Contextual Determinants of Stunting in Indonesia: A Systematic Review of Nutritional Interventions and Antenatal Care

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Abstract: *Background*: Stunting is a significant global health issue, especially in Indonesia, where long-term malnutrition adversely affects children's growth and development, with prevalence rates still exceeding the WHO's recommended threshold. This study examines the contextual factors that influence the effectiveness of nutritional interventions and antenatal care (ANC) in combating stunting in Indonesia.

Methods: A systematic review was conducted by the PRISMA guidelines. A comprehensive search across five major academic databases (Google Scholar, PubMed, ScienceDirect, Embase, and ProQuest) identified 3,690 articles. After a rigorous screening process, 13 studies published between 2019 and 2023 were included in the analysis, focusing on key contextual factors that impact stunting interventions in Indonesia. The quality appraisal utilized Joanna Briggs Institute checklists for analytical cross-sectional studies, cohort studies, quasi-experimental studies, qualitative research, systematic reviews, case reports, and text and opinion papers, each matched to the respective study design.

Findings: The review identified four critical contextual factors shaping stunting interventions: (1) socioeconomic status, particularly household income and education, which significantly influence access to healthcare and nutrition; (2) cultural beliefs, including food taboos and misconceptions, which hinder optimal nutritional practices; (3) geographical disparities, with rural populations experiencing higher stunting rates due to limited access to healthcare and resources; and (4) government policies, highlighting the importance of strong political commitment, multisectoral collaboration, and localized programs.

Conclusion: Nutritional interventions and ANC are more effective in reducing stunting among Indonesian children when tailored to local socioeconomic, cultural, and geographical contexts. These findings highlight the need for targeted, context-specific strategies to improve child growth outcomes in vulnerable populations.

Keywords: Stunting, Nutritional interventions, Antenatal care, Contextual factors, Indonesia.

INTRODUCTION

Stunting is a major global health issue characterized by impaired growth and development in children, primarily resulting from prolonged malnutrition [1]. According to the World Health Organization (WHO), approximately 149.2 million children under the age of five were stunted in 2020. By 2021, an estimated 151 million children worldwide were affected, with the highest prevalence recorded in low- and middle-income countries, where stunting impacts 22.2% of children [2]. Asia bears the most significant burden of stunting, with 83.8 million children affected, particularly in Southeast and South Asia [3].

In Indonesia, addressing stunting remains a significant challenge. Although the prevalence of stunting in Indonesia has declined by 9.63% over the past five years, from 30.8% in 2018 to 21.5% in 2023 [4], it remains above the WHO-recommended threshold. UNICEF/WHO and The World Bank have noted that Indonesia has underperformed in reducing stunting compared to other upper-middle-income and regional countries [5]. The persistently high prevalence hinders children's physical and cognitive development, posing a significant threat to the nation's future productivity. Projections indicate that Indonesia's future workforce productivity could be reduced to only half of its potential due to stunting [3]. Addressing stunting has been a top priority for the Indonesian government, as reflected in the National Medium-Term Development Plans for 2015–2019 and 2020–2024 [6, 7]. The government has set an ambitious target to reduce the prevalence of stunting to 14% by 2024, as outlined in Presidential Decree No. 72/2021, which emphasizes the acceleration of efforts to combat stunting.

Stunting primarily results from chronic malnutrition during the first 1,000 days of life, a critical window for a child's growth and brain development. Interventions during this period are crucial, as height at two to three years of age serves as a critical predictor of long-term health and productivity [8, 9]. Addressing stunting requires a multifaceted approach that integrates nutritional interventions and antenatal care (ANC).

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Nutritional interventions aim to ensure that mothers and children receive adequate nutrition during this critical period. These strategies include micronutrient supplementation, promoting dietary diversity, and improving food security for vulnerable populations [10]. Research shows that maternal nutrition during pregnancy has a direct impact on healthier birth outcomes and better long-term health for children [11, 12]. ANC plays a vital role in providing comprehensive maternal health services during pregnancy [13]. These include regular health check-ups, monitoring maternal and fetal health, and offering education on nutrition and breastfeeding practices. Findings from India indicate that effective ANC programs integrate essential health services, such as vaccinations and mental health support, to ensure comprehensive care for mothers and their babies [14]. Evidence also suggests that combining nutritional counseling with ANC significantly reduces the likelihood of giving birth to underweight or stunted children [15].

