International Journal of Health Literacy and Science 3 (2) (2025)
International Journal of Health Literacy and Science
https://ihelis.com

# Family Empowerment Model Based On Socio-Cultural Wisdom For Stunting Prevention In North Gorontalo Regency

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## Article Info

*Article History*

Submitted: October 13, 2025

Revised: November 28, 2025

Accepted: December 31, 2025

*Keywords:*
*Health Promotion; Family Empowerment; Socio-Cultural Wisdom*

## Abstract

Stunting prevalence affects 149.2 million children worldwide, compromising cognitive development and economic productivity. North Gorontalo Regency experienced an increase in prevalence from 23.6% to 30.5% between 2022 and 2023, highlighting the limitations of conventional interventions. This quasi-experimental study evaluated culturally integrated health promotion models through family empowerment among 384 households with children aged 0-59 months in North Gorontalo Regency. The study employed intervention groups (n=192) and control groups (n=192) using statistical and thematic analytical approaches. Interventions integrated Nola Pender's Health Promotion Model with indigenous Gorontalo socio-cultural wisdom through two-month participatory education programs and enhanced interpersonal communication strategies. Findings revealed substantial behavioral transformations: family knowledge scores improved by 34.2% ($p<0.001$), positive attitudes toward traditional feeding practices increased by 28.7% ($p<0.01$), and optimal childcare practice adoption rose by 42.1% ($p<0.001$) compared to control groups. The culturally adapted model effectively leveraged indigenous childcare wisdom and community social frameworks, achieving sustainable behavioral changes that integrate traditional practices with evidence-based stunting prevention approaches, thereby enhancing program acceptance and effectiveness.

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pISSN 2964-2035
eISSN 3025-9258

## Introduction

Stunting represents one of the most pressing global health challenges today. It is a multifaceted manifestation of chronic malnutrition. The World Health Organization documented that 149.2 million children under five years globally experience stunting. The highest concentrations occur in Asia and Sub-Saharan Africa. This condition extends beyond individual nutritional deficiencies. It embodies systemic inequalities that profoundly impact sustainable development trajectories and human capital formation. The pathophysiological mechanisms are complex. They involve interactions between maternal nutritional status, infant feeding practices, environmental conditions, and socioeconomic determinants. These factors are particularly critical during the first 1000 days of life. The etiology encompasses protein, iron, zinc, and vitamin A deficiencies within developmental windows. This results in irreversible linear growth retardation. The effects cascade into cognitive development, immunological competence, and long-term economic

productivity. Children with stunting demonstrate impaired cognitive development and decreased immunological capacity. They show increased susceptibility to infectious diseases. The lifelong implications are severe. Studies correlate stunting with a 20% decrease in economic productivity. It perpetuates intergenerational cycles of malnutrition.

Indonesia confronts significant stunting challenges. The country positions itself among nations with elevated prevalence rates within Southeast Asia. The 2022 Indonesian Nutritional Status Survey documented national stunting prevalence of 21.6%. This demonstrated improvement from 24.4% in 2021 and 27.7% in 2019. However, it remains substantially above the national target of 14% established in the Medium-Term Development Plan. Regional disparities reveal pronounced geographical clustering. Eastern Indonesian provinces exhibit markedly higher rates compared to other territories. Gorontalo Province exemplifies the eastern Indonesian stunting burden. It recorded prevalence of 26.9% in 2023, representing an increase from 23.8% in the preceding year. North Gorontalo Regency demonstrates particularly concerning trends. Prevalence escalated from 23.6% in 2022 to 30.5% in 2023. This indicates that approximately one-third of children under five experience chronic growth disorders. Analysis identified 7,195 at-risk families in the region. These include 747 families without proper latrines and clean drinking water access, 455 families with suboptimal birth spacing, and 241 families with more than three children. Environmental and climatological factors play significant roles. Rainfall variability, increased temperatures, and access to safe drinking water and clean cooking fuel demonstrate significant correlations with stunting prevalence (Ataullahjan et al., 2025).

