

Review Article

Healthcare Access and Regional Inequalities as Determinants of Childhood Stunting in East Nusa Tenggara, Indonesia: A Systematic Review

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Received 15 May 2026; Accepted 21 July 2026; Published 23 July 2026

ABSTRACT

Background: Stunting remains a major public health problem in Indonesia, particularly in East Nusa Tenggara (NTT) Province, which has the highest prevalence of stunting nationally. The high incidence of stunting in NTT is influenced not only by inadequate nutrition but also by limited access to health services, clean water, and sanitation, as well as socioeconomic and development disparities between regions.

Method: This study employed a systematic review method following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic literature search was conducted through Google Scholar, PubMed, and Garuda databases using the keywords "stunting," "access to health services," "regional inequality," and "East Nusa Tenggara." A total of 1,653 articles were found in the initial search phase, and 12 met the criteria for further analysis.

Results: The study results show that stunting in East Nusa Tenggara is closely related to various multidimensional factors, including limited access to sanitation and clean water, minimal health care facilities, geographic isolation, poverty, and inequality between rural and urban areas.

Conclusion: Stunting in East Nusa Tenggara is a multidimensional problem. Therefore, efforts to address stunting in NTT require an integrated, cross-sectoral approach that emphasizes equitable access to health services, improved sanitation, clean water provision, poverty alleviation, and region-based development.

Keywords: Access to Healthcare Services; East Nusa Tenggara; Regional Inequality; Sanitation; Stunting

INTRODUCTION

Stunting remains a significant chronic nutritional problem in Indonesia. Stunting is a condition of stunted growth in children caused by chronic malnutrition that occurs during the first 1,000 days of life (from pregnancy to age 2).¹ The prevalence of stunting in Indonesia remains relatively high. The prevalence reached 31.8% in 2020, decreasing to 24.4% in 2021, and further to 21.6% in 2022. Despite showing a downward trend, this figure remains concerning, considering the 2024 stunting prevalence target of 14% and the WHO standard of below 20%.²⁻⁴

Based on data from the 2024 Indonesian Nutritional Status Survey (SSGI), the three provinces with the highest stunting prevalence in Indonesia are East Nusa Tenggara (37%), West Sulawesi (35.4%), and Southwest Papua (30.5%).⁵ This figure is well above the national average, which has fallen to 19.8%. The high incidence of stunting is not solely a matter of inadequate nutritional intake. Still, it is also closely related to parental knowledge, attitudes, and behavior, as well as structural factors such as limited access to nutritious food, clean water, proper sanitation, and maternal and child health services.^{6, 7}

Stunting has a broad impact on the quality of human resources, both in the short and long term. Children who experience stunting are at risk of impaired cognitive development, reduced learning capacity, and lower productivity as adults. On a macro scale, high levels of stunting can hamper regional economic development and widen social disparities between regions. In NTT, if issues of access and regional inequality are not addressed immediately, the risk of an intergenerational cycle of poverty and malnutrition will increase. Therefore, stunting is not only a health issue, but also a development and social justice issue that requires cross-sectoral attention.⁸⁻¹⁰

Various prevention efforts have been implemented by various parties, including collaborations between private institutions, non-governmental organizations (NGOs), and the government through health departments in each region. One of the government's flagship programs is the Free Nutritious Meals (MBG) program. However, several issues, such as geographic conditions, limited transportation access, and development disparities between regions, prevent this program from being implemented evenly in remote areas of eastern Indonesia.

Given this complexity, stunting reduction approaches in NTT need to be designed in a context- and region-specific way. Interventions cannot be uniform but must consider geographic barriers, infrastructure limitations, and existing socioeconomic inequalities. Strengthening access to basic health services, increasing household food security, improving clean water and sanitation infrastructure, and integrating nutrition programs with sensitive interventions such as social protection are strategic steps that need to be prioritized. Therefore, studying stunting from the perspective of access and regional inequality is crucial to provide a scientific basis for formulating more targeted and equitable policies in NTT.