However, the effectiveness of these interventions varies across populations due to contextual factors that influence their implementation and outcomes in Indonesia. Socioeconomic status, encompassing household income and parental education, plays a crucial role in determining access to nutritional resources and the quality of antenatal care. Families with higher incomes are more likely to engage in health-seeking behaviors and achieve better health outcomes [16-19]. Cultural beliefs and practices also shape dietary habits and health-seeking behaviors, often acting as barriers to the adoption of recommended nutritional practices [19]. Additionally, geographical disparities exacerbate these challenges. Urban areas typically have better access to healthcare facilities and resources, whereas rural regions often lack sufficient infrastructure and services [18, 20, 21]. Government policies and programs play a crucial role in addressing these disparities. Policies that prioritize nutrition and healthcare access enhance the implementation and effectiveness of interventions aimed at reducing stunting [22].

Although these studies provide valuable insights, they are often limited to local contexts and lack broader perspectives or conclusions that researchers can generalize to larger populations. To date, no research has comprehensively examined this issue using a Systematic Literature Review (SLR) approach. This method offers the advantage of synthesizing diverse findings to provide a more thorough understanding of the contextual influences on nutritional interventions and ANC for stunting in Indonesia. By addressing these contextual factors and employing an SLR approach, this review aims to provide actionable insights that can inform policies and strategies tailored to the unique needs of Indonesian communities. These targeted efforts are crucial for enhancing maternal and child health outcomes and combating stunting more effectively.

MATERIALS AND METHODS

This systematic review aims to synthesize and evaluate existing literature on the contextual factors influencing the effectiveness of nutritional interventions and ANC in combating stunting in Indonesia. The review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure a comprehensive, transparent, and rigorous methodology [23]. Two primary research questions guide this review:

1. What are the critical contextual factors influencing the effectiveness of nutritional interventions and ANC in addressing stunting in Indonesia?

2. How do socioeconomic, cultural, geographical, and policy-related factors impact the implementation and outcomes of these interventions?

The inclusion and exclusion criteria are designed to refine the selection of relevant studies. Only articles published in peer-reviewed journals within the last five years (2018–2023) are included, ensuring that the review reflects the most current advancements in public health and nutrition. This timeframe is crucial for capturing recent trends and strategies in addressing stunting, given the rapidly evolving nature of these fields. Articles written in English or Indonesian are included to maximize accessibility and relevance for a broader audience. Eligible studies must focus on the effectiveness of nutritional interventions and ANC in addressing stunting, maternal health, or child growth outcomes. Studies that do not directly address these themes or are published in non-peer-reviewed journals are excluded from consideration.

Search Strategy and Scope

A comprehensive literature search will be conducted across multiple academic databases, including Google Scholar, PubMed, ScienceDirect, Embase, and ProQuest. The search strategy will incorporate a

combination of keywords and Medical Subject Headings (MeSH) terms such as “stunting,” “nutritional interventions,” “antenatal care,” “contextual factors,” and “Indonesia.”

The search will be structured to investigate specific contextual factors as follows:

1. Socioeconomic Factors: Keywords such as “socioeconomic status,” “income level,” “education,” and “occupation” will be combined with terms like “nutritional interventions,” “antenatal care,” or “maternal healthcare” in the context of Indonesia.

2. Cultural Influences: Keywords such as “cultural beliefs,” “local traditions,” “taboos,” and “practices” will be paired with terms like “dietary choices,” “health-seeking behaviors,” “stunting,” or “malnutrition” to explore cultural impacts.

3. Geographical Factors: The search will include terms such as “rural,” “urban,” “healthcare access,” and “resource availability” to analyze geographical disparities.

4. Government Policies: Keywords such as “government policies,” “national programs,” “maternal and child health policies,” and “social protection schemes” will be used to examine the influence of policy initiatives.

