

Association between exclusive breastfeeding and stunting among toddlers in a high-burden rural community of South Central Timor: a cross-sectional study

Roslin E. M. Sormin¹, Emanuel Gerald Alan Rahmat²

¹Midwifery Study Program, STIKes Maranatha Kupang, Kupang, Indonesia

²Pharmacy Study Program, Poltekkes Kemenkes Kupang, Kupang, Indonesia

Article Info

Article history:

Received Dec 13, 2025

Revised May 7, 2026

Accepted Jul 12, 2026

Keywords:

Child nutrition

Exclusive breastfeeding

Linear growth

Rural timor

Stunting

ABSTRACT

This cross-sectional study assessed the relationship between exclusive breastfeeding and stunting among toddlers in Batuputih, South-Central Timor, East Nusa Tenggara, Indonesia. Conducted in July 2025, it involved 52 children aged 6–59 months using total sampling. Exclusive breastfeeding history was obtained through caregiver interviews and verified with health records to reduce recall bias. Height-for-age z-scores were measured using WHO standards, and data were analyzed with Fisher's exact test and penalized logistic regression with Firth correction to address the small sample size. Stunting prevalence was 59.6%, while exclusive breastfeeding coverage reached 82.7%. All toddlers who were not exclusively breastfed were stunted. Regression analysis confirmed a strong protective effect of exclusive breastfeeding against stunting (OR 0.05; 95% CI 0.003–0.92; $p = 0.012$), which remained significant after adjusting for birth weight, sex, recent illness, and maternal education. These findings highlight exclusive breastfeeding as a critical protective factor in high-burden rural settings. Yet, the persistence of stunting despite high coverage underscores the need for integrated strategies at the primary health-care and district levels. Strengthening breastfeeding counseling must be complemented by maternal nutrition, infection prevention, and sanitation improvements within broader stunting prevention frameworks tailored to rural Timorese communities.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Roslin E. M. Sormin

Midwifery Study Program, STIKes Maranatha Kupang

Kampung Bajawa Nasipanaf Street, West Baumata Village, Kupang Regency, East Nusa Tenggara

Indonesia

Email: roslin.sormin78@gmail.com

1. INTRODUCTION

Stunting remains one of the most persistent forms of child undernutrition worldwide and continues to pose a major public health challenge in low- and middle-income countries. It reflects chronic nutritional deprivation and repeated exposure to adverse environmental conditions during early life, leading to long-term consequences for cognitive development, educational attainment, and economic productivity in adulthood [1], [2]. Despite gradual global progress in reducing stunting prevalence, substantial disparities persist across regions, underscoring the critical role of structural, socioeconomic, and ecological determinants in shaping child growth outcomes [3], [4].

Indonesia continues to experience pronounced regional inequalities in child nutritional status. National survey data consistently indicate that eastern provinces, particularly East Nusa Tenggara, report the

highest prevalence of stunting nationwide [5], [6]. These disparities are closely associated with persistent poverty, household food insecurity, limited dietary diversity, suboptimal maternal nutrition, and inadequate access to clean water and sanitation [7], [8]. Such conditions contribute to a complex interplay of risk factors that adversely affect child growth, particularly in resource-limited rural settings.

South Central Timor/Timor Tengah Selatan (TTS), including the Batuputih Health Center catchment area, represents one of the most affected districts in East Nusa Tenggara. Children in this region are exposed to multiple overlapping risk factors for growth faltering, including chronic household food shortages, seasonal food insecurity, recurrent infections, limited dietary diversity, and constrained access to maternal and child health services [7], [9]. Complementary feeding practices are often dominated by staple-based diets with limited animal-source protein, reflecting both economic and cultural constraints. These contextual vulnerabilities are particularly critical during the first 1,000 days of life, a period in which linear growth is highly sensitive to nutritional deficiencies and environmental insults.

