

Behavior Change Communication on Nutrition Interventions for Improving Mothers' and Caregivers' Complementary Feeding Practices: A Scoping Review

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Abstract. Most stunting occurred in the first 1,000 days of life, particularly during the complementary feeding period, increasing from 22% at 6 months to 38% at 24 months of age. This shows a failure in complementary feeding practice regarding age, frequency, amount, texture, and food variety. This study aims to analyze the key themes of behavior change communication related to nutritional interventions, with an emphasis on mothers' and caregivers' complementary feeding practices for children under five through a scoping review. A total of 20 articles were obtained from the Scopus, MEDLINE PubMed, Science Direct, and Lens.org databases, published between 2015 and 2025. The analysis used in this scoping study focused on the type of intervention, outcome measures, impact of intervention on complementary feeding practice, and target population of mothers and caregivers with children under 5 years old. Results showed that the combination of BCC interventions consistently improved complementary feeding practices (dietary diversity, meal frequency, and minimum acceptable diet), increased consumption of animal-source foods, and reduced stunting. The strongest evidence comes from multi-component, community-based, long-term interventions that combine interpersonal communication (IPC) with other strategies such as mass media, community mobilization, and nutrition-sensitive interventions. This review offers a foundation for targeted interventions and evidence-based reforms to improve complementary feeding practices.

1 Introduction

Almost 45% of child deaths worldwide are caused by malnutrition [1]. In many countries, children are born small; although some are protected from infections and nutrient deficiencies through breastfeeding in the first few months after birth, they often experience growth faltering between 6 and 24 months of age. This indicates the failure of complementary feeding practices beginning at 6 months of age in terms of food variety, frequency, amount, texture, and age appropriateness [2].

The term "complementary feeding" refers to the stage when breast milk or formula alone is insufficient to meet a baby's nutritional requirements, necessitating the addition of solid foods and liquids alongside breast milk or its substitutes [3]. Although complementary feeding is a common practice, its methods and ordinances vary among cultures, individuals, and

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socioeconomic classes. Babies who are not breastfed or weaned before four months of age are more likely to receive solid foods earlier than infants who continue breastfeeding beyond this age. Failure to introduce complementary foods in a timely and adequate manner can contribute to stunting during the developmental period between 6 and 23 months [4].

Skilled assistance is crucial for mothers and caregivers to ensure that children receive adequate nutrition. Educational programs can enhance food diversity and complementary feeding practices, thereby contributing significantly to safe and effective child feeding. One strategy to prevent stunting in children is to enhance their feeding practices [5]. Comprehending this involves adapting feeding practices to a child's age and developmental stage, practicing responsive feeding, identifying hunger cues in infants, motivating children to eat, discerning indications of diminished appetite, establishing a favorable eating setting by minimizing diversions, and monitoring children during meals [6]. Assessing the impact of nutritional interventions on caregivers' complementary feeding practices during this stage is essential.

Communication strategies in the context of behavior change for health (BCC) aim to promote the adoption and sustained practice of beneficial health behaviors that lead to favorable health outcomes [7]. Health programs employ BCC to deliver tailored messages and create a supportive environment that encourages individuals and communities to adopt healthy behaviors. BCC typically employs methods such as interpersonal counseling, the production of printed and digital educational resources, and mass media campaigns [5].

Several studies have been conducted to assess the effectiveness of complementary feeding interventions. Warren et al [7] conducted the intensive intervention on complementary feeding in Bangladesh. The BCC intervention in this study included three main components, interpersonal counseling, community mobilization, and mass media campaigns, but the study did not analyze the relative contribution of each. Consequently, it remains unclear which component had the greatest impact on improving household food expenditure and consumption.

In this study, a scoping review was conducted to map, identify, and analyze the effectiveness of behavioral change communication approaches in improving appropriate feeding practices among caregivers of children under five years old. This study aims to examine the key themes of behavior change communication in the context of nutrition interventions, with a specific emphasis on complementary feeding practices provided by mothers and caregivers to toddlers.

2 Methods

The scoping review approach in this study was based on the preferred reporting items for systematic reviews and meta-analysis extensions for scoping reviews (Prisma-ScR). A systematic search was conducted in the Scopus, MEDLINE PubMed, Science Direct and Lens.org databases to identify frequently reported behavior change communication strategies for complementary feeding interventions. This study applied a five-step scoping review methodology to examine literature on behavior change communication related to nutritional interventions for children under five years old, focusing on enhancing complementary feeding practices among mothers and caregivers and assessing the impact of nutritional interventions on stunting prevention, following Arksey and O'Malley's framework.

Based on the method developed by Arksey and O'Malley, the scoping review was conducted in several stages: (1) identifying research questions; (2) searching for relevant literature; (3) selecting relevant literature; (4) data extraction and mapping; and (5) reporting results and discussions. The primary focus of this study was to address the following research

questions: “RQ1= What are the forms of behavior change communication in nutrition interventions to increase mothers’ and caregivers’ complementary feeding practice?” and “RQ2= How effective is the intervention in improving child-feeding practices?”

