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Determinants and risk factors influencing stunting among toddlers

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Abstract

Background: Optimal growth and development in toddlers require appropriate food for growing toddlers. Stunting indicates inadequate nutritional intake in children.
Purpose: To determine the risk factors and determinants associated with stunted infant development growth.
Method: A descriptive quantitative with analytical survey specially focusing on cross-sectional method. The study took place from September 2024 to July 2025 in Dadok Tunggul Hitam Community Health Center, Padang. The independent variables studied were toddler age, gender, birth weight history, exclusive breastfeeding history, number of siblings, mother's age, mother's education, mother's occupation, family income, and gadget use, while the dependent variable was toddler growth. Using random sampling and the Slovin formula, 86 respondents meeting the inclusion and exclusion criteria were selected and categorized into two groups: suspect and normal. Data analysis began with univariate tests to describe the distribution of respondent characteristics, followed by bivariate analysis using the chi-square test and multivariate analysis with logistic regression.
Results: The logistic regression results show that the most influential factor on the occurrence of suspicious developmental events is gadget use, especially in the high use category, with an increased risk of up to 18 times (Exp(B) = 18.125; p = 0.000). Toddler age also plays a significant role, with an approximately 5-fold increase in risk (Exp(B) = 5.406; p = 0.008). The number of siblings and family income also contribute each increasing the likelihood of developmental disorders by approximately 3–4 times (p < 0.05).
Conclusion: Gadget use is the factor most strongly linked to growth delays in toddlers.

Keywords: Nutrition; Risk; Stunting; Toddler.

INTRODUCTION

Optimal growth and development in toddlers require food suitable for growing toddlers. The toddler period is also known as the "golden period" or golden age, where the foundations of sensory, thinking, and speaking abilities are formed, as well as intensive mental and intellectual growth and the beginning of moral development (Sinaga, Purba, Simamora, Pardede, & Dachi, 2021).

According to the United Nations Children's Fund (UNICEF), in 2022, there were 148.1 million (22.3%) toddlers experiencing stunting globally, with approximately 52% of these cases occurring in Asia and 43% in Africa. Based on the Indonesian Health Survey in 2023, 21.5% of toddlers were stunted nationally, a prevalence that is still far from the 2024 national target of 14%. One of the provinces in Indonesia, West Sumatra, has a prevalence of stunted toddlers of 23.7%. The number of stunted toddlers in Padang City in 2023 was 1,876. The Dadok Tunggul Hitam Community Health Centre had the highest number of stunted toddlers in Padang City, 245 (13.8%) (Prihatini, 2024).

Stunting has serious consequences for physical growth and children's cognitive, social-emotional, and motor development. Research shows that stunted children are at higher risk of cognitive

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impairment, speech delays, and fine and gross motor development disorders (Nahar, Hossain, Mahfuz, Islam, Hossain, Murray, & Ahmed, 2020). Risk factors that influence the occurrence of stunting include low birth weight, age, gender, number of siblings, low family income, excessive use of gadgets, and maternal factors such as age, education level, knowledge, and employment status (Munzer, Miller, Wang, Kaciroti, & Radesky, 2020).

Child development is a continuous process that begins in the womb and continues into adulthood. During this process, there are critical periods when children need appropriate stimulation to optimize their potential. Monitoring a child's development is no less important than monitoring their physical growth, as early detection can identify developmental deviations (Kusuma, Yunitasari, Sugiyanto, Anggraini, & Mukhlis, 2022). Thus, prevention, stimulation, intervention, or referral efforts can be provided appropriately according to the child's developmental age, achieving optimal growth and development (Michel & Molitor, 2022).

RESEARCH METHOD

A descriptive quantitative design with an analytical survey employing a cross-sectional approach. The research was conducted from September 2024 to July 2025 at the Dadok Tunggul Hitam Community Health Centre in Padang. The independent variables included toddler age, gender, birth weight, exclusive breastfeeding history, number of siblings, maternal age, maternal education, maternal occupation, family income, and gadget use. Toddler growth served as the dependent variable.

A total of 86 respondents were selected through random sampling using the Slovin formula and categorized into suspect and normal groups based on predetermined inclusion and exclusion criteria. The inclusion criteria consisted of toddlers within the specified age range who resided in the study area and whose parents or caregivers consented to participate and provided complete information. Exclusion criteria included toddlers with incomplete data, those with severe congenital anomalies or chronic illnesses affecting growth, and families who declined or were unreachable for assessment.

