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## Digital and Non - Digital Educational Media for Stunting Prevention Among Children: A Scoping Review

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### ABSTRACT

**Background:** Stunting prevalence in Indonesia reached 21.5% in 2023, highlighting the need for effective and accessible educational strategies. Advances in technology have expanded the use of both digital and non-digital media for disseminating health information. **Objective:** This study aimed to map and characterize the types, features, and effectiveness of digital and non-digital educational media employed in stunting prevention. **Methods:** A scoping review was conducted using the Arksey and O'Malley framework and JBI guidelines. Literature searches across PubMed, ScienceDirect, Cochrane Library, Taylor & Francis, and Google Scholar used keywords related to stunting and educational media. Eligible studies focused on educational interventions for stunting prevention in children. Extracted data included media type, target population, intervention design, setting, and outcomes. **Results:** Of 849 records identified, 11 met the inclusion criteria. Four thematic categories emerged: (1) the importance of interventions to improve child nutrition; (2) types of interventions utilized; (3) strengths; and (4) limitations of digital interventions. This study provide evidence-based recommendations regarding the most appropriate educational media for stunting prevention interventions. **Conclusion:** Non-digital media promote deeper comprehension and cultural alignment, while digital media enhance accessibility and message reinforcement. Importance of integrating both media types to ensure effective and culturally adaptable stunting prevention strategies. Both media types is essential to establish comprehensive and sustainable stunting prevention strategies.



## INTRODUCTION

Stunting is a type of chronic malnutrition defined as a height-for-age (H/A) measurement that is more than two standard deviations below the median according to the WHO Child Growth Standards. It remains a major global public health concern, particularly in developing countries. The global prevalence of stunting is estimated at 23.2% (1). While in Southeast Asia it reaches 27.4% (2). The implications of stunting extend to both short- and long-term outcomes. Short-term effects include increased mortality and morbidity among children under five (3), developmental delays in motor, cognitive, and language skills (4), as well as metabolic disorders and greater susceptibility to illness, leading to higher healthcare costs (5). In the long term, individuals who experienced stunting are at higher risk of (6), reduced learning capacity and productivity (7), and economic losses at the national level due to decreased workforce productivity in the future (8). Due to its chronic and multifactorial etiology, characterized by the interplay of nutritional deficiencies, health-related factors, and environmental conditions, stunting requires timely, multidimensional, and preventive interventions.

Effective stunting prevention interventions involve two key components: improvement of childcare practices and nutritional intake (9). These behavioral changes can only be achieved through intensive and continuous health education for parents and caregivers (10). With technological advancement and varied accessibility across developing countries, educational programs can utilize various forms of media to deliver key messages on infant and young child feeding, hygiene, and healthcare access (11).

Two main types of educational media are commonly used. Non-digital media include face to face counselling, cooking demonstrations, home visits, and printed materials such as posters and leaflets. These approaches are known to be effective in building trust, facilitating two-way communication, and tailoring messages to the local cultural and socioeconomic context (12). In contrast, digital media encompass mobile applications, text messaging (SMS), educational videos, and social media platforms. Digital media offer significant potential to expand reach, increase message frequency, and provide real-time behavioral reminders, particularly in urban areas or among populations with adequate digital literacy (13).

While evidence suggests that digital interventions possess the capacity to significantly enhance caregivers' or mothers' knowledge, attitudes, and practices concerning stunting, their overall efficacy is subject to several critical implementation challenges. These hurdles, which notably include the constraints of internet penetration and disparities in digital literacy, along with the necessity of ensuring cultural relevance, must be addressed to optimize the impact of digital approaches within the specific context of stunting prevention (14). Digital platforms demonstrate significant efficacy in enhancing adolescent understanding of stunting prevention, strongly suggesting their role in bolstering digital health literacy as a key preventive strategy. Specifically, social media emerged as the most influential medium, as evidenced by substantial gains in pre-test and post-test knowledge scores across multiple platforms: TikTok (36.75%), Instagram (22.29%), Twitter (20.25%), Youtube (16.66%), and Facebook (12.61%). This underscores the necessity of strategically designed digital interventions to effectively leverage these platforms for stunting mitigation (15). Understanding which media are most frequently used, how they are integrated (blended media), and what outcomes are reported across different cultural and economic contexts is crucial for policymakers and program implementers.

Previous studies have predominantly examined digital interventions, with limited attention to the effectiveness of non-digital approaches in stunting prevention. While numerous studies have implemented educational interventions using either digital or traditional media, no synthesis has systematically compared their contextual applications, effectiveness, and integration across developing settings. Therefore, the aim of this scoping review is to identify and map the available literature on the use of both digital and non-digital educational media for preventing stunting in children under five, to describe the characteristics of implemented media interventions, and to identify existing research gaps. The findings are expected to provide evidence-based guidance for designing the most effective and adaptive communication and educational strategies to accelerate the reduction of stunting prevalence.

## METHOD

This scoping review focuses on digital and non-digital educational media for stunting prevention among children under five in developing countries. According to the Canadian Institutes of Health Research (CIHR), a scoping review is an “*exploratory project*” that systematically maps the available literature on a particular topic by identifying key concepts, theoretical frameworks, sources of evidence, and existing research gap (16). The review process followed the framework developed by Arksey and O’Malley, which consists of five stages: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the result(17).

#### Framework Stage 1: Identifying the Research Question

To ensure a systematic and well-structured approach, this scoping review applies the four-element PCC model, which recommends formulating research questions that are clearly defined across the following components: Population (P), Concept (C), Context (C).

Table 1. PICO framework

Population (P)	Concept (C)	Context (C)
Parents of children under five and pregnant women	Health education using various media	Digital and non digital media interventions implemented

#### Research Question:

What types of digital educational media have been utilized to improve knowledge regarding child growth and development and stunting prevention among parents of children under five and pregnant women ?