To ensure comprehensive coverage, keywords for articles published in Indonesian will be translated appropriately. The full electronic search strategy for all databases is documented in Appendix A, ensuring reproducibility and transparency in study identification.

Data Extraction and Analysis

Relevant studies will be reviewed, and essential data will be extracted using a standardized data extraction form. The extracted information will include the author(s), year of publication, study design, methodology, sample size, population characteristics, contextual factors examined, outcomes related to nutritional interventions and ANC, and the key findings and conclusions. The data extraction process will be performed collaboratively by two reviewers, KS and EK, to ensure accuracy and consistency. Any discrepancies will be resolved through discussion and consensus. To maintain methodological rigor, study selection, and data extraction were independently conducted by two reviewers. The inter-rater agreement was assessed using Cohen's kappa, with substantial agreement achieved for both title/abstract screening ($\kappa = 0.77$) and full-text review ($\kappa = 0.71$) [24]. Any disagreements were resolved through discussion and consensus without the need for a third-party review. This process enhances the objectivity and reproducibility of the systematic review. All included studies underwent critical quality appraisal using the relevant Joanna Briggs Institute (JBI) critical appraisal tools, matched to the specific study design of each paper. The JBI checklist for analytical cross-sectional studies was applied to cross-sectional surveys and studies; the checklist for cohort studies was used for longitudinal research; the checklist for quasi-experimental studies was applied to quasi-experimental designs; the checklist for qualitative research was used for qualitative studies; the checklist for systematic reviews and research syntheses was used for systematic reviews; the checklist for case reports was applied to case studies; and the checklist for text and opinion papers was used for narrative reviews. Quality assessment was conducted independently by KS and EK, followed by a discussion to reach a consensus on the final ratings. The findings will be synthesized narratively to provide a clear interpretation of the results and their implications. This narrative synthesis will highlight key insights into the contextual factors influencing stunting reduction efforts in Indonesia, offering a deeper understanding of the effectiveness of nutritional interventions and ANC within varying socioeconomic, cultural, geographical, and policy contexts.

RESULTS

The systematic literature review employed a comprehensive search strategy across five major databases: Google Scholar, PubMed, ScienceDirect, Embase, and ProQuest. The initial search yielded 3,690 articles. After removing 890 duplicates, 2,800 articles remained for screening. During the abstract screening stage, 2,645 articles were excluded because they did not meet the predefined inclusion criteria, which focused on contextual factors influencing nutritional interventions and antenatal care (ANC) in addressing stunting in Indonesia. This process left 155 articles for detailed full-text review. Of these, 142 were excluded due to irrelevance or noncompliance with the inclusion criteria. Ultimately, 13 studies—representing approximately 12% of the screened articles—were included in the final analysis. This rigorous selection process ensured that all included articles were of high quality and directly relevant to the research objectives.

