



# Community-Based Educational Approaches to Stunting Prevention



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## ABSTRACT

**Aims** This study aimed to assess the effectiveness of community-based educational interventions in preventing stunting, with a focus on their planning, execution, and effects on growth outcomes and associated behaviors in low- and middle-income countries.

**Information & Methods** This systematic review was conducted following PRISMA 2020 criteria, by a comprehensive search of PubMed, MEDLINE, Embase, Scopus, and other relevant databases until December 2024. Studies that focused on community-based education for stunting prevention were considered experimental, including randomized controlled trials and quasi-experimental research. Changes in height-for-age z-scores were the primary outcome measured, while improvements in maternal and child nutrition knowledge, attitudes, and practices served as secondary objectives. The ROBINS-I and RoB 2 tools were utilized to assess the risk of bias.

**Findings** A total of 17 studies from various low- and middle-income countries (Indonesia, Kenya, Bangladesh, Afghanistan, China, and Peru) were included. These studies employed a range of educational strategies, such as home visits, group workshops, mobile health applications, and digital platforms. The duration of interventions varied from two weeks to two years, with many incorporating behavior change communication techniques, practical demonstrations, and culturally tailored content. Significant improvements were observed in height-for-age z-scores, dietary diversity, exclusive breastfeeding, and complementary feeding practices. Programs that were culturally adapted, sustained over longer periods, and integrated multiple delivery methods proved to be the most effective. However, shorter interventions demonstrated limited long-term impact.

**Conclusion** Community-based educational interventions effectively reduce stunting and improve nutrition-related behaviors in low- and middle-income countries.

**Keywords** Growth; Education; Child; Behavior

## CITATION LINKS

[1] Stunting is not a synonym ... [2] Early and long-term consequences of nutritional ... [3] Child wasting and concurrent stunting in ... [4] Global, regional and national epidemiology and prevalence ... [5] Patterns in child stunting by age ... [6] Long-term effects of severe acute ... [7] Achieving zero stunting: A sustainable ... [8] Nutrition in the context of ... [9] Levels and trends in child ... [10] Determining the role of exclusive ... [11] Community service initiative: ... [12] Stunting prevention education ... [13] Evidence-based interventions ... [14] Global nutrition epidemiology ... [15] Impact of infant and young child feeding ... [16] How countries can reduce child stunting ... [17] Multilevel determinants of community ... [18] The PRISMA 2020 statement: An ... [19] Nutrition education in Southeast Sulawesi ... [20] Effects of third trimester counseling on pregnancy ... [21] The impact of a large-scale social and behavior change ... [22] Short-term nutrition education reduces low birthweight and improves ... [23] Mobile phone support to sustain exclusive ... [24] Effectiveness of home-based nutritional ... [25] The effect of interactive education program ... [26] Preliminary study: The effectiveness ... [27] The effectiveness of educational applications ... [28] Effect of maternal nutritional education and ... [29] The effect of nutrition and reproductive ... [30] Effectiveness of an educational ... [31] Impact of eHealth education to reduce ... [32] Early stunting detection education ... [33] The intervention of maternal nutrition ... [34] Specialized nutritious foods and behavior ... [35] Effectiveness of complementary ... [36] Maternal and child undernutrition ... [37] Thinking about the environment ... [38] Systematic review of the efficacy ... [39] Tailored nutrition education in ... [40] Balancing nurturance, cost and ... [41] Urban-rural disparities of antenatal ... [42] Associations of linear growth ... [43] Effectiveness of cash-plus ... [44] Maternal and child undernutrition ... [45] Feasibility and effectiveness assessment ...

## Introduction

Impaired growth and development caused by chronic malnutrition is known as stunting, which is a serious public health issue with long-term effects on both individuals and nations [1, 2]. Millions of children worldwide suffer from this condition, primarily in low- and middle-income countries (LMICs), where access to nutritious food, medical care, and sanitation facilities is limited [3-5]. The World Health Organization (WHO) states that early childhood stunting is associated with permanent cognitive impairments, poor academic performance, decreased adult productivity, and an increased risk of chronic illnesses [6]. Addressing stunting is essential for achieving global objectives such as the sustainable development goals (SDGs), particularly SDG 2.2, which aims to eradicate all forms of malnutrition by 2030 [7, 8].

Despite significant international efforts, reductions in stunting have not been uniformly achieved. The UNICEF/WHO/World Bank Joint Child Malnutrition Estimates indicate that while the global prevalence of stunting decreased from 33.1% in 2000 to 22.0% in 2020, regions such as South Asia and Sub-Saharan Africa continue to report stunting rates above 30% [9]. In Indonesia, the Studi Status Gizi Indonesia (SSGI) 2022 reported a national stunting prevalence of 21.6%, falling short of the government's target to reduce it to 14% by 2024. These statistics underscore the urgent need for effective, scalable, and context-specific interventions [10].