#### Framework Stage 2: Identifying Relevant Studies

The databases used in this scoping review comprised PubMed, ScienceDirect, the Cochrane Library, and gray literature sources such as Google Scholar. A range of search strategies was employed, including truncation symbols (\*, #) and Boolean operators (OR, AND), to enhance the comprehensiveness and sensitivity of the search process. The keywords were developed based on the PCC framework and adapted to each database’s syntax. literature search period in October 2020 - October 2025

Table 2 Keyword

Population (P)	Concept (C)	Context (C)
Parents of children under five OR pregnant women AND mothers of children	Health education using various media AND intervention AND development of educational instruments	Digital and non digital media interventions for parents of children AND non-digital media interventions implemented

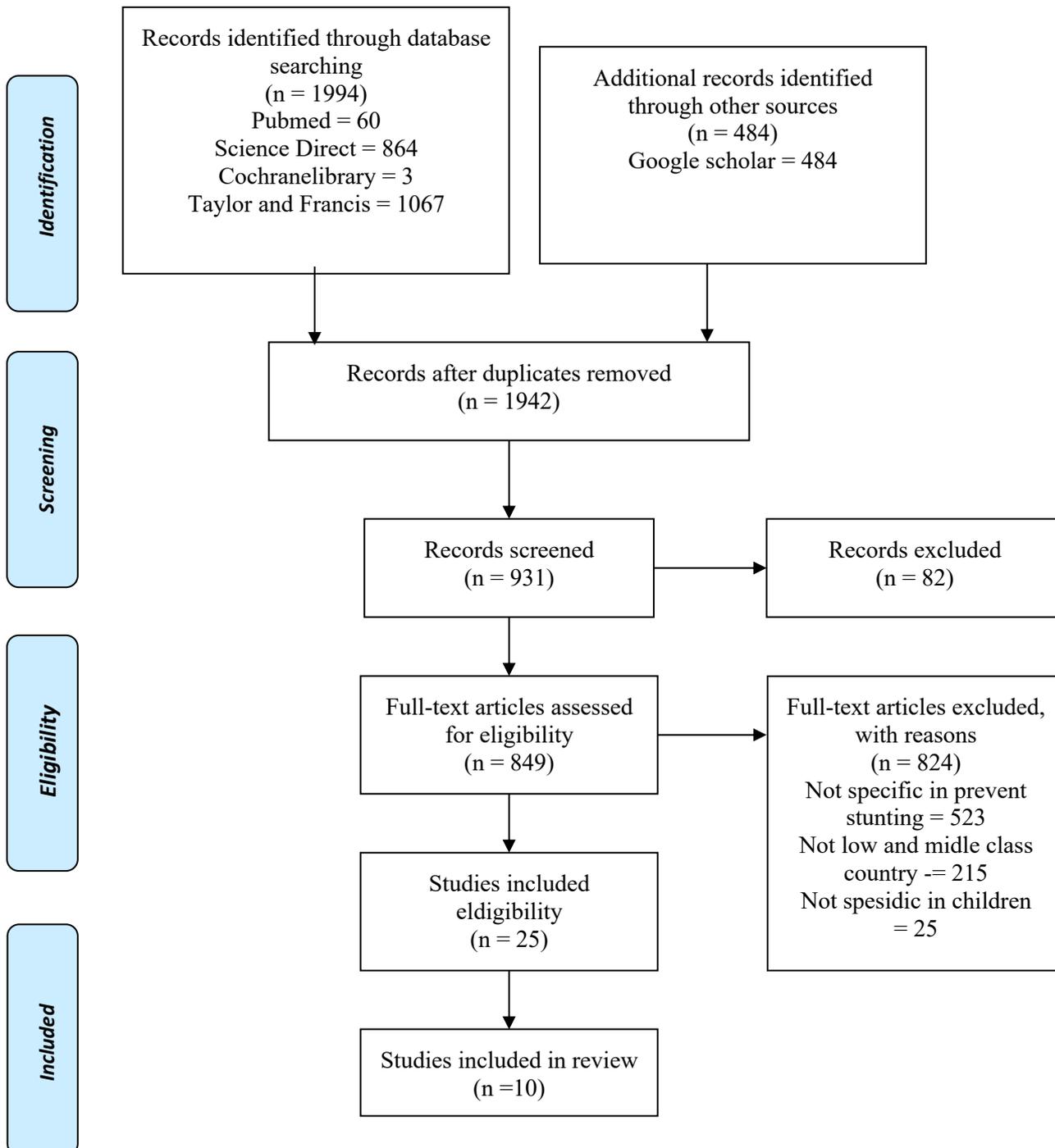
The inclusion and exclusion criteria for this scoping review are presented in the following table:

Table 3. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Peer-reviewed research articles published in English Publications dated from October 2020 to October 2025 Original research studies Studies focusing on digital educational media for stunting prevention among parents or pregnant women	Review articles Articles without full-text access

#### Study Selection

Study selection was conducted following the PRISMA 2020 flow diagram for systematic reviews, which outlines the process of identifying records through database and registry searches. Five researchers independently assessed the retrieved articles based on predefined inclusion and exclusion criteria. Articles meeting these criteria advanced to the full-text review stage. Any disagreements during the screening process were resolved through discussion until consensus was reached, ensuring transparency, objectivity, and consistency in selecting studies for inclusion in the review.



## Charting the data

Data extraction involves identifying, collecting, and organizing relevant information from the selected sources of evidence for research or review purposes. The outcomes of this data charting process are presented in the table below.

No	Title/Author/Year	Objective	Country	Method	Results
1	Mobile phone-based lifestyle support for families with young children in primary health care (MINISTOP 2.0): Exploring behavioral change determinants for implementation using the COM-B model (16)  Kristin Thomas, Margit Neher, Christina Alexandrou, Ulrika Müssener, Hanna Henriksson, Marie Löf	This research examined the factors influencing behavior change in the implementation of a mobile health (mHealth) promotion program (the MINISTOP 2.0 application) aimed at parents of children aged four years.	Sweden	A qualitative approach was employed, involving telephone interviews with 15 nurses from nine primary child healthcare centers.	The analysis examined nurses' perceptions of their existing health promotion practices and applied the COM-B model (20) to systematically identify and map the determinants within the data.
2	Using a Responsive Feedback Approach to Develop and Pilot a Counseling Chatbot to Strengthen Child Nutrition in Rural India (17)  Namrata Tomar, Sriya Srikrishnan, Neal Lesh, Brian DeRenzid	This study outlines the process of developing and testing a chatbot designed to enhance nutritional outcomes among children aged 0 to 12 months.	India	A mixed-methods design was employed, combining quantitative and qualitative approaches across two phases. Phase 1 involved 10 mothers to evaluate the chatbot's acceptability and feasibility, while Phase 2 included 100 mothers to determine ongoing engagement with both automated content and free-form interactions. Additionally, four focus group discussions were conducted with healthcare workers and mothers, along with interviews involving 26 mothers.	Mothers perceived the chatbot as a confidential platform for discussing various topics and regarded the persona of Poshan Didi as knowledgeable. Approximately 80% of users responded to at least one message generated by the chatbot, and 64% interacted beyond the standard content by discussing at least one issue with a nurse.
3	Another voice in the crowd: the challenge of changing family planning and child feeding practices through	To complement the randomized controlled trial (RCT) by	India	The randomized controlled trial (RCT) involved mothers (n = 29) and included interviews and	Digital direct-to-beneficiary services should be supported by broader communication

