REVIEW ARTICLE

Efforts to Prevent Stunting in Children Aged 0-24 Months: An Integrative Review

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ABSTRACT

Stunting, a consequence of chronic malnutrition, particularly affects children aged 0-24 months, impacting child mortality and development. This review aims to explore stunting prevention interventions in this age group, focusing on caregiving during the first 1000 days of life. A systematic search yielded 18 relevant studies published between 2019 and 2023, diverse in location and intervention approaches. Interventions varied from supplementation to community and healthcare programs. Integrating nutrition education with maternal support proved crucial. The review stresses the need for sustainable, context-specific approaches tailored to local contexts. Recommendations include integrating nutrition education into healthcare and community interventions. Continuous evaluation is vital. This review offers insights into stunting prevention, aiding evidence-based strategies globally. Future research should explore caregiving complexities and intervention sustainability. Nursing practitioners are key in implementing holistic approaches to stunting prevention and improving child health outcomes.
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INTRODUCTION

Stunting, which denotes a child being too short for their age due to chronic or recurrent malnutrition, is a significant global health issue among children (1,2). It contributes to child mortality and reflects disparities in human development, indicating inequalities (3). Stunted children are unable to attain their full physical and cognitive capabilities (4).

As of 2020, the global prevalence of stunting stands at approximately 149.2 million children under 5. This condition adversely impacts children's growth and development, impeding their capacity to flourish and realise their full potential (5,6). Stunting, a pervasive challenge affecting early childhood development, is emblematic of impaired growth and development in children aged 0-24 months (7,8). This condition, characterised by suboptimal physical growth, has far-reaching consequences, encompassing compromised cognitive capacities, reduced educational achievements, and lasting impacts on overall well-being (9–11). The critical nature of the first 1000 days of life underscores the urgency of addressing stunting during this developmental window (12,13).

The prevalence of stunting has garnered heightened attention, necessitating a comprehensive exploration of interventions and caregiving dynamics aimed at prevention (14,15). Addressing stunting involves comprehensive efforts such as enhancing nutrition, ensuring access to clean water, improving sanitation, and providing adequate healthcare (7,16). This systematic review endeavours to meticulously unravel and analyse the diverse landscape of interventions implemented to thwart stunting in children aged 0-24 months.

In the pursuit of comprehensively reviewing efforts to prevent stunting in children aged 0-24 months, several crucial knowledge gaps that align with the systematic objectives have been identified. The literature currently lacks an in-depth analysis of the variations in the success or failure of stunting prevention interventions (17–19). Motivated by the imperative to consolidate existing knowledge, discern patterns of effectiveness, and identify gaps in understanding, this review addresses fundamental questions. It aims to categorically identify various intervention types, shedding light on their success or failure in reducing the prevalence of stunting. Additionally, the review will critically explore the role of caregiving factors, particularly within the first 1000 days of life, in shaping the outcomes of stunting prevention efforts.

Study aim

In navigating the intricate landscape of stunting

prevention, this review aspires to provide a comprehensive synthesis of existing knowledge and offer actionable recommendations for policymakers and practitioners. By systematically presenting findings, this research endeavours to illuminate the nuances of stunting prevention efforts, addressing critical knowledge gaps and shaping a pathway towards more effective, informed, and compassionate interventions.

METHOD

Search strategy

The integrative review employed a comprehensive search strategy to identify relevant studies focused on efforts to prevent stunting in children aged 0-24 months. The search was conducted across multiple electronic databases, including PubMed, Scopus, CINAHL (EBSCO), ProQuest, Cochrane, and Web of Science (WOS). The search combined relevant MeSH terms and keywords to explore the literature comprehensively. The primary search terms included "Stunting," "Prevention," "Child Nutrition Disorders," "Infant," "Parenting," and "Critical Period (Developmental)."

The search was confined to studies published within the last five years, from 2019 to 2023, to ensure the inclusion of the most recent research. This timeframe was selected to provide contemporary insights into efforts aimed at preventing stunting in children aged 0-24 months.

Inclusion and exclusion criteria

Inclusion criteria encompassed studies investigating interventions targeting the prevention of stunting in children aged 0-24 months. The review considered a variety of study designs, including randomised controlled trials (RCTs), quasi-experimental studies, cohort studies, cross-sectional studies, and qualitative studies. The language of publication was restricted to English.

Exclusion criteria involved studies not directly addressing stunting prevention efforts in the specified age group, those lacking pertinent outcome measures, or studies falling outside the defined publication timeframe.

Study selection process

Three independent reviewers initially screened titles and abstracts to identify potentially eligible studies. Full-text articles were retrieved to assess the inclusion and exclusion criteria. Discussions and consensus between the reviewers resolved any disparities in study selection.

Data extraction

A standardised data extraction form was developed, encompassing key elements such as author, year, location, study design, participant characteristics, variables assessed, interventions/measurement, analysis methods, findings, and recommendations. This systematic approach aimed to ensure consistency and accuracy in data extraction.

Quality assessment

The quality of the included studies was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal tools specific to the respective study designs. The assessment considered randomisation, blinding, allocation concealment, and other criteria pertinent to the study design. Studies were categorised based on their methodological rigour, and the findings were interpreted considering the quality of evidence.

Data synthesis

The synthesis of findings involved a systematic organisation based on predefined objectives. The extracted data were synthesised to provide a comprehensive overview of intervention types, caregiving factors, effectiveness, and factors influencing success or hindrance in stunting prevention efforts. Using JBI criteria contributed to a nuanced understanding of study quality, enhancing the robustness of the review's conclusions.

RESULTS

This integrative review aims to thoroughly examine interventions aimed at preventing stunting in children aged 0-24 months.

