CASE STUDY

Determinants of stunting and prevention strategies in remote villages of West Aceh, Indonesia: A case–control study

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Abstract

This study examined determinants of stunting among children aged 24–59 months in remote rural areas of West Aceh, Indonesia, and proposed context-specific prevention strategies. A case–control study was conducted in the Kaway XVI sub-district between March and June 2022, involving 33 stunted and 33 non-stunted children selected from the same communities. Data were collected through maternal interviews, anthropometric measurements, and health records, assessing nutritional care practices, household sanitation, food availability, infectious disease history, maternal knowledge, and breastfeeding practices. Multivariate logistic regression showed that inadequate household sanitation (aOR = 26.41), poor nutritional care practices (aOR = 17.43), limited household food availability (aOR = 8.96), and frequent infectious diseases (aOR = 8.45) were independently associated with stunting. These findings demonstrate the relative strength of caregiving, environmental, and food access determinants in a highly resource-limited setting. A multilevel prevention model guided by the MATCH framework is proposed to inform integrated, community-based stunting prevention strategies in remote rural areas. *(Afr J Reprod Health 2026; 30 [7]: 139-149).*

Keywords: Stunting, Child Nutrition, Sanitation, Food Security, Risk Factors, Indonesia

Résumé

Cette étude a examiné les déterminants du retard de croissance chez les enfants de 24 à 59 mois dans des zones rurales reculées de l'Aceh occidental, Indonésie, et a proposé des stratégies de prévention adaptées. Une étude cas-témoins a été menée dans le sous-district de Kaway XVI (mars-juin 2022) auprès de 33 enfants présentant un retard de croissance et 33 enfants non atteints issus des mêmes communautés. Les données ont été collectées via entretiens maternels, mesures anthropométriques et dossiers de santé, évaluant les pratiques de soins nutritionnels, l'assainissement du ménage, la disponibilité alimentaire, l'historique des infections, les connaissances maternelles et l'allaitement. La régression logistique multivariée a montré qu'un assainissement insuffisant (aOR = 26,41), des soins nutritionnels inadéquats (aOR = 17,43), une faible disponibilité alimentaire (aOR = 8,96) et des infections fréquentes (aOR = 8,45) étaient indépendamment associés au retard de croissance. Ces résultats soulignent la force relative des déterminants liés aux soins, à l'environnement et à l'accès à la nourriture. Un modèle de prévention multiniveau basé sur le cadre MATCH est proposé pour guider des interventions communautaires intégrées. *(Afr J Reprod Health 2026; 30 [7]: 139-149).*

Mots-clés: Retard de croissance; Nutrition de l'enfant; Assainissement; Sécurité alimentaire; Facteurs de risque; Indonésie

Introduction

One of the most pressing health issues in recent years has been child nutrition, especially stunting. Stunting, a condition where children experience impaired growth, affects their morbidity, cognitive development, and long-term human potential.[1] Children who suffer from stunting often display reduced cognitive abilities, poor learning outcomes, and inadequate psychosocial development.[2] Beyond childhood, stunting has important implications for reproductive health. Girls who are stunted in early life are more likely to become short-statured women, increasing their risk of adverse pregnancy outcomes, including anemia, obstructed labor, and the delivery of low birth weight infants.[3] This intergenerational cycle of undernutrition perpetuates poor maternal and child health outcomes across generations, underscoring the importance of stunting prevention for both child

development and women's reproductive health. Stunting is measured using the length/height-for-age z-score (HAZ), with children under five classified as stunted if their HAZ is below -2.0 standard deviations.[4]

The etiology of stunting is multifactorial. Key determinants include poor maternal nutrition, low birth weight (LBW), inadequate infant and young child feeding practices, suboptimal parenting behaviors, and repeated infections associated with unhealthy household environments.[5] LBW, defined as birth weight below 2500 grams, substantially increases the risk of growth faltering, developmental delay, and mortality.[6] At the population level, these individual and household factors are further shaped by broader community and environmental contexts, such as access to health services, sanitation, and social support systems.

