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Educational Strategies to Enhance Motor and Language Development in Children with Stunting: A Systematic Review

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ABSTRACT
Stunting in early childhood is a complex health problem with broad impacts, not only on physical growth but also on motor and language development, which are essential for children's future success. This review was conducted to identify and synthesize the latest scientific evidence on the effectiveness of various educational approaches in stimulating motor and language development in children with stunting. A systematic literature search was carried out through nine scientific databases, covering publications from 2014 to 2024. Articles that met the inclusion criteria were assessed for quality using the JBI appraisal tool and analyzed thematically. A total of 23 primary articles were analyzed, showing that family- and community-based educational interventions—such as home visits, educational games, simple stimulation media, and the Montessori approach—had a positive impact on improving fine motor, gross motor, and both expressive and receptive language skills in stunted children. Approaches that involved active parental participation and were tailored to the local context proved to be more effective than general or non-targeted methods. This review emphasizes the need to strengthen education-based early stimulation programs in Indonesia's national strategy for addressing stunting.

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1. INTRODUCTION

Stunting is one of the major public health challenges that remains persistent in Indonesia. This condition is characterized by a child's height being below the standard for their age due to chronic malnutrition, especially during the first 1,000 days of life. According to the [1], more than 149 million children under five worldwide experience stunting, with a global prevalence of approximately 22%. In Indonesia, the prevalence of stunting reached 21.5% in 2023, still above the WHO standard (<20%) and the government's target of 14% by 2024. Stunting impacts not only the physical growth of children but also brain development, learning ability, motor skills, language, and productivity in adulthood [1][2][3].

One of the major yet often overlooked impacts of stunting is delayed motor and language development. Stunted children tend to experience difficulties in fine and gross motor coordination, as well as in verbal and nonverbal communication abilities. A study by [4] found that stunted children aged 2–3 years experienced significant improvements in gross and fine motor skills after receiving psychosocial stimulation interventions delivered through maternal training. Similar findings were reported in the study by [5], which observed increased parental behavior in providing stimulation following educational sessions, along with improvements in children's motor development outcomes.

A study by [6] specifically investigated children with a history of stunting who received language stimulation interventions through play and literacy activities such as shared reading, singing, and word games. The results showed a 70% increase in vocabulary within four weeks. This research emphasizes that educational approaches implemented in a structured manner, either by teachers or parents, have a significant impact on the language abilities of children with stunting backgrounds.

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Furthermore, educational approaches such as parent training, play-based learning, home visits, and the Montessori method have begun to be applied in various interventions to stimulate child development. For example, research by [7] in Ethiopia found that a six-month family-based play intervention improved the cognitive and motor development of malnourished toddlers. Similarly, [8] reported that family-based stimulation activities helped enhance language development in stunted toddlers.

Although numerous studies have shown the effectiveness of educational approaches in stimulating stunted children, few have systematically compiled and evaluated the variety of such approaches in both global and national contexts. Most studies are local and descriptive in nature, lacking comprehensive analysis regarding the methods, coverage, sustainability, and long-term impacts of the interventions used. In fact, a thorough understanding of effective educational approaches is essential for developing evidence-based and sustainable interventions.

Therefore, a Systematic Literature Review is needed to identify, evaluate, and synthesize educational approaches used to stimulate motor and language development in stunted children. This review is expected to provide a comprehensive overview of best practices, reveal the strengths and weaknesses of various approaches used, and serve as a conceptual basis for developing more adaptive, contextual, and evidence-based educational interventions, including as a foundation for investigating the effectiveness of the Montessori approach in accelerating the development of children with stunting.

2. METHOD

2.1. Study Design

This study is a Systematic Literature Review (SLR) developed based on the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.[9] The review aims to identify, evaluate, and synthesize the latest scientific evidence regarding educational approaches in stimulating motor and language development among stunted children.

2.2. Eligibility Criteria

The eligibility criteria will determine the inclusion and exclusion of studies to ensure the relevance and quality of selected articles.

2.2.1. Inclusion Criteria

a. Primary studies (quantitative, qualitative, or mixed-method) focusing on early childhood children with stunting or a history of stunting.
b. Studies that involve educational interventions or approaches aimed at stimulating motor and/or language development.
c. Articles published in English or Indonesian.
d. Studies published between 2014 and 2024.
e. Full-text articles accessible for review.

