THE MAPPING OF MATERNAL RISK FACTORS AND THEIR IMPACT ON STUNTING IN CHILDREN UNDER 2 YEARS OF AGE IN INDONESIA: A SCOPING REVIEW

Rahmalina[1], E. Phyowai Ganap[2], A. Dewanto[2], A. Lukman Wicaksana[3], R. Rosyidah[4], M. Luthfi Adnan[5]

[1]Department of Obstetrics and Gynecology, Soerojo Hospital, Magelang, Central Java – Indonesia
[2]Department of Obstetrics and Gynecology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Special Region of Yogyakarta – Indonesia
[3]Department of Medical Surgical Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Special Region of Yogyakarta – Indonesia
[4]Department of Midwifery, Universitas Muhammadiyah Sidoarjo, East Java – Indonesia
[5]Nusa Medika Clinic, Bekasi, West Java – Indonesia

Abstract. *Stunting among children under two years of age is a critical public health issue in Indonesia, with rates still remaining high nowadays. While maternal health is a significant factor influencing child growth and development, the specific maternal risk factors contributing to stunting have not yet been fully researched. This review aimed to address these gaps by synthesizing the literature and providing essential insights for development interventions and policies. The PRISMA flow diagram has been utilized to illustrate the study selection process and provide transparency. A total of 14 articles were included in the final analysis. The maternal risk factors that have been contributing to the issue of stunting were divided into direct and indirect ones. The direct factors were malnutrition, anemia, history of infection, the child's gender, food consumption diversity, and low birth weight. Meanwhile, the indirect factors included breastfeeding, monthly household expenditure, age of the child and the primary caregiver, maternal age, parity, maternal marital status, occupation, education level, the parents' physical stature, antenatal care (ANC) status, residence, and socioeconomic factors. Healthcare professionals are vital in identifying and addressing the factors by offering support and education to families. Collaboration between healthcare providers and the government is essential in order to reduce stunting rates and effectively improve child healthcare.*

Key words: *children under two years of age, growth disorder, maternal risk factor, scoping review, stunting*

Introduction

Stunting remains a major health issue and requires public health attention. Although the prevalence of stunting decreased from 22% (149.2 million children) in 2020 to 21% (148.1 million children) in 2022, the current downward trend remains relatively low [1] In Indonesia, although the stunting rate decreased from 24.4% in 2021 to 21.6% in 2022, according to data from the Indonesian Nutritional Status Survey (SSGI), it still remains the highest in Southeast Asia [2]. Despite high economic growth, this investment in public health does not meet the demand, and the population's health status faces challenges similar to those in low- and middle-income countries (LMICs). This situation is illustrated by a 2020 World Bank report, which estimates that Indonesia's productive workforce will reach only 53% of its potential, a figure attributed in part to poor child nutrition [3]. Although the World Health Organization (WHO) predicts that the number of stunting cases in children under five years of age will decrease from 128.3 million to 116.5 million by 2030 and has set the eradication of malnutrition as one of its targets in the 2030 Sustainable Development Goals (SDGs), these efforts address many complex issues caused by different challenges in each country region, with low- and middle-income countries (LMICs) facing greater challenges than higher-income countries [4].

The complications associated with stunting are significant and multifaceted. Stunted children are more likely to have delayed motor and cognitive development, recurrent illnesses, and higher mortality rates [5-7]. Addressing stunting is, therefore, critical for improving child health outcomes, national development and economic growth. Interventions aimed at preventing and addressing stunting must be comprehensive and multifaceted [8]. This includes improving maternal nutrition, promoting optimal infant feeding practices, and enhancing access to healthcare services [9, 10]. Current trends in maternal and child healthcare have had the greatest impact on reducing stunting incidence by focusing on the first 1,000 days of life.