The publications included in this review were research articles published between 2015 and 2025, written in English and Bahasa. Searches were conducted in the Scopus, Medline, Pubmed, Science Direct, and Lens.org databases using the following keywords and queries:

Table 1. Search Strategy

Database	Keywords and Queries	
Scopus	TITLE-ABS (mother*) OR TITLE-ABS (caregiver*) AND TITLE-ABS (health W/1 communication) OR TITLE-ABS (interpersonal W/1 communication) OR TITLE-ABS (health W/1 promotion) OR TITLE-ABS (counseling*) OR TITLE-ABS (nutrition W/1 education) OR TITLE-ABS (home W/1 visit) OR TITLE-ABS (house W/1 calla) AND TITLE-ABS (feeding W/1 practice) OR TITLE-ABS (feeding W/1 behavior) OR TITLE-ABS (protein W/1 animal) OR TITLE-ABS (animal W/1 protein) OR TITLE-ABS (self W/1 efficacy) OR TITLE-ABS (infant W/1 nutritional) AND TITLE-ABS (stunting) OR TITLE-ABS (growth W/1 disorder) OR TITLE-ABS (stunted W/1 growth) OR TITLE-ABS (growth W/1 disorders)	64 documents found
	Limitation: PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Indonesian"))	49 documents found
MEDLINE PubMed	(((((("mother*"[MeSH Terms] OR "mother*"[Title/Abstract]) AND ("caregiver*"[MeSH Terms] OR "caregiver*"[Title/Abstract]) AND (("counseling*"[MeSH Terms] OR "counseling*"[Title/Abstract]) OR ("health communication"[MeSH Terms] OR "health communication"[Title/Abstract:~1])) AND "health education"[Title/Abstract:~1]) OR ("house calls"[Title/Abstract:~1] OR "home visit"[Title/Abstract:~1]1] OR "home visits"[Title/Abstract:~1])))) AND ("Infant Nutritional Physiological Phenomena"[MeSH Terms] OR ("Infant Nutritional Physiological Phenomena"[Title/Abstract:~1] OR "Complementary Feedings"[Title/Abstract:~1] OR "Complementary Feedings"[Title/Abstract:~1]) OR ("feeding behaviors"[Title/Abstract:~1] OR "feeding behaviors"[Title/Abstract:~1] OR "food handling"[Title/Abstract:~1]) OR "self-efficacy"[Title/Abstract:~1] OR "growth disorders"[Title/Abstract:~1] OR "growth disorder"[Title/Abstract:~1] OR "Stunted Growth"[Title/Abstract:~1] OR "stunting"[Title/Abstract]))	537 documents found
	Limitations: ((medline[Filter]) AND (humans[Filter]) AND (english[Filter] OR indonesian[Filter]) AND (2015:2025[pdat]))	241 documents found
Science	("feeding practice" OR "feeding behavior" OR "animal	565 documents

Direct	protein") AND ("growth disorder" OR "stunting") AND ("counseling" OR "nutrition education") AND ("mother" OR "caregiver")	found
	Limitations: PUBYEAR > 2014 AND PUBYEAR < 2026	394 documents found
Lens.org	(stunting OR PMBA OR "animal protein" OR fish OR eggs) AND ("nutrition education" OR "counseling" OR "home visit") AND (mother OR caregiver OR family OR grandmother)	338 documents found
	Limitation: publishedYear from = 2015, published to 2025	282 documents found

The literature identified during the initial stage was filtered using inclusion and exclusion criteria. Studies were included if they met the following criteria: the type of nutrition intervention was explained explicitly; complementary feeding practice on children was a measured outcome, including the knowledge and attitudes of mothers or caregivers; the focus was on children under 5 years of age; and the impact of the intervention was explained. Studies were excluded if they were a conference proceeding, systematic or scoping review, meta-analyses, or non-research articles, or if the research subjects were not mothers or caregivers of children under 5 years of age.

Data from all full-text studies and reports that met the inclusion and exclusion criteria were extracted into a form. From the eligible studies, key items, and information were recorded and extracted. The analysis was categorized as follows: type of intervention, outcome measures, and effectiveness of nutrition interventions on complementary feeding practices among mothers and caregivers.

The effectiveness of Behavior Change Communication was evaluated using process indicators and outcome indicators. From the process dimension, effectiveness was assessed by analyzing how the intervention was implemented, including the extent of target population reach, duration of program delivery, activity intensity, and types of communication channels or approaches employed. From the outcome dimension, effectiveness was reflected in measurable behavioral changes, particularly in complementary feeding practices aligned with global standards. Key indicators included improvements in Minimum Dietary Diversity (MDD), Minimum Meal Frequency (MMF), Minimum Acceptable Diet (MAD), and consumption of Animal Source Foods (ASFs), as well as better knowledge and attitudes among mothers and caregivers. At a higher level, effectiveness was reflected in children’s nutritional status, measured using anthropometric indicators (HAZ, WAZ, WHZ).