One promising approach to stunting prevention is community-based education. Unlike top-down strategies, community-based education empowers local communities to become active participants in addressing stunting [11, 12]. These programs often incorporate culturally relevant messages, involve local stakeholders, and integrate educational sessions on maternal and child nutrition, hygiene, breastfeeding practices, and complementary feeding. The participatory nature of these approaches not only improves knowledge but also fosters behavior change, enabling sustainable improvements in child health outcomes [9, 12].

Several systematic reviews have explored interventions for stunting prevention, providing valuable insights into global efforts. For instance, a review by Bhutta *et al.* highlights the efficacy of nutrition-specific interventions, such as micronutrient supplementation and exclusive breastfeeding (EBF) promotion, in reducing stunting [13, 14].

More recently, a meta-analysis by Lassi *et al.* [15] emphasizes the importance of integrating nutrition-sensitive approaches, such as poverty alleviation and education, to address the underlying determinants of stunting. However, these reviews often focus on broader interventions and do not specifically analyze the role of community-based education.

Another notable review by Bhutta *et al.* [16] synthesizes evidence on stunting reduction policies globally but lacks detailed insights into localized, community-driven educational programs. Similarly, systematic reviews of maternal and child health interventions have acknowledged the role of community health workers but often do not isolate educational components specifically tailored to stunting prevention [17]. This gap underscores the need for a focused examination of community-based education as both a standalone and synergistic strategy.

The present systematic review aimed to address this gap by synthesizing evidence from experimental studies on community-based education interventions targeting stunting prevention. It aimed to analyze their design, implementation, and effectiveness in diverse settings. By doing so, this review will contribute to understanding best practices, contextual factors influencing success, and critical areas for future research. This evidence is vital for policymakers, healthcare practitioners, and community leaders striving to develop sustainable and culturally sensitive strategies to combat stunting at the grassroots level. This review not only builds on previous findings but also adds specificity by narrowing its focus to community-based education approaches. By examining this critical aspect, the study aimed to provide actionable insights to bridge the gap between knowledge and practice in stunting prevention, ultimately contributing to healthier and more equitable communities.

## Information and Methods

This systematic review was conducted in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 criteria to maintain openness and methodological rigor [18].

### Eligibility criteria

The eligibility criteria were established using the PICOS framework (Table 1).

### Information sources

To ensure comprehensive coverage, multiple sources of information were utilized. The electronic databases searched included PubMed, MEDLINE, Embase, Cochrane Library, Scopus, Web of Science, and PsycINFO. Grey literature was explored through platforms, such as ProQuest Dissertations and Theses, WHO IRIS, Google Scholar, and reports from local ministries of health and international organizations, like UNICEF and FAO. Manual screening of references from included studies and relevant reviews was also conducted. The search encompassed studies published from the inception of the databases to December 2024.

### Search strategy

For each database, a customized search strategy was created that combined free-text terms with controlled vocabulary, such as MeSH terms for

PubMed and Emtree terms for Embase. To ensure the accurate retrieval of pertinent papers, the search was refined using Boolean operators and filters.

Table 2 contains the full search strings for each database.

### Study selection

Duplicate results were eliminated after importing all search results into reference management software. Two reviewers independently examined abstracts and titles to identify papers that met the inclusion criteria. Full-text publications of eligible studies were obtained and further evaluated for inclusion. A third reviewer was consulted to resolve any disputes between the reviewers. A PRISMA flow diagram was used to document the selection process.

### Data extraction

A standardized form, which was piloted and refined for this evaluation, was utilized to extract data. Extracted information included study characteristics, such as author, year, country, and design; population details including sample size; intervention specifics covering duration, content, and mode of delivery; comparator group details; outcomes measured,

including primary and secondary outcomes; and key findings. Information on funding sources and potential conflicts of interest was also collected. Two reviewers independently extracted the data, and disagreements were resolved through discussion.

### Risk of bias assessment

Validated instruments were employed to assess the risk of bias in the included studies. Aspects such as randomization, departures from planned interventions, missing data, outcome assessment, and reporting bias were evaluated for RCTs using the Cochrane Risk of Bias 2 (RoB 2) methodology. For quasi-experimental studies, confounding, selection bias, and deviations from intended interventions were assessed using the ROBINS-I (risk of bias in non-randomized studies of interventions) tool. Two reviewers conducted the assessments independently, and any disputes were resolved through discussion or by consulting a third reviewer.

