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Factors Associated With Stunting in Children Aged 24–59 Months in Gariuai Village, Timor-Leste, 2026

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ABSTRACT

Stunting remains a major public health problem in developing countries. It is a condition of chronic malnutrition characterized by a child's height being below the standard for his or her age and may lead to impaired physical growth, cognitive development, and increased risks of health problems later in life. This study aimed to analyze the factors associated with stunting prevalence among children aged 24–59 months in Gariuai Village, Baucau Municipality, Timor-Leste. A quantitative study with a cross-sectional design was conducted among a population of 557 children. A sample of 253 children was selected using proportionate stratified random sampling. Data were analyzed using univariate analysis, the Chi-Square test for bivariate analysis, and multiple logistic regression for multivariate analysis. The results revealed that 11.1% of the children were stunted. Exclusive breastfeeding, family income, access to clean water, and toilet facilities were significantly associated with stunting prevalence, whereas maternal education and birth weight history were not significantly associated with stunting. Exclusive breastfeeding was identified as the most dominant factor associated with stunting. These findings indicate that local health interventions should prioritize strengthening exclusive breastfeeding support and counseling, particularly for vulnerable families, while continuing to improve household income, access to clean water, and sanitation facilities.

Keywords: *Stunting; exclusive breastfeeding; family income; sanitation*

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INTRODUCTION

Stunting is a growth failure condition in children characterized by height-for-age below −2 standard deviations according to WHO standards. This condition reflects chronic malnutrition occurring from early life and results in impaired linear growth, along with long-term consequences for physical and cognitive development. The effects of stunting are permanent and can persist into adulthood, even influencing subsequent generations.

Globally, stunting remains a significant public health problem. The 2025 Joint Child Malnutrition Estimates (JME) report indicates that in 2024, approximately 150.2 million children under five years of age (23.2%) experienced stunting. In addition, 6.6% of children suffered from wasting and 5.5% were overweight. Although the prevalence of stunting has declined from 26.4% in 2012 to 23.2% in 2024, the rate of reduction is insufficient to meet the 2030 SDGs target. In the Asian region, stunting prevalence reaches 23.3%, with Southeast Asia recording an even higher figure of 31.4%, indicating that the burden of this problem remains substantial in this region.

In Indonesia, the prevalence of stunting has shown a declining trend in recent years. SSGI data recorded a decrease from 24.4% in 2021 to 21.6% in 2022, and 21.5% in 2023. In 2024, the prevalence further declined to 19.8%, surpassing the annual target of 20.1%. Nevertheless, this figure remains far from the medium-term national target of 14.2% by 2029. For comparison, Singapore demonstrates a very low prevalence of approximately 2.8% in 2025, reflecting the success of a more optimal health and nutrition system.

In contrast to the declining global and national trends, Timor-Leste continues to face a high prevalence of stunting. The 2020 TLFNS data showed a stunting prevalence of 47.1% among children aged 0–59 months, although this represents a decrease from previous years. Prevalence was higher among boys and in rural areas. In Baucau Municipality, stunting prevalence reached 48.8%, with significant proportions of severe and moderate

stunting. More recent data from 2023–2024 indicate a decline to 32%, but this figure remains far from the SDGs target of below 25%.

The causes of stunting are multifactorial, encompassing both direct and indirect factors. Direct factors include maternal nutritional intake during pregnancy, nutritional status of children under five, exclusive breastfeeding practices, and incidence of infections. Indirect factors involve socioeconomic conditions, parental education, and access to clean water and sanitation. Research indicates that mothers with chronic energy deficiency have a higher risk of giving birth to stunted children, while the absence of exclusive breastfeeding significantly increases the risk. In addition, sanitation factors such as poor sanitation and limited access to clean water also contribute substantially to the occurrence of stunting.

In Gariuai Village, Baucau Municipality, stunting remains a serious challenge. This area faces economic constraints, limited access to health services, and inadequate facilities for clean water and sanitation. Out of a total of 557 children under five aged 24–59 months, several cases of stunting and malnutrition have been recorded in the catchment area of the Wailili Community Health Center. Preliminary interviews indicate that low maternal education, insufficient exclusive breastfeeding practices, and inadequate sanitation conditions are the main contributing factors. Based on these conditions, this study aims to analyze the factors associated with the occurrence of stunting among children under five aged 24–59 months in Gariuai Village, Baucau Municipality, Timor-Leste in 2025.