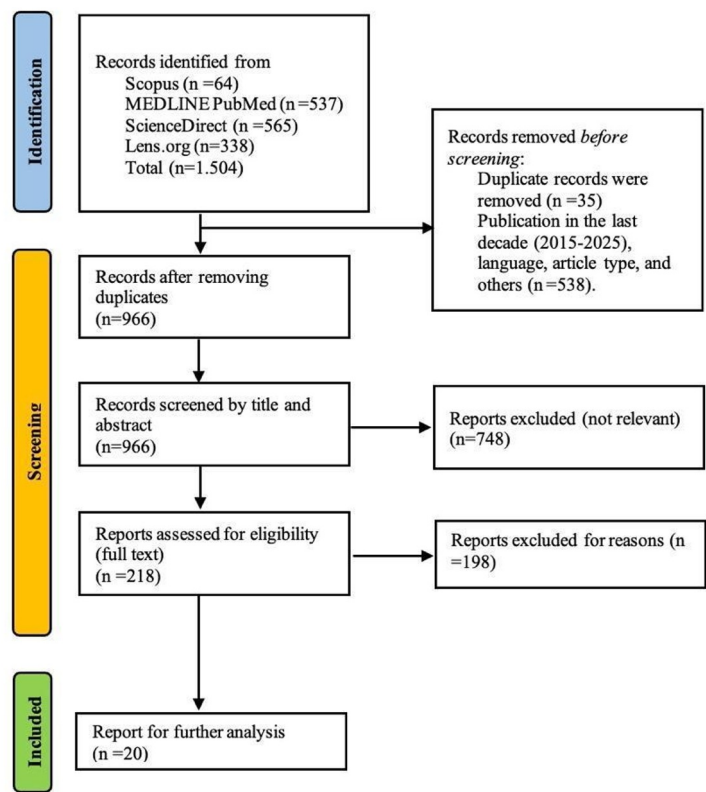


Fig. 1. PRISMA ScR flow diagram of the search strategy

The study selection process is described in Figure 1. A total of 1,504 articles were retrieved from the Scopus, MEDLINE Pubmed, Science Direct, and Lens.org databases. Screening was then performed by removing 35 duplicate articles and 538 articles that did not meet the criteria. Of the remaining articles, 966 were screened based on titles and abstracts using the inclusion criteria, and 748 were excluded for not being relevant to the review’s objectives. A total of 218 full text articles were analyzed, and 20 articles were included in the final analysis of this scoping review.

3 Results and Discussion

A literature search across four databases identified 1,504 articles matching the keywords used by the researchers. After the screening process, 20 articles that met the research objectives and inclusion/exclusion criteria were included in the analysis and discussion. Based on the data extraction and mapping results, the reviewed articles comprised 8 RCT (Randomized Control Trial), 6 quasi-experimental studies, 4 evaluation studies, and 2 qualitative studies.

Table 2. Characteristics of Studies

Study Design	Total	References
Randomized Control Trial	8	[1], [2], [3], [4], [5], [8], [9], [10]
Quasi Experimental	6	[11], [12], [13], [14], [15], [16]
Evaluation Studies	4	[6], [7], [17], [18]
Qualitative Studies	2	[19], [20]

Based on the 20 articles reviewed in this study, all were conducted in developing countries: India, Bangladesh, Ethiopia, Guatemala, Tanzania, Indonesia, Ghana, Kenya, Malawi, Sierra Leone, and Nigeria. The studies identified several models of behavior change communication interventions in nutrition education aimed at improving caregivers’ complementary feeding practice and preventing malnutrition in children under five years old.

This study investigated various kinds of BCC interventions applied to improve complementary feeding habits and their role in decreasing stunting rates. This review provides a comprehensive explanation of the strategies, media, and approaches used to communicate nutrition-related behavioral changes. Among the identified BCC delivery methods, most utilized a combination of individual and group interpersonal counseling (IPC) strategies (n = 18). Nine articles explained the use of media, including radio and television broadcasts, along with publicly provided printed promotional materials. Ten studies reported the periodic implementation of community mobilization strategies.

Figure 2 shows the combination of BCC interventions by identifying the number and types of BCC interventions implemented in several countries, including Indonesia. Each color represents the type of intervention approach, while the bar height reflects the number of BCC approaches used simultaneously in each country. Ethiopia had the highest number of intervention combinations (5 components), whereas countries such as Ghana use only one approach (mass media), indicating limited BBC coverage. Interpersonal communication appeared in almost all countries, indicating that face-to-face individual counseling approach is an important foundation in BCC across various contexts.