### Data synthesis

All included studies underwent a narrative synthesis with an emphasis on the features, methods, and results of the interventions.

**Table 1.** PICOS statement

Item	Statement
<b>Population</b>	Children under five years old, pregnant women, and caregivers residing in community settings, with a focus on those vulnerable to stunting due to socioeconomic, geographic, or cultural factors.
<b>Intervention</b>	Community-based educational programs explicitly aimed at preventing stunting, including activities such as nutrition education, breastfeeding promotion, growth monitoring, complementary feeding guidance, and hygiene education delivered at the community level.
<b>Comparison</b>	No intervention, standard care or usual practices, or alternative interventions, such as cash transfers or healthcare provision without an educational component.
<b>Outcome</b>	Changes in knowledge, attitudes, and practices regarding mother and child nutrition, breastfeeding, supplemental feeding, and cleanliness were secondary goals, whereas the primary outcome was the decrease in the prevalence of stunting as indicated by height-for-age z-scores (HAZ).
<b>Study design</b>	Experimental studies, including randomized controlled trials (RCTs), cluster RCTs, and quasi-experimental designs with a comparator group, were included. Observational studies, reviews, commentaries, and qualitative studies were excluded.

**Table 2.** Search terms in the databases

Database	Search string
<b>PubMed</b>	("stunting" [MeSH Terms] OR "chronic malnutrition") AND ("community-based" [Title/Abstract] OR "community intervention" [Title/Abstract] OR "local participation" [Title/Abstract]) AND ("education" [MeSH Terms] OR "nutrition education" [Title/Abstract] OR "health education" [Title/Abstract]) AND ("randomized controlled trial" [Publication Type] OR "trial" [Title/Abstract])
<b>MEDLINE</b>	("stunting" OR "chronic malnutrition") AND ("community-based" OR "community intervention" OR "local participation") AND ("education" OR "nutrition education" OR "health education") AND ("randomized controlled trial" OR "intervention study")
<b>Embase</b>	('stunting'/exp OR 'chronic malnutrition'/exp) AND ('community-based'/exp OR 'community intervention'/exp OR 'local participation'/exp) AND ('education'/exp OR 'nutrition education'/exp OR 'health education'/exp) AND ('randomized controlled trial'/exp OR 'intervention study'/exp)
<b>Cochrane Library</b>	("stunting" OR "chronic malnutrition") AND ("community-based" OR "community intervention" OR "local participation") AND ("education" OR "nutrition education" OR "health education") AND ("trial" OR "randomized controlled trial" OR "intervention")
<b>Scopus</b>	TITLE-ABS-KEY ("stunting" OR "chronic malnutrition") AND TITLE-ABS-KEY ("community-based" OR "community intervention" OR "local participation") AND TITLE-ABS-KEY ("education" OR "nutrition education" OR "health education") AND TITLE-ABS-KEY ("trial" OR "randomized controlled trial")
<b>PsycINFO</b>	("stunting" OR "chronic malnutrition") AND ("community-based" OR "community intervention" OR "local participation") AND ("education" OR "nutrition education" OR "health education") AND ("trial" OR "randomized controlled trial" OR "intervention study")

## Findings

Database searches yielded a total of 858 publications, and a manual review of reference lists revealed no additional research. After eliminating 553 duplicates and irrelevant records, 305 studies were screened for

titles and abstracts. Nineteen of these studies were selected for full-text review after 286 were disqualified for failing to meet the eligibility criteria. Following a comprehensive review, 17 studies remained for inclusion after nine were disqualified

due to factors, such as the lack of a community-based educational component or irrelevant participant categories.

The PRISMA flow diagram illustrates the study selection process (Figure 1).

#### Characteristics of the studies included

Seventeen studies from diverse LMICs, including Indonesia (n=8), Kenya (n=2), Bangladesh (n=4), Afghanistan (n=1), China (n=1), and Peru (n=1), were included (Table 3). The studies employed various designs, with randomized controlled trials (RCTs, n=10) and quasi-experimental designs (n=7). Sample sizes ranged from small, localized interventions (40 participants) to large-scale community-based programs (over 2,000 participants). The majority of the studies targeted caregivers, mothers, and pregnant women, focusing on improving nutrition-related practices to prevent stunting.

The duration of the interventions varied, from single sessions lasting 90 minutes to sustained multi-year programs. Delivery methods included home visits, group workshops, counseling sessions, mobile phone support, and digital platforms, often tailored to the cultural and contextual needs of the target population. The primary outcomes measured were improvements in height-for-age z-scores (HAZ) and reductions in stunting prevalence, while secondary

outcomes included changes in knowledge, attitudes, and practices (KAP) related to maternal and child nutrition, hygiene, and feeding behaviors (Table 3).