METHODS

This study is a quantitative research with an observational analytic design, aiming to determine why and how a disease occurs, as well as the magnitude of the contribution of risk factors to its effects. The research design employed in this study is a cross-sectional approach, meaning that the researcher collects data on the study variables at the same point in time. The study was conducted in Gariuai Village, Baucau Municipality, Timor-Leste, in

2025. The target population comprised all children aged 24–59 months residing in Gariuai Village during the study period. The accessible population included children in this age range whose mothers or primary caregivers were present at home and willing to participate.

The sample size was calculated using the formula for estimating a single proportion in a cross-sectional study. Based on previous municipal-level data indicating a stunting prevalence of approximately 32% in Baucau, we used $p = 0.32$, $d = 0.07$, and $Z = 1.96$. Substituting these values yielded a minimum sample size of approximately 170 children. To account for an anticipated 10% non-response rate, the final sample size was increased to 187 children. Given the finite population of 557 children aged 24–59 months in Gariuai Village, a finite population correction was applied. where $N = 557$. The adjusted sample size was approximately 144 children. A simple random sampling technique was used to select participating households from a complete list of children aged 24–59 months obtained from the Wailili Community Health Center registry. A random number generator was used to select the required number of children from the list. In households with more than one eligible child, one child was randomly selected using a lottery method.

Data were collected using a structured questionnaire covering sociodemographic characteristics, feeding practices, household environmental conditions, and birth weight history. Content validity was assessed by three experts, with items having a CVI <0.80 revised or removed. Face validity was tested with 20 mothers, while reliability was assessed using Cronbach's alpha (α=0.72–0.85). Weight and height were measured twice using standardized procedures, with a third measurement taken when differences exceeded the specified limits. HAZ was calculated using WHO Anthro 3.2.2 based on the WHO 2006 Child Growth Standards. Stunting was defined as HAZ <−2 SD.

Data were collected over four weeks in 2025 by four trained data collectors through face-to-face interviews in Tetum or Portuguese. A three-day training covered study

procedures, ethics, interviewing, anthropometry, and quality control. Quality control included daily questionnaire review, re-measurement of 10% of children, and weekly team meetings. Data were analyzed using SPSS 26.0. Descriptive statistics summarized participant characteristics. Chi-square or Fisher's exact tests assessed bivariate associations. Variables with $p<0.25$ were entered into multiple logistic regression. Adjusted odds ratios (AOR) with 95% CI were reported, with $p<0.05$ considered statistically significant. Multicollinearity was assessed using VIF, with VIF >10 indicating concern.

RESULTS

Univariate Analysis

This study included 253 mothers of children aged 24–59 months as respondents. The analysis described the maternal and household characteristics of the respondents, as well as factors potentially associated with stunting prevalence. These factors included maternal education, exclusive breastfeeding practices, family income, birth weight history, access to clean water, and toilet facilities. The nutritional status of the children was assessed using the height-for-age indicator and classified as normal or stunted.

Table 1
Distribution of Respondents and Study Variables

Variable	Category	n	%
Maternal Age	20-29 years	123	48,6
	30-40 years	130	51,4
Maternal Education	Low	67	26,5
	Moderate	132	52,2
	High	54	21,3
Exclusive breastfeeding	Yes	229	90,5
	No	24	9,5
Family income	Low	59	23,3
	Moderate	129	51,0
	High	65	25,7
Birth weight history	<2.500 g	65	25,7

	≥2,500 g	188	74,3
Clean water source	Adequate	22	8,7
	Inadequate	231	91,3
Toilet facility	Adequate	24	9,5
	Inadequate	229	90,5
Nutritional status	Normal	28	11,1
	Stunted	225	88,9

Source: Primary data from Gariuai Village, 2026.

