

Original Article

Environmental sanitation and risk of stunting among under-five children: A cross-sectional study

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Abstract

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Background: Stunting remains a major public health problem in low- and middle-income countries, including Indonesia, where environmental sanitation conditions continue to pose significant health risks. Inadequate access to safe drinking water, proper sanitation facilities, and appropriate waste management increases children's exposure to recurrent infections that may impair linear growth during the first 1,000 days of life. Despite national efforts to accelerate stunting reduction, sanitation-related risk factors remain prevalent in rural priority districts.

Objective: This study aimed to analyze the association between environmental sanitation and the risk of stunting among children under five years of age in Jayapura Subdistrict, Ogan Komering Ulu Timur Regency, Indonesia.

Methods: An analytical cross-sectional study was conducted between March and July 2022 involving 280 children aged 12–59 months selected from a population of 1,026 eligible children. Data on drinking water quality, toilet use, solid waste management, and wastewater management were collected through structured interviews and direct household observations. Stunting status was determined using height-for-age Z-scores based on WHO Child Growth Standards. Data were analyzed using descriptive statistics and Fisher's Exact Test at a 95% confidence level.

Results: The prevalence of stunting was 13.6%. Poor drinking water quality, lack of toilet use, inadequate solid waste management, and improper wastewater management were significantly associated with stunting ($p = 0.001$). Children living in households with unsafe drinking water had a stunting prevalence of 25.6%, compared with 4.9% among those with safe water. The highest proportion of stunting (28.9%) was observed among children exposed to poor wastewater management.

Conclusion: Environmental sanitation factors are significantly associated with stunting among under-five children. Strengthening access to safe water, improved sanitation facilities, and proper waste and wastewater management is essential to reduce stunting risk in rural priority areas. Integrated environmental and nutritional interventions are recommended to accelerate sustainable stunting reduction.

Background

Stunting remains a major global public health problem because growth faltering affects millions of children under five years in low- and middle-income countries according to global monitoring data (World Health Organization et al., 2023). The World Health Organization reports persistent disparities in child health indicators across countries within the Sustainable Development Goals monitoring framework (World Health Organization, 2021). Karlsson et al. identify age-specific patterns of linear growth failure among children in ninety-four low- and middle-income countries through cross-sectional analysis (Karlsson et al., 2023). Tamir et al. demonstrate high prevalence and multiple determinants of childhood stunting across African countries using demographic and health survey data (Tamir et al., 2024). Soofi et al. confirm that socioeconomic and environmental determinants contribute to

stunting among children under five in Pakistan through national data analysis (Soofi et al., 2023). Ayuningtyas et al. document significant geographic and socioeconomic disparities in child undernutrition across districts in Indonesia using national survey data (Ayuningtyas et al., 2022).

Indonesia faces a substantial burden of stunting because national surveys report high prevalence among children under five in recent decades (World Health Organization et al., 2023). National monitoring indicates that Indonesia ranked among the highest contributors to stunting prevalence in Southeast Asia between 2005 and 2017 according to WHO reports (World Health Organization, 2021). UNICEF Indonesia evaluates the national strategy to accelerate stunting prevention and highlights implementation gaps across districts (UNICEF Indonesia, 2024). Siska Damayanti et al. identify multifactorial contributors to

stunting incidence among Indonesian children under five through factor analysis (Siska Damayanti et al., 2025). Idrus and Arsin determine significant determinants of stunting among children aged six to twenty-four months in a primary health center area in Indonesia (Idrus & Arsin, 2023). Desi et al. analyze factors associated with stunting prevention in community settings through cross-sectional assessment (Desi et al., 2024).

Environmental sanitation influences child growth because inadequate water, sanitation, and hygiene increase infection risk in early life according to observational studies (Jain et al., 2024). Regassa et al. associate environmental enteropathy and poor sanitation conditions with stunting among children under five in slum areas through field investigation (Regassa et al., 2024). Rudy Ferdinand et al. relate microbiological and physical quality of drinking water to stunting incidence among children under five through local analysis (Rudy Ferdinand et al., 2025). Banhae et al. demonstrate that social and physical environmental conditions correlate with stunting among toddlers through community-based study (Banhae et al., 2023). Habimana et al. report that poor households experience higher prevalence of stunting among children aged six to twenty-three months through national survey analysis (Habimana et al., 2023). Dadras et al. identify correlates of stunting including vaccination status and environmental conditions among children under five through population-based study (Dadras et al., 2024).