The concept of the first 1,000 days of life spans from conception to age 2. It represents a period of intense interaction among biological maturation, early life experiences, and opportunities for child development and growth [11]. Although the concept of the first 1,000 days of life has been widely introduced in various research and policies, its implementation in public health policies still faces many challenges, especially in lower-middle-income countries, including Indonesia [12, 13]. The problem of stunting in Indonesia is complex, intertwined with socioeconomic and cultural factors, due to the country's multi-ethnic population, and differences in parenting styles and perceptions. Therefore, reducing stunting requires multi-level and long-term interventions [14]. However, despite the availability of various intervention methods, the effectiveness of these strategies can be influenced by maternal risk factors, underscoring the need for a deeper understanding of their impact on stunting [15]. Given the complexity of maternal risk factors and their relationship with stunting, conducting a scoping review was essential. This study aimed to map the evidence to provide a perspective on stunting risk factors during the 1,000 days of life in the Indonesian setting.

Materials and methods

This scoping review was performed using the approach developed by Arksey and O'Malley [16]. It follows the requirements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [17].

Stage 1: Identifying the research question

This study identified a question based on the Population, Exposure, and Outcome (PEO) framework to formulate the research question [18]. Based on this framework, three significant aspects were included: maternal (Population), risk factors (Exposure), and stunting (Outcome). The research question is "What maternal risk factors are associated with stunting in children under 2 years of age in Indonesia?".

Stage 2: Identifying relevant studies

We performed a literature search across multiple databases, including PubMed, Scopus, ProQuest, EBSCO, and GARUDA (*The Garba Rujukan Digital*). GARUDA is an electronic databse for Indonesian reseachers from the Ministry of Research, Technology and Higher Education. The inclusion criteria for selection comprised the following: 1) all observational research, including cross-sectional, retrospective, prospective, case-control, qualitative studies, and related works; 2) studies that includedIndonesian subjects; 3) publications in English or Indonesian between January 2019 and March 2024; 4) studies that reported maternal risk factors for stunting; and 5) studies that included children under 2 years of age. The Randomized controlled trials and review articles were excluded from the selection. The PRISMA flow diagram has been utilized to illustrate the study selection process and provide transparency. The search utilized the following keywords: "stunting" or"stunted growth" or "growth disorder" or "children under 2 years of age" and "maternal risk factor." When searching in GARUDA, Indonesian keywords were used to include literature in Indonesian. Specifically, the keywords "Faktor risiko stunting," "Stunting di bawah 2 tahun," and "Faktor risiko kehamilan" were used.

Stage 3: Study selection

Two authors were involved in the study selection, based on our eligibility criteria for this study: the population of interest was mothers with a risk factor and children under 2 years of age with stunting. The studies should be observational in design, such as cross-sectional, retrospective, prospective, case-control, and qualitative studies, as well as related works that describe the assessment of risk factors for stunting. This process involved independent screening and review of titles, abstracts, and full texts of available publications by two reviewers to eliminate articles that did not meet the inclusion criteria. The two reviewers' findings were further compared, and the third author conducted a second review to screen the included studies.

Stage 4: Data extraction and analysis

A reference management library application (Mendeley) was used to download the results of the electronic search and identify duplicate records. To determine the study's requirements, three impartial reviewers examined the articles. After retrieving the relevant studies' complete texts, the material was evaluated to determine whether it qualified for the study. To settle any disagreements between the first two authors, the third author was tasked through discussion. Two reviewers performed data extraction, and any discrepancies were discussed to reach consensus. The collected information was summarized in a table, including the following items: authors, year of publication, setting, study design, sample size, data collection method, and key findings. A narrative summary was prepared after data analysis.

Stage 5: Collecting, summarising, and reporting results

All included studies were then data collected, reviewed, and reported based on the following themes: (1) Study characteristics, (2) Description and features of outcome measures, and (3) Risk factors for stunting. The results section contains a detailed summary of the data obtained from this review. A fifth reviewer was contacted to review the entire report and provide consultation to improve the paper's readability.

Results and discussion

The study initially included a scoping review, considering 281 studies. In the first phase of identification, 15 papers were excluded for failing to meet the predetermined inclusion criteria. Subsequently, the authors screened the remaining 266 articles, evaluated their content, and further discarded 252 of them. As the authors delved deeper into the research, a thorough perusal of the full text of the 14 remaining articles was conducted. At last, the study selected 14 articles as the foundation for the final analysis (Figure 1). This review identifies risk factors for stunting in children under 2 years of age, categorized by Western and Eastern regions of Indonesia (Table 1). Western Indonesia comprises the island of Java, while the Central and Eastern regions include Kalimantan, Sulawesi, Maluku, Nusa Tenggara, and Papua. Additionally, the review provides a mapping that offers an overview of maternal risk factors associated with stunting in Indonesian children under two years of age (Figure 2). The identified risk factors can be classified into direct and indirect categories, facilitating a clearer understanding of their impact on child growth and development (Tables 2 and 3).

