



Socio-Economic Barriers to The Adoption of Hygiene Behaviors for Stunting Prevention in Developing Countries: A Systematic Review

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Abstract

This systematic review aims to identify and analyze the various socio-economic barriers that hinder the adoption of hygiene behaviors for stunting prevention. It specifically examines how economic factors, infrastructure limitations, and social norms influence the effectiveness of environmental health interventions in developing nations. A Systematic Literature Review (SLR) was conducted following the PRISMA protocol. Data were sourced from three primary databases: Scopus, Web of Science, and Google Scholar, covering the period from 2016 to 2024. A total of 24 research articles focusing on stunting dynamics and environmental factors in developing regions, including Indonesia, were selected for in-depth synthesis and analysis. The findings reveal that systemic poverty, limited access to affordable clean water, and high operational expenses are the primary obstacles to hygiene practice. Additionally, the study identifies that maternal education level and household gender roles are significant determinants of the sustainability of these behaviors. The results underscore that hygiene education campaigns alone have a limited impact if the underlying economic and structural barriers remain unaddressed. Stunting prevention requires a multi-sectoral strategy that transcends purely medical and nutritional interventions. To be effective, policies must integrate household economic empowerment with the development of inclusive sanitation infrastructure. This study provides a critical perspective for policymakers to design interventions that are sensitive to the socio-economic constraints of communities in developing nations.

Keywords: Stunting, socio-economic barriers, hygiene behavior, developing country.

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Introduction

Environmental factors play a pivotal role in the etiology of childhood stunting, primarily through the intricate interplay of sanitation, hygiene, and nutrition. Substandard environmental conditions are direct catalysts for infectious diseases, which impair biological nutrient absorption and systemic health, ultimately leading to stunting (Lestari et al., 2024). Stunting, defined as a growth and development disorder where a child's height falls below the standard for their age, is not merely a biological failure but a reflection of multifaceted environmental deprivation. Recent studies emphasize that inadequate sanitation characterized by insufficient latrines and contaminated water sources elevates the risk of chronic infections, particularly diarrheal diseases, which significantly exacerbate nutritional deficiencies.

However, the complexity of stunting in Indonesia suggests that environmental degradation does not occur in a vacuum. It is deeply intertwined with overarching socio-economic determinants such as systemic poverty and food insecurity (Santoso & Pujianto, 2024). While the biological link between poor water, sanitation, and hygiene (WASH) and stunted growth is well-documented, a critical gap remains in understanding the socio-economic barriers that hinder households from adopting healthier behaviors. In many Indonesian regions, inadequate waste management and lack of clean water access are responsible for stunting prevalence as high as 82%. Even when health education is available, economic instability frequently limits a family's capacity to procure nutritious food or invest in adequate sanitation facilities.

Furthermore, socio-cultural influences and maternal nutrition practices during pregnancy significantly dictate long-term growth outcomes. Cultural beliefs regarding child-rearing can either facilitate or obstruct the adoption of modern hygiene practices. This situation creates a "poverty-stunting trap," where economic constraints limit future human capital, thereby sustaining a cycle of intergenerational poverty. Despite various government initiatives, there is an urgent need for a coordinated plan that integrates environmental health into broader socio-economic policies (Sentika et al., 2024). To date, while many studies discuss the individual impacts of either nutrition or sanitation, there is a lack of a comprehensive systematic review that specifically synthesizes the socio-economic barriers to hygiene adoption within the Indonesian context. Most existing literature focuses on clinical outcomes rather than the structural obstacles preventing behavior change. This study addresses this gap by identifying and highlighting the complex interactions between stunting, the environment, and socio-economic constraints. This research attempts to answer the following research questions:

1. How do environmental factors interact with socio-economic determinants to influence stunting rates in Indonesia?
2. What are the primary systemic barriers that hinder the adoption of hygiene behaviors in stunting-prone households?
3. What integrated policy recommendations can be formulated to harmonize environmental health and socio-economic strategies for stunting prevention?