METHOD

This systematic review aims to examine the incidence of stunting in East Nusa Tenggara in relation to service access and regional disparities. This method was chosen to collect, review,

and synthesize various previously published research findings to provide a comprehensive overview of the factors contributing to the high prevalence of stunting in East Nusa Tenggara.

The stages in the literature search, selection, and analysis follow the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and consistency throughout the systematic review. The research stages begin with preparing the background, defining the research objectives, and formulating research questions that form the basis for the literature search. The literature search was conducted systematically through several scientific databases, such as Google Scholar, PubMed, and Garuda, using a combination of relevant keywords, including "stunting," "access to health services," "regional inequality," and "East Nusa Tenggara."

Articles obtained from the search process then underwent an initial screening stage, including the removal of duplicate articles and an assessment of the suitability of the title and abstract for the research focus. Furthermore, articles that met the initial criteria were further analyzed based on the established inclusion criteria, namely the article was a scientific study published in a national or international journal, published between 2015 and 2025, discussed stunting in toddlers or children with a focus on factors such as access to health services, geographic conditions, or regional disparities, the research was conducted in Indonesia, specifically in East Nusa Tenggara, and was available in full text.

The initial search yielded 1,653 articles, of which 12 were selected for further analysis. The selection of articles using the PRISMA method (Figure 1).

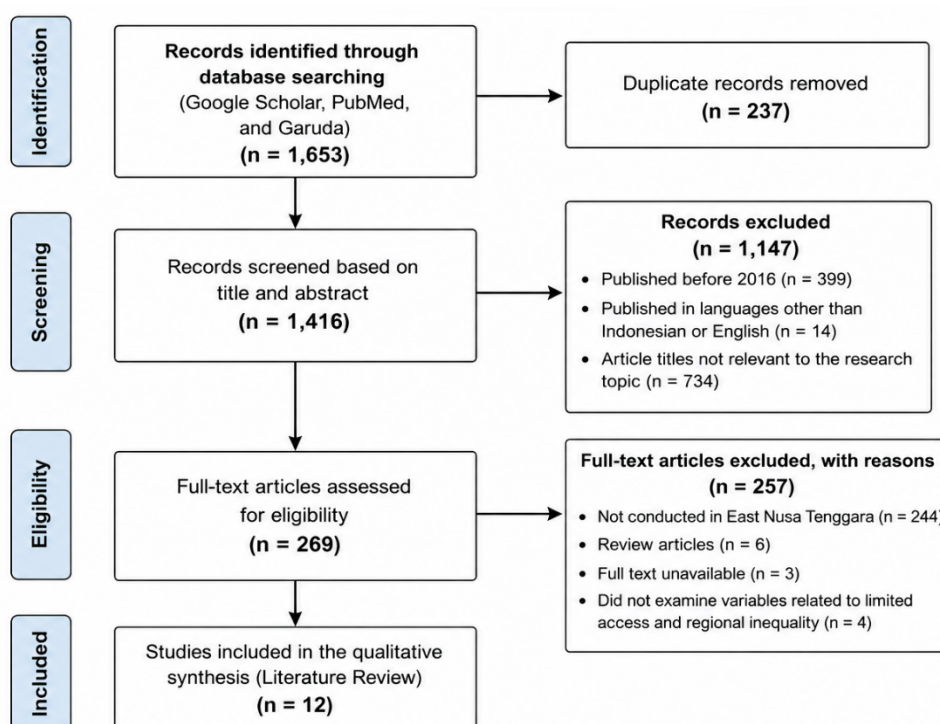


Figure 1. Article Screening Diagram Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

RESULTS

Based on a series of article selections, 12 articles were selected for further analysis to understand the stunting situation in East Nusa Tenggara (Table 1)