2.2.2. Exclusion Criteria

a. Narrative reviews, opinion pieces, commentaries, or editorials.
b. Studies that are irrelevant to the focus of educational stimulation for motor and/or language development in stunted children.
c. Articles without full-text availability.

2.3. PICO Framework

In line with the objective of mapping effective educational strategies to stimulate motor and language development in stunted children, a PICO framework (Population, Intervention, Comparison, Outcome) is utilized to guide the formulation of the research question in this systematic literature review. The framework is outlined as follows:

Table 1. PICO Elements Guiding the Review on Educational Approaches for Stunted Children

PICO Element	Description
Population	Early childhood children with stunting or a history of stunting
Intervention	Educational approaches for stimulating motor and/or language development (e.g., parental education, Montessori, play-based learning, home visits)
Comparison	Conventional approaches or no specific intervention
Outcome	Improvement in motor (gross and fine) and language (expressive and receptive) development

2.4. Information Sources and Search Strategy

A systematic search was conducted across nine electronic databases: PubMed, Scopus, Web of Science, ScienceDirect, Google Scholar, DOAJ, and SINTA. The literature search included studies published between 2014 and 2024, focusing on educational interventions aimed at stimulating motor and/or language development in stunted children. The search strategy was developed using combinations of relevant keywords and Boolean operators. For example, the search string used in PubMed was: ("stunted children" OR "child stunting") AND ("motor development" OR "language development") AND ("educational approach" OR "learning stimulation" OR "parental education" OR "Montessori" OR "play-based learning") All search results were imported into Mendeley reference manager for duplicate removal and reference organization. The screening process and article selection followed the PRISMA 2020 guidelines to ensure transparency and replicability.

2.5. Study Selection

The study selection process was carried out in accordance with the PRISMA 2020 guidelines to ensure transparency and methodological rigor. The process consisted of three main stages:

1. Identification: All records retrieved from the database searches were imported into Mendeley reference manager. Duplicate entries were removed automatically and manually checked to ensure accuracy.
2. Screening: Titles and abstracts of the remaining articles were screened independently by two reviewers to determine their potential relevance based on the predefined inclusion and exclusion criteria.
3. Eligibility Assessment: Full texts of potentially relevant articles were retrieved and reviewed in detail by the same reviewers. Any disagreements during the selection process were resolved through discussion, and a third reviewer was consulted when necessary to reach a consensus.

The entire selection process was documented using a PRISMA 2020 flow diagram, illustrating the number of studies included and excluded at each stage, along with reasons for exclusion.

2.6. Data Extraction

Data from the included studies will be systematically collected using a standardized data extraction form to ensure consistency and accuracy. The form will capture essential study characteristics such as the author(s), year of publication, country of origin, study design, and educational context. Additionally, it will record the type of stunting addressed, the educational approach used (e.g., Montessori, play-based learning, parental education), and the targeted developmental domain (motor and/or language). Outcome measures related to developmental progress, intervention effectiveness, and parental or caregiver involvement will also be extracted. This structured approach will facilitate thematic synthesis and allow comparison across studies.

2.7. Data Analysis and Synthesis

The extracted data will undergo qualitative synthesis using both descriptive and thematic analysis. Descriptive analysis will summarize the characteristics of the included studies, including types of educational approaches used, targeted developmental domains (motor and/or language), population characteristics, and reported outcomes. Thematic analysis will be performed to identify recurring patterns and themes related to the effectiveness of educational interventions, the role of caregivers or educators, contextual influences, and observed impacts on child development. Furthermore, gaps in the current literature will be mapped to identify underexplored areas that warrant future investigation.

2.8. Quality Assessment

To ensure the credibility and reliability of the findings, the methodological quality of the included studies will be assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, selected according to the specific study designs. Two independent reviewers will conduct the quality assessment of each study. [10] Any discrepancies in scoring or judgment will be resolved through discussion or, if necessary, adjudication by a third reviewer. This rigorous quality appraisal process will contribute to the robustness of the review and enhance the validity of its conclusions.

2.9. Ethical Considerations

As this scoping review involves the analysis of previously published literature and does not involve direct research with human participants, ethical approval is not required. However, the review will adhere to ethical research standards by ensuring accurate citation of all sources and maintaining compliance with copyright regulations throughout the processes of data collection, analysis, and dissemination.

