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The Relationship Between Vitamin D Intake, Calcium Intake, and Sleep Quality with the Nutritional Status of Toddlers in Besito Village, Gebog Subdistrict, Kudus Regency

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ABSTRACT

Introduction: The nutritional status of toddlers is influenced by various factors, including the intake of micronutrients such as vitamin D and calcium, as well as sleep quality. Vitamin D and calcium play important roles in the process of bone mineralization and linear growth, while sleep quality also affects metabolism and the balance of growth hormones. In Besito Village, Gebog District, Kudus Regency, malnutrition among toddlers is still high, as evidenced by a significant number of cases of very short and short stature. This study aims to analyze the relationship between vitamin D intake, calcium intake, and sleep quality on the nutritional status of toddlers in the region.

Methods: This study uses a cross-sectional analytical observational design with 51 toddlers aged 6–35 months selected purposively. Data were collected through the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) for vitamin D and calcium intake, as well as the Children's Sleep Habits Questionnaire (CSHQ) for sleep quality. Nutritional status was measured based on the z-score of height-for-age (H/A), and analyzed using correlation tests and p-values.

Result: the result showed that many as 80.4% of toddlers had sufficient vitamin D intake, and all respondents (100%) had adequate calcium intake. However, all the children experienced significant sleep disturbances. From the nutritional status perspective, 49% of toddlers have normal nutritional status, 21.6% are classified as stunted, and 29.4% are classified as severely stunted. The analysis results show that there is no significant relationship between vitamin D intake ($p = 0.232$), calcium intake ($p = 0.268$), or sleep quality ($p = 0.351$) and nutritional status.

Conclusion: Based on the results of the statistical test, it can be concluded that there is no significant correlation between vitamin D intake, calcium intake, or sleep quality with the nutritional status of toddlers in Besito Village, Gebog District, Kudus Regency ($p > 0.05$).

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1. INTRODUCTION

Nutritional status is a depiction of the body's health condition influenced by dietary consumption patterns and the optimal utilization of nutrients. Several factors affecting children's nutritional status include breastfeeding, complete immunization, parenting patterns, food intake, and maternal knowledge (Valentina et al., 2014). The classification of nutritional status includes categories of malnutrition, undernutrition, good nutrition, overnutrition, and obesity. Malnutrition can be manifested through conditions such as underweight, stunting, wasting, and micronutrient deficiencies, whereas overnutrition includes overweight and obesity (Simarmata et al., 2017). Malnutrition remains a major challenge in developing countries like Indonesia, while the issue of overnutrition, commonly found in developed countries, is also beginning to rise in developing nations (Kliegman et al., 2016). Based on SSGI data from 2022, the prevalence of stunting decreased from 24.4% to 21.6%, although this figure still exceeds the WHO standard of below 20%. The Indonesian government aims to reduce the prevalence of stunting to 14% by 2024 (Setiyawati et al., 2024).

Vitamin D deficiency is also a health issue in Indonesia with a prevalence between 15–75% (Utami et al., 2015). Vitamin D deficiency has the potential to inhibit linear growth in children, increasing the risk of stunting caused by malnutrition or chronic infections (Chairunnisa et al., 2018). Vitamin D plays a crucial role in the absorption of calcium and phosphorus to maintain blood calcium balance and the process of bone mineralization. Deficiencies in vitamin D or calcium can impact bone health, the nervous system, muscles, and overall child growth (van Stuijvenberg et al., 2015; Zakiah, 2015). Calcium and vitamin D are essential micronutrients that play a role in the process of bone growth, especially during childhood. Both support the mineralization process that is important for normal linear growth. Vitamin D deficiency can disrupt calcium absorption in the intestines, which ultimately hinders children's growth (Ilmani & Fikawati, 2023; Putri et al., 2018).

Besides nutrition, sleep quality is also a factor that affects nutritional balance. Lack of sleep can disrupt the regulation of hormones that control hunger and satiety, as well as reduce metabolic function (Sherwood, 2011). Micronutrients such as vitamin B, iron, calcium, and magnesium affect the neurobiological functions related to the sleep cycle. Adequate and quality sleep supports the body's recovery process and optimal growth in children (Haryono et al., 2016).

Several studies indicate that calcium plays a role in improving sleep quality, although most research still focuses on the adult population. Research in North Sulawesi found that the intake of calcium, magnesium, iron, and vitamin B is related to sleep quality. Calcium deficiency is known to increase the risk of sleep disorders in children (Simarmata et al., 2017). Additionally, children with low levels of vitamin D tend to have less sleep time and lower sleep efficiency (Prono et al., 2022). Lack of sleep also has the potential to cause hormonal imbalances and trigger weight gain (Annisa & Setiarini, 2022).