The descriptive findings indicate that the study population was predominantly composed of mothers aged 30–40 years and mothers with a moderate level of education. Most children had received exclusive breastfeeding, had a birth weight of at least 2,500 g, and lived in households with adequate access to clean water and toilet facilities.

The nutritional-status distribution showed that most children were classified as having normal height-for-age, whereas 11.1% were classified as stunted. Although the prevalence observed in Gariuai was lower than the reported prevalence for Baucau Municipality, the finding still represents an important public health concern because stunting reflects chronic growth impairment and may have long-term consequences for child development.

Bivariate Analysis

Bivariate analysis was conducted to examine the association between maternal education, exclusive breastfeeding, family income, birth weight history, clean water access, toilet facilities, and the child's nutritional status. The outcome variable is presented as Nutritional Status (HAZ) rather than "occurrence of stunting" to improve the epidemiological accuracy of the table headings.

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Table 2
Association Between Study Factors and Nutritional Status (HAZ)

Variable	Category	Normal n (%)	Stunted n (%)	Total n (%)	p-value
Maternal Education	Low	57 (85,1)	10 (14,9)	67 (100,0)	0,260
	Moderate	117 (88,6)	15 (11,4)	132 (100,0)	
	High	51 (94,4)	3 (5,6)	54 (100,0)	
Exclusive breastfeeding	Yes	210 (91,7)	19 (8,3)	229 (100,0)	0,000
	No	15 (62,5)	9 (37,5)	24 (100,0)	
Family income	Low	50 (84,7)	9 (15,3)	59 (100,0)	0,017
	Moderate	111 (86,0)	18 (14,0)	129 (100,0)	
	High	64 (98,5)	1 (1,5)	65 (100,0)	
Birth weight history	<2.500 g	58 (89,2)	7 (10,8	65 (100,0)	0,929
	≥2,500 g	167 (88,8)	21 (11,2)	188 (100,0)	
Clean water source	Adequate	209 (90,5)	22 (9,5)	22 (100,0)	0,011
	Inadequate	16 (72,7)	6 (27,3)	231 (100,0)	
Toilet facility	Adequate	209 (91,3)	20 (8,7)	229 (100,0)	0,000
	Inadequate	16 (66,7)	8 (33,3)	24 (100,0)	

Source: Primary Data of In Gariuai Village 2026

Maternal education showed a gradient in the distribution of stunting, with a higher proportion among children whose mothers had lower educational attainment. However, the pattern was not statistically significant, suggesting that maternal education alone did not explain the differences in nutritional status in this population.

Exclusive breastfeeding showed a more substantial pattern. Children who did not receive exclusive breastfeeding had a markedly higher proportion of stunting than children who received exclusive breastfeeding. This finding supports the importance of breastfeeding as an early-life protective factor and indicates that breastfeeding support should be a priority in local child-nutrition programs.

Family income was also associated with nutritional status. The proportion of stunting was highest among children from low-income households and lowest among children from high-income households. This pattern suggests that household economic conditions may influence access to diverse foods, healthcare, clean water, and adequate sanitation.

Birth weight history showed relatively similar proportions of stunting between children with low and normal birth weight. This finding suggests that postnatal conditions, including breastfeeding, complementary feeding, infection prevention, and household environmental conditions, may have had a stronger influence on growth status in this study population.

Environmental factors showed important differences. Children living in households with inadequate clean water sources had a higher proportion of stunting than those with adequate water access. Similarly, children living in households with inadequate toilet facilities were nearly four times more likely to be stunted than those living in households with adequate toilet facilities, based on the observed proportions of 33.3% and 8.7%, respectively. These findings highlight the role of water and sanitation in preventing recurrent infections and supporting child growth.

Multivariate Analysis

Variables with a bivariate significance level of $p < 0.25$ were included in the initial multiple logistic regression model. Based on this criterion, exclusive breastfeeding, family income, access to clean water, and toilet facilities were eligible for entry into the initial model. Maternal education and birth weight history were not included in the final model because their bivariate p-values did not meet the predefined entry criterion.

To ensure transparency, variables included in the initial model but subsequently removed during the modeling process should be reported. The removal of water and toilet facilities from the final model does not indicate that these factors are unimportant. Their effects may overlap with family income, household living conditions, or other environmental variables.