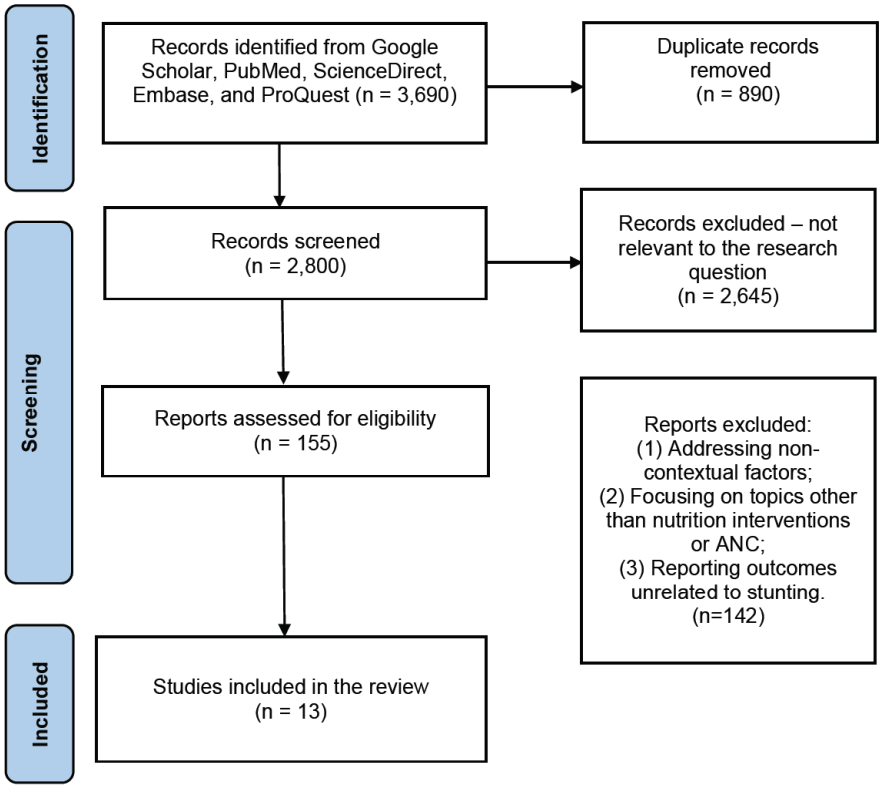

Figure 1: PRISMA Flow Chart.

Figure **1** provides a detailed depiction of the flow of articles through the various stages of the review process, from initial retrieval to final inclusion.

The systematic mapping of research on nutritional interventions and ANC for stunting in Indonesia provides a comprehensive understanding of the issue, categorized by year of publication, research methodologies, and contextual factors influencing stunting. As summarized in Table **1**, studies published between 2019 and 2023 demonstrate a growing interest in addressing stunting. Early research, such as Papers 2 and 4, primarily focused on the prevalence of stunting and the influence of socioeconomic and geographical factors [25, 26]. In contrast, more recent studies, such as those in Papers 3 and 5, have shifted their focus to the impact of government policies and broader health interventions [27, 28]. This progression highlights the growing recognition of the complex, multidimensional nature of stunting and the need to adopt context-specific, comprehensive strategies.

The included studies employ a range of research methodologies, including qualitative narrative reviews, cross-sectional surveys, systematic reviews, meta-analyses, and case studies. For example, qualitative studies such as those by Paper 1 and Paper 12 explore community perspectives, cultural beliefs, and barriers to implementing nutritional interventions, providing valuable insights into local challenges and cultural dynamics [29, 30]. Cross-sectional studies, such as those conducted by Paper 2 and Paper 3, present data on stunting prevalence and identify associated risk factors, particularly among children under two years of age and multiparous mothers [25, 27]. Meanwhile, systematic reviews and meta-analyses, such as those by Paper 5 and Paper 6, highlight effective stunting reduction programs that incorporate local adaptations and multisectoral collaborations, emphasizing the importance of coordinated and integrated approaches [28,31].

The findings from these studies collectively highlight four critical contextual factors that significantly influence the effectiveness of nutritional interventions and ANC:

1. Socioeconomic Factors

Socioeconomic status is a significant determinant of families' access to nutritional resources and quality healthcare. Paper 2 reports that children from low-income families, particularly in Eastern Indonesia, face significantly higher rates of stunting [25]. Similarly, Paper 4 notes that economic growth and improved

health service coverage help reduce inequalities in stunting prevalence [26].

2. Cultural Beliefs and Practices

Cultural beliefs and practices strongly shape dietary choices and health-seeking behaviors. Paper 12 found that misconceptions about hereditary stunting diminish parental concern for children's nutrition [30]. Additionally, Paper 9 underscores that cultural food taboos and restrictive breastfeeding practices prevent mothers from providing adequate nutrition for their children [32].

3. Geographical Disparities

Geographical differences have a pronounced impact on access to healthcare and nutritional resources. Rural areas, especially in Eastern Indonesia, experience higher rates of stunting compared to urban regions, mainly due to limited infrastructure and healthcare services [25]. Paper 4