Data were obtained from secondary sources, specifically the Maternal and Child Health Handbook, covering variables such as toddler age and gender, birth weight, breastfeeding history, number of siblings, maternal demographic characteristics, family income, and gadget use.

Stunting was assessed by measuring toddler length or height according to age and comparing the results with WHO growth standards using z-scores. A z-score below –2 SD from the median indicated stunting, while a score below –3 SD signified severe stunting.

Data analysis included univariate procedures to describe respondent characteristics, followed by bivariate testing using the chi-square method, and multivariate analysis with logistic regression.

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RESEARCH RESULTS

Table 1. Characteristics of the Respondents (N=86)

Variable	Growth of Stunting Toddlers		p-value
	Suspect (n=49)	Normal (n=37)	
Age (Mean±SD)(Range)(Year)	(3.561±0.942) (1-5)	(3.028±0.662) (1-5)	
1-3	24/48.9	9/24.3	0.035
3-5	25/51.1	28/75.7	
Gender (n/%)			
Male	17/34.7	4/10.8	0.127
Female	32/65.3	33/89.2	
Birth Weight (n/%)			
Low	14/28.6	4/10.8	0.022
Normal	35/71.4	33/89.2	
Breastfeeding (n/%)			
No	14/28.6	3/8.1	0.037
Yes	35/71.4	34/91.9	
Number of Siblings (N/%)			
0 – 1	28/57.1	10/27.1	0.010
> 1	21/42.9	27/72.9	
Mother's Age (N/%)			
≤ 20	30/61.2	25/67.6	0.074
21 – 35	19/38.8	12/32.4	
Mother's Education (n/%)			
Elementary	12/24.5	10/27.1	0.598
Secondary	25/51.0	15/40.5	
College/University	12/24.5	12/32.4	
Mother's Employment (n/%)			
Employed	14/28.6	6/16.2	0.278
Unemployed	35/71,4	31/83.8	
Family Income (n/%)			
Low	32/65.3	14/37.8	0.021
High	17/34.7	23/62.2	
Gadget Use (n/%)			
High	25/51.0	6/16.2	0.001
Moderate	15/30.6	13/35.1	
Low	9/18.4	18/48.7	

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Table 1 presents respondent characteristics, with mean ages of 3.561±0.942 years in the suspect group and 3.028±0.662 years in the normal group (range 1–5 years). Most respondents were female, totaling 32 (65.3%) in the suspect group and 33 (89.7%) in the normal group. The majority in both groups had normal birth weight—35 respondents (71.4%) in the suspect group and 33 (89.2%) in the normal group. Regarding siblings, 28 respondents (57.1%) in the suspect group had 0–1 sibling, whereas the normal group was mostly composed of those with more than one sibling (27 respondents; 72.9%). Maternal age showed a similar distribution in both groups, with most mothers aged <20 years—30 (61.2%) in the suspect group and 25 (67.6%) in the normal group. In terms of education, 25 respondents (51%) in the suspect group had secondary education, compared with 15 respondents (40.5%) in the normal group. Most respondents were unemployed in both groups—35 (71.4%) in the suspect group and 31 (83.8%) in the normal group. Family income differed markedly: 32 respondents (65.3%) in the suspect group were in the low-income category, while 23 (62.2%) in the normal group had high incomes. Gadget use also varied, with high usage reported in the suspect group (25 respondents; 51.0%) and low usage in the normal group (18 respondents; 48.7%).

Several factors were significantly associated with developmental outcomes, including toddler age, birth weight, exclusive breastfeeding history, number of siblings, family income, and gadget use. Younger age, low birth weight, lack of exclusive breastfeeding, fewer siblings, lower income, and higher gadget exposure increased the likelihood of suspected developmental delays ($p < 0.05$). Meanwhile, gender, maternal age, maternal education, and maternal employment were not significantly related to developmental status ($p > 0.05$).

Table 2. Regression Logistic Results

Variable	p-value	Exp (B)	95% CI For Exp (B)	
			Lower	Upper
Toddler Age	0.008	5.406	1.560	18.730
Number of siblings	0.022	3.638	1.208	10.951
Family income	0.030	3.443	1.129	10.499
Gadget use (1)	0.013	5.985	1.456	24.598
Gadget use (2)	0.000	18.125	3.909	84.032

Table 2 presents the logistic regression findings, indicating that gadget use—particularly in the high-use category—is the most influential factor in suspected developmental delays, raising the risk by approximately 18 times (Exp(B) = 18.125; p = 0.000). Toddler age also shows a significant effect, increasing the risk nearly fivefold (Exp(B) = 5.406; p = 0.008). Additionally, the number of siblings and family income contribute to a higher likelihood of developmental problems, each elevating the risk by about three to four times ($p < 0.05$). Overall, gadget use emerges as the strongest predictor in the model.