Exclusive breastfeeding during the first six months of life is widely recognized as a foundational intervention for child survival and optimal growth. Breast milk provides essential nutrients, bioactive compounds, and immunological protection, while reducing infants' exposure to contaminated foods and liquids [7], [10]. Numerous studies in Indonesia and other low-resource settings have demonstrated a protective association between exclusive breastfeeding and reduced risk of stunting. However, the magnitude and consistency of this protective effect vary across contexts, particularly in environments characterized by high infection burden, poor sanitation, and persistent structural constraints [11]–[13].

Stunting has consequences that extend far beyond childhood. Children who experience stunting are more likely to exhibit impaired cognitive development, lower educational achievement, and reduced productivity in adulthood, thereby perpetuating intergenerational cycles of poverty and poor health [1], [14], [15]. These long-term implications highlight the importance of identifying context-specific protective factors and designing targeted interventions that are responsive to local conditions.

However, empirical evidence quantifying the magnitude of the association between exclusive breastfeeding and stunting in high-burden rural Timorese communities remains limited and underrepresented in the literature. Most existing studies in Indonesia rely on large-scale national surveys or urban-based populations, which may not adequately capture the complex interaction of structural, environmental, and health service-related determinants in remote rural settings. In such contexts, ecological vulnerability, food insecurity, and constrained access to health services may modify both the strength and direction of the relationship between exclusive breastfeeding and child growth outcomes. Moreover, studies applying analytical approaches capable of addressing small sample sizes and complete separation common in localized datasets—are still scarce, limiting the robustness of context-specific inference.

Novelty of this study, unlike previous stunting studies in Indonesia that largely rely on large-scale national surveys or urban settings, this study provides empirical evidence from a remote, high-burden rural community in South Central Timor a region persistently underrepresented in the literature. It quantifies the association between exclusive breastfeeding and stunting using penalized logistic regression with Firth correction to address complete separation, a method rarely applied in local stunting research. Furthermore, it integrates structural, environmental, and service-governance determinants into the interpretation, offering actionable insights for Puskesmas-level interventions in ecologically vulnerable Timorese communities.

Therefore, this study aimed to examine the association between exclusive breastfeeding and stunting among toddlers in a high-burden rural community of South Central Timor using a community-based cross-sectional design. Specifically, this study sought to: i) determine the prevalence of stunting and exclusive breastfeeding coverage among toddlers in the Batuputih area; ii) assess the association between exclusive breastfeeding and stunting while controlling for key confounding variables; and iii) explore the implications of these findings for integrated stunting prevention strategies at the primary health-care level in similar high-burden rural settings.

2. METHOD

2.1. Study design and setting

A community-based cross-sectional study was conducted in July 2025 in the Batuputih Health Center catchment area, South Central Timor, East Nusa Tenggara, Indonesia. This rural setting was selected because of its persistently high prevalence of stunting and limited access to maternal and child health services. A cross-sectional design was chosen to provide a timely and context-appropriate assessment of breastfeeding practices and child growth in a hard-to-reach population, where longitudinal follow-up is operationally challenging.

2.2. Population and sampling

The study population included all toddlers aged 6–59 months residing permanently in the Batuputih area. Total sampling was applied to include all eligible children in the community ($n = 52$), thereby maximizing statistical power and minimizing selection bias in a small population setting. Children with congenital conditions known to affect growth were excluded.

2.3. Variables and operational definitions

Exclusive breastfeeding was defined as the provision of breast milk only during the first six months of life, without additional liquids or solid foods, in accordance with World Health Organization guidelines [10]. Stunting was defined as a height-for-age z-score (HAZ) below -2 standard deviations based on WHO Child Growth Standards. Additional variables included child sex, birth weight (<2.5 kg vs ≥ 2.5 kg), history of illness in the past three months, and maternal education level.