Table 1: Study Characteristics of Included Studies

Author(s) /Year	Study Design	Population/ Sample	Contextual Factor	Outcome	Key-Finding(s)
Zaleha & Idris (2022) – Paper 1	Systematic Review	13 articles	Socioeconomic, Geographical, Policy	Implementation of stunting programs	Nutrition programs are hindered by low socioeconomic status, geographic limitations, and ineffective budgeting policies.
Titaley *et al*. (2019) – Paper 2	Cross-sectional survey	Women with children under 2 (n=24,657)	Socioeconomic, Geographical	Prevalence of Stunting	33.7% stunting prevalence, higher in Eastern Indonesia regions.
Hasanalita (2023) – Paper 3	Cross-sectional study	Multiparous pregnant women (n=32)	Socioeconomic	Incidence of stunting in toddlers	56% of mothers not consuming Fe tablets experienced stunting in their children.
Rizal and van Doorslaer (2019) – Paper 4	Longitudinal study	8,970 children (0-59 months)	Socioeconomic, Geographical	Prevalence of Stunting	Reduced stunting rates from 35.4% to 34.2%, driven by reduced socioeconomic inequality.
Wahyuningsih *et al*. (2022) – Paper 5	Systematic Review	22 articles	Socioeconomic, Geographical, Policy	Program Effectiveness	Programs like the CARING Trial significantly reduced stunting.
Arbie and Labatjo (2019) – Paper 6	Narrative Review (Qualitative)	6 articles	Socioeconomic, Policy	Impact of interventions	Nutritional interventions and sanitation improvements effectively reduced stunting.
Fristiwi *et al*. (2023) – Paper 7	Systematic Review	15 articles	Socioeconomic, Sanitation, Policy	Program Effectiveness	Maternal education about nutrition effectively prevents stunting.
Rahmawati *et al*. (2020) – Paper 8	Cross-sectional	100 toddlers (24-59 months)	Socioeconomic, Geographical	Prevalence of Stunting	Maternal education and use of community health services positively impacted stunting outcomes.
Apulina Ginting *et al*. (2023) – Paper 9	Systematic Review (Quantitative Focus)	10 articles	Cultural beliefs, Socioeconomic, Geographical	Stunting prevalence	Cultural beliefs and maternal knowledge about nutrition significantly influence stunting outcomes.
Permatasari *et al*. (2021) – Paper 10	Quasi-experimental	194 pregnant women	Socioeconomic, Cultural, Policy	Improved Knowledge	Educational interventions significantly improved nutritional knowledge and practices among pregnant women.
Wiliyanarti *et al*. (2022) – Paper 11	Cross-sectional	120 mothers	Socioeconomic, Cultural	Maternal Knowledge	Family support and maternal knowledge were critical in fulfilling children's nutritional needs.
Diana *et al*. (2022) – Paper 12	Qualitative Study	61 informants, family members	Cultural beliefs	Nutritional Status	Cultural perceptions of stunting and dietary habits influenced child nutrition.
Erlyn *et al*. (2021) – Paper 13	Case Study	Secondary data (Palembang City Health Office)	Policy	SWOT analysis	Lack of coordination between agencies and low community motivation hinder stunting interventions.

emphasizes the importance of enhancing healthcare access and infrastructure in rural areas to address these disparities effectively [26].

4. Government Policies

Government policies play a crucial role in the success of nutritional interventions. Paper 5 emphasizes the role of adaptive local policies and multisectoral collaboration in reducing the prevalence of stunting [28]. Furthermore, Paper 10 demonstrates that nutrition education programs significantly enhance maternal knowledge and practices, thereby reducing the risk of stunting [10].

This mapping of studies underscores the interconnected influence of socioeconomic, cultural, geographical, and policy-related factors in addressing stunting in Indonesia. It highlights the need for tailored, context-specific interventions that account for these diverse influences to achieve sustainable improvements in maternal and child health outcomes.

All studies included in this systematic review underwent critical quality appraisal using the relevant JBI tools for their respective study designs. The assessment revealed considerable variation in methodological rigor across the evidence base. Several studies, such as those by Papers 2, 4, and 10, demonstrated exemplary methodological standards, reflected in high scores for clear eligibility criteria, valid and reliable measurement of exposures and outcomes, comprehensive confounder management, and robust statistical analyses [10, 24, 25]. These studies serve as the core references for the main findings and recommendations of this review.

