Journal of Indonesian Specialized Nutrition | e-ISSN: 3032-3878
Vol. 04 No. 03, 2026

NUTRITION EDUCATION AS BENEFICIAL COMPLIMENT ON CHILDREN'S NUTRITION INTERVENTION: A NARRATIVE REVIEW

Saskia Piscesa[1*], Al Ilham Ksatria Gagah Perkasa[1,2], Niken Salsabyla[3]

[1]Edukazi Indonesia Bergizi, Jakarta, Indonesia
[2]Nutrition Department, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia
[3]Varians Statistik Kesehatan, Tangerang, Indonesia

*Corresponding Author: gagahperkasa52@gmail.com

Abstract

Introduction: Malnutrition remains a significant public health concern, particularly in low- and middle-income countries where children are disproportionately affected. In Indonesia, although various nutrition-specific and nutrition-sensitive interventions have been implemented, stunting, wasting, and growth faltering continue to pose major challenges. Most nutrition programs emphasize food or nutrient provision, yet the behavioural factors influencing feeding practices and intervention adherence often receive less attention. Nutritional education has increasingly been recognized as an important strategy to complement these interventions. This narrative review aims to examine the current evidence on the role of nutritional education in improving the effectiveness of nutrition interventions. **Methods:** A narrative literature review was conducted by searching PubMed, Scopus, Google Scholar, and ScienceDirect for English-language publications from 2014 to 2026. The review included studies that integrated nutritional education with nutrition interventions, such as food supplementation, complementary feeding, and community-based nutrition programs. Relevant reports from international organizations were also included to provide broader context. **Results:** The available evidence suggests that nutritional education strengthens the impact of nutrition interventions by improving caregivers' knowledge, infant and young child feeding practices, dietary diversity, adherence to intervention programs, and health-seeking behaviors. Overall, interventions that combined nutritional education with nutrition support showed more favorable improvements in child growth and nutritional outcomes than those focusing solely on nutrient provision. In addition, educational components contributed to more sustainable changes in health and nutrition behaviors. **Conclusion:** Nutritional education is a valuable complement to nutrition interventions because it addresses the behavioral and knowledge-related factors that influence nutritional outcomes. Integrating evidence-based educational approaches into nutrition programs has the potential to improve program effectiveness and contribute to more sustainable reductions in childhood malnutrition.

Copyright © 2026 by the Authors.
This article is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License (CC BY-SA 4.0)

Keywords: nutritional education; nutrition intervention; stunting; wasting; growth faltering; behavior change

Introduction

Child undernutrition continues to be a major public health challenge worldwide, particularly in low- and middle-income countries. Although substantial progress has been made over the past few decades, millions of children still experience poor growth and inadequate nutritional status during the critical early years of life. According to the UNICEF/WHO/World Bank Joint Child Malnutrition Estimates, an estimated 148 million children under five years of age were stunted and 45 million suffered from wasting in 2024, highlighting that child undernutrition remains a persistent global concern.[1] Despite international commitments to achieve the Sustainable Development Goals (SDGs), progress toward reducing child malnutrition has been slower than expected in many countries.

Child undernutrition is commonly reflected by stunting, wasting, underweight, and growth faltering, each representing different forms of nutritional deficiency and growth impairment. These conditions often result from inadequate dietary intake, recurrent infections, poor feeding practices, and limited access to health and sanitation services. The first 1,000 days of life (from conception until two years of age) are widely recognized as the most critical period for physical growth and brain development. Nutritional deficits during this window can have long-lasting consequences that are difficult to reverse later in life.[2]

The impact of undernutrition extends far beyond childhood. Children who experience chronic nutritional deficiencies are more likely to have impaired cognitive development, reduced learning capacity, poorer academic performance, and weakened immune function, making them more susceptible to infectious diseases. These adverse effects often continue into adulthood, leading to lower educational attainment, reduced work productivity, and diminished economic potential. Consequently, child undernutrition not only affects individual health but also places a considerable social and economic burden on families and countries.[2,3]

To address this challenge, various nutrition interventions have been implemented worldwide. Common approaches include supplementary feeding programs, school feeding initiatives, fortified complementary foods, micronutrient supplementation, and food

assistance programs aimed at improving children's dietary intake and nutritional status. These interventions have played an important role in increasing access to essential nutrients and reducing the risk of nutritional deficiencies, particularly among vulnerable populations.[3]

However, providing food alone is often insufficient to achieve optimal improvements in child growth. While many feeding programs successfully increase nutrient intake, their effects on anthropometric outcomes are frequently modest and inconsistent. One possible explanation is that children's nutritional status is influenced not only by food availability but also by how food is selected, prepared, and fed. Caregivers may lack adequate knowledge regarding age-appropriate feeding, meal frequency, dietary diversity, food hygiene, or the proper use of supplementary foods. In some settings, supplementary foods intended for children may also be shared among other household members or not consumed as recommended, thereby reducing the effectiveness of nutrition interventions.[4]

Growing evidence suggests that combining nutrition education with feeding interventions can help address these challenges. Nutrition education equips caregivers with practical knowledge and skills that encourage appropriate feeding practices, improve dietary diversity, strengthen adherence to nutrition recommendations, and promote healthier child-care behaviours. By addressing both nutritional intake and caregiver behaviour, integrated interventions are more likely to produce sustainable improvements in child nutritional outcomes than feeding interventions alone.[5]

Therefore, this narrative review aims to summarize current evidence on the role of nutrition education as a beneficial complement to child nutrition interventions. Specifically, this review discusses the limitations of feeding programs implemented without behavioural support, examines evidence comparing feeding-only and combined feeding-plus-education approaches, explores the mechanisms underlying their synergistic effects, and highlights their implications for strengthening child nutrition programs.

