
The Relationship Between Vitamin D Intake In Toddlers Aged 6–24 Months And The Severity Of Stunting

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Abstract

Stunting is one of the major nutritional problems in Indonesia, with a prevalence of 21.6% based on the 2022 Indonesian Nutritional Status Survey (SSGI). Vitamin D deficiency may contribute to impaired child growth and increased severity of stunting. To analyze the relationship between vitamin D intake and the severity of stunting among children aged 6–24 months in the working area of Bagu Public Health Center, Central Lombok Regency. *Methods:* This study used a cross-sectional design involving 43 mothers with stunted and severely stunted toddlers selected through total sampling. Vitamin D intake was assessed using a 24-hour food recall method and analyzed with NutriSurvey 2007. Data were analyzed using Spearman's Rank Correlation test with a significance level of $\alpha = 0.05$. This study used a cross-sectional design involving 43 mothers with stunted and severely stunted toddlers selected through total sampling. Vitamin D intake was assessed using a 24-hour food recall method and analyzed with NutriSurvey 2007. Data were analyzed using Spearman's Rank Correlation test with a significance level of $\alpha = 0.05$. There was no significant relationship between vitamin D intake and the severity of stunting ($p = 0.595$; $r_s = 0.083$). Most toddlers were aged 12 to <24 months (97.7%), male (58.1%), had received supplementary feeding programs (100%), and had a history of recurrent infections (67.4%). All toddlers had vitamin D deficiency (100%), with the main dietary sources derived from animal-based foods (74.4%). Vitamin D intake was not significantly associated with the severity of stunting among toddlers in the working area of Bagu Public Health Center, Central Lombok Regency.

Keywords: Stunting, Children Under Two Years of Age, Vitamin D.

INTRODUCTION

Malnutrition is a condition of imbalance between the need and intake of nutrients that can cause deficiency or overnutrition. This condition includes various forms of nutritional problems, such as Wasting, underweight, stunting, vitamin and mineral deficiencies, overweight, obesity, as well as diet-related non-communicable diseases (WHO 2023, 2024, 2025). One form of malnutrition that is still a public health problem in Indonesia is stunting.

Based on the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting national reached 21.6%, while in West Nusa Tenggara Province it was 32.7%. In the working area of the Bagu Health Center, the prevalence stunting recorded at 11.22% (Central Lombok Health Office 2023). Events stunting influenced by various factors, including inadequate complementary feeding (MPASI), suboptimal parenting, improper feeding practices, suboptimal exclusive breastfeeding, and recurrent infections (Apriluana and Fikawati 2018).

In meeting children's nutritional needs, attention is often more focused on the consumption of macronutrient source foods, especially carbohydrates, to meet daily energy needs (Arini et al. 2022). Meanwhile, the fulfillment of micronutrients has not always been the main concern, even though these nutrients play an important role in supporting children's growth and development. One of the micronutrients that contributes to linear growth is vitamin D, which functions to increase the absorption of calcium and phosphorus to support bone formation and mineralization (Mokhtar et al. 2018; Munns et al. 2016).

Vitamin D is obtained through two main sources, namely endogenous synthesis in the skin due to exposure to ultraviolet B (UVB) rays and food intake. About 90% of vitamin D in the body is produced through synthesis in the skin, while about 10% of the rest comes from food intake (Pusparini 2018). Sources of vitamin D from food can be natural foods or fortified foods. Natural foods that

contain vitamin D include fatty fish, fish oil, eggs, and mushrooms, while fortified foods include milk, yogurt, margarine, cereals, plant-based drinks, baby biscuits, and formula (Benedik 2022).

Several studies have shown a link between vitamin D and children's linear growth. Research by Mokhtar et al. (2018) in Ecuador reported that low vitamin D levels are associated with the incidence of stunting in early childhood (Mokhtar et al. 2018). Vitamin D deficiency causes impaired calcium and phosphorus homeostasis as well as bone metabolism. Decreased absorption of calcium and phosphorus in the intestine triggers an increase in the secretion of parathyroid hormone to maintain blood calcium levels. This mechanism occurs through the mobilization of calcium from bone tissue and increased excretion of phosphorus through the urine. A continuous increase in parathyroid hormone levels leads to a decrease in bone mineral density and a weakening of bone structure (Akimbekov et al. 2022; Aparna et al. 2018). As a result, the child's linear growth is impaired and the risk of stunting increased (Mokhtar et al. 2018).

Based on this background description, there has been no study that examines the relationship between vitamin D intake and the severity of stunting in toddlers aged 6-24 months in the working area of the Badu Health Center, Central Lombok Regency. Therefore, this study was conducted to analyze the relationship between vitamin D intake and the severity of stunting in this group.