#### Risk of bias assessment

The quality of the included studies was evaluated using the ROBINS-I tool for quasi-experimental studies and the Cochrane RoB 2 tool for RCTs. Among the RCTs, six were deemed to be at low risk, while the remaining four raised some concerns due to incomplete blinding or issues with outcome data reporting. The quasi-experimental studies generally exhibited a moderate risk of bias, with common challenges including confounding variables, deviations from intended interventions, and reliance on self-reported outcomes (Figures 2 and 3).

#### Educational content delivered

All 17 studies incorporated community-based educational elements aimed at improving maternal and child nutrition behaviors.

**Breastfeeding promotion:** Twelve studies included EBF promotion, emphasizing early initiation, proper techniques, and the benefits of continued breastfeeding up to 24 months. For instance, mobile phone support in Bangladesh significantly increased EBF adherence rates ( $p<0.001$ ), while a home-based program in Kenya led to a 25% improvement in EBF practices among urban mothers.

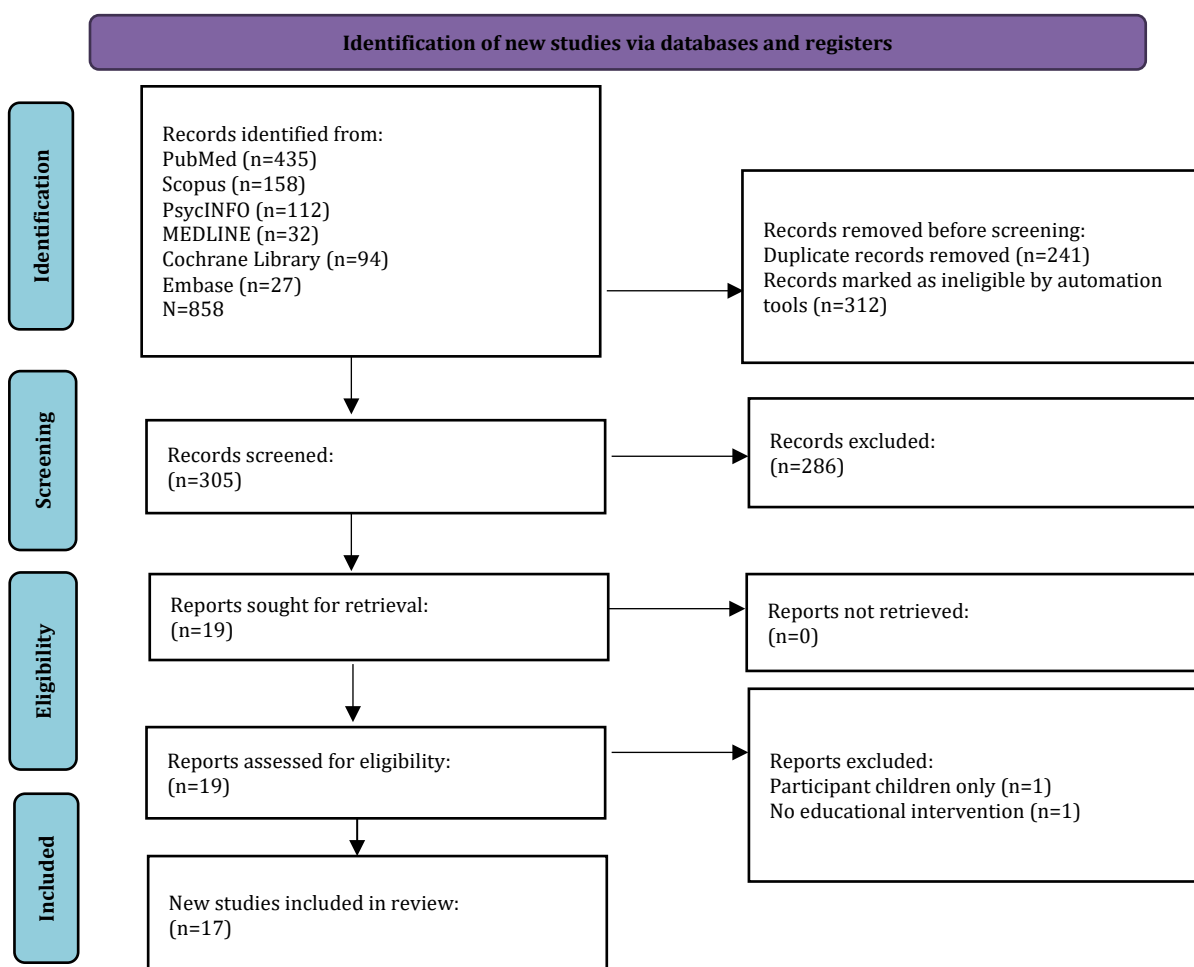


Figure 1. PRISMA flowchart for study selection

**Table 3.** Characteristics of studies included

Author(s), Year, Country	Study design	Sample size		Intervention		Educational content	Education method	Duration	Outcome measurements	Main finding(s)
		Intervention group	Control group	Intervention group	Control group					
<b>Effendy <i>et al.</i>, 2020, Indonesia</b> <sup>[19]</sup>	Randomized controlled trial (RCT)	126	116	GEN ASIK	Routine care (RC)	- Continuing breastfeeding - Principles of feeding for children - Cooking practice	Nutrition classes and home visits	3 hours, twice a week for 2 weeks	Dietary diversity scores (DDSs), minimum dietary diversity (MDD), minimum meal frequency (MMF), and minimum acceptable diet (MAD)	Increased DDS
<b>Akter <i>et al.</i>, 2012, Bangladesh</b> <sup>[20]</sup>	Quasi-experimental	57	58	Nutrition education	RC	- Food intake - Hygiene of the food - Daytime rest - Steer clear of pre-lactational meals - EBF	Counseling	3 months, 1 hour	Interview; Anthropometric	- Increased mother and baby's weight - Initiated breastfeeding within 1 hour
<b>Dearden <i>et al.</i>, 2023, Tanzania</b> <sup>[21]</sup>	Quasi-experimental	21,722	-	Social and behavioral change communication	-	- Handwashing - Feeding practices - Antenatal care - Breastfeeding	Home visits; Stimulation activities	12 months	Self-structured questionnaire	Improved knowledge, attitude and practice
