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Review Article

Association Between Maternal Height and Childhood Stunting in Indonesia: A Systematic Review

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ABSTRACT

Background: Stunting is one of Indonesia's most complex health problems with the incidence of stunting reaches almost 30%. Maternal factors are known to play a significant role in the risk of stunting. However, further analysis of the influence of maternal height is needed to identify the influence of maternal height on child growth and development for future intervention. This study aims to evaluate maternal height as risk factor for stunting in Indonesia based on previous published article.

Method: This systematic review was prepared in accordance with the PRISMA guidelines. The literature search was conducted in PubMed and Google using keywords in English including "maternal height", "maternal stature", "stunting" and "Indonesia", while keyword in Bahasa Indonesia using "tinggi badan ibu" and "stunting." The search was limited to English and Indonesian language studies with included studies published after 2020.

Results: Of the 581 studies identified from two electronic search engines, seven studies met our inclusion criteria. A total of 703 population samples from seven included studies were analyzed regarding the relationship between maternal height and stunting. Five of the seven included studies showed that maternal height influenced the risk of stunting Although maternal height is correlated with the risk of stunting, analysis of the causes of low maternal height is necessary for planning further interventions.

Conclusion: Maternal height influences the risk of stunting. However, maternal influences can also influence prenatal growth and development. Long-term studies and interventions are needed to analyze the maternal role in stunting risk.

Keywords: Children; Indonesia; Maternal health; Nutritional status; Stunting

INTRODUCTION

Stunting is a global health challenge that efforts are being made to eradicate by 2025, with nearly 150 million children reported to be stunted, especially in Asia and Africa.[1] Stunting is also one of Indonesia's most complex health problems, with an incidence of almost 30%, higher than the average in Southeast Asia (27.6%).[2] Stunting has long been known to have short- and long-term impacts on children, including impaired physical and cognitive development, increased risk of non-communicable diseases such as cardiovascular and metabolic diseases, and the risk of poor outcomes in their offspring.[1] Therefore, addressing stunting is a complex problem that requires multilevel interventions to reduce its incidence.

Stunting is characterized by inadequate nutritional intake during children's growth period, when they need energy, protein, and other nutrients that are essential for growth.[3] Suppression of protein and various other nutritional coverage can inhibit growth hormone (GH), which is very important for insulin-like growth factor 1 (IGF-1). Nutritional deterioration can also be influenced by infectious factors, especially in lower-middle-income countries; acute gastrointestinal infections often occur, along with chronic diseases that contribute to reduced nutrient absorption.[4] Stunted children have a higher risk of infection due to underdeveloped immune regulation and low intake.[4] As a result, infections exacerbate stunting and inhibit children's growth and development.[5]

Various factors, including household conditions, family environment, infections, and dietary patterns, influence nutritional adequacy in children.[3] In various studies, the risk factors for stunting analyzed show a multifactorial nature and interconnectedness among social, economic, and demographic factors in each region.[6,7] The impact of stunting also increases the country's economic burden as a result of delayed cognitive development, the influence of height, health problems, and in early childhood contributes to a decrease in per capita income of more than 7%.[8] 8 In addition to impacting child factors, stunting burden also has an economic impact through maternal factors, with losses due to the impact of stunting affecting maternal psychosocial and affecting health costs of more than USD $ 29.3 billion.[9]

One review suggests that the maternal role is crucial in early childhood development.[10] In the concept of the first 1,000 days of life, prenatal influences play a significant role in fetal development, with maternal height consistently being a predictor across regions.[10] Further analysis suggests that maternal height is consistent with measurements of stunting incidence across regions and is associated with intergenerational effects linking mothers and children.[11] Although the association between maternal height and stunting risk has been widely studied with consistent findings, analysis in Indonesia remains limited due to the complexity of stunting risk factors. Therefore, this review aims to evaluate the relationship between maternal height and stunting risk in Indonesian children.

METHOD

We conducted a systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [12]. A systematic literature search was conducted in PubMed by using keywords ("maternal height" OR "maternal stature") AND "stunting" AND "Indonesia" and Google using keywords "maternal height",

"maternal stature", "stunting", and "Indonesia" in English and “tinggi badan ibu" and "stunting" in Bahasa Indonesia. The search was limited to English- and Bahasa Indonesia-language studies with a maximum search timeframe of 2020.

In this systematic review, inclusion criteria were met if studies reported the influence of maternal height on stunting incidence in Indonesia, including analytical cross-sectional, case-control, and prospective or retrospective cohort studies. The target population was Indonesian toddlers under five years old living in Indonesia. We included studies published after 2020. We excluded stunted toddlers with comorbidities such as congenital diseases or those with a parent with achondroplasia, as well as studies in gray literature.

After determining the final set of included studies, one author independently extracted data according to the eligibility criteria using a standard data extraction form that included author names, publication year, study location, study type, sample size, and main findings. Data were analyzed by combining similar data across all studies and scaling effect variables to numerical values. If discrepancies were found, the authors discussed the data with the other authors to resolve them by consensus. The quality of the included studies was assessed using the JBI critical appraisal tool. Based on this assessment, the studies were classified as low, moderate (median), or high quality. If there were any discordant responses, two of the authors discussed to reach a consensus.

