



The Effect of Screen Time Duration on Fine Motor Development in Children Aged 2–5 Years in Kupang, East Nusa Tenggara

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ABSTRACT

Background: Preschool children in Indonesia continue to experience developmental challenges. National data indicate that fewer than half of children aged 1–59 months receive standardized developmental monitoring. At the same time, increased access to digital devices has made screen time a routine part of early childhood, potentially reducing opportunities for physical play that are essential for fine motor skill development.

Objective: To examine the association between screen-time duration and fine motor development among children aged 2–5 years in the service areas of the Sikumana and Tarus Community Health Centers.

Methods: This study employed an analytic correlational design with a cross-sectional approach. A total of 55 children aged 24–60 months were recruited using consecutive sampling. Screen-time duration was assessed using a questionnaire adapted from the SMALL-Q, while fine motor development was evaluated using age-specific fine motor items from the Developmental Pre-Screening Questionnaire (Kuesioner Pra Skrining Perkembangan/KPSP). Data were analyzed using the Spearman rank correlation test.

Results: The results showed that 54.5% of children were exposed to excessive screen time (>60 minutes/day), and 63.6% demonstrated fine motor development that was not appropriate for their age. A significant moderate negative correlation was observed between screen-time duration and fine motor development ($r = -0.449$; $p = 0.001$). Children with excessive screen time had a substantially lower proportion of age-appropriate fine motor development (16.7%) compared with children who adhered to recommended screen-time limits (60%).

Conclusion: There is a significant and moderately strong association between screen-time duration and fine motor development among children aged 2–5 years. Parental education on limiting screen time and ensuring active supervision is crucial to support optimal fine motor development in early childhood.

KEYWORDS: screen time; fine motor development; preschool children; child development; digital media; Kupang.

INTRODUCTION

The rapid development of digital technology and the widespread availability of electronic devices have substantially transformed family routines, particularly in semi-urban communities transitioning from traditional to modern lifestyles. National evidence demonstrates a continuing increase in digital device use among young children in Indonesia. Data from the 2024 National Socio-Economic Survey indicate that 39.71% of children under six years of age use mobile phones, while 35.57% have internet access, reflecting a notable rise compared with previous years.¹ In East Nusa Tenggara (NTT) Province, the prevalence of digital device use is higher in urban settings (44.69%) than in rural areas (34.76%).¹ This growing exposure to screen-based media has raised concerns regarding its potential implications for early childhood development.

Developmental disorders continue to represent a major public health concern at both global and national levels. The World Health Organization reported that the prevalence of growth and developmental disorders among toddlers in Southeast Asia reached 28.7%.² At the national level, findings from the 2023 Indonesian Health Survey (SKI) showed that only 43.2% of children aged 1–59 months achieved developmental monitoring outcomes that met established standards. Furthermore, in NTT Province, 45.3% of



children were classified as having development that was not appropriate for their age.³ These data highlight the urgency of identifying modifiable risk factors contributing to developmental delays, particularly in this region.

Prolonged screen exposure during early childhood has been linked to various adverse developmental outcomes, as it may reduce opportunities for active, hands-on play that is essential for the development of hand-eye coordination and fine motor skills. However, previous studies examining the association between screen time and fine motor development have reported inconsistent findings. Lontoh et al. demonstrated that children with screen time of ≤ 2 hours per day showed higher rates of passing fine motor assessments compared to children with longer screen exposure.⁴ In contrast, Bedford et al. reported that early touchscreen use, particularly scrolling activities, was associated with earlier attainment of certain fine motor milestones.⁵ These divergent findings suggest that the relationship between screen time and fine motor development may be influenced by multiple contextual and behavioral factors.