Indonesia continues to face a substantial burden of stunting, despite notable progress in recent years. According to the 2024 Indonesian Nutritional Status Survey (SSGI), the national prevalence of stunting among children under five declined to 19.8%, down from 21.5% in 2023.[7] Although this figure has fallen slightly below the World Health Organization (WHO) public health threshold of 20%, it remains above the national stunting reduction target of 14.2% by 2025-2029 as outlined in Indonesia's National Medium-Term Development Plan.[8,9] These gaps indicate that structural, behavioral, and environmental challenges persist, particularly in disadvantaged and remote areas. In response, the Indonesian government has prioritized stunting prevention through multisectoral and community-based approaches, emphasizing village-level interventions to improve nutrition, caregiving practices, and environmental health.[10]

Community participation has been recognized as a critical component of sustainable stunting prevention. Village-based initiatives encourage families to utilize local resources and strengthen social support networks to improve maternal and child health practices.[11] Integrated Service Posts (Posyandu) play a pivotal role in this strategy by providing regular growth monitoring, nutrition counseling, and early detection of growth problems through community engagement involving volunteers and primary healthcare workers.[12] However, the effectiveness of these initiatives varies widely across regions, particularly in remote and rural areas.

In West Aceh Regency, stunting remains a significant public health concern, especially in remote villages. Stunting prevalence increased from 25.5% to 33.22% between 2015 and 2017 before declining to 22% in 2018, with disproportionately higher rates observed among socioeconomically disadvantaged households.[13] Despite the region's agricultural potential, unhealthy lifestyle practices, limited access to health information, and suboptimal household environments continue to contribute to child growth failure.[14] These patterns suggest that stunting in rural West Aceh is driven by interacting individual, familial, and environmental determinants rather than by a single causal factor.

Despite the growing body of literature on stunting in Indonesia, there remains a critical research gap. Few studies have comprehensively examined the combined influence of maternal knowledge, parenting practices, and household environmental conditions on stunting in remote rural settings, particularly in West Aceh. Moreover, existing studies rarely translate empirical findings into structured, context-specific prevention strategies that can effectively guide community-level action.[15,16]

To address this gap, this study adopts the Multilevel Approach to Community Health (MATCH) as its core conceptual framework to examine the determinants of stunting and to systematically map these determinants onto multilevel, context-specific prevention strategies. MATCH is particularly relevant to rural West Aceh as it conceptualizes health outcomes as the product of interacting levels of influence, including individual behaviors (maternal knowledge), interpersonal dynamics (parenting practices), and broader community and environmental conditions (household sanitation and access to community health services). By positioning MATCH as the guiding framework, this study facilitates the translation of empirical findings into practical, community-based recommendations aligned with existing health structures, such as Posyandu, and addresses the complex realities of stunting

prevention in remote villages. Therefore, this study aimed to identify the key determinants of stunting among children under five in remote villages of the Kaway XVI sub-district, West Aceh, Indonesia, and to translate these determinants into multilevel, context-specific prevention strategies guided by the MATCH framework.

Methods

Study design and setting

This observational case–control study was conducted to identify factors associated with stunting among children and to estimate the magnitude of risk for each factor, expressed as odds ratios. The study was carried out between March and June 2022 in the Kaway XVI sub-district, West Aceh District, Aceh Province, Indonesia. Kaway XVI is a predominantly rural and geographically remote sub-district characterized by limited transportation infrastructure and a high reliance on agriculture-based livelihoods. Administratively, the sub-district comprises 44 villages. All villages within the sub-district were included as the study area.