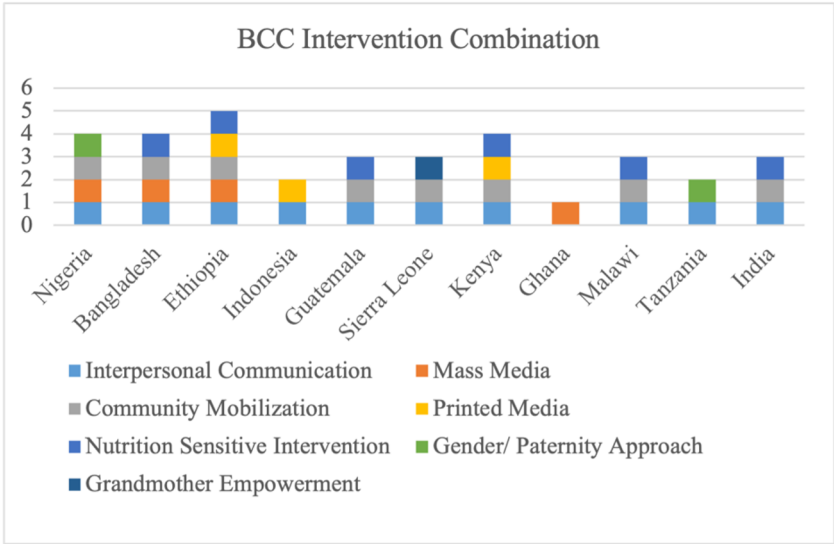


Fig. 2. Combinations of BCC interventions in different countries

Figure 3 illustrates the key outcomes targeted by the interventions. Dietary diversity was the most commonly addressed complementary feeding behavior, targeted by 12 interventions. This indicates a strong emphasis on ensuring children with a variety of food from different groups to ensure adequate micronutrient intake. Seven interventions specifically promoted animal-source foods (ASFs) such as eggs, fish, and meat, as well as foods rich in iron, vitamin A, fruits, and vegetables. This reflects a focused attempt to improve micronutrient intake and address deficiencies contributing to malnutrition and stunting. Meal frequency and anthropometric measurement (i.e., HAZ, WAZ, and WHZ) were the next most common outcomes (n = 6). Food security (n = 4), family or social support (n = 3), breastfeeding (n = 2), timing of CF, responsive feeding, and food consistency were the least common practices emphasized.

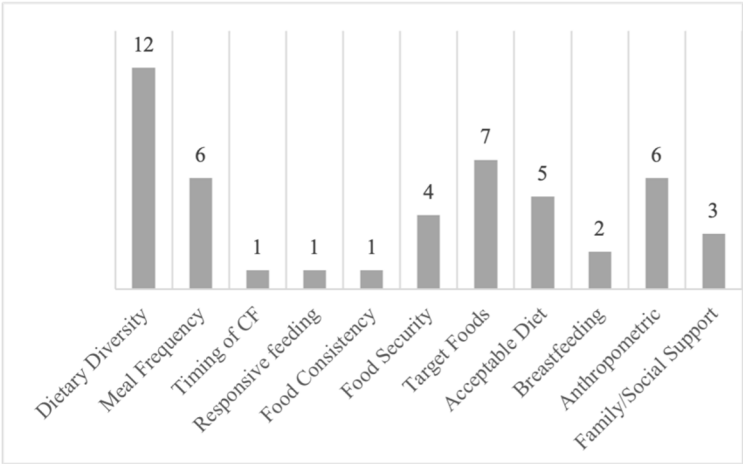


Fig. 3. Number of outcomes measured in 20 articles

3.1 Behavior Change Communication Interventions and Their Implementation

Based on data extracted from 20 studies, BCC in nutrition interventions was delivered through various methods. **Interpersonal Counseling (IPC)** was the most common form of BCC, implemented through individual and group counseling sessions conducted directly by health workers or trained cadre workers. For instance, a study by Flax et al. [17] in Nigeria used multiple approaches, such as home visits, community gatherings, and religious services, to increase paternal and maternal involvement in complementary feeding practices. In addition to successfully raising fish and egg consumption, this intervention significantly increased the minimum dietary diversity (MDD), minimum meal frequency (MMF), and minimum acceptable diet (MAD) indicators. A study by Ara et al. [8] in Bangladesh also showed that peer counseling combined with psychosocial stimulation increased early breastfeeding initiation, exclusive breastfeeding duration, and nutritious intake in infants. This indicates that the messages delivered by peer counselors with practical experience can improve communication effectiveness.