Search results

Our initial searches across PubMed, Scopus, CINAHL (EBSCO), ProQuest, Cochrane, and WOS yielded a total of 796 records. After removing duplicates (n = 20) and excluding records with incomplete data (n = 1), we proceeded to screen 775 records. The exclusion criteria during screening involved titles deemed irrelevant (n = 613) and abstracts lacking relevance (n = 112). Subsequently, 50 reports were identified for retrieval.

During the retrieval phase, 25 reports could not be obtained. The remaining 25 reports were assessed for eligibility, excluding two supplement articles, three studies with ineligible participants, and two studies with ineligible study designs. A total of 18 studies were deemed eligible for inclusion in the integrative review.

The study selection process adhered to the PRISMA guidelines (20), and a flow diagram detailing the search results and selection process is presented in Figure 1. This comprehensive approach ensures transparency and rigour in identifying and including relevant studies for the integrative review of stunting prevention efforts in children aged 0-24 months.

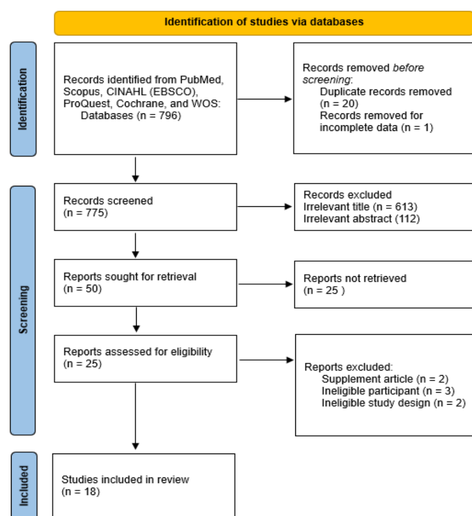

Figure 1: Diagram Flow Selection

Characteristics of included studies

The integrative review encompassed 18 studies; their characteristics are summarised in Appendix, Table I. The selected studies were conducted over a range of years, from 2019 to 2023, ensuring the inclusion of recent research findings. The study designs varied, with eleven studies employing quantitative methodologies (21,22,31,23–30), three utilising qualitative approaches (32–34), one adopting a mixed-methods design (35), and three following RCT designs (36–38).

Geographically, the studies were diverse, representing multiple regions. Ten studies were conducted in Indonesia (21,22,24,26,27,29–31,33,38), emphasising a regional focus on stunting prevention efforts. Other study locations included Pakistan (23,35), Vietnam (25), Guatemala (28), Burkina Faso (36,37), Malawi (34), USA (32) and a meta-analysis encompassing a broader scope. This diverse geographical distribution enhances the generalizability of the findings across different socio-cultural contexts and healthcare settings.

The interventions in the selected studies exhibited a spectrum of approaches. These interventions were categorised into distinct types, such as community-based trials (23), quasi-experimental designs (21,25,26,28,30), cross-sectional studies (22,24,29,31,34), and randomised controlled trials (RCTs) (36–38). The diversity in intervention types allows for a comprehensive exploration of stunting prevention strategies, ranging from community-level initiatives to more controlled experimental settings.

Furthermore, the included studies encompassed a wide range of participant demographics, including pregnant women (26,30,38), mothers (21,22,31,33,35), children aged 0 – 24 months (23–25,27–29,32,34,36), and caregivers (37). The variation in participant characteristics provides a nuanced understanding of the effectiveness of interventions across different population groups.

In terms of outcome measures, the studies assessed various aspects of stunting prevention, such as changes in maternal behaviour (21,22,31,33,35), child growth indicators (23–25,27–29,32,34,36), nutritional outcomes (32,36,37), and the impact of specific interventions (23). This diversity of outcome measures contributes to a comprehensive evaluation of the multifaceted nature of stunting prevention efforts.

The integrative review's inclusion criteria were robust, ensuring a thorough selection of studies that met the predefined objectives. The rigorous methodology adopted in this review provides a strong foundation for synthesising evidence and deriving meaningful insights into the diverse landscape of efforts to prevent stunting in children aged 0-24 months.

Table I: Efforts to prevent stunting in children aged 0-24. month

Author, year, location	DSVIA (study Design, Subject/participant, Variable, Intervention/measurement, and Analysis)	Findings	Recommendations
[1] Ain et al. (2023), Indonesia	D: Quasi-experimental S: Purposive sample of 90 mothers V: The independent variables in this study were the DSDoSC intervention, the PD intervention, and the control condition. The dependent variables encompassed various aspects of maternal behavior related to stunting prevention I: Dynamic Self-Determination of Self-Care (DSDoSC) model and the Positive Deviance (PD) model A: Paired t-test, MANOVA, and Level of Significance	Key findings indicate that interventions utilizing the Dynamic Self-Determination of Self-Care (DSDoSC) and Positive Deviance (PD) models significantly improved maternal behavior. Both groups showed enhancements in eating habits, parenting practices, environmental and personal hygiene, water sanitation, and healthcare-seeking behavior. However, personal hygiene did not notably change. Overall, both interventions collectively impacted stunting prevention behavior, as demonstrated by the results of the MANOVA test.	The successful implementation of the PD and DSDoSC models suggests that these interventions can be replicated in similar contexts. Additionally, there may be opportunities to adapt these models for use in diverse settings to address stunting prevention.

CONTINUE

Table I: Efforts to prevent stunting in children aged 0-24 month. (CONT.)