In the working area of the Gribig Health Center in Kudus Regency, the nutritional status of toddlers still presents significant challenges, particularly in cases of undernutrition and malnutrition. By the end of 2019, there were 637 recorded cases, with 30 of them experiencing wasting, which is a serious indicator of poor nutritional status (Jamaludin, 2022). Besito village was chosen as the research location because it has a sufficiently large number of toddlers, making it relevant for a detailed analysis of nutritional status. Based on the importance of the role of vitamin D intake, calcium, and sleep quality on toddler nutritional status, the working area of Gribig Health Center, particularly Besito Village, becomes the main focus in efforts to ensure adequate nutrition and good sleep patterns. Based on this, the researchers are interested in examining the relationship between these three factors and the nutritional status of toddlers in the area.

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2. METHODS

This research is an analytical observational study with a cross-sectional approach that simultaneously measures independent and dependent variables. The study was conducted in Besito Village, Gebog District, Kudus Regency from June 10, 2025, to June 19, 2025, with a population of 250 toddlers. The sample was calculated using the Relative Hypothesis Test formula and obtained 51 respondents after adding a 10% estimate. The sample selection was conducted through purposive sampling based on the inclusion criteria of children aged 6 months to 35 months. Data collection was conducted using questionnaires and anthropometric measurements. The instruments used include the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) to measure vitamin D and calcium intake, as well as the Children's Sleep Habits Questionnaire (CSHQ) to assess sleep quality. Vitamin D and calcium intake were calculated using NutriSurvey and evaluated based on the percentage of the Recommended Dietary Allowance (AKG), categorized as Insufficient (<77% of AKG 2019) and Sufficient (≥77% of AKG 2019) (Chairunnisa et al., 2018), while sleep quality was measured using the CSHQ score with three categories: no sleep disturbances (<41), mild sleep disturbances (41-45), and significant sleep disturbances (>45) (Hartini et al., 2017). The nutritional status of toddlers is determined based on the height-for-age index (HAZ) using WHO Anthro for children aged 0-50 months. Data analysis used univariate and bivariate tests with IBM SPSS software.

3. RESULTS AND DISCUSSION

3.1. Characterictics of Responden

Table 1. Characteristics of Respondents Based on Gender, Age, Mother's Job, Mother's Education, and Family Income

Characteristics of respondents	Amount	%
Age		
6-11 Months	4	7.8
12-23 Months	13	25.5
24-35 Months	34	66.7
Gender		
Man	26	51
Woman	25	49
Mother's Job		
Housewife	37	72.5
Worker	9	17.6
Entrepreneur	5	9.8
Mother's Education		
Junior High School	8	15.7
High School	33	64.7
Undergraduate	10	19.6
Family Income		
< IDR.2.500.000	44	86.3
IDR.2.500.000	7	13.7
Total	51	100

Based on Table 1, this study involved 51 toddler respondents distributed across various age categories. The majority of respondents were in the age range of 24–35 months, totaling 34 children (66.7%), followed by the age group of 12–23 months with 13 children (25.5%), and the remaining 6–11 months age group with 4 children (7.8%). Based on gender, the proportion of

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boys is slightly higher than that of girls, with 26 boys (51%) and 25 girls (49%). The characteristics of the respondents' mothers show that the majority are housewives with 37 individuals (72.5%), while 9 individuals (17.6%) work as employees, and 5 individuals (9.8%) are self-employed. In terms of education level, the majority of mothers have a high school education with 33 individuals (64.7%), followed by 10 individuals (19.6%) with a bachelor's degree, and the remaining 8 individuals (15.7%) with a junior high school education. Based an economic perspective, the majority of the respondents' families have an income below IDR 2,500,000 per month, with 44 families (86.3%), while 7 families (13.7%) have an income of IDR 2,500,000 or more.

3.2. Vitamin D intake of respondents

Table 2. Vitamin D Intake of Respondents

Variable	Amount	%
Vitamin D intake		
Inadequate (<77%)	10	19,6
Adequate (>77%)	41	80,4
Total	51	100

Based on Table 2, the majority of toddlers have adequate vitamin D intake, with 41 children (80.4%) falling into this category, while 10 children (19.6%) fall into the insufficient category. Among the 41 children with adequate vitamin D intake, 12 children have very short nutritional status, 11 children are classified as short, and 18 children are in the normal nutritional category. Meanwhile, among the 10 children with insufficient vitamin D intake, 3 children are classified as very short and 7 children have normal nutritional status. No children with high nutritional status were found in either the adequate or inadequate intake groups, and no children with short nutritional status were found in the inadequate vitamin D intake group. Adequate vitamin D intake is very important in supporting linear growth in children, especially through the process of bone mineralization. Vitamin D deficiency can increase the risk of growth disorders such as stunting. Observational studies in Indonesia also show that children with inadequate vitamin D intake tend to experience linear growth retardation (Nurhayati et al., 2020).