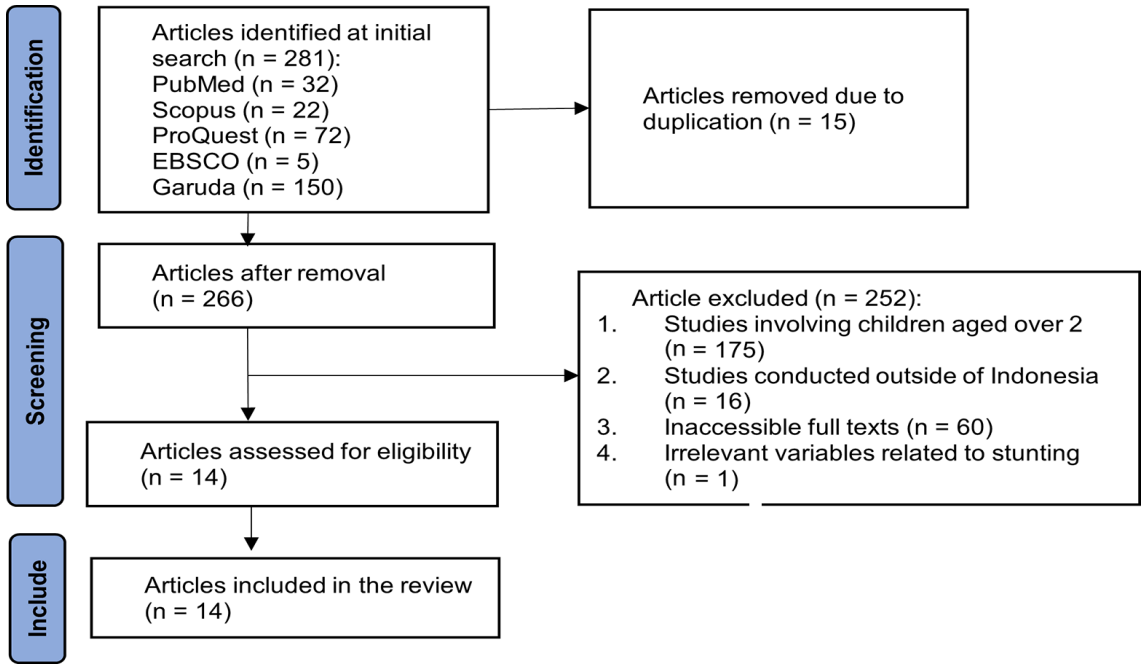


Figure 1. Article selection process using the PRISMA flow diagram

Table 1. Study findings and summary based on the inclusion study

No	Author, Year	Setting	Design	Sample size	Data collection method	Finding
1	Aprianty and Bachtiar, 2022 [19].	Tasikmalaya, West Java	Prospective cohort	50 pregnant women (including normal and chronic energy deficiency)	Questionnaire to assess upper armband measurements, body length, infant scales, food models, photographs of respondents, the intake of zinc and iron, and energy consumption.	Pregnant women with histories of infectious diseases showed a strong correlation with the prevalence of stunting. (RR = 6-000; p = 0.041).
2	Arini et al., 2020 [20].	Surabaya, East Java	Retrospective cohort	108 mothers who had infants aged 0-12 months	Independent variables were measured using questionnaire sheets and the mother's and children's books. The dependent variable used the center value table and z-score.	There was a correlation between the nutritional health of a mother during pregnancy and the prevalence of stunting in children aged 0 to 12 months. (p = 0.05).
3	Ashar et al., 2024 [21].	City of Papua and West Papua Province	Cross-sectional research	2,937 children under 2 years of age	Secondary data analysis was conducted using SSGI, with a stratified cluster-random sampling method.	Factors related to stunting are: living in urban areas (AOR 1.168), maternal age 35-39 years (p < 0.001, AOR 1.889), having only primary or secondary education (p < 0.001 4AOR 1.341), unemployment (p < 0. 001 AOR 15.174), low social status (p < 0.001 AOR2.533), children aged 12-23 (p < 0.001 AOR3.381), gender differences – male children are more at risk of stunting than female children (p < 0.001 AOR1.348), and no early initiation of breastfeeding can lead to stunting (p < 0.001 AOR 1.078).
4	Hadi et al., 2021 [22].	South Timor Tengah, East Nusa Tenggara	Mixed method	408 moms with kids between the ages of 6 and 24 months	Structured questionnaires on childcare, breastfeeding history, and household spending were used to gather quantitative data. Focus groups with caregivers on newborn feeding habits were used to gather qualitative data from collectors and interpreters.	About two-thirds of respondents (61%) have claimed exclusive breastfeeding. Children with stunting who were from lower-income households were 20% less likely to be exclusively breastfed (p = 0.018; AOR = 1.66). Children from richer families who were exclusively breastfed were 50% less likely to have stunting than those from poorer households who were not exclusively breastfed. The focus group discussions revealed that several moms were unaware of the importance of breastfeeding.