Table 1. Summary of selected articles

No	Authors and Year	Title	Method	Results
1	M. R. Nufus (2025)	"The Gath–Geva Algorithm for Clustering Spatial Inequality of Stunting in East Nusa Tenggara Province"	Cluster analysis using the Gath–Geva algorithm in 22 districts/cities in NTT with variables of poverty, access to decent housing, open unemployment, and number of health facilities. Cluster validation using the Silhouette coefficient.	Three regional clusters were formed: (1) low poverty and high health facilities but relatively high unemployment; (2) the most vulnerable areas with high poverty, low housing access, and limited health facilities; (3) relatively stable areas with better housing and low unemployment. The Silhouette value of 0.41 indicates quite good cluster separation.
2	Eflita Meiyetrian, Intje Picauly, Anak Agung Ayu Mirah Adi, Majematang Mading, Pius Weraman, Daniela L. Adeline Boeky, Asmulyati S. Saleh, Jane A. Peni, Varry Lobo, Ahmad Thohir Hidayat, and Siti Fadhillatun Nashriyah (2023)	"Distribusi Stunting dan Determinan Stunting di Provinsi Nusa Tenggara Timur, Indonesia Tahun 2021: Analisis Spasial"	This is an analytical observational study with a cross-sectional design using secondary data from the 2021 Indonesian Nutritional Status Survey (SSGI) on 7,835 toddlers and analyzed using a spatial analysis approach and the Spatial Autoregressive (SAR) model.	The study results showed that low birth weight and short birth length were significantly associated with the incidence of stunting, which exhibited a spatial pattern (cluster). This finding confirms that birth-related factors play a significant role in stunting in East Nusa Tenggara.
3	Dumilah Ayuningtyas, Dwi Hapsari, Rika Rachmalina, and Dian Kusuma (2022)	"Geographic and Socioeconomic Disparities in Child Undernutrition across 514 Districts in Indonesia"	This study uses a quantitative approach with geospatial and statistical analysis (descriptive and Ordinary Least Squares/OLS regression) using secondary data from the 2018 Riskesdas on 93,620 toddlers and socio-economic data from the World Bank to analyze child nutrition disparities between regions in Indonesia.	There are significant geographic and socio-economic disparities in the incidence of undernutrition, where the prevalence is higher in Papua, poor areas, and rural areas compared to developed and urban areas.
4	Siti Sofiaturohmah, Raga Andika Mahasin and Andi Kasman (2025)	"Ketimpangan Pelayanan Kesehatan Sebagai Faktor Determinan Stunting: Studi Perbandingan Antara NTT Dan DKI Jakarta"	Analytical observational design with a cross-sectional approach involving toddlers as samples and analyzing the relationship between various risk factors using bivariate and multivariate statistical tests.	Limited access and quality of health services in East Nusa Tenggara results in a high prevalence of stunting compared to DKI Jakarta.
5	Vitri Widyaningsih, Tri Mulyaningsih, Fitria Nur Rahmawati and	"Determinants of socioeconomic and rural-urban disparities in	An analytical observational study with a cross-sectional design using toddler data as a sample and analyzed using	There are differences in factors related to stunting between children in rural and urban areas, and between

