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The Relationship Between Sleep Patterns, Sleep Quality, and Recurrent Infections with the Incidence of Stunting in Toddlers

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Abstract

Stunting is a condition of growth failure in toddlers caused by chronic malnutrition, recurrent infections, and environmental factors during the critical first 1,000 days of life. Sleep patterns and sleep quality in toddlers are among the risk factors for stunting. This study aimed to analyze the relationship between sleep patterns (duration, efficiency, and sleep disturbances) and the incidence of stunting in toddlers aged 24–59 months, as well as to identify factors influencing sleep quality among stunted toddlers in the working area of Pandrah Public Health Center, Bireuen District. This research uses a quantitative design with a cross-sectional approach. Data were collected using the Brief Infant Sleep Questionnaire (BISQ) and anthropometric measurements of toddlers to determine stunting status. The sample consisted of toddlers aged 24–59 months selected through purposive sampling from the health center's working area. Data analysis was performed using the Chi-Square test to examine the association between sleep pattern and sleep quality variables with stunting incidence. The results showed that most of the studied toddlers were aged 3.00–4.11 years with a relatively balanced gender distribution. The majority had regular sleep patterns, but many demonstrated poor sleep quality. Chi-Square test results indicated a significant association between sleep patterns and sleep quality with stunting incidence in toddlers ($p < 0.005$). The study concludes that there is a significant relationship between sleep patterns and sleep quality with stunting among toddlers. Therefore, behavior-based interventions, such as educating parents about consistent sleep routines and creating a conducive sleep environment, should be considered as part of stunting prevention programs.

Keywords: Sleep Patterns, Sleep Quality, Recurrent Infections, Stunting

Introduction

Stunting is a condition of impaired growth resulting from chronic malnutrition, recurrent infections, and inadequate stimulation during the critical period of child development, particularly the first 1,000 days of life. It remains a major public health issue in Indonesia. National data show that although the prevalence of stunting has decreased, the rate is still considered high. The 2024 Indonesian Nutritional Status Survey reported a stunting prevalence of 19.8%, a decline from 21.5% in the previous year. This reduction is encouraging; however, the figure remains far from the government's target of reducing stunting to 14.2% by 2029. This situation highlights the need for continuous efforts to improve child nutrition.

The prevalence of stunting in Aceh Province is recorded at 31.2%, significantly higher than the national figure. This places Aceh as one of the provinces with the highest stunting prevalence in Indonesia. Bireuen Regency, including Pandrah District, also faces a serious stunting problem. According to a 2023 report from the Bireuen District Health Office, stunting prevalence in several districts remains above 30%. Pandrah District, as a rural area, faces unique challenges, particularly in terms of parenting patterns, nutritional status, recurrent infections, and suboptimal health behaviors.

Until now, the causes of stunting have been more commonly linked to food intake and dietary patterns in toddlers. However, recent studies show that other factors such as sleep patterns, sleep quality, and a history of recurrent infections also contribute significantly to child growth and development. Sleep plays an important role in growth processes, particularly because Growth Hormone (GH) is optimally produced during high-quality nighttime sleep. Sleep disturbances such as short sleep duration (<10 hours/day), prolonged sleep latency (>30 minutes), or fragmented sleep can inhibit GH secretion, disrupt protein synthesis, and reduce immune response (Beal et al., 2018; Purnama & Hikmah, 2024).

Another factor closely associated with stunting is recurrent infection. Toddlers who frequently experience diarrhea, acute respiratory infections (ARI), or other illnesses are more likely to suffer from nutrient loss, impaired nutrient absorption, and increased energy needs due to recovery processes. Recurrent infections worsen malnutrition and are a major cause of growth failure in children.