3.3. Calcium Intake of Respondents

Table 3. Calcium Intake of Respondents

Variable	Amount	%
Asupan Kalsium		
Inadequate (<77%)	-	-
Adequate (>77%)	51	100
Total	51	100

Based on Table 3, it shows that all respondents in this study (100%) had calcium intake in the sufficient category, totaling 51 children. There were no respondents with insufficient calcium intake. Among the 51 children, 15 had very short nutritional status, 11 were classified as short, and 25 were in the normal nutritional status category. This indicates that although calcium intake is sufficient, the nutritional status of the children is still influenced by various other factors. Calcium is an essential nutrient that plays an important role during a child's growth period. Adequate calcium intake supports the formation and optimal mineralization of bones. In addition, calcium also functions in various other physiological processes such as muscle contraction and nerve impulse transmission (Marsellinda & Ferilda, 2023).

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3.4. The Quality of Respondents Sleep

Table 4. Quality of Respondents Sleep

Varieble	Amount	%
Kualitas Tidur		
Restless Sleep	-	-
Moderate Sleep Disturbance	-	-
Significant Sleep Disturbance	51	100
Total	51	100

Based on Table 4, it shows that all respondents in this study experienced significant sleep disturbances, with a total of 51 children (100%). No children with normal sleep quality or mild sleep disturbances were found. Of the entire respondents, 15 children had very short nutritional status, 11 children were classified as short, and 25 children were in the normal nutritional category. Significant sleep disturbances in early childhood have the potential to affect the growth and development process. Poor quality sleep can disrupt the secretion of growth hormones and the metabolism of essential nutrients, thereby affecting the child's nutritional status (Anessa & Asrawati, 2023). Several studies also show that sleep pattern disturbances, such as high frequency of waking up at night and short sleep duration, can increase the risk of growth disorders, including stunting, in toddlers (Taslim et al., 2023).

3.5. Nutritional Status

Table 5. Frequency of Respondents Nutritional Status

Variable	Amount	%
Nutritional Status		
Extremely Short (<-3SD)	15	29.4
Short (-3SD to <-2SD)	11	21.6
Normal (-2SD to +3SD)	25	49
Tall (> +3SD)	-	-
Total	51	100

Based on Table 5, out of a total of 51 toddler respondents studied in Besito Village, Gebog District, Kudus Regency, 15 children (29.4%) fall into the very short category (<-3 SD), 11 children (21.6%) fall into the short category (-3 SD to <-2 SD), and 25 children (49%) have normal nutritional status. No children with high nutritional status were found in this study. The distribution of nutritional status shows that nearly half of the respondents are in less than ideal nutritional conditions. The proportion of toddlers with very short and short nutritional status is an early indication of stunting, which is a major chronic nutritional problem in Indonesia. Stunting is a condition of growth failure caused by chronic malnutrition, repeated infections, and inadequate caregiving, especially during the golden period of the first 1,000 days of life (Kemenkes RI, 2021).

3.6. The Relationship Between Vitamin D and The Nutritional Status of Toddlers In Besito Village, Gebog Sub-District, Kudus District

Table 6. The Relationship Between Vitamin D Intake and The Nutritional Status of Toddlers

Vitamin D Intake	Nutritional Status								Total		p-value
	Extremely Short		Short		Normal		Tall				
	n	%	n	%	n	%	n	%	n	%	0,000
Inadequate	3	5,9	0	0,0	7	13,7	0	0,0	10	19,6	0,232

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Vitamin D Intake	Nutritional Status								Total		p-value
	Extremely Short		Short		Normal		Tall				
	n	%	n	%	n	%	n	%	n	%	0,000
(< 77%) Adequate											
(> 77%)	12	23,5	11	21,6	18	35,3	0	0,0	41	80,4	
Total	15	29,4	11	21,6	25	49,0	0	0,0	51	100	
Correlation Coefficient = -0,170											

Based on Table 6, the p-value is 0.232 (p > 0.05), indicating that there is no significant relationship between vitamin D intake and the nutritional status of toddlers in Besito Village. The correlation coefficient of -0.170 shows a very weak negative relationship, meaning that changes in vitamin D intake do not significantly affect nutritional status. Most toddlers with very short and short nutritional status have adequate vitamin D intake. In the normal nutritional status group, there are both children with insufficient and sufficient intake, while no toddlers with high nutritional status were found. Vitamin D is important for bone health and children's growth. Although it can be obtained from foods such as fish and eggs, most (80–90%) comes from sun exposure. Children in tropical areas remain at risk of vitamin D deficiency if they are not exposed to enough sunlight or have a low dietary intake (Hapsari, 2025; Septianggreini et al., 2022). These results are consistent with the research by Septianggreini et al. (2022), which also found no significant relationship between vitamin D intake and children's nutritional status, and indicated that other factors such as energy intake play a more significant role in nutritional status.