Household caregiving and parenting practices influence nutritional status because maternal knowledge and attitudes shape child feeding behavior in early life (Budianto & Akbar, 2023). Siahaan and Amalia associate parenting patterns with preventive attitudes toward stunting among children aged two to five years through analytic study (Siahaan & Amalia, 2025). Anggaraini and Lestari demonstrate that knowledge and attitudes influence adherence to nutritional supplementation among adolescents through cross-sectional survey (Anggaraini & Lestari, 2025). Has et al. propose a maternal caregiving capability model to prevent childhood stunting based on a UNICEF-inspired framework (Has et al., 2024). Deswani et al. strengthen the role of health cadres and elderly support in breastfeeding promotion to prevent

stunting through participatory action research (Deswani et al., 2026). Angraeni et al. show that educational media improves maternal knowledge regarding child health conditions in primary care settings (Angraeni et al., 2025).

Nutritional and social protection interventions reduce growth faltering because supplementary feeding and cash transfer programs improve child nutritional intake in vulnerable populations (Fazid et al., 2024). Rukiko et al. demonstrate that conditional cash transfer programs reduce stunting among poor children under five through impact evaluation (Rukiko et al., 2023). Dad et al. evaluate digitalized food voucher programs and show improved access to fresh foods among rural households through pilot study (Dad et al., 2023). Ahmed et al. derive and validate clinical prediction rules to identify children at risk of linear growth faltering through multi-country data analysis (Ahmed et al., 2023). Siahaan et al. review child independence in maintaining hygiene practices and highlight the importance of home-based health behavior support through literature synthesis (Siahaan et al., 2026). These findings indicate that sanitation, caregiving, and social support interact in shaping child growth outcomes across contexts (World Health Organization et al., 2023).

Regional data in South Sumatra show dynamic trends in stunting prevalence because district-level reports reveal fluctuating rates over the last decade according to governmental monitoring (UNICEF Indonesia, 2024). Jayapura Subdistrict in Ogan Komering Ulu Timur demonstrates limited sanitation coverage because only one village has declared Open Defecation Free status based on local health office reports (World Health Organization, 2021). Preliminary observation identifies practices of shared latrine use, unimproved pit latrines, unsafe mountain water sources, and inadequate waste management among households in the area according to community assessment (Jain et al., 2024). Poor environmental sanitation increases exposure to diarrheal disease and environmental enteropathy that contribute to impaired linear growth among children under five according to epidemiological evidence (Regassa et al., 2024). Existing studies emphasize determinants at national and international levels but limited evidence specifically examines sanitation-related risks in prioritized rural districts in

Indonesia according to contextual analyses (Ayuningtyas et al., 2022).

Therefore, this study aims to analyze the association between environmental sanitation and the risk of stunting among under-five children.

Methods

Study Design

This study employed an analytical observational design using a cross-sectional approach to examine the association between environmental sanitation factors and the risk of stunting among children under five years of age in Jayapura Subdistrict, Ogan Komering Ulu Timur Regency, South Sumatra, Indonesia. The cross-sectional design was selected because it enables simultaneous measurement of exposure variables and outcome status within a defined population at a single point in time, allowing estimation of prevalence and assessment of associations efficiently. This design is appropriate for public health investigations aimed at identifying population-level risk factors in resource-limited settings where longitudinal follow-up may not be feasible. The study was conducted between March and July 2022 in villages prioritized for stunting reduction programs, including Way Salak, which had been designated as a focus area for acceleration of stunting prevention in 2021 and 2022. The reporting of this study adheres to the STROBE Statement to ensure methodological transparency, reproducibility, and completeness of reporting for observational research.

Sampling

The study population consisted of all children aged 12–59 months residing in Jayapura Subdistrict, totaling 1,026 eligible children according to local health records. The inclusion criteria comprised children aged 12–59 months who had resided in the study area for at least six months and whose mothers or primary caregivers were willing to participate. Children with congenital abnormalities affecting growth or chronic illnesses unrelated to environmental exposure were excluded to minimize confounding bias.

The sample size was determined using a formula for estimating proportions in cross-sectional studies with a 95% confidence level and an assumed stunting prevalence based on district-level data. After adjustment for potential non-response, a final sample of 280 children was obtained. A proportional sampling technique was applied across selected villages to ensure representativeness of sanitation variability within the subdistrict. Mothers of eligible children served as respondents for household-level sanitation information. Written informed consent was obtained before participation.