Method

Research design

This study employed a systematic literature review (SLR) approach to synthesize existing research on the socio-economic and environmental determinants of stunting (Figure 1). A systematic review is a rigorous method used to identify, evaluate, and interpret all available research relevant to a specific research question, ensuring the results are comprehensive and unbiased.

Search strategy and data sources

Literature identification was performed using the Publish or Perish (PoP) software across three prominent academic databases: Scopus, Web of Science, and Google Scholar. These databases were selected for their extensive coverage of peer-reviewed literature and their reliability for bibliometric and systematic analysis. The search focused on articles published between 2016 and 2024 to capture the most recent developments in the field. The search string utilized a combination of Boolean operators and keywords: “stunting,” “stunting in Indonesia,” “environment,” “environmental causes of stunting,” and “socio-economic barriers and hygiene.”

Inclusion and exclusion criteria

To ensure the selection of high-quality and relevant studies, specific eligibility criteria were established (Table 1). We focused on original research employing quantitative, qualitative, or mixed-methods approaches that explicitly discussed the interactions between stunting and environmental or socio-economic factors.

Table 1.
The inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Focus	There is an interaction between stunting, environment, and socio-economic factors	Studies are not addressing environmental or socio-economic interactions.
Database	Scopus, Web of Science, and Google Scholar.	Other databases (e.g., Moraref, Eric, WorldCat).
Timeframe	The work was published between 2017 and 2024.	The article was published outside the 2017–2025 period.
Methodology	This can be either quantitative, qualitative, or mixed-methods research.	These can include literature reviews, editorials, or non-empirical papers.
Accessibility	Peer-reviewed articles with a digital object identifier (DOI).	Articles without a DOI or non-peer-reviewed reports are considered.

Study selection

The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Figure 1) to ensure transparency and reproducibility (Haddaway et al., 2022):

1. Identification: Initial search yielded a significant number of records. After removing duplicates (n=53) and records failing initial criteria (n=136), 293 papers remained.
2. Screening: Titles and abstracts were screened, leading to the exclusion of 120 papers that did not align with the core research questions.
3. Inclusion: A total of 151 full-text articles were assessed for eligibility. Finally, 24 potential papers were selected for the final synthesis based on their direct relevance to the complex interactions of stunting in the Indonesian context.