Methods

This narrative review was conducted through a comprehensive literature search across three major scholarly databases: PubMed, Scopus, and Google Scholar. The search covered studies published between 2008 and 2025, reflecting more than a decade of scientific

advancement in nutrition education from a nutritional intervention point of view. This range search is to capture broader scientific development in nutrition education and its integration into nutrition interventions, allowing the review to encompass both established evidence and more recent advances in intervention approaches, behavioural strategies, and implementation.

The primary search terms included: nutritional education; nutrition intervention; stunting; wasting; growth faltering; behavior change. Titles, abstracts, and full-text articles were screened independently for relevance. A total of 21 journals and narrative reviews focusing on nutrition education from nutritional intervention and children nutritional status. These studies were synthesized narratively in the Results and Discussion sections, emphasizing insights, intervention relevance, and consistency of findings across contexts.

Result and Discussions

Child Feeding Programs for Preventing Child Undernutrition

Child feeding programs are among the most widely implemented nutrition-specific interventions to prevent and manage child undernutrition. These programs aim to improve dietary intake by increasing access to energy, protein, and essential micronutrients during critical periods of growth and development. They are particularly important for children living in low- and middle-income countries, where food insecurity, poor dietary quality, and recurrent infections remain major contributors to malnutrition. Depending on the target population and program objectives, feeding interventions may be delivered through health facilities, schools, community-based platforms, or humanitarian assistance programs. Although the design and implementation vary across settings, most interventions share the common goal of improving children's nutritional status by addressing inadequate nutrient intake[6,7] .

Supplementary Feeding Programs

Supplementary feeding programs are intended to provide additional nutrients to children who are at risk of undernutrition or experiencing moderate acute malnutrition. Unlike therapeutic feeding, which is designed for children with severe acute malnutrition,

supplementary feeding aims to prevent further nutritional deterioration while supporting normal growth and development.

Several types of supplementary foods have been widely adopted. Ready-to-consume supplementary foods are energy-dense, lipid-based products enriched with essential vitamins and minerals that require no cooking or refrigeration, making them particularly suitable for emergency settings and community-based nutrition programs. Another common approach is the use of fortified blended foods, such as corn-soy blend or wheat-soy blend, which provide additional protein and micronutrients when prepared as porridges or other omplementary meals. In many countries, locally produced supplementary foods are also promoted to improve sustainability and cultural acceptability. These products are typically developed using locally available ingredients, including cereals, legumes, eggs, fish, or dairy products, while maintaining adequate nutritional quality, for instance, iron intake adequacy.[6,8]

Evidence indicates that supplementary feeding programs improve dietary intake and can reduce the prevalence of moderate acute malnutrition, particularly when implemented among food-insecure populations. However, improvements in linear growth are generally modest and tend to vary according to intervention duration, baseline nutritional status, and program adherence.[7,9]

School Feeding Programs

School feeding programs represent one of the largest social protection and nutrition interventions worldwide. These programs provide meals or snacks to school-aged children with the primary objectives of improving nutritional status, enhancing school attendance, increasing classroom participation, and supporting learning outcomes.[7]

Beyond reducing short-term hunger during school hours, school meals contribute to daily energy and micronutrient intake, particularly among children from economically disadvantaged households. Many countries have incorporated fortified foods, milk, eggs, or locally sourced fresh foods into school menus to improve dietary quality while simultaneously supporting local agriculture.[7]

Numerous studies have shown that school feeding programs improve school enrollment, attendance, and concentration during classroom activities. Some evidence also

suggests positive effects on body weight and micronutrient status among children with inadequate dietary intake. Nevertheless, improvements in height gain are less consistently observed because linear growth is influenced by nutritional exposures accumulated during the first two years of life, well before most children enter school. In addition, the nutritional impact of school feeding depends on meal quality, program coverage, implementation fidelity, and the home food environment. Despite these limitations, school feeding remains an important platform for delivering broader health and nutrition interventions, including nutrition education, deworming, and micronutrient supplementation.[7,10]

Complementary Feeding Programs

Appropriate complementary feeding is essential once breast milk alone is no longer sufficient to meet the nutritional requirements of infants, generally beginning at six months of age. Complementary feeding programs seek to improve both the quality and quantity of foods offered during this critical developmental period.[8]

Several strategies have been implemented worldwide. Fortified complementary foods are commonly used to increase dietary intake of protein, iron, zinc, vitamin A, and other essential nutrients. Another widely adopted strategy is home fortification using micronutrient powders, which contain vitamins and minerals such as iron and zinc, allowing caregivers to enrich home-prepared foods while maintaining familiar feeding practices.[9,11,12]

Systematic reviews suggest that these interventions improve micronutrient intake and reduce the prevalence of iron deficiency and anemia. However, their effects on growth indicators, particularly stunting, remain variable. Factors such as dietary diversity, feeding frequency, recurrent infections, caregiver practices, and household food security continue to influence overall nutritional outcomes beyond the provision of fortified foods alone.[9,11]

Community-Based Nutrition Programs

Many countries develop community-based nutrition programs to improve access to nutrition services while encouraging active participation by caregivers and local communities. These programs often combine food supplementation with growth monitoring, nutrition counseling, health services, and behavior change communication.

In Indonesia, the *Pemberian Makanan Tambahan* (PMT) program provides supplementary foods to pregnant women and children identified as nutritionally vulnerable through integrated community health services (*Posyandu*). Similar child nutrition programs have been implemented in several countries by combining growth monitoring, immunization, breastfeeding promotion, and complementary feeding counseling within primary healthcare systems. In settings affected by poverty or humanitarian crises, food voucher or cash transfer programs have also been introduced to improve household food access while allowing families greater flexibility in purchasing nutritious foods.

Community-based approaches offer several advantages because they strengthen local participation, improve program accessibility, and can be integrated with existing maternal and child health services. Nevertheless, their effectiveness often depends on adequate program coverage, continuous funding, trained community health workers, and sustained caregiver engagement.