Visual Educational Media. Melangka et al. [11] in Indonesia used booklets to convey nutritional information at Posyandu. The results revealed an increase in maternal knowledge from 8.87 to 16.85 after 3 months. This demonstrates the effectiveness of simple yet practical print media for conveying repeated messages that mothers can revisit at any time. **Mass Media and Digital Technology.** Mass media, especially radio, proved effective in reaching wider

audiences. A study by Saaka et al. [12] in Ghana showed that mothers exposed to nutritional messages via radio showed higher knowledge and attitude scores, along with significant improvements in complementary feeding practice (MDD increased DID 9.7%; $p = 0.014$; MAD increased DID 12.1%; $p = 0.001$). Another study by Mardani et al. [4] in Indonesia applied a Health Belief Model-based approach through telephone counseling and booklet provision. After 12 and 24 weeks, the results demonstrated a significant decrease in stunting and a significant increase in knowledge, self-efficacy, and complementary feeding practices. In conclusion, IPC is effective for promoting immediate behavioral change, highly beneficial for household-level interventions, and capable of increasing animal protein intake and adherence to minimum dietary standards.

Participatory and Community Approach. Some interventions leverage social forces within the community, such as the involvement of grandmothers and religious leaders. Aidam et al. [13], through the Grandmother-Inclusive Approach (GMIA) in Sierra Leone, showed that the active involvement of grandmothers in nutrition discussion sessions significantly increased MDD coverage (77.2% from 51.8% ($p < 0.001$)) and MAD coverage (22.6% to 53.8% ($p < 0.001$)) in children. The involvement of grandmothers is very impactful because they have cultural influences and direct experience in child feeding. In the same region, McDonald et al. [19] conducted a qualitative study to explore the family's role, namely grandmothers and fathers, in improving children's nutritional status. The study found that grandmothers are the mother's advisor and supervisor during pregnancy, newborn and infant care, and child development, while fathers, as heads of the households, are responsible for providing food and ensuring family well-being, though they are rarely involved in domestic tasks such as child care.

In addition, Martin et al. [20] in Tanzania found that empowering fathers in complementary feeding practice increased their involvement in food provisions and support for breastfeeding and child feeding. However, the high cost of animal protein remained a major barrier. The gender-based (father-focused) approach increased practical and emotional support for mothers, although its effectiveness was strongly influenced by social and economic context. Flax et al. also involved religious leaders in delivering nutrition-related messages during religious activities [17].

This review found some crucial elements that help BCC interventions improve children's complementary feeding practices. The duration of interventions in the studies included in this scoping review varied widely, depending on the program's complexity and the BCC approach applied. Interventions with higher intensity (e.g., more than 6 months with regular sessions) tended to produce more significant results in behavioral change [2], [5], [17]. Five studies implemented intervention, including pre-post assessments and follow-ups, over a 2 years period [2], [5], [7], [13]. In a study by Gope et al. in India, the interventions were separated into three categories: monthly women's groups for participatory learning and action (PLA); home visits and counseling; and children's creches with the four-year intervention conducted in four phases [14]. Another study in Ethiopia by Kim et al. reported a 2-year intervention in the Alive & Thrive (A&T) program [5]. A subsequent study in Malawi by Kuchenbecker et al. implemented a three-year intervention with two rounds. Each round included a five-month intervention consisting of ten sessions, each lasting two to three hours, conducted weekly or biweekly. The interventions involved community-based food security and nutrition education activities, home visits, and counseling [2]. In Bangladesh, Warren et al. conducted a three-year intervention study comprising two phases of interpersonal counseling and three months of mass media intervention. The study found increased household spending on meat and eggs, along with improved dietary diversity (from 4.55 to 5.25; DD of 0.44) [7].

Short intervention durations were found in some studies, including Waswa et al. [9] in Kenya and Melangka et al. in Indonesia [11]. These studies combined group training, cooking

demonstrations, and booklet distributions, with booklets distributed monthly for only three months. Studies with moderate duration generally ranged from 6 to 12 months, as shown by Saaka et al. in Ghana, who used radio and drama as nutritional interventions for 12 months. Radio programs were broadcast once a week, while nutrition education dramas in local languages were aired three times daily [12]. Moreover, a study from Flax et al. in Nigeria implemented 12-month intervention involving weekly mobile phone messages and voice prompts, home visits, and monthly meetings [17]. Research by Omer et al. in Ethiopia lasted for six months and included monthly individual counseling to promote egg consumption through private chick ownership [10]. In addition, a study by Ara et al. (2019) in Bangladesh used an intervention cycle approach consisting of 13 sessions from pregnancy to 11 months of age [8].

The cultural suitability and contextualization of nutrition messages must align with local culture and social norms. Zongrone et al. [6] showed that maternal self-efficacy increased when nutritional messages were associated with local practices and foods available in the community. The success of many interventions depends on the involvement of multi-stakeholders, including health workers, cadre workers, community leaders, and nuclear family members such as fathers and grandmothers. Regarding the implementers of interventions, most studies employed community-based health workers. In countries such as Ethiopia, India, Kenya, and Guatemala, interventions were mostly performed by Health Extension Workers (HEWs), Community Health Workers (CHWs), field facilitators, and agricultural extension workers (Agricultural Extension Workers). Kim et al.'s study in Ethiopia involved three types of personnel: HEWs, CHVs (community volunteers), and agricultural extension workers [5].