Considering that the ages of 2–5 years represent a critical period for the acquisition of fine motor skills necessary for daily functioning and school readiness, and given the limited empirical evidence from the Kupang region, this study addresses an important research gap. Therefore, this study aims to determine the association between screen-time duration and fine motor development among children aged 2–5 years in the service areas of the Sikumana and Tarus Community Health Centers.^{4,5}

METHODS

This study applied a quantitative analytic observational approach with a cross-sectional design to examine the association between screen-time duration and fine motor development. The research was conducted in the service areas of Puskesmas Sikumana and Puskesmas Tarus, Kupang, East Nusa Tenggara, Indonesia, from March to August 2025, with data collection carried out between June and August 2025. The study population consisted of children aged 2–5 years and their parents who resided within the working areas of the selected health centers.

A total of 55 participants were recruited using a consecutive sampling technique from four Integrated Healthcare Centers (Posyandu), which were selected through cluster sampling. The inclusion criteria comprised children aged 24–60 months who were registered at the health centers, had a history of screen exposure, and whose parents or guardians provided informed consent. Children with special needs or physical disabilities were excluded from the study.

Data were collected using two main instruments. Screen-time duration was measured using a questionnaire adapted from the Surveillance of Digital Media Habits in Early Childhood Questionnaire (SMALL-Q). Based on World Health Organization recommendations, screen time was classified as normal when the duration was ≤ 60 minutes per day and excessive when it exceeded 60 minutes per day. Fine motor development was assessed using the Developmental Pre-Screening Questionnaire (Kuesioner Pra Skrining Perkembangan/KPSP) issued by the Indonesian Ministry of Health. Assessment focused exclusively on fine motor items appropriate for the child's age group (24, 30, 36, 42, 48, 54, or 60 months). Fine motor development was categorized as appropriate when the child achieved a score of ≥ 2 and not appropriate when the score was < 2 .

Screen-time data were obtained through structured interviews with parents or guardians, while fine motor skills were evaluated through direct observation of the children. All data were subjected to editing, coding, and entry prior to analysis. Statistical analysis was performed using SPSS software. Univariate analysis was used to describe the distribution of participant characteristics, and bivariate analysis was conducted using the Spearman rank correlation test to assess the relationship between screen-time duration and fine motor development. The level of statistical significance was set at $\alpha = 0.05$.

Ethical approval for this study was obtained from the Health Research Ethics Committee of the Faculty of Medicine and Veterinary Medicine, Universitas Nusa Cendana (No. 11/KEPK/FK/2025) prior to data collection.

RESULT

This study included 55 children aged 2–5 years. Most participants were female (54.5%), and half of the children were in the ≥ 4 -year age group (50.9%). The majority of parents or guardians were housewives (76.4%) and had completed senior high school education (52.7%). Regarding parental supervision during gadget use, only 23.6% of parents consistently accompanied their children, while 41.8% reported rare supervision and 34.5% reported no supervision.



Table 1. Distribution of Screen-Time Duration and Fine Motor Development (n = 55)

Variable	Category	n	%
Screen-time duration	Normal (≤ 60 minutes/day)	25	45.5
	Excessive (> 60 minutes/day)	30	54.5
Fine motor development	Appropriate	20	36.4
	Not appropriate	35	63.6

Table 1 shows that more than half of the children (54.5%) were exposed to screen time exceeding the recommended duration of 60 minutes per day. Assessment of fine motor development revealed that 63.6% of children demonstrated fine motor skills that were not appropriate for their age.

Table 2. Relationship Between Screen-Time Duration and Fine Motor Development

Screen-time duration	Fine motor development		Total n (%)	Spearman rank correlation	p-value
	Appropriate n (%)	Not appropriate n (%)			
Normal (≤ 60 min/day)	15 (60.0)	10 (40.0)	25 (100)	-0.449	0.001
Excessive (> 60 min/day)	5 (16.7)	25 (83.3)	30 (100)		
Total	20 (36.4)	35 (63.6)	55 (100)		

Table 2 indicates that children with excessive screen time had a higher proportion of inappropriate fine motor development (83.3%) compared to children with normal screen-time duration (40.0%). Statistical analysis demonstrated a significant negative correlation between screen-time duration and fine motor development.