<b>Jahan <i>et al.</i>, 2014, Bangladesh</b> <sup>[22]</sup>	RCT	150	150	Nutrition education	RC	- Pregnancy weight gain - Food intake (Khichuri) - Personal hygiene - Rest - Making use of prenatal care services - Initiation of breastfeeding	Booklets, manuals, and flip charts with colored photos; Practical demonstration	3 months, 1 hour	Interview	- Weight gain of the mother - Initiation of breastfeeding within 1 hour
<b>Jerin <i>et al.</i>, 2020, Bangladesh</b> <sup>[23]</sup>	Quasi-experimental	129	-	Mobile phone-based EBF support	-	EBF	Phone calls counseling	6 months, 15 min	Interview and self-structured questionnaires	- Increased EBF - No significant difference in birth weight
<b>Kimani-Murage <i>et al.</i>, 2017, Kenya</b> <sup>[24]</sup>	RCT	415	485	Home-based nutritional counseling	RC	- Maternal nutrition - EBF - Lactation management	Home visit, counseling	12 months, monthly	Breastfeeding score	Increased EBF
<b>Maryati <i>et al.</i>, 2022, Indonesia</b> <sup>[25]</sup>	RCT	139	139	Interactive education program	RC	Parenting practices	Workshops	12 sessions, 2 a week, 6 months	Self-structured questionnaires	Increased parenting style to prevent stunting
<b>Muhamad <i>et al.</i>, 2023, Indonesia</b> <sup>[26]</sup>	Quasi-experimental	41	41	Nutrition education	Nutrition education	- Maternal health - Nutrition	Leaflet assisted by cadres	6 months	Self-structured questionnaires	Improved knowledge, attitude, and practice
<b>Nurfajriyani &amp; Andhini, 2022, Indonesia</b> <sup>[27]</sup>	Quasi-experimental	34	34	Stunting-based prevention education AECAS App	Nutrition education: Booklet	- Diet of expectant mothers - Early breastfeeding initiation - The supply of colonoscopy, Six months of exclusive breastfeeding - Supplemental nutrition - Breastfeeding for a maximum of 24 months	Online media; WhatsApp	2 weeks	Stunting Prevention Perception Questionnaire	Increased perception
<b>Nyamasege <i>et al.</i>, 2021, Kenya</b> <sup>[28]</sup>	RCT	2174	2326	Home-based maternal necrotizing enterocolitis (NEC)	RC	- Maternal nutrition - Exclusive breastfeeding - Expressing breast milk, storage, handling, and feeding - Lactation management	Counseling	12 months, 2 a week	Household Food Insecurity Access Scale (HIAS); EBF practices; Anthropometric; height-for-age Z-scores/ height-for-age z-scores (HAZ)	Lower stunting prevalence
<b>Permatasari <i>et al.</i>, 2021, Indonesia</b> <sup>[29]</sup>	Quasi-experimental	97	97	Interactive education	RC	- Parenting - Psycho-emotional parenting - Nutritional parenting - Nutrition - Reproductive health education	Lectures, games, role-playing, and simulation	3 months, once in 2 weeks, 2 hours	Self-structured questionnaire	Improved knowledge, attitudes, and practice



Continue of Table 3 from the last page.