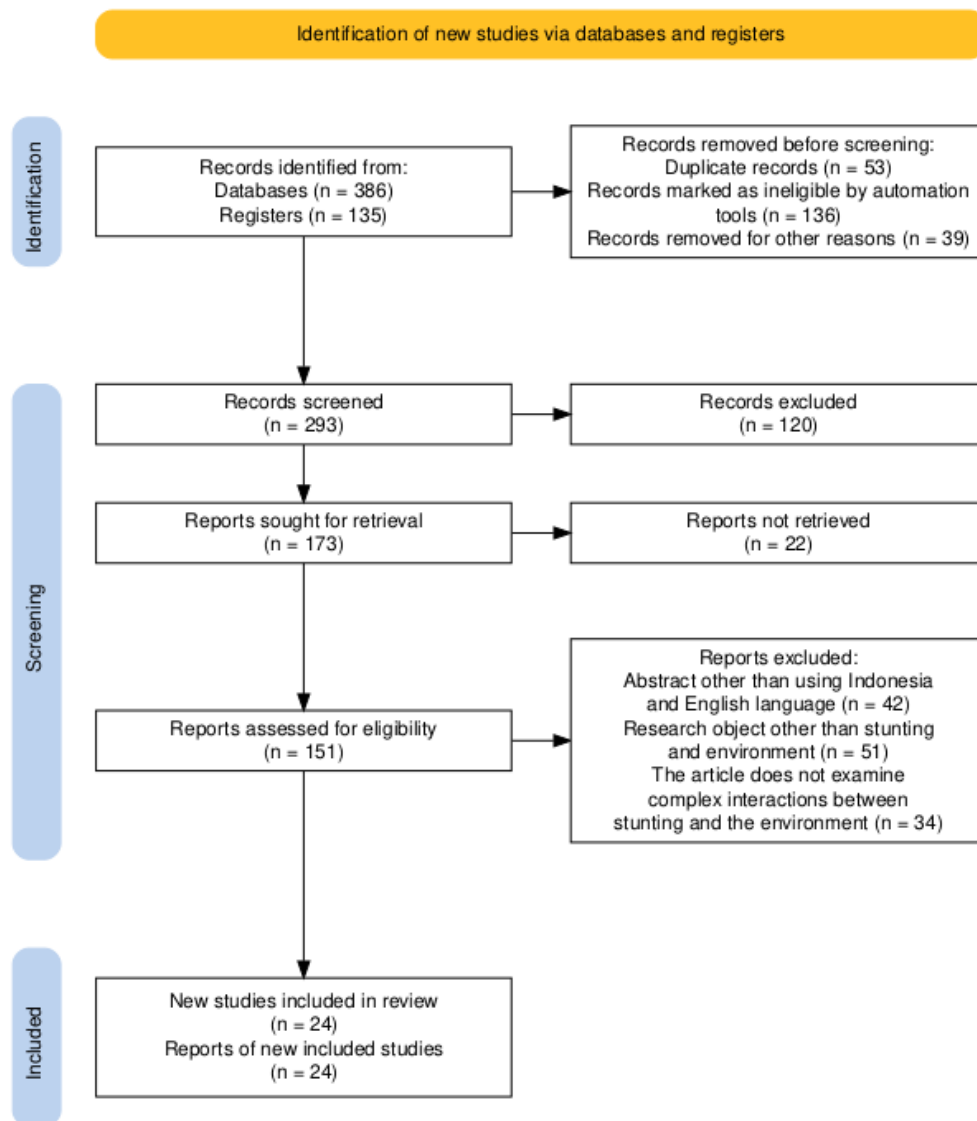


Figure 1. PRISMA diagram

Data synthesis

Data synthesis was conducted to address the three primary research questions (RQ1, RQ2, and RQ3). Because the chosen studies used different methods, a narrative synthesis strategy was used instead of a quantitative meta-analysis. This approach allowed for a systematic integration of diverse findings. The 24 selected papers were categorized based on their contribution to each RQ: 8 papers for RQ1 (Environmental interaction), 8 papers for RQ2 (Complex determinants), and 8 papers for RQ3 (Policy recommendations) (Figure 2). Each article was systematically reviewed for its author(s), country of origin, methodology, and key findings.

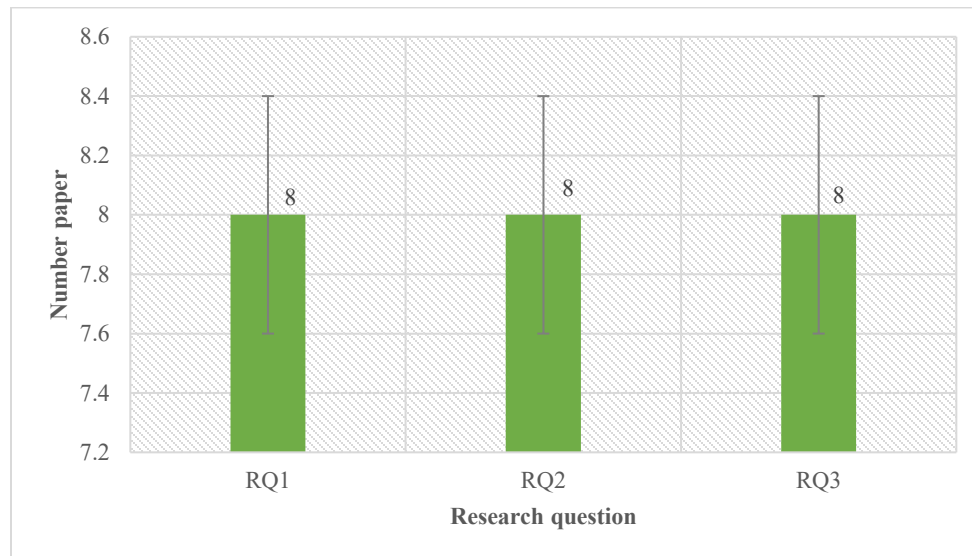


Figure 2. Number of papers based on RQ

Result

The systematic review of 24 selected papers demonstrates that stunting is a multifaceted phenomenon driven by the synergy of environmental degradation, socio-economic constraints, and policy implementation gaps.