RESULTS

Selection and Characteristics of Included Studies

After 581 studies were identified, we analyzed nine studies for a comprehensive review. One study did not explicitly mention maternal height, and another study did not conduct adequate statistical analysis. The search and screening process followed the PRISMA process and is shown in Figure 1.

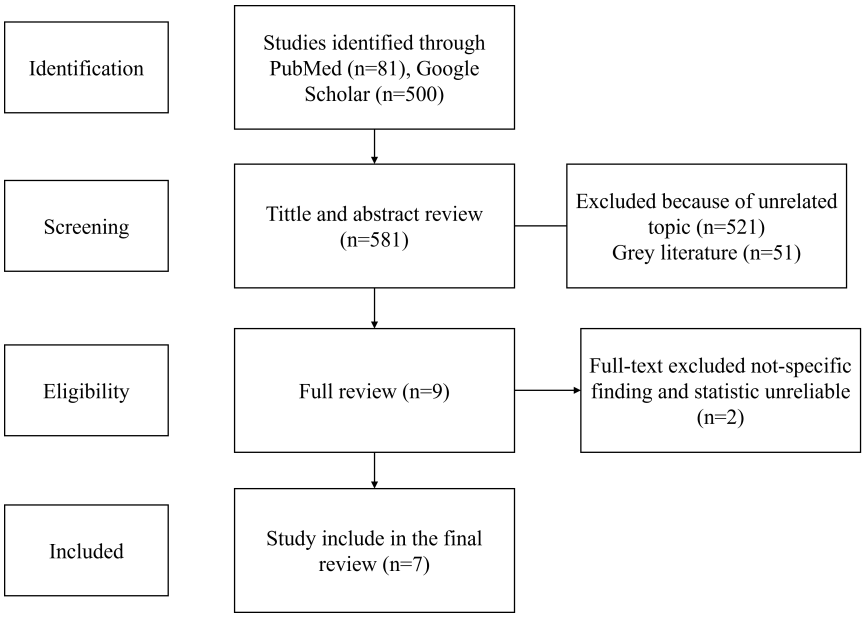

Figure 1. PRISMA Flowchart of literature search.

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A total of seven studies were included in this review, including two cross-sectional studies and five case-control studies (Table 1). A total of 703 children were included in our included studies, with stunting rates ranging from 33.3% to 78.3%. Four studies were conducted in Java, and the remaining studies were conducted in Lampung, Kalimantan, and Sulawesi. Three studies analyzed the incidence of stunting specifically in children aged 2 years and older, and two studies analyzed children aged 2 years and younger. Included studies were of moderate to high quality based on JBI quality assessment.

The relationship between maternal height and stunting risk

Of the seven studies that met our inclusion criteria, five studies demonstrated an association between maternal height and the risk of stunting in children, with three studies focusing on mothers <150 cm tall. [13–17] The other two studies did not show statistically significant results, although one study did find an association between maternal height and stunting risk.[18,19] The increased risk of stunting ranges from two to more than eight times in the group of mothers with short height compared to mothers with normal height.

Table 1. Characteristic and main finding from included studies

Author (Publication year)	Location	Type of study	Participant's number	Stunting percentage	Main finding
Andari et al (2020)[13]	Bantul, Special Region of Yogyakarta	Case-control	86 children aged 24 – 59 months (43 children in the stunting group and 43 normal children)	NA	Maternal height (< 150 cm) increases the risk of stunting (OR 2.72 (CI95% 1.05 – 7.05; p = 0.035))
Baidho et al (2021)[14]	Bantul, Special Region of Yogyakarta	Case-control	154 children aged 0 – 59 months (77 per group)	NA	Maternal height (< 150 cm) increases the risk of stunting (OR 3.218 (CI95% 1,37-7,52; p = 0.005)
Trisnawati et al (2021)[17]	Pesawaran, Lampung	Case-control	195 children aged 12 – 59 months (65% stunting and 130 healthy children)	33.3%	There is a correlation between maternal height (< 150 cm) and the risk of stunting (p = 0.017)
Wardani (2021)[16]	Pamekasan, East Java	Case-control	54 children aged 24 – 59 months (27 per group)	NA	Short maternal height (< 145 cm) increases the risk of children with stunting (OR 16,000 (CI95% 3,781 – 67,700; p = 0.000)
Widiyarti et al (2023)[18]	Boyolali, Central Java	Cross-sectional	61 children aged 24 – 59 months	39.3%	Maternal height (> 150 cm) had no relationship with the incidence of stunting (OR 0.034; p = 1.000)
Lotulung et al (2023)[19]	North Minahasa, North Sulawesi	Case-control	93 children aged < 2 years (31 stunted children and 62 healthy children)	NA	Maternal height (< 150 cm) was not associated with the risk of stunting in children (OR 2.127 (CI95% 0.168 – 1.316; p = 0.146))
Widyanti (2025)[15]	Tapin, South Kalimantan	Cross-sectional	60 children aged <2 years with stunting,	78,3% stunting and 21,7% with	Short maternal height (<145 cm) increases the risk of children with

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Author (Publication year)	Location	Type of study	Participant's number	Stunting percentage	Main finding
				severe stunting	severe stunting compared to stunting (OR 8.325 (CI95% (2,117 - 32,741; p = 0.002)

DISCUSSION

Our review confirms the role of maternal height in stunting risk, consistent with previous studies that found parental height contributes to stunting.[20] In previous studies, the risk of stunting tended to be lower in mothers with short stature than in those with paternal factors or both.[20] However, unlike previous studies, we focused on maternal factors, as low height has been defined based on existing studies (<150 cm). These findings demonstrate the intergenerational role and complexity of stunting risk factors, necessitating long-term interventions.