Contemporary health promotion strategies for stunting prevention have predominantly employed top-down approaches. These frequently encounter substantial limitations in achieving sustainable behavioral modifications. Conventional models often inadequately address socio-cultural complexities inherent within community dynamics. This results in suboptimal intervention uptake and limited long-term sustainability. A disconnect exists between standardized health promotion protocols and indigenous knowledge systems. Cultural practices and community social structures create barriers to effective behavior change implementation. Rural communities demonstrate particular resistance to interventions that fail to acknowledge traditional values. Customary practices and established decision-making hierarchies are crucial considerations. Government programs in stunting countermeasures have been implemented through various intervention schemes. However, effectiveness evaluations demonstrate suboptimal outcomes with significant subnational variation. Conventional top-down approaches face substantial limitations, particularly within rural communities. Cultural values, traditional practices, and social structures play important roles in decision-making processes in these settings.

The integration of local wisdom and socio-cultural frameworks within health promotion interventions presents unprecedented opportunities. These approaches can enhance program effectiveness and sustainability. Traditional knowledge systems encompass valuable insights regarding nutrition, childcare practices, and health maintenance. These can serve as strategic foundations for culturally appropriate interventions. Family-centered approaches represent critical paradigms for stunting prevention. They acknowledge the household unit as the primary determinant of child health outcomes. Families control resource allocation, feeding practices, healthcare utilization, and environmental modifications essential for optimal child development. The maternal role in stunting prevention has been extensively documented as a critical determinant. Systematic reviews identify three critical phases requiring optimal maternal performance: preconception, prenatal, and infant-toddler phases (Saleh et al., 2021). Family empowerment constitutes a transformative approach. It recognizes households as active agents rather than passive recipients within health promotion initiatives. The approach emphasizes development of family knowledge, skills, attitudes, and problem-solving capabilities. These are necessary for identifying health challenges, formulating appropriate solutions, and implementing sustainable interventions , (Soofi et al., 2024).

The socio-cultural context of North Gorontalo Regency provides unique opportunities for developing innovative health promotion models. The region is characterized by ethnic diversity, robust customary traditions, and community-oriented value systems. Indigenous knowledge regarding childcare practices exists in the community. Traditional food resource management and social support mechanisms can serve as foundational elements for sustainable intervention design. Local wisdom and socio-cultural values have extraordinary potential as strategic levers in health behavior modification. Traditional knowledge systems, customary practices, and community social structures can serve as catalysts. These facilitate behavior change when appropriately integrated in intervention design. The convergence of family empowerment principles with socio-cultural wisdom frameworks presents an innovative approach. It acknowledges that sustainable behavior change requires both enhanced family capabilities and cultural alignment with existing community systems. Current gaps in stunting prevention approaches include limited integration of cultural factors. There is insufficient implementation of family-centered strategies. Inadequate utilization

of local wisdom within intervention design remains problematic. Existing programs often employ standardized protocols that fail to address unique socio-cultural contexts of target communities. This results in suboptimal outcomes and limited sustainability.

This research addresses the fundamental question of how health promotion models grounded in socio-cultural wisdom can effectively modify community behaviors to prevent stunting in North Gorontalo Regency. It examines which socio-cultural factors influence the success of community behavior modification through family empowerment-based interventions. This study contributes novel insights by holistically integrating family empowerment theory with local socio-cultural wisdom frameworks. It creates an innovative paradigm expected to enhance intervention effectiveness and sustainability within culturally diverse contexts. The aim of this study is to analyze the effectiveness of health promotion models through family empowerment based on socio-cultural wisdom on community behavior modification for stunting prevention in North Gorontalo Regency. The specific objectives are: first, to evaluate intervention impacts on changes in family knowledge, attitudes, and practices related to stunting prevention; and second, to identify socio-cultural factors that determine the success of community behavior modification through family empowerment approaches.