The interplay of environmental factors (RQ1)

Analysis of the literature confirms that environmental factors do not act in isolation. Table 2 illustrates that stunting is the result of a "chain of contamination." Poor water quality, coupled with inadequate fecal management and proximity to livestock, creates a high-pathogen environment. The most critical finding is the role of environmental enteric dysfunction (EED); chronic exposure to environmental toxins and pathogens leads to subclinical gut inflammation, which prevents the absorption of nutrients even when food intake is sufficient.

Table 2. Environmental synergy and growth failure

Author	Key environmental interaction	Impact on stunting
Zahtamal et al. (2024)	Water Quality & latrines	Combined failure of WASH increases infection risks.
Regassa et al. (2024)	Vectors (Flies) & hygiene	This triggers environmental enteropathy (gut inflammation).
Halimah et al. (2022)	Clean water infrastructure	There is a direct correlation with toddler growth metrics.
Wardani & Rofika, (2022)	Livestock proximity	Fecal-oral transmission from animals to humans is a well-established phenomenon.
Lee et al. (2021)	Land & water access	23%-41% reduction in stunting via infrastructure.
Budge et al. (2019)	Pathogen disruption	WASH interventions prevent linear growth failure.
Beal et al. (2019)	Geographical factors	Spatial disparities in environmental access.
Fregonese et al. (2017)	Contamination	Environmental toxins as critical as nutrition.

The synthesis of these findings suggests that a synergistic failure of environmental barriers primarily drives stunting (Table 2). The data suggests that the mere presence of water and sanitation infrastructure is insufficient; it is the biological quality of these resources and their interaction with the immediate living environment such as the proximity to livestock that determines a child's susceptibility to EED and subsequent growth failure.

Complexity of cross-sectoral interactions (RQ2)

The interaction between the environment and external determinants adds another dimension to the phenomenon of stunting. Table 3 demonstrates that maternal-fetal dynamics and community-level sanitation heavily mediate environmental health. A "neighborhood effect" was identified, where a child's growth is influenced not only by their household's hygiene but also by the collective sanitation coverage of the surrounding area.

Table 3. Interactions between environment and external determinants

Author	Interaction type	Key finding	Complexity level
Kustriyanti et al. (2024)	Environment x behavior	Waste management practices determine water safety.	High (Behavioral)
AL-qurashi et al., (2024)	Nutrition x hygiene	Diet + hygiene initiatives > diet only.	Moderate (Synergy)
Raiten & Bremer, (2020)	Fetal x environment	Maternal health impacts child's environmental resilience.	High (Biomedical)

Owino et al. (2016)	EED x supplements	Specific supplements needed to fix gut dysfunction.	Moderate (Clinical)
Gleason et al. (2020)	Toxins x nutrition	Stunting modifies the cognitive impact of lead exposure.	High (Toxicological)
Nurjazuli et al. (2023)	Breastfeeding x water	Exclusive breastfeeding protects against poor water.	Moderate (Protective)
Cameron et al. (2021)	Community x private	Neighborhood sanitation is as vital as private toilets.	High (Systemic)
Rahut et al. (2024)	Climate x energy	Contaminated cooking fuel exacerbates malnutrition.	High (Climate/energy)

These interactions (marked as 'x' in Table 3) show that stunting is caused by a combination of different weaknesses. Maternal behaviors, community-level sanitation coverage, and exposure to non-biological toxins significantly moderate environmental risks, according to the evidence. This complexity underscores that stunting is not a purely nutritional or clinical issue but a systemic outcome where environmental hazards act as a catalyst for other socio-economic and toxicological stressors.