Author, year, location	DSVIA (study Design, Subject/participant, Variable, Intervention/measurement, and Analysis)	Findings	Recommendations
[2] Cliffer et al. (2020), Burkina Faso	D: Geographically randomized trial design S: 6,112 children aged 6 – 23 months V: Independent Variable: Types of specialized nutritious foods (CSB+, CSWB, SC+, RUSF). Dependent Variables: Length-for-age z score (LAZ), weight-for-length z score (WLZ), end-line stunting (LAZ < −2), and total monthly measurements of wasting (WLZ < −2). I: Blanket supplementary feeding program A: Comparative cost-effectiveness analysis	Key findings reveal that none of the four specialized nutritious foods (CSB+, CSWB, SC+, RUSF) prevented declines in growth among the studied children. Additionally, children in the SC+ and RUSF arms did not differ significantly from those in the CSB+ with oil arm. Interestingly, children in the CSWB with oil arm experienced higher rates of end-line stunting and more months of wasting. Regarding cost-effectiveness, CSB+ with oil emerged as the most economical option across all costing scenarios, demonstrating similar effectiveness to SC+ and RUSF. Overall, CSB+ with oil was identified as the most cost-effective product for the intended purposes.	Considering the effectiveness and cost-effectiveness, the study recommends the use of CSB+ with oil in programs targeting the prevention of wasting and stunting in children aged 6–23 months.
[3]Dewey et al. (2021), USA	D: Meta-analysis study S: 37,000 children across the 14 RCT V: Independent Variable: Provision of small-quantity lipid-based nutrient supplements (SQ-LNSs). Dependent Variables: Prevalence of stunting, wasting, and underweight, Language, social-emotional, and motor development scores, Prevalence of anemia, and Prevalence of iron-deficiency anemia. I: The SQ-LNSs A: Meta-analysis and examination of effect modifiers	Key findings: 1. SQ-LNS recipients had 12–14% lower malnutrition prevalence. 2. SQ-LNS reduced language, social-emotional, and motor development risks by 16–19%. 3. SQ-LNS lowered anemia prevalence by 16%, iron-deficiency anemia by 64%. 4. SQ-LNS benefits spanned diverse study factors. 5. Greater SQ-LNS benefits seen in high-stunting, low-SES, and acutely malnourished populations. 6. Targeted SQ-LNS distribution based on potential benefits suggested.	Co-packaging SQ-LNSs with interventions that address constraints on response, such as preventing and controlling prenatal and child infections, improving health care access, and promoting early child development, may lead to greater impact.
[4] Diana et al. (2021), Indonesia	D: Cross-sectional S: Purposive sampling, 150 mothers as respondents. V: Independent Variable: Enhanced maternal behaviors towards the prevention of stunting. Dependent Variables: Prior related behaviors of the respondents, Perceived benefits, Perceived barrier to action, and Preventive behavior. I: Self-administered online questionnaire A: Descriptive and Correlational analysis	Key findings: 1. Enhanced maternal behaviors were noted, with a significant focus on prior related behaviors. 2. Perceived benefits related to stunting prevention were relatively low. 3. There's a high perceived barrier to taking action in preventing stunting. 4. Moderate engagement in preventive behaviors was observed. 5. Prior related behavior, perceived benefits, perceived barriers, and preventive behavior showed interconnections, influencing maternal behaviors in stunting prevention.	The study recommends a need for enhancing some maternal behaviors towards the prevention of stunting among children under 5 years old. Specific areas for enhancement may include addressing perceived barriers to action and increasing awareness of the perceived benefits.
[5] Fazid et al. (2023), Pakistan	D: Community-based, non-randomized cluster-controlled trial design S: children aged 6–18 months, with a total of 1680 participants V: Independent Variable: Utilization of locally produced ready-to-use supplementary food (Wawa-Mum). Dependent Variable: Change in length-for-age z-score (LAZ) compared to WHO growth standards. Incidence rate of stunting. I: Providing supplementary food and LAZ scores A: T-test, ANOVA, and Cox Proportional Hazard Models	Key findings: 1. Locally produced supplementary food - Intervention group: LAZ significantly increased from -1.13 to -0.93. - Lower stunting incidence in intervention group (1.3/person-year) vs. control (3.4/person-year). 2. Statistical analysis: - Intervention group had reduced stunting likelihood vs. control. - Hazard Ratio: Control group had 1.7 times higher likelihood of stunting.	
[6] Fentiana et al. (2022), Indonesia	D: Cross-sectional Study S: Probability Proportional to Size (PPS), Children aged 0-23 months V: Independent variables included antenatal care, contraceptive use, and handwashing with soap at the district/city level. The dependent variable was stunting. I: Z-score A: Path analysis	1. Antenatal care linked to 2.56% lower stunting rates (b = -0.16; p = 0.04). 2. Contraceptive use associated with 2.25% stunting rate decrease (b = -0.15; p = 0.05). 3. Handwashing with soap tied to 5.76% stunting reduction (b = -0.24; p = 0.003). 4. Combined impact: Antenatal care, contraceptive use, and handwashing led to 18.18% lower stunting prevalence.	The study emphasizes the pivotal role that districts/cities can play in stunting prevention, indicating that targeted interventions at the local level can significantly contribute to reducing stunting in children under two years of age

CONTINUE

Table I: Efforts to prevent stunting in children aged 0-24 month. (CONT.)