Previous studies indicate that toddlers with poor sleep patterns are more vulnerable to growth disorders, including stunting. However, research on the direct relationship between sleep patterns, sleep quality, and stunting remains limited and has produced mixed findings. A study at Ubud 1 Community Health Center (2022) found that 83% of stunted toddlers had low sleep efficiency with disturbances such as frequent nighttime awakenings, whereas the study by Purnama and Hikmah (2024) found no significant relationship between sleep patterns and stunting. This inconsistency indicates the need for more comprehensive research that combines both quantitative and qualitative approaches to better understand these dynamics (Ministry of Health RI, 2023; Purnama & Hikmah, 2024).

A preliminary survey in Pandrah Subdistrict, Bireuen District, in 2024 found that among toddlers aged 2–5 years, there were 36 stunted children, 46 undernourished children, and 3 overweight children. Environmental conditions, sanitation access, and community lifestyle still pose risks for recurrent infections among toddlers. Limitations in hygiene practices, inadequate access to clean water, and insufficient parental knowledge about disease prevention remain major challenges. The combination of recurrent infections, poor sleep patterns, and low sleep quality may be key determinants of the high stunting rates in this area.

Methods

This study employed a quantitative method with a cross-sectional design. The study population consisted of 525 toddlers aged 2–5 years. The research sample was determined using the Slovin formula, resulting in a sample size of 200 participants. The inclusion criteria were toddlers aged 24 to 59 months (2–5 years), living with their mother or primary caregiver who could provide information about the child's sleep patterns, having complete anthropometric data including height and clear age information, and whose parents/caregivers were willing to participate by signing an informed consent form. The consent form contained detailed information on the research objectives, procedures,

participants' rights and responsibilities, risks and benefits, confidentiality assurance, and a statement of voluntary participation. Additionally, participating children had to be in generally good health and not hospitalized or in an emergency condition during data collection.

This study was conducted in the working area of the Pandrah Subdistrict Health Center, Bireuen District, from July to September 2025. Quantitative data were obtained through questionnaires and interviews with the toddlers' parents. Data analysis was performed using logistic regression statistical tests with the assistance of SPSS software, and the results were presented in tables accompanied by narrative explanations. This research also received ethical clearance from Universitas Prima Indonesia with approval number 141/KEPK/UNPRI/VII/2025.

Results

The results of the assessment of respondent characteristics based on gender, sleep quality, repeated index, and stunting toddler status can be seen in the following frequency distribution table.

Table 1. Frequency Distribution of Age, Sex, Sleep Patterns, Sleep Quality, Recurrent Infections, and Stunting Status of Toddlers

Variable	F	%
Age		
< 36 months	79	39.5
36–48 months	115	57.5
> 48 months	6	3.0
Sex		
Male	95	47.5
Female	105	52.5
Sleep Pattern		
Regular	162	81.0
Irregular	38	19.0
Sleep Quality		
Very good	22	11.0
Fair	70	35.0
Poor	85	42.5
Bad	23	11.5
Recurrent Infections		
Not experiencing	74	37.0
Experiencing	126	63.0
Nutritional Status		
Not stunted	164	82.0
Stunted	36	18.0
Total	200	100

(*Source: Primary Data, 2025*)

Based on the characteristics of the respondents, most toddlers in this study were aged 36–48 months (57.5%), followed by those aged <36 months (39.5%) and >48 months (3.0%). Previous studies support this finding, where reports from the Indonesian House of Representatives (DPR RI, 2023) and SSGI data (2022) indicate that the majority of stunting cases occur among children aged 3–4 years. This age represents a critical developmental period that is highly vulnerable to nutritional problems. Thus, the researcher assumes that toddlers in this age group require special attention regarding nutritional intake and healthy lifestyle practices to support optimal growth.

In terms of sex, the number of female toddlers (52.5%) was slightly higher than males (47.5%). Research by Dewi (2023) indicates that female toddlers tend to have better sleep quality than males, which can influence their nutritional status. Therefore, the researcher assumes that sex differences may influence sleep patterns and nutritional status, although the effect may not always be significant.