Table 3
Multiple Logistic Regression Analysis of Factors Associated with Stunting Prevalence

Variable	B	*P-Value*	Odds Ratio (OR)	95% CI
Exclusive Breastfeeding	1.782	0.000	5.941	2.252-15.676
Family Income	0.645	0.038	1.907	1.035-3.513

Source: Primary Data of In Gariuai Village 2026

The results of the multiple logistic regression analysis in the final model (step 3) showed that exclusive breastfeeding was the most dominant factor associated with stunting occurrence. This variable had a significance value of ρ = 0.000 (p < 0.05) and an odds ratio (OR) of 5.941 with a 95% confidence interval of 2.252–15.676. This indicates that children under five who did not receive exclusive breastfeeding had approximately 5.9 times greater odds of experiencing stunting compared to those who received exclusive breastfeeding.

DISCUSSION

Maternal Education Level and Stunting Occurrence

Stunting is a growth failure condition in children characterized by height-for-age below −2 standard deviations according to WHO standards. This condition reflects chronic malnutrition occurring from early life and results in impaired linear growth, along with long-term consequences for physical and cognitive development. The effects of stunting are permanent and can persist into adulthood, even influencing subsequent generations.

Globally, stunting remains a significant public health problem. The 2025 Joint Child Malnutrition Estimates (JME) report indicates that in 2024, approximately 150.2 million children under five years of age (23.2%) experienced stunting. In addition, 6.6% of children suffered from wasting and 5.5% were overweight. Although the prevalence of stunting has declined from 26.4% in 2012 to 23.2% in 2024, the rate of reduction is insufficient to meet the 2030 SDGs target. In the Asian region, stunting prevalence reaches 23.3%, with

Southeast Asia recording an even higher figure of 31.4%, indicating that the burden of this problem remains substantial in this region.

In Indonesia, the prevalence of stunting has shown a declining trend in recent years. SSGI data recorded a decrease from 24.4% in 2021 to 21.6% in 2022, and 21.5% in 2023. In 2024, the prevalence further declined to 19.8%, surpassing the annual target of 20.1%. Nevertheless, this figure remains far from the medium-term national target of 14.2% by 2029. For comparison, Singapore demonstrates a very low prevalence of approximately 4.4% in children under five years in 2025, reflecting the success of a more optimal health and nutrition system.

In contrast to the declining global and national trends, Timor-Leste continues to face a high prevalence of stunting. The 2020 TLFNS data showed a stunting prevalence of 47.1% among children aged 0–59 months, although this represents a decrease from previous years. Prevalence was higher among boys and in rural areas. In Baucau Municipality, stunting prevalence reached 48.8%, with significant proportions of severe and moderate stunting. More recent data from 2023–2024 indicate a decline to 32%, but this figure remains far from the SDGs target of below 25%.

The causes of stunting are multifactorial, encompassing both direct and indirect factors. Direct factors include maternal nutritional intake during pregnancy, nutritional status of children under five, exclusive breastfeeding practices, and incidence of infections. Indirect factors involve socioeconomic conditions, parental education, and access to clean water and sanitation. Research indicates that mothers with chronic energy deficiency have a higher risk of giving birth to stunted children, while the absence of exclusive breastfeeding significantly increases the risk. In addition, sanitation factors such as poor sanitation and limited access to clean water also contribute substantially to the occurrence of stunting.

In Gariuai Village, Baucau Municipality, stunting remains a serious challenge. This

area faces economic constraints, limited access to health services, and inadequate facilities for clean water and sanitation. Out of a total of 557 children under five aged 24–59 months, several cases of stunting and malnutrition have been recorded in the catchment area of the Wailili Community Health Center. Preliminary interviews indicate that low maternal education, insufficient exclusive breastfeeding practices, and inadequate sanitation conditions are the main contributing factors. Based on these conditions, this study aims to analyze the factors associated with the occurrence of stunting among children under five aged 24–59 months in Gariuai Village, Baucau Municipality, Timor-Leste in 2025.