No	Authors and Year	Title	Method	Results
	Dhian Adhitya (2022)	stunting: Evidence from Indonesia”	statistical tests to see the relationship between economic status and the incidence of stunting.	children from poor and non-poor families.
6	Nia Junia Puteri and Laila Fitria (2025)	“Access to Sanitation and Its Impact on Stunting in Toddlers in East Nusa Tenggara, Indonesia”	Cross-sectional design with secondary data analysis of IHS 2023 on 4,224 toddlers, analyzed using chi-square test and multivariate logistic regression	Inadequate sanitation access increases the risk of stunting by 1.56 times compared to good sanitation. Other significantly associated factors include toddler age, gender, and residence, with the risk being particularly higher in rural areas.
7	Ramadhaniyati, Lilis Lestari, Ruka Saito and Akiko Tsuda (2025)	“Exploring Mothers’ Experiences in Accessing Primary Healthcare Service Facilities in Rural Indonesia: Implication for Stunting Prevention”	Descriptive qualitative approach with in-depth interviews with pregnant women and mothers of toddlers in rural areas of West Kalimantan	Access to primary health care remains limited due to geographic and economic barriers, as well as underutilization. These conditions contribute to the low effectiveness of stunting prevention efforts in rural areas.
8	Icha Aprilianti and Siti Fatimah Nurhayati (2025)	“Analisis Faktor-Faktor yang Mempengaruhi Jumlah Balita Stunting di 10 Wilayah NTT Tahun 2021-2024”	Quantitative research using a panel data regression approach. Panel data is a combination of cross-sectional and time series data.	The number of poor people has a positive effect on the increase in stunting rates, meaning that the higher the poverty rate, the number of stunted toddlers also increases.
9	Muhammad Zilal Hamzah, Eleonora Sofilda and Suhail Kusairi (2025)	“How Do Socioeconomic Indicators and Fiscal Decentralization Affect Stunting? Evidence from Indonesia”	Quantitative (empirical) research with an econometric approach based on panel data (panel data study)	The food security index, poverty line, women's education, and special allocation funds reduce stunting, while village funds and fiscal decentralization actually increase stunting.
10	Dini Suciyanti, Grace Wangge, Elisa Iskandar, Umi Fahmida and Taniawati Supali (2021)	“Social Determinants and Access to Water-Sanitation-Hygiene as Dominant Risk Factors of Stunting Among Under-Five Children in Rural Area of East Indonesia”	Cross-sectional design using statistical analysis (chi-square and logistic regression) on data of children aged 24–59 months in rural areas.	The number of household members is the only significant independent risk factor for the incidence of stunting in children aged 24–59 months in rural areas of Eastern Indonesia.
11	Yoerdy Agusmal Saputra, Mona Lisa, Nailul Hikmi, Septiria Irawati, Achmad Rizki Azhari and Disa Hijratul Muharramah (2025)	“Association of Inadequate WaSH, Housing, and Infectious Diseases with Undernutrition Hotspots Among Children Under Five: Findings from a National Survey in Indonesia”	The secondary cross-sectional design used national survey data (Indonesia Health Survey 2023) and multivariate logistic regression analysis and spatial mapping.	Lack of access to basic hygiene, clean water, and inadequate housing conditions significantly increase the risk of stunting, underweight, and wasting in children.
12	Lalu Riza Singrapati and Erni Tri Astuti (2024)	“Determinants of stunting prevalence in Nusa Tenggara 2023”	Quantitative research with an ecological approach (ecological study) and spatial analysis	The regencies/cities with the highest stunting category are mostly in East Nusa Tenggara Province with a prevalence reaching around 50 percent, while in West Nusa Tenggara Province it is only around 3.13 percent.

DISCUSSION

A systematic review shows that stunting in East Nusa Tenggara Province is influenced not only by individual and household factors but also by interactions among social, economic, environmental, and health service determinants shaped by regional development disparities. Inequality between urban and rural areas contributes to the widening disparity in access to proper sanitation and health care facilities, with rural communities tending to have more limited access than urban areas. Furthermore, relatively high poverty rates impact households' ability to meet nutritional needs and create a healthy living environment, thereby increasing the risk of stunting.¹¹⁻¹⁵

This finding is in line with WHO's Social Determinants of Health Framework, which explains that public health conditions are influenced by structural determinants such as socio-economic conditions, development policies, resource distribution, and geographic characteristics.¹⁶ In East Nusa Tenggara, regional inequality is a fundamental factor affecting communities' ability to access basic services that contribute to children's nutritional status. This inequality is reflected in differences in the availability of infrastructure, access to health services, sanitation, and clean water, socioeconomic conditions, and geographic characteristics across regions.

Regional Inequality as a Structural Determinant

Regional inequality is one of the structural determinants contributing to the high prevalence of stunting in East Nusa Tenggara Province. The geographic characteristics of East Nusa Tenggara, dominated by islands, hills, and dryland areas, result in uneven development of basic infrastructure and public services. These geographic barriers result in differences in community access to health services, education, clean water, sanitation, and transportation between regions. Research by Singapati and Astuti (2024) shows that stunting prevalence in the Nusa Tenggara region has a spatial pattern influenced by differences in regional characteristics and access to health facilities.¹⁷ These findings are reinforced by Nufus (2025), who identified spatial inequality among districts in East Nusa Tenggara based on the availability of health facilities, poverty levels, and regional conditions, indicating that geographic factors play a role in shaping stunting vulnerability.¹⁸