	<p>mHealth messaging in rural central India (18)</p> <p>Kerry Scott, Osama Ummer, Aashaka Shinde, Manjula Sharma, Shalini Yadav, Anushree Jairath, Nikita Purty, Neha Shah, Diwakar Mohan, Sara Chamberlain, Amnesty Elizabeth LeFevre</p>	<p>exploring the underlying factors that may explain the observed findings.</p>		<p>family group discussions with their husbands and extended family members (n = 25).</p>	<p>strategies—such as ongoing face-to-face interactions, media campaigns, and community engagement—to influence social norms, while also considering socio-environmental, behavioral, and individual determinants.</p>
4	<p>Feasibility of Employing mHealth in Delivering Preventive Nutrition Interventions Targeting the First 1000 Days of Life: Experiences from a Community-Based Cluster Randomised Trial in Rural Bangladesh</p> <p>Tarana E Ferdous, Md. Jahiduj Jaman, Abu Bakkar Siddique, Nadia Sultana, Takrib Hossain, hams El Arifeen and Sk Masum Billah</p>	<p>(i) To describe the design and development of a tablet- and web-based nutrition intervention delivery system; (ii) to present the adequacy of intervention visit coverage using real-time data; and (iii) to explore the facilitating and challenging factors of the system as reported by its users (community health workers and their supervisors).</p>	Bangladesh	<p>A community-based cluster randomized controlled trial (cRCT).</p>	<p>The mHealth approach proved valuable for the design, planning, scheduling, and delivery of nutrition interventions by community health workers (CHWs), as well as for monitoring and supervision conducted by their supervisors.</p>
5	<p>Smartphone-Based Maternal Education for the Complementary Feeding of Undernourished Children Under 3 Years of Age in Food-Secure Communities: Randomised Controlled Trial in Urmia, Iran (19)</p>	<p>This randomized controlled trial aimed to evaluate the effectiveness of a smartphone-based maternal nutrition education program focused on complementary feeding for</p>	Iran	<p>A randomized controlled trial design was employed, consisting of two groups: an intervention arm using a smartphone application and a control arm receiving treatment as usual (TAU), with participants allocated in a 1:1 ratio.</p>	<p>Children in the smartphone intervention group demonstrated a greater improvement in wasting status (WHZ +0.65, 95% CI <math>\pm</math>0.16) compared to those in the TAU group (WHZ +0.31, 95% CI <math>\pm</math>0.21; <math>p = 0.011</math>), as well as a significantly higher reduction in the prevalence of wasting (89.6%</p>

	Navisa Seyyedi, Bahlol Rahimi, Hamid Reza Farrokh Eslamlou, Hadi Lotfnezhad Afshar, Armin Spreco and Toomas Timpka	undernourished children under three years old in a food-secure, middle-income community in Urmia, Iran.			vs. 51.5%; $p = 0.016$ ), defined as $WHZ < -2$ .
6	Feasibility and efficacy of a web-based family telehealth nutrition intervention to improve child weight status and dietary intake: A pilot randomised controlled trial (20)  Li Kheng Chai, Clare E Collins, Chris May, Amy Ashman, Carl Holder, Leanne J Brown <sup>5</sup> and Tracy L Burrows <sup>1</sup>	This study evaluated the efficacy of a novel 12-week, family-focused online telehealth nutrition intervention in improving children's weight status and dietary intake. A secondary objective was to determine whether adding evidence-based SMS messages directed at both mothers and fathers would enhance the intervention's effectiveness.	Australia	Families with children aged 4 to 11 years were randomly assigned to one of three groups: Telehealth, Telehealth + SMS, or a waitlist control. Participants in the Telehealth and Telehealth + SMS groups received two telehealth consultations conducted by a dietitian, 12 weeks of access to a nutrition-focused website, and membership in a private Facebook group. Additionally, the Telehealth + SMS group received supplementary SMS messages.	The majority of participants reported that the feedback (94%) and tips (87%) provided were helpful, and most (91%) stated they would recommend the program. A significant increase was observed in the consumption of leafy green vegetables compared to baseline ( $p = 0.01$ ). Overall, mothers of children enrolled in WIC perceived the text messaging intervention focused on WIC-approved foods as both enjoyable and beneficial.
7	Feasibility, Acceptability, and Initial Efficacy of a Digital Intervention to Improve Consumption of Foods Received within a National Nutrition Assistance Program (21)  Melissa C. Kay, Nour M. Hammad, Tracy Truong, Sharon J. Herring and Gary G. Bennett	This study presents the acceptability, reach, implementation, and preliminary efficacy of the <i>Healthy Roots</i> program as a strategy to enhance the consumption of WIC-approved foods, thereby improving maternal diet quality.	United States	This randomized controlled trial enrolled 54 mother-child dyads receiving WIC benefits. Participants received three to four weekly text messages over a 12-week period, focusing on behavioral goals aimed at increasing the consumption of WIC-approved foods. Engagement with weekly tracking messages and satisfaction levels were assessed, and 24-hour dietary	The majority of participants reported that the feedback (94%) and tips (87%) provided were helpful, and most (91%) stated they would recommend the program. A significant increase was observed in the consumption of leafy green vegetables compared to baseline ( $p = 0.01$ ). Overall, mothers of children enrolled in WIC perceived the text

				recalls were collected to evaluate preliminary efficacy on dietary intake. Half of the participants (n = 27) were classified as high engagers, responding to 80% or more of the weekly messages, while 28% (n = 15) responded to all messages.	messaging intervention focused on WIC-approved foods as both enjoyable and beneficial.
8	<p>Efficacy of the Foodbot Factory digital curriculum-based nutrition education intervention in improving children's nutrition knowledge, attitudes and behaviours in elementary school classrooms: protocol for a cluster randomised controlled trial (22)</p> <p>Jacqueline Marie Brown, Saman Tahir, Beatriz Franco-Arellano, Ann LeSage, Janette Hughes, Bill Kapralos, Wendy Lou, Ellen Vogel, Michael Farkouh, Claire Tugault-Lafleur, JoAnne Arcand</p>	The study's primary outcome is to determine the overall nutrition knowledge acquired from the intervention. Secondary outcomes include nutrition knowledge subscores (ie, knowledge of specific food groups), nutrition attitudes, dietary intake, general nutrition behaviours (eg, eating breakfast) and intervention acceptability.	Canada	To conduct a single-blinded cluster randomized controlled trial in which 32 Grade 4 and 4/5 classrooms in Ontario are randomized to receive either (1) the <i>Foodbot Factory</i> intervention or (2) a control nutrition education program using conventional materials, such as activity sheets.	<i>Foodbot Factory</i> may effectively increase children's nutrition knowledge.
9	<p>Nutrition education strategies to promote vegetable consumption in preschool children: the Veggies4myHeart project (23)</p> <p>Cátia Braga-Pontes, Sara Simões-Dias, Marlene Lages, Maria P Guarino, and Pedro Graça4</p>	To evaluate the effectiveness of three nutrition education strategies in increasing the consumption of various vegetables among preschool children.	Portugal	This experimental study was carried out in four Portuguese preschools. The intervention included 20-minute educational sessions once a week for five weeks, using one of the following randomized strategies: the Portuguese Food Wheel Guide (control), a digital game, a storybook, or a	All tested interventions successfully increased vegetable consumption in both the short and medium term, with no statistically significant differences compared to the control group. The use of stickers was more effective in promoting vegetable intake in the short term than in the medium term.