Overall, community nutrition programs recognize that improving child nutrition requires more than food provision alone and increasingly emphasize the importance of combining nutrition services with community empowerment and health promotion activities.

Collectively, supplementary feeding, school feeding, complementary feeding, and community-based nutrition programs have made important contributions to improving children's dietary intake and reducing nutritional deficiencies worldwide. These interventions consistently increase energy and micronutrient consumption and may improve selected nutritional outcomes, particularly among vulnerable populations. However, improvements in child growth—especially linear growth and stunting reduction—have been less consistent across studies. This suggests that adequate food provision, while essential, is only one component of successful nutrition interventions. Children's nutritional status is also strongly influenced by caregiver knowledge, feeding behaviors, household practices, environmental conditions, and healthcare access. These considerations have led researchers and policymakers to recognize the need for complementary strategies, particularly nutrition education**,** to maximize the effectiveness of feeding interventions.

Nutrition Education as a Behavioural Intervention

Nutrition education has increasingly been recognized as an essential component of child nutrition programs because adequate food availability alone does not guarantee optimal nutritional outcomes. According to the World Health Organization (WHO), nutrition education encompasses a range of educational strategies designed to facilitate the voluntary adoption of healthy dietary behaviours and nutrition-related practices that contribute to improved health and well-being.[11] Unlike food supplementation, which primarily addresses nutrient intake, nutrition education focuses on changing knowledge, attitudes, and behaviours that influence how food is selected, prepared, and consumed within the household.

The concept of nutrition education is grounded in the understanding that caregivers play a central role in determining children's dietary intake and feeding environment. Decisions regarding breastfeeding, complementary feeding, meal frequency, portion size, dietary diversity, food hygiene, and healthcare-seeking behaviours are largely influenced by caregivers' knowledge and perceptions. Therefore, improving caregiver nutrition literacy is considered a key strategy for achieving sustainable improvements in child nutritional status.[5,13]

One of the primary objectives of nutrition education is to strengthen caregivers' understanding of age-appropriate infant and young child feeding practices. Educational interventions commonly emphasize the importance of exclusive breastfeeding during the first six months of life, timely introduction of complementary foods, adequate meal frequency, dietary diversity, responsive feeding, and appropriate portion sizes according to a child's age and developmental stage. In addition to feeding practices, nutrition education also promotes healthier food choices by encouraging the use of locally available, nutrient-dense foods that are affordable, culturally acceptable, and nutritionally adequate.[11,13]

Another important objective is to improve food hygiene and household practices that influence nutritional outcomes. Caregivers are often educated on safe food preparation, handwashing, clean water use, and proper food storage to reduce the risk of foodborne illnesses and recurrent infections, both of which can impair nutrient absorption and contribute

to growth faltering. Consequently, nutrition education addresses not only dietary intake but also the broader behavioural and environmental factors that influence child growth.[11]

Although mothers have traditionally been the primary target of nutrition education, recent evidence highlights the importance of involving a wider range of caregivers. Fathers increasingly participate in household decision-making related to food purchasing and childcare, while grandparents and other family members often contribute to daily feeding practices, particularly in multigenerational households. Teachers and school personnel also play an important role in reinforcing healthy eating habits among school-aged children. In community settings, community health workers serve as trusted sources of nutrition information and provide continuous support for caregivers through routine growth monitoring and counselling. Expanding nutrition education to multiple stakeholders helps create a supportive environment in which healthy feeding behaviours can be consistently practiced.[5,13]

Nutrition education can be delivered through various approaches depending on local resources, cultural context, and healthcare infrastructure. Individual counselling remains one of the most common methods and allows healthcare providers to tailor recommendations according to the child's nutritional status and family circumstances. Group education sessions encourage peer learning and discussion among caregivers, while cooking demonstrations provide practical experience in preparing balanced, nutrient-rich meals using locally available ingredients. Home visits offer opportunities to identify household-specific challenges and provide personalized guidance within the family's living environment. Printed educational materials, including booklets, posters, and flipcharts, continue to complement face-to-face education, particularly in primary healthcare settings.[5,13]

With the rapid expansion of digital technology, mobile health (mHealth) interventions have emerged as promising tools for delivering nutrition education. Mobile applications, text messaging services, and online educational platforms can improve access to nutrition information, reinforce key messages, and support caregiver adherence to recommended feeding practices. Although evidence regarding their long-term effectiveness is still evolving,

digital platforms offer opportunities to extend the reach of nutrition education, particularly in areas where access to healthcare professionals is limited.[5]

In Indonesia, *Posyandu* remains one of the most important community platforms for delivering nutrition education. Through monthly growth monitoring sessions, caregivers receive counseling on breastfeeding, complementary feeding, child growth, dietary diversity, and hygiene practices from trained community health volunteers (*kader Posyandu*) and healthcare professionals. Because *Posyandu* is deeply integrated into primary healthcare services, it provides a practical and sustainable mechanism for combining nutrition education with routine child health monitoring and nutrition interventions.