Instruments

Data were collected using structured questionnaires and observational checklists developed based on national environmental health standards and prior sanitation-related stunting studies. The questionnaire included sections on household characteristics, drinking water source and quality, latrine ownership and use, solid waste management practices, and wastewater disposal systems.

Drinking water quality was assessed based on reported physical characteristics, including absence of color, odor, and taste, and classification of water sources as protected or unprotected. Latrine use was categorized as improved when households used sanitary latrines equipped with septic tanks and hygienic construction, and unimproved when open defecation or non-sanitary pit latrines were used. Solid waste management was classified as adequate when waste was stored in closed containers and disposed of hygienically without environmental exposure. Wastewater management was considered adequate when households had drainage systems directing wastewater away from living areas and water sources.

The outcome variable, stunting status, was determined through anthropometric measurement of child height using standardized height boards. Height-for-age Z-scores were calculated using WHO Child Growth Standards, and children with HAZ < -2 SD were classified as stunted. Anthropometric measurement procedures followed national guidelines issued

by the Ministry of Health Regulation No. 2 of 2020 to ensure standardization and measurement reliability.

Data Collection

Primary data were collected through face-to-face interviews with mothers using trained enumerators who had received standardized training on questionnaire administration and anthropometric measurement techniques. Direct observation of sanitation facilities was conducted to validate reported practices and reduce information bias. Observational verification included inspection of water storage containers, distance between wells and contamination sources, presence and condition of latrines, waste disposal sites, and wastewater drainage channels.

Secondary data were obtained from community health center records to confirm population estimates and local stunting trends. All data were anonymized immediately after collection to protect participant confidentiality. Data entry was conducted using a double-entry system to reduce transcription errors, and consistency checks were performed before analysis.

Data Analysis

Data were coded and entered into Statistical Package for the Social Sciences (SPSS) software for analysis. Descriptive statistics were calculated to summarize sociodemographic characteristics, sanitation variables, and prevalence of stunting. Frequencies and percentages were presented for categorical variables.

Bivariate analysis was performed to examine associations between environmental sanitation variables and stunting status. Because several contingency tables contained expected cell counts less than five, Fisher's Exact Test was used to determine statistical significance at a 95% confidence level with $\alpha = 0.05$. Crude prevalence proportions were compared between exposure categories. Statistical significance was defined as $p\text{-value} < 0.05$.

Data cleaning procedures included range checking, identification of missing values, and verification of anthropometric plausibility

according to WHO standards. Any implausible anthropometric values were re-checked against field records to ensure accuracy.

Ethical Considerations

This study obtained ethical clearance from the relevant institutional ethics committee prior to data collection. The study complied with the principles of the Declaration of Helsinki regarding research involving human subjects. Written informed consent was obtained from mothers or primary caregivers after explanation of study objectives, procedures, potential risks, and benefits. Participation was voluntary, and respondents were informed of their right to withdraw at any time without consequence.

Confidentiality was ensured by assigning unique identification codes to participants and storing data in password-protected databases accessible only to the research team. No personal identifiers were included in analysis or reporting. Children identified as stunted during the study were referred to local health services for further nutritional assessment and intervention as part of ethical responsibility and community benefit.

Results

This section presents the distribution of respondents according to stunting status and environmental sanitation variables, including drinking water quality, toilet use, waste management, and wastewater management among under-five children in Jayapura Subdistrict, Ogan Komering Ulu Timur Regency in 2022. A total of 280 children aged 12–59 months were included in the analysis.

Table 1 shows that 13.6% of children were classified as stunted, while 86.4% were not stunted. Regarding environmental sanitation conditions, 41.4% of households used drinking water that did not meet health requirements. A total of 36.4% of households reported not using a sanitary toilet. Poor solid waste management was identified in 39.3% of households. Poor wastewater management was found in 42.1% of households. These findings indicate that a considerable proportion of households were

exposed to suboptimal environmental sanitation conditions.