Author, year, location	DSVIA (study Design, Subject/participant, Variable, Intervention/measurement, and Analysis)	Findings	Recommendations
[7] Hanieh et al. (2019), Vietnam	D: Prospective cohort design S: 1168 and 475 live-born infants for model development and validation V: Independent Variables (Predictors): Paternal height, Maternal height, Maternal weekly weight gain during pregnancy, Infant sex, Gestational age at birth, Infant weight at 6 months of age, and Infant length at 6 months of age. Dependent Variable: Child stunting at 3 years of age I: Predictive model A: Logistic regression and Predictive Model Evaluation	The study found that in both the development and validation datasets, stunting prevalence stood at 16.9% (172 out of 1015) and 16.4% (70 out of 426) respectively. Several key predictors were identified for stunting risk, including paternal and maternal height, maternal weekly weight gain during pregnancy, infant sex, gestational age at birth, and infant weight and length at 6 months. The predictive model incorporating these factors demonstrated robust performance, with an area under the receiver operating characteristic (ROC) curve of 0.85 in the validation dataset, indicating a high level of accuracy in forecasting stunting risk at 3 years of age.	The tool, applied to infants at 6 months of age, provided valid predictions of the risk of stunting at 3 years of age. Healthcare practitioners and policymakers can consider integrating this tool into routine assessments to identify infants at risk of stunting early on.
[8] Kodish et al. (2022), Malawi	D: Descriptive study 2 years implementation S: Children aged 0-23 months V: Independent Variables: The study examined factors contributing to the successful translation of policy into program activities. Dependent Variable: The primary focus was on the successful implementation of the stunting prevention program. I: Implementation of an integrated stunting prevention program titled "The Right Foods at the Right Time" from 2013 to 2018 A: Inductive qualitative approach	The effectiveness of the stunting prevention program was driven by key factors: a structured National Scaling Up Nutrition (SUN) framework, reliable coordination, evidence-informed program design, diverse data utilization, multisectoral approaches, technological innovation, collaborative stakeholder engagement, and strong public health nutrition capacity. These elements ensured tailored interventions, holistic responses, and efficient execution, emphasizing a multifaceted approach to combating stunting.	Policymakers and implementers are encouraged to replicate successful models demonstrated in Ntchisi, Malawi. This includes adopting well-structured frameworks, fostering reliable coordination platforms, and ensuring systematic and evidence-informed program design.
[9] Langlois et al. (2020), Burkina Faso	D: Geographically clustered, longitudinal trial S: Caregivers, recipients (children aged 6–23 months), and other individuals involved in the preparation and consumption of the SNFs V: Independent Variables: Type of specialized nutritious food (CSB+ w/oil, CSWB w/oil, SC+, RUSF) and Household characteristics affecting SNF utilization (sharing, diversion, preparation, storage, and hygiene practices). Dependent Variables: Effectiveness of SNFs in preventing stunting and wasting and Consumption patterns of the specialized nutritious foods by the recipient child and other household members. I: In-depth interviews, in-home observations, and FGD A: Qualitative analysis	In households, sharing of specialized nutritious foods (SNFs) was common, particularly in the Super Cereal Plus (SC+) and Corn Soy Whey Blend with oil (CSWB w/oil) arms. However, only around 49% of households reported the recipient child consuming the SNF. Daily porridge preparation adherence varied across arms, with reports of bitterness and spoilage noted in the CSWB w/oil arm. Household water samples showed high Escherichia coli (E. coli) contamination, and observed handwashing practices were inadequate.	Recommendations include improving adherence to preparation instructions, addressing issues related to bitterness and spoilage, and promoting proper storage conditions. The study identified several limitations, including the potential spoilage of the ration containing whey before reaching recipients, improper storage conditions, and the prevalence of unsafe water quality in households. These factors could have influenced the effectiveness of SNFs.
[10] Marni et al. (2023), Indonesia	D: Qualitative Phenomenological Study S: 20 mothers with babies aged 0-23 months and 3 health workers V: Independent Variables: Mother's awareness, Mother's motivation, and Mother's intentions Dependent Variables: Prevention efforts for stunting, knowledge about stunting, and Action cues and risk perception I: Interviews, FGD, and observations A: Qualitative analysis	Mothers showed differing levels of awareness about stunting prevention, ranging from unawareness to incomplete understanding. Motivation for prevention stemmed from cues by health workers and family, with breastfeeding being a key action. A knowledge gap existed, with some mothers and community members unfamiliar with stunting concepts.	Develop and implement tailored interventions to address the varying levels of awareness among mothers. This could include educational programs, workshops, and awareness campaigns specifically designed for the community.

CONTINUE

Table I: Efforts to prevent stunting in children aged 0-24 month. (CONT.)