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3. RESULTS AND DISCUSSION

3.1. Result

3.1.1. Literature Search

A systematic search across five databases—Scopus, Web of Science, PubMed, ScienceDirect, and Google Scholar, yielded a total of 102 articles. The search strategy included keywords such as ("stunted children" OR "child stunting") AND ("motor development" OR "language development") AND ("educational approach" OR "learning stimulation" OR "parental education" OR "Montessori" OR "play-based learning"). After duplicate removal and title, abstract, and keyword screening, 51 articles were excluded due to lack of relevance. Full-text assessments were then conducted for the remaining articles. Of these, 28 articles were excluded, 15 due to being study protocols or editorials, and 13 due to irrelevant outcomes. Ultimately, 23 primary studies met the inclusion criteria and were included in the final synthesis. These studies provide evidence on the effectiveness of various educational approaches—such as parental education, structured play, and Montessori-based interventions, in stimulating motor and/or language development among children with stunting.

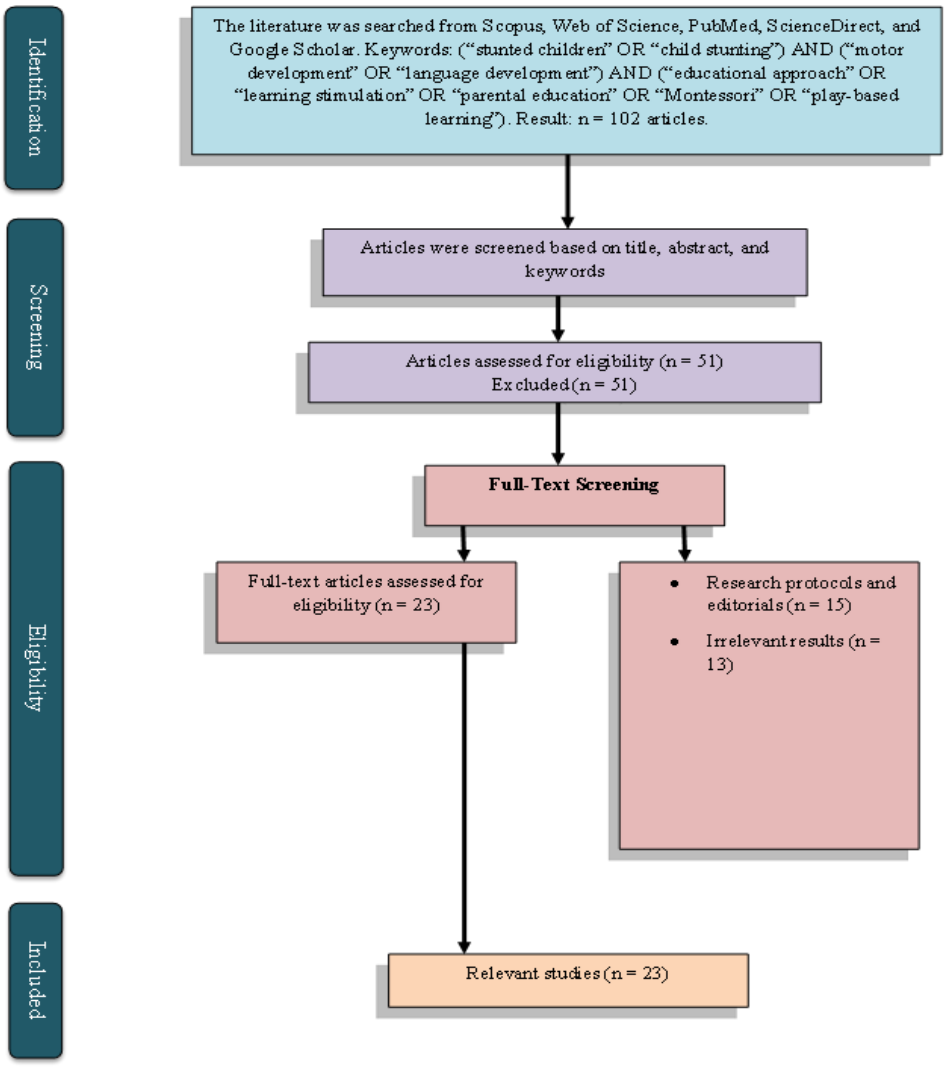

Figure 1. Flowchart of Search Strategy and Selection Process

3.1.2. Descriptive Characteristics of Included Studies

The 23 studies included in this review were published between 2014 and 2024, with the majority conducted in Indonesia and other low- and middle-income countries. These studies employed a wide range of research designs, including qualitative studies**,** quasi-experimental research, cross-sectional surveys, and randomized controlled trials, offering methodological diversity that enriched the synthesis. The interventions examined were primarily focused on educational approaches aimed at stimulating motor and language development in stunted children aged under five years. Most studies targeted parents or caregivers as key participants in delivering the intervention, either through home visits**,** play-based learning**,** parental training, or structured sessions in early childhood settings.This heterogeneity provided a robust foundation for analysis, offering multidimensional insights into how educational strategies are implemented, what outcomes they achieve, and how they interact with social and contextual factors in the lives of children affected by stunting. The key characteristics of these studies are summarized in the extraction table below.

Table 2. Summary of Included Studies on Educational Approaches for Motor and Language Stimulation in Stunted Children (n=23)

No.	Article Details	Methods	Results
1	[11] *Exploration of Children's Motor Skills with Stunting Vs. Non-Stunting.*	Cross-sectional study involving children aged 3–5 years (n=31), using the TGMD-2 instrument. The study focused on analyzing motor skills without intervention.	The majority of stunted children exhibited below-average gross motor skills. Educational interventions are needed to address developmental delays.
2	[12] *Nutrition, hygiene, and stimulation education to improve growth, cognitive, language, and motor development among infants in Uganda: A cluster-randomized trial*	Cluster-randomized trial involving 511 mother-infant pairs aged 6–8 months. The intervention included education on nutrition, hygiene, and stimulation. Instruments: Bayley Scales of Infant and Toddler Development, Ages and Stages Questionnaire (ASQ).	Cognitive, motor, and language development scores were significantly higher in the intervention group. No significant difference was found in linear growth.
3	[8] *The Correlation Between Parental Stimulation and Motor Development in Stunted Toddlers*	Cross-sectional study involving 96 mothers and stunted toddlers. Parental stimulation was assessed using a stimulation questionnaire; motor development was assessed using the Denver Developmental Screening Test (DDST).	A significant correlation was found between parental stimulation and both gross and fine motor development in stunted children.
