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SCREEN EXPOSURE, NUTRITIONAL STATUS AND EMOTIONAL DEVELOPMENT AMONG CHILDREN IN PADANG CITY : A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Emotional development is a crucial aspect of child growth that determines long-term mental health, social competence, and academic achievement. Screen exposure and nutritional status are key modifiable factors that may influence children's socio-emotional outcomes, yet limited evidence exists regarding their combined effects in urban Indonesian settings. The aim of this study was to investigate the correlation between screentime, nutritional status with emotional development in children 5-10 years. Methods: A cross-sectional study was conducted in Padang City, Indonesia, from January to July 2025, involving 56 children aged 5-10 years with purposive sampling technique for recruitment. Emotional development was assessed using a validated questionnaire. Screen exposure was categorized as ≤ 2 hours/day or > 2 hours/day based on caregiver reports. Height-for-age and weight-for-age were measured using WHO Anthro software. Data were analyzed with Chi-square tests and multivariate logistic regression to identify predictors of emotional development. Results: Among the participants, 67.9% had screen exposure > 2 hours/day, 26.8% had abnormal height-for-age, and 32.1% had abnormal weight-for-age. Overall, 30.4% demonstrated poor emotional development. Multivariate analysis showed that screen exposure > 2 hours/day was significantly associated with poor emotional development (AOR = 4.84; 95% CI: 1.37-17.14; $p = 0.014$). Abnormal height-for-age (AOR = 3.76; 95% CI: 1.04-13.53; $p = 0.043$) and abnormal weight-for-age (AOR = 3.42; 95% CI: 1.02-11.42; $p = 0.048$) were also independent predictors. Sex was not significantly associated. Conclusion: Excessive screen exposure and abnormal nutritional status were correlated with poor emotional development among children in Padang City. Interventions should prioritize parental regulation of screen use, promotion of interactive play, and nutritional improvement strategies. Collaborative efforts between families, schools, health professionals, and policymakers are essential to enhance children's socio-emotional well-being.

Keywords: children, emotional development, Indonesia, nutritional status, screen exposure

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INTRODUCTION

Emotional development is a critical component of child development and has long been recognized as a key determinant of life-long mental health, social competence, and educational attainment [1]. Children who possess adequate emotional skills are able to interpret their own emotions, understand the emotions of others, and regulate their responses during social encounters [2]. Conversely, inadequate emotional development has been associated with behavioral problems, low levels of social interaction, and a heightened risk of later psychological disorders [3]. The process of emotional development is shaped by a wide range of environmental and behavioral factors that operate during early childhood, including caregiver interaction, nutrition, and media exposure [4].

The rapid development of digital technologies has led to an unprecedented rise in children's exposure to screen-based devices such as smartphones, tablets, televisions, and computers. Screen time has become an integral part of daily life in many households and is increasingly used as a means to distract or soothe children in busy family environments [5]. Despite its potential educational benefits, excessive screen exposure is reported to reduce opportunities for children to interact with caregivers and engage in imaginary play, both of which play an important role in developing emotional and social competencies [6]. A recent longitudinal cohort study reported that children with more than two hours of screen use per day had significantly lower socioemotional development scores compared with their peers who were exposed to screens for less than two hours per day [7]. In Indonesia, especially in urban settings such as Padang City, the rapid growth of digital technology has made it more difficult for parents to monitor and limit their children's screen time, resulting in an increased prevalence of excessive screen use among young children [8].

At the same time, nutritional status remains a crucial public health issue in Indonesia, with national data indicating that a substantial proportion of children under five years of age are affected by stunting or underweight [9]. Nutritional status plays an essential role in the neurobiological processes that underlie emotional development, including the formation of brain structures and the regulation of neurotransmitters [10]. Children with suboptimal nutritional status may exhibit slower emotional responses, reduced engagement with their environment, and diminished ability to regulate their emotions [11]. In addition, recent evidence has linked chronic undernutrition to an increased risk of poor socioemotional outcomes in children from low- and middle-income countries [12]. For example, a study conducted in rural Indonesia revealed that stunted children were more likely to display emotional dysregulation compared with children with normal growth patterns [13].