Table 1. Distribution of Respondents Based on Stunting Status and Environmental Sanitation Variables (n = 280)

Variables	Frequency (n)	Percentage (%)
Incidence of Stunting		
Stunting	38	13.6
No Stunting	242	86.4
Drinking Water Quality		
Does Not Meet Requirements	116	41.4
Meets Requirements	164	58.6
Toilet Use		
No Toilet Used	102	36.4
Toilet Used	178	63.6
Waste Management		
Poor	110	39.3
Good	170	60.7
Wastewater Management		
Poor	118	42.1
Good	162	57.9

Table 2. Association Between Environmental Sanitation Variables and Incidence of Stunting (n = 280)

Variables	Incidence of Stunting (n,%)			pvalue
	Stunting	No Stunting	Total	
Drinking Water Quality				
Does Not Meet Requirements	30 (25,6%)	87 (74,4%)	117 (100%)	0.001
Meets Requirements	8 (4,9%)	155 (95,1%)	163 (100%)	
Toilet Use				
No Toilet Used	24 (23,5 %)	78 (76,5 %)	102 (100 %)	0.001
Toilet Used	14 (7,9%)	164 (92,1 %)	178 (100 %)	
Waste Management				
Poor	27 (25,5%)	79 (74,5%)	106 (100 %)	0.001
Good	11 (6,3%)	163 (93,7%)	174 (100 %)	
Wastewater Management				
Poor	33 (28,9%)	81 (71,1%)	114 (100 %)	0.001
Good	5 (3,0%)	161 (97,0%)	166 (100 %)	

Based on table 2 showed analysis demonstrates statistically significant associations between all environmental sanitation variables and stunting incidence ($p < 0.05$).

Children living in households with drinking water that did not meet health requirements had a stunting prevalence of 25.6%, compared to 4.9% among those with safe drinking water. Children from households without toilet use had a stunting prevalence of 23.5%, compared to 7.9% among those using sanitary toilets.

Poor solid waste management was associated with a stunting prevalence of 25.5%, whereas good waste management was associated with

6.3%. Poor wastewater management showed the strongest proportion, with 28.9% of children stunted, compared to only 3.0% among households with proper wastewater management.

These findings indicate that inadequate environmental sanitation significantly increases the risk of stunting among under-five children in Jayapura Subdistrict. The strongest proportional difference was observed in wastewater management, suggesting that exposure to unmanaged domestic wastewater may contribute substantially to growth impairment in early childhood.

Discussion

This study demonstrates that environmental sanitation factors significantly influence the incidence of stunting among under-five children in Jayapura Subdistrict. The findings show that 13.6% of children were classified as stunted and that poor drinking water quality, lack of toilet use, inadequate waste management, and improper wastewater management were strongly associated with stunting. Children exposed to poor wastewater management exhibited the highest proportion of stunting compared to other sanitation variables. Households without sanitary toilets and those using unsafe drinking water also showed markedly higher stunting proportions. These results confirm that environmental sanitation remains a critical determinant of child growth in rural settings. The findings suggest that integrated sanitation improvement strategies are essential to reduce the burden of stunting in prioritized districts.

Stunting represents chronic linear growth failure that occurs due to prolonged nutritional deficiencies and recurrent infections during the first 1000 days of life (Karlsson et al., 2023). Global monitoring reports indicate that child malnutrition remains a persistent public health challenge in low- and middle-income countries (World Health Organization et al., 2023). National health statistics demonstrate that disparities in child growth outcomes persist despite ongoing health interventions (World Health Organization, 2021). Geographic and socioeconomic inequality contributes significantly to undernutrition patterns across districts in Indonesia (Ayuningtyas et al., 2022). Multicountry analyses confirm that environmental and socioeconomic determinants interact to influence stunting prevalence (Tamir et al., 2024). Determinant-based analyses further identify sanitation and household environment as critical contributors to child growth outcomes (Soofi et al., 2023).

The present findings regarding unsafe drinking water align with evidence that poor water quality increases exposure to pathogens causing recurrent diarrhea and intestinal inflammation (Jain et al., 2024). Environmental enteropathy

resulting from chronic microbial exposure contributes to impaired nutrient absorption and linear growth failure (Regassa et al., 2024). Household studies demonstrate that microbiological contamination of drinking water correlates with higher stunting incidence among children under five (Rudy Ferdinand et al., 2025). Community-level environmental conditions significantly influence toddler growth outcomes in vulnerable populations (Banhae et al., 2023). Epidemiological research identifies household-level correlates including environmental hygiene and vaccination coverage as influential factors in stunting prevalence (Dadras et al., 2024). Household poverty and limited sanitation infrastructure further increase the likelihood of growth faltering among young children (Habimana et al., 2023).