In developing countries such as Bangladesh and Indonesia, the implementation of interventions relies heavily on local cadres and trained volunteers. For instance, Melangka et al. involved Posyandu cadres in nutrition counseling using educational booklets [11], while Rahman et al. and Warren et al. in Bangladesh adopted a cadre-based approach and employed NGO field workers [7], [18]. Other studies, such as Ara et al. (2019), emphasized the peer counseling model, involving counseling by experienced and trained breastfeeding mothers [8]. A few studies also show cross-sectoral interventions, such as those conducted by Guzman et al. in Guatemala, where CHWs collaborated with agricultural workers in family nutrition garden activities. The combination of health workers and agronomists proved effective in increasing food diversity and the availability of animal protein sources at the household level [15].

The strongest evidence originates from multi-component, community-based, long-term interventions (≥ 6 months, often more than 1 year) that combine interpersonal communication (IPC) with other strategies such as mass media, community mobilization, and nutrition-sensitive interventions. A large cluster-randomized study in Ethiopia demonstrated that integrating IPC, community mobilization, nutrition-sensitive agricultural activities, and mass media significantly improved MDD, MAD, and MMF, while also reducing stunting prevalence [5]. Similarly, nutrition-sensitive interventions such as home gardening and livestock, when integrated with BCC, as observed in studies from Guatemala (home gardens) and Ethiopia (child-owned poultry), enhanced access to animal source foods (ASFs) and improved HAZ and dietary diversity [10,15]. Single interventions may produce short-term improvements in knowledge and behavior, but meaningful impacts on child development are more likely when interventions are multi-sectoral and sustained over time.

3.2 Impact of Intervention on Complementary Feeding Practice

The WHO indicators of MDD, MMF, and MAD aligned with most interventions' effects on complementary feeding practices. These studies concluded that behavioral changes occurred both through increasing feeding frequency, food diversity, and consumption of animal protein foods. For instance, an intervention by Kim et al. [5] in Ethiopia increased MDD from 5.2% to 24.9% and MAD from 4.1% to 18.2%, alongside a decrease in stunting prevalence from 36.3% to 22.8%. Similarly, a study by Omer et al. (2022) [10] using a child-owned poultry approach showed a significant increase in egg consumption and dietary diversity through the "One Egg a Day," contributing to higher intake of animal protein and vitamin A. This demonstrates the importance of integrating nutritionally sensitive interventions to strengthen the effect of BCC on children's nutritional status. Guzman et al. (2022) in Guatemala reported that nutrition garden interventions increased MDD outcomes, decreased food insecurity, and increased Z score of body length by 0.22 SD ($p = 0.009$) [15]. Nutrition-sensitive interventions (agriculture, household food production) significantly affect ASF availability and household dietary diversity. Similarly, a study by Haileselassie et al. (2022) in Ethiopia showed a 19.5 percentage point higher consumption of animal-sourced foods (ASFs) in the intervention group compared to the comparison group ($p = 0.008$) [16].

A study by Aidam et al. in Sierra Leone also reported an increase in MDD to 77.2% and MAD to 53.8% through a grandmother involvement approach [13]. Other studies, such as Ara et al., Kuchenbecker et al., and Warren et al., also reported significant improvements to children's dietary indicators, suggesting that a combination of interpersonal counseling, community strengthening, and educational media effectively encourages appropriate feeding practices in toddlers [2,7,8]. However, some interventions did not significantly improve children's anthropometric status. For instance, Kuchenbecker et al. noted an increase in the consumption of nutritious foods, but did not significantly affect height-for-age z-score, confirming that behavioral changes require more time to influence linear growth.

Nevertheless, studies by Mardani et al. and Melangka et al. in Indonesia showed significant increases in maternal knowledge scores and self-efficacy. Mardani noted increased knowledge ($\beta = 4.77$), self-efficacy ($\beta = 32.22$), and practice ($\beta = 5.70$). Adugna et al. recorded an increase in positive attitudes from 58% to 70.8% while Saaka et al. reported an overall increase in KAP [3]. Maternal self-efficacy was positively correlated with the consumption of green leafy vegetables, but not with egg consumption, according to Zongrone et al [6]. These studies show that changes in child-feeding behavior are highly influenced by mothers' cognitive and affective dimensions, as well as their internal capacity to act in the local socio-cultural context [3,4,6,11,12].