Study population and sampling

The study population consisted of children aged 24–59 months, comprising 33 stunted children (cases) and 33 non-stunted children (controls) residing in the Kaway XVI sub-district, West Aceh District. Eligible respondents were the mothers or primary caregivers of the selected children. Eligible stunted children were identified using routine, facility-based growth monitoring records from Posyandu and Puskesmas within the sub-district during the study period. Due to the limited number of eligible stunted children identified, all eligible stunted children were included as cases. Non-stunted children were identified from the same source population and selected as controls using a 1:1 case–control ratio to enhance internal comparability. Control participants were selected through random selection from lists of eligible non-stunted children obtained from Posyandu and Puskesmas records. The sample size was determined based on the availability of eligible stunted children and feasibility considerations related to the remote study setting. No formal a priori statistical power calculation was conducted, and the study is therefore considered exploratory.

Data collection

Data were collected through structured face-to-face interviews with mothers or primary caregivers using a questionnaire adapted from previous studies and national guidelines. Interviews were conducted by trained enumerators to ensure consistency and minimize interviewer bias. Anthropometric measurements of children were conducted during the same visit following standardized WHO procedures. Interviews and measurements were carried out at community health posts (Posyandu) or during home visits, depending on respondent availability. To ensure data quality, completed questionnaires were reviewed on the same day for completeness and internal consistency, and unclear responses were clarified immediately. Data entry was double-checked by the research team prior to statistical analysis to minimize errors.

Study variables

The dependent variable in this study was stunting status among children aged 24–59 months, defined according to the World Health Organization (WHO) child growth standards using the height-for-age z-score (HAZ). Children with HAZ < −2 standard deviations were classified as stunted (cases), while those with HAZ ≥ −2 SD were classified as non-stunted (controls). The independent variables comprised child-related factors, maternal factors, and household factors. Child-related factors included birth weight and birth length obtained from the Maternal and Child Health (MCH) handbook, breastfeeding practices, history of infectious diseases during the previous six months, immunization status, access to health services, age, and sex. Birth weight was categorized as low birth weight (<2,500 g) or normal (≥2,500 g), and birth length as <48 cm or ≥48 cm. Breastfeeding practices were assessed using a 13-item questionnaire and categorized as good or poor, while infection history was categorized as frequent (≥6 episodes) or infrequent (<6 episodes).Maternal factors included maternal knowledge of stunting and nutritional care practices for the children.

Maternal knowledge of stunting was assessed using a 10-item questionnaire (score range 0–10) and categorized as good or poor based on the median score. Nutritional care practices reflected maternal feeding and caregiving behaviors for the children and were measured using an 8-item questionnaire, categorized based on the mean score. Household factors included maternal and paternal height and education, household food availability, and household sanitation conditions. Sanitation was classified as good if households had access to clean water, a sanitary latrine, and a wastewater disposal system, and poor if one or more of these indicators were absent.

Measurement procedures

Anthropometric measurements were conducted following WHO standards. For children under 24 months of age, recumbent length was measured using a length board, while standing height was measured using a microtoise with an accuracy of 0.1 cm for children aged ≥24 months. Birth weight and birth length data were obtained from the Maternal and Child Health (MCH) handbook records. Infant feeding practices were assessed using a structured questionnaire consisting of 13 dichotomous (yes/no) items covering exclusive breastfeeding, feeding frequency, early introduction of complementary foods, and breastfeeding practices during maternal or infant illness, and were classified into good or poor categories. History of infectious diseases was collected using a structured questionnaire covering episodes of acute respiratory infections, diarrhea, fever, cough, and cold within the previous six months, with frequency categorized as rare (<6 episodes) or frequent (≥6 episodes). Immunization status was assessed based on records in the MCH handbook and categorized as complete or incomplete according to the national immunization schedule. Access to and utilization of health services were assessed using categorical questions regarding availability, accessibility, and perceived adequacy of services.