In addition to geographic conditions, regional disparities in East Nusa Tenggara are also reflected in differences in poverty levels, infrastructure quality, and the fiscal capacity of local governments. Regencies with relatively low levels of development generally have limited capacity to provide adequate basic services, including maternal and child health services, clean drinking water, sanitation, and health education. Based on the results of the 2023 Indonesian Health Survey (SKI) by the Ministry of Health of the Republic of Indonesia, the coverage of basic health services and access to proper sanitation still show significant disparities between regions in Indonesia, particularly in eastern Indonesia.¹⁹ Similarly, Haning et al. (2025) explain that the characteristics of NTT as an archipelago with low rainfall result in unequal distribution of clean water and sanitation, thereby increasing the risk of health problems associated with stunting.²⁰

From the perspective of the World Health Organization's Social Determinants of Health Framework, regional inequality is a structural determinant that influences the distribution of

resources, opportunities, and community access to various basic services needed to achieve optimal health. This inequality then influences intermediary determinants, such as residential environmental conditions, access to health services, household food security, and childcare practices, which ultimately impact the nutritional status of toddlers. Therefore, the high prevalence of stunting in NTT not only reflects malnutrition at the individual level but also indicates uneven regional development that requires a multisectoral approach through equal distribution of infrastructure, improved quality of basic services, and reduced socioeconomic disparities. This view aligns with the World Health Organization's (2024) conceptual framework, which emphasizes that social and regional inequality are the root causes (upstream determinants) of various public health problems, including stunting.²¹

Regional Inequality and Access to Sanitation and Clean Water

Regional inequality is one of the factors contributing to the high prevalence of stunting in East Nusa Tenggara Province. East Nusa Tenggara's geographical location, dominated by islands, hills, and areas with low rainfall, results in uneven distribution of basic infrastructure, including sanitation and clean water. Many villages in remote areas still lack access to safe drinking water and adequate sanitation facilities. These conditions contribute to the poor quality of the community's living environment and increase the risk of infectious diseases.^{18,20}

One important factor related to stunting in East Nusa Tenggara is limited access to sanitation and clean water. Geographic factors, drought, and uneven infrastructure often influence limited access to clean water.¹² In several areas of East Nusa Tenggara, communities still rely on unprotected water sources, such as rivers, open springs, or rainwater reservoirs, whose quality does not necessarily meet health standards. During the dry season, clean water availability becomes increasingly limited, forcing communities to travel long distances to obtain water or to use less suitable water sources. These conditions lead some communities to continue using water sources unsuitable for consumption. As a result, children are more susceptible to recurrent infections, which can impact long-term growth.²² A total of 99 villages across nine regencies in East Nusa Tenggara Province use rainwater as their drinking water source. Most families in these 99 villages rely on rainwater due to difficulties in obtaining water sources in their respective areas. The breakdown is as follows: 13 villages in Alor Regency, 27 in Lembata, 7 in East Flores, 21 in Sikka, 1 in Ende, 1 in Manggarai, 3 in Rote Ndao, 24 in Southwest Sumba, and 2 in Nagekeo Regency.²³

Recent research shows that households with inadequate access to sanitation have a higher risk of stunting than those with adequate sanitation. Poor sanitation increases exposure to pathogens that cause infectious diseases, such as diarrhea, which ultimately impairs nutrient absorption in children and contributes to stunting.^{12,24} This condition is often found in rural and remote areas in NTT, which still face limitations in basic infrastructure.²⁵

Clean water is a basic need that plays an important role in maintaining health, food hygiene, sanitation, and preventing infectious diseases.²⁶ When households lack access to adequate clean water, the risk of environmental diseases, such as diarrhea, gastrointestinal infections, and worms, increases. These diseases disrupt nutrient absorption in children, thus hindering their linear growth and leading to stunting.^{27,28} Research by Puteri and Fitria (2025) shows that toddlers living in environments with inadequate sanitation have a 1.56-fold higher risk of

stunting than those living in environments with good sanitation.¹² Saputra et al. (2025) also emphasized that a lack of access to clean water, hygiene, and adequate housing is significantly associated with an increased risk of stunting and other nutritional problems.¹³