RESEARCH METHODS

This study uses an observational analytical design with a cross-sectional approach which was carried out in the working area of the Badu Health Center, Central Lombok Regency, in September–November 2025. The research has received ethical approval from the Research Ethics Commission of the Faculty of Medicine, University of Mataram with number 263/UN18. F8/ETIK/2025 and research permit from the Regional Development Planning Agency (BAPPEDA) of Central Lombok Regency number 7581/UN18. F8/DL/2025.

The study population was toddlers aged 6–24 months with stunted status (TB/U <−2 elementary school to ≥−3 elementary school) and severely stunted (TB/U <−3 elementary school) in the working area of the Badu Health Center. Based on the calculation of sample size using the correlation analysis formula, the minimum sample requirement is 37 toddlers. Of the total population of 58 toddlers, as many as 43 met the inclusion and exclusion criteria so that all of them were included as samples using the total sampling technique. The independent variable was vitamin D intake, the bound variable was the degree of stunting severity, while the history of recurrent infection was collected as a supporting variable.

The research instruments used included a 1 x 24-hour Food Recall sheet, a research questionnaire, and a Maternal and Child Health Book (KIA). The 24-hour Food Recall sheet is used to obtain data on the type, amount, and time of consumption of toddler food and beverages during the last 24 hours. Consumption data were recorded using household size (URT) and converted into grams to analyze vitamin D intake. Data on children's growth and development was obtained from the KIA Book as a source of supporting data.

The data collection was carried out after obtaining ethical approval from the Faculty of Medicine and Health Sciences, University of Mataram and permission from Bappeda. The researcher first identified toddlers with height status according to the age of <−3 elementary school and −3 elementary school to <−2 elementary school based on data in the Maternal and Child Health Book (KIA), then selected the research subjects according to the inclusion criteria, namely toddlers aged 6–24 months. After the subjects meet the research criteria, the researcher provides an explanation of the objectives, benefits, and procedures of the study to the mother or caregiver, then asks for consent through the signing of informed consent.

The researcher collected data on the characteristics of mothers and toddlers using questionnaires with direct assistance to ensure the suitability of the data with the KIA Book. Data on the consumption of toddlers food and beverages was obtained through interviews using the Food Recall 24 jam which

is carried out systematically based on the order of meal times, including breakfast, lunch, dinner, and snack consumption. Consumption data was then grouped by type of food ingredient and analyzed using the NutriSurvey 2007 application to calculate the average daily intake of vitamin D. The results of the analysis were compared with the 2019 Nutritional Adequacy Rate (AKG) for the age group of 6–24 months. Vitamin D intake levels were categorized into deficit (<77% of the AKG), poor (77% to <100% of the AKG), and good ($\geq$ 100% of the AKG) (Chairunnisa, Kusumastuti, and Panunggal 2018).

The research data were analyzed using univariate analysis to describe the characteristics of the variables and bivariate analysis using the Spearman's Rank Correlation test to assess the relationship between ordinal-scale variables.

RESULTS AND DISCUSSION

Based on Table 1, the majority of toddlers are in the age group of 12–<24 months as many as 42 toddlers (97.7%) and 25 toddlers (58.1%) are male. All toddlers are in the vitamin D deficit category (100%). The source of vitamin D comes mostly from animal food, namely in 32 toddlers (74.4%). Based on the severity of stunting, the majority of toddlers are in the stunted category as many as 27 toddlers (62.8%). In addition, most toddlers have a history of recurrent infection, which is as many as 29 toddlers (67.4%).

Table 1. Characteristics of Stunted Toddlers Aged 6-24 Months in the Working Area of the Bagu Health Center

Category	Frequency (n)	Percentage (%)	Percentage- Cumulative
Toddler Age			
6-<8 Months	0	0	0,0
8-<12 Months	1	2,3	2,3
12-<24Months	42	97,7	100,0
Gender of Toddlers			
Male	25	58,1	58,1
Women	18	41,9	100,0
Asupan Vitamin D			
Defisit	43	100	100,0
Less	0	0	100,0
Good	0	0	100,0
Source of Vitamin D			
Felt	1	2,3	2,3
Swansea	32	74,4	76,7
None	10	23,3	100,0
Severity of Stunting			
Stunted	27	62,8	62,8
Severely stunted	16	37,2	100,0
Recurrent Infections in Toddlers			
Ada	29	67,4	67,4
None	14	32,6	100,0
Total	43	100,0	100,0