Evaluation of policy and programmatic recommendations (RQ3)

The review of Indonesian programs highlights a shift toward integrated interventions (Table 4). While infrastructure-based programs like the self-help housing assistance have shown success in improving living conditions, the primary bottlenecks remain at the implementation level. Key findings suggest that "siloe" working cultures among agencies, bureaucratic inefficiencies, and a lack of cultural integration in health education limit the long-term impact of stunting prevention initiatives.

Table 4. Policy recommendations for Indonesia

Author	Proposed solution	Target area	Recommendation for Policy
Yusriadi et al. (2024)	Inter-agency collaboration	Governance	Minimize redundancy across healthcare sectors.
Gusnedi Gusnedi et al. (2023)	Social empowerment	Community	Focus on young mothers' nutritional literacy.
Wasono & Sukmana, (2024)	Bureaucracy reform	Management	Improve resource allocation at the village level.

Agustin & Ar, (2024)	Stakeholder synergy	Coordination	Enhance awareness through cross-sectoral meetings.
Fadilla & Choiriyah, (2024)	Communication strategy	Outreach	Better outreach for higher community engagement.
Hasanah & Susanti, (2018)	Personnel training	Human capital	Intensive training for early stunting detection.
Lestari (2023)	Housing subsidy (BSPS)	Infrastructure	Scale up housing assistance for poor households.
Achyar et al. (2024)	Conservation education	Sustainability	Link stunting prevention with environmental care.

Collectively, these recommendations highlight a critical shift from top-down medical interventions to integrated, community-based governance. The literature indicates that although Indonesia has implemented strong structural programs such as the BSPS, the ultimate success of stunting eradication depends on dismantling bureaucratic silos, strengthening the communication skills of frontline health workers, and aligning formal policies with local cultural values to guarantee long-term behavioral sustainability.

Discussion

The results from Table 2 underscore that stunting in Indonesia and other developing nations is not merely a consequence of poor nutrition but a biological response to a contaminated environment. The interaction between substandard water quality and inadequate sanitation creates a persistent "pathogen load." As proven by Regassa et al. (2024) and Budge et al. (2019), this constant exposure leads to EED, a subclinical condition characterized by flattened intestinal villi, which significantly reduces the surface area for nutrient absorption. This discovery changes the focus from "food availability" to "biological utilization." Even if a child receives optimal caloric intake, the presence of fecal-oral contamination exacerbated by the proximity of livestock (Wardani & Rofika, 2022) renders nutritional interventions ineffective. Therefore, environmental hygiene must be prioritized as a prerequisite for the success of any nutritional supplementation program.

Stunting in Indonesia is a complex issue shaped by several environmental and socioeconomic causes. Environmental factors, including access to clean water, sanitation, and housing conditions, significantly influence stunting rates, while socioeconomic elements such as poverty, maternal education, and household income are also critical contributors. These factors interact to either intensify or alleviate the risk of stunting in children. Comprehending these connections is crucial for formulating effective strategies to reduce stunting prevalence in Indonesia. Availability of potable water and adequate sanitation are essential environmental determinants affecting stunting (Syahroni & Nugroho, 2023). Elevated stunting rates strongly correlate with limited access to potable water and insufficient sanitation facilities. Access to safe drinking water accounted for 21.08% of the variance in stunting rates in Indonesia. Likewise, inadequate

sanitation practices, including open defecation, exacerbate the incidence of stunting. Proper housing is an additional environmental factor associated with stunting. Inferior housing conditions are associated with increased stunting prevalence, underscoring the necessity of enhancing living environments to address stunting.

Poverty is a crucial socio-economic factor influencing stunting. Reduced household income restricts access to nutritious food and healthcare, elevating the risk of stunting. Poverty was revealed as the primary predictor of stunting prevalence in Central Sulawesi, Indonesia (Arifuddin et al., 2025). Maternal education significantly impacts child nutrition and health outcomes. Elevated maternal education levels correlate with improved child health practices and reduced stunting rates. This trend is especially apparent in rural regions where structural constraints, such as reduced maternal education, lead to increased stunting prevalence. The interplay between environmental and socio-economic factors is apparent in their combined impact on stunting. Socioeconomic gaps influence variations in healthcare access and environmental factors, subsequently impacting stunting rates. In Eastern Indonesia, elevated stunting rates are associated with socio-economic inequalities and insufficient public health interventions (Syahroni et al., 2023). The impact of these factors varies between urban and rural settings. In rural regions, structural and service-related constraints are more evident, whereas in urban areas, behavioral issues, including food habits, are more influential.

