rappang, which have high access to gadgets. The study lasted for 6 months, from June to December 2024. The study population was infants and toddlers aged 6 months to 5 years who lived in the area. The sample taken was 150 parents with children aged 6 months to 5 years who used gadgets in their homes [19]. The sample was selected based on the diversity of gadget use, including device duration, device type, and applications used by children. This study used a purposive sampling technique[20]. The assessment of motor and cognitive development was conducted using a standardized instrument, the Developmental Pre-Screening Questionnaire (KPSP), developed by the Indonesian Ministry of Health [21]. The KPSP evaluates a child's developmental achievements according to age, covering domains such as gross motor skills, fine motor skills, speech/language ability, and socio-cognitive functioning [22]. Each child was assessed within their respective age group, and the results were categorized into three classifications: appropriate development, questionable development, or developmental deviation [23]. To enhance the validity of the data, structured interviews were also conducted with parents to gather information about the child's gadget usage habits and daily behaviors related to motor and cognitive activities [24]. Descriptive analysis was used to describe data, such as the frequency of gadget use and children's motor and cognitive development [25]. The Pearson Correlation Test was used to determine the relationship between the duration of gadget use and children's motor and cognitive development[21]. The Simple Linear Regression Test is used to measure how much influence gadget use has on children's motor and cognitive development, taking into account other variables such as age and gender [26]. This study received ethical approval under the reference number 60/KEP/III.3.AU/F/2024 from the Research and Community Service Institute (LPPM) of Universitas Muhammadiyah Palopo.

RESULTS

Table 1 presents the demographic characteristics and gadget use habits of the study subjects, comprising 150 infants and toddlers from various regions of South Sulawesi. Based on age data, the majority of children were in the > 12-month-to-5-year age group, totaling 90 children (60%), while 60 children (40%) were aged 6 to 12 months. This indicates that most participants were in a more advanced developmental stage beyond early infancy. In terms of gender, males slightly outnumbered females in the sample, with 78 children (52%) compared to 72 (48%), suggesting a relatively balanced gender distribution. Regarding gadget usage duration, most children (90, or 60%) used gadgets for more than 1 hour per day, while only 60 (40%) used them for 1 hour or less per day. These findings suggest a high

level of gadget exposure among young children in the region. The results of this study are presented in the table below. :

Table 1. Frequency Distribution of Research Subject Characteristics

Characteristic	Category	Frequency (n = 150)	Percentage (%)
Child's Age	6–12 months	60	40%
	>12 months – 5 years	90	60%
Child's Gender	Male	78	52%
	Female	72	48%
Gadget Usage Duration	≤1 hour/day	60	40%
	>1 hour/day	90	60%
Type of Gadget Used	Smartphone	90	60%
	Tablet	45	30%
	Television/Smart TV	15	10%
Type of Application Accessed	Educational	75	50%
	Entertainment	45	30%
	Mixed	30	20%

Smartphones were the most frequently used devices, reported by 60% of respondents (90 children), followed by tablets (30% or 45 children), and televisions or smart TVs (10% or 15 children). This reflects that smartphones are the most dominant gadget used by children in daily activities, likely due to their accessibility and portability. In terms of application types accessed, educational apps were the most common, used by 75 children (50%), followed by entertainment apps (30% or 45 children), and a combination of both (20% or 30 children). This indicates that most parents or caregivers tend to direct children toward educational content, although a significant portion still access entertainment or mixed content. Overall, these results provide an initial profile of gadget-using children in the study area and serve as a basis for further analysis of the relationship between gadget usage duration and children's motor and cognitive development.

Table 2. Distribution of Children’s Motor and Cognitive Development Based on KPSP Results

Developmental Aspect	**Category**	**Frequency (n = 150)**	**Percentage (%)**
Motor Development	Age-Appropriate	90	60%
	Questionable	40	26.7%
	Deviated	20	13.3%
Cognitive Development	Age-Appropriate	85	56.7%
	Questionable	45	30%
	Deviated	20	13.3%

Table 2 presents the results of the motor and cognitive development assessment of children aged 6 months to 5 years, using the Developmental Pre-Screening Questionnaire (KPSP). According to the findings, the majority of children (60%) demonstrated age-appropriate motor development, while 26.7% fell into the questionable category, and 13.3% showed signs of developmental delay. Identified motor delays included difficulties in crawling, standing, or walking. In terms of cognitive development, 56.7% of the children were age-appropriate, 30% were questionable, and 13.3% exhibited developmental deviations. Cognitive issues observed included delays in object recognition, responding to sounds or simple instructions, and basic verbal communication skills. These results align with the earlier bivariate correlation analysis, which indicated a negative relationship between the duration of gadget use and both motor (r = -0.37) and cognitive (r = -0.28) development. The longer children were exposed to gadgets, the greater the likelihood of delays in their motor and cognitive development.