Regarding sleep patterns, the majority of toddlers had regular sleep patterns (81.0%), while 19.0% had irregular sleep patterns. This aligns with findings by Parmasari and Maharani (2025), who stated that irregular or late sleep may inhibit growth hormone production, increasing the risk of stunting in toddlers. The researcher assumes that regular sleep patterns help support optimal growth through adequate growth hormone secretion.

As for sleep quality, most toddlers had poor sleep quality (42.5%), followed by fair (35.0%), bad (11.5%), and very good (11.0%). Research by Dewi (2023) and Aron (2024) suggests that toddlers with poor sleep quality are more likely to experience stunting, while interventions such as massage therapy can improve sleep quality and nutritional status. The researcher assumes that good sleep quality is essential for supporting physical growth and bodily recovery in toddlers.

Assessment of recurrent infections within the past month related to fever, cough, runny nose/stuffy nose, sore throat, and diarrhea found that 126 (63%) toddlers experienced recurrent infections, while 74 (37%) toddlers did not experience recurrent infections. Among the 200 toddlers included in this study, 36 (18%) experienced stunting.

Overall, this study indicates that age, sex, sleep patterns, sleep quality, and recurrent infections play important roles in the incidence of stunting. The 3–4 year age group represents a critical period that requires attention to both sleep patterns and sleep quality. Appropriate interventions targeting these factors may support the optimal growth and development of toddlers.

Table 2. Cross-Tabulation of the Relationship Between Sleep Patterns, Sleep Quality, and Recurrent Infections with Stunting Among Toddlers

Variable	Nutritional Status				P value	Odds Ratio	95% CI
	Normal		Stunting				
	f	%	f	%			
Sleep Pattern							
Regular	152	76.0	10	5.0	0.000	1.003	0,218-4,721
Irregular	12	6.0	26	13.0			
Sleep Quality							
Very good	21	10.5	1	0.5	0.000	1.203	0,251-3,552
Fair	63	31.5	7	3.5			
Poor	70	35.0	15	7.5			
Bad	10	5.0	13	6.5			
Recurrent Infections							
Not experiencing	66	33.0	8	4.0	0.056	1.895	1,012-5,490
Experiencing	98	49.0	28	14.0			
Total	164	82.0	36	18.0			

(Source: Primary Data, 2025)

Based on the study findings, sleep patterns were found to have a significant relationship with stunting among toddlers (p = 0.000). Of the 200 toddlers, the majority of those with regular sleep patterns had normal nutritional status (76.0%), and only a small proportion were stunted (5.0%). Conversely, toddlers with irregular sleep patterns showed a higher proportion of stunting (13.0%) compared with those who had normal nutritional status (6.0%).

Table 3. Regression Test Results

Variable	B	T	P value
Sleep pattern	0.557	10.425	0.000
Sleep quality	0.062	2.374	0.019
Recurrent infections	0.064	1.474	0.142

(Source: Primary Data, 2025)

Based on Table 3, the regression results show that the sleep pattern variable has a regression coefficient (B) of 0.557 with a t-value of 10.425 and a p-value of 0.000. This indicates that sleep patterns have a significant effect on the incidence of stunting in toddlers. Meanwhile, the sleep quality variable has a regression coefficient (B) of 0.062 with a t-value of 2.374 and a p-value of 0.019, which is also statistically significant.

In contrast, the recurrent infection variable has a regression coefficient (B) of 0.064 with a t-value of 1.474 and a p-value of 0.142, indicating that it does not have a significant effect on stunting among toddlers. Thus, it can be concluded that both sleep patterns and sleep quality play roles as influencing factors in the occurrence of stunting in toddlers. However, sleep patterns have a stronger influence compared to sleep quality, as reflected by their higher regression coefficient value.