Author, year, location	DSVIA (study Design, Subject/participant, Variable, Intervention/measurement, and Analysis)	Findings	Recommendations
[11] Muhamad et al. (2023), Indonesia	D: Quasi-experimental S: 82 pregnant women V: Independent Variables: Nutrition education intervention, Short stature of pregnant women, support from cadres. Dependent Variables: Knowledge, attitudes, and actions of pregnant women about prenatal care services, knowledge of pregnant women about nutrition, and Delivery timing I: Nutrition education A: Paired t-test	The intervention significantly improved pregnant women's knowledge, attitudes, and actions regarding prenatal care services. There was enhanced understanding of nutrition among pregnant women post-intervention, indicating positive educational impacts. Cadre support notably influenced the intervention group, suggesting additional support beyond modules. Pregnant women's knowledge of nutrition and ANC services directly influenced delivery timing, potentially leading to improved pregnancy outcomes.	Interventions should focus on improving the knowledge, attitudes, and behavior of short-statured pregnant women regarding antenatal care. This can be achieved through targeted educational programs.
[12] Nurhayati et al. (2020), Indonesia	D: Case-control design S: 158 Children aged 6-23 months V: Independent Variables: Child-related factors, Parental factors, Household factors, Community factors. Dependent Variable: Stunting status in children aged 6-23 months. I: Semi-FFQ A: Logistic regression	Significant factors associated with stunting included children aged 18-23 months, birth length ≥48 cm, inadequate vitamin D intake, and lack of diet diversity. Household economic status, living residency, exclusive breastfeeding history, infectious diseases, energy, and protein intake showed no significant association with stunting.	Minimum dietary diversity, adequate vitamin D intake from complementary foods, and birth length were found to be associated with stunting status among children. The study emphasizes the importance of focusing on stunting prevention programs during the first two years of life, including the preconception period.
[13] Perry et al. (2023), Guatemala	D: Quasi-experimental S: 275 children under 2 years old V: Independent Variables: Nutrition-related messages, cooking sessions, lipid-based nutrient supplement (Nutributter®), anti-helminthic medication, growth monitoring, and nutrition counseling. Dependent Variables: Prevalence of underweight, stunting, and wasting in children under 2 years old. I: Growth monitoring and nutrition counseling A: Comparing analysis	Stunting prevalence significantly decreased in Project Intervention Area A, from 74.5% in September 2012 to 39.5% in June 2015, indicating marked improvement. However, no decline was observed in stunting rates in rural areas of the Northwestern Region of Guatemala and the Department of Huehuetenango between 1999 and 2015. At the endline assessment in June 2015, stunting prevalence in Area A (39.5%) was notably lower than in Area B (51.7%) ($p<0.004$). While Project Area B had lower stunting rates compared to non-Project comparison areas, they remained higher than those in Project Area A. These findings suggest a dose–response effect, with more significant improvements in nutritional status observed in Area A, likely due to longer intervention durations.	Given the positive outcomes in Project Area A, there is a recommendation to consider prolonged implementation of nutrition-related activities. Recognize and emphasize the dose–response effect, highlighting the importance of the duration of interventions in achieving improved nutritional outcomes.
[14] Rah et al. (2020), Indonesia	D: Cross-sectional S: 1,450 children aged 6–35 months V: Independent Variables: Household sanitation conditions and sources of drinking water. Dependent Variables: Stunting and anaemia among children aged 6–35 months. I: Paper-based interviews and anthropometric measurements A: Logistic regression	1. Children living in households with improved sanitation facilities had a 29% reduction in the odds of being stunted compared to those in households with unimproved sanitation. 2. The source of drinking water did not show an association with stunting or anaemia among children.	The study suggests that efforts to improve household sanitation conditions should be considered an essential, integral part of programmatic responses for preventing childhood stunting.
[15] Rohmawati et al. (2021), Indonesia	D: RCT S: 71 pregnant mothers and their newborns V: ndependent Variable: Zinc supplementation (20 mg/day) during pregnancy. Dependent Variables: Maternal serum zinc levels, Cord blood osteocalcin levels, and Neonatal birth length. I: Providing zinc supplementation and birth length measurements A: Comparison of mean, correlation analysis	1. Maternal serum zinc levels after zinc supplementation were significantly higher than those of the placebo group. 2. Cord blood osteocalcin levels and median neonatal birth lengths in the supplementation group were higher than in the placebo group. 3. Maternal serum zinc levels after supplementation had a positive significant correlation with cord blood osteocalcin and neonatal birth length.	The study suggests that zinc supplementation during pregnancy positively influences maternal serum zinc levels, cord blood osteocalcin, and neonatal birth length.

CONTINUE

Table I: Efforts to prevent stunting in children aged 0-24 month. (CONT.)

Author, year, location	DSVIA (study Design, Subject/participant, Variable, Intervention/measurement, and Analysis)	Findings	Recommendations
[16] Siregar et al. (2023), Indonesia	D: Pre-experimental design S: 32 pregnant women V: Independent Variable: Maternal assistance. Dependent Variable: Stunting prevention behaviors of pregnant women. I: Structured questionnaires and maternal assistance A: T-test	1. The study focused on the impact of maternal assistance on behaviors aimed at preventing stunting among 32 pregnant women. 2. Most participants were aged 18-25, highly educated, housewives, with income exceeding 2,868,081 units. The majority were primigravida and lived in nuclear families. 3. Maternal assistance, including education and counseling, significantly improved stunting prevention behaviors among the participants. 4. The improvement in stunting prevention behaviors was statistically significant, as indicated by a p-value of 0.005.	Health professionals should prioritize providing comprehensive support, including education and counseling, to pregnant women.
[17] Yunitasari et al. (2021), Indonesia	D: Cross-sectional S: 109 respondents of mothers with children aged 6–24 months V: Independent Variables: Knowledge, Attitudes, Income, Cultural values, and Parenting patterns. Dependent Variable: Stunting prevention I: Questionnaire A: Chi-square test	1. Knowledge, attitudes, income, cultural values, and parenting significantly influenced parents' strategies for preventing stunting in their children. 2. The prevalence of stunting prevention behaviors was associated with these influencing factors.	Stunting prevention programs should focus on improving parental behavior by addressing and modifying factors such as knowledge, attitudes, income, cultural values, and parenting.
[18] Zaidi et al. (2020), Pakistan	D: Mixed-Methods S: 800 households V: Independent Variables: Type of Food Supplements (Wheat Soy Blend, Lipid-based Nutrient Supplement, Micronutrient Powder), Knowledge Among Caregivers, Cultural Food Practices, and Interaction with Community Health Workers (CHWs) Dependent Variables: Uptake of Food Supplements, Consumption of Full Supplement Dose, Sharing of Supplements within Households, Perception of Value and Acceptability of Supplements, and Interaction and Counseling Effectiveness of CHWs I: Providing food supplements A: Inductive thematic analysis	1. Low supplement consumption and common sharing within households were observed, potentially diminishing targeted impact. 2. Wheat Soy Blend (WSB) was well received, while Lipid-based Nutrient Supplement (LNS) was favored for its taste, contrasting with Micronutrient Powder (MNP) perceived as less valuable. 3. Cultural practices influenced sharing behaviors, hindering individual-focused interventions. 4. Community Health Workers (CHWs) faced challenges including low motivation and inadequate counseling skills, impacting program effectiveness.	Emphasize context-specific demand creation strategies to enhance community awareness and understanding of the value of supplements.