Overall, nutrition education should be viewed as more than the simple transfer of information. Effective educational interventions seek to facilitate lasting behavior change by equipping caregivers with the knowledge, practical skills, and confidence needed to make appropriate feeding decisions in their everyday lives. As such, nutrition education represents a behavioural intervention that complements food-based programs by improving how available foods are utilized within the household, thereby increasing the potential effectiveness and sustainability of child nutrition interventions.[5,13]

Feeding Programs Alone May Not Be Sufficient

Food supplementation has long been recognized as a cornerstone of child nutrition interventions because it directly addresses inadequate dietary intake and nutrient deficiencies. Nevertheless, improvements in child growth following feeding programs have often been smaller than anticipated, particularly for linear growth and stunting reduction. Although providing nutrient-rich foods is essential, child nutritional status is influenced by a complex interaction of biological, behavioral, environmental, and socioeconomic factors. As a result, increasing food availability alone does not necessarily translate into improved nutritional outcomes if children do not receive or utilize those foods appropriately. This recognition has shifted attention toward the broader determinants of child nutrition that extend beyond food provision itself.[7]

Poor feeding practices

One of the most common reasons why feeding programs fail to achieve optimal outcomes is the persistence of inappropriate infant and young child feeding practices. Even when supplementary foods are available, caregivers may provide meals too infrequently, offer portions that do not meet children's nutritional requirements, or introduce complementary foods either too early or too late. These practices reduce total energy and nutrient intake during a period of rapid growth and may contribute to continued growth faltering despite participation in feeding programs.[11]

In many settings, caregivers also experience difficulties in applying recommended feeding guidelines within their daily routines. For example, complementary foods may lack dietary diversity, contain insufficient protein or micronutrients, or be offered in quantities that are inadequate for the child's age. Responsive feeding practices such as encouraging children to eat patiently, recognizing hunger and satiety cues, and providing meals in a supportive environment are also frequently overlooked. Consequently, the nutritional benefits of food supplementation may not be fully realized if feeding behaviors remain unchanged.[13]

Poor adherence to supplementary feeding

The effectiveness of feeding interventions also depends on consistent utilization of the provided foods. However, adherence is often suboptimal because of factors such as poor palatability, limited caregiver understanding of the program, misconceptions regarding supplement use, irregular attendance at food distribution sessions, or competing household priorities. In some cases, supplements are consumed inconsistently, stored for prolonged periods, or discontinued once the child's condition appears to improve.[3,5]

Program adherence is further influenced by caregivers' motivation and perception of the intervention. Without adequate counseling and continuous support, families may not appreciate the importance of consuming supplementary foods according to recommended schedules. As a result, the nutritional impact of supplementation may be considerably lower than anticipated under controlled research conditions.[3,5]

Inadequate nutrition literacy

Nutrition literacy plays a fundamental role in determining how caregivers utilize available foods. Even when nutrient-rich foods are accessible, caregivers may not possess sufficient knowledge to prepare balanced meals, select age-appropriate foods, or understand recommended feeding practices. Misconceptions regarding child nutrition remain common in many communities and may include inappropriate beliefs about breastfeeding duration, complementary feeding, meal frequency, or the nutritional value of locally available foods.[13]

Limited nutrition literacy may also influence caregivers' ability to interpret child growth monitoring results and recognize early signs of undernutrition. Consequently, food-based interventions alone are unlikely to achieve optimal effectiveness if caregivers lack the knowledge required to make informed feeding decisions. Improving nutrition literacy has therefore become an important strategy for promoting sustainable behavior change and maximizing the benefits of nutrition programs.[13]

Low hygiene and sanitation

Adequate dietary intake alone cannot ensure optimal nutritional status if children experience repeated infections. Poor hygiene, unsafe drinking water, inadequate sanitation, and improper food handling increase the risk of diarrheal diseases and environmental enteric dysfunction, both of which impair nutrient digestion and absorption. Recurrent infections also increase metabolic demands and suppress appetite, creating a cycle in which children consume fewer nutrients while simultaneously requiring more energy for recovery.

This interaction between infection and undernutrition explains why children living in environments with poor water, sanitation, and hygiene (WASH) conditions often continue to experience growth faltering despite receiving food supplementation. Therefore, interventions that address hygiene practices alongside nutrition are increasingly recognized as essential components of comprehensive child nutrition programs.[3,7]

Household socioeconomic issues

Household socioeconomic conditions substantially influence the success of feeding interventions. Poverty remains one of the strongest determinants of child undernutrition

because it limits access to diverse foods, healthcare, education, and sanitation. Even when supplementary foods are provided free of charge, families facing severe economic hardship may struggle to maintain appropriate feeding practices due to competing financial priorities.[3,5]

Food insecurity further complicates this situation by increasing the likelihood of food sharing and reducing dietary diversity outside the intervention. In addition, caregivers—particularly mothers—often face considerable time constraints related to employment, household responsibilities, and childcare. Heavy workloads may reduce opportunities to prepare nutritious meals, attend nutrition counseling sessions, or practice responsive feeding consistently. These socioeconomic challenges demonstrate that improving child nutrition requires interventions that address not only food availability but also the broader context in which caregiving occurs.[3,7]

Evidence on Combined Feeding and Nutrition Education Interventions

An increasing body of evidence suggests that nutrition education enhances the effectiveness of feeding interventions by addressing behavioral factors that influence how foods are utilized within the household. While food supplementation provides the necessary nutrients for growth, nutrition education improves caregivers' ability to translate these nutritional resources into appropriate feeding practices. Consequently, interventions that integrate both approaches generally produce greater improvements in child nutritional outcomes than programs that focus solely on food provision.[5,14]

Rather than acting independently, feeding interventions and nutrition education appear to function synergistically. Food supplementation addresses the immediate nutritional deficit, whereas nutrition education promotes sustained behavioral changes that improve dietary quality, feeding practices, and long-term adherence. The following sections summarize current evidence according to major nutritional outcomes.[5,14]

Nutrition education help improved linear growth

Child growth, particularly linear growth, is one of the most frequently evaluated outcomes in nutrition intervention studies. Although supplementary feeding alone has shown modest benefits, several systematic reviews indicate that combining food supplementation

with nutrition education results in greater improvements in height-for-age and reductions in stunting.[5,14,15]

A systematic review by Lassi et al**.** reported that educational interventions on infant and young child feeding significantly improved growth outcomes, particularly when delivered alongside complementary feeding or food supplementation programs.[5] Similarly, Imdad and colleagues found that combining caregiver education with complementary food provision produced greater improvements in height-for-age and weight gain than providing complementary foods alone.[14] Additional evidence points out higher increment increases in height, and weight-for-height Z-scores.[15]

Evidence from community-based interventions also suggests that integrated programs are particularly effective during the first two years of life, when growth velocity is highest. Caregivers who receive practical guidance on meal preparation, feeding frequency, and responsive feeding are more likely to utilize supplementary foods appropriately, thereby increasing the likelihood of achieving positive growth outcomes.[5,14]

Nevertheless, improvements in linear growth remain relatively modest across many studies. This is unsurprising because child growth is influenced by multiple factors beyond dietary intake, including recurrent infections, sanitation, household food security, and maternal health. These findings reinforce the importance of comprehensive nutrition strategies rather than relying exclusively on food provision.