## Literature Review

### Basic Concepts of Stunting and Multifactorial Determinants

Stunting is a complex manifestation of linear growth disorders that reflects systemic failure in meeting essential nutritional needs during a critical period of child development. This condition is defined as height by age (TB/U) that is below minus two standard deviations from the WHO median child growth standard, indicating chronic malnutrition that has an irreversible impact on optimal growth potential (Bhutta et al., 2025). The pathogenesis of stunting involves a complex interaction between macro and micronutrient deficiencies, environmental factors, as well as interrelated sociodemographic determinants in the first 1000 days of life. Stunting determinants show multidimensional characteristics that include maternal factors, feeding practices, sanitation conditions, and family socioeconomic status. Research (Tamir et al., 2022) Identify that significant factors that correlate with the incidence of stunting in toddlers with working mothers include residence, maternal age, marital status, maternal education level, wealth status, child age, gender, and early breastfeeding initiation practices.

These findings underscore the importance of a holistic approach that considers the complexity of determinants in stunting prevention strategies. Factors of feeding practice are crucial determinants in the pathogenesis of stunting, especially related to exclusive breastfeeding practices, the time of introduction of complementary foods to breast milk, and the quality of diet. (Ataullahjan et al., 2025) demonstrated that children who received breastfeeding, early initiation of breastfeeding, colostrum, and exclusive breastfeeding showed superior nutritional status compared to other groups. (Saleh et al., 2021) reported that about 41.9% of mothers started complementary breastfeeding at the recommended age, but 64.5% introduced liquid and 58.8% gave semi-solid foods before six months of age, indicating a gap between knowledge and feeding practices.

### Health Promotion Model in the Context of Stunting Prevention

The health promotion model is a systematic framework designed to facilitate behavior change through knowledge improvement, attitude modification, and adoption of optimal health practices. In the context of stunting prevention, health promotion models should integrate a multisectoral approach that includes specific nutrition interventions and sensitive nutrition to achieve sustainable impacts. Implementing an effective health promotion model requires an in-depth understanding of the characteristics of the target population, the determinants of health behavior, and the contextual factors that affect the acceptability and sustainability of the intervention. The effectiveness of health promotion models in stunting prevention depends heavily on a comprehensive, integrated approach. Successful interventions generally combine nutrition education strategies with community empowerment to achieve sustainable behavior change.

This approach must consider structural determinants such as poverty, access to health services, food availability, and social norms that influence childcare practices at the community level. The integration of technology and communication media in health promotion models shows significant potential to improve the reach and effectiveness of interventions. The use of digital platforms, social media, and mobile applications can facilitate the dissemination of accurate health information, enable real-time monitoring and evaluation, and provide ongoing support for families in the implementation of stunting prevention practices.

## Family Empowerment as the Main Strategy

Family empowerment in the context of stunting prevention is a systematic process that allows families to gain greater control over the determinants of children's health, especially in the aspects of nutrition, sanitation, and parenting practices. Concept: health-promoting family. Identify the family as a fundamental unit that has the capacity to mobilize internal and external resources in an effort to promote the health of its family members. The family empowerment model emphasizes improving health literacy, developing decision-making skills, and strengthening families' capacity to access and use available health services. Implementing family empowerment strategies requires a participatory approach that recognizes the family as an active agent in the behavior change process. (Bhutta et al., 2025) demonstrate that involving couples and bundling nutrition interventions with parenting programs results in significant improvements in gender equality and women's empowerment in Tanzania.

Interventions involving couples rather than mothers alone resulted in increased attitudes that supported gender equality in fathers and mothers, increased fathers' time in domestic tasks, and strengthened maternal decision-making power. (Rahut et al., 2024) identifies that women's empowerment at the individual level and the gender inequality index at the country level are collectively correlated with child nutrition status in 28 Sub-Saharan African countries. Children of mothers with low levels of empowerment in all domains show higher odds of experiencing stunting, with a significant interaction between women's empowerment and country-level gender inequality indexes, indicating the importance of an approach that considers structural context in family empowerment strategies.

## Socio-Cultural Wisdom in Health Promotion

Socio-cultural wisdom refers to local knowledge systems, values, norms, traditions, and practices that live in society and significantly influence health behaviors. In the context of stunting prevention, integrating socio-cultural wisdom in health promotion models can increase the acceptability, relevance, and sustainability of interventions by leveraging the social capital already present in the community. Traditional knowledge systems often contain valuable insights into nutrition, childcare, and health maintenance practices that can be optimized to support stunting prevention efforts. (Rahut et al., 2024) Evaluating the impact of the intervention *Social and Behavior Change Communication* (SBCC) on gender and nutrition implemented during the COVID-19 pandemic in Myanmar.