Quality of included studies

The quality assessment of studies in the review involved evaluating three qualitative studies using the JBI checklist for qualitative research, which comprises 10 criteria. These studies demonstrated appropriateness in research methods, objectives, data collection, analysis, presentation of results, and interpretation. However, only eight studies showed alignment between theory and research methods, and six out of 16 did not provide information on ethics panel approval. Despite these considerations, all qualitative studies were regarded as good quality, with four achieving an excellent rating. The mixed-methods study in the review underwent assessment using quantitative (8 criteria) and qualitative (10 criteria) research criteria. This study met seven out of 10 criteria for qualitative research. The evaluation of the 11 quantitative studies involved the JBI checklist for quantitative research, comprising eight criteria. All studies demonstrated the validity and reliability of risk factors and outcomes through appropriate statistical analysis methods. However, only six studies addressed identifying confounding factors and provided ways to deal with them. Quantitative studies were generally of good quality, with three achieving maximum scores.

The assessment of three RCTs utilised the JBI checklist for RCTs, including 13 criteria. One RCT achieved a maximum of 12 "yes" scores, ensuring triple blinding of participants, intervention deliverers, and outcomes assessors. Two other RCTs had 10 and 11 "yes" scores, indicating blinding of outcomes assessors but lacking blinding of participants and intervention deliverers. One RCT met six "yes" scores out of 13 criteria, lacking blinding of outcomes assessors and clear reporting on blinding of participants and intervention deliverers. A quasi-experimental study was evaluated based on nine criteria and achieved eight "yes" scores. In total, four studies demonstrated adequate overall methodological quality.

Regarding ethical considerations, two out of three qualitative studies had ethical approval. All 11 included quantitative studies demonstrated validity and reliability in measuring outcomes. All three studies

had an appropriate trial design in RCTs, accounting for deviations from the standard RCT design. Detailed results of the critical appraisal for each study, including specific checklist items, are presented in Appendix Table II.

Table II: Quality of included studies.

Qualitative studies [1]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**			
Dewey et al. (2021)	1	1	1	1	1	0	1	0	0	1	7			
Marni et al. (2023)	0	1	1	1	1	0	0	0	1	1	6			
Kodish et al. (2022)	1	1	1	1	1	0	0	0	1	1	7			
Mixed-method studies														
Zaidi et al. (2020)	1	1	1	1	1	0	0	0	1	1	7			
Quantitative studies [2]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**					
Ain et al. (2023)	1	1	1	1	0	0	1	1	6					
Diana et al. (2021)	1	1	1	1	1	0	1	1	7					
Fazid et al. (2023)	1	1	1	1	1	0	1	1	7					
Fentiana et al. (2022)	1	1	1	1	1	1	1	1	8					
Hanieh et al. (2019)	1	1	1	1	0	0	1	1	6					
Muhamad et al. (2023)	1	1	1	1	1	0	1	1	7					
Nurhayati et al. (2020)	1	1	1	1	0	0	1	1	6					
Perry et al. (2023)	1	1	1	1	1	1	1	1	8					
Rah et al. (2020)	1	1	1	1	0	0	1	1	6					
Siregar et al. (2023)	1	1	1	1	0	0	1	1	6					
Yunitasari et al. (2021)	1	1	1	1	0	0	1	1	6					
RCT [3]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Cliffer et al. (2020)	1	1	1	1	1	1	0	1	1	0	1	1	1	11
Langlois et al. (2020)	1	1	1	1	1	1	0	0	1	0	1	1	1	10
Rohmawati et al. (2021)	1	1	1	1	1	1	0	1	1	0	1	1	1	11

Qualitative study "1. Is there congruity between the stated philosophical perspective and the research methodology?; 2. Is there congruity between the research methodology and the research question or objectives?; 3. Is there congruity between the research methodology and the methods used to collect data?; 4. Is there congruity between the research methodology and the representation and analysis of data?; 5. Is there congruity between the research methodology and the interpretation of results?; 6. Is there a statement locating the researcher culturally or theoretically?; 7. Is the influence of the researcher on the research, and vice-versa, addressed?; 8. Are participants, and their voices, adequately represented?; 9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?; 10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?"

Quantitative study "1. Were the criteria for inclusion in the sample clearly defined?; 2. Were the study subjects and the setting described in detail?; 3. Was the exposure measured in a valid and reliable way?; 4. Were objective, standard criteria used for measurement of the condition?; 5. Were confounding factors identified?; 6. Were strategies to deal with confounding factors stated?; 7. Were the outcomes measured in a valid and reliable way?; 8. Was appropriate statistical analysis used?"

RCT "1. Was true randomization used for assignment of participants to treatment groups?; 2. Was allocation to treatment groups concealed?; 3. Were treatment groups similar at the baseline?; 4. Were participants blind to treatment assignment?; 5. Were those delivering the treatment blind to treatment assignment?; 6. Were treatment groups treated identically other than the intervention of interest?; 7. Were outcome assessors blind to treatment assignment?; 8. Were outcomes measured in the same way for treatment groups?; 9. Were outcomes measured in a reliable way?; 10. Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?; 11. Were participants analyzed in the groups to which they were randomized?; 12. Was appropriate statistical analysis used?; 13. Was the trial design appropriate and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?"

Efforts to prevent stunting in children aged 0-24 months

In Cliffer et al.'s (2020) comprehensive evaluation of four specialised nutritious foods (SNFs) in Burkina Faso, a meticulous examination revealed their limited efficacy in preventing growth declines. However, the study strategically identified CSB+ with oil as the most cost-effective option, providing valuable guidance for programs targeting wasting and stunting prevention in children aged 6–23 months. The emphasis on cost-

effectiveness highlights the importance of thoughtful resource allocation to achieve optimal outcomes for this vulnerable age group (36).