Improved dietary diversity

One of the most consistent benefits of nutrition education is its positive effect on dietary diversity. Educational interventions encourage caregivers to incorporate a wider variety of locally available foods, helping children receive a broader range of essential nutrients.[10,14]

Several intervention studies have demonstrated that caregivers who participate in nutrition education programs provide more diverse diets than those receiving feeding interventions alone. Educational sessions commonly promote practical strategies such as combining staple foods with animal-source foods, legumes, fruits, and vegetables while emphasizing age-appropriate meal frequency and portion sizes. As a result, children in

integrated intervention programs generally achieve higher dietary diversity scores and improved complementary feeding practices.[10,14]

Importantly, improvements in dietary diversity often persist beyond the duration of food supplementation because caregivers continue applying the knowledge they have acquired. This suggests that nutrition education contributes to more sustainable dietary improvements by empowering families to make healthier food choices using locally available resources.

Evidence on improving feeding practices

Perhaps the greatest contribution of nutrition education lies in its ability to improve caregiver feeding behaviors. Multiple studies have consistently reported significant improvements in infant and young child feeding practices following educational interventions, including more appropriate meal frequency, timely introduction of complementary foods, responsive feeding, and safer food preparation.

A systematic review by Shi and Zhang concluded that educational interventions substantially improved complementary feeding practices across diverse low- and middle-income countries, particularly when counseling included practical demonstrations and repeated caregiver support[16] . Similar findings were reported by Lassi et al., who observed that caregiver education increased adherence to recommended infant and young child feeding guidelines while improving overall child nutritional status.[5]

Behavioral improvements are especially important because they directly influence how supplementary foods are utilized. Appropriate feeding practices maximize nutrient intake, reduce food waste, and encourage children to consume adequate quantities of food during periods of rapid growth.

Help to improve Caregiver Knowledge

Improving caregiver knowledge is considered one of the primary mechanisms through which nutrition education influences child nutrition. Numerous studies have shown that educational interventions significantly increase caregivers' understanding of breastfeeding, complementary feeding, dietary diversity, food hygiene, and child nutrition.[10,17]

Beyond increasing factual knowledge, nutrition education enhances caregivers' confidence in making appropriate feeding decisions and strengthens their ability to recognize nutritional problems at an earlier stage. Better-informed caregivers are more likely to attend growth monitoring sessions, follow nutrition recommendations, prepare balanced meals, and seek healthcare when children exhibit signs of growth faltering. Importantly, improvements in caregiver knowledge frequently translate into measurable behavioral changes. This relationship supports the concept that nutrition education serves as an enabling intervention, bridging the gap between food availability and effective food utilization within the household.[10,17]

Outcome	Main Findings	Representative Evidence
Linear growth	Greater improvements in height-for-age and reduced risk of stunting compared with feeding alone, although effects are generally modest.	Lassi et al. (2020); Imdad et al. (2011)
Dietary diversity	Increased consumption of diverse food groups and improved complementary feeding practices.	Imdad et al. (2011); WHO (2023)
Feeding practices	Improved meal frequency, responsive feeding, timely complementary feeding, and safer food preparation.	Shi & Zhang (2011); Lassi et al. (2020)
Caregiver knowledge	Higher nutrition knowledge, increased confidence, and better adherence to recommended feeding guidelines.	WHO (2023); Lassi et al. (2020)

Mechanisms Underlying the Synergistic Effect

The growing evidence supporting integrated feeding and nutrition education interventions suggests that their effectiveness extends beyond simply increasing nutrient availability. Rather than functioning independently, food provision and nutrition education complement one another through a sequence of behavioral and nutritional changes that ultimately improve child growth. While feeding interventions address immediate nutrient deficits, nutrition education equips caregivers with the knowledge and practical skills needed to ensure that these nutrients are appropriately utilized. Consequently, the synergistic effect of combined interventions can be understood as a pathway that begins with improved caregiver knowledge and culminates in better nutritional and growth outcomes.

Improved caregiver knowledge as the foundation of behavioural change

The first step in this pathway is the improvement of caregiver knowledge. Nutrition education increases caregivers' understanding of infant and young child nutrition, including breastfeeding recommendations, appropriate complementary feeding, meal frequency, portion size, dietary diversity, food hygiene, and recognition of growth problems. However, knowledge alone is not the ultimate goal. Rather, it provides the foundation for caregivers to make informed decisions regarding their children's daily feeding practices.[5,17]

Educational interventions also improve caregivers' confidence, or self-efficacy, in applying recommended nutrition practices. Caregivers who understand why specific feeding recommendations are important are generally more likely to implement them consistently, even in resource-constrained settings. This increase in knowledge and confidence represents the first mechanism through which nutrition education enhances the effectiveness of feeding interventions.[5,17]

Recent evidence from Indonesia further supports this mechanism. A cross-sectional study conducted among toddlers in East Jakarta found that maternal self-efficacy, responsive feeding practices, and dietary diversity were all significantly associated with both stunting and wasting. These findings suggest that caregiver-related behavioral factors are closely linked to child nutritional status and should be considered alongside food provision in nutrition programs.[5,14,17]

From knowledge to better feeding behavior

Improved knowledge is expected to translate into healthier caregiver behaviors. Rather than relying on traditional beliefs or inconsistent feeding practices, caregivers become more capable of implementing evidence-based recommendations in their everyday routines.