Maternal knowledge regarding stunting was assessed using a structured questionnaire consisting of 10 multiple-choice items covering causes, impacts, prevention of stunting, exclusive breastfeeding, complementary feeding, and routine growth monitoring, with total scores categorized into good or poor knowledge. Nutritional parenting practices were measured using an 8-item multiple-choice questionnaire assessing dietary diversity, meal scheduling, portion control, avoidance of unhealthy foods, and parental guidance on healthy eating. Household food availability was assessed using a 5-item questionnaire covering access to adequate food, dietary diversity, and perceived limitations in obtaining nutritious food. Environmental factors were assessed using a structured observation checklist consisting of three dichotomous items: access to clean water, availability of a sanitary latrine, and the presence of a wastewater disposal system. All questionnaires were adapted from standardized national and international guidelines commonly used in public health research.[17–21]

Data analysis

Data were analyzed using Stata version 17.0. Univariate analysis was conducted to describe the frequency distributions of study variables. Bivariate associations between independent variables and stunting status were assessed using unadjusted logistic regression to estimate crude odds ratios (ORs) and 95% confidence intervals (CIs). For variables with zero cell counts, Fisher's exact test was applied, and odds ratios were not estimated. Variables with p-values < 0.05 in the bivariate analysis were subsequently included in a multivariate logistic regression model to identify factors independently associated with stunting. Multivariate results are presented as adjusted odds ratios (AORs) with 95% confidence intervals, and statistical significance was set at $p < 0.05$.

Ethical considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Permission to conduct the study and to access Posyandu and Puskesmas records was obtained from the West Aceh District Health Office prior to data collection. The study involved non-interventional data collection through interviews and anthropometric measurements, and all data were anonymized prior to analysis. Written informed consent was obtained from all participating mothers. Participation was voluntary,

and confidentiality and anonymity were strictly maintained to protect participants' rights and welfare.

Results

Characteristics of the study population

As shown in Table 1, children aged 24–59 months in the case group were more likely to have a history of low birth weight (<2,500 g), shorter birth length (<48 cm), poor breastfeeding practices, and frequent infections compared to the control group. Maternal knowledge gaps and suboptimal caregiving practices were also more common among cases. Household factors, including parental education, food availability, and household environmental sanitation, were less favorable among cases.

Table 1 presents the bivariate associations between children-related factors and stunting among children aged 24–59 months. Poor breastfeeding practices and frequent infectious diseases were more prevalent among cases than controls, and both factors showed statistically significant associations with stunting in the bivariate analysis. Children with poor breastfeeding practices had higher odds of being stunted (OR = 4.24; 95% CI: 1.32–14.07), while children with a history of frequent infections were also more likely to be stunted (OR = 6.13; 95% CI: 1.89–20.52).

Table 2 presents the bivariate associations between maternal factors and stunting among children aged 24–59 months. Poor maternal knowledge of stunting and inadequate nutritional care practices were more prevalent among cases than controls, and both factors showed statistically significant associations with stunting in the bivariate analysis. Children whose mothers had poor knowledge of stunting had substantially higher odds of being stunted (OR = 3.54; 95% CI: 1.14–11.15), while inadequate nutritional care practices were also strongly associated with stunting (OR = 7.43; 95% CI: 2.19–26.38).

Table 3 presents the bivariate associations between household factors and stunting status among children aged 24–59 months. Parental height and parental education were not statistically significantly associated with stunting in the bivariate analysis. In contrast, household food availability and household environmental sanitation showed strong and statistically significant associations with stunting. Children living in households with poor food availability had substantially higher odds of being stunted (OR = 12.88; 95% CI: 3.41–53.27), as did those living in households with poor environmental sanitation (OR = 14.06; 95% CI: 3.76–55.53). All odds ratios presented in this table represent unadjusted (crude) estimates derived from logistic regression analysis.