Langlois et al.'s (2020) geographically clustered, longitudinal trial explored the consumption patterns of specialised nutritious foods (SNFs) in Burkina Faso. The study brought to light challenges such as the common sharing of SNFs across arms, potential hindrances in targeted distribution, and issues related to bitterness, spoilage, and water quality. These findings underscore the necessity of addressing intricate challenges tied to sharing dynamics, consumption patterns, and SNF quality. The insights gleaned from this research inform targeted interventions, focusing on improving adherence to preparation instructions and addressing challenges related to bitterness and spoilage, ultimately promoting proper storage conditions (37).

Rohmawati et al.'s (2021) rigorous randomised controlled trial in Indonesia delved into the impact of zinc supplementation on maternal serum zinc levels, cord blood osteocalcin, and neonatal birth length. The study yielded compelling evidence showcasing the positive influence of zinc supplementation on these crucial parameters. These findings underscore the potential benefits of micronutrient interventions in enhancing maternal and neonatal outcomes, particularly in the context of stunting prevention. The study contributes valuable evidence to the broader discourse on the role of micronutrients in promoting optimal growth during pregnancy (38).

These review results collectively shed light on nuanced aspects of stunting prevention interventions, ranging from cost-effective choices in specialised nutritious foods to the challenges associated with consumption patterns and the potential benefits of targeted micronutrient supplementation. This comprehensive understanding provides a foundation for refining and advancing strategies in pursuing effective stunting prevention measures.

Diana et al.'s cross-sectional study sheds light on enhanced maternal behaviours related to stunting prevention. The findings significantly focus on prior related behaviours, highlighting their substantial role, accounting for 113%. However, a lower perceived understanding of the benefits of preventing stunting exists, indicating a potential area for targeted interventions. The study emphasises a relatively high perceived barrier to taking action in preventing stunting. The level of engagement in preventive behaviours is moderate, and the study underscores the interconnectedness of these factors. Recommendations include enhancing maternal behaviours, addressing perceived barriers, and increasing awareness of benefits (22).

Muhamad et al.'s quasi-experimental study emphasises the impact of a nutrition education intervention on pregnant women. The intervention significantly improves knowledge, attitudes, and actions regarding prenatal care services. The educational program positively influences pregnant women's understanding of nutrition, showcasing the effectiveness of targeted interventions. Cadre support adds value, contributing significantly to positive outcomes. The study highlights the direct influence of knowledge on delivery timing, emphasising the importance of informed and supported pregnant women. Recommendations focus on interventions improving knowledge, attitudes, and behaviour, emphasising targeted educational programs (26).

Siregar et al.'s pre-experimental study explores maternal assistance's impact on stunting prevention behaviours. The study involves 32 pregnant women, primarily aged 18-25, highly educated, with incomes exceeding 2,868,081 units. Maternal assistance, including education and counselling, significantly improves stunting prevention behaviours, showcasing the effectiveness of comprehensive support. The improvement is statistically significant, underlining the importance of tailored assistance in promoting effective stunting prevention. Health professionals are encouraged to prioritise comprehensive support for pregnant women (30).

Yunitasari et al.'s cross-sectional study delves into factors influencing parental strategies for preventing stunting in children aged 6–24 months. Knowledge, attitudes, income, cultural values, and parenting significantly influence parental strategies, with the prevalence of stunting prevention behaviours associated with these factors. The study recommends stunting prevention programs focus on improving parental behaviour by addressing and modifying influencing factors. A comprehensive understanding of these factors informs targeted interventions for effective stunting prevention strategies (31).

Synthesising the findings from these studies underscores the complexity of caregiving factors in stunting prevention. Enhanced maternal behaviours, informed by prior related behaviours, play a crucial role. Targeted interventions addressing barriers and increasing awareness are recommended. Nutrition education interventions for pregnant women and cadre support prove effective, emphasising the need for comprehensive programs. Maternal assistance emerges as a powerful tool, significantly improving stunting prevention behaviours. The factors influencing parental strategies highlight the need for tailored interventions addressing knowledge, attitudes, income, cultural values, and parenting practices. The synthesis offers a nuanced

understanding, guiding future research and intervention strategies in caregiving factors for stunting prevention.

The evaluation of intervention success in reducing stunting prevalence reveals diverse outcomes across studies, emphasising the need for sustainable and context-specific approaches. Ain et al.'s study in Indonesia demonstrated the positive impact of the dynamic self-determination of self-care and positive deviation models on maternal behaviour, suggesting potential replicability in various settings. Dewey et al.'s meta-analysis highlighted the significant benefits of small-quantity lipid-based nutrient supplements, advocating for their incorporation into sustainable interventions (21). Fazid et al.'s assessment of locally produced supplementary food in Pakistan underscores the potential of community-based solutions, aligning with sustainability principles (23). Fentiana et al.'s exploration of district-level interventions in Indonesia emphasises the cumulative impact of multiple strategies for sustained reductions in stunting rates (24). Hanieh et al.'s predictive model for stunting risk in Vietnam advocates integrating predictive tools into routine assessments for early and sustainable interventions (25). Kodish et al.'s identification of programmatic success factors in Malawi offers a blueprint for replicable and effective models, promoting sustainability through systematic approaches and collaboration (34). Marni et al.'s study on maternal awareness in Indonesia highlights the importance of tailored interventions for sustainable impact (33). Nurhayati et al.'s identification of factors associated with stunting in Indonesia emphasises targeted interventions for sustainable strategies. Perry et al.'s assessment of trends and dose–response effects in Guatemala underscores the prolonged implementation of interventions for sustained impacts on stunting prevention (27). Rah et al.'s study on improved sanitation facilities emphasises the significance of sustainable sanitation interventions (29). Zaidi et al.'s study in Pakistan acknowledges the importance of addressing cultural factors for the sustainable uptake of supplementary foods. These studies collectively advocate for comprehensive, sustained, and adaptable approaches to stunting prevention.