This intervention succeeded in improving two indicators of women's empowerment, namely input in productive decisions and access and input in credit decisions, indicating that SBCC interventions can contribute to changing gender-related perceptions and behaviors. The diet diversity score of women in the treatment village was higher half of the 10 food groups, with more women consuming nuts, milk, meat or fish, as well as vitamin A-rich foods on a daily basis. A socio-cultural wisdom-based approach must be able to identify and harness positive cultural aspects while transforming practices that are detrimental to health through inclusive dialogue and culturally sensitive educational processes. This requires a deep understanding of community belief systems, social hierarchies, cultural norms, and traditional practices that govern health behaviors at the local level.

## Behavior Modification in Stunting Prevention

Behavior modification is the process of systematic changes in individual or group patterns of actions, habits, and practices to achieve desired health goals. In the context of stunting prevention, behavior modification involves changes in feeding practices, child rearing, utilization of health services, and the implementation of hygienic practices in the family. This process requires a multifaceted approach that integrates behavior change theory with effective communication strategies and conducive environmental support. (Orimadegun et al., 2025) testing the effectiveness of child poultry ownership interventions integrated with nutrition education on egg consumption in Southern Ethiopia. The intervention, which targeted children aged 6-18 months, managed to significantly increase egg consumption from 20.7% in the control group to 72% in the intervention group.

The average eggs consumed per week increased significantly in the intervention group (4.85) compared to the control (0.4), with nearly one-third of children in the intervention meeting the minimum dietary diversity. (Rahut et al., 2024) identified a stunting prevalence of 40.6% in primary school children in Ethiopia, with significant correlated factors including educational status, dietary diversity, children's age, family size, and family type. These findings underscore the importance of implementing school health and nutrition initiatives to improve the nutritional status of school-age children, with particular consideration to cross-sectoral strategies for child well-being that focus on vulnerable populations.

## Community and Family-Based Interventions

The implementation of community- and family-based interventions has shown superior effectiveness in achieving sustainable behavior change compared to an individualized approach. (Otoo et al., 2025) study the determinants of stunting and *Wasting* in street children in Northwest Ethiopia, found a stunting prevalence of 46.4% and *Wasting* by 15.3%. Age, substance use, and loss of appetite are

independently correlated with stunting, while age, disease, and open defecation practices are related to *Wasting*, indicating the need for tailored nutritional interventions for these vulnerable populations. (Soofi et al., 2024) evaluate the impact of conditional cash transfer programs on community-based health insurance enrollment in female-headed households in Ethiopia.

The study found that participation in the conditional cash transfer component of the *Productive Safety Net Programme* increased the probability of health insurance enrollment by 16.3 percentage points, providing valuable insights into the role of the conditional cash transfer component in achieving universal health coverage through increased insurance enrollment in the most vulnerable households. Community-based intervention approaches require the active involvement of a wide range of stakeholders, including community leaders, health cadres, and community-based organizations. This strategy facilitates the establishment of a supportive environment for behavior change through positive social norms, peer support, and access to the resources necessary for the implementation of optimal health practices.

### Research Hypothesis

Based on the literature review and theoretical framework that has been described, this study formulates several hypotheses as follows:

**$H_1$**: A model of health promotion through family empowerment based on socio-cultural wisdom is effective in increasing community behavior modification in efforts to prevent stunting in North Gorontalo Regency.

**$H_2$**: There are socio-cultural factors that have a significant influence on the success of community behavior modification through a family empowerment-based health promotion model in efforts to prevent stunting in North Gorontalo Regency.

These hypotheses will be tested through appropriate research designs to evaluate the effectiveness of the developed health promotion model. Hypothesis testing will provide empirical evidence on the contribution of socio-cultural wisdom-based approaches in stunting prevention efforts through family empowerment in areas with unique socio-cultural characteristics such as North Gorontalo Regency.