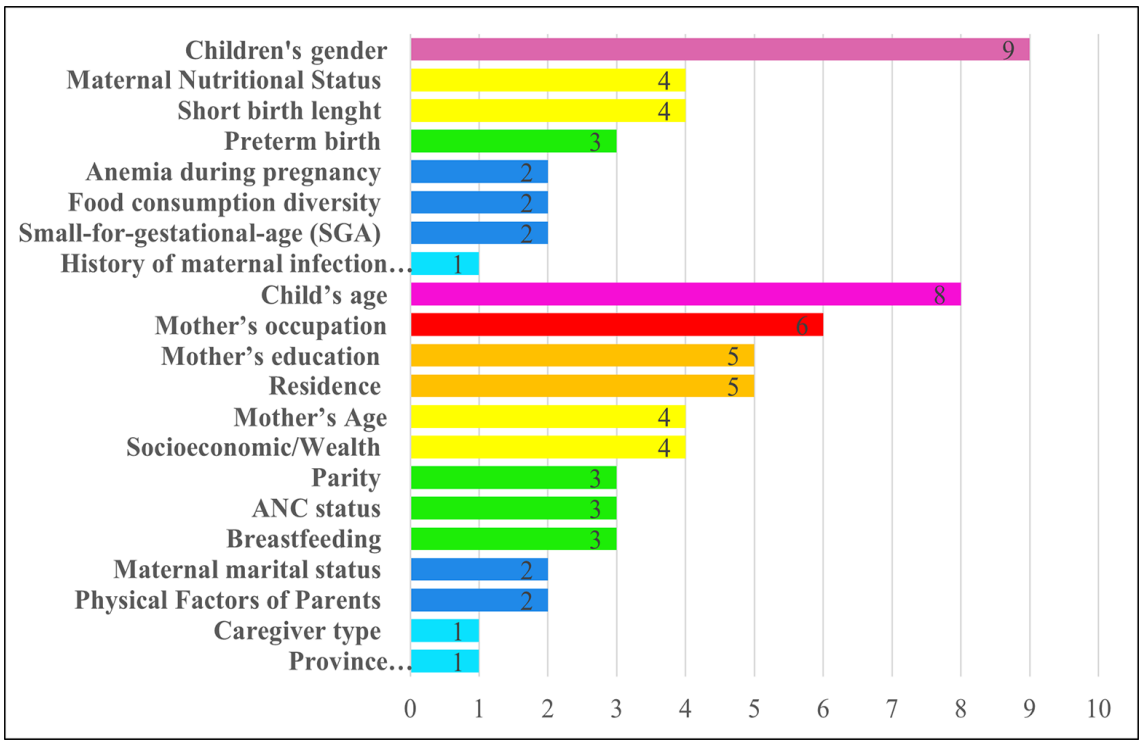
Table 1. Study findings and summary based on the inclusion study. Continuation