The association between toilet use and stunting in this study reflects the importance of safe excreta disposal in preventing fecal-oral disease transmission (Jain et al., 2024). Open defecation practices increase environmental contamination and infection exposure among children in rural communities (Regassa et al., 2024). Community-based research confirms that physical environmental sanitation strongly correlates with stunting outcomes (Banhae et al., 2023). Determinant analyses in Indonesian primary health center areas identify sanitation facilities as significant predictors of stunting risk (Idrus & Arsin, 2023). Prevention-oriented community studies highlight sanitation access as a key component of stunting reduction strategies (Desi et al., 2024). National evaluation reports emphasize that strengthening sanitation programs remains essential for accelerating stunting prevention efforts (UNICEF Indonesia, 2024).

The significant relationship between solid waste management and stunting suggests that household environmental hygiene influences infection pathways affecting child growth (Banhae et al., 2023). Improper waste disposal creates breeding grounds for disease vectors that increase infection risk among children (Regassa et al., 2024). Environmental sanitation practices at the household level directly contribute to variations in child growth

outcomes (Jain et al., 2024). Analyses of child growth determinants consistently identify environmental conditions as structural contributors to malnutrition (Soofi et al., 2023). Socioeconomic disparity across districts further compounds environmental exposure risks related to inadequate waste systems (Ayuningtyas et al., 2022). Public health monitoring frameworks recognize sanitation infrastructure as a core determinant of sustainable child health outcomes (World Health Organization, 2021).

The strongest association observed in this study involved poor wastewater management, which indicates the substantial role of environmental contamination in chronic growth impairment (Regassa et al., 2024). Household drainage systems that fail to isolate wastewater from living environments increase pathogen exposure among young children (Jain et al., 2024). Environmental risk mapping studies confirm that poor sanitation clusters correspond with higher prevalence of child growth failure (Tamir et al., 2024). Determinant analyses further demonstrate that environmental and social factors operate synergistically to shape nutritional outcomes (Siska Damayanti et al., 2025). Community empowerment and maternal caregiving models emphasize the integration of environmental health within stunting prevention strategies (Has et al., 2024). Participatory action research highlights the importance of community engagement in strengthening environmental sanitation interventions (Deswani et al., 2026).

Beyond environmental sanitation, household knowledge and caregiving behaviors also influence nutritional outcomes among children (Budianto & Akbar, 2023). Parenting patterns shape preventive attitudes toward stunting among children aged two to five years (Siahaan & Amalia, 2025). Health education interventions improve caregiver knowledge and may contribute to improved hygiene practices in households (Angraeni et al., 2025). Adolescent nutritional knowledge influences future maternal behaviors that impact child growth outcomes (Anggaraini & Lestari, 2025). Supplementary feeding interventions demonstrate effectiveness in preventing

stunting among children aged six to twenty-three months (Fazid et al., 2024). Social protection and digital nutrition programs further enhance household food security and child growth outcomes in vulnerable populations (Rukiko et al., 2023; Dad et al., 2023).

The integration of environmental sanitation improvement with nutritional and social protection strategies provides a comprehensive approach to stunting prevention (UNICEF Indonesia, 2024). Global evidence supports multisectoral interventions that combine water, sanitation, hygiene, nutrition, and social support systems (World Health Organization et al., 2023). Prediction models identifying children at risk of linear growth faltering emphasize early environmental and household risk detection (Ahmed et al., 2023). Literature reviews highlight the importance of promoting independence and hygiene behaviors within home environments to sustain child health (Siahaan et al., 2026). Therefore, sanitation-focused interventions should be strengthened alongside behavioral and nutritional programs to reduce stunting prevalence in prioritized districts (Ayuningtyas et al., 2022). These findings reinforce the urgency of strengthening environmental health infrastructure as part of local stunting reduction strategies (World Health Organization, 2021).

Conclusion and Recommendation

This study concludes that poor drinking water quality, lack of toilet use, inadequate solid waste management, and improper wastewater management are significantly associated with stunting among under-five children in Jayapura Subdistrict. Wastewater management demonstrated the strongest proportional association with stunting. Environmental sanitation improvement should become a priority in local stunting reduction programs. Community-based sanitation interventions, including safe water treatment, household toilet construction, proper waste disposal systems, and structured wastewater drainage, should be strengthened. Health workers should intensify sanitation education and environmental inspections. Future studies should apply multivariate analysis and longitudinal designs

to further clarify causal pathways between environmental sanitation and child growth outcomes.