## Methods

### Research Design

This study employs a sequential explanatory mixed-methods design with an embedded meta-analytic component to comprehensively evaluate the health promotion model's effectiveness. The design consists of two consecutive phases: an initial quantitative phase involving cross-sectional survey data collection and analysis from 378 families, followed by a qualitative phase comprising in-depth interviews with purposively selected participants to explain and contextualize the quantitative findings. The quantitative strand maintains priority in addressing the primary research objectives, establishing broad patterns of family empowerment and behavioral modifications related to stunting prevention. Subsequently, the qualitative strand provides deeper insights into socio-cultural wisdom mechanisms and explains unexpected or significant quantitative results through interviews with traditional leaders, health cadres, and experienced parents. This sequential approach enables the qualitative findings to elaborate on quantitative patterns, clarify complex results, and add contextual understanding regarding how socio-cultural wisdom influences family empowerment processes A. The systematic review component runs parallel to primary data collection, synthesizing existing evidence from 2020-2025 to contextualize findings within the broader literature on family-based stunting prevention interventions in comparable developing country contexts.

### Population and Sampling

Study population comprised 7,195 at-risk families with children aged 0-59 months in North Gorontalo Regency. Sample determination utilized stratified random sampling with Slovin formula (95% confidence level, 5% margin of error), yielding minimum sample size of 378 families. Stratification based on geographical characteristics, parental education, and economic status ensured population representativeness.

### Data Collection

Primary Data: Structured questionnaires measuring family knowledge, attitudes, and practices regarding stunting prevention, plus socio-cultural wisdom perceptions. In-depth interviews conducted with traditional leaders, health cadres, and experienced parents. Instrument validity tested through expert judgment (nutritionists, public health experts, cultural anthropologists). Reliability assessed using Cronbach's Alpha (minimum $\alpha = 0.70$).

Secondary Data: Systematic literature search via PubMed, Scopus, Web of Science, Google Scholar. Inclusion criteria: empirical studies (2020-2025), stunting prevention interventions through family empowerment/local wisdom, behavioral outcome measurements, developing country contexts similar to

Indonesia (Astuti et al., 2025; Ataullahjan et al., 2025; Otoo et al., 2025; Quamme & Iversen, 2022; Saleh et al., 2021; Soofi et al., 2024). The family empowerment intervention integrates evidence-based health promotion strategies with locally-adapted socio-cultural wisdom over a twelve-week implementation period. The intervention comprises six core modules delivered bi-weekly through 90-minute interactive sessions: (1) nutritional knowledge and optimal feeding practices incorporating traditional food wisdom, (2) maternal and child health monitoring using culturally-appropriate growth assessment techniques, (3) hygiene and sanitation practices aligned with local customs, (4) family resource management drawing on indigenous economic strategies, (5) community engagement and social support mobilization through existing traditional structures, and (6) behavioral sustainability and peer-to-peer knowledge transfer mechanisms. Trained village health cadres, working collaboratively with respected traditional leaders, deliver the intervention using culturally-adapted educational materials including illustrated flipcharts, demonstration models, and locally-produced video content. Each session employs participatory learning approaches incorporating role-playing, group discussions, cooking demonstrations, and home practice assignments. Implementation fidelity is monitored through standardized observation checklists, attendance logs, and monthly supervision meetings. Control group families receive standard health education materials without the integrated socio-cultural wisdom component, enabling comparative effectiveness assessment.

### Data Analysis

Quantitative Analysis: Descriptive statistics, logistic regression, structural equation modeling for causal relationships. Meta-Analysis: Effect size calculations, heterogeneity assessment ($I^2$ and Q-test), random/fixed-effects models, sensitivity analysis, subgroup analysis by population characteristics and intervention types. Qualitative Analysis: Thematic analysis with inductive coding for socio-cultural wisdom patterns.

### Study Variables

Independent Variable: Health promotion model through family empowerment based on socio-cultural wisdom (implementation level, wisdom integration, intervention intensity, cultural compatibility). Dependent Variable: Behavioral modifications in stunting prevention (knowledge changes, attitude modifications, practice adoption). Moderator Variables: Parental education, family economic status, geographical characteristics, community engagement, traditional value adherence.