No	Author, Year	Setting	Design	Sample size	Data collection method	Finding
5	Kusumawardani et al., 2021 [23].	City of Maluku and North Maluku's province	Cross-sectional	4,764 children under 2 years of age	Secondary data analysis was taken from SSGI with a two-stage, stratified sampling method and with mothers as respondents in the survey.	Six factors were associated with stunting. 1. Location: Children in the Maluku province were at a 1.13-fold higher risk of stunting than those in the North Maluku province (p = 0.001, AOR = 1.136), 2) Living area: Children in rural areas were at a higher risk of stunting than those in urban areas (p = 0.001, AOR = 1.100). 3) Hereditary risk: Mothers who experienced stunting themselves were at a higher risk of having children with stunting than those who did not (p = 0.001, AOR = 2.200). 4) Maternal education and employment status: Children of better educated moms were at lower risk of stunting (p = 0.001 AOR = 2.264), as well as children of working mothers (p = 0.001, AOR = 2.755). 5) Social status: Children from low-income households are at a higher risk of stunting (p = 0.001, AOR = 4.090) than children from high-income households. 6) Gender: Boys are at higher risk of stunting than girls (AOR = 1.878, p = 0.001).
6	Istiningsih and Riyanti, 2022 [24].	Kapuas, Central Kalimantan	Cross-sectional	136 mothers who had toddlers aged 12-24 months	Body length was measured with an infant length board (Seca 210; Seca, Hamburg, Germany).	Stunting was found to be correlated with the mother's employment (p = 0.008, AOR 0.285) and ante-natal status (p = 0.031, AOR 2,670).
7	Laksono et al., 2022 [25].	Whole country	Cross-sectional	70,293 mother-children pairs	The sample was selected from the 2017 SSGI data of respondents who met the eligibility criteria.	Factors associated with stunting are: the mother's degree of education (p = < 0.001; AOR = 1.430), occupation (p = < 0.001; AOR = 0.972), age (p = < 0.001; AOR = 0.994), marital status (p = < 0.001; AOR = 0.804) and the children's age (p < 0.001; AOR = 1.111), gender (p = < 0.001; AOR = 1.352), and residence (p = < 0.001; AOR= 0.828).
8	Salakory and Wija, 2021 [26].	Jayapura, Papua	Cohort retrospective	30 pregnant women	Medical data on the mother Hemoglobin level and the baby height.	Anemia in pregnant women showed a significant association with stunting (p = 0.004).
9	Samosir et al., 2023 [27].	Whole country	Cross-sectional	14,216 mother-children pairs	Data from the Indonesian Ministry of Health 2018 Basic Health Research. A two-stage sampling design was used, namely a cluster and household selection method.	Dietary diversity was associated with better nutritional health in children aged 6–23 months, even after adjusting for socioeconomic, demographic, and nursing behaviors (95% CI: 1.07–1.24; AOR = 1.15).
10	Sari dan Sartika, 2021 [28].	Whole country	Cross-sectional	756 neonates	Data were obtained and analyzed from the 2018 Basic Health Research (RISKESDAS) before conducting direct interviews with parents or caregivers of children using structured questionnaires.	The mother's age during the first pregnancy (p = < 0.001; AOR = 1.34), and her parity status (p = < 0.001; AOR = 1.70), as well as the parents' height (p = < 0.001; AOR = 1.59) were all associated with stunting at birth.
11	Sartika et al., 2021 [29] followed by underweight (25.5%).	Sambas, West Kalimantan	Cross-sectional	559 infants aged 0-11 months	Pregnant women and moms with children aged 0–12 months	LBW was found to be a predictor in a study involving 484 eligible individuals. Children born weighing less than 2.500 grams, with recent diarrhea, and incomplete immunization at 9-11 months, were at a significantly higher risk. For children of normal birth weight, factors such as premature birth, short maternal height, and incomplete immunization also increased the risk of stunting.