Table 3. Bivariate Analysis: Effect of Duration of Gadget Use on Motor and Cognitive Development

Variable	Correlation Value	P-Value
Gadget Usage Duration	-0.37	<0.05
Motor Development Cognitive	-0.41	<0.05
Development Application	-0.28	<0.05
Application Type (Education vs Entertainment)	0.12	<0.05
Child Age (6-12 months)	0.32	>0.05
Gender	0.03	>0.05
Gadget Usage Duration with Application Type (Interaction)	-0.15	>0.05

Based on Table 3, there are significant negative correlations with motor development (-0.37) and cognitive development (-0.28). This means that the longer children use gadgets, the slower their motor and cognitive development. Motor Development shows a stronger negative correlation (-0.41), indicating that the impact of gadgets is greater on children's motor development, including delays in walking and crawling. The type of Application (education vs. entertainment) has a significant positive correlation (0.32) with cognitive development. Educational applications are proven to be more supportive of children's cognitive development compared to entertainment applications. Child Age and Gender do not show a significant effect on the influence of gadgets on motor and cognitive development. This indicates that age and gender factors do not significantly influence this analysis. The interaction between Duration of Gadget Use and Type of Application does not show a significant correlation, indicating that the effect of gadget duration on child development is not significantly influenced by the type of application used.

Table 3. Multivariate Analysis of the Effect of Duration of Gadget Use and Type of Application on Motor and Cognitive Development

Variables	Regression Coefficient	P-Value
Duration of Gadget Use	-0.45	<0.05
Type of Application (Education vs Entertainment)	0.32	<0.05
Age of Child	0.14	>0.05
Gender	0.05	>0.05
Interaction of Duration and Type of Application	-0.12	>0.05

Table 3 shows that the Duration of gadget use exhibits a significant negative correlation with motor development (-0.37) and cognitive development (-0.28). This means that the longer children use gadgets, the slower their motor and cognitive development. Motor Development shows a stronger negative correlation (-0.41), indicating that the impact of gadgets is greater on children's motor development, such as delays in walking or crawling abilities. The type of Application (education vs. entertainment) has a significant positive correlation (0.32) with cognitive development. Educational applications are proven to be more supportive of children's cognitive development compared to entertainment applications. Child Age and Gender do not show a significant effect on the influence of gadgets on motor and cognitive development. This indicates that age and gender factors do not significantly influence this analysis. The interaction between Duration of Gadget Use and Type of Application does not show a significant correlation, indicating that the effect of gadget duration on child development is not significantly influenced by the type of application used.

DISCUSSION

The findings of this study indicate that the duration of gadget use has a significant impact on the motor and cognitive development of infants and toddlers. Among the 150 children studied, the majority (60%) used gadgets for more than one hour per day. This is consistent with the developmental assessment results using the Developmental Pre-Screening Questionnaire (KPSP), which showed that 26.7% of children were categorized as questionable and 13.3% as having developmental deviations in motor development. In terms of cognitive development, 30% were classified as questionable and 13.3% as deviated, suggesting a strong association between prolonged gadget exposure and developmental delays in both areas. Pearson correlation analysis revealed a significant negative relationship between gadget use duration and both motor ($r = -0.37$) and cognitive ($r = -0.28$) development. This means that the longer a child uses gadgets, the greater the likelihood of experiencing developmental delays. Notably, the impact is stronger on motor development ($r = -0.41$), indicating reduced physical activities such as crawling, standing, or walking, which are crucial at an early age. The lack of physical stimulation from the surrounding environment due to excessive gadget use hinders the development of both gross

and fine motor skills. On the other hand, the use of educational applications showed a positive correlation with cognitive development ($r = 0.32$), suggesting that the type of application used can moderate the negative effects of gadget use, especially in terms of recognizing numbers, colors, letters, and language. However, despite the potential cognitive benefits of educational apps, prolonged exposure still poses risks by reducing children's social interaction and physical activity essential for optimal motor development. Multivariate analysis further confirmed that the duration of gadget use ($\beta = -0.45$, $p < 0.05$) significantly and negatively affects development, while the type of application has a significant positive effect ($\beta = 0.32$, $p < 0.05$). However, the interaction between duration and application type did not show a significant effect, indicating that while educational apps may aid development, excessive usage duration still leads to negative outcomes. Meanwhile, child age and gender were not significantly associated with developmental outcomes. This indicates that the impact of gadget use is general in nature and is not dependent on those biological factors.