Table 4 presents the results of the multivariate logistic regression analysis conducted to estimate adjusted odds ratios while controlling for potential confounding. Stunting status (stunted vs. non-stunted) was used as the dependent variable. After adjustment, poor nutritional care practices and poor household environmental sanitation remained the strongest independent factors associated with stunting among children aged 24–59 months. Limited household food availability and frequent infectious diseases also remained significantly associated with stunting, although with lower magnitudes of association. These findings indicate that the observed associations persist after accounting for other factors included in the model

Discussion

This study identified nutritional care practices, infectious diseases, household food availability, and socioeconomic conditions as key factors associated with stunting among children aged 24–59 months living in a geographically remote rural area of West Aceh. While these determinants are consistent with findings from previous studies conducted in Aceh Province and other rural settings, this study adds value by demonstrating which factors remain independently associated with stunting after mutual adjustment in a multivariate model within a highly resource-limited and geographically remote sub-district.

Table 1: The association between child-related factors and stunting among children aged 24–59 months in Kaway XVI Sub-district, West Aceh District

Variables	Categories	Cases n (%)	Control n (%)	p-value	OR	(CI 95%)
Birth weight	< 2,500 g	5 (15.2)	0 (0)	0.053	-	-
	> 2,500 g	28 (84.8)	33 (100)	*Ref*		
Birth length	< 48 cm	17 (51.5)	10 (30.3)	0.079	2.44	0.79 – 7.61
	> 48 cm	16 (48.5)	23 (69.7)	*Ref*		
Breastfeeding practice	Poor	25 (75.8)	19 (57.6)	0.005*	4.24	1.32 – 14.07
	Good	8 (24.2)	14 (42.4)	*Ref*		
Infection history	Frequently	24 (72.7)	10 (30.3)	0.000*	6.13	1.89 – 20.52
	Fewer	9 (27.3)	23 (69.7)			
Health care and immunization access	Adequate	17 (51.5)	20 (60.6)	0.456	0.69	0.23 – 2.04
	Inadequate	16 (48.5)	13 (39.4)	*Ref*		
Sex	Male	20 (60.6)	18 (54.5)	0.618	1.28	0.43 – 3.82
	Female	13 (39.4)	15 (45.5)	*Ref*		

**Significant: p < 0.05*
Odds ratios in this table are unadjusted (crude OR)
p-values were obtained using unadjusted logistic regression, except for variables with zero cell counts, for which Fisher's exact test was applied

Table 2: The association of maternal factors and stunting among children aged 24–59 months in the remote rural area of Kaway XVI sub-district, West Aceh District

Variables	Categories	Cases n (%)	Control n (%)	p-value	OR	(CI 95%)
Mother's knowledge	Poor	20 (60.6)	10 (30.3)	0.013*	3.54	1.14 – 11.15
	Good	13 (39.4)	23 (69.7)	*Ref*		
Nutritional care practices	Poor	26 (78.8)	11 (33.3)	0.000*	7.43	2.19 – 26.38
	Good	7 (21.2)	22 (66.7)	*Ref*		

**Significant: p < 0.05*
Odds ratios in this table are unadjusted (crude OR)

Table 3 : The association of household factors with stunting among children aged 24–59 months in the remote rural area of Kaway XVI sub-district, West Aceh District

Variables	Categories	Cases n (%)	Control n (%)	p-value	OR	(CI 95%)
Father's height	< 165 cm)	20 (60.6)	17 (51.5)	0.456	1.45	0.49 – 4.31
	≥ 165 cm)	13 (39.4)	16 (48.5)	*Ref*		
Mother's height	< 156 cm)	30 (90.9)	29 (87.9)	0.688	1.38	0.21 – 10.19
	≥ 156 cm)	3 (9.1)	4 (12.1)	*Ref*		
Father's education	Primary	23 (69.7)	25 (75.8)	0.580	0.74	0.21 – 2.49
	Secondary and higher	10 (30.4)	8 (24.2)	*Ref*		
Mother's education	Primary	20 (60.6)	27 (81.8)	0.057	0.34	0.10 – 1.19
	Secondary and higher	13 (42.9)	6 (18.1)	*Ref*		
Food availability	Poor	28 (84.8)	10 (30.3)	0.000*	12.88	3.41 – 53.27
	Good	5 (15.2)	23 (69.7)	*Ref*		
Environmental sanitation	Poor	27 (81.8)	8 (24.2)	0.000*	14.06	3.76 – 55.53
	Good	6 (18.2)	25 (75.8)	*Ref*		