Table 1. Study findings and summary based on the inclusion study. Continuation

No	Author, Year	Setting	Design	Sample size	Data collection method	Finding
12	Titaley et al., 2019 [30].	Whole country	Cross-sectional	24,657 mothers-children pairs	Household members from all 33 provinces were included in the data analysis of the 2013 Indonesian Basic Health Survey, and 497 people were questioned using 2 different questionnaires.	The risk of stunting in small children depends on the following factors: the mother's educational status (middle and primary/no school) (p = < 0.001; AOR = 1.31), the quality of antenatal care (1-3 times) (p = < 0.001; AOR = 1.31), and the mother's age at childbirth (< 20 years old) (p = 0.043; AOR = 1.21).
13	Thahir et al., 2023 [31] particularly in low- and middle-income countries like Indonesia. Intervention efforts often come too late as many of the underlying causal factors have already occurred earlier. While antenatal multiple micronutrient supplements (MMS.	Banggai, Central Sulawesi	Prospective cohort	152 mother-children pairs	Used open-ended questionnaires in Bahasa Indonesia.	During the first 6 months of life, SGA was the most important early risk factor for stunting (AOR = 11.29; 2.73-46.66). Additional factors associated with the condition at six months were: the child's sex (female babies (AOR = 3.27; 1.04-10.27)), preterm delivery (AOR = 6.33; 1,25-31,97), short height at birth (AOR = 4.31; 1.11-16.78), and the mother's mid-upper arm circumference < 23.5 cm.
14	Wulandari and Susanti, 2021 [32].	Purworejo, Central Java	Case-control	56 mothers with infants 0-24 months	Secondary data were collected from the neonatal maternal health registry in primary healthcare using a checklist instrument.	The mother's nutritional status during pregnancy showed a significant relationship with children aged 0-24 months (p = 0.003).

RR: Relative Risk, AOR: Adjusted Odd Ratio SSGI: Indonesian National Nutrition Status Survey, CU2: Children Under 2 Years, LBW: Low Birth Weight, SGA: Small-for-gestational-age



1-10: number of articles discussing the topic

Figure 2. The mapping of maternal risk factors of stunting in children under 2 years

Table 2. Direct maternal risk factors for stunting

Direct maternal risk factor	References	Explanation
Maternal nutritional status	Arini et al., [20]; Sartika et al., [29]; Wulandari et al., [32]; Thahir et al., [31].	Maternal BMI in the 3rd trimester and MUAC < 23.5 are associated with height-for-age scores in infants aged 0-24 months.
History of maternal infection	Aprianty et al., [19].	Maternal infection occurred in the 3rd trimester of pregnancy, related to stunting.
Anemia during pregnancy	Salakory et al., [26]; Sartika et al., [29].	Moderate and severe anemia in the 2nd trimester related to the baby's height < 45 cm
Food consumption diversity	Sartika et al., [29]; Samosir et al., [27].	In children aged 6 to 23 months, stunting is associated with a lack of dietary diversity.
Small for gestational age	Titaley et al., [30]; Thahir et al., [31].	SGA and a birth weight < 2,500 g are strong predictors
Preterm birth	Sari and Sartika, [28]; Sartika et al., [29]; Thahir et al., [31].	Preterm birth, lower birth weight, and length are associated with stunting at 6 months
Short birth length	Titaley et al., [30]; Sari and Sartika, [28]; Salakory et al., [26]; Thahir et al., [31].	Short birth height (height/length at birth < 145 cm) and HAZ score less than -2,2 associated with stunting at 6 months
Children's gender	Titaley et al., [30]; Sari and Sartika, [28]; Hadi et al., [22]; Sartika et al., [29]; Kusumawardani et al., [23]; Laksono et al., [25]; Samosir et al., [27]; Thahir et al., [31]; Ashar et al., [21].	Boys and girls are at similar risk of stunting

BMI: Body Mass Index, MMS: Multiple Micronutrients Supplementation, MUAC: Mid-Upper Arm Circumference, SGA: Small-for-gestational-age, HAZ: high for Age Z, WHO: World Health Organization