Grandmothers and other family authorities play a pivotal role in child feeding, often serving as cultural decision-makers about what infants should eat. Programs that exclude them frequently encounter resistance or limited adoption of new practices [13,19]. The effectiveness of nutrition interventions, therefore, depends greatly on engaging these key family influencers. In addition, local food norms and preferences, such as attitudes toward eggs, fish, or vegetables, shape how Behavior Change Communication (BCC) messages are received. Evidence shows that messages adapted to the local food context are more effective in promoting sustained behavior change [5,6].

Food costs, limited availability of animal-source foods (ASF), and household food insecurity are major barriers to sustaining behavior change. Evidence from studies in Tanzania and Nigeria [17,20] shows that although families often understand nutrition messages, they struggle to follow recommendations due to economic limitations and poor market access. Interventions that enhance food access, such as home gardening, poultry ownership, and

microeconomic support, have proven effective in increasing the likelihood that behavioral change is maintained and translated into better nutritional outcomes [10,14,15].

Fathers' involvement in providing financial and practical support can enhance families' capacity to meet recommended feeding practices. However, traditional gender roles that define fathers as breadwinners and mothers as primary caregivers often hinder progress unless complemented by empowerment initiatives or redistribution of household responsibilities. Interventions aimed at shifting gender norms, such as father-focused counseling or family dialogues, have been shown to increase practical support and may help reduce financial constraints and mothers' workload [17,20]. However, their impact is strongly influenced by underlying socio-cultural structures, indicating that meaningful norm change requires a contextualized and sustained approach.

Most existing studies originate from lower-middle-income countries (LMICs), limiting their applicability to high-income countries (HICs). Differences in social dynamics, service delivery systems, and dietary patterns contribute to the scarcity of evidence from HICs. Digital interventions, such as mobile applications, telehealth platforms, and SMS-based approaches, are rarely implemented as the primary strategy. In most cases, they serve only as complementary tools, as seen in the Flax study [17], where text messages were sent to fathers. There remains a notable gap in randomized controlled trials (RCTs) that rigorously assess the effectiveness of digital BCC as a standalone approach, especially in urban populations with widespread smartphone access. Additionally, longitudinal research is strongly needed to evaluate the long-term sustainability of behavior change and its impact on children's anthropometric outcomes.

4 Conclusion

An analysis of 20 studies from developing countries shows that the most effective BCC approaches combine interpersonal counseling (IPC), mass media, print media, and community participation involving key figures such as grandmothers, fathers, and religious leaders. These interventions consistently improved child feeding indicators, including MDD, MMF, and MAD.

Successful programs share key features: sufficient intensity and duration, cultural contextualization to local norms and food availability, active involvement of community health workers (e.g., Posyandu cadres, agricultural officers), and strong educational components using verbal, visual, and experiential methods such as cooking demonstrations.

Policy recommendations include integrating BCC into primary healthcare systems with adequate training and supervision, developing simple and context-specific communication materials (visual, audio, digital), engaging families and community leaders in nutrition empowerment, promoting multi-sector collaboration with agriculture and education, and prioritizing behavioral monitoring alongside anthropometric measures.

References

1. C. Negash, T. Belachew, C. J. Henry, A. Kebebu, K. Abegaz, and S. J. Whiting, Nutrition Education and Introduction of Broad Bean—Based Complementary Food Improves Knowledge and Dietary Practices of Caregivers and Nutritional Status of Their Young Children in Hula, Ethiopia. *Food Nutr Bull*, **35**, 480–486 (2014). doi: 10.1177/156482651403500409.
2. J. Kuchenbecker, A. Reinbott, B. Mtimuni, M. B. Krawinkel, and I. Jordan, Nutrition education improves dietary diversity of children 6-23 months at community-level:

- Results from a cluster randomized controlled trial in Malawi. *PLoS ONE*, **12**, (2017). doi: 10.1371/journal.pone.0175216
3. G. Adugna, G. Egata, D. A. Fufa, and D. T. Desta, Effect of nutrition education on improving dietary diversity of children aged 6–23 months in Horo district, Oromia region, Ethiopia. *Human Nutrition & Metabolism*, **35**, (2024). doi: 10.1016/j.hnm.2024.200244.
4. R. A. D. Mardani, W.-R. Wu, Z. Hajri, Z. Thoyibah, H. Yolanda, and H.-C. Huang, Effect of a Nutritional Education Program on Children’s Undernutrition in Indonesia: A Randomized Controlled Trial. *Journal of Pediatric Health Care*, **38**, 552–563 (2024). doi: 10.1016/j.pedhc.2024.02.006.
5. S. S. Kim *et al.*, Behavior Change Interventions Delivered through Interpersonal Communication, Agricultural Activities, Community Mobilization, and Mass Media Increase Complementary Feeding Practices and Reduce Child Stunting in Ethiopia. *The Journal of Nutrition*, **149**, 1470–1481 (2019). doi: 10.1093/jn/nxz087.
6. A. A. Zongrone *et al.*, The Pathways from a Behavior Change Communication Intervention to Infant and Young Child Feeding in Bangladesh Are Mediated and Potentiated by Maternal Self-Efficacy. *The Journal of Nutrition*, **148**, 259–266 (2018). doi: 10.1093/jn/nxx048.
7. A. M. Warren, E. A. Frongillo, P. H. Nguyen, and P. Menon, Nutrition Intervention Using Behavioral Change Communication without Additional Material Inputs Increased Expenditures on Key Food Groups in Bangladesh. *The Journal of Nutrition*, **150**, 1284–1290 (2020). doi: 10.1093/jn/nxz339.
8. G. Ara *et al.*, Peer Counseling Promotes Appropriate Infant Feeding Practices and Improves Infant Growth and Development in an Urban Slum in Bangladesh: A Community-Based Cluster Randomized Controlled Trial. *Current Developments in Nutrition*, **3**, (2019). doi: 10.1093/cdn/nzz072.
9. L. M. Waswa, I. Jordan, J. Herrmann, M. B. Krawinkel, and G. B. Keding, Community-based educational intervention improved the diversity of complementary diets in western Kenya: results from a randomized controlled trial. *Public Health Nutr.*, **18**, 3406–3419 (2015). doi: 10.1017/S1368980015000920.
10. A. Omer, D. Hailu, and S. J. Whiting, Egg consumption of children under two years of age through a child-owned poultry and nutrition intervention in rural Ethiopia: A community-based randomized controlled trial. *Journal of Agriculture and Food Research*, **9**, (2022) doi: 10.1016/j.jafr.2022.100354.
11. Y. S. H. Melangka, M. Masudin, I. Iwan, S. M. Hasan, and T. Sahe, Increasing Mothers’ Knowledge of Infant and Young Child Feeding through Booklets in Banggai Regency, Central Sulawesi Province, Indonesia. *Open Access Maced J Med Sci*, **9**, 924–930 (2021). doi: 10.3889/oamjms.2021.6232.
12. M. Saaka, K. Wemah, F. Kizito, and I. Hoeschle-Zeledon, Effect of nutrition behaviour change communication delivered through radio on mothers’ nutritional knowledge, child feeding practices and growth. *J Nutr Sci*, **10**, (2021). doi: 10.1017/jns.2021.35.
13. B. A. Aidam *et al.*, An Innovative Grandmother-Inclusive Approach for Addressing Suboptimal Infant and Young Child Feeding Practices in Sierra Leone. *Current Developments in Nutrition*, **4**, (2020). doi: 10.1093/cdn/nzaa174.
14. R. K. Gope *et al.*, Effects of participatory learning and action with women’s groups, counselling through home visits and crèches on undernutrition among children under three years in eastern India: a quasi-experimental study. *BMC Public Health*, **19**, (2019). doi: 10.1186/s12889-019-7274-3.
15. A. Guzmán-Abril, S. Alajajian, P. Rohloff, G. V. Proaño, J. Brewer, and E. Y. Jimenez, Academy of Nutrition and Dietetics Nutrition Research Network: A Home Garden

Intervention Improves Child Length-for-Age Z-Score and Household-Level Crop Count and Nutritional Functional Diversity in Rural Guatemala. *J Acad Nutr Diet*, **122**, 640-649 (2022). doi: 10.1016/j.jand.2021.04.002.

16. M. Haileselassie, G. Redae, G. Berhe, C. J. Henry, M. T. Nickerson, and A. Mulugeta, Educational intervention and livestock ownership successfully improved the intake of animal source foods in 6–23 months old children in rural communities of Northern Ethiopia: Quasi-experimental study. *PLoS ONE*, **17**, (2022). doi: 10.1371/journal.pone.0277240.
17. V. L. Flax *et al.*, Complementary Feeding Social and Behavior Change Communication for Fathers and Mothers Improves Children’s Consumption of Fish and Eggs and Minimum Meal Frequency in Kaduna State, Nigeria. *Current Developments in Nutrition*, **6**, (2022). doi: 10.1093/cdn/nzac075.
18. M. Rahman, M. Tariqujjaman, T. Ahmed, and H. Sarma, Effect of home visits by community health workers on complementary feeding practices among caregivers of children aged 6-23 months in 10 districts of Bangladesh. *Front Public Health*, **10**, (2022). doi: 10.3389/fpubh.2022.1014281.
19. C. A. MacDonald, J. Aubel, B. A. Aidam, and A. W. Girard, Grandmothers as Change Agents: Developing a Culturally Appropriate Program to Improve Maternal and Child Nutrition in Sierra Leone. *Current Developments in Nutrition*, **4**, (2020). doi: 10.1093/cdn/nzz141.
20. S. L. Martin *et al.*, Engaging fathers to improve complementary feeding is acceptable and feasible in the Lake Zone, Tanzania. *Maternal & Child Nutrition*, **17**, (2021). doi: 10.1111/mcn.13144.