Discussion

The results of the study indicate a significant relationship between sleep patterns and the incidence of stunting among toddlers (p = 0.000). Of the 200 toddlers observed, most children with regular sleep patterns had normal nutritional status (76.0%), and only a small proportion were stunted (5.0%). Conversely, in the group of toddlers with irregular sleep patterns, the proportion experiencing stunting was higher (13.0%) compared with those who had normal nutritional status (6.0%).

This finding is consistent with previous studies emphasizing the importance of sleep patterns for child growth. Mazan Darani and Bahramabadi (2023) in Iran reported that infants and toddlers aged 0–36 months who experienced sleep disturbances, such as frequent nighttime awakenings and insufficient sleep duration were at higher risk of impaired growth. Research by Chen et al. (2025) in Beijing, China, involving more than 5,000 children, also found that poor sleep patterns were associated with lower height-for-age z-scores (HAZ), a key indicator of linear growth faltering. Similarly, a study by Beena et al. (2023) in Kerala, India, showed that young children with short sleep duration and irregular sleep schedules experienced more frequent sleep disturbances, which may biologically inhibit growth hormone secretion and consequently affect linear growth. Although most international studies did not directly measure stunting, their findings consistently support the idea that poor sleep patterns can hinder growth, reinforcing the results of this study that good sleep patterns serve as a protective factor against stunting.

Based on the study results showing that sleep patterns have a significant relationship with stunting, the researcher assumes that regular sleep patterns contribute positively to toddlers' linear growth through several biological mechanisms, including increased growth hormone secretion, improved protein metabolism, and enhanced immune function. On the other hand, irregular sleep patterns and poor sleep quality, such as frequent nighttime awakenings or short sleep duration, may disrupt these physiological processes, thereby increasing the risk of stunting.

The researcher also assumes that although stunting is influenced by both nutritional and non-nutritional factors, sleep patterns represent a modifiable behavioral factor that can be improved through education for parents and caregivers. This assumption is supported by evidence from studies in Indonesia that demonstrate a relationship between poor sleep quality and stunting, as well as international studies by Peni et al. (2025) and Pramukawati et al. (2024) that confirm the role of sleep patterns in child growth. Therefore, sleep-related behavioral interventions can be considered as complementary non-nutritional strategies in preventing stunting among toddlers.

The findings also show that sleep quality has a significant relationship with stunting among toddlers (p = 0.000). Among the 200 toddlers, most children with poor sleep quality had normal nutritional status (35.0%), and only a small portion were stunted (7.5%). Conversely, toddlers with bad sleep quality exhibited higher rates of stunting (6.5%) compared with those with normal nutritional status (5.0%). These results support the biological concept that good sleep quality plays a crucial role in growth hormone secretion, protein metabolism, and immune function. Sleep disturbances such as short duration or frequent nighttime awakenings may disrupt these biological processes, thereby increasing the risk of impaired growth.

This finding aligns with studies by Baroya (2019) and the Ubud 1 Community Health Center (2022), which reported that children with poor sleep quality were more prone to stunting. However, studies by Maharani (2020) and Purnama & Hikmah (2024) yielded different results, finding no significant relationship between sleep patterns and stunting. These inconsistencies highlight that sleep patterns are not the sole determining factor but can be influenced by confounding variables such as parenting practices, sleep environment conditions, maternal nutritional status, recurrent infections, and the level of developmental stimulation. Therefore, sleep quality must be understood within a broader context, not merely as an individual factor of the child.

The novelty of this study lies in its emphasis on the importance of non-nutritional factors, particularly sleep patterns, in stunting prevention efforts. To date, stunting interventions have largely focused on nutrition and environmental health, while sleep behavior has received less attention. Previous studies have shown that personal hygiene practices strongly influence whether a toddler becomes stunted (Nuraina et al., 2023). Good hygiene practices were associated with a lower risk of stunting. Additionally, research in many developing countries indicates that access to clean water affects stunting prevalence, as limited water access increases the risk of infectious diseases that subsequently disrupt growth and nutrient utilization (Yuswita et al., 2024). The results of this study add empirical evidence at the community level that consistent sleep patterns can be a simple yet effective strategy to support toddler growth. Therefore, behavioral interventions such as parental education on consistent sleep routines and creating a conducive sleep environment should be considered as part of stunting prevention programs.