<b>Penny et al., 2005, Peru</b> [30]	RCT	187	190	Nutrition education	RC	- Feeding habits - Dietary intakes - Children's development	Counseling, training, one-page recipe fliers, and flip charts	18 months	Anthropometric; Peruvian food-composition tables	- A notable increase in preventive medical visits - Increased breastfeeding more often - Increased energy intake - Increased zinc intake
<b>Rahman et al., 2023, Bangladesh</b> [31]	RCT	180	180	Complementary feeding promotion	RC	- Hand washing each and every time before cooking - The frequency of meals and the amount of feed based on age - The consistency of the food - The variety of foods - Responsive feeding	Lecture; Home visit	6 months, 1 hour	CFI; Anthropometric	Significant effect on HAZ and WHZ
<b>Sari, 2021, Indonesia</b> [32]	Quasi experimental	40	-	Early detection education	-	- Stunting - Breastfeeding - Clean and healthy living behavior - Practicing to use a stunting detection blanket measuring device	Lecture, interactive question	Once, 90 min	Not mentioned	Improved knowledge
<b>Sirajuddin et al., 2021, Indonesia</b> [33]	RCT	43	42	Maternal nutritional literacy	RC	- Breastfeeding - Hygiene activities - Care	Lecture; Class simulation; Home visits	3 months	Anthropometric	Increased HAZ
<b>Soofi et al., 2024, Afghanistan</b> [34]	Quasi-experimental	1,461	1,467	Social and behavior change communication and specialized nutritious food	RC	- Infant and young child feeding (IYCF) practices - Child and maternal nutrition, Nutritional supplements	Counseling, training, group meeting, guidance using flip chart	2 years, monthly sessions	Household survey questionnaire; Anthropometric	- Improved the early commencement of breastfeeding - Improved minimum meal frequency (MMF) - Improved minimal acceptable diet (MAD) - Increased dietary diversity
<b>Zhang et al., 2016, China</b> [35]	Quasi-experimental	1,804	804	Dietary counseling	RC	Complementary feeding	Counseling	2 years	Anthropometric	Increased dietary diversity

**Complementary feeding guidance:** Fourteen studies addressed complementary feeding practices, focusing on dietary diversity, meal frequency, and responsive feeding. Practical demonstrations, such as cooking classes in Indonesia, showed significant improvements in caregivers' ability to prepare nutrient-rich meals, resulting in better dietary diversity scores ( $p < 0.05$ ).

**Hygiene and sanitation:** Nine studies integrated hygiene education, highlighting the importance of handwashing, clean food preparation, and sanitation to prevent infections that exacerbate malnutrition. A year-long intervention in Afghanistan reported a 40% improvement in hygiene practices among caregivers.

**Behavioral change communication (BCC):** Ten studies incorporated BCC strategies to modify caregiver attitudes and practices. A program in Bangladesh that used motivational messaging through WhatsApp enhanced maternal confidence

and adherence to nutritional guidelines, improving complementary feeding practices ( $p < 0.0001$ ).

#### Delivery methods and intervention duration

**Home visits:** Utilized in six studies, home visits provided tailored counseling and direct support. For example, Kenyan community health workers conducting monthly home visits significantly improved exclusive breastfeeding rates and maternal nutritional literacy.

**Group workshops and practical demonstrations:** Five studies emphasized interactive learning, such as cooking classes and hygiene demonstrations. In Indonesia, group sessions led to a 20% increase in dietary diversity awareness among caregivers.

**Digital Tools:** Two studies used mobile apps and messaging platforms to deliver education, demonstrating significant behavioral improvements while reducing logistical barriers.

#### Duration

Intervention duration emerged as a critical factor

influencing outcomes. Longer programs (12-24 months) consistently demonstrated greater effectiveness in reducing stunting prevalence and sustaining behavioral changes. For example, a two-year program in Afghanistan that combined educational sessions with nutritional supplementation reduced stunting prevalence by over 10% ( $p < 0.001$ ). Conversely, shorter interventions (e.g., a two-week online education program in Indonesia) were effective in raising awareness but had limited impact on long-term outcomes.