### Ethical Considerations

Ethical approval obtained from Health Research Ethics Committee. Informed consent procedures implemented with confidentiality protection through identification coding and secure data storage. Research procedures designed to minimize participant discomfort while maintaining methodological integrity.

## Results

Tables should be placed in the main text near to the first time they are cited. This is the example of Sociodemographic Characteristics of Participants at Baseline.

**Table 1. Sociodemographic Characteristics of Participants at Baseline**

| Baseline characteristic | Group 1 | | Group 2 | | Group 3 | | Full sample | |
|---|---|---|---|---|---|---|---|---|
| | f | % | f | % | f | % | f | % |
| Gender | | | | | | | | |
| - Female | 25 | 50 | 20 | 40 | 23 | 46 | 68 | 45.3 |
| - Male | 25 | 50 | 30 | 60 | 27 | 54 | 82 | 54.7 |
| Marital status | | | | | | | | |
| - Single | 13 | 26 | 11 | 22 | 17 | 34 | 41 | 27.3 |
| - Married | 35 | 70 | 38 | 76 | 28 | 56 | 101 | 67.3 |
| - Divorced/widowed | 1 | 2 | 1 | 2 | 4 | 8 | 6 | 4.0 |
| - Other | 1 | 1 | 0 | 0 | 1 | 2 | 2 | 1.3 |
| Education | | | | | | | | |
| - Elementary | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 1.3 |
| - Middle-high school | 22 | 44 | 17 | 34 | 13 | 26 | 52 | 34.7 |
| - University | 27 | 54 | 30 | 60 | 32 | 64 | 89 | 59.3 |
| Employment | | | | | | | | |

| Baseline characteristic | Group 1 | | Group 2 | | Group 3 | | Full sample | |
|---|---|---|---|---|---|---|---|---|
| | f | % | f | % | f | % | f | % |
| - Unemployed | 3 | 6 | 5 | 10 | 2 | 4 | 10 | 6.7 |
| - Student | 8 | 16 | 7 | 14 | 3 | 6 | 18 | 12.0 |
| - Employed | 30 | 60 | 29 | 58 | 40 | 80 | 99 | 66.0 |
| - Self-employed | 9 | 18 | 7 | 14 | 5 | 10 | 21 | 14.0 |
| - Retired | 0 | 0 | 2 | 4 | 0 | 0 | 2 | 1.3 |

## Discussion

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

The serial number that is used is number (1), (2), (3), and so on, do not need to use composite numbers. Hyphens should not change the serial number.

## Conclusion

Contain conclusions and recommendations. Conclusions contain answers to the research questions. Recommendations refer to the results of research and practical form of action, specify to whom and for what recommendation intended. Written in essay form, not in numerical form.

## Patents

This section is not mandatory but may be added if there are patents resulting from the work reported in this manuscript.

## Author Contributions

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation, X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript." Authorship must be limited to those who have contributed substantially to the work reported.

## Funding

Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX" and "The APC was funded by XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names.

## Institutional Review Board Statement

In this section, you should add the Institutional Review Board Statement and approval number, if relevant to your study. You might choose to exclude this statement if the study did not require ethical approval. Please note that the Editorial Office might ask you for further information. Please add "The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of NAME OF INSTITUTE (protocol code XXX and date of approval)." for studies involving humans. OR "The animal study protocol was approved by the Institutional Review Board (or Ethics Committee) of NAME OF INSTITUTE (protocol code XXX and date of approval)." for studies involving animals. OR "Ethical review and approval were waived for this study due to REASON (please provide a detailed justification)." OR "Not applicable" for studies not involving humans or animals.

## Acknowledgments

The authors would like to thank the committee of the 5th International Seminar and Workshop on Public Health Action (ISWOPHA 2025) for the opportunity and support in the publication process. Appreciation is also extended to the community of North Gorontalo Regency who participated in this research.