**Significant: p < 0.05*
Odds ratios in this table are unadjusted (crude OR)

Table 4 : Multivariate analysis of factors associated with stunting among children aged 24–59 months in Kaway XVI sub-district, West Aceh District

Variables	Categories	Cases n (%)	Control n (%)	p-value	aOR	(CI 95%)
Breastfeeding practice	Poor	25 (75.8)	19 (57.6)	0.666	0.64	0.09 – 4.76
	Good	8 (24.2)	14 (42.4)	*Ref*		
Infection history	Frequently	24 (72.7)	10 (30.3)	0.034*	8.45	1.18 – 60.52
	Fewer	9 (27.3)	23 (69.7)	*Ref*		
Mother's knowledge	Poor	20 (60.6)	10 (30.3)	0.053	7.30	0.97 – 54.77
	Good	13 (39.4)	23 (69.7)	*Ref*		
Nutritional care practices	Poor	26 (78.8)	11 (33.3)	0.010*	17.43	1.98 – 153.58
	Good	7 (21.2)	22 (66.7)	*Ref*		
Food availability	Poor	28 (84.8)	10 (30.3)	0.030*	8.96	1.24 – 64.98
	Good	5 (15.2)	23 (69.7)	*Ref*		
Environmental sanitation	Poor	27 (81.8)	8 (24.2)	0.005*	26.41	2.73 – 255.42
	Good	6 (18.2)	25 (75.8)	*Ref*		

**Significant: p < 0.05*
Odds ratios in this table are adjusted (aOR)

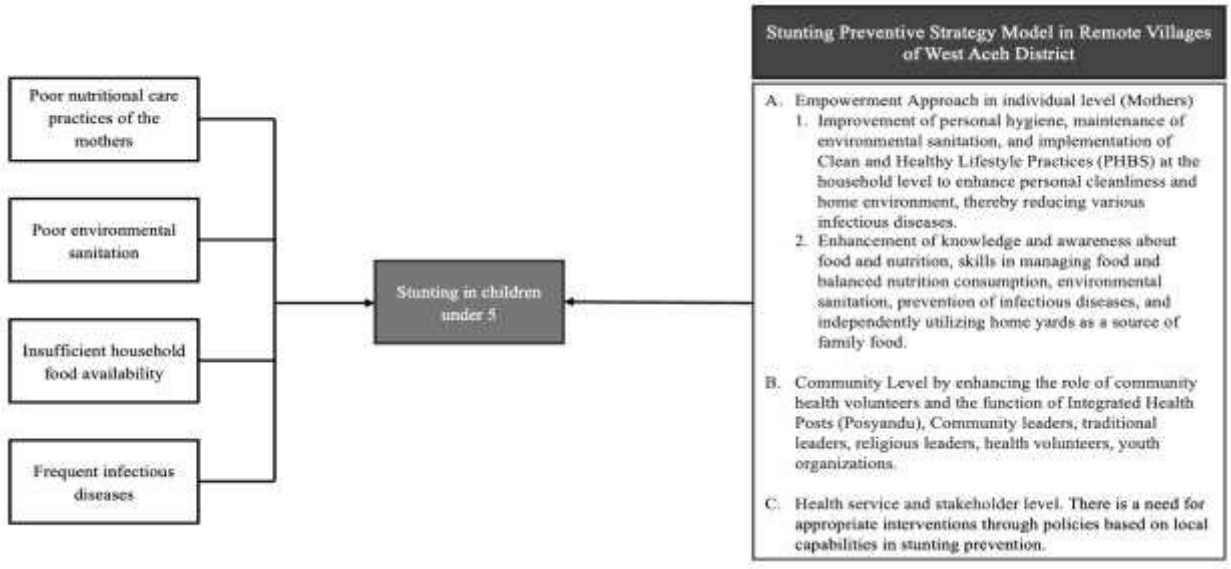

Figure 1: Determinant stunting model and proposed preventive strategy to combat stunting in remote villages in West Aceh District