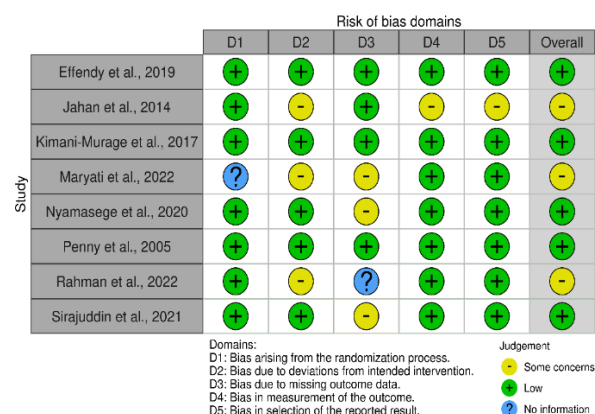


Figure 2. Risk of bias visualization of randomized studies

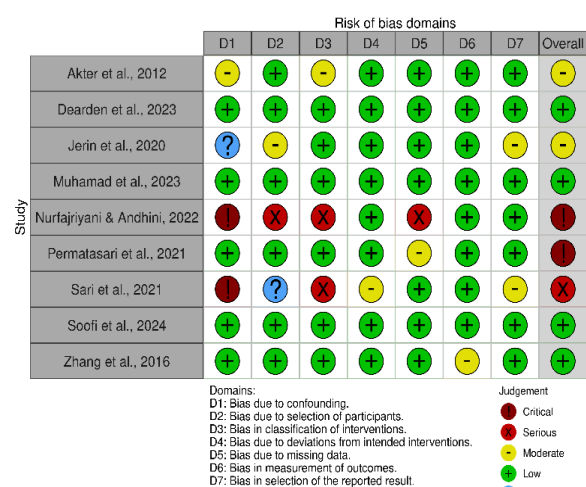


Figure 3. Risk of bias visualization of non-randomized studies

### Impact on nutritional and behavioral outcomes

**Primary outcomes:** Improvements in HAZ were reported in 11 studies. Long-term interventions, such as an 18-month program in Peru, achieved substantial gains in child growth, with mean HAZ scores improving by 0.5 standard deviations ( $p < 0.01$ ). Similarly, a multi-year initiative in China observed a significant reduction in stunting prevalence, attributed to dietary counseling and complementary food provision ( $p < 0.0001$ ).

**Secondary outcomes:** Changes in caregiver KAP were observed in 15 studies. Enhanced dietary

diversity scores, increased exclusive breastfeeding rates, and improved hygiene practices were notable achievements. A study in Bangladesh using mobile apps has reported a 40% increase in maternal perceptions and practices related to stunting prevention. Behavioral improvements are particularly pronounced in programs that employ culturally relevant materials and community-driven approaches.

### Contextual and cultural adaptations

Cultural relevance was a key success factor in most studies. Programs that incorporated local foods, traditional recipes, and culturally familiar communication styles were more effective in engaging participants. For example, in Indonesia, community health cadres delivered educational sessions in local dialects, which increased caregiver participation and adherence.

### Barriers and challenges in implementation

**Logistical constraints:** Challenges, such as limited resources, caregiver attendance, and time constraints impacted program effectiveness in six studies.

**Scalability:** While long-term, high-frequency programs were more effective, they posed challenges for scaling up in resource-constrained settings.

**Caregiver resistance:** Cultural norms and misconceptions occasionally hindered the adoption of recommended practices, emphasizing the need for culturally sensitive messaging.

### Sustainability of educational outcomes

Few studies ( $n=3$ ) assessed the long-term sustainability of outcomes. While initial improvements in KAP and growth indicators were promising, they often diminished without continued reinforcement. For example, a follow-up in Peru six months after the intervention showed retained dietary practices, but the gains in stunting reduction were less sustained.

## Discussion

This study aimed to assess the effectiveness of community-based educational interventions in preventing stunting. Evidence from 17 studies assessing the efficacy of community-based educational interventions in preventing stunting in LMICs is compiled in this systematic review. The findings underscore the critical role of culturally tailored, participatory educational programs in improving child growth outcomes and related maternal and caregiver behaviors. This discussion integrates insights from the reviewed studies with previous research, highlighting both alignments and contrasts to provide a nuanced understanding of their impact and limitations.

By improving HAZ and facilitating positive changes in KAP related to nutrition and hygiene, the review demonstrated that community-based educational interventions significantly contribute to the prevention of stunting. The observed improvements

align with Bhutta *et al.* [16], demonstrating that nutrition education enhances dietary diversity and child growth outcomes when delivered through community-based approaches [13].

Interventions targeting EBF consistently showed strong outcomes. Studies in Bangladesh, Kenya, and Indonesia have highlighted substantial increases in EBF rates, reflecting the efficacy of BCC strategies. These findings mirror those of Kimani-Murage *et al.* [24], reporting significant improvements in breastfeeding following community-based interventions in urban Kenyan settlements [24].