Classification of methods to prevent stunting at different phases of life

1. Preconception
   - Enhanced maternal behaviors related to stunting prevention (e.g., prior related behaviors) (22)
   - Nutrition education interventions for pregnant women (26)
   - Maternal assistance (e.g., education and counseling) (30)
2. Prenatal
   - Zinc supplementation during pregnancy (38)
3. Infant phase
   - Consumption of specialized nutritious foods (breastmilk) (36), (37)
   - Nutrition education interventions (26)
   - Maternal assistance (e.g., education and counseling) (30)
   - Factors influencing parental strategies for preventing stunting in infants (e.g., knowledge, attitudes, income, cultural values, and parenting practices) (31)
4. Toddler phase
   - Consumption of specialized nutritious foods (SNFs) (36), (37)
   - Factors influencing parental strategies for preventing stunting in toddlers (e.g., knowledge, attitudes, income, cultural values, and parenting practices) (31)
   - Evaluation of intervention success in reducing stunting prevalence (21)
   - Assessment of locally produced supplementary food (23)
   - District-level interventions (24)
   - Predictive models for stunting risk (25)
   - Identification of programmatic success factors (34)
   - Assessment of trends and dose–response effects (27)
   - Improvement of sanitation facilities (29)
   - Addressing cultural factors for sustainable uptake of supplementary foods (33)

DISCUSSION

Our scoping analysis presents a comprehensive overview of diverse interventions deployed globally to prevent stunting in children aged 0-24 months. Encompassing domains such as nutritional supplementation, maternal education, community-based programs, and healthcare interventions, the reviewed studies underscore the multifaceted nature of stunting prevention efforts, emphasising the necessity for comprehensive and integrated strategies within the international context.

The role of caregiving during the first 1000 days of life emerges as a pivotal factor influencing stunting prevention efforts (39). Crucial elements identified include maternal behaviours (40–42), breastfeeding practices (43–45), hygiene (46–48), and responsive caregiving (49,50). These findings emphasise the imperative of targeting caregiving practices to optimise nutritional outcomes during this critical early developmental period, offering valuable insights for global health initiatives.

Evaluation of intervention success revealed varied outcomes, with some interventions demonstrating significant positive effects on child growth, while others faced challenges in achieving desired outcomes (51). The effectiveness of interventions was intricately linked to factors such as implementation fidelity, community engagement, and adaptability to local contexts, highlighting the need for nuanced and culturally sensitive approaches in international stunting prevention

endeavours (52).

Recommendations for Policy and Practice

Our analysis delved into differences in effectiveness among various stunting prevention approaches, with a specific focus on the role of caregiving. Interventions integrating nutritional support with targeted maternal and caregiving education showed promising results. Context-specific approaches tailored to cultural and socioeconomic aspects enhanced intervention effectiveness, providing valuable insights for international policymakers and practitioners (53).

Factors supporting or hindering the success of stunting prevention efforts were identified, with supportive factors including community engagement, accessible healthcare infrastructure, and culturally sensitive interventions. Inhibiting factors encompassed socioeconomic disparities, limited access to resources, and challenges in changing entrenched caregiving practices. Recognising these factors is crucial for developing contextually relevant and impactful interventions on an international scale (54–56).

Drawing from our research findings, we propose recommendations to support the development of policies and practices in stunting prevention for children aged 0-24 months. These recommendations emphasise integrating nutrition education into existing maternal and child healthcare services, community-based interventions targeting caregiving practices, and developing culturally tailored programs. Continuous monitoring and evaluation are stressed for refining interventions and ensuring sustained impact in diverse global settings.

Despite the wealth of research on stunting prevention, knowledge gaps persist, particularly concerning caregiving aspects during the first 1000 days of life. The nuanced interplay between cultural, socioeconomic, and individual factors influencing caregiving practices remains an area that requires further exploration. Future research should aim to unravel these complexities, contributing to a more nuanced understanding of effective stunting prevention strategies on the international stage.

Limitations

Changes in the definition and measurement of stunting over time may introduce variability into the study. Differences in diagnostic criteria or measurement techniques between studies may affect the comparability of findings.

CONCLUSION

In conclusion, our examination of interventions to prevent stunting in children aged 0-24 months provides a comprehensive understanding. From identifying cost-effective nutritional options to addressing challenges in consumption patterns and emphasising the benefits of micronutrient supplementation, the integrative review offers valuable insights for refining stunting prevention strategies. The role of caregiving in the critical first 1000 days emerges as crucial, with maternal behaviours, breastfeeding practices, and responsive caregiving influencing nutritional outcomes. Recommendations emphasise integrating nutrition education into maternal and child healthcare services, community-based interventions, and culturally tailored programs, with continuous monitoring for global impact.

Our synthesis of findings underscores the complexity of caregiving factors in stunting prevention. Enhanced maternal behaviours are pivotal, and targeted interventions addressing barriers prove effective. Comprehensive programs for pregnant women and cadre support are recommended, emphasising holistic approaches.

The evaluation of intervention success reveals diverse outcomes, emphasising the need for sustainable and context-specific approaches. Studies advocate for replicable and effective models, promoting sustainability through systematic approaches. Factors supporting or hindering success guide the development of impactful interventions internationally. This analysis consolidates knowledge on stunting prevention, highlighting the need for continued exploration of caregiving complexities and the importance of sustained, adaptable, and comprehensive approaches in the global pursuit of stunting prevention.

Implications for nursing practice

Nursing practitioners should adopt a holistic approach that integrates nutrition education, community-based interventions, and culturally sensitive programs to address the multifaceted nature of stunting prevention. This involves incorporating caregiving elements, such as maternal behaviours, breastfeeding practices, and responsive caregiving, into routine healthcare services for children aged 0-24 months.

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