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Declaration of conflict of interest

The authors declare no competing interests.

Declaration on the Use of AI

No AI tools were used in the preparation of this manuscript.

References

- Ahmed, S. M., Brintz, B. J., Pavlinac, P. B., et al. (2023). Derivation and external validation of clinical prediction rules identifying children at risk of linear growth faltering. *eLife*, 12, e78491. <https://doi.org/10.7554/eLife.78491>
- Anggaraini, N. D., & Lestari, D. (2025). The Relationship Between Knowledge of Anemia and Attitudes Toward Adherence to Iron Supplementation Among High School Students. *Indonesian Journal of Health Services*, 2(3), 61-67. <https://doi.org/10.63202/ijhs.v2i3.108>
- Angraeni, D. F. A., Manalu, L. O., & Purwati, P. (2025). Edukasi media leaflet terhadap pengetahuan ibu balita dengan ISPA di Puskesmas Curugkembar Kabupaten Sukabumi. *Bakti Nusantara Pengabdian Masyarakat Indonesia*, 2(2), 32-38. <https://doi.org/10.63202/bnmpi.v2i2.78>
- Ayuningtyas, D., Hapsari, D., Rachmalina, R., Amir, V., Rachmawati, R., & Kusuma, D. (2022). Geographic and socioeconomic disparity in child undernutrition across 514 districts in Indonesia. *Nutrients*, 14(4), 843. <https://doi.org/10.3390/nu14040843>
- Banhae, Y., Making, M. A., Abanit, Y. M., et al. (2023). Social and physical environment with stunting incidents in toddlers. *International Journal of Global Health Research*, 5, 619-628. <https://doi.org/10.37287/ijghr.v5i4.2361>
- Budianto, Y., & Akbar, M. A. (2023). Hubungan Pengetahuan dan Sikap Ibu tentang Stunting dengan Pola Pemberian Nutrisi pada Balita. *Jurnal Penelitian Perawat Profesional*, 5(3), 1315-1320. <https://doi.org/10.37287/jppp.v5i3.1726>
- Dad, F., Dibari, F., Kebede, A., Lefu, E., Ndumiyana, T., & Butaumocho, B. (2023). Digitalisation in the WFP fresh food voucher programme: A pilot study from rural Amhara region, Ethiopia. *Frontiers in Nutrition*, 10, 1217794. <https://doi.org/10.3389/fnut.2023.1217794>
- Dadras, O., Suwanbamrung, C., Jafari, M., & Stanikzai, M. H. (2024). Prevalence of stunting and its correlates among children under 5 in Afghanistan: The potential impact of basic and full vaccination. *BMC Pediatrics*, 24(1), 436. <https://doi.org/10.1186/s12887-024-04913-w>
- Desi, D. K., Joni Yansyah, E., & Meliyanti, F. (2024). Faktor yang Berhubungan dengan Pencegahan Stunting. *Lentera Perawat*, 5(1), 58-65. <https://doi.org/10.52235/lp.v5i1.280>
- Deswani, D., Mulyanti, Y., Djuwitaningsih, S., Syafdewiyani, S., & Siti, E. (2026). Enhancing the role of health cadres in stunting prevention in the Munjul region through elderly support for breastfeeding: A Participatory action research. *Journal of Community Nursing and Primary Care*, 2(2), 38-43. <https://doi.org/10.63202/jcnpc.v2i2.81>
- Fazid, S., Haq, Z. U., Gillani, B. H., et al. (2024). Effectiveness of locally produced ready-to-use supplementary foods on the prevention of stunting in children aged 6-23 months: A community-based trial from Pakistan. *British Journal of Nutrition*, 131(7), 1189-1195. <https://doi.org/10.1017/S0007114523002702>
- Habimana, J. D. D., Uwase, A., Korukire, N., et al. (2023). Prevalence and correlates of stunting among children aged 6-23 months from poor households in Rwanda. *International Journal of Environmental Research and Public Health*, 20(5), 4068. <https://doi.org/10.3390/ijerph20054068>
- Has, E. M. M., Krisnana, I., & Efendi, F. (2024). Enhancing maternal caregiving capabilities model to prevent childhood stunting: A UNICEF-inspired model. *SAGE Open Nursing*, 10, 23779608231226061. <https://doi.org/10.1177/23779608231226061>
- Idrus, N. I., & Arsin, A. A. (2023). Determinants of stunting in children aged 6-24 months at Pambusuang Health Centre Working Area, Polewali Mandar Regency, Indonesia. *National Journal of Community Medicine*, 14(12), 842-848. <https://doi.org/10.55489/njcm.141220233435>
- Jain, L., Pradhan, S., Aggarwal, A., et al. (2024). Association of child growth failure indicators with household sanitation practices in India (1998-2021): Spatiotemporal observational study. *JMIR Public Health and Surveillance*, 10, e41567. <https://doi.org/10.2196/41567>