Exclusive Breastfeeding and Stunting Occurrence

The finding that exclusive breastfeeding was the dominant determinant of stunting in Gariuai reinforces the biological importance of breastfeeding during early life. Breast milk provides energy, essential nutrients, and immunological components that support infant growth and protect against infections. Recurrent diarrhea and respiratory infections may reduce nutrient absorption and increase nutritional requirements, thereby contributing to impaired linear growth.

Exclusive breastfeeding may also protect children through mechanisms beyond nutrient provision. Breast milk supports immune maturation, reduces exposure to contaminated food and water during early infancy, and may strengthen the child's ability to recover from common infections. These mechanisms help explain why breastfeeding remains a central component of strategies for preventing child undernutrition and stunting.

The finding is consistent with previous research showing that children who are not exclusively breastfed may face greater nutritional and infectious risks during the first six months of life. Community-based interventions, including breastfeeding promotion through the SISCa program, are therefore important in Timor-Leste. Such interventions should provide mothers with practical support, address breastfeeding difficulties, and involve

family members who influence infant-feeding decisions.

The importance of exclusive breastfeeding should not be interpreted as reducing stunting prevention to a single intervention. Breastfeeding must be followed by timely, adequate, safe, and diverse complementary feeding after six months, together with continued growth monitoring, infection prevention, and access to healthcare. Nevertheless, the present findings indicate that breastfeeding support should remain one of the highest priorities in stunting-prevention programs in Gariuai.

Family Income and Stunting Occurrence

The association between family income and stunting indicates that household economic conditions influence children's access to adequate nutrition and health-supporting environments. Families with limited income may have difficulty purchasing diverse foods, accessing healthcare, obtaining safe water, and maintaining adequate sanitation. Economic constraints can therefore affect several pathways that contribute to child growth failure.[1–3]

Income alone, however, does not fully determine the quality of a child's diet. The number of household members, the allocation of income to food and non-food expenses, maternal knowledge, food preferences, and the availability of locally produced food also influence nutritional outcomes. A household classified as having moderate income may still experience food insecurity if its resources are distributed among many family members or if food prices are high.

The findings support the UNICEF conceptual framework, which identifies socioeconomic conditions as important indirect determinants of child nutrition. Improving household income should therefore be accompanied by nutrition education, food-security initiatives, livelihood support, and improved access to maternal and child health services. Integrated interventions are more likely to produce sustainable improvements than income-

based interventions alone..

Birth Weight History and Stunting Occurrence

The absence of a clear association between birth weight history and stunting prevalence suggests that postnatal conditions may have played a more influential role in determining child growth in this population. Birth weight is an important early-life indicator, but it does not determine a child's subsequent growth independently of breastfeeding, complementary feeding, infection prevention, and healthcare access.

The concept of catch-up growth provides a possible explanation. Children born with low birth weight may achieve more favorable growth when they receive adequate nutrition, appropriate care, and a supportive household environment after birth. Conversely, children born with normal birth weight may later become stunted when exposed to inadequate feeding, recurrent infections, food insecurity, or poor sanitation. These findings highlight the importance of continuous monitoring beyond the delivery period. Birth weight should be recorded as part of routine maternal and child health services, but prevention programs should also focus on breastfeeding, complementary feeding, infection control, and regular growth assessment. A normal birth weight should not be interpreted as protection against stunting throughout childhood

Clean Water Source and Stunting Occurrence

The association observed between access to clean water and stunting indicates that household water conditions may influence child growth through repeated exposure to infectious pathogens. Unsafe water can contribute to diarrhea and other gastrointestinal infections, which may impair nutrient absorption, reduce appetite, and increase nutritional requirements. These effects can accumulate over time and interfere with linear growth.

Adequate water access also supports hygiene practices, including handwashing, food preparation, utensil cleaning, and child hygiene. Therefore, the effect of clean water is not

limited to drinking water alone. Its broader contribution to household hygiene may reduce the frequency of infection and improve the effectiveness of nutrition interventions.