The findings further show that toddlers experiencing recurrent infections were more likely to be stunted compared with those who did not. Among the 200 toddlers, 28 children (14.0%) in the recurrent infection group were stunted, while only 8 children (4.0%) in the non-infection group were stunted. Statistical analysis revealed a borderline significant relationship between recurrent infections and stunting (p = 0.056), with an odds ratio of 1.895 (95% CI: 1.012–5.490), indicating that toddlers with recurrent infections have approximately 2.3 times greater risk of stunting.

This finding is consistent with research by Kurniawati (2023), which found that toddlers with recurrent diarrhea had a 3.7-times higher risk of stunting than those without recurrent diarrhea. Setyawati et al. (2022) in East Lombok, West Nusa Tenggara, also reported a significant relationship between recurrent acute respiratory infections (ARI) and

stunting among children under five. Furthermore, research by Subroto et al. (2021) in Bogor, West Java, showed that toddlers with chronic infectious diseases were more susceptible to stunting due to impaired nutrient absorption and increased energy demands during illness.

The researcher assumes that recurrent infections may cause chronic inflammation and impaired nutrient absorption, which affect linear growth. Moreover, children who are frequently ill typically experience decreased appetite and inadequate nutrient intake, hindering energy recovery. When such conditions occur repeatedly, they may lead to chronic nutritional deficits that increase the risk of stunting.

Based on the linear regression analysis in Table 3, the results show that sleep patterns have a regression coefficient (B) of 0.557 with a t-value of 10.425 and a p-value of 0.000, indicating a significant influence on stunting in toddlers. Additionally, sleep quality has a regression coefficient (B) of 0.062 with a t-value of 2.374 and a p-value of 0.019, showing a statistically significant relationship. Meanwhile, the recurrent infection variable has a regression coefficient (B) of 0.064 with a t-value of 1.474 and a p-value of 0.142, indicating that it does not significantly influence stunting.

These findings are supported by a literature review by Hermes et al. (2022), which emphasized the close relationship between sleep, nutritional status, and eating behavior in children. They explained that poor sleep can disrupt metabolic balance, alter eating patterns, and contribute to nutritional problems that impact growth. This aligns with the results of the present study, which indicate that irregular sleep patterns increase the risk of stunting among toddlers.

A more specific international study by Chen et al. (2025) in Beijing, China, involving more than 5,000 children, found that poor sleep habits were associated with lower height-for-age z-scores (HAZ), reinforcing the conclusion that sleep patterns strongly influence stunting risk. Additionally, research by Zahrah & Damayanti (2024) found that poor maternal sleep quality during pregnancy was associated with stunting in children. Poor maternal sleep, particularly during the NREM phase, may interfere with growth hormone secretion, which is vital for fetal development. This finding illustrates that sleep quality is important not only for toddlers but also during pregnancy as an early risk factor for stunting. Thus, this study underscores the importance of non-nutritional interventions, such as establishing consistent sleep routines and creating conducive sleep environments, as strategies for stunting prevention among toddlers.

Conclusion

The results of the study conclude that most of the toddlers observed were aged 36–48 months, with a relatively balanced distribution of sex. The majority had regular sleep patterns; however, many demonstrated poor sleep quality. There was a significant relationship between sleep patterns, sleep quality, and recurrent infections with the incidence of stunting in toddlers. Multivariate analysis showed that both sleep patterns and sleep quality had a significant influence on stunting, although sleep patterns exhibited a stronger effect compared to sleep quality. Thus, regular sleep patterns and good sleep quality may serve as protective factors in preventing stunting, indicating that healthy sleep behavior interventions for toddlers are essential to support optimal growth and development.

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