4	[13] *Effect of play-based family-centered psychomotor/psychosocial stimulation on the development of severely acutely malnourished children under six in a low-income setting: a randomized controlled trial*	Randomized controlled trial involving undernourished preschool children in a low-income setting. The intervention consisted of play-based, family-centered psychomotor and psychosocial stimulation.	Significant improvements were observed in both motor and cognitive development after the intervention.
5	[14] *Improving gross motor skill development through the Montessori method in children aged 3–5 years*	Quasi-experimental study using the Montessori method as an intervention for children aged 3–5 years.	Significant improvement in gross motor skills was observed after implementing the Montessori method.

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6	[15] *Impact of an Integrative Nutrition Package through Home Visit on Maternal and Children Outcome*	Integrative home visit intervention focusing on nutrition and stimulation for mothers and young children.	Improvements were observed in nutritional status and child development across cognitive, motor, and language domains.
7	[7] *Effects of home-based play-assisted stimulation on developmental performances of children living in extreme poverty*	Randomized controlled trial involving home-based play-assisted stimulation for children living in extreme poverty.	Children in the intervention group showed better motor and language development compared to the control group.
8	[16] *Integrating an early childhood development programme into Bangladeshi primary health-care services: an open-label, cluster-randomised controlled trial*	Cluster-randomised controlled trial integrating an early childhood stimulation program into primary health-care services in Bangladesh	The intervention improved child development (motor, language, and cognitive) and increased maternal engagement in caregiving
9	[17] *Early child stimulation, linear growth and neurodevelopment in lowbirth weight infants*	Longitudinal study providing early child stimulation to lowbirth weight infants.	Stimulation had a positive impact on both linear growth and neurocognitive development.
10	[18] *Effects of responsive stimulation and nutrition interventions on children's development and growth at age 4 years in a disadvantaged population in Pakistan*	Cluster-randomised controlled trial delivering responsive stimulation and nutrition interventions from infancy to age four.	The combination of stimulation and nutrition significantly improved cognitive and motor development, as well as physical growth.
11	[19] *Online educational intervention: Improving maternal knowledge and attitudes in providing developmental stimulation for stunting toddlers*	Online educational intervention targeting mothers of stunted toddlers, delivering content through digital media focused on developmental stimulation.	The intervention improved maternal knowledge and attitudes toward providing developmental stimulation to their children
12	[20] *Predictors of change in early child development among children with stunting: Secondary analysis of a randomized trial in Uganda*	Secondary analysis of a randomized trial in Uganda evaluating predictors of developmental change in stunted children	Stimulation interventions, nutritional status, and maternal involvement were identified as key factors contributing to developmental improvement
13	[21] *Stunted and Stimulation Affect Child Development in Jeneponto District, Indonesia*	Cross-sectional study involving young children in Jeneponto District, focusing on the relationship between stunting, stimulation, and child development	Stunted children with low stimulation levels exhibited developmental delays. Positive stimulation was shown to mitigate the effects of stunting.
14	[22] *Correlates of early child development among children with stunting: A cross-sectional study in Uganda*	Cross-sectional study in Uganda assessing the relationship between environmental factors and stimulation on the development of stunted children.	Quality of stimulation and home environment was positively associated with developmental outcomes in stunted children