				storybook combined with rewards (stickers). All groups received repeated exposure to vegetables during each session. Pre- and post-tests were conducted to assess vegetable intake, with a follow-up evaluation at six months.	
10	<p>A Mobile App–Based Intervention (Parentbot–a Digital Healthcare Assistant) for Parents: Secondary Analysis of a Randomized Controlled Trial (24)</p> <p>Joelle Yan Xin Chua, Mahesh Choolani, Cornelia Yin Ing Chee, Huso Yi, Joan Gabrielle Lalor, Yap Seng Chong, Shefaly Shore</p>	The PDA was designed to offer informational, socioemotional, and psychological support to parents throughout the perinatal period.	Singapura	A secondary analysis of a randomized controlled trial was conducted using a convenience sample of 118 heterosexual couples (236 participants: 118 mothers and 118 fathers, each comprising 50% of the sample).	Use of the educational materials was significantly associated with improvements in parents' outcomes at one month postpartum, including reduced anxiety ( $\beta = -0.48$ , 95% CI $-0.94$ to $-0.009$ ; $P = .046$ ), enhanced parent-child bonding ( $\beta = -0.10$ , 95% CI $-0.19$ to $-0.01$ ; $P = .03$ ), increased social support ( $\beta = 0.31$ , 95% CI $0.08$ – $0.54$ ; $P = .01$ ), and higher parenting satisfaction ( $\beta = 0.57$ , 95% CI $0.07$ – $1.07$ ; $P = .03$ ).
11	<p>Effect of nutritional intervention in child health care on improving growth and development and disease prevention of infants (25)</p> <p>Juan Du, Feiyan Huang, Zhanghua Tang</p>	To investigate the effects of nutritional interventions in child healthcare on infant growth and the prevention of diseases.	China	A retrospective study was conducted involving 92 infants who received child health interventions at The Affiliated Hospital of Southwest Medical University.	The overall incidence of nutritional diseases was lower in the observation group (2.17%) compared to the control group (17.39%). Additionally, the total satisfaction rate was higher in the observation group (100.00%) than in the control group (86.96%), with the difference being statistically significant ( $P < 0.05$ ).

### Assessment of Quality Article with the Critical Appraisal tool

Critical appraisal involves a systematic and comprehensive assessment of research studies to evaluate their validity, importance, and contextual relevance. In this scoping review, the methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools for qualitative, randomized controlled and quasi-experimental designs, and the Mixed Methods Appraisal Tool (MMAT) studies. Eleven studies were evaluated through this process, all of which were rated as high quality (Grade A). In qualitative articles, researchers assess the credibility, transferability, and auditability during the research process. Conversely, researchers utilize specific methodologies to evaluate the risk of bias when conducting Randomized Controlled Trials (RCTs) and the Mixed Methods, given their focus on intervention efficacy and sample selection using blind method

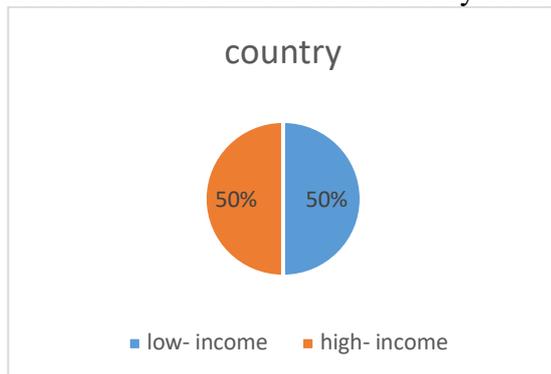
The JBI and MMAT frameworks assess key components such as methodological soundness, adequacy of sample size, appropriateness of data collection methods, and consistency with research objectives. Any disagreements between the two independent reviewers were resolved through discussion to maintain accuracy and objectivity. All assessed studies met the rigorous quality standards set by these tools, supporting their classification as Grade A.

## RESULTS AND DISCUSSION

### Article Characteristics

#### Characteristics of Articles by Country

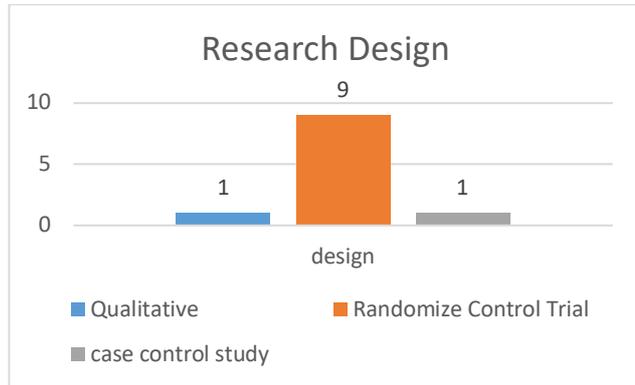
Table 1. Characteristic of articles by country



Based on the findings of this scoping review, the included articles originated from various countries, including Sweden, India, Bangladesh, Iran, Australia, the United States, Canada, Portugal, and Singapore. The use of digital interventions was widely implemented in countries, primarily targeting child health, particularly nutrition. Most of the excluded articles involved digital interventions designed for children with specific health conditions, such as cancer, kidney failure, obesity, or low birth weight.