While both excessive screen exposure and poor nutritional status have been identified as important risk factors, few studies have examined their combined influence on

emotional development in children [14]. Previous research has typically focused on either screen use or nutrition in isolation and therefore may underestimate the cumulative impact of these factors on emotional development. However, a critical research gap remains regarding how biological vulnerability (such as stunting or undernutrition) interacts with environmental risk factors (such as early digital overexposure) to alter socioemotional trajectories [16]. Specifically, existing literature fails to explain whether chronic undernutrition amplifies the neurodevelopmental toxicity of excessive screen time, or if sedentary screen habits exacerbate the detrimental effects of nutritional deficits on self-regulation [17]. Furthermore, most existing studies have been conducted in high-income settings or rural areas, leaving a significant evidence deficit regarding middle-income urban environments like Padang City, where unique lifestyle shifts—such as reduced physical activity spaces, changing parental employment patterns, and double burden of malnutrition—co-occur [18]. Without evaluating these dual modifiable factors within a unified analytical framework, public health interventions risk being fragmented, targeting lifestyle or nutritional habits in isolation without addressing their compounding effects [19].

In rapidly growing cities such as Padang, changes in parental working patterns, urban lifestyles, and limited access to outdoor play areas may lead to a higher frequency of screen use and increased difficulties in maintaining optimal nutrition among children. Integrated studies that explore both nutritional and behavioral factors are needed in order to provide robust evidence for designing preventive strategies targeting modifiable risk factors. Therefore, the present study was conducted to examine the association between excessive screen exposure, nutritional status—measured using height-for-age and weight-for-age—and emotional development among children in Padang City, Indonesia [15].

METHODS

This cross-sectional study was conducted in Padang City, Indonesia, from January to July 2025 and involved 56 children aged 5–10 years who were selected through purposive sampling based on caregiver consent. This age range was selected because middle childhood represents a critical developmental transition characterized by rapid neurocognitive maturation, the formal entry into school environments, and an increased vulnerability to self-regulatory and emotional difficulties. Furthermore, children in this age bracket experience heightened exposure to digital devices alongside evolving nutritional demands, making them particularly suitable for examining the cumulative impact of environmental and biological risk factors on emotional development.

Data collection used a Strengths and Difficulties Questionnaire to assess emotional development and was administered through face-to-face interviews conducted by trained research assistants to minimize misunderstanding. In addition, direct anthropometric measurements of height and weight were performed at the child's home or at a nearby

community health post using calibrated equipment. Body weight was measured to the nearest 0.1 kg using a digital scale, and height was measured to the nearest 0.1 cm with a standing stadiometer with the child in an upright and barefoot position. Height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ) were calculated using WHO AnthroPlus software (v1.0.4) based on the WHO 2007 Growth Reference for school-aged children. Nutritional status was categorized as normal ($-2 \text{ SD} \leq \text{z-score} \leq +2 \text{ SD}$) or abnormal ($\text{z-score} < -2 \text{ SD}$ or $> +2 \text{ SD}$). Specifically, abnormal height-for-age was defined as stunting ($\text{HAZ} < -2 \text{ SD}$, reflecting chronic growth deficit) or extreme tallness ($\text{HAZ} > +2 \text{ SD}$), whereas abnormal weight-for-age was defined as underweight ($\text{WAZ} < -2 \text{ SD}$, indicating undernutrition) or overweight ($\text{WAZ} > +2 \text{ SD}$). Screen exposure was obtained from caregivers by asking the average amount of time their child spent using television, smartphones, tablets, or computers on a typical day and categorized as ≤ 2 hours or > 2 hours. All caregivers provided written informed consent prior to participation after receiving an explanation of the purpose and procedures of the study.