15	[23] *Assessing early child development and its association with stunting and schistosome infections in rural Zimbabwean children using the Griffiths Scales*	Observational study in rural Zimbabwe using the Griffiths Scales to assess development and its association with stunting and parasitic infection.	Children with stunting and schistosomiasis showed lower developmental scores. Combined health and stimulation interventions are needed.
16	[24] *High doses of a national preschool program are associated with the long-term mitigation of adverse outcomes in cognitive development and life satisfaction among children who experience early stunting: a multi-site longitudinal study in Vietnam*	Multi-site longitudinal study in Vietnam evaluating the impact of a national preschool program on children who experienced early stunting	High exposure to preschool programming was associated with better cognitive development and life satisfaction in stunted children
17	[25] *Urban–rural differences in the relationship between stunting, preschool attendance, home learning support, and school readiness: A study in Côte d'Ivoire*	Quantitative study comparing urban and rural children, examining stunting, preschool attendance, home learning support, and school readiness	Stunted children in rural areas were more delayed in school readiness. Home learning support and preschool participation improved readiness outcomes.
18	[26] *Malnutrition and Its Determinants Are Associated with Suboptimal Cognitive, Communication, and Motor Development in Tanzanian*	Observational study in Tanzania evaluating the relationship between malnutrition and developmental outcomes in children.	Malnutrition was linked to decreased cognitive, motor, and communication development.
19	[27] *Influences of early child nutritional status and home learning environment on child development in Vietnam*	Cross-sectional study analyzing the influence of nutritional status and home learning environment on child development.	Good nutrition and a supportive home learning environment were associated with better cognitive and language development.
20	[28] *Pengaruh Pemberian Media Stimulasi Fine Motor Activity Book Terhadap Perkembangan Motorik Halus Balita Stunting*	Quasi-experimental study. Intervention using a fine motor activity book as a stimulation medium for stunted toddlers.	Significant improvement in fine motor development was observed after the stimulation intervention.
21	[5] *The Effect of Education Giving on the Parent's Behavior About Growth Stimulation in Children with Stunting*	Quasi-experimental pretest-posttest design. Educational intervention provided to parents about child growth stimulation	Parents' behavior in stimulating their children improved after the educational program.
22	[4] *Pengaruh Stimulasi Psikososial Anak terhadap Perkembangan Motorik Kasar dan Motorik Halus serta Peningkatan Berat Badan Anak Balita Stunting Usia 2-3 Tahun*	Quasi-experimental pretest-posttest design. Educational intervention provided to parents about child growth stimulation.	Parents' behavior in stimulating their children improved after the educational program.
23	[6] *Stimulasi Perkembangan Bahasa Anak Usia Dini dengan Riwayat Stunting*	Kuasi eksperimen. Intervensi stimulasi bahasa melalui bermain, membaca bersama, bernyanyi, dan permainan kata	Terjadi peningkatan kosakata hingga 70% dalam 4 minggu pada anak dengan riwayat stunting

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3.1.3. Identified Implementation Strategies

Across the 23 included studies, a variety of educational approaches were implemented to stimulate motor and language development in children with stunting. The most commonly employed strategies included parental education**,** structured play-based learning**,** home visits**,** use of culturally relevant educational media, and Montessori-based methods. Interventions were often delivered through community health workers, early childhood educators, or directly by trained parents. Several studies integrated these approaches into existing community-based nutrition or child development programs, ensuring greater acceptance and sustainability. In some contexts, group sessions were used to facilitate peer learning among parents, while others employed individual coaching during home visits. Digital tools and printed materials were also utilized to reinforce key messages.