This finding aligns with research by Gotz et al. (2021), which found that excessive gadget use can hinder children's motor skill development through physical activities such as play and movement. Rohyana Fitriani (2018) also stated that physical interaction with the environment is key to stimulating motor development in early childhood [27]. However, several studies suggest that not all interactions with gadgets have negative effects. Research by Bavelier et al. (2019) shows that certain applications or games that emphasize eye-hand coordination exercises can provide benefits in developing fine motor skills, although this cannot replace the benefits of direct physical activity [28]. Regarding cognitive development, this study found that the longer children use gadgets, the lower their cognitive development. Children who spend more time with gadgets interact less directly with their parents or their physical environment, which is important in stimulating cognitive development [5].

Research conducted by Nur, Yessi Et all et al. (2021) confirms these findings, stating that excessive gadget use can reduce children's social interaction time, which is important for their language development and cognitive abilities [2]. Anita Oktaviani (2021) also emphasizes that the lack of social interaction can hinder children's ability to develop communication and cognitive skills, such as language acquisition and problem-solving. Click or tap here to enter text. However, not all impacts of gadget use on cognitive development are negative. Research by Hafizh et al. (2023) demonstrates that educational applications, particularly those designed to teach fundamental concepts such as numbers, letters, and colors, can stimulate children's cognitive abilities in a fun and interactive mannerClick or tap here to enter text.. This study also revealed that the use of educational applications can have a positive impact on children's cognitive development. Applications that teach language, numbers, or other basic skills are related to children's cognitive abilities, especially in accelerating their understanding of these concepts.

This finding is in line with research by Nabila et al. (2024), which states that educational applications can accelerate children's cognitive development, especially at an early age, as long as they are used with appropriate time limits and with parental supervision [29]. In contrast, entertainment

applications that focus more on visual viewing or games without educational goals can reduce children's ability to develop cognitive and social skills. Although several previous studies have shown that age and gender can influence how children interact with gadgets, the results of this study did not find a significant effect of these two factors on children's motor and cognitive development. Research by Pitayanti (2024) shows that although age influences how children use gadgets, the duration of gadget use and the type of application used are more dominant factors in influencing their development [27]. This study also supports the finding that gender does not significantly affect the influence of gadgets on children's motor and cognitive development. In this study, the interaction between the duration of gadget use and the type of application did not show a significant effect on children's motor and cognitive development. Although the type of application can have a positive impact, especially educational applications, long duration of use still has a negative impact on children's development. Research by Putriana et al. (2019) also emphasized that although educational applications can help in children's cognitive development, long-term gadget use still has negative effects, including reduced time for social and physical interactions, which are very important for children's development.

Overall, this study shows that excessive gadget use can hinder children's motor and cognitive development. This finding is supported by recent studies showing that time spent in front of gadget screens reduces the time children should spend interacting with their environment and with parents. However, controlled and directed gadget use, especially educational applications, can support children's cognitive development. Based on these findings, it is important for parents and educators to limit the duration of gadget use and ensure that the applications used have useful educational value. Parents also need to encourage children to stay physically active and interact socially with their environment to support optimal motor and cognitive development.

CONCLUSIONS AND RECOMMENDATIONS

This study aims to explore the effect of gadget use on the motor and cognitive development of infants and toddlers. The findings indicate that excessive gadget use is associated with developmental delays, particularly in motor skills such as walking and crawling, as well as in cognitive domains such as language acquisition and understanding basic concepts. Although controlled use of educational applications may support cognitive growth—such as improving recognition of numbers, colors, and words—the overall prolonged exposure to gadget screens still poses negative effects. Notably, the child's age and gender did not significantly influence developmental outcomes related to gadget use. These results highlight the importance of limiting screen time for young children and prioritizing the selection of educational content. Furthermore, active engagement with the physical and social environment is crucial to stimulate motor development. Therefore, parents and educators must be informed about balancing gadget use with real-world interactions. Continued research is also needed to examine the specific impacts of different types of applications and to investigate moderating factors such as parental involvement and home environment quality.

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