2.4. Data collection

Data were collected through structured face-to-face interviews with mothers or primary caregivers using a standardized questionnaire. To minimize recall bias related to exclusive breastfeeding history, interviews employed probing questions and were cross-checked with maternal and child health records when available. Anthropometric measurements were performed using calibrated height/length boards following standardized procedures. Each measurement was taken twice, and the mean value was used for analysis. Height-for-age z-scores were calculated using WHO Anthro software.

2.5. Statistical analysis

Descriptive statistics were used to summarize participant characteristics. Fisher's exact test was applied to assess the bivariate association between exclusive breastfeeding and stunting. Because all non-exclusively breastfed children were stunted, the dataset exhibited complete separation. Penalized logistic regression with Firth correction was therefore employed to obtain unbiased adjusted odds ratios. Statistical significance was set at $p < 0.05$.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Characteristics of study participants

A total of 52 toddlers were included in the analysis. The mean age was 23.8 ± 11.6 months, with a nearly equal distribution between males (51.9%) and females (48.1%). Most children were born with normal birth weight (82.7%), while 17.3% had low birth weight. Exclusive breastfeeding coverage was high (82.7%); however, the prevalence of stunting remained substantial at 59.6%, as shown in Table 1. Figure 1 illustrates that 59.6% of toddlers were classified as stunted, while 40.4% had normal linear growth.

Table 1. Characteristics of study participants ($n = 52$)

Variable	n	%
Male sex	27	51.9
Female sex	25	48.1
Low birth weight (<2.5 kg)	9	17.3
Normal birth weight (≥ 2.5 kg)	43	82.7
Exclusive breastfeeding	43	82.7
Not exclusively breastfed	9	17.3
Stunted	31	59.6
Not stunted	21	40.4

3.1.2. Association between exclusive breastfeeding and stunting

All toddlers who were not exclusively breastfed were stunted. In contrast, approximately half of the exclusively breastfed children achieved normal linear growth. Fisher's exact test demonstrated a statistically significant association between exclusive breastfeeding and stunting, as shown in Table 2. Figure 2 visually demonstrates that all non-exclusively breastfed toddlers were stunted, whereas approximately half of exclusively breastfed children achieved normal linear growth.

3.1.3. Multivariate analysis

After adjustment for child sex, birth weight, recent illness, and maternal education, exclusive breastfeeding remained a strong protective factor against stunting. Low birth weight and recent illness were

associated with increased odds of stunting. Higher maternal education showed a protective tendency, as shown in Table 3.

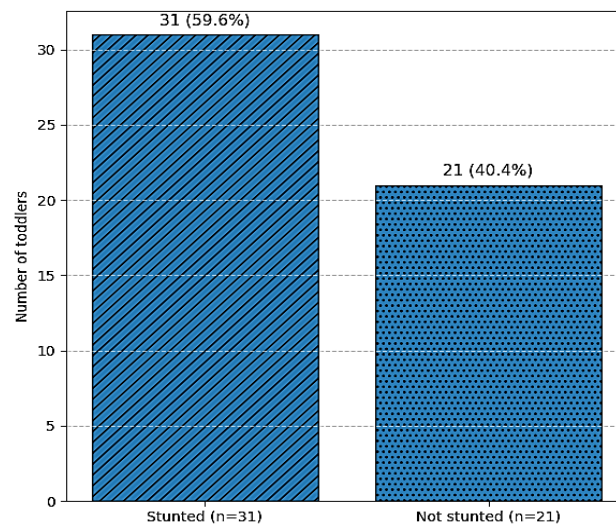


Figure 1. Distribution of stunting among toddlers, Batuputih Health Center, South Central Timor (n = 52)

Table 2. Association between exclusive breastfeeding and stunting

Exclusive breastfeeding	Stunted n (%)	Not stunted n (%)	Total n (%)	OR (95% CI)	p-value
No	9 (100.00)	0 (0.00)	9 (100.00)	Reference	–
Yes	22 (51.20)	21 (48.80)	43 (100.00)	0.05 (0.003–0.92)	0.012
Total	31 (59.60)	21 (40.40)	52 (100.00)	–	–

Note: Odds ratios were estimated using penalized logistic regression (Firth correction) due to complete separation.