Table 3. Indirect maternal risk factors for stunting

Maternal Risk Factor – Indirect	References	Explanation
Mother's age	Kusumawardani et al., [23]; Sari and Sartika, [28]; Laksono et al., [25]; Ashar et al., [21].	Mothers aged ≤ 20 or ≥ 35 are at higher risk of having a child with stunting.
Parity	Titaley et al., [30]; Sari and Sartika, [28]; Samosir et al., [27].	Both first-time mothers and mothers with more than three children are at a higher risk of having a child with stunting.
Maternal marital status	Kusumawardani et al., [23]; Laksono et al., [25].	Children raised only by single mothers are at a higher risk of stunting.
Maternal education	Hadi et al., [22]; Kusumawardani et al., [23]; Laksono et al., [25]; Samosir et al., [27]; Ashar et al., [21].	Mothers with elementary school education are at higher risk of children with stunting compared to mothers with better education.
Maternal occupation	Kusumawardani et al., [23]; Hadi et al., [22]; Istiningsih and Riyanti, [24]; Laksono et al., [25]; Samosir et al., [27]. Ashar et al., [21].	Children of unemployed mothers are at higher risk of stunting. One study showed that the lack of dietary diversity is associated with joblessness.
Physical factor of parents	Sari and Sartika, [28]; Sartika et al., [29].	Children of parents of short stature (mother's height < 145 cm and father's height < 161.9 cm) are at a higher risk of stunting.
Caregiver type	Hadi et al., [22].	Biological maternal care is a protective factor against the risk of stunting.
ANC status	Titaley et al., [30]; Sartika et al., [29]; Istiningsih and Riyanti, [24].	A mother with an incomplete ANC is at a higher risk of having a child with stunting compared to a mother with a complete ANC status.
Children's age	Titaley et al., [30]; Sartika et al., [29]; Kusumawardani et al., [23]; Hadi et al., [22]; Laksono et al., [25]; Samosir et al., [27]; Thahir et al., [31]; Ashar et al., [21].	The majority of studies show that children aged < 12 months are at higher risk of stunting compared to older children.
Breastfeeding	Hadi et al., [22]; Samosir et al., [27]; Ashar et al., [21].	Children who do not receive EBFI until they are < 2 years old are at a higher risk of stunting.
Socioeconomic status/wealth	Kusumawardani et al., [23]; Hadi et al., [22]; Samosir et al., [27]; Ashar et al., [21].	Children from households of lower socio-economic status (income < USD 60) are at a higher risk of stunting than those from wealthier households.
Province/Location	Kusumawardani et al., [23].	Children from a province with the topography and unique natural characteristics of an archipelago (such as the Moluccas) are at a higher risk of stunting.
Residence	Titaley et al., [30]; Kusumawardani et al., [23]; Laksono et al., [25]; Samosir et al., [27]; Ashar et al., [21].	There is a similar risk of stunting among children in rural and urban areas, with children in urban areas lacking dietary diversity compared to children in rural areas.

EBFI: Early breastfeeding Initiation, USD: US Dollar

Based on our study, stunting in children under two years of age is a multifaceted public health issue which a variety of maternal risk factors contribute to. This plays an important role during the first 1,000 days of life [25]. Understanding these factors is crucial for developing effective interventions to reduce the incidence of childhood stunting in Indonesia. This prevention strategy included anaemia screening, providing blood supplement tablets to pregnant women and adolescent girls, addressing malnutrition in pregnant women, promoting exclusive breastfeeding, and educating about complementary feeding [25]. However, not only the maternal risk factors contributed to stunting incidence – other factors – socioeconomic, topography of natural characteristic, and local traditions – also played a crucial role in it.

Gender differences are a common indicator of stunting in children under two years of age. Various studies worldwideshow that gender differences are a biological factor influencing the risk of stunting [33]. In the sub-Saharan region and in some lower-income regions, boys are at greater risk of stunting than girls and tend to develop a higher risk of infection [33, 34]. This may be due to differences

in growth during the fetal period, with male fetuses being at greater risk of intrauterine growth restriction than female fetuses, which leads to higher incidence of preterm birth and low birth weight, which is similar to the previously indicated finding [2-31, 33]. Boys need a higher calorie intake compared to girls – this also contributes to the risk of stunting and wasting during childhood, and in some regions there are additional risk factors, such as non-exclusive breastfeeding and low protein consumption [34].

Based on the findings, maternal nutritional status is another common factor impacting stunting in children under two years of age. Poor nutrition pregnancy also contributes to the incidence of anemia in some pregnant populations.Nutritional status, dietary diversity, and infection risk all affect fetal growth [35, 36]. Similar to previous studies, maternal infection is also known as a risk factor for stunting in the Indonesian population, and it has been established that the risk of stunting is more than six times higher in mothers with infection than in mothers without infection [19, 36]. This is consistent with previous meta-analysis that infections during adolescent pregnancy, such as malaria, HIV/AIDS, and parasitic worms, can contribute to small for gestational age (SGA) births and hinder infant growth [35]the risk factors associated with its incidence are unclear and controversial.Methods: PubMed, Ovid Embase, Web of Science, and Cochrane databases were systematically searched (inception to June 27, 2022).