The dependent variable was emotional development, categorized as good or poor based on the scoring system of the standardized instrument. Prior to statistical analysis, all data were checked for completeness and accuracy, and multicollinearity tests were conducted to verify the independence of the predictor variables using tolerance values and variance inflation factors. Bivariate analysis was performed using the Chi-square test to identify associations between each independent variable and emotional development. Variables with a p-value < 0.25 in the bivariate analysis were entered into a multivariate logistic regression model to determine independent predictors. The Hosmer–Lemeshow test confirmed good model fit ($\chi^2 = 4.16$, $\text{df} = 8$, $p = 0.842$). Results were reported as adjusted odds ratios (AOR) with corresponding 95% confidence intervals (95% CI). All analyses were conducted using computerization and statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

The study involved a total of 56 children. The distribution of sex showed that the majority of respondents were female (60.7%), while 39.3% were male. Most of the children reported screen exposure of more than 2 hours per day (67.9%), whereas only 32.1% had a daily screen time of ≤ 2 hours. With regard to nutritional status, 73.2% of the respondents had a normal height-for-age, whereas 26.8% were categorized as abnormal. Similarly, 67.9% had a normal weight-for-age, and 32.1% were classified as abnormal. In terms of emotional development, 69.6% of the children demonstrated good emotional development, while 30.4% presented with poor emotional development.

These characteristics indicate that, although the majority of the children in this study had normal nutritional status and good emotional development, a considerable proportion were exposed to excessive screen time (> 2 hours per day). The finding also

suggests that approximately one third of the respondents experienced abnormal height- or weight-based nutritional status, which may represent an important public health concern. In addition, the proportion of children with poor emotional development (30.4%) underscores the need for early identification and targeted interventions focusing on behavioral and nutritional factors during childhood.

Table 1. Distribution, Bivariate Analysis, and Multivariate Logistic Regression of Factors Associated with Emotional Development (n = 56)

Variable	Category	n (%)	p-value (bivariate)	AOR	95% CI	p-value (multivariate)
Sex	Male	22 (39.3)	0.421	1.21	0.38–3.80	0.739
	Female	34 (60.7)				
Screen time	≤2 hours/day	18 (32.1)	0.013	4.84	1.37–17.14	0.014
	>2 hours/day	38 (67.9)				
Nutritional status (Height- for-age)	Normal	41 (73.2)	0.021	3.76	1.04–13.53	0.043
	Abnormal	15 (26.8)				
Nutritional status (Weight-for- age)	Normal	38 (67.9)	0.018	3.42	1.02–11.42	0.048
	Abnormal	18 (32.1)				

*Significant at $p < 0.05$

The present study investigated several sociodemographic and nutritional factors associated with emotional development among children. A total of 56 children were included in the analysis. In the univariate analysis, the majority of the participants were females (60.7%). Most children reported using screen devices for more than 2 hours per day (67.9%). Regarding nutritional status, 73.2% of the children had normal height-for-age (TB/U), while 67.9% had normal weight-for-age (BB/U). In general, the proportion of children with good emotional development was greater than those with poor emotional development.

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The bivariate analysis demonstrated that screen time, height-for-age status, and weight-for-age status were significantly associated with emotional development ($p < 0.05$). Children with screen exposure of more than 2 hours per day had a significantly higher proportion of poor emotional development compared to those with screen use of ≤ 2 hours per day. In addition, children with abnormal TB/U and abnormal BB/U were more likely to show poor emotional development compared to those with normal nutritional status. Conversely, sex was not significantly associated with emotional development ($p > 0.05$), indicating that male and female children had relatively similar emotional development profiles.

Multivariate logistic regression analysis was performed to determine the independent contribution of each variable. After adjusting for all covariates, screen time remained a significant predictor of emotional development. Children with screen exposure of more than 2 hours per day were 4.84 times more likely to have poor emotional development than those with screen exposure of ≤ 2 hours per day (AOR = 4.84; 95% CI: 1.37–17.14; $p = 0.014$). Nutritional status also showed significant and independent associations. Children with abnormal height-for-age were 3.76 times more likely to develop poor emotional development (AOR = 3.76; 95% CI: 1.04–13.53; $p = 0.043$). Similarly, abnormal weight-for-age was associated with a 3.42-fold increased risk of poor emotional development (AOR = 3.42; 95% CI: 1.02–11.42; $p = 0.048$). Meanwhile, sex did not show a statistically significant relationship in the multivariate model (AOR = 1.21; 95% CI: 0.38–3.80; $p = 0.739$), indicating that gender differences did not contribute substantially after controlling for screen time and nutritional status.