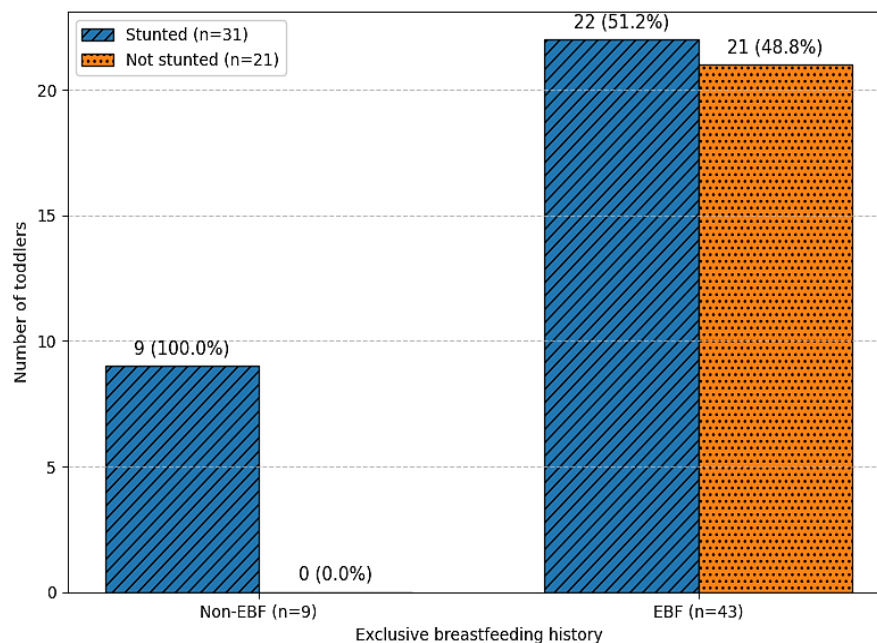


Figure 2. Stunting status stratified by exclusive breastfeeding history in a high-burden rural community (n = 52)

Table 3. Adjusted odds ratios for predictors of stunting

Variable	Adjusted OR (95% CI)	Interpretation
Exclusive breastfeeding (Yes vs No)	0.05 (0.003–0.92)	Strong protective factor
Male sex (vs Female)	4.20 (1.01–17.54)	Higher odds of stunting
Low birth weight < 2.5 kg	5.70 (0.64–50.63)	Higher odds of stunting
Illness in last 3 months	3.10 (0.77–12.43)	Increased risk
Higher maternal education	0.65 (0.17–2.47)	Protective tendency

Note: Adjusted odds ratios were estimated using penalized logistic regression with Firth correction due to complete separation.

3.2. Discussion

This study demonstrates a strong association between exclusive breastfeeding and a reduced risk of stunting among toddlers in a high-burden rural community of South Central Timor. The finding that all non-exclusively breastfed children were stunted underscores the importance of exclusive breastfeeding in preventing stunting during early childhood. It also highlights the critical role of exclusive breastfeeding as an early-life nutritional and immunological safeguard in environments characterized by high infection burden, food insecurity, and structural deprivation.

The biological plausibility of this association is well established. Exclusive breastfeeding supports optimal growth through adequate macro- and micronutrient intake, immune modulation, and protection against enteric infections that contribute to intestinal inflammation, environmental enteric dysfunction, and impaired nutrient absorption [7], [16]. Breast milk also provides bioactive components that enhance gut integrity and systemic immunity, thereby reducing growth-compromising inflammatory responses during early life. In rural Timorese communities, where access to clean water, sanitation, and safe complementary foods remains limited, these mechanisms may exert an amplified protective effect.