3.1.4. Reported Outcomes and Impact

The majority of studies reported positive developmental outcomes following the implementation of educational interventions. These included significant improvements in:

a. Gross and fine motor development
b. Expressive and receptive language skills
c. Cognitive abilities
d. Parent-child interaction quality

Quantitative assessments using standardized tools such as the Bayley Scales, Denver Developmental Screening Test, and Ages and Stages Questionnaires showed statistically significant differences in developmental scores between intervention and control groups. In qualitative studies, caregivers reported greater confidence in providing stimulation and improved understanding of child development needs.

3.1.5. Barriers to Implementation

Several challenges were reported that limited the effectiveness or scalability of interventions:

a. Low parental literacy and educational background, reducing comprehension of materials
b. Time constraints among caregivers, especially in low-income households
c. Cultural beliefs that undervalue early stimulation
d. Limited access to trained facilitators or developmental screening tools
e. Inconsistent follow-up due to lack of transportation or remote geographical locations

These barriers highlight the importance of tailoring educational content to the sociocultural and logistical context of each community.

3.1.6. Facilitators of Successful Implementation

Key enablers of effective implementation identified across the studies included:

a. Active involvement of parents or caregivers throughout the intervention
b. Use of simple, culturally appropriate tools and materials
c. Support from community health workers or educators
d. Integration into existing health or early childhood programs
e. Ongoing supervision and refresher training for program facilitators

Studies that provided repeated exposure and practical demonstrations, particularly during home visits, tended to report higher compliance and developmental gains.

3.1.7. Research Gaps and Future Directions

Despite promising findings, several gaps remain. There is a limited number of longitudinal studies assessing the long-term effects of educational stimulation in stunted children. Additionally, the Montessori approach, while referenced in some studies, remains under-investigated in low-resource settings.

Few studies examined the cost-effectiveness or scalability of interventions, which is crucial for policy adoption. There is also a need for more research in diverse sociocultural contexts, especially in rural and indigenous populations. Future research should prioritize:

a. Well-designed RCTs with larger sample sizes
b. Culturally tailored interventions
c. Integration of nutritional and educational strategies
d. Use of digital technology to expand access and engagement

3.1.8. Main Findings

This systematic review identified consistent evidence that educational approaches play a crucial role in supporting the motor and language development of stunted children. Across diverse settings and study designs, interventions that actively engaged caregivers, especially mothers, through structured stimulation**,** parental education, and contextualized play-based learning demonstrated notable improvements in gross motor skills, fine motor coordination, expressive language, and receptive communication.

The integration of educational interventions into community-based programs**,** combined with culturally appropriate delivery methods, was key to enhancing both uptake and effectiveness. Furthermore, home visit strategies and the use of simplified educational media empowered caregivers to participate more actively in child development practices. While these findings emphasize the potential of educational strategies, the review also highlighted implementation challenges such as caregiver literacy limitations, time constraints, and logistical barriers in rural or low-resource areas. Nevertheless, the presence of committed facilitators, ongoing support systems, and localized materials were found to significantly facilitate successful outcomes. In summary, the findings confirm that education-centered interventions, particularly those adapted to local needs and involving parental participation, are among the most effective strategies to stimulate early development in stunted children. These approaches offer a promising pathway to complement nutrition-focused efforts in addressing the broader developmental consequences of stunting.

3.2. Discussion

3.2.1. Types of Educational Approaches

Educational approaches are a crucial component in interventions aimed at stimulating the development of stunted children. This systematic review identifies that most studies employed educational strategies targeting parents, caregivers, or through community health workers. The forms of these approaches vary, including home visits, direct training, online education, and learning methods such as Montessori. Several studies in this review highlight the importance of parental involvement in children's developmental education. [19] Conducted an online educational intervention for mothers and showed a significant increase in their knowledge and attitudes towards stimulation for stunted toddlers. [15] also found that an educational approach through home visits had a positive impact on child development outcomes and strengthened the mother's role. [5] added that face-to-face educational interventions for parents contributed to behavioral changes in providing growth stimulation.