In addition to increasing the risk of infectious diseases, limited access to clean water also affects low-income families' hygiene practices, such as handwashing, cleaning eating utensils, and maintaining environmental cleanliness. This condition increases children's exposure to environmental bacteria and pathogens, which can trigger Environmental Enteric Dysfunction (EED), a chronic intestinal disorder caused by continuous exposure to microorganisms. EED causes intestinal inflammation, which decreases the body's ability to absorb nutrients, even though the child's food intake is relatively adequate. Research in Ethiopia found that poor sanitation and access to clean water are closely associated with increased incidence of EED and stunting in children aged 24-59 months.^{29,30}

Addressing these issues requires a cross-sectoral approach involving the government, health, public works, and communities. Increasing access to safe drinking water, developing community-based sanitation, educating people about clean and healthy living habits (PHBS), and strengthening the Community-Based Total Sanitation (STBM) program are essential. Furthermore, equitable infrastructure development in remote areas is crucial to ensuring that all communities have equal access to quality basic services.

Regional Inequality Affects Access to Basic Health Services

Development disparities across regions further affect public access to basic services. In areas with limited health facilities or remote distances, communities face barriers in obtaining antenatal care, toddler growth monitoring, immunizations, and nutrition consultations. This situation reduces the opportunity to detect growth disorders early. Furthermore, the limited number of health workers and their uneven distribution further weaken the quality of services received by the community.³¹ Areas with limited health facilities, health workers, and transportation access generally show higher stunting rates than areas with better health services. Difficulty accessing health services can reduce the opportunities for mothers and children to receive antenatal care, toddler growth monitoring, immunizations, and education on infant and young child feeding. These conditions can increase the risk of stunting, especially among communities living in remote areas.¹⁷ However, several studies have shown that the presence of health facilities alone is insufficient without adequate service utilization and quality.

Research shows that regional disparities in East Nusa Tenggara can be grouped into three clusters based on poverty levels, access to adequate housing, unemployment, and healthcare facilities. Areas with high poverty rates and limited healthcare facilities are the most vulnerable to stunting.^{18,32} Other research has also found that maternal and child health conditions during pregnancy are linked to the characteristics of the area where they live. Areas with poor access to maternal healthcare tend to have a higher risk of stunting.⁹ These findings show that uneven development is an important factor in explaining the high prevalence of stunting across several districts in East Nusa Tenggara.

In several remote areas in East Nusa Tenggara, the number of community health centers (Puskesmas), sub-community health centers (Pustu), and health workers is not commensurate with the size of the service area. This situation results in pregnant women not receiving optimal antenatal care, lower immunization coverage, and inadequate routine monitoring of toddler growth. Yet, high-quality health services play a crucial role in the early detection of growth disorders and in timely nutritional interventions.

Limited access to basic services contributes to environmental conditions that are less than conducive to child growth and development. Environments with inadequate sanitation, poor drinking water quality, and poor waste management increase the risk of infectious diseases, particularly diarrhea and other gastrointestinal infections. This unsupportive environment impacts children's nutritional status through several mechanisms. Children living in environments with poor sanitation are more susceptible to recurrent infections, which increase energy needs and reduce the body's ability to absorb nutrients. In the long term, these conditions can lead to stunted linear growth in children.^{33,34}