## The characteristics of the articles, based on the research designs employed

Table 2. Characteristics of article based on the research designs



The results of this scoping review identified one study with a qualitative design, one study employing a retrospective cohort case-control design, and nine studies utilizing randomized controlled trial (RCT) designs. The RCT studies included both single-phase interventions and two-phase mixed-method approaches

Table 1. Characteristics of article based on the research designs

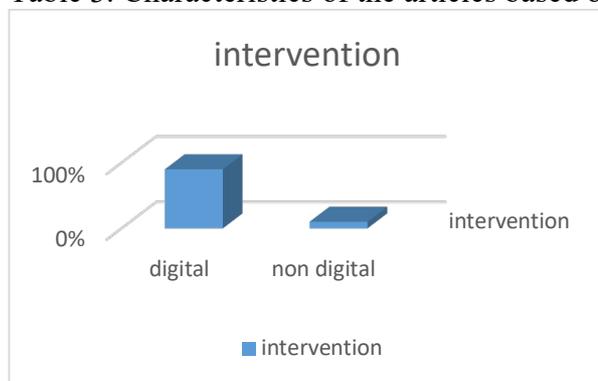
No	Title	Country	Method	Results
1	Mobile phone-based lifestyle support for families with young children in primary health care (MINISTOP 2.0): Exploring behavioral change determinants for implementation using the COM-B model	Swedish	qualitative	The intervention must take into account the physical, psychological and motivational abilities of nurses and parents as users.
2	Using a Responsive Feedback Approach to Develop and Pilot a Counselling Chatbot to Strengthen Child Nutrition in Rural India	India	Randomize Control Trial (RCT)	Approximately 80% of users responded to at least one message generated by the chatbot, and 64% interacted beyond the standard content by discussing at least one issue with a nurse.
3	Feasibility of Employing mHealth in Delivering Preventive Nutrition Interventions Targeting the First 1000 Days of Life: Experiences from a Community-Based Cluster Randomised Trial in Rural Bangladesh	Bangladesh	Randomize Control Trial (RCT)	The mHealth approach proved valuable for the design, planning, scheduling, and delivery of nutrition interventions by community health workers (CHWs), as well as for monitoring and supervision conducted by their supervisors.
4	Smartphone-Based Maternal Education for the	Iran	Randomize Control Trial (RCT)	Children in the smartphone intervention group demonstrated a greater

	Complementary Feeding of Undernourished Children Under 3 Years of Age in Food-Secure Communities: Randomised Controlled Trial in Urmia, Iran			improvement in wasting status (WHZ +0.65, 95% CI $\pm$ 0.16) compared to those in the TAU group (WHZ +0.31, 95% CI $\pm$ 0.21; $p = 0.011$ ), as well as a significantly higher reduction in the prevalence of wasting (89.6% vs. 51.5%; $p = 0.016$ ), defined as WHZ $< -2$ .
5	Feasibility and efficacy of a web-based family telehealth nutrition intervention to improve child weight status and dietary intake: A pilot randomised controlled trial	Australia	Randomize Control Trial (RCT)	A significant increase was observed in the consumption of leafy green vegetables compared to baseline ( $p = 0.01$ )
6	Feasibility, Acceptability, and Initial Efficacy of a Digital Intervention to Improve Consumption of Foods Received within a National Nutrition Assistance Program	United States	Randomize Control Trial (RCT)	The majority of participants reported that the feedback (94%) and tips (87%) provided were helpful, and most (91%) stated they would recommend the program
7	Efficacy of the Foodbot Factory digital curriculum-based nutrition education intervention in improving children's nutrition knowledge, attitudes and behaviours in elementary school classrooms: protocol for a cluster randomised controlled trial	Canada	Randomize Control Trial (RCT)	Foodbot Factory may effectively increase children's nutrition knowledge.
8	Nutrition education strategies to promote vegetable consumption in preschool children: the Veggies4myHeart project	Portugal	Randomize Control Trial (RCT)	The use of stickers was more effective in promoting vegetable intake in the short term than in the medium term.
9	A Mobile App-Based Intervention (Parentbot—a Digital Healthcare Assistant) for Parents: Secondary Analysis of a Randomized Controlled Trial	Singapura	Randomize Control Trial (RCT)	Use of the educational materials was significantly associated with improvements in parents' outcomes at one month postpartum, including reduced anxiety ( $\beta = -0.48$ ,

				95% CI $-0.94$ to $-0.009$ ; $P = .046$ ), enhanced
10	Effect of nutritional intervention in child health care on improving growth and development and disease prevention of infants	China	Case control study	the total satisfaction rate was higher in the observation group (100.00%) than in the control group (86.96%), with the difference being statistically significant ( $P < 0.05$ ).
11	The Effect of Audio-Visual Media on the Knowledge and Attitudes of Pregnant Women Regarding Stunting Prevention in Cinta Rakyat Village	Indonesia	Randomized Controlled trial	There was a significant difference in the knowledge of pregnant women before and after the intervention using audio-visual media, with a p-value of 0.001 ( $p < 0.05$ ). Furthermore, there was a significant difference in the attitudes of pregnant women before and after the intervention using audio-visual media, with a p-value of 0.004 ( $p < 0.05$ )

### Characteristics of the articles based on digital and non-digital intervention

Table 3. Characteristics of the articles based on digital and non-digital intervention



The scoping review revealed that 90% of the interventions utilized digital approaches, while 10% employed non-digital methods, such as direct nutritional support for young children.

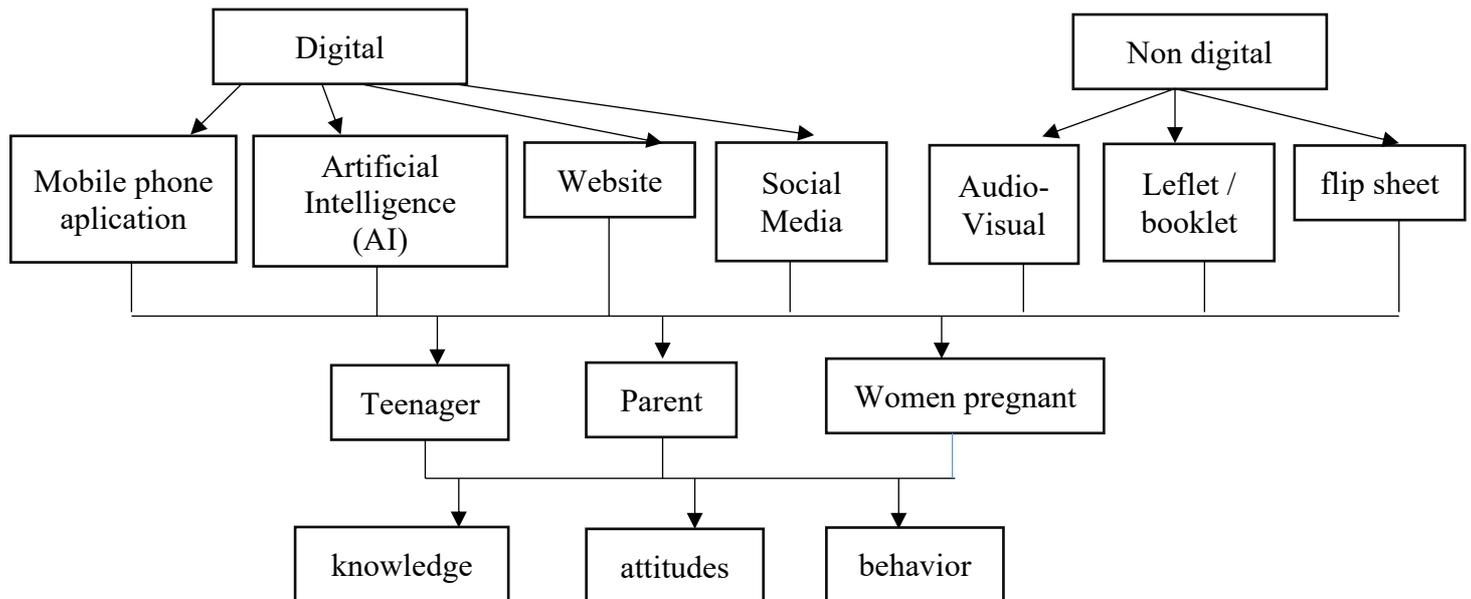
Following data extraction and quality appraisal of the selected studies, a thematic analysis was conducted to identify key patterns. Themes were derived using an inductive approach, whereby recurring ideas and concepts related to interventions for stunting prevention and child well-being were systematically coded and organized into broader thematic categories. To ensure reliability and reduce bias, five independent researchers participated in the theme identification process, and any discrepancies were resolved through discussion and consensus.