Recent studies from Indonesia and other Asian settings consistently indicate that exclusive breastfeeding remains a key protective factor against stunting, particularly when combined with adequate maternal nutrition, appropriate complementary feeding practices, and effective infection control strategies [7], [11], [13], [17]. Systematic reviews and meta-analyses further support the role of nutrition-specific and nutrition-sensitive interventions in reducing childhood undernutrition, emphasizing that breastfeeding promotion is most effective when integrated within broader community-based nutritional programs [18]–[20]. The findings of the present study align with this body of evidence and extend it by providing context-specific data from a high-burden rural Timorese setting characterized by ecological vulnerability and chronic structural constraints.

The observed association must also be interpreted within the broader framework of early-life determinants of linear growth. Environmental enteric dysfunction pathways, driven by repeated pathogen exposure and suboptimal sanitation, have been strongly implicated in growth faltering [21]. Similarly, recurrent diarrheal disease has been consistently associated with impaired linear growth in pooled meta-analytic evidence [22]. These mechanisms are particularly relevant in South Central Timor, where water and sanitation infrastructure remains uneven and seasonal food insecurity is common. Complementary feeding practices during the 6–23 month window also play a critical role. The World Health Organization's updated guideline on complementary feeding underscores the importance of dietary diversity, nutrient density, and safe food preparation during this vulnerable period [23]. In contexts where complementary diets are dominated by staple-based foods with limited animal-source protein, the protective role of exclusive breastfeeding during the first six months may become even more consequential.

Although exclusive breastfeeding coverage in this study was relatively high (82.7%), the prevalence of stunting remained substantial (59.6%). This finding underscores the multifactorial nature of growth faltering. Structural determinants such as household food insecurity, limited dietary diversity, inadequate sanitation, recurrent infections, and constrained maternal nutrition continue to shape growth trajectories beyond infancy [2], [7], [19]–[21]. Evidence from cross-sectional and population-based studies in other low-resource settings demonstrates that amendable risk factors operate at individual, household, and community levels simultaneously [23]. Therefore, breastfeeding promotion alone cannot fully offset entrenched socioeconomic and environmental constraints.

Sex-based differences in child health outcomes may also contribute to vulnerability patterns. Although the present study did not find statistically significant sex differences after adjustment, demographic analyses from sub-Saharan Africa and other regions have shown that biological and sociocultural factors can influence differential exposure and resilience to nutritional stressors [24]. Such patterns warrant further investigation in rural Indonesian contexts to better understand potential gender-related vulnerabilities in child growth.

Importantly, global experience demonstrates that meaningful and sustainable reductions in stunting require coordinated multisectoral action. Nutrition-specific interventions, such as breastfeeding promotion and micronutrient supplementation, must be complemented by nutrition-sensitive strategies addressing water and sanitation, maternal education, social protection, and food systems strengthening [12], [18], [19]. Community-based interventions and locally tailored nutrition education programs have shown measurable benefits when embedded within primary health-care platforms [20]. These integrated approaches are consistent with international guidance emphasizing alignment between infant and young child feeding strategies and broader development frameworks [10], [23].

In South Central Timor, strengthening integrated stunting prevention requires operational coordination at the Puskesmas and district levels. Community-based education during the first 1,000 days of life, improved service management, and the strategic role of midwives as frontline health actors are particularly relevant [25]-[28]. Such governance-oriented and community-embedded approaches may enhance the effectiveness of breastfeeding counseling while simultaneously addressing maternal nutrition, complementary feeding quality, infection prevention, and sanitation improvement.

3.2.1. Study limitations

This study has several limitations. Its cross-sectional design precludes causal inference, and the relatively small sample size may limit generalizability beyond similar rural contexts. Exclusive breastfeeding history relied partly on caregiver recall, although probing techniques and record verification were used to reduce misclassification. Furthermore, unmeasured confounders such as detailed household food security, dietary diversity indices, environmental contamination exposure, and seasonal variation may have influenced the observed associations. Nevertheless, the application of total sampling and penalized logistic regression with Firth correction strengthens the internal validity of the findings within this specific high-burden rural setting.