The findings support the need to consider water access as part of stunting prevention rather than treating it as a separate infrastructure issue. Community health programs should combine nutrition counseling with practical education on water treatment, safe storage, hand hygiene, and the prevention of contamination during food preparation.[9–11]

Toilet Facility and Stunting Occurrence

The association between toilet facilities and stunting highlights the importance of household sanitation in child health. Inadequate toilet facilities may increase environmental contamination and facilitate the transmission of diarrhea, intestinal parasites, and other infections. Repeated exposure to these infections can reduce nutrient absorption and contribute to chronic growth impairment.

Sanitation conditions may also contribute to environmental enteric dysfunction, a condition associated with repeated exposure to fecal pathogens and impaired intestinal function. Even when a child's food intake is adequate, persistent environmental contamination may limit the body's ability to absorb and utilize nutrients effectively.

Improving access to hygienic toilets should therefore be integrated with handwashing promotion, safe disposal of child feces, household cleanliness, and community-level environmental management. Sanitation interventions are likely to be most effective when infrastructure improvements are accompanied by sustained behavior-change activities..

Relatively Low Stunting Prevalence in Gariuai

The observed stunting prevalence in Gariuai was lower than the reported prevalence of approximately 32% in Baucau Municipality. This difference may indicate that children in Gariuai benefit from more favorable local conditions, although the comparison should be interpreted cautiously because the two estimates may differ in sampling procedures, age

composition, measurement timing, and case-definition procedures.

One possible explanation is more effective implementation of community-based health and nutrition activities, including SISCa services, growth monitoring, breastfeeding counseling, and early identification of children at nutritional risk. If these services are more consistently accessed or implemented in Gariuai, they may contribute to earlier support for mothers and children and reduce the progression of growth faltering.

Local water and sanitation conditions may provide another explanation. If a greater proportion of households in Gariuai has access to safe water or adequate toilet facilities than the municipal average, children may experience fewer recurrent infections. Differences in agricultural patterns may also contribute if households have better access to locally produced food, livestock products, or diverse crops throughout the year.

However, the lower prevalence should not be interpreted as evidence that stunting is no longer a major concern in Gariuai. Differences between village-level and municipality-level estimates may also result from sampling variation, underrepresentation of vulnerable households, or differences in measurement quality. Continued surveillance and standardized anthropometric assessment are necessary to determine whether the observed lower prevalence is sustained over time.

Interpretation of the Multivariate Findings

The bivariate findings indicate that water access and toilet facilities were individually associated with stunting prevalence. However, these variables did not remain statistically significant in the final multiple logistic regression model after adjustment for other factors. This pattern suggests that their apparent effects may overlap with, or be partly explained by, other variables such as family income, breastfeeding practices, household living conditions, and access to health services.

One possible explanation is confounding. Families with higher income may be more

likely to have adequate toilets and safer water sources, while also being better able to provide nutritious food and access healthcare. When income and other determinants are entered into the same regression model, the independent contribution of water or sanitation may become smaller because part of their association with stunting is shared with socioeconomic conditions.

Multicollinearity may also have affected the regression results. Water access, toilet facilities, household income, and overall living conditions are often correlated. When correlated variables are analyzed simultaneously, standard errors may increase and individual variables may no longer reach statistical significance, even though they remain important from a public health perspective. This does not mean that water and sanitation are unimportant; rather, their effects may operate through a broader socioeconomic and environmental pathway.

The relatively small number of stunting cases may have further limited the stability of the multivariate model. With a low prevalence of stunting, the number of outcome events available for estimating several predictors is limited. Consequently, the final model should be interpreted cautiously, and future studies should use larger samples, assess collinearity diagnostics, and report model-fit statistics to improve confidence in the findings..

Limitations of the Study

This study has several limitations. First, the cross-sectional design measures exposure and outcome at the same point in time. Consequently, the study can identify statistical associations but cannot establish a temporal sequence or confirm causality. For example, although exclusive breastfeeding was associated with stunting prevalence, the design cannot fully determine the timing and pathways through which breastfeeding, infections, household conditions, and later feeding practices influenced growth.

Second, the study included children aged 24–59 months and therefore did not directly

assess the full first 1,000 days of life, which includes pregnancy and the period from birth through the first two years. This period is critical because many determinants of stunting begin before birth or during the first two years of life. Information concerning maternal nutrition during pregnancy, antenatal care, early initiation of breastfeeding, and feeding practices during infancy may have been subject to recall limitations.