DISCUSSION

The analysis shows that developmental delays among stunted children are more common in toddlers than preschoolers, supported by a significant association between age and developmental outcomes (p = 0.035). Early childhood especially the first three years is a critical phase because rapid brain growth occurs, with up to 80% of total brain mass developing during this period. Adequate stimulation, responsive parenting, and early detection of developmental issues are essential to support optimal motor, language, social, and self-help development (Chen, Huang, Swain, Yang, & Yu, 2021).

The study emphasizes that early intervention is crucial for children under three, as lack of stimulation during the toddler period can lead to long-term developmental problems. Parental involvement during the first 1000 days of life plays a vital role in preventing stunting and developmental delays. Developmental delays found in some preschoolers may result from insufficient stimulation, limited parental interaction, reduced independence, excessive gadget use, and poor dietary patterns, which collectively reduce opportunities for active exploration and learning (Gaikwad, Uke, Kundalwal, & Swarnakar, 2024).

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The analysis indicates that although a higher proportion of male toddlers with stunting experience suspected developmental delays (64.7%), statistical testing shows no significant relationship between gender and developmental outcomes (p = 0.127). This finding aligns with several previous studies stating that gender is not an independent predictor of child development. Differences in developmental patterns between boys and girls are generally influenced more by environmental stimulation, parenting practices, social interaction, and opportunities to explore rather than biological sex (Kaur, Sidhu, & Randhawa, 2021). Although some studies report variations in gross motor skills between stunted boys and girls, this study found no meaningful developmental differences by gender. Both boys and girls have the same developmental potential when provided with adequate stimulation and a supportive environment. Interventions should prioritize improving parenting quality, stimulation, and learning environments for all toddlers, regardless of gender (Rocha & Nunes, 2020)

Stunted toddlers with a history of low birth weight are significantly more prone to suspected developmental delays. Although delays also occur among children with normal birth weight, environmental factors especially nutrition, parenting quality, and stimulation remain decisive. Early monitoring and intervention during the first 1000 days of life are essential to prevent developmental delays and support optimal growth (Wu, Zhang, Li, Zhao, Sun, Shi, & Jiang, 2022).

The study concludes that exclusive breastfeeding and the number of siblings are significantly associated with the developmental outcomes of stunted toddlers. Stunted toddlers who were not exclusively breastfed were far more likely to experience suspected developmental delays, indicating the essential role of breast milk in supporting cognitive, motor, language, and emotional development through its unique nutritional and psychosocial benefits (Wardiyah, Rilyani, & Nirwanto, 2023). Developmental delays may still occur among exclusively breastfed children when environmental stimulation, caregiving quality, and socioeconomic conditions are inadequate. In addition, toddlers with fewer siblings (0–1) were more likely to experience developmental delays, suggesting that sibling presence can contribute positively to psychosocial and learning experiences. The quality of family interactions and parental attention remains crucial, as some children with multiple siblings also showed delays (Pasaribu & Barus, 2023).

Maternal age alone does not determine a mother's knowledge, skills, or ability to provide adequate stimulation, as these are influenced by education, experience, socio-cultural factors, and daily responsibilities. Consistent with previous studies, this research confirms that developmental outcomes are shaped more by parenting quality, environmental stimulation, and parental involvement than by age (Wigati, Untari, & Sahara, 2025). Even toddlers with older, more mature mothers may experience developmental delays due to limited interaction time, low educational background, or inadequate stimulation practices. These findings highlight the need for interventions focused on enhancing parenting quality and increasing mothers' knowledge about child development. Parenting support, education, and skill-building programs are essential for all mothers, regardless of age, to ensure optimal stimulation and developmental outcomes for their children (Astawa, Wisnawa, & Susanto, 2021).

The analysis shows that although many mothers with low and medium education levels have toddlers with suspected developmental problems, statistical testing indicates no significant relationship between maternal education and stunted toddler development (p = 0.598). This aligns with several studies reporting that education alone does not determine developmental outcomes, as other factors such as parenting quality, stimulation, interaction, and daily caregiving responsibilities play a larger role (Arula & Nurlinda, 2025). Even mothers with higher education levels may have children with developmental concerns due to limited time, inconsistent parenting styles, or overreliance on gadgets as substitutes for direct engagement. These findings highlight that improving child development requires interventions for mothers across all education levels, emphasizing the importance of direct stimulation, consistent interaction, and active parental involvement beyond formal education alone (Anhar, 2023).