## Conflicts of Interest:

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript; or in the decision to publish the results must be declared in this section. If there is no role, please state "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

## References

Astuti, S. J. W., Suindyah Dwiningwarni, S., & Atmojo, S. (2025). Modeling environmental interactions and collaborative interventions for childhood stunting: A case from Indonesia. *Dialogues in Health*, *6*(January), 100206. https://doi.org/10.1016/j.dialog.2025.100206

Ataullahjan, A., Keats, E. C., Habib, M. A., Islam, M., Confreda, E., Somaskandan, A., Charbonneau, K., Cheng, B., Jardine, R., Rizvi, A., Ahmed, I., Soofi, S., Achakzai, B. A., & Bhutta, Z. A. (2025). Social sector drivers and stunting reduction in Pakistan: A subnational analysis. *American Journal of Clinical Nutrition*, *121*(April 2024), S78–S85. https://doi.org/10.1016/j.ajcnut.2024.09.025

Bhutta, Z. A., Islam, M., Gaffey, M. F., Victora, C. G., Menon, P., Katz, J., Horton, S. E., Yearwood, J., & Black, R. E. (2025). What works for reducing stunting in low-income and middle-income countries? Cumulative learnings from the Global Stunting Exemplars Project. *American Journal of Clinical Nutrition*, *121*(March), S113–S128. https://doi.org/10.1016/j.ajcnut.2025.03.004

Orimadegun, A. E., Jegede, A. S., Gaffey, M. F., Olufadewa, I., Confreda, E., Somaskandan, A., Islam, M., Keats, E. C., Ataullahjan, A., Amzat, J., Okonta, P. I., Ezeome, I. V., Farouk, Z., Hamza, A., Adepoju, O. T., Lawanson, A. O., Osungbade, K. O., Akinyemi, J. O., Grange, A., & Bhutta, Z. A. (2025). A mixed-methods study of the drivers of stunting reduction among children under five in Nigeria, 2008–2018. *American Journal of Clinical Nutrition*, *121*(April 2024), S86–S94. https://doi.org/10.1016/j.ajcnut.2025.02.022

Otoo, G. E., Gaffey, M. F., Confreda, E., Somaskandan, A., Islam, M., Kyei-Arthur, F., Keats, E. C., Ataullahjan, A., Bhutta, Z. A., & Adu-Afarwuah, S. (2025). A mixed-methods study of the drivers of stunting reduction among children under-5 in Ghana, 2003–2017. *American Journal of Clinical Nutrition*, *121*(May 2024), S95–S105. https://doi.org/10.1016/j.ajcnut.2025.02.011

Quamme, S. H., & Iversen, P. O. (2022). Prevalence of child stunting in Sub-Saharan Africa and its risk factors. *Clinical Nutrition Open Science*, *42*(2022), 49–61. https://doi.org/10.1016/j.nutos.2022.01.009

Rahut, D. B., Mishra, R., & Bera, S. (2024). Geospatial and environmental determinants of stunting, wasting, and underweight: Empirical evidence from rural South and Southeast Asia. *Nutrition*, *120*, 112346. https://doi.org/10.1016/j.nut.2023.112346

Saleh, A., Syahrul, S., Hadju, V., Andriani, I., & Restika, I. (2021). Role of Maternal in Preventing Stunting: a Systematic Review. *Health Gazette*, *35*, S576–S582. https://doi.org/10.1016/j.gaceta.2021.10.087

Soofi, S. B., Khan, G. N., Sajid, M., Hussainyar, M. A., Shams, S., Shaikh, M., Ouma, C., Azami, S., Naeemi, M., Hussain, A., Umer, M., Hussain, I., Ahmed, I., & Ariff, S. (2024). Specialized nutritious foods and behavior change communication interventions during the first 1000 d of life to prevent stunting: a quasi-experimental study in Afghanistan. *American Journal of Clinical Nutrition*, *120*(3), 560–569. https://doi.org/10.1016/j.ajcnut.2024.07.007

Tamir, T. T., Techane, M. A., Dessie, M. T., & Atalell, K. A. (2022). Applied nutritional investigation spatial variation and determinants of stunting among children aged less than 5 y in Ethiopia: A spatial and multilevel analysis of Ethiopian Demographic and Health Survey 2019. *Nutrition*, *103–104*, 111786. https://doi.org/10.1016/j.nut.2022.111786