Unlike earlier studies that primarily relied on bivariate analyses or broader district-level data, the present study disentangles the relative contributions of caregiving practices, household environmental sanitation, food access, and infectious diseases within a single analytical framework, highlighting nutritional care practices and household environmental sanitation as the strongest predictors of stunting. Furthermore, by situating these findings within the MATCH framework as an analytical lens, this study provides a structured interpretation of how behavioral, environmental, and service-related determinants interact to influence stunting, thereby offering actionable evidence for prioritizing interventions in resource-limited rural settings.

Nutritional care practices emerged as one of the strongest factors associated with stunting in this study. This finding aligns with the UNICEF

conceptual framework, which identifies inadequate childcare practices at the household level as a fundamental cause of child malnutrition.[22] Suboptimal feeding behaviors, including limited dietary diversity, inappropriate complementary feeding, and inadequate hygiene practices, have been consistently linked to impaired child growth.[23] Evidence from India and South Africa similarly demonstrates that poor dietary diversity, insufficient meal frequency, and inappropriate complementary feeding are associated with higher rates of stunting and underweight among children aged 24–59 months.[23,24] Proper nutritional care practices, such as ensuring dietary diversity, appropriate portion sizes, utilization of locally available nutritious foods, and adherence to basic hygiene standards, are essential for optimizing child nutritional status. Conversely, inadequate caregiving practices may lead to unbalanced nutrient intake and impaired growth.[25] These findings underscore the importance of strengthening maternal caregiving capacity as a central component of stunting prevention strategies in remote rural settings.

Infectious diseases also showed a significant association with stunting in this study, reinforcing evidence that repeated infections contribute to growth failure among young children. Frequent episodes of acute respiratory infections and diarrhea have been widely documented as risk factors for stunting due to their effects on appetite, nutrient absorption, and metabolic demands.[26,27] Previous studies have similarly reported that recurrent infections substantially increase the likelihood of stunting among children.[28] In remote areas where access to healthcare and sanitation infrastructure is limited, infection prevention through improved hygiene practices, adequate immunization coverage, and strengthened primary healthcare services remains critical.[28]

Household food availability was another important factor associated with stunting. Limited access to adequate and diverse food reflects broader structural challenges, including poverty, unemployment, and low household income, which constrain families' purchasing power and dietary choices.[29,30] In large households, these constraints often result in reduced meal quality and quantity, with families relying on coping strategies such as home gardening.[31] However, such strategies alone may be insufficient to meet the nutritional needs of growing children. These findings highlight the importance of interventions that address household food security, including support for sustainable food production, agricultural improvements, and targeted assistance for low-income families.

Socioeconomic conditions further contextualize the observed associations. Although parental education was not identified as an independent factor in the multivariate analysis, this does not diminish its indirect role. In this study, maternal knowledge was not consistently translated into appropriate caregiving practices, suggesting that knowledge alone is insufficient without enabling conditions such as adequate income, resources, and supportive environments.[32] Many parents in the study area were engaged in agriculture or small-scale informal economic activities, which often provide unstable and limited income. As a result, financial constraints may limit families' ability to apply nutritional knowledge in practice. Similar findings have been reported in other low- and middle-income countries, where income level alone does not guarantee improved child nutritional status unless it is effectively allocated toward dietary needs.[33]