The interactions (x) identified in Table 3 further reveal the complexity of stunting. The data suggests that environmental hazards act as a multiplier of vulnerability. For example, the interaction between nutrition and hygiene (Al-qurashi, 2024) proves that hygiene acts as a protective shield for nutritional investment. Without this shield, "nutrient leakage" occurs due to frequent bouts of diarrhea and subclinical infections. Furthermore, the "neighborhood effect" identified by Cameron et al. (2021) suggests a shift in focus from private to public sanitation. A household with a private toilet is still at risk if the surrounding community practices open defecation. This highlights a critical socio-environmental gap: stunting prevention is a collective responsibility, and individual behavioral change is insufficient without community-wide infrastructure coverage. The additional interaction with non-biological stressors, such as contaminated cooking fuel (Rahut et al., 2024) and lead exposure (Gleason et al., 2020), indicates that children in poverty face a "syndemic" of risks that require a holistic environmental detoxification strategy.

Stunting in Indonesia is a complex issue shaped by environmental and social variables. Stunting, affecting roughly 30.8% of children under five, is associated with insufficient WASH conditions, alongside systemic economic obstacles. These elements lead to persistent malnutrition and frequent infections, which are primary causes of stunting. The interplay among these factors indicates that enhancing environmental circumstances and socioeconomic status is essential for effective stunting prevention. Such an outcome necessitates a shift from isolated nutritional interventions to holistic community-based initiatives that address deficiencies in the environment and infrastructure. Access to clean drinking water and proper sanitation facilities is crucial for reducing stunting.

Such an outcome necessitates a shift from isolated nutritional interventions to holistic community-based initiatives that address deficiencies in the environment and infrastructure. Studies show a strong correlation between elevated stunting rates and insufficient water supplies and inadequate sanitation practices, such as open defecation (Olo et al., 2020). Improvements in community-based sanitation have demonstrated a reduction in stunting prevalence, indicating the importance of collaborative action in sanitation infrastructure. Adhering to proper hygiene habits,

such as handwashing with soap, is crucial for preventing illnesses that lead to stunting. The economic conditions and educational attainment of parents are critical factors influencing stunting. Families with higher incomes and more educated parents are more inclined to ensure sufficient nutrition and access to healthcare services, thereby diminishing the risk of stunting.

In Ethiopia, enhancing handwashing practices and access to clean water is advised to mitigate stunting rates, highlighting the necessity for improved water infrastructure (Kwami et al., 2019). Economic variables significantly influence the adoption of hygienic practices. Low-income households often lack the means to invest in adequate sanitation and hygiene facilities (Christopher, 2024). In the Nsukka Zone of Nigeria, socio-economic inequities, encompassing income and education, profoundly affect WASH practices and resource distribution, resulting in the structural marginalization of lower-income communities from sufficient WASH services. Cultural dynamics and historical practices may impede the adoption of enhanced hygiene behaviors. In certain places, ingrained cultural norms and political partiality may hinder the enhancement of WASH services (Christopher, 2024). Educational interventions aimed at children and caregivers have demonstrated potential in enhancing cleanliness behaviors, indicating that cultural perceptions of hygiene can be altered via focused teaching. Environmental constraints, such as water shortages and seasonality, influence the availability and quality of WASH services; hence, challenging initiatives to improve hygiene practices in homes susceptible to stunting. In food-insecure regions, stunting rates may vary with seasonal fluctuations, highlighting the necessity for adaptive solutions that account for environmental circumstances (Woldesenbet et al., 2023).