Based on the thematic analysis of ten studies focusing on digital and non-digital interventions for stunting prevention, two main approaches were identified. The first approach, appearing in 70% of the articles, targeted parents. These interventions aimed to empower parents to guide their children in improving

nutritious food consumption. The second approach, found in 30% of the studies, focused directly on children. These interventions sought to enhance children's healthy eating behaviors and literacy regarding All of the reviewed articles employed digital interventions, which were found to be effective in improving knowledge, attitudes, and behaviors related to nutritious food consumption among children.

### A Conceptual map relationship between type of media, target audience, and educational outcomes.

Figure 4. Conceptual Map Relationship Between Type Of Media, Target Audience, And Educational Outcomes.



### Theme 1: The Importance of Interventions to Improve Child Nutrition

Nutritional interventions for children play a crucial role in supporting optimal growth and development while preventing various health problems associated with malnutrition. Evidence indicates that integrated nutrition interventions including caregiver education and micronutrient supplementation contribute significantly to improving children's nutritional status as well as their motor and cognitive development (26). Moreover, programs that combine macronutrient and micronutrient supplementation with continuous education and follow-up activities have been shown to be more effective in reducing the prevalence of stunting and nutrition-related diseases (27).

Nutritional interventions should also adopt a comprehensive approach that includes nutrition education within both school and family settings to promote healthy eating behaviors among children. Systematic reviews have highlighted that school-based interventions incorporating experiential learning activities such as cooking sessions, school gardens, and parental involvement effectively enhance children's nutrition knowledge and foster positive dietary behavior changes (28). Improvements in children's dietary intake not only impact their physical health but also support better mental health and social development outcomes (29)

### Theme 2: Types of Interventions Used to Improve Child Nutrition

Various digital interventions have been developed to enhance children's nutritional intake, including the use of mobile applications and web-based platforms designed for nutrition education, dietary tracking, and growth monitoring. One notable innovation is the *M-Nutricore* telehealth application, which effectively improves maternal knowledge of proper nutrition during the first 1,000 days of life (HPK) and reduces the

risk of stunting through engaging and interactive features (30). Another example is the AI-based *ReMPASI* application, which offers a digital solution for monitoring and combating child malnutrition through early detection and personalized interventions tailored to each child's needs (31). Mobile-based interventions utilizing behavioral frameworks such as the COM-B model exemplified by the *MINISTOP 2.0* lifestyle intervention program have also demonstrated potential in promoting healthy habits among children (18). Other forms of digital interventions include chatbots powered by artificial intelligence (19), mHealth messaging systems (32), smartphone, mobile App-Based Intervention (20,25), and interactive educational platforms such as the *Veggies4myHeart Project* (24)

Smartphone-based nutrition education platforms have also been widely implemented, providing nutrition counseling and information through SMS, health promotion messages, and interactive digital content that fosters positive attitudes and knowledge among parents and school-aged children (33). Web-based programs such as *Team Nutriathlon* have shown innovative approaches to increasing children's consumption of vegetables, fruits, and dairy products through digitally motivated, interactive methods (34). In addition to mobile and web applications, digital interventions have also been integrated with virtual community approaches. For instance, the *Virtual Posyandu* program, developed during the COVID-19 pandemic, successfully maintained children's growth and development through online nutrition education and remote monitoring. This approach expanded the reach of health interventions to remote areas while reducing healthcare costs and workload (33)

### **Theme 3: Strengths and Limitations of Digital Interventions to Improve Child Nutrition**

Digital interventions offer several advantages, including the ability to reach a wide audience at relatively low cost and the convenience of access at any time through smartphones or computers. Digital platforms such as mobile applications, web-based nutrition education tools, and social media based e-counseling enable interactive learning, personalized nutrition management, and real-time self-monitoring of nutritional status (18). Moreover, digitalization facilitates continuous tracking of child development and provides easily accessible practical recommendations for parents and health professionals (20). However, digital interventions also face challenges, including limited technology access in remote or low-income areas, dependency on digital literacy, and reduced face-to-face interaction that may hinder comprehension and the practical application of educational messages (13).

In contrast, non-digital interventions such as in-person counseling, caregiver training, micronutrient supplementation, and community-based programs offer stronger direct social interaction and can be tailored to local socio-cultural contexts (35). The main advantage of this approach lies in its capacity to foster social support and enhance motivation through direct engagement between caregivers and health workers. Nonetheless, non-digital interventions tend to require more resources and manpower, have narrower coverage, and are more susceptible to irregular implementation and logistical challenges in the field (26).

## **DISCUSSION**

The Health Belief Model (HBM) provides a useful framework for understanding how digital and non-digital educational media influence caregivers' preventive behaviors related to stunting. By strengthening perceived susceptibility and severity, such media increase awareness of children's risk and the long-term developmental consequences of stunting (8). Educational tools also clarify the benefits of recommended practices such as appropriate complementary feeding, hygiene, and routine growth monitoring while reducing perceived barriers through accessible and practical guidance (36). Digital resources (mobile applications) and non-digital materials (leaflets, posters, video) act as cues to action and enhance caregivers' self-efficacy by offering clear, step-by-step instructions (37).

Nutrition education interventions delivered through both digital and non-digital media play a vital role in preventing stunting among children under five. Studies have shown that digital educational tools such as digital pocketbooks, animated videos, and mobile applications are effective in improving mothers'

knowledge and attitudes toward stunting prevention. Digital approaches offer accessible, engaging, and interactive features that make them more appealing and capable of reaching a broader audience, particularly among increasingly tech-literate populations. However, limited access to technology and varying levels of digital literacy remain significant challenges for certain community groups (35)

Non-digital educational media, including lectures, hands on food preparation demonstrations, and face-to-face training sessions, continue to be relevant in fostering deeper understanding and promoting sustainable behavioral change. Such traditional approaches often strengthen social reinforcement through direct interaction between health workers and families, making them particularly effective in communities with limited technological infrastructure (38). Consequently, combining digital and non-digital media represents an ideal strategy to overcome the limitations of each approach.