4. CONCLUSION

Despite its limitations, including the cross-sectional design, small sample size, and reliance on caregiver recall, this study provides robust local evidence for public health programming. Exclusive breastfeeding is strongly associated with a reduced risk of stunting among toddlers in a high-burden rural community of South Central Timor. This protective effect persisted after adjustment for key biological and social confounders. However, breastfeeding alone is insufficient to eliminate stunting in settings characterized by structural deprivation. At the local policy level, these findings support strengthening exclusive breastfeeding promotion within integrated stunting prevention programs at the Puskesmas and district levels, alongside interventions addressing maternal nutrition, complementary feeding, infection prevention, and sanitation improvement tailored to rural Timorese contexts.

ACKNOWLEDGMENTS

The authors would like to express their sincere appreciation to Belandina Nggadas, Head of Batuputih Health Center, for her administrative support and facilitation during the field implementation of this study. The authors also acknowledge Stevanon R. D. B. Suparmin and Delvy Adu for their valuable assistance as data collectors, particularly in coordinating household visits and ensuring the accuracy of anthropometric and interview data. All individuals acknowledged have provided consent to be mentioned and did not meet the criteria for authorship.

FUNDING INFORMATION

This research received no external funding.

AUTHOR CONTRIBUTIONS STATEMENT

This study involved two authors. Each author contributed substantially to the work and meets the authorship criteria defined by the journal. The roles were assigned according to the Contributor Roles Taxonomy (CRediT).

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Roslin E. M. Sormin	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	
Emanuel Gerald Alan Rahmat	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

ETHICAL APPROVAL

Ethical approval was obtained from the Ethics Committee of STIKes Maranatha Kupang.

DATA AVAILABILITY

Data are available from the corresponding author upon reasonable request.