The effectiveness of this approach is in line with the findings of [29] who evaluated a home visit program by health cadres in Zambia and found significant improvements in child development scores, especially in cognitive and gross motor domains. Similar support comes from a meta-analysis of 21 parenting intervention studies by [30], which showed that parental education had a moderate to large effect on cognitive and socio-emotional development in children from low- and middle-income countries. In addition to educating parents, structured learning approaches are also used. [14] implemented the Montessori method to enhance gross motor skills in children aged 3–5 years, with results showing significant improvements compared to the control group. While some studies did not explicitly mention Montessori, several in this SLR applied family-based play activities as forms of stimulation, such as [7] in Ethiopia.

External evidence supports the effectiveness of the Montessori method, as demonstrated by [31] in a longitudinal study of school-aged children who attended Montessori education. These children showed higher scores in social, executive, and language skills compared to those in public schools. Furthermore, [33] in their review concluded that Montessori education supports children’s motor and cognitive development more naturally and independently than traditional approaches. Some studies in this review integrated stimulation education with other programs such as nutrition and sanitation education. [32] in Uganda implemented an integrated approach combining developmental stimulation education with child feeding training and hygiene practices. The results showed improvements in child development scores, particularly in cognitive and fine motor domains. This approach is supported by findings from [12], which showed that the combination of nutrition education and stimulation improved motor, language, and cognitive development in young children in Tanzania. Similarly, [26] in a global review on parenting and early childhood development, stated that combined interventions of stimulation, nutrition, and parental education had the greatest impact on stunted children.

Overall, this review shows that educational approaches to improve motor and language development in stunted children are implemented through various strategies: parental education, involvement of health cadres, application of the Montessori method, and integration with nutrition and hygiene education. These approaches have

been proven to enhance child development outcomes across gross motor, fine motor, cognitive, and language domains, particularly when implemented intensively and in context-specific settings.

3.2.2. Media and Stimulation Strategies

Media and stimulation strategies are essential components of educational approaches supporting the development of stunted children. This review found that the media used in various interventions were diverse, ranging from simple tools such as fine motor activity books and traditional games to informal stimulation practices carried out at home. These strategies are not only affordable and accessible but also highly effective in developing children's motor and language skills. In a study conducted by [28], the use of a Fine Motor Activity Book significantly improved fine motor skills in stunted toddlers. The book was designed to train finger and hand movements through activities such as tracing, beading, and pattern arrangement. The success of this intervention shows that simple, structured printed media can be an effective tool for parents or health cadres to conduct independent stimulation at home. Another common approach found in the literature is the use of sensory and traditional games. For example, [15] combined nutritional education with sensory stimulation through home visits. Games such as block stacking, playing with sand, and light physical activities were regularly used to encourage both gross and fine motor development. The success of this program emphasizes that simple but consistent household-based interventions can produce significant results, especially when directly assisted by health workers or cadres.

In addition, informal stimulation strategies by families, such as reading books, singing, and playing together, have proven to be highly effective in supporting child development. Studies by [21] and [20] found that daily routines carried out consistently by parents are positively correlated with improved language and socio-emotional development in children experiencing stunting. These strategies also form the foundation for interventions in various early childhood parenting programs, as they emphasize the importance of emotional connection and direct involvement between parents and children. The findings from these articles align with global research results. [33] in a study conducted across five low- and middle-income countries, found that parental involvement in activities such as reading, singing, and playing together significantly enhanced children’s motor, language, literacy, and executive function development. Interventions that promote regular home-based stimulation have been shown to have a lasting impact on child development, even among populations with limited resources.

Similarly, a study by [30] in Kenya and Zambia showed that maternal stimulation—including storytelling and active conversations with children, is strongly associated with higher cognitive and motor development scores in early childhood. This research reinforces that family-based stimulation strategies are key elements in supporting child growth and development, especially in regions affected by stunting. In addition to conventional approaches, the use of technology-based educational media, such as educational animations, has also shown positive potential.[34]) found that the use of interactive animation can enhance children’s verbal expressive abilities when accompanied by responsive parental interaction. Although this approach has not yet been widely implemented in studies in Indonesia, it holds promising potential for the future, particularly in urban areas with sufficient access to technology.

Thus, it can be concluded that the most effective media and stimulation strategies for stunted children are those that:

a. Are accessible and contextually appropriate (e.g., traditional games or print media);
b. Encourage active parental involvement in enjoyable activities;
c. Are implemented routinely and sustainably in the child's daily life;
d. Can be integrated with educational technology when available.