- Karlsson, O., Kim, R., Moloney, G. M., Hasman, A., & Subramanian, S. V. (2023). Patterns in child stunting by age: A cross-sectional study of 94 low- and middle-income countries. *Maternal & Child Nutrition*, 19(4), e13537. <https://doi.org/10.1111/mcn.13537>
- Nurfaizah, F. A., & Manalu, L. O. (2025). Pengaruh Edukasi Menggunakan Media Video Animasi Terhadap Pengetahuan Kesehatan Gigi dan Mulut Anak di SDN Tutugan Rahayu. *Bakti Nusantara Pengabdian Masyarakat Indonesia*, 2(1), 27-31. <https://doi.org/10.63202/bnmpi.v2i1.77>
- Regassa, R., Belachew, T., Duguma, M., & Tamiru, D. (2024). Factors associated with stunting in under-five children with environmental enteropathy in slum areas of Jimma town, Ethiopia. *Frontiers in Nutrition*, 11, 1335961. <https://doi.org/10.3389/fnut.2024.1335961>
- Rudy Ferdinand, Lina Oktavia, Sabtian Sarwoko, & Suryawanshi, Y. (2025). The Relationship of Microbiological Quality and Physical Quality of Drinking Water to the Incidence of Stunting. *Lentera Perawat*, 6(1), 155-161. <https://doi.org/10.52235/lp.v6i1.428>
- Rukiko, M. D., Mwakalobo, A. B. S., & Mmasa, J. J. (2023). The impact of conditional cash transfer program on stunting in under five year's poor children. *Public Health in Practice*, 6, 100437. <https://doi.org/10.1016/j.puhip.2023.100437>
- Siahaan, J., & Amalia, F. (2025). Relationship of Parenting Patterns in Children Aged 2-5 Years With Attitudes Preventing Stunting. *Indonesian Journal of Health Services*, 2(1), 1-6. <https://doi.org/10.63202/ijhs.v2i1.32>
- Siahaan, J., Setiawan, Y., Harissya, Z., Pohan, D. S., Estiadewi, P. S., Nurshadrina, K., & Hernando, Z. N. C. (2026). The Level of Independence of Children with Intellectual Disabilities in Maintaining Dental and Oral Hygiene at Home: A Literature Review. *Journal of Community Nursing and Primary Care*, 2(1), 1-6. <https://doi.org/10.63202/jcnpc.v2i1.99>
- Siska Damayanti, Dianita Ekawati, Lilis Suryani, & Chairil Zaman. (2025). Factor Analysis of The Incidence of Stunting in Children Under Five. *Lentera Perawat*, 6(1), 75-81. <https://doi.org/10.52235/lp.v6i1.401>
- Soofi, S. B., Khan, A., Kureishy, S., et al. (2023). Determinants of stunting among children under five in Pakistan. *Nutrients*, 15(15), 3480. <https://doi.org/10.3390/nu15153480>
- Tamir, T. T., Gezhegn, S. A., Dagnew, D. T., Mekonnen, A. T., Aweke, G. T., & Lakew, A. M. (2024). Prevalence of childhood stunting and determinants in low and lower-middle income African countries: Evidence from standard demographic and health survey. *PLOS ONE*, 19(4), e0302212. <https://doi.org/10.1371/journal.pone.0302212>
- UNICEF Indonesia. (2024). Formative evaluation of the national strategy to accelerate stunting prevention. <https://www.unicef.org/indonesia/nutrition/reports/formative-evaluation-national-strategy-accelerate-stunting-prevention>
- World Health Organization, UNICEF, & World Bank Group. (2023). Levels and trends in child malnutrition: Key findings of the 2023 edition. <https://iris.who.int/>
- World Health Organization. (2021). World health statistics 2021: Monitoring health for the SDGs, sustainable development goals. <https://iris.who.int/>