To contextualize these findings within the MATCH framework, the identified factors were mapped to corresponding MATCH components. Nutritional care practices reflect behavioral determinants at the individual and household levels; infectious diseases represent environmental conditions and health service utilization; household food availability corresponds to environmental determinants influencing dietary access; and socioeconomic conditions reflect broader structural and policy-level influences. This mapping illustrates that stunting in remote rural areas of West Aceh is driven by interconnected behavioral, environmental, and structural factors rather than a single determinant. Based on this integration, a multilevel promotional model was developed (Figure 1), linking key determinants, poor nutritional care practices, frequent infections, inadequate sanitation, and limited food availability to coordinate preventive strategies across individual, community, and health service levels. From a practical perspective, these findings suggest

that stunting prevention efforts in remote rural settings should prioritize strengthening maternal caregiving practices, improving household food security, enhancing environmental sanitation, and reducing the burden of infectious diseases through accessible healthcare and immunization services. Community-based platforms such as integrated health posts (Posyandu) play a critical role in delivering nutrition education, monitoring child growth, and fostering community engagement.[34,35] In addition, improving maternal knowledge and awareness of food and nutrition, optimizing household food management, and ensuring dietary balance are important strategies for enhancing sustainable family nutrition in resource-limited settings. Home-based initiatives, such as utilizing household yards for food production, may further support household food availability and dietary diversity.[36]

To address the high prevalence of stunting, priority interventions should also include strengthening education and information for adolescent girls and women, ensuring access to safe water and adequate sanitation, and enhancing household economic capacity.[37,38] Evidence indicates that stunting can be mitigated through well-coordinated and strategic interventions that promote optimal child growth, highlighting the importance of integrated nutrition and health programs.[39] Collectively, these approaches underscore the need for a multisectoral strategy involving health, education, and community sectors, which aligns with and complements the MATCH framework by embedding preventive actions at both household and community levels, thereby supporting sustainable efforts to reduce stunting and improve child health outcomes in resource-limited rural contexts.[40]

Strengths and limitations

The key strength of this study lies in its contextual and empirical application of the MATCH framework to examine stunting determinants in a geographically remote and understudied rural setting. By integrating multivariate analysis with a multilevel conceptual approach, this study provides a structured understanding of how caregiving practices, household environmental conditions, food availability, and infectious diseases interact to influence stunting among children. In addition, the focus on a specific age group (24–59 months) and the use of primary data collected through standardized procedures strengthen the internal consistency of the findings.

Nevertheless, several limitations should be acknowledged. The case–control design precludes causal inference, and the relatively small sample size limits statistical power and generalizability beyond similar remote rural contexts. The modest sample size also constrained the number of variables that could be included simultaneously in the multivariate model, warranting cautious interpretation of the adjusted estimates. Finally, reliance on caregiver recall for some exposure variables may introduce recall bias. Future longitudinal and interventional studies with larger samples are needed to confirm these findings, explore causal pathways, and assess the scalability of the proposed MATCH-based prevention model in diverse settings.

Conclusion

This study demonstrates that stunting among children under five living in remote rural villages of West Aceh District is independently associated with poor nutritional care practices, inadequate household environmental sanitation, limited food availability, and frequent infectious diseases. These findings underscore the interconnected roles of family caregiving capacity, household living conditions, and access to basic resources in shaping child growth outcomes in geographically disadvantaged settings. By integrating these determinants within a multivariate framework, this study provides empirical support for a multilevel interpretation of stunting in remote rural contexts. In response to the identified factors, a MATCH-based multilevel promotional model was developed, emphasizing family empowerment, community engagement, and strengthened primary health services to support stunting prevention during the critical first 1,000 days of life. This context-specific framework offers a practical and integrated approach to guide stunting reduction efforts in resource-limited rural areas.

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Contribution of Authors

Fitriani and Teungku N. Farisni conceptualized the study and designed the overall research framework, while Yarmaliza contributed to the study design, provided resources, and supervised the field implementation. Zakiyuddin and Fitrah Reynaldi conducted the investigation and coordinated field activities. Safrizal and Veni N. Syahputri performed data curation, formal analysis, validation, and prepared the visualizations and tables. Denis O. Handika contributed to the methodology, provided critical input on data interpretation, and assisted in manuscript refinement. Fitriani drafted the original manuscript. All authors participated in writing, review and editing, contributed to the interpretation of findings, critically reviewed the manuscript, and approved the final version.

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