Furthermore, digital education provides opportunities to empower young people and adolescents as agents of change in stunting prevention. Through digital literacy training, they learn how to access and critically evaluate accurate nutrition information, an essential skill given their role as future parents who can influence the nutritional status of the next generation. Interactive media also enhance emotional engagement and learning motivation, contributing positively to attitude and behavior change regarding nutrition (39)

The COM-B model helps explain how digital and non-digital educational media shape caregivers' behaviors in preventing stunting by strengthening capability, opportunity, and motivation. Educational tools enhance capability by improving caregivers' knowledge and skills related to nutrition, hygiene, and growth monitoring through simple, structured guidance. They expand opportunity by offering accessible information across settings digital platforms provide interactive support, while non-digital materials remain effective in low-resource contexts. These media also boost motivation by emphasizing the importance of early-life nutrition, highlighting attainable actions, and reinforcing caregivers' confidence. Through these pathways, educational media activate the core COM-B components necessary for sustained stunting prevention behavior (40).

The effectiveness of both digital and non-digital educational media largely depends on the sociocultural context and the community's readiness to adopt technology and educational messages. Therefore, aligning educational content with local needs, habits, and cultural values is essential to ensure the success of stunting prevention programs. Developing innovative media that are simple, understandable, and practical can enhance the sustainability of interventions (41). The integration of locally adapted digital and non-digital educational strategies represents an optimal approach to preventing stunting among children under five. Strengthening both nutrition and digital literacy, supported by conventional counseling methods, can expand outreach efforts and foster more profound, sustainable behavioral change within communities.

## CONCLUSION

The findings of this scoping review highlight that both digital and non-digital educational media play a pivotal role in enhancing parents' and caregivers' knowledge, attitudes, and behaviors toward stunting prevention among children under five. Digital media, such as mobile nutrition applications, educational videos, and social media platforms have demonstrated strong effectiveness in broadening access to information and improving user engagement, particularly in settings with sufficient technological infrastructure. Integrated digital and non-digital education strategies should be prioritised in stunting prevention policies to ensure equitable access to health information across diverse socio-economic contexts. Conversely, non-digital media such as face to face counseling, printed materials, and educational booklets remain relevant and effective in areas with limited digital access, as they can be tailored to local socio-cultural contexts. This study contributes novel insights by systematically mapping digital and traditional educational interventions for stunting prevention, an area that lacks consolidated evidence

## AUTHOR CONTRIBUTIONS

All authors participated in the conceptualization and design of the study, formulated the review question based on the PCC framework, selected the relevant studies, and managed the data organization. They were collectively involved in data collection, synthesis, and interpretation of the results. Each author reviewed and approved the final version of the manuscript. Mapping digital and non-digital educational media in the context of stunting prevention by IRK, WDP. Recommendations for integrating technology-based and local culture-based educational approaches by RMA, MDS, MINA.

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## REFERENCES

1. WHO. Prevalensi Stunting Pada Anak di Bawah Usia 5 Tahun(%) Estimasi berdasarkan Model. Kemenkes. 2022. p. 1–150.
2. Project GN. Laporan Nutrisi Global | Profil Nutrisi Negara - Laporan Nutrisi Global [Internet]. 2022. Available from: <https://globalnutritionreport.org/resources/nutrition-profiles/>
3. Hartati L, Wahyuningsih A. Hubungan Kejadian Stunting dengan Perkembangan Anak Usia 24-59 Bulan di Desa Wangen Polanharjo. *INVOLUSI J Ilmu Kebidanan*. 2021;11(1):28–34.
4. Imeldawati R. Dampak Terjadinya Stunting terhadap Perkembangan Kognitif Anak : Literature Review. *J Med Nusant*. 2025;3(1):101–7.
5. Azmi F, Alinda A, Yusanti E, Alisa Meilia S, Nurul Sakinah G, Rosmala R, et al. Hubungan Pengetahuan Dan Sikap Ibu Dengan Kejadian Stunting Pada Balita Di Desa Parungsehah Kecamatan Sukabumi. *J Sosio dan Hum*. 2022;1(2):74–84.
6. Ambon dr MH. Stunting\_ Masalah Kesehatan yang Harus Kita Atasi Bersama. 2022.
7. Suarnianti. FAKTOR RISIKO STUNTING : LITERATUR REVIEW Suarnianti. *Fakt Risiko Stunting Lit Rev*. 2020;15(2):144–7.
8. Dewey KG, Begum K. Long-term consequences of stunting in early life. *Matern Child Nutr*. 2021;7(SUPPL. 3):5–18.
9. Udoudom U, Igiri A, George K, Aruku KJ. Promoting Health Education through Effective Communication for Development. *ALSYSTECH J Educ Technol*. 2023;2(1):68–88.
10. Lestari DI, Fadilah SZ, Arifah N, Azari AA, Balaputra I. Health education and interprofessional collaboration to improve maternal knowledge on stunting prevention. 2025;13:130–4.
11. Kitila SB, Feyissa GT, Olika AK, Wordofa MA. Maternal Healthcare in Low- and Middle-Income Countries: A Scoping Review. *Heal Serv Insights*. 2022;15:1–7.
12. Prendergast AJ, Humphrey JH. The stunting syndrome in developing countries. *Paediatr Int Child Health*. 2020;34(4):250–65.
13. Kumar P, Srivastava S, Chauhan S, Patel R, Marbaniang SP, Dhillon P. Associated factors and socio-economic inequality in the prevalence of thinness and stunting among adolescent boys and girls in Uttar Pradesh and Bihar, India. *PLoS One* [Internet]. 2021;16(2 February):1–20. Available from: <http://dx.doi.org/10.1371/journal.pone.0247526>
14. Darusman KR, Sundjaya T, Wasito E. Effectiveness of digital intervention for early stunting prevention in Indonesian children. 2024;13(3):1559–65.
15. Marlinawati DA, Rahfiludin MZ, Mustofa SB. Effectiveness of Media-Based Health Education on Stunting Prevention in Adolescents : A Systematic Review. 2024;4(2):102–11.

16. Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. *JBIEvid Synth.* 2020;18(10):2119–26.
17. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol Theory Pract.* 2005;8(1):19–32.
18. Thomas K, Neher M, Alexandrou C, Müssener U, Henriksson H, Löf M. Mobile phone-based lifestyle support for families with young children in primary health care (MINISTOP 2.0): Exploring behavioral change determinants for implementation using the COM-B model. *Front Heal Serv.* 2022;2.
19. Tomar N, Srikrishnan S, Lesh N, DeRenzi B. Using a Responsive Feedback Approach to Develop and Pilot a Counseling Chatbot to Strengthen Child Nutrition in Rural India. *Glob Heal Sci Pract.* 2023;11:1–12.
20. Seyyedi N, Rahimi B, Eslamlou H, Afshar H, Spreco A, Timpka T. Smartphone-Based Maternal Education for the Complementary Feeding of Undernourished Children. *J Nutr [Internet].* 2020;12(587):1–12. Available from: <https://www.mdpi.com/2072-6643/12/2/587>
21. Chai LK, Collins CE, May C, Ashman A, Holder C, Brown LJ, et al. Feasibility and efficacy of a web-based family telehealth nutrition intervention to improve child weight status and dietary intake: A pilot randomised controlled trial. *J Telemed Telecare.* 2021;27(3):146–58.
22. Kay MC, Hammad NM, Truong T, Herring SJ, Bennett GG. Feasibility, Acceptability, and Initial Efficacy of a Digital Intervention to Improve Consumption of Foods Received within a National Nutrition Assistance Program. *Nutrients.* 2023;15(2).
23. Brown JM, Tahir S, Franco-Arellano B, Lesage A, Hughes J, Kapralos B, et al. Efficacy of the Foodbot Factory digital curriculum-based nutrition education intervention in improving children's nutrition knowledge, attitudes and behaviours in elementary school classrooms: Protocol for a cluster randomised controlled trial. *BMJ Open.* 2025;15(1):1–10.
24. Braga-Pontes C, Simões-Dias S, Lages M, Guarino MP, Graça P. Nutrition education strategies to promote vegetable consumption in preschool children: The Veggies4myHeart project. *Public Health Nutr.* 2022;25(4):1061–70.
25. Chua JYX, Choolani M, Chee CYI, Yi H, Lalor JG, Chong YS, et al. A Mobile App-Based Intervention (Parentbot—a Digital Healthcare Assistant) for Parents: Secondary Analysis of a Randomized Controlled Trial. *J Med Internet Res.* 2025;27:1–19.
26. Du J, Huang F, Tang Z. Effect of nutritional intervention in child health care on improving growth and development and disease prevention of infants. *Pakistan J Med Sci.* 2024;40(3):477–81.
27. Sharn AR, Oliveros E, Lai S, Sanchez CP, Villa-Real Guno MJ, Rojas Montenegro C. Multi-faceted nutritional interventions are imperative to reduction of stunting among children in low- and middle-income countries. *Front Nutr.* 2025;12(September).
28. Chatterjee P, Nirgude A. A Systematic Review of School-Based Nutrition Interventions for Promoting Healthy Dietary Practices and Lifestyle Among School Children and Adolescents. *Cureus.* 2024;16(1):1–17.
29. Omidvar N, Doustmohammadian A, Shakibazadeh E, Clark CCT, Kasaii MS, Hajigholam-Saryazdi M. Effects of school-based interventions on Food and Nutrition Literacy (FNLIT) in primary-school-age children: a systematic review. *Br J Nutr.* 2023;129(12):2102–21.
30. Maysaroh S, Alisya NC. Mobile Nutricore Sebagai Optimalisasi Program Intervensi Gizi Guna Mempercepat Penurunan Stunting Di Indonesia Tuntas Sdgs 2030. *Berk Ilm Mhs Gizi Indones [Internet].* 2023;10(2):72–8. Available from: <http://bimgi.or.id/index.php/bimgi/article/view/7%0Ahttp://bimgi.or.id/index.php/bimgi/article/download/7/6>
31. Pratiwi R, Atmaka DR, Sutoyo DAR, Mahmudiono T. The Effectiveness of Smartphone-Based Nutrition Education Intervention in Successful Practice of Exclusively Breastfeeding: A Meta-

- Analysis. *Amerta Nutr.* 2023;7(4):615–25.
32. Scott K, Ummer O, Shinde A, Sharma M, Yadav S, Jairath A, et al. Another voice in the crowd: The challenge of changing family planning and child feeding practices through mHealth messaging in rural central India. *BMJ Glob Heal.* 2021;6:1–15.
  33. Marchianti ACN, Rachmawati DA, Kusuma IF, Sudarmanto Y. Virtual Posyandu Program during the Pandemic Maintained Children's Growth and Development. *Amerta Nutr.* 2024;8(3):461–7.
  34. Amita DF, Siti Yuyun Rahayu Fitri, Wiwi Mardiah. Intervensi Digital Untuk Meningkatkan Perilaku Makan Buah Dan Sayur Pada Remaja : Systematic Review. *Lentera Perawat.* 2024;5(1):156–65.
  35. Sari IY, Prawesti I, Febrianti S. E-counseling Nutrisi Berbasis Media Sosial sebagai Upaya Menurunkan Angka Stunting. *J Kebidanan dan Keperawatan Aisyiyah.* 2021;16(2):156–66.
  36. Jones CL, Jensen JD, Scherr CL, Brown NR, Christy K, Weaver J. The Health Belief Model as an Explanatory Framework in Communication Research: Exploring Parallel, Serial, and Moderated Mediation. 2020;30(6):566–76.
  37. World Health Organization. WHO guideline on self-care interventions for health and well-being. Geneva: World Health Organization. 2022. 1–186 p.
  38. Tyarini IA, Setiawati A, Achmad VS, Astuti A. Meningkatkan Perilaku Sehat Dalam Mencegah Stunting Melalui Media Digital. *Abdimas Polsaka J Pengabdian Kpd Masy.* 2023;2(2):97–103.
  39. Pengabdian J, Kesehatan I, Ambarika R, Attamimi R. Pengembangan Media Edukasi Digital : Website Promosi Kesehatan sebagai Strategi Pencegahan Stunting pada Pengguna ( Siswa ) di Kabupaten Sumbawa Digital Educational Media Development : Health Promotion Website as a Stunting Prevention Strategy for Users. 2025;5(November).
  40. West R, Michie S, Rubin GJ, Amlôt R. Applying principles of behaviour change to reduce SARS-CoV-2 transmission. *Nat Hum Behav [Internet].* 2020;4(May):451–9. Available from: <http://dx.doi.org/10.1038/s41562-020-0887-9>
  41. Hamidah J, Rahmah A, Noviana DP, Ariana RA. Pelatihan Literasi Digital untuk Edukasi Pencegahan Stunting pada Remaja di SMAN 11 Banjarmasin. *J Pengabdian Masy Progresif Humanis Brainstorming [Internet].* 2024;7(2):547–54. Available from: <https://ejournal.poltekharber.ac.id/index.php/abdimas/article/view/6637>