Table 2. Sources of Vitamin D Content Most Consumed by Toddlers Aged 6-24 Months in the Working Area of the Bagu Health Center

Source of Vitamin D	Vitamin D Content (µg/100 g)
Omelet	1.0 µg
ABOUT	<0,1 µg
Liquid milk	<0,1 µg
Source of Vitamin D	Vitamin D Content (µg/100 g)
Hard-boiled eggs	2.9 µg
Cob fish	5.0 µg
Manitobala	16.0 µg
Milk powder	20 µg
Energen	2.5 µg
Chicken liver	1.3 µg
Mackerel	7.3 µg
Carp	9.0 µg
Beef	0.4 µg
Yogurt	<0,1 µg

Based on Table 2, it is known that the most consumed sources of vitamin D by toddlers include omelet (1.0 µg/100 g), breast milk (<0.1 µg/100 g), liquid milk (<0.1 µg/100 g), boiled eggs (2.9 µg/100 g), cod fish (5.0 µg/100 g), mackerel (16.0 µg/100 g), milk powder (20 µg/100 g), Energen (2.5 µg/100 g), chicken liver (1.3 µg/100 g), mackerel (7.3 µg/100 g), carp (9.0 µg/100 g), beef (0.4 µg/100 g), yogurt (<0.1 µg/100 g), and sausages (1.0 µg/100 g).

Table 3. Relationship between Vitamin D Intake in Toddlers Aged 6–24 Months and the Severity of Stunting in the Working Area of the Bagu Health Center

Vitamin D Intake	Severity of Stunting				Total		
	Stunted		Severely stunted				
		%	n	n	%	n	%
Deficiency	27	62,8	16	37,2	43	100	
Total	27	62,8	16	37,2	43	100	
Uji Spearman's Rho p=0.595; r=0.083							

Based on the results of the analysis in Table 3, all toddlers totaling 43 children (100%) were included in the category of vitamin D intake deficit >.

The value of the Spearman's Rho *correlation coefficient* of 0.083 is in the range of 0.00–0.199, which indicates that the strength of the relationship between variables is very weak. The positive correlation direction shows that the better the intake of vitamin D, the degree of severity of *stunting* tends to decrease in the working area of the Baku Health Center, Central Lombok Regency.

Discussion

Based on the characteristics of toddlers in this study. The majority of stunted toddlers are in the age group of 12–<24 months. The findings are in line with a critical period of child growth, when nutritional needs increase with age. If these needs are not met optimally, the risk of linear growth disorders will increase. In addition, stunting is a chronic condition that develops due to malnutrition in the long term, especially in the period of the first 1,000 days of life which includes the age of 12–24 months as an important phase of child growth and development (Hafid et al. 2024; Scott, 2012).

Based on gender, most stunted toddlers are male. These results are in line with several studies that show that the prevalence of stunting tends to be higher in boys than girls. These differences are thought to be related to biological factors, higher energy needs, and behavioral and parenting factors

that can affect the adequacy of children's nutritional intake. In the long term, an imbalance between nutritional needs and intake can increase the risk of growth disorders (Hafid et al. 2024; Haryani, Putriana, and Hidayati 2023; Nurhayati et al. 2020).

Vitamin D intake in all toddlers is classified as very low, where all of them are included in the deficit category, namely if the intake $< 77\%$ of the Nutritional Adequacy Rate (AKG). This condition is caused by the limited variety of food sources containing vitamin D in the daily consumption of toddlers. Dietary sources of vitamin D are very limited, with only a few foods that naturally contain sufficient amounts of vitamin D, unless toddlers regularly consume high-fat fish such as salmon, mackerel, or tuna (Mokhtar et al. 2018). The majority of toddlers in this study obtained vitamin D sources from animal foods. However, vitamin D intake is still classified as a deficit because the amount of vitamin D source foods consumed is relatively low. This finding may be related to the low intake of toddlers, who based on the results of the interviews are known to prefer to eat snacks or snacks rather than the main meal. As a result, daily vitamin D needs cannot be met optimally.

The findings can be seen in Table 2, the type of food consumed by toddlers is eggs. Basically, most babies in low-income countries need a good quality and easily available source of protein, one of which is eggs (Faber et al. 2022). Eggs are the most consumed food by toddlers in this study, the vitamin D content in eggs is relatively low per 100 grams containing vitamin D of 1.0 mcg (Benedict 2022). In this study, the amount of food consumption obtained by toddlers is relatively low due to lack of appetite. As a result, the vitamin D intake obtained has not been able to meet the daily needs of children. Based on the Minister of Health Regulation Number 28 of 2019 concerning Nutritional Adequacy Figures, the need for vitamin D for children aged 0–11 months is 10 mcg per day, while at the age of 12–36 months it is 15 mcg per day (Ministry of Health of the Republic of Indonesia 2019). This condition can explain the high risk of vitamin D deficiency in toddlers even though they have consumed animal food sources such as eggs. This explains why all toddlers in this study are still at risk of vitamin D deficiency even though they have consumed animal sources.