Positive behavioral changes include providing meals at appropriate intervals, serving age-appropriate portions, practicing responsive feeding, encouraging children to eat patiently, and preparing meals using safe and hygienic methods. Nutrition education also encourages caregivers to recognize children's hunger and satiety cues instead of forcing or restricting food intake, thereby creating a more supportive feeding environment.[10,17]

Behavior change is particularly important because children's nutritional status depends not only on the quantity of food consumed but also on how feeding occurs. Appropriate caregiver-child interactions during meals improve food acceptance and increase the likelihood that children consume sufficient amounts of nutrients necessary for growth.[10,17]

Importantly, educational interventions do not simply improve knowledge but also enhance adherence to recommended nutritional practices. A recent narrative review on integrated strategies to prevent iron deficiency concluded that nutrition education increases awareness, strengthens adherence to supplementation programs, and promotes healthier long-term behaviours through active community engagement. These findings suggest that education functions as a behavioural catalyst that enables families to consistently implement nutrition recommendations.[17]

Improved Infant and Young Child Feeding Practices

As caregiver behaviors improve, infant and young child feeding (IYCF) practices also become more consistent with international recommendations. Educational interventions have been shown to increase exclusive breastfeeding rates, encourage timely introduction of complementary foods at six months of age, improve meal frequency, and promote responsive feeding throughout early childhood.[5]

Improved IYCF practices ensure that supplementary foods provided through nutrition programs are incorporated into children's daily diets according to their nutritional requirements. Rather than replacing regular meals or being used inconsistently, these foods become part of an overall balanced feeding pattern that better supports growth and development.[5]

The importance of continuous education has also been highlighted in recent breastfeeding literature, which emphasizes that educational interventions are most effective when supported by healthcare systems, family members, workplaces, and community environments. Combining education with supportive facilities and policies enables mothers to sustain recommended infant feeding practices over time, illustrating that knowledge must be reinforced through enabling environments to produce lasting behavioural change.[14]

Increased dietary diversity and better utilization of supplementary foods

Another important mechanism involves improvements in dietary diversity. Nutrition education encourages caregivers to combine supplementary foods with locally available animal-source foods, legumes, vegetables, fruits, and other nutrient-rich ingredients instead of relying predominantly on staple carbohydrates.[18]

This behavioral change increases the variety of nutrients available to children and improves the overall quality of complementary feeding. At the same time, caregivers become more likely to use supplementary foods according to program recommendations rather than sharing them among family members or storing them for later use.[18]

The Indonesian study by Shidiqah et al. demonstrated that children receiving more diverse diets had significantly lower risks of both stunting and wasting, highlighting dietary diversity as an important pathway linking caregiver practices with nutritional outcomes. The same study also showed that responsive feeding and maternal self-efficacy were strongly associated with better nutritional status, reinforcing the interconnected nature of these mechanisms.[18]

Reduced infections through improved hygiene practices

Nutrition education also addresses behaviors beyond food selection. Many educational programs include practical guidance on handwashing, food preparation, safe water use, and household sanitation. These behaviors reduce children's exposure to enteric pathogens, lowering the incidence of diarrheal diseases and other infections that interfere with nutrient digestion and absorption.[11]

Repeated infections create a vicious cycle in which poor nutritional status weakens immunity while illness further increases nutrient requirements and suppresses appetite. By improving hygiene behaviors, nutrition education helps interrupt this cycle, allowing children to utilize nutrients more efficiently and support healthy growth.[11]

Improved Nutrient Utilization and Child Growth

Collectively, these behavioral changes contribute to more effective utilization of available nutrients. Supplementary foods are consumed more consistently, meals become

nutritionally balanced, feeding practices improve, and infection risks decline. Consequently, children are more likely to achieve adequate dietary intake to support normal physical growth and development.

Although child growth remains influenced by broader determinants such as household poverty, food security, environmental conditions, and access to healthcare, integrated interventions address several modifiable determinants simultaneously. This multifaceted approach helps explain why programs combining nutrition education with feeding interventions generally produce greater improvements in dietary quality, caregiver practices, and growth outcomes than feeding interventions alone.

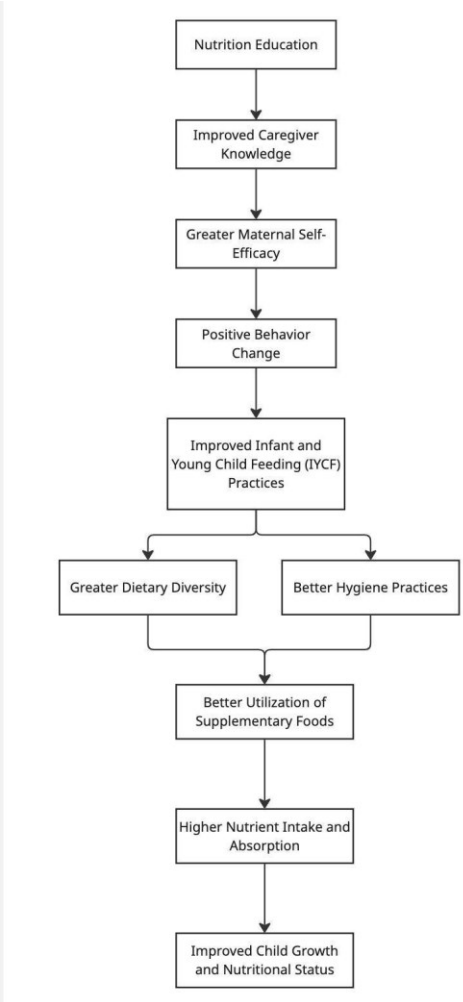


Figure 1. Conceptual Framework on How Nutrition Education Affects Nutrition Program