The analysis shows no significant relationship between maternal employment status and stunted toddler development (p = 0.278), as both working

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and non-working mothers have toddlers with suspected developmental delays. Although employment may theoretically influence development through time availability and caregiving quality, this study aligns with previous research showing no direct association. Developmental concerns among toddlers of non-working mothers may stem from limited access to information, reduced stimulation, and caregiver fatigue from household responsibilities (Indrayani & Khadijah, 2020). These findings highlight that interventions should not focus solely on employment status but should equip all mothers regardless of occupation with parenting skills, stimulation practices, time-management strategies, and accessible information to support optimal child growth and development (Muminah & Salim, 2022).

The analysis shows a significant relationship between family income and stunted toddler development (p = 0.021), with most low-income families having toddlers with suspected developmental problems (69.6%), while high-income families more often have children with typical development. The presence of stunting and developmental concerns in high-income families indicates that income alone does not guarantee optimal child outcomes. Factors such as limited social interaction, poor parenting practices, excessive gadget use, and reduced parental attention especially when parents work long hours also contribute to developmental delays (Priliana & Ulkhasanah, 2023). These findings emphasize that supporting children's growth requires a holistic approach, combining adequate nutrition, effective parenting, controlled gadget exposure, and opportunities for social interaction, regardless of economic status (Sihaloho, 2024).

The study shows a strong relationship between gadget use and toddler development (p = 0.001), where moderate and high gadget exposure is mostly associated with suspected developmental delays, while low usage aligns with normal development. Prior research supports this, noting that early, frequent, and prolonged screen exposure can negatively affect various developmental domains especially language, personal social skills, and children's ability to interact with their environment (Varadarajan, Govindarajan, Venguidesvarane, Ramaswamy, Rajamohan, Krupa, & Winfred, 2021). Although limited and well-guided gadget use may offer cognitive benefits through educational content, excessive use reduces social interaction and increases developmental risks, particularly for stunted children who are already more vulnerable. These findings highlight the need for parents to monitor screen time, choose appropriate content, and ensure daily opportunities for social and physical activities to support healthy development (Coyne, Shawcroft, Gale, Gentile, Etherington, Holmgren, & Stockdale, 2021).

The results of multivariate analysis using multiple logistic regression statistical tests concluded that gadget use is the most dominant factor influencing the development of stunted toddlers. Children learn behaviour through observing and imitating what they see in their surroundings, including digital media such as YouTube videos on *gadgets*. Children, especially toddlers, tend to mimic the behaviours and actions they see in these videos, affecting their cognitive, social, and emotional development. Excessive screen exposure from *gadgets* can affect children's emotional state, sleep patterns, and behaviour, interfering with their growth and cognitive development. Excessive exposure to *gadgets* can have complex effects on children (Karani, Sher, & Mophosho, 2022). Frequent exposure can reduce the time that should be spent interacting directly with their environment and the people around them, which is essential for their social and emotional development. Toddlers who are overexposed *to gadgets* will have limited opportunities for active play, which is important for their physical and motor development (Marlina & Syafwandi, 2023). *Gadgets* can have a positive impact when the exposure is to age-appropriate educational content and there is always parental or caregiver supervision in terms of both content and duration of *gadget* use by children, so that negative impacts can be prevented (Nurmayanti, Prasetyawan, Sholihin, Iswahyudi, & Arifuddin, 2024).

Screen time in toddlers is significantly associated with developmental delays, particularly in language and communication. This study shows that gadget use in children, especially those experiencing stunting, needs to be monitored and limited as it can hurt their physical and mental development. Parents must be educated about the dangers of excessive gadgets, the importance of direct physical and social activities, and the selection of age-appropriate

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content (Fitrahadi & Priskila, 2020). Toddlers accustomed to using digital devices show an increased risk of tantrums when screen access is stopped. An experimental study revealed that children were more likely to show tantrum reactions when asked to stop playing on a tablet than when asked to stop reading a physical book (Suryana, Tika, & Wardani, 2022). Children who use media for self-soothing tend to exhibit extreme emotions when taken away, indicating potential problematic media use and its impact on emotional regulation (Sari & Pariani, 2022).

CONCLUSION

Gadget use is the factor most strongly linked to growth delays in toddlers. Community health centers are encouraged to strengthen parental education through routine counseling, informational materials, and child health consultations that emphasize age-appropriate gadget use, the value of direct interaction, and the developmental risks associated with excessive screen exposure.

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