Conversely, several studies received moderate to low-quality scores. Works by Papers 3, 7, 9, 10, and 13 exhibited methodological limitations, including

Table 2: Quality Appraisal of Included Studies

Paper	Design	Score	Main Remarks
Zaleha & Idris (2022) – Paper 1	Systematic Review	7/11	No explicit quality appraisal, independent reviewers not mentioned, publication bias not discussed
Titaley *et al*. (2019) – Paper 2	Cross-sectional survey	8/8	Excellent methodology, appropriate statistical analysis, clear confounder management
Hasanalita (2023) – Paper 3	Cross-sectional study	4/8	Instrument validity unclear, no explicit standard for outcome measurement, confounders not managed
Rizal and van Doorslaer (2019) – Paper 4	Cohort (Longitudinal)	10/11	Strong longitudinal methodology, robust measures, rigorous confounder management, minor issue of outcome at baseline
Wahyuningsih *et al*. (2022) – Paper 5	Systematic Review	8/11	Good clarity of methods, explicit use of JBI appraisal, lacks explicit reviewer independence, no discussion on publication bias
Arbie and Labatjo (2019) – Paper 6	Narrative Review (Qualitative)	6/10	Labeled as meta-analysis, but lacks quantitative synthesis; no coding explanation, researcher reflexivity, or ethics statement. Mostly narrative synthesis.
Fristiwi *et al*. (2023) – Paper 7	Systematic Review	6/11	Quality appraisal not detailed, risk of bias and publication bias not addressed, no reviewer blinding
Rahmawati *et al*. (2020) – Paper 8	Cross-sectional	7/8	Clear objectives and sampling, exposure and outcomes well defined. No mention of confounder control.
Apulina Ginting *et al*. (2023) – Paper 9	Systematic Review (Quantitative Focus)	6/11	Labeled as systematic review, but lacks detailed quality appraisal, independent review, and publication bias discussion. No clear synthesis method (e.g., meta-analysis or thematic synthesis) is presented. Inclusion/exclusion criteria are defined, but screening and data extraction methods are insufficiently explained.
Permatasari *et al*. (2021) – Paper 10	Quasi-experimental	9/9	Well-designed quasi-experimental study with clear sampling, validated instruments, and appropriate statistical analysis.
Wiliyanarti *et al*. (2022) – Paper 11	Cross-sectional	5/8	Instrument validity and variable definitions are insufficiently described. There's no mention of confounder mitigation or detailed explanation of bias.
Diana *et al*. (2022) – Paper 12	Qualitative Study	7/10	Clear qualitative design with triangulation and strong ethical reporting. Lacks detail on reflexivity, coding process, and researcher-participant relationships.
Erlyn *et al*. (2021) – Paper 13	Case Study	6/10	Clear program mapping and context using secondary data and SWOT. Lacks coding detail, reflexivity, ethics, and rigorous analysis explanation.

insufficient detail on instrument validation, a lack of standardized outcome measures, minimal or absent management of confounding factors, and incomplete or non-transparent reporting of synthesis and quality appraisal processes [26, 33-35]. The decision to retain these lower-quality studies in the review was driven by the limited availability of high-quality, contextually relevant evidence on stunting interventions in Indonesia. Excluding these studies would risk narrowing the analytical perspective and omitting valuable context, particularly in subtopics where the literature is still in its early stages of development.

To address potential bias, methodological weaknesses were flagged in the results table and discussed within the narrative synthesis. Findings from these sources were interpreted with caution and were not used as the primary basis for policy recommendations or overarching conclusions. Sensitivity analyses, conducted where feasible, demonstrated no substantial alteration of the principal findings with the inclusion or exclusion of lower-scoring studies. Analytic priority was maintained with higher-quality evidence, while inclusivity was ensured to provide comprehensive coverage in a setting with limited research. The findings provide an up-to-date synthesis of current knowledge and simultaneously highlight the urgent need for methodologically rigorous studies to advance the evidence base on stunting interventions in Indonesia. Table **2** presents the methodological appraisal scores, and key limitations of all included studies, offering transparency regarding the relative strength and reliability of each source included in the synthesis.