REFERENCES

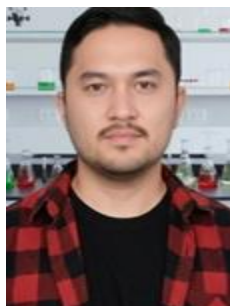
- [1] World Health Organization, *Stunting in a nutshell: causes, consequences and global epidemiology*. Geneva: World Health Organization, 2020. Available from: <https://www.who.int>.
- [2] C. G. Victora, P. Christian, L. P. Vaidaletti, G. Gatica-Domínguez, P. Menon, and R. E. Black, "Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda," *Lancet*, vol. 397, no. 10282, pp. 1388-1399, 2021, doi: 10.1016/S0140-6736(21)00394-9.
- [3] UNICEF, World Health Organization, and World Bank Group, *Levels and trends in child malnutrition: joint child malnutrition estimates (JME), 2025 edition*. Geneva: World Health Organization, 2025. Available from: <https://data.unicef.org>.
- [4] R. E. Black *et al.*, "Maternal and child undernutrition and overweight in low-income and middle-income countries," *The Lancet*, vol. 382, no. 9890, pp. 427-451, 2013, doi: 10.1016/S0140-6736(13)60937-X.
- [5] Ministry of Health Republic of Indonesia, *Indonesia nutrition status survey (SSGI) 2021 report*. Jakarta: Ministry of Health Republic of Indonesia, 2021. Available from: <https://kemkes.go.id>.
- [6] Ministry of Health Republic of Indonesia, *Indonesia basic health research (RISKESDAS) 2022 report*. Jakarta: Ministry of Health Republic of Indonesia, 2023. Available from: <https://www.litbang.kemkes.go.id>.
- [7] H. Hadi *et al.*, "Exclusive breastfeeding protects young children from stunting in a low-income population: a study from Eastern Indonesia," *Nutrients*, vol. 13, no. 12, p. 4264, 2021, doi: 10.3390/nu13124264.
- [8] T. Vaivada *et al.*, "Stunting in childhood: global burden, trends, and determinants," *Maternal & Child Nutrition*, vol. 16, no. S2, p. e12975, 2020, doi: 10.1111/mcn.12975.
- [9] A. J. Prendergast and J. H. Humphrey, "The stunting syndrome in developing countries," *Paediatrics and International Child Health*, vol. 34, no. 4, pp. 250-265, 2014, doi: 10.1179/2046905514Y.0000000158.
- [10] World Health Organization and UNICEF, *Global strategy for infant and young child feeding*. Geneva: World Health Organization, 2021. Available from: <https://www.who.int>.
- [11] G. Gusnedi *et al.*, "Risk factors associated with childhood stunting in Indonesia: a systematic review and meta-analysis," *Asia Pacific Clinical Nutrition Society*, vol. 32, no. 2, pp. 184-195, 2023, doi: 10.6133/apjcn.20230632(2).0001.
- [12] N. A. Escher *et al.*, "The effect of nutrition-specific and nutrition-sensitive interventions on the double burden of malnutrition in low- and middle-income countries: a systematic review," *The Lancet Global Health*, vol. 12, no. 3, pp. e419-e432, 2024, doi: 10.1016/S2214-109X(23)00562-4.
- [13] Z. A. Bhutta *et al.*, "What works for reducing stunting in low-income and middle-income countries? Cumulative learnings from the Global Stunting Exemplars Project," *The American Journal of Clinical Nutrition*, vol. 121, no. 1, pp. S113-S128, 2025, doi: 10.1016/j.ajcnut.2025.03.004.
- [14] B. L. Horta, C. L. de Mola, and C. G. Victora, "Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil," *Lancet Global Health*, vol. 3, no. 4, pp. e199-205, 2022, doi: 10.1016/S2214-109X(15)70002-1.
- [15] A. Popova, D. K. Evans, M. E. Breeding, and V. Arancibia, "The economic costs of stunting and how to reduce them," *The World Bank Research Observer*, vol. 37, no. 1, pp. 107-136, 2022, doi: 10.1093/wbro/lkab006.
- [16] S. E. Cusick, A. Barks, and M. K. Georgieff, "Nutrition and brain development," *Current Topics in Behavioral Neurosciences*, vol. 53, pp. 131-165, 2022, doi: 10.1007/7854_2021_244.
- [17] A. Saleh, S. Syahrul, V. Hadju, I. Andriani, and I. Restika, "Role of maternal factors in preventing stunting: a systematic review," *Gaceta sanitaria*, vol. 35, pp. S576-S582, 2021, doi: 10.1016/j.gaceta.2021.10.087.
- [18] Z. S. Lassi *et al.*, "Community-based child food interventions/supplements for the prevention of wasting in children up to 5 years at risk of wasting and nutritional oedema: a systematic review and meta-analysis," *Nutrition Reviews*, vol. 83, no. 8, pp. 1402-1424, 2025, doi: 10.1093/nutrit/nuaf041.
- [19] M. Hossain *et al.*, "Evidence-based approaches to childhood stunting in low- and middle-income countries: a systematic review," *Archives of Disease in Childhood*, vol. 102, pp. 903-909, 2017, doi: 10.1136/archdischild-2016-311050.