The present study examined the association between screen exposure, nutritional status, and emotional development among children in Padang City, Indonesia. The findings revealed that excessive screen exposure (> 2 hours per day), abnormal height-for-age, and abnormal weight-for-age were significantly associated with poor emotional development, even after adjusting for potential confounding variables. These results support the growing body of evidence suggesting that both behavioral and biological factors play an important role in shaping children's emotional development.

The association between screen exposure and emotional development identified in this study is consistent with previous reports from Indonesia and other Southeast Asian countries, which have demonstrated that prolonged use of smartphones, tablets, or television can negatively affect children's socio-emotional functioning. A recent cross-sectional study conducted in Jakarta found that preschool children who spent more than two hours per day on digital devices exhibited higher levels of emotional dysregulation than those with lower exposure [8]. Similar trends have been observed in Malaysia and Thailand, where screen time has been positively correlated with emotional and behavioral problems among early school-age children. These observations are also in line with international research. For example, a cohort study in Canada reported that children with daily screen exposure exceeding two hours had significantly poorer performance in

several domains of socioemotional development compared to their peers with lower usage [7]. Taken together, these findings strengthen the argument that excessive screen use can reduce opportunities for parent–child interaction and limit children’s engagement in activities that stimulate emotional learning, such as imaginative play and peer interaction.

This study also found that abnormal height-for-age (stunting) and abnormal weight-for-age were independently associated with poor emotional development. These findings are supported by previous studies in Indonesia, which have demonstrated that malnourished children exhibit slower emotional responses and impaired interaction with caregivers compared to well-nourished children. For example, a study in West Java showed that stunted children aged 4–6 years had significantly lower socioemotional development scores than non-stunted children [13]. Comparable results have been reported in other low- and middle-income countries. A multi-country analysis demonstrated that nutritional deficiencies in early childhood were associated with an increased risk of emotional problems and poorer social competence later in life [12]. Biological mechanisms may explain these relationships, as malnutrition has been shown to alter brain structure and function, particularly in regions involved in emotional processing and regulation [10,11].

Interestingly, the results of this study revealed that sex was not significantly associated with emotional development. This finding differs from some international studies that have reported higher rates of emotional difficulties among boys compared with girls. However, it is consistent with other studies in Indonesia that found no significant differences in emotional development by sex among children aged 5–10 years. The inconsistent findings across studies may be related to cultural factors and parenting practices that differ across settings and may either buffer or exacerbate sex-based emotional expression.

Although several studies have examined screen exposure and nutritional status separately, only a limited number have investigated the combined influence of these variables on children’s emotional development. The present study contributes to the literature by demonstrating that both excessive screen use and suboptimal nutritional status are independent predictors of poor emotional development. The findings suggest that children who experience both risk factors may be particularly vulnerable to socioemotional disturbances. These results are consistent with findings from the Philippines indicating that children with both stunting and high screen time demonstrated the lowest scores on emotional development assessments. It is possible that the cumulative effect of reduced physical growth and reduced social engagement due to screen use may impair the development of self-regulation, empathy, and affective expression.

This study has several strengths, including the use of validated measurement instruments and objective anthropometric assessments. Additionally, it addresses a

relevant public health issue in an urban Indonesian context, where both malnutrition and excessive screen exposure are prevalent. However, some limitations should also be considered. First, the cross-sectional design of the study limits the ability to establish causal relationships between the variables. Second, screen exposure was based on caregiver report and may be subject to recall bias. Third, the sample size was relatively small and restricted to one urban area, which may limit the generalizability of the findings to other settings.

Despite these limitations, the results provide valuable insights into the factors associated with emotional development in children and underscore the need for integrated approaches that target both behavioral and nutritional determinants.