DISCUSSION

This study provides a comprehensive analysis of the contextual factors influencing the effectiveness of nutritional interventions and ANC in addressing stunting in Indonesia. Key factors identified include socioeconomic status, cultural beliefs, geographical disparities, and government policies, all of which significantly shape the outcomes of these interventions. The findings underscore the importance of adopting multidimensional, locally tailored approaches and fostering cross-sectoral collaboration to ensure the success of programs aimed at preventing stunting.

Socioeconomic status plays a crucial role in determining the prevalence of stunting and the effectiveness of interventions. Household wealth, education level, and access to healthcare services are critical determinants of child health outcomes. Paper 4 demonstrates that economic growth and poverty reduction are essential for lowering stunting rates [25], identifying household wealth and maternal education as the most significant contributors to reducing socioeconomic inequalities in stunting. Improved access to resources, education, and healthcare has a positive impact on child growth outcomes. Similarly, Paper 2 reports a strong correlation between low household income and higher stunting rates, particularly in economically disadvantaged regions such as Eastern Indonesia [25]. These findings align with the Social Determinants of Health Theory, which posits that income and education directly influence health outcomes by shaping access to essential healthcare and nutritional resources [36]. Addressing these disparities is vital to reducing stunting prevalence across diverse regions in Indonesia.

Cultural beliefs and practices have a significant influence on stunting outcomes. Studies by Papers 11 and 13 highlight the importance of family support, particularly from husbands, in making nutritional decisions for children [37, 38]. Family involvement is crucial to meeting children's nutritional needs; however, traditional beliefs and cultural practices often hinder the adoption of effective nutritional practices. For example, Paper 9 identifies food taboos and misconceptions about nutrition during pregnancy and early childhood as significant barriers to effective stunting prevention [32]. Common taboos, such as avoiding squid, shrimp, crab, moringa leaves, and banana flowers, are believed to cause childbirth complications or undesirable traits in children. Adherence to these taboos can lead to protein deficiencies in pregnant women, adversely affecting maternal health, breast milk production, and, ultimately, child nutrition. Paper 12 found that the perception of stunting as a hereditary condition diminishes parents' concern for addressing it as a health issue [30]. This finding is consistent with the Cultural Health Belief Model, which emphasizes that health behaviors are shaped by cultural norms and practices [40]. These insights underscore the importance of incorporating culturally sensitive approaches into stunting prevention programs to address local misconceptions about health and nutrition. Such approaches help ensure that interventions are more acceptable and effective within communities.

Geographical disparities between urban and rural areas are a significant factor influencing stunting outcomes in Indonesia. Paper 2 reports that children in rural and remote regions, particularly in Eastern

Indonesia, face significantly higher stunting rates compared to those in urban areas [25]. This disparity is attributed to limited access to healthcare services, inadequate infrastructure, and economic disadvantages in rural areas. Paper 4 emphasizes that geographical location has a substantial impact on health outcomes, particularly in remote areas with scarce healthcare facilities and limited nutritional resources [26]. These findings are consistent with those of Field & Briggs, who identified geographical location as a critical determinant of access to healthcare and social services [41]. Global research indicates that pregnant women who receive ANC services at least four times during pregnancy can reduce the risk of stunting in children by 19–28% [42]. Addressing these geographical disparities is essential for lowering stunting prevalence in underserved areas. Targeted efforts to improve healthcare access, infrastructure, and resource availability in rural regions are crucial for achieving better health outcomes among vulnerable populations.

Government policies and programs play a crucial role in stunting prevention. Paper 5 emphasizes the importance of strong political commitment, multisectoral collaboration, and localized adaptations in designing effective stunting interventions [28]. These findings align with those of Oh *et al*., who argued that the success of public health policies depends on their effective implementation and the capacity of health systems to address population-level challenges [11]. Studies by Rahmi *et al*. and Paper 6 highlight the effectiveness of government-led initiatives, such as nutrition education, breastfeeding promotion, and supplementary feeding programs, in reducing stunting rates [31, 43]. These programs aim to enhance maternal and child health through integrated approaches that incorporate healthcare services, community engagement, and sanitation improvements.