- [20] S. Abdulloeva *et al.*, “Centering community-based maternal and child nutrition services in Bangladesh’s rural primary healthcare: what has potential to scale,” *Frontiers in Public Health*, vol. 13, p. 1464792, 2025, doi: 10.3389/fpubh.2025.1464792.
- [21] K. M. Harper, M. Mutasa, A. J. Prendergast, J. H. Humphrey, and A. R. Manges, “Environmental enteric dysfunction pathways and child stunting: a systematic review,” *PLOS Neglected Tropical Diseases*, vol. 12, no. 1, p. e0006205, 2018, doi: 10.1371/journal.pntd.0006205.
- [22] R. R. T. Firmansyah, B. Murti, and H. Prasetya, “A meta-analysis of correlation between diarrhea and stunting in children under five,” *Journal of Epidemiology and Public Health*, vol. 8, no. 1, pp. 88–97, 2023, doi: 10.26911/jepublichealth.2023.08.01.08.
- [23] World Health Organization, *WHO guideline on complementary feeding of infants and young children 6–23 months of age*. Geneva: World Health Organization, 2023. Available from: <https://www.who.int>.
- [24] M. Garenne, “Sex differences in health indicators among children in African DHS surveys,” *Journal of Biosocial Science*, vol. 35, no. 4, pp. 601–614, 20003, doi: 10.1017/S0021932003006047.
- [25] O. Y. Lado, D. O. Dodo, and M. Sinaga, “Evaluasi program penanggulangan stunting di wilayah kerja Puskesmas Panite Kecamatan Amanuban Selatan Kabupaten TTS tahun 2023,” *SEHATMAS: Jurnal Ilmiah Kesehatan Masyarakat*, vol. 3, no. 4, pp. 785–797, 2024, doi: 10.55123/sehatmas.v3i4.4286.
- [26] R. E. M. Sormin, F. Salesman, M. Neolaka, and H. Toda, “Stunting service management model in the South-Central Timor region, East Nusa Tenggara, Indonesia,” *Advances In Image and Video Processing*, vol. 12, no. 6, pp. 709–720, 2024, doi: 10.14738/aivp.126.18036.
- [27] R. E. M. Sormin, F. Salesman, M. N. B. C. Neolaka, and H. Toda, “Midwifery care model as street-level bureaucrats in handling stunting in supporting the achievement of sustainable development goals,” *Journal of Lifestyle and SDGs Review*, vol. 5, no. 1, p. e04883, 2025, doi: 10.47172/2965-730X.SDGsReview.v5.n01.pe04883.
- [28] E. J. Kase, S. L. Purimahua, and M. Sahdan, “Faktor-faktor yang berhubungan dengan kejadian stunting pada balita di wilayah kerja Puskesmas Kuanfatu Kabupaten Timor Tengah Selatan,” *SEHATMAS: Jurnal Ilmiah Kesehatan Masyarakat*, vol. 3, no. 4, pp. 831–842, 2024, doi: 10.55123/sehatmas.v3i4.4208.

BIOGRAPHIES OF AUTHORS



Roslin E. M. Sormin    is a lecturer and researcher at STIKes Maranatha Kupang, Indonesia. She holds a doctoral degree (Dr.) in administrative sciences with a specialization in public service governance and health system administration. She also holds a Master of Public Health (M.Kes) and a professional midwifery qualification (SST). Her research focuses on maternal and child health, stunting management, exclusive breastfeeding, community nutrition, and health service governance in rural and resource-limited settings. Dr. Sormin has published peer-reviewed articles on stunting determinants and maternal–child health interventions and is actively involved in community-based programs aimed at strengthening primary health care services in East Nusa Tenggara. She can be contacted at email: roslin.sormin78@gmail.com.



Emanuel Gerald Alan Rahmat    is an Indonesian pharmaceutical researcher and academic affiliated with the Health Polytechnic of the Ministry of Health in Kupang. He is an alumnus of the Faculty of Pharmacy, Universitas Airlangga, where he developed a strong foundation in pharmaceutical research and health policy. His scholarly interests encompass community pharmacy practice, public health management, medication adherence, vaccine cold chain systems, and pharmacognosy, with particular emphasis on indigenous medicinal plants from Eastern Indonesia. His work is characterized by applied research and evidence-based strategies aimed at strengthening pharmaceutical services and enhancing health system performance, particularly in resource-limited settings. He can be contacted at email: emanueljfd2017@gmail.com.