In addition to findings from Southeast Asia, similar results have been reported in high-income countries, indicating that the negative impact of excessive screen exposure on children's emotional development is a global concern [16]. A study in the United States observed that prolonged screen time was associated with reduced parent-child verbal interaction and less engagement in emotionally stimulating activities, which in turn contributed to lower emotional competence [17]. Likewise, research conducted in the United Kingdom suggested that excessive exposure to digital devices may contribute to heightened emotional reactivity and reduced ability to cope with stress among primary school children [18]. These findings reinforce the view that excessive screen use disrupts essential developmental processes, including social interaction, emotional learning, and self-regulation.

The present study also supports the hypothesis that suboptimal nutritional status compromises emotional development through biological pathways. Nutrient deficiencies can impair synapse formation, neurotransmitter synthesis, and myelination, all of which are critical for the development of executive functions and emotion-regulation networks in the brain [19]. Research using neuroimaging techniques has demonstrated structural differences in the prefrontal cortex and amygdala of malnourished children, which may underlie emotional dysregulation and behavioral problems [20]. These neurobiological mechanisms may explain why children with abnormal height-for-age or weight-for-age in the current study were significantly more likely to experience poor emotional development.

Another plausible explanation for the association between nutritional status and emotional development is that children with chronic malnutrition tend to have reduced levels of physical activity and social engagement compared with well-nourished peers [21]. Lower energy levels and increased susceptibility to illness may limit their ability to participate in interactive and emotionally enriching activities, thereby reducing opportunities for learning social and affective skills. In addition, children with poor nutritional status may be more irritable or withdrawn, which can negatively influence parent-child interaction and emotional responsiveness in daily life [22]. These behavioral manifestations can further exacerbate emotional development problems over time.

Although this study demonstrated independent associations of screen time and nutritional status with emotional development, future research should examine the possibility of synergistic effects between these factors. It is possible that the negative consequences of excessive screen exposure may be amplified in children who are also experiencing nutritional deficiencies, as both factors may target similar neural systems involved in cognitive and emotional regulation [23]. Longitudinal studies are needed to examine whether the combined exposure to excessive screen use and malnutrition has a cumulative or multiplicative effect on emotional development across different stages of childhood.

Finally, in addition to evaluating the impact of screen time and nutritional status separately, future studies could explore other potential mediators and moderators such as parental emotional support, educational stimulation at home, and the quality of screen content. Recent international evidence suggests that high-quality educational screen content delivered in a co-viewing context with parents may mitigate some of the adverse emotional effects associated with screen use [24]. Therefore, understanding how these contextual factors interact with screen exposure and nutritional status could help identify protective mechanisms and inform the design of integrated interventions.

CONCLUSION

This study demonstrated that excessive screen exposure (>2 hours/day), abnormal height-for-age, and abnormal weight-for-age were significantly associated with poor emotional development among children in Padang City, Indonesia. Conversely, sex was not identified as a significant predictor of emotional development. These findings emphasize the importance of addressing both behavioral and nutritional factors as determinants of children's socio-emotional well-being.

From a practical perspective, parents are encouraged to supervise and regulate children's screen use, ensuring that daily exposure does not exceed two hours. Substituting passive screen time with interactive activities—such as outdoor play, creative engagement, and parent-child interaction—can foster better socio-emotional growth. Health professionals and educators should also strengthen interventions aimed at improving child nutrition, particularly in preventing stunting and underweight conditions, given their direct impact on emotional regulation. At the community level, schools and health centers are recommended to collaborate in delivering integrated educational programs that promote balanced nutrition and healthy digital habits. Policymakers should further consider incorporating screen-time guidelines and nutritional improvement strategies into broader child health policies, especially in urban areas where both risk factors are highly prevalent.

Despite its contributions, this study has several limitations. The cross-sectional design precludes causal inference, and caregiver-reported data on screen exposure may be

subject to recall bias. In addition, the relatively small sample size and restriction to one urban setting may limit the generalizability of the findings.

Future research should employ longitudinal and interventional designs to clarify causal relationships and examine the combined or cumulative effects of excessive screen exposure and poor nutritional status on children's emotional development. Furthermore, exploring moderating and mediating factors—such as parenting style, quality of screen content, and the presence of educational stimulation at home—may help identify protective mechanisms and inform the design of more comprehensive child development interventions.

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