Maternal knowledge also plays a crucial role in stunting prevention. Paper 7 demonstrates that improving maternal knowledge about nutrition and caregiving practices significantly enhances child nutrition outcomes [44]. Similarly, Paper 8 finds that maternal education has a direct influence on stunting prevalence, particularly among low-income families [45]. Community-based health services, such as Posyandu (integrated health posts), are crucial for implementing interventions to address stunting. However, challenges such as poor inter-agency coordination and low community participation often hinder program effectiveness. Strengthening Posyandu services and improving collaboration among relevant agencies are essential steps to enhance the outcomes of stunting prevention programs.

It is important to note that optimal nutritional practices—such as exclusive breastfeeding, age-appropriate complementary feeding, and balanced dietary intake—are both key outcomes and essential components of nutritional interventions and antenatal care (ANC) programs. Many of the interventions and ANC services reviewed in this study aim to promote and support these optimal practices among mothers and caregivers. For example, nutritional counseling and education provided during ANC visits are intended to encourage mothers to adopt healthy eating behaviors and to avoid cultural food taboos that may compromise maternal and child nutrition. Accordingly, the effectiveness of both nutritional interventions and ANC in reducing stunting is closely linked to their capacity to improve knowledge, attitudes, and, ultimately, the adoption of optimal nutritional practices across diverse sociocultural and economic contexts.

CONCLUSION

This SLR highlights the critical contextual factors that influence the effectiveness of nutritional interventions and ANC in addressing stunting in Indonesia. Key factors include socioeconomic status, which significantly impacts access to essential resources and healthcare services, and cultural beliefs, which often create barriers to adequate nutrition. Geographical disparities further exacerbate the issue, as children in rural areas face higher stunting rates due to limited access to healthcare services and inadequate infrastructure. Additionally, government policies play a crucial role in the success of efforts to reduce stunting, emphasizing the need for a strong political commitment, multisectoral collaboration, and locally adapted interventions. Addressing these interconnected factors through multidimensional and context-specific strategies is crucial for enhancing the effectiveness of programs aimed at reducing stunting among vulnerable populations in Indonesia.

LIMITATIONS OF THE STUDY

This review has several limitations. First, the selection of articles was limited to five major databases—Google Scholar, PubMed, ScienceDirect, Embase, and ProQuest—which may have introduced publication bias and excluded relevant studies not indexed in these databases. The focus on studies published between 2019 and 2023 may have also

overlooked earlier research that could offer valuable insights. Furthermore, while key contextual factors such as socioeconomic status, cultural beliefs, and geographical disparities were addressed, the review did not comprehensively examine environmental influences that may also contribute to stunting outcomes. The reliance on secondary data limited the ability to control for variations in study design and methodology, which may have affected the comparability and generalizability of the results.

Additionally, this review did not conduct a quantitative meta-analysis, which precluded the estimation of pooled effect sizes and limited the ability to draw statistically robust conclusions about the effectiveness of nutritional interventions and antenatal care. The findings are based on narrative synthesis, which is more susceptible to subjective interpretation and heterogeneity in study designs and outcomes. The review protocol was not prospectively registered on PROSPERO, which may introduce reporting bias and reduce transparency regarding potential protocol amendments. To mitigate these limitations, the methodology, inclusion and exclusion criteria, and analytic strategies were clearly defined a priori and rigorously followed.

Future research should address these limitations by incorporating a broader range of data sources, including studies from earlier periods and non-indexed publications, to provide a more comprehensive understanding of the topic. Furthermore, a more thorough understanding of the complexities surrounding stunting interventions could be achieved through further exploration of the interactions among contextual factors, as well as the inclusion of environmental influences. As a reference, Peru successfully reduced stunting rates from 28% to 13% over 10 years through a multisectoral approach that included nutrition education, poverty reduction initiatives, and improved access to healthcare services [22]. Lessons from such successful interventions could inform future strategies to address stunting in Indonesia.

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AUTHORS' CONTRIBUTION

EK was responsible for conceptualizing the research and conducting the primary data analysis. KS contributed to the design of the methodology, data collection, literature review, and drafting of the manuscript. Both authors actively participated in reviewing and editing the manuscript, approved the final version for publication, and assumed full responsibility for the content of the study.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest in this study. All research activities, analyses, and interpretations were conducted independently and without any external influence or bias from funding sources or affiliations.

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