Breast milk is the second most widely consumed source of vitamin D by toddlers. In this study, some mothers still use breast milk as the main source of intake for their children. Although it has various benefits for growth and development, the vitamin D content in breast milk is relatively low, which is less than 0.1 μg per 100 grams, so it is not able to meet the daily vitamin D needs of toddlers (Benedik 2022). The results of Al-Qahtani et al. (2022) research in Saudi Arabia show that children who only get breast milk have more than twice the risk of developing vitamin D deficiency compared to children who get additional intake (Al-Qahtani et al. 2022).

In this study, the proportion of children with the Stunted higher than the category severely stunted. These findings are in line with Joe's (2025) study in Afghanistan which reported that the prevalence of stunted was higher than severely stunted in children aged 0–59 months. The severity of stunting can be influenced by various factors, such as family socioeconomic conditions, maternal education level, children's age, birth order, food consumption patterns, and living environmental conditions. These factors play a role in determining the adequacy of nutritional intake and the health status of the child which ultimately affects linear growth (Joe et al. 2025).

Most toddlers stunting in this study had a history of recurrent infections, especially diarrhea and acute respiratory infections (ARI) in the past month. These findings show that children stunting have a higher susceptibility to infectious diseases. This condition can be influenced by various factors, including low quality nutritional intake, suboptimal feeding practices, and inadequate health status of children. Infections that occur repeatedly can reduce appetite, increase metabolic needs, and interfere with the utilization of nutrients so as to worsen the nutritional condition of children (Carvalho et al. 2025; Prabowo et al. 2025).

A mechanism that can explain the relationship between stunting and recurrent infections is impaired intestinal barrier function due to chronic malnutrition. Under normal conditions, the small intestine has microvilli that function to expand the absorption surface of nutrients, as well as tight junction which plays a role in maintaining the integrity of the intestinal epithelium by preventing the

entry of microorganisms and harmful substances into the systemic circulation. However, in children with malnourished conditions, microvilli atrophy occur, causing a decrease in the area of the absorption surface. Structural changes tight junction may increase intestinal permeability (increased intestinal permeability or leaky gut). This condition facilitates the translocation of bacteria, toxins, and antigens from the lumen of the intestine into the systemic circulation, triggering a chronic inflammatory response. Damage to the intestinal barrier results in malabsorption of various macro and micronutrients, including carbohydrates, proteins, fats, vitamins, and minerals, so that the nutritional needs for the growth and development of the child cannot be met optimally (Carvalho et al. 2025).

The link between malnutrition and infection forms a cycle that exacerbates each other. Malnutrition can reduce the body's defense function and increase the risk of infection, while repeated infections can inhibit the absorption of nutrients and increase the body's energy needs. The cycle can ultimately worsen nutritional status and inhibit the linear growth of the child (Carvalho et al. 2025; Sinha and Guerrant 2024).

Research Limitations

This study has several limitations that need to be considered in interpreting the research results. First, the study used a cross-sectional design so that the relationships found between the study variables only showed a relationship at one observation time and could not explain the causal relationship. Second, all respondents in this study were toddlers with stunted status, so there was no comparison group with normal nutritional status. Third, the assessment of food intake was carried out using the 1×24-hour food recall method which depends on the ability of the respondent or caregiver to remember the food consumed by the child. This method has the potential to cause recall bias and does not reflect the usual daily consumption patterns in the long term. Fourth, the relatively small number of samples, namely 43 toddlers, can limit the representativeness of the research results to the wider population and reduce the strength of analysis in describing the condition of stunting toddlers in general.

CONCLUSIONS

There was no association between vitamin D intake and the severity of stunting in toddlers aged 6–24 months in the working area of the Badu Health Center, Central Lombok Regency. The majority of toddlers aged 12–<24 months, are male, have received PMT, and have a history of recurrent infections. All toddlers experience a deficit in vitamin D intake with the most sources of vitamin D coming from animal food.

Further research is recommended to use a case-control design by involving a comparison group of good nutritional status, using a more comprehensive intake assessment method, such as a repeated 24-hour recall or a combination of food recall and food frequency questionnaire (FFQ), and involving a larger sample size so that the results have better validity and generalization.

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