Research by Sofiaturohmah et al. (2025) shows that the quality and affordability of healthcare services in East Nusa Tenggara lag far behind developed regions like Jakarta. Limited healthcare workers, service facilities, and transportation access make it difficult for people in remote areas to obtain optimal maternal and child healthcare.³⁵ This condition is reinforced by research by Ramadhaniyati et al. (2025), who found that geographical and economic barriers in rural areas reduce the use of primary health services, making stunting prevention efforts less effective.³⁶ Spatial analysis-based research indicates a spatial clustering pattern of stunting incidence in the Nusa Tenggara region, influenced by geographic conditions, regional isolation, and the uneven distribution of health facilities and public infrastructure. Areas with limited transportation access or a long distance from health service centers tend to face barriers to accessing maternal and child health services, including growth monitoring, immunization, and nutritional interventions.¹⁷ In addition, the study also found that the districts/cities with the highest prevalence of stunting were mostly in East Nusa Tenggara Province, which has the geographical characteristics of an archipelago, difficult topography, and limited infrastructure and basic services.³⁷

Socioeconomic Inequality

In addition to environmental factors, socioeconomic disparities between regions play a significant role in exacerbating stunting. The prevalence of undernutrition in Indonesia is higher in poorer regions, eastern Indonesia, and rural areas than in urban and developed regions. Studies have found that districts with high poverty rates have a significantly higher prevalence of stunting and other nutritional problems than more prosperous districts. The poorest districts recorded a 30% higher prevalence of underweight, an 83% higher prevalence of severe underweight, a 16% higher prevalence of wasting, a 21% higher prevalence of stunting, and a 74% higher prevalence of severe stunting compared to the richest districts. In other words, poverty is a significant factor associated with a high risk of stunting in children.³⁸

High poverty rates and limited basic infrastructure mean that many families have difficulty meeting their children's nutritional needs or obtaining adequate access to health services.³⁹ Based on research using panel data analysis by Aprilia and Nurhayati (2024), in several

districts in NTT, increasing poverty rates are positively correlated with increasing numbers of stunted toddlers. Conversely, regions with higher minimum wages tend to have lower stunting rates.⁴⁰ A study found that all toddlers with stunting came from low-income families, while no cases of stunting were found in high-income families. Economic factors are not isolated factors but are interrelated with parental education, parenting styles, environmental conditions, and access to healthcare. Economic limitations also cause families to prioritize basic needs over nutritious food, increasing the risk of stunting. This indicates that household economic capacity influences a family's ability to provide nutritious food, access healthcare, and improve childcare practices.⁴¹

Thus, reducing the prevalence of stunting in NTT requires an approach that focuses not only on specific nutritional interventions but also on efforts to reduce regional disparities as structural determinants. Equitable infrastructure development, increased access to maternal and child health services, provision of clean water and proper sanitation, strengthening household food security, and improving the quality of public health education need to be implemented in an integrated manner. This approach aligns with the WHO, which emphasizes the importance of addressing the social determinants of health through cross-sectoral policies, and with UNICEF, which explains that improving children's nutritional status requires interventions that simultaneously address underlying, indirect, and direct causes. Therefore, the stunting reduction strategy in East Nusa Tenggara needs to focus on reducing regional development disparities so that every child has an equal opportunity to grow and develop optimally.

CONCLUSION

Based on the literature review, stunting in NTT is a multidimensional problem closely tied to regional disparities in access. Limited basic infrastructure, poverty, and uneven distribution of health services are the main determinants that increase children's vulnerability to stunting. Therefore, efforts to address stunting in NTT require a cross-sectoral approach that emphasizes not only nutritional interventions but also the strengthening of regional development, the equitable distribution of health services, and increased access to clean water and sanitation. The government is expected to strengthen basic infrastructure development in remote areas, particularly access to clean water, sanitation, transportation, and health care facilities. Furthermore, equitable distribution of health workers and improvement of the quality of maternal and child health services are needed, even in rural areas and remote islands.

Acknowledgement

The author would like to thank all parties who contributed to this article, especially the researchers who provided many references in its compilation.

Declarations

Authors' contributions

All authors contributed substantially to the development and completion of this manuscript and take full responsibility for the integrity of the article's content. AA contributed to the research

design, development of the methodology, literature analysis, manuscript preparation, interpretation of the research results, and critical revision of the article. ASL contributed to research conceptualization, literature search, data collection, manuscript drafting, data analysis and interpretation, and review and editing. Both authors reviewed and approved the final version of the manuscript before publication.

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