Third, several variables, including breastfeeding history, household income, water source, and toilet facilities, were based on respondent reports. These responses may be affected by recall bias or social desirability bias. In addition, the study was conducted in one village, so the findings may not be directly generalizable to all communities in Baucau Municipality or Timor-Leste.

Future research should use longitudinal designs to follow mothers and children from pregnancy or birth through the first two years and beyond. Such designs would help clarify the causal pathways linking maternal nutrition, breastfeeding, complementary feeding, infections, household income, water, sanitation, and stunting.[3,6–8,13] Larger samples and standardized measurements would also improve the precision and generalizability of the findings..

CONCLUSIONS AND RECOMMENDATIONS

This study identified factors associated with the prevalence of stunting among children aged 24–59 months in Gariuai Village, Baucau Municipality, Timor-Leste, in 2026. The findings showed that maternal education level and birth weight history were not significantly associated with stunting prevalence. In contrast, exclusive breastfeeding, family income, access to clean water, and toilet facilities were significantly associated with stunting prevalence among children under five.

Exclusive breastfeeding was found to be the most influential factor associated with

stunting. Children who did not receive exclusive breastfeeding were significantly more vulnerable to stunting than those who were exclusively breastfed. This finding highlights the importance of strengthening exclusive breastfeeding practices, improving household economic conditions, and ensuring access to clean water and adequate sanitation as essential strategies for stunting prevention.

The recommendations of this study are directed toward the community, mothers of children under five, local health services, local authorities, and future researchers. For the community, stunting prevention should focus on improving nutritional and environmental conditions by using safe water sources, maintaining adequate toilet facilities, practicing proper hygiene, and providing balanced and nutritious food according to children's age and developmental needs. For mothers of children under five, greater attention should be given to fulfilling children's nutritional needs through exclusive breastfeeding during the first six months of life, followed by appropriate and nutritionally balanced complementary feeding. Mothers are also encouraged to monitor children's growth regularly, maintain household hygiene, and seek health services when children experience recurrent infections or growth problems.

The Wailili Community Health Center should prioritize breastfeeding counseling, particularly for families with low incomes and those who may face difficulties in maintaining adequate child nutrition. Counseling should include the benefits of exclusive breastfeeding, practical support for breastfeeding mothers, appropriate complementary feeding, child growth monitoring, and referral services for children at risk of growth faltering. Local authorities should prioritize improvements to water infrastructure for households that currently use unfit or inadequate water sources. These efforts should include expanding access to safe water, improving sanitation facilities, supporting household hygiene practices, and strengthening community-based monitoring of environmental health conditions.

For future researchers, longitudinal study designs are recommended to better understand the causal pathways between breastfeeding practices, household socioeconomic conditions, water and sanitation access, childhood infection history, and stunting. Future studies may also examine maternal nutrition during pregnancy, the quality and adequacy of complementary feeding, childhood infection history, dietary diversity, household food security, and access to maternal and child health services using larger sample sizes and more comprehensive methods.

Although these findings are specific to Gariuai Village, the important role of exclusive breastfeeding provides a critical lesson for stunting prevention programs throughout Baucau Municipality. Strengthening breastfeeding support, particularly among vulnerable and low-income families, should remain a priority in local maternal and child health programs.

BIBLIOGRAPHY

1. World Health Organization. Global nutrition targets 2030: stunting brief. Geneva: WHO; 2025.
2. UNICEF. Conceptual framework on stunting. New York: UNICEF; 2023.
3. Azriani A, et al. Long-term consequences of childhood stunting on physical and cognitive development: a systematic review. J Glob Health. 2024;14:04012.
4. UNICEF, WHO, World Bank Group. Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates – Key findings of the 2025 edition. Geneva: WHO; 2025.
5. World Health Organization. Global nutrition targets 2030: policy brief series. Geneva: WHO; 2025.
6. Ministry of Health of the Republic of Indonesia. Survei Status Gizi Indonesia (SSGI) 2024. Jakarta: Kemenkes RI; 2025.
7. Health Development Policy Agency. Portrait of stunting in Indonesia. Jakarta: BKPK Kemenkes RI; 2025.
8. Office of the Vice President of the Republic of Indonesia. Stunting rate falls below 20 percent: national commitment to accelerate stunting reduction. Jakarta: Setwapres RI; 2025.