3.7. The Relationship Between Calcium Intake and The Nutritional Status of Toddlers In Besito Village, Gebog Sub-District, Kudus District

Table 7. The Relationship Between Calcium Intake and The Nutritional Status of Toddlers

Calcium Intake	Nutritional Status								Total		p-value
	Extremely Short		Short		Normal		Tall				
	n	%	n	%	n	%	n	%	n	%	0,000
Inadequate (< 77%)	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	
Adequate (> 77%)	15	29,4	11	21,6	25	49,0	0	0,0	51	100	0,268
Total	15	29,4	11	21,6	25	49,0	0	0,0	51	100	
Correlation Coefficient = -0,158											

Based on Table 7, the p-value is 0.268 (p > 0.05) and the correlation coefficient is -0.158, indicating no significant relationship between calcium intake and the nutritional status of toddlers in Besito Village. This very weak relationship indicates that changes in calcium intake do not have a significant impact on changes in nutritional status. All respondents (100%) had adequate calcium intake, distributed across the categories of very short nutritional status (29.4%), short (21.6%), and normal (49%). No toddlers with insufficient calcium intake or high nutritional status were found. Calcium is the main mineral in the body, playing an important role in bone formation, muscle contraction, and nerve function (Zakiah, 2015). Calcium absorption is influenced by vitamin D as well as other factors such as growth and nutritional intake (Flora et al., 2022). Calcium deficiency or excess can cause health problems (Marsellinda & Ferilda, 2023; Tytusa et al., 2022). These findings are consistent with the research by Septianggreini et al. (2022) at Poncol Health Center, which also did not find a significant relationship. However, different results were found by (Marsellinda & Ferilda, 2023) who linked

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calcium deficiency with the incidence of stunting in Sijunjung. These differing results are likely influenced by location, recording methods, as well as environmental and social factors.

3.8. The Relationship Between Sleep Quality and The Nutritional Status of Toddlers In Besito Village, Gebog District, Kudus Regency

Table 8. The Relationship Between Sleep Quality and The Nutritional Status of Toddlers

Sleep Quality	Nutritional Status								Total		p-value
	Extremely Short		Short		Normal		Tall				
	n	%	n	%	n	%	n	%	n	%	0,000
Restless Sleep	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	
Moderate Sleep Disturbance	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0,351
Significant Sleep Disturbance	15	29,4	11	21,6	25	49,0	0	0,0	51	100	
Total	15	29,4	11	21,6	25	49,0	0	0,0	51	100	
Correlation Coefficient = -0,133											

Based on Table 8, it shows a p-value of 0.351 ($p > 0.05$) and a correlation coefficient of -0.133, indicating no significant relationship between sleep quality and the nutritional status of toddlers in Besito Village. This very weak negative relationship indicates that changes in sleep quality do not significantly affect nutritional status. All respondents (100%) experienced significant sleep disturbances, with nutritional status classified as very short (29.4%), short (21.6%), and normal (49%). No toddlers were found with normal sleep quality or high nutritional status. Sleep is important in supporting children's growth and metabolism, especially through the secretion of growth hormones during sleep (Qothrunnada & Fitriyani, 2023). Lack of sleep can also affect appetite hormones and increase the risk of metabolic disorders (Yisahak et al., 2023). These results are consistent with the study by Chen et al. (2022) in Shanghai, which also found no relationship between sleep quality and nutritional status. The differences with other studies, such as Baroya (2019) and Tristiyanti et al. (2018), may be caused by variations in factors such as location, sleep habits, and dietary patterns.

4. CONCLUSION

Based on the results of the statistical analysis, no significant relationship was found between vitamin D intake, calcium intake, or sleep quality and the nutritional status of toddlers in Besito Village, Gebog District, Kudus Regency, as indicated by a p-value > 0.05 and a very weak negative correlation coefficient for all three variables. For future research, it is recommended to involve a larger sample size, consider other factors such as the status of infectious diseases, parenting patterns, and the educational level of parents, as well as use more detailed and accurate measurement methods to obtain a more comprehensive picture of the determinants of toddler nutritional status.

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