This approach demonstrates that the success of educational interventions does not necessarily depend on technological sophistication, but rather on the consistency of practice and the quality of interactions between the child and their supportive environment.

3.2.3. Impact on Motor and Language Development in Stunted Children

Educational approaches applied to stimulate children with stunting have a tangible impact on developmental aspects, particularly in motor and language domains. Various studies in this review indicate that approaches involving family participation, targeted stimulation media, and interactive strategies can enhance children’s communication, mobility, and social interaction skills. From the synthesis of extracted articles, several interventions showed positive effects on gross and fine motor development. For instance, [28] reported significant improvement in fine motor skills among stunted toddlers after using a *Fine Motor Activity Book* over several weeks. This media

in fine motor skills among stunted toddlers after using a *Fine Motor Activity Book* over several weeks. This media engaged children in activities like tracing, cutting, and assembling shapes, utilizing simple tools that parents could easily use at home.

Likewise, [15] in an intervention combining nutrition education and sensory stimulation through home visits, showed positive outcomes in children's gross motor coordination. Activities such as playing ball, walking on a line, or stringing beads not only enhanced muscle strength but also trained balance and coordination in stunted children. Other studies by [21] and [22] highlighted improvements in children's language abilities following home-based stimulation. Activities that involved two-way communication between parents and children such as storytelling, singing, and daily conversations, were shown to improve both expressive and receptive language skills while strengthening socio-emotional family bonds.

The effectiveness of these educational approaches is also supported by external evidence. [35] in the *Lancet Early Childhood Development* series, stated that early family-based stimulation interventions can improve child developmental outcomes by up to 0.5 standard deviations, particularly in language and motor domains. This underscores the importance of parents as primary educators in the home environment. Furthermore, [30] in a global systematic review involving studies from over 20 low- and middle-income countries, found that family-based stimulation programs and parenting education significantly contributed to improved child development scores in language, cognitive, and motor areas.

Findings from [26] also supported the notion that malnutrition and low home stimulation are associated with delays in motor and communication development in children in Tanzania. Interventions that employed structured educational approaches and actively involved mothers contributed to improved child developmental functioning. From this review, it can be concluded that participatory, contextual, and home-based educational approaches have a significant impact on improving motor and language development in stunted children. Programs that actively involve parents in daily activities—such as playing, reading, or using simple educational media—have proven effective and can be applied across various socioeconomic settings. Evidence from international studies also supports the idea that consistent, even simple, early stimulation can reduce developmental delays caused by stunting.

4. STRENGTHS AND LIMITATIONS

This SLR has strengths in its methodology, which follows the PRISMA 2020 guidelines, clear inclusion–exclusion criteria, wide database coverage, and a variety of study designs analyzed, providing a comprehensive picture from both local and global contexts. The thematic analysis also identifies factors that contribute to success and barriers to implementation, making it practically useful. However, its limitations include the absence of quantitative meta-analysis, heterogeneity in study designs and measurement tools that restrict direct comparison of results, the scarcity of long-term studies, potential publication bias due to access limitations, and the lack of cost and scalability analysis as well as specific evidence on the Montessori method in resource-limited settings.

5. CONCLUSION

This systematic review shows that educational approaches play a significant role in supporting the stimulation of motor and language development in children with a history of stunting. From the synthesis of 23 primary research articles, the following findings were identified:

a. The forms of educational approaches used are highly diverse, ranging from informal family-based education, home visits by health cadres, playgroup activities, to the use of print and traditional media adapted to the local context.
b. The media and stimulation strategies applied include activity books, sensory play, verbal stimulation through conversation and storytelling, as well as daily interactions between parents and children. These strategies have been proven to significantly enhance fine motor skills, gross motor skills, and language abilities, especially when implemented consistently and responsively.

   The positive impact of educational approaches is evident in improvements in child development, both in motor coordination and in expressive and receptive language abilities. Approaches that are participatory, actively involve families, and are home-based show the highest effectiveness in addressing developmental delays in children with stunting.

This review is further supported by evidence from global literature, which affirms that structured educational interventions based on family stimulation can help close the developmental gap caused by stunting, particularly in low- and middle-income countries. Therefore, educational interventions that involve the roles of parents and

communities should become a key pillar in programs aimed at preventing and mitigating the long-term impacts of stunting on child development.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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