Based on the information gathered about the indirect factors, maternal age and parity have a higher effect on increasing stunting among children under two years of age. Younger maternal age is often associated with low socioeconomic status, limited maturity, and poor hygiene practices. Nutritional status, such as anemia, which often occurs in adolescents, can also increase the incidence of stunting due to unmet iron requirements that begin in the pre-conception period [37]. High parity also increases the risk of stunting, with mothers with first parity being at a higher risk of developing stunted children, which influences breastfeeding practices and the provision of supplementary feeding, resulting in delayed growth and development [28]. This is not only influenced by maternal factors, but is also influenced by cultural and religious factors. Many people in Indonesia still want many children, which burdens women to breastfeed, thus risking their children's breast milk needs not being met [38].

Our findings highlight how maternal factors influence children, aligning with the UNICEF Conceptual Framework on Malnutrition, which focuses on child development. We found that maternal and child factors are interconnected with environmental conditions, influenced not only by caregivers, but also by the community, government, and health and educational institutions that implement multisectoral programs [39]. At the household level, the role of mothers is traditionally crucial during childhood development, with women with better socioeconomic conditions having a 40% lower risk of having children with stunting [40]. Maternal-focused interventions could be key to reducing stunting incidences in the future [40].

Primary health service-based interventions have been implemented in Indonesia to reduce stunting, including empowering health workforce at the regional level and providing supplementary feeding [41]. However, maternal-focused interventions are still rarely discussed in public policy planning in Indonesia. Currently, maternal interventions focus on improving health literacy to meet children's nutritional needs. Health literacy is used to understand the importance of feeding, breastfeeding, compliance with stunting therapy, and the use of local food ingredients [42, 43]. Meanwhile, interventions with ANC still have limitations, where many pregnant women have limited support from family and society, low knowledge about supplementary food for pregnancy, and poor sanitation and no access to drinking water [44, 45]. Studies discussing maternal empowerment interventions during the preconception and pregnancy periods are still rare. Our findings indicate that the preconception period plays a pivotal role in determining the risk of stunting in children in the future. Our findings can serve as a basis for maternal-focused interventions during the preconception period as a strategy to reduce future stunting rates.

This scoping review demonstrates that Indonesia faces multifactorial challenges in addressing stunting. These challenges are similar to the ones faced globally – reducing stunting requires different strategies in many countries [46]. Interventions targeting maternal nutrition and newborn outcomes have been key strategies for reducing stunting [46]. Indirect interventions, such as improvements in parental education, economic conditions, and sanitation, also play a significant role [46]. To implement these programs, government commitment in the form of high-level financial support and financial assistance is essential for large-scale implementation [46]. Because risk factors for stunting can develop not only in the conception period, but also in the preconception period, where maternal health factors before pregnancy play a crucial role. Therefore, focusing on women's health services is crucial for future stunting prevention strategies [47, 48].

Conclusions

This scoping review highlights the significant role of maternal risk factors in Indonesia's prevalence of stunting in children under two years of age. Addressing these risk factors requires a multi-sectoral approach. To investigate the long-term effects of maternal health on child growth, particularly across different Indonesian regions, more studies should adopt longitudinal designs. Additionally, global research should investigate how cultural and socioeconomic variations influence stunting worldwide. To accelerate stunting reduction, the Indonesian government should strengthen maternal health programs by enhancing antenatal and postnatal

care, ensuring adequate maternal nutrition, and detecting pregnancy-related complications early. Also, expanding community-based nutrition education is crucial, with a focus on breastfeeding, complementary feeding, and maternal dietary intake. Finally, implementing evidence-based interventions can significantly reduce stunting and serve as a model for other nations facing comparable challenges.

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✉ *Address for correspondence:*
Rahmalina
e-mail: rahmalina61172@gmail.com
ORCID: 0000-0002-8222-9313