9. Singapore Department of Statistics. SDG Indicator 2.2.1: Prevalence of stunting among children under 5 years. Singapore: SingStat; 2026.
10. UNICEF, Ministry of Health Timor-Leste. Timor-Leste Family Nutrition Survey (TLFNS) 2020. Dili: UNICEF & MoH Timor-Leste; 2022.
11. UNMICS, WFP. Multisectoral Nutrition Action Plan Timor-Leste 2025–2030. Dili: UNMICS & WFP; 2025.
12. Government of Timor-Leste. Unidade de Missão para o Combate ao "Stunting" (UNMICS) launch. Dili: GovTL; 2026.
13. Danaei G, Sundaram N, Giménez Sánchez H, et al. Risk factors for childhood stunting in low- and middle-income countries: a systematic review and meta-analysis. PLoS One. 2016;11(11):e0165101.
14. Victora CG, Bahl R, Barros AJD, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet. 2016;387(10017):475–490.
15. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382(9890):427–451.
16. World Health Organization. Infant and young child feeding: fact sheet. Geneva: WHO; 2021.
17. UNICEF. Conceptual framework on stunting. New York: UNICEF; 2021.
18. Pransika A, et al. Exclusive breastfeeding and stunting among children under five in Indonesia: a cross-sectional study. J Nutr Public Health. 2024;7(2):45–56.
19. Ministry of Health Timor-Leste, UNICEF. Integrated Community Health and Nutrition Service (SISCa) operational guidelines. Dili: MoH Timor-Leste & UNICEF; 2022.
20. Julianawati I, et al. Family income and stunting among children under five in Indonesia: a cross-sectional study. J Public Health Res. 2023;12(3):245–256.
21. Headey D, Alderman H. The economic determinants of child nutrition: evidence from low- and middle-income countries. World Bank Econ Rev. 2019;33(2):219–247.
22. Shinta R, et al. Household income, sanitation, and stunting in Indonesian children: a secondary data analysis. Indones J Health Dev. 2022;4(1):12–23.
23. UNICEF. Conceptual framework on stunting. New York: UNICEF; 2021.
24. World Bank. Food inflation and household food security in low- and middle-income countries. Washington, DC: World Bank; 2023.
25. Victora CG, Bahl R, Barros AJD, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet. 2016;387(10017):475–490.

26. Desmond C, Casale M. Catch-up growth in low birth weight infants: a systematic review. Matern Child Nutr. 2017;13(4):e12456.
27. Prentice AM, et al. Critical windows for nutritional interventions against stunting. Am J Clin Nutr. 2013;97(5):911–918.
28. Nindi S, et al. Access to clean water and stunting among children under five in Indonesia: a community-based study. J Environ Health. 2024;15(2):78–89.
29. Maulina D, et al. Water, sanitation, and hygiene (WASH) factors associated with stunting in Indonesian children. J Public Health Epidemiol. 2022;14(3):101–112.
30. World Health Organization. WHO global water, sanitation and hygiene: annual report 2024. Geneva: WHO; 2025.
31. Azhary F, et al. Household toilet facilities and stunting among children under five in Indonesia: a cross-sectional analysis. J Community Health. 2023;8(1):34–45.
32. Danaei G, Sundaram N, Giménez Sánchez H, et al. Risk factors for childhood stunting in low- and middle-income countries: a systematic review and meta-analysis. PLoS One. 2016;11(11):e0165101.
33. UNMICS, WFP. Multisectoral Nutrition Action Plan Timor-Leste 2025–2030. Dili: UNMICS & WFP; 2025.
34. Ministry of Health Timor-Leste, UNICEF. Integrated Community Health and Nutrition Service (SISCa) operational guidelines. Dili: MoH Timor-Leste & UNICEF; 2022.