In contrast, interventions of shorter duration or those limited to one-off sessions demonstrated less impact on stunting prevention. For example, a two-week program in Indonesia has shown modest improvements in dietary practices but no measurable changes in HAZ scores. This finding aligns with that of Bhutta *et al.* [16], emphasizing that sustained engagement is necessary to achieve meaningful outcomes in stunting reduction [16].

The review highlights the critical importance of delivery methods in determining the effectiveness of educational interventions. Multi-modal approaches (combining home visits, group workshops, and digital platforms) emerged as the most impactful. For instance, in Kenya, monthly home visits by community health workers (CHWs) have improved maternal nutrition literacy and EBF practices. Similarly, digital interventions, such as the WhatsApp-based program in Indonesia, have demonstrated significant improvements in caregiver perceptions and practices.

These findings align with that of Black *et al.* [36], noting that combining personal interactions with digital tools enhances engagement and adherence to recommended practices [36]. However, some studies have revealed that digital tools alone may not suffice in resource-poor settings, where Internet access and digital literacy are limited. This contrasts with Morgan *et al.* [37], advocating for mHealth tools as scalable solutions in LMICs but acknowledging their dependence on enabling infrastructure [37].

Behavior change was a central outcome across the studies, with interventions driving significant improvements in maternal and caregiver practices. In particular, BCC techniques, such as motivational counseling, role-playing, and practical demonstrations effectively facilitated behavioral shifts. Similar findings are reported by Dewey & Adu-Afarwuah [38], highlighting the transformative potential of participatory education in complementary feeding programs [38]. Nevertheless, sustaining these changes remains a challenge. This review found that gains in caregiver behaviors, such as dietary diversity and hygiene practices, often diminished without continued reinforcement. A similar observation was made by Wallace *et al.* [39], emphasizing the importance of follow-up sessions to consolidate learning and sustain behavior change [39].

Cultural relevance was a key success factor in the interventions reviewed. Programs that incorporated local traditions, foods, and communication styles achieved higher participation and greater adherence to recommendations. For instance, interventions in Indonesia have employed traditional recipes and engaged local cadres, significantly improving caregiver practices. These findings align with those of Peltó & Armar-Klemesu [40], emphasizing the importance of culturally grounded approaches in nutrition education programs [40].

In contrast, interventions that failed to consider local norms faced resistance. For example, a study in Afghanistan has noted initial caregiver hesitance to adopt new breastfeeding practices due to misconceptions and traditional beliefs. Wulandari *et al.* [41] similarly found that culturally insensitive programs often struggle to achieve behavioral change in rural Asian communities [41].

Despite their successes, educational interventions face several challenges. Logistical constraints, such as inconsistent caregiver attendance and resource limitations, are common. Rural programs, in particular, have struggled to maintain consistent participation due to caregivers' time constraints and limited transportation. This finding aligns with that of Lassi *et al.* [15], highlighting similar barriers to implementing maternal and child health programs in LMICs [15].

Additionally, socio-cultural barriers, such as deeply rooted norms and gender dynamics, occasionally hindered the adoption of recommended practices. Adair *et al.* [42] have reported similar challenges, noting that patriarchal structures often limit women's decision-making autonomy, affecting their ability to implement nutritional recommendations [42].

This review underscores the standalone potential of education in improving KAP and stunting-related outcomes. However, the findings suggest that its impact can be amplified when combined with broader nutrition-sensitive strategies. According to Little *et al.* [43], integrating education with cash transfers or food supplementation accelerates stunting reduction, providing a more holistic approach to addressing malnutrition [43].

Conversely, this review also highlights the limitations of education-focused interventions, particularly in addressing the underlying structural determinants of stunting, such as poverty and food insecurity. Victora *et al.* [44] similarly have emphasized the need for multi-sectoral strategies that tackle the root causes of malnutrition alongside direct interventions [45].

The findings offer several key implications for policy and practice. Long-term programs with frequent sessions are essential for achieving lasting behavioral and growth-related improvements. Interventions must be designed to align with local traditions, norms, and dietary practices to enhance their relevance and effectiveness. Additionally, education



programs should be integrated with broader development initiatives, such as social protection schemes, to address the structural determinants of stunting. Finally, digital tools, such as mobile apps, can complement traditional methods to expand reach and cost efficiency, particularly in urban settings. Community-based educational interventions are a powerful tool for stunting prevention, demonstrating significant impacts on growth and behavioral outcomes. Their success hinges on cultural relevance, participatory delivery, and sustained engagement. However, addressing logistical challenges and integrating these programs into broader multi-sectoral frameworks is essential for achieving scalable and sustainable solutions.

## Conclusion

Community-based educational interventions effectively reduce stunting and improve nutrition-related behaviors in LMICs.

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