Implications for Public Health Programs

The evidence presented in this review suggests that improving child nutrition requires more than simply increasing the availability of food. While feeding interventions remain indispensable for addressing nutrient deficiencies and food insecurity, their effectiveness depends largely on how foods are utilized within households. The consistent finding that nutrition education improves caregiver knowledge, feeding behaviors, dietary diversity, and adherence indicates that educational interventions should no longer be viewed as optional components of nutrition programs. Instead, nutrition education should be incorporated as an essential element of public health strategies aimed at preventing child undernutrition.[3,4]

Strengthening integrated nutrition programs in Indonesia

Indonesia has implemented numerous nutrition-specific interventions to reduce the burden of stunting, wasting, and other forms of child undernutrition. Programs such as Makan Bergizi Gratis (MBG)**,** Pemberian Makanan Tambahan (PMT), and routine nutrition services delivered through *Posyandu* have substantially expanded children's access to nutritious foods. However, as demonstrated throughout this review, food provision alone may not achieve optimal improvements in child growth if caregivers lack the knowledge and skills needed to implement appropriate feeding practices.[19]

Therefore, nutrition education should be systematically integrated into these programs. For example, adding short educational sessions or practical demonstrations for parents and caregivers at school nutrition program. Similarly, PMT activities could be accompanied by individualized counseling to ensure that supplementary foods are consumed by the intended child and incorporated appropriately into daily meals. Such integration would maximize the nutritional benefits of food assistance while encouraging sustainable behavioral change.[3,11]

Posyandu provides a particularly valuable platform for delivering these interventions because it already combines growth monitoring with maternal and child health services. Strengthening the nutrition counseling capacity of *kader Posyandu* and healthcare workers may further improve caregiver engagement and reinforce recommended infant and young child feeding practices during routine monthly visits.

This approach is also supported by findings from a nationwide health education program among Indonesian parents, which demonstrated significant improvements in parental knowledge following a structured educational intervention. Although that study focused on immunity and cognitive development, it illustrates that parents readily acquire nutrition-related knowledge when educational messages are delivered through organized community-based activities.[20].

School feeding programs as opportunities for nutrition education

School feeding programs also offer an important opportunity to promote healthy eating behaviors beyond providing meals. Although school meals improve dietary intake during school hours, teachers and school staff can reinforce nutrition messages through classroom activities, healthy eating campaigns, school gardens, and practical food education.[5,11]

Nutrition education delivered within schools not only benefits children directly but may also influence household behaviors, as children frequently share health messages with their families. Integrating educational activities into school feeding programs therefore has the potential to establish lifelong healthy dietary habits while complementing existing nutrition interventions.[4]

Strengthening maternal and child health services

Maternal and child health services should continue to emphasize nutrition counseling throughout the first 1,000 days of life. Pregnancy, infancy, and early childhood represent critical periods during which caregivers establish feeding behaviors that strongly influence future growth and development.[3,5]

Routine antenatal care, postnatal services, immunization visits, and child growth monitoring sessions all provide opportunities for delivering consistent nutrition education. Counseling should address breastfeeding, complementary feeding, meal frequency, dietary diversity, responsive feeding, and household hygiene using practical and culturally appropriate approaches. Repeated counseling delivered across multiple healthcare contacts is more likely to reinforce positive behaviors than a single educational encounter.[3,5]

Evidence from the workplace nutrition education literature further suggests that education is most effective when reinforced by supportive environments rather than delivered as a one-time activity. Programs combining education with organizational support achieved greater improvements in nutrition knowledge, healthy behaviors, and health outcomes than education alone. Although conducted among adults, this principle is equally applicable to maternal and child nutrition programs, where supportive family, community, and healthcare environments are needed to sustain recommended feeding practices.[19,21]

Improving program monitoring and evaluation

The success of nutrition programs has traditionally been evaluated using indicators such as food distribution coverage, supplement utilization, or anthropometric outcomes. While these indicators remain important, they do not fully capture whether behavioral changes have occurred among caregivers.[21]

Future monitoring systems should therefore include process and behavioral indicators alongside growth outcomes. Examples include caregiver nutrition knowledge, infant and young child feeding practices, dietary diversity scores, adherence to supplementary feeding recommendations, and hygiene behaviors. Monitoring these intermediate outcomes would enable program managers to identify implementation gaps earlier and better understand why some interventions succeed while others produce limited improvements.[21,]

Behavioral indicators are particularly valuable because they often change before measurable improvements in child growth become evident. Consequently, incorporating these indicators into routine program evaluation may provide a more comprehensive assessment of intervention effectiveness.[21]

Policy implications

At the policy level, the findings of this review support a shift from food-centered interventions toward integrated nutrition strategies that combine food provision with behavior change communication. National nutrition policies should explicitly recognize nutrition education as a core intervention rather than a supportive activity.

Successful implementation will require investment in training healthcare workers, community health volunteers, teachers, and other frontline personnel responsible for delivering nutrition education. Standardized educational materials, practical counseling tools, and culturally appropriate communication strategies should also be developed to ensure consistent implementation across regions.[22]

Conclusion

This review demonstrates that food-based nutrition interventions alone may be insufficient to achieve optimal improvements in child nutritional outcomes, as feeding practices are influenced by behavioural, environmental, and socioeconomic factors. Integrating nutrition education with feeding interventions improves caregivers' knowledge, confidence, and practical feeding skills, which can lead to better dietary diversity, appropriate use of supplementary foods, intervention adherence, hygiene practices, and ultimately improved child nutrition outcomes.