Table 4 provides a roadmap for improving Indonesia's policy framework. While structural programs like the Self-Help Housing assistance have successfully addressed the physical environment, the review identifies a significant implementation gap caused by bureaucratic silos and poor communication (Wasono & Sukmana, 2024). The synthesis of policy recommendations emphasizes that "intersectoral collaboration" needs to go beyond formal meetings and into real-world implementation at the grassroots level. Success of stunting reduction hinges on community empowerment specifically targeting maternal literacy and involving local cultural leaders to ensure that hygiene practices are not just "taught" but "culturally assimilated". By aligning formal government targets with local social values, Indonesia can create a more resilient and sustainable stunting prevention ecosystem.

To align environmental health with socio-economic measures for stunting prevention, comprehensive policy suggestions must tackle the complex nature of stunting, influenced by nutritional, health, environmental, and socio-economic factors. Research findings indicate that a holistic approach necessitating cross-sector collaboration, community involvement, and sustainable resource distribution is crucial. This strategy should prioritize the enhancement of maternal and child health, the improvement of environmental circumstances, and the mitigation of socio-economic inequities. Implement efficient coordination frameworks among health, education, and environmental sectors to guarantee unified policy execution and resource allocation. Involve local governments, non-governmental organizations (NGOs), and community leaders in the design and implementation of stunting prevention initiatives to guarantee culturally appropriate and context-specific treatments (Da Silva et al., 2024). Establish community-oriented educational initiatives centered on maternal health, nutrition, and exclusive breastfeeding to equip women with essential knowledge and skills for child health.

Enhance public knowledge about the significance of nutrition and environmental health through campaigns and health education sessions. Allocate resources to WASH initiatives to mitigate disease prevalence and enhance nutrient absorption in children, thereby affecting stunting rates directly (Vico, 2024). Implement environmental risk mitigation methods, including drought resilience programs, to strengthen community capacity and avert stunting in at-risk regions. The development of economic strategies aimed at boosting household income and ensuring food security is crucial in reducing the prevalence of stunting. Enhance infrastructure in rural and underserved regions to facilitate access to healthcare and education, thereby mitigating socio-economic obstacles to stunting prevention. Implement comprehensive monitoring and evaluation mechanisms to evaluate the efficacy of stunting prevention programs and facilitate data-informed modifications as necessary. Implement longitudinal studies to assess the enduring effects of integrated interventions on stunting rates and child developmental outcomes.

Conclusion

The findings of this systematic review reveal that the effective adoption of hygiene behaviors for stunting prevention is primarily hindered by systemic poverty, limited access to affordable clean water, and high operational expenses. Additionally, maternal education levels and household gender roles serve as significant determinants for the sustainability of these practices, suggesting that hygiene education campaigns alone have a limited impact when underlying economic and structural barriers remain unaddressed. This study concludes that preventing stunting requires a multi-sectoral approach that goes beyond just medical and nutritional interventions. To be effective, public health policies must integrate household economic empowerment with the development of inclusive sanitation infrastructure, providing a more sensitive approach to the socio-economic constraints faced by communities in developing nations. The implication of these findings is that health interventions will remain ineffective unless they are aligned with social safety nets that improve economic access to hygiene resources. However, this study is subject to certain limitations, as it is based on 24 selected research articles from the 2016–2024 period, which may not fully capture every localized nuance across all developing regions. Going forward, policymakers should make it a priority to combine subsidized clean water projects with programs that help people become more financially independent. Furthermore, practitioners should design interventions that account for the financial and time constraints of caregivers, while future research should focus on longitudinal studies to evaluate the direct impact of combined socio-economic and hygiene interventions on long-term child growth outcomes.

Conflicts of Interest

The authors declare no conflict of interest.

Author contribution

R. R. P. M. S: Conceptualization, methodology, validation, formal analysis, investigation; resources, data curation; LY: writing-original draft preparation, writing-review and editing, visualization. All authors have read and agreed to the published version of the manuscript.

Declaration of generative AI in scientific writing

During the preparation of this work, the author(s) used ChatGPT to improve readability and language/brainstorm initial outlines / summarize technical literature. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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