Maternal influences play a significant role in child growth and development during the prenatal phase, with fetal growth potentially influenced by maternal height and BMI, which can in turn prolong the gestational phase.[21] However, maternal factors also contribute to the risk of adverse outcomes, such as increased blood pressure, which can lead to complications such as shorter fetal growth.[21] However, these influences require further investigation, particularly during pregnancy, where monitoring for complications due to weight gain, such as gestational hypertension and preeclampsia, can occur even without a prior history.[22]

The influence of maternal height on children can be influenced by genetic material, as Toni et al. (2024) demonstrated pathogenetic variations affecting several genes, such as growth hormone IGF (GH-IGF), pituitary development, the axis, and the cartilaginous matrix.[23] Disruptions in these genes contribute to growth disorders during the child's postnatal phase.[23] These genetic disorders contribute to abnormal bone growth by disrupting growth hormone function, which stimulates chondrocyte proliferation and hypertrophy in the bone growth plate.[24] Because height can be up to 80% heritable, it is crucial to promote nutrition-based interventions to meet the energy and protein requirements essential for growth during this period.[24]

In addition to genetic factors, socioeconomic factors such as household income, education level, and the environment contribute to the risk of stunting, which also contributes to the postnatal phase.[25,26] Environmental factors can vary by location, with poor nutrition services contributing to poorer outcomes in more urban populations.[26] In addition to influencing the risk of stunting, groups with higher socioeconomic status contribute to better birth outcomes, which in turn affect that risk. Fetal growth and development, and the postpartum neonatal development period. Maternal habits of providing exclusive breastfeeding also contribute to reducing the risk of stunting, as the population of women with shorter heights has a shorter breastfeeding period.[27]

Nutritional interventions for women are crucial for preventing malnutrition and reducing the risk of stunting. Studies in Ethiopia show that short mothers are more than twice as likely to

suffer from malnutrition as taller mothers.[28] Nutrition-based interventions are also expected to contribute to improving economic conditions, as several regions have shown that dietary diversity, hygiene, and land ownership impact the risk of stunting in areas with limited access.[29] Nutritional factors also influence breast milk quality and the duration of breastfeeding, with exclusive breastfeeding being a key factor in reducing the risk of stunting.[30] Therefore, interventions focused on preventing stunting require long-term preparation and cross-sectoral approaches.[31,32]

Existing studies have demonstrated the effects of nutritional interventions with micronutrient supplementation in pregnant women to reduce the incidence of stunting, where the results indicate an effect on weight gain in pregnant women.[33] Although the duration of interventions varies from less than a year to 3.5 years, existing studies have not yet addressed the long-term influence of maternal factors.[33] Special interventions are needed that focus on productive women's groups, which, in addition to providing education on nutritional needs, also provide nutritious food to at-risk population groups, such as those with short stature.[34,35] However, nutritional interventions alone may not achieve the desired impact if the target population frequently suffers from infections common in low-income areas.[35] Therefore, the focus of interventions may not be limited to nutrition alone, but also to improving socioeconomic conditions more broadly to improve the quality of life of mothers and children.[36]

Although our study confirms the impact of maternal height on the risk of stunting, it has several limitations. In addition to the limited number of studies, which limited the number of children participating, we did not find literature focusing on other regions, such as Papua and Maluku. Consequently, our findings cannot be broadly generalized. Furthermore, maternal height is influenced by nutritional adequacy during the DNA development phase before pregnancy, so our findings risk oversimplification due to our lack of further analysis of maternal nutrition. Therefore, further research is needed to analyze the long-term impact of maternal nutrition before pregnancy on the risk of stunting.

CONCLUSION

Maternal height (< 150 cm) is associated with the risk of stunting in children, a relationship related to the overlap between genetics and the history of nutritional adequacy during the prenatal, growth, and development periods. Maternal height influences the risk of stunting in children and may be genetic. Height is multifactorial and influenced not only by maternal factors but also by socioeconomic conditions and is related to maternal nutritional status during the growth and development phase. Nutrition-based interventions are needed to increase expectant mothers' energy and protein intake during pregnancy. Further research is needed to analyze the long-term impact of maternal nutritional status before pregnancy on the risk of stunting and its consequences in the future.

Declarations

Authors' contributions

YYP and MLA contributed equally to the research design, data collection, data analysis, and the manuscript.

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Conflict of interest

There is no conflict of interest in this research.

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