DISCUSSION

This study aimed to examine the association between screen-time duration and fine motor development in preschool-aged children. The results demonstrated a statistically significant moderate negative correlation ($r = -0.449$; $p = 0.001$), indicating that longer screen exposure is associated with a lower likelihood of age-appropriate fine motor development. These findings support the displacement hypothesis described by Lontoh et al.⁴ and Oswald et al.⁶, which suggests that excessive engagement with digital devices reduces time allocated to physical and manipulative play that is essential for motor skill development.

The underlying mechanisms contributing to delayed fine motor development are multifactorial, involving both behavioral and neurobiological processes. Fine motor proficiency depends on the maturation of the corticospinal tract and the integration of sensory, proprioceptive, and motor inputs.⁷ Conventional play activities, such as stacking blocks, drawing, and cutting, provide graded resistance and tactile feedback necessary for regulating grip strength and finger coordination. In contrast, touchscreen interactions are typically limited to repetitive and low-resistance movements, such as tapping or swiping, which offer insufficient biomechanical complexity to support optimal fine motor refinement.⁸

From a neuroplasticity perspective, early childhood—particularly between the ages of 2 and 5 years—represents a critical period during which brain development is highly responsive to environmental stimulation. Hutton et al. reported that increased screen exposure among preschool children was associated with reduced microstructural integrity of white matter tracts involved in language and emergent literacy, which are anatomically and functionally linked to motor planning networks.⁹ In addition, many digital applications utilize reward-intensive designs that rapidly stimulate dopamine release.⁸ Such overstimulation may blunt the sensitivity of the brain's reward system, subsequently diminishing children's motivation to participate in non-digital activities requiring sustained attention and physical effort, such as handwriting practice or self-care tasks.¹⁰

Parental involvement emerged as an important contextual factor influencing screen exposure. Although most mothers in this study were housewives (76.4%), a condition that theoretically allows for greater parental supervision, unsupervised screen use was highly prevalent. Only 23.6% of parents consistently accompanied their children during gadget use. This finding challenges the assumption that parental presence at home ensures active mediation. Laksmi et al. emphasized that responsive parenting practices, including co-viewing and interactive engagement, are essential to reducing the negative effects of screen exposure.¹¹ Active parental



involvement can transform passive screen use into opportunities for language and cognitive stimulation, although concerns regarding displacement of motor activities remain.¹²

Furthermore, more than half of the children in this study (54.5%) exceeded the World Health Organization's recommendation to limit sedentary screen time to no more than one hour per day for young children.² The high prevalence of inappropriate fine motor development (63.6%) observed underscores the urgency for early intervention. Unlike gross motor skills, which may develop incidentally through spontaneous play, fine motor skills require targeted and consistent stimulation, which appears to be insufficient among children with excessive screen dependence.

Several limitations should be acknowledged. The cross-sectional design restricts the ability to infer causality between screen time and fine motor outcomes. Additionally, screen-time duration was assessed through parental self-report, which may be subject to recall bias. Nevertheless, the strength and consistency of the observed association highlight the need for heightened awareness among healthcare providers and caregivers regarding the neurodevelopmental risks associated with excessive reliance on digital devices as a substitute for active engagement in early childhood.

CONCLUSION

This study found a significant relationship between screen-time duration and fine motor development in children aged 2–5 years in the Sikumana and Tarus Community Health Center areas. Longer screen time was associated with poorer fine motor development ($r = -0.449$; $p = 0.001$). More than half of the children used screens for longer than the recommended duration, and many showed fine motor development that was not appropriate for their age. These findings indicate that excessive screen time may reduce opportunities for children to practice fine motor activities needed for normal development. Parents are advised to follow the World Health Organization recommendation of limiting screen time to no more than one hour per day for preschool children. Parents are also encouraged to actively accompany children during screen use and to provide more physical play activities, such as drawing, building blocks, and other hand-based play, to support fine motor development.

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