These findings support the objective of this review by demonstrating the complementary role of nutrition education in strengthening the effectiveness and sustainability of nutrition interventions. Although improvements in anthropometric outcomes vary across settings, the overall evidence supports integrating nutrition education as a core component rather than an optional addition to child nutrition programs. Future nutrition programs should incorporate structured, culturally appropriate, and behaviour-focused nutrition education alongside food-based interventions.

Acknowledgement

The authors would like to acknowledge all contributors who provide significant insights to the paper, especially the last author, Niken Salsabyla for the extensive mentorship and critical perspective on the topic.

Conflict of Interest

Authors declare that there is no conflict of interests in this publication.

References

1. UNICEF, World Health Organization, World Bank Group. Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates. Geneva; 2025.
2. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013 Aug;382(9890):427–51. doi:10.1016/S0140-6736(13)60937-X
3. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? The Lancet. 2013 Aug;382(9890):452–77. doi:10.1016/S0140-6736(13)60996-4
4. Ruel MT, Alderman H. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? The Lancet. 2013 Aug;382(9891):536–51. doi:10.1016/S0140-6736(13)60843-0
5. Lassi ZS, Rind F, Irfan O, Hadi R, Das JK, Bhutta ZA. Impact of Infant and Young Child Feeding (IYCF) Nutrition Interventions on Breastfeeding Practices, Growth and Mortality in Low- and Middle-Income Countries: Systematic Review. Nutrients. 2020 Mar 10;12(3):722. doi:10.3390/nu12030722
6. Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. Matern Child Nutr. 2008 Apr 14;4(s1):24–85. doi:10.1111/j.1740-8709.2007.00124.x
7. Kristjansson EA, Gelli A, Welch V, Greenhalgh T, Liberato S, Francis D, et al. Costs, and cost-outcome of school feeding programmes and feeding programmes for young children. Evidence and recommendations. Int J Educ Dev. 2016 May;48:79–83. doi:10.1016/j.ijedudev.2015.11.011
8. Chandra DN, Surapsari J, Ratih MP, Herawati A, Prawari M, Sundjaya T, et al. Iron-Fortified Growing-Up Milk Supplementation Effectively Fulfilled The Requirements of Daily Iron Intake in Children Aged 1-3 Years Old. JPGN Rep. 2025 May 13;6(S1):1469. doi:10.1002/jpr3.70024

9. World Health Organization. WHO guideline for complementary feeding of infants and young children 6-23 months of age. Geneva: WHO; 2023. 76 p.
10. Pérez-Escamilla R, Segura-Pérez S, Lott M. Feeding Guidelines for Infants and Young Toddlers. Nutr Today. 2017 Sep;52(5):223–31. doi:10.1097/NT.0000000000000234
11. Wahidin M, Riyadina W, Aryastami NK, Sitorus N, Pane M, Nitami M, et al. Digital Education to Improve Knowledge of Sugar, Salt, and Fat Consumption Among Indonesian Adolescents: A Quasi-Experimental Study. Adv Public Health. 2025 Jan 13;2025(1). doi:10.1155/adph/9969313
12. W. Basrowi R, Dilantika C. Optimizing iron adequacy and absorption to prevent iron deficiency anemia: The role of combination of fortified iron and vitamin C. World Nutrition Journal. 2021 Jun 29;5(S1):33–9. doi:10.25220/WNJ.V05.S1.0005
13. Pratiwi D, Sundjaya T, DIlantika C, Putri N. Nurturing the future and exploring the philosophical implications of recent advances in breastfeeding education and technology. Bali Medical Journal. 2024;13(2).
14. Shi L, Zhang J. Recent Evidence of the Effectiveness of Educational Interventions for Improving Complementary Feeding Practices in Developing Countries. J Trop Pediatr. 2011 Apr 1;57(2):91–8. doi:10.1093/tropej/fmq053
15. Tanjung C, Fikri B, Prawitasari T, Massi N, Zainuddin AA, Juliaty A, et al. Comparative Analysis of Nutritional Advice and a Combined Approach for Addressing Impending Stunting in Infants: A Clinical Trial. Nutrients. 2024 Aug 24;16(17):2832. doi:10.3390/nu16172832
16. Imdad A, Yakoob MY, Bhutta ZA. Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries. BMC Public Health. 2011 Dec 13;11(S3):S25. doi:10.1186/1471-2458-11-S3-S25
17. Basrowi RW, Sitorus N, Dilantika C, Ausi Y. Bridging the gap: Education, nutrition, and community action against iron deficiency. Bali Medical Journal. 2025 Feb 17;14(1):506–11. doi:10.15562/bmj.v14i1.5613
18. Salim A, Basrowi RW. The Impact of Nutrition Education in Workplace. Journal of

Indonesian Specialized Nutrition. 2024 Jun 26;1(4):153–60. doi:10.46799/jisn.v1i4.21

19. Nur Adliyani ZO, Basrowi RW. Lactation Intervention Study at Workplace; A Narrative Review. Journal of Indonesian Specialized Nutrition. 2023 Dec 25;1(2):76–85. doi:10.46799/jisn.v1i2.12
20. Narendraputra AD, Basrowi RW. Informed Consent in the Workplace Nutrition Intervention Studies: A Narrative Review on Ethical Challenges. Journal of Indonesian Specialized Nutrition. 2024 Mar 20;1(3):112–20. doi:10.46799/jisn.v1i3.14
21. Oktarina MD, Ibrahim R, Kinesya E, Kartjito MS, Wasito E. Raising Awareness on Children's Immunity and Cognitive Abilities: Nationwide Survey to Indonesian Parents. Journal of Indonesian Specialized Nutrition. 2024 Jun 26;1(4):161–71. doi:10.46799/jisn.v1i4.20
22. Rohsiswatmo R. Nutritional Management and Recommendation for Preterm Infants: A Narrative Review. Amerta Nutrition. 2021 Sep 30;5(1SP):1. doi:10.20473/amnt.v5i1SP.2021.1-13