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Original Article

Parental stature as a risk factor for stunting in Indonesia: A systematic review and meta-analysis

Mazaya P. Amriviana[1], Cut Khairunnisa[1] and Teguh H. Sasongko[2,3*]

[1]Department of Public Health, Faculty of Medicine, Universitas Malikussaleh, Lhokseumawe, Indonesia; [3]Department of Physiology, School of Medicine, International Medical University, Kuala Lumpur, Malaysia; [4]Institute for Research, Development and Innovations, International Medical University, Kuala Lumpur, Malaysia

*Corresponding author: tghsasongko@gmail.com

Abstract

Stunting is defined by height of more than two standard deviations below the World Health Organization's (WHO) child growth standard median. It is a significant nutritional problem in developing countries, where in 2021, Indonesia recorded a stunting prevalence at 24.4%, slightly higher than the global prevalence (22%). Reducing the prevalence of stunting has been the focus of the current administration in the Indonesian government, as delineated in the 2020–2024 National Medium-Term Development Plan. Globally, many studies have addressed parental stature as a risk factor of stunting. However, systematic reviews that summarized and critically appraised the relationship between parental stature and the incidence of stunting in Indonesia was scarce. This systematic review aimed to assess parental stature as a risk factor for stunting among Indonesian toddlers. Studies were searched through PubMed (MEDLINE), Google Scholar and Mendeley. Studies on Indonesian toddlers under five years old living in Indonesia were included. The quality of the included studies was assessed using Joanna Briggs Institute (JBI) critical appraisal tool. Data were extracted using a standardized data extraction form and were analyzed using Cochrane's RevMan 5.3. Twenty-seven prospective and retrospective cohort, case-control and cross-sectional studies were included with a total 4041 children. Out of 27 included studies, eight were found to be of low, seven of moderate and twelve of high quality. The result showed that parental stature was associated with the incidence of stunting among toddlers in Indonesia, either the mother only (odds ratio (OR) 1.92; 95% confidence interval (95%CI: 1.71–2.15), the father only (OR 5.21; 95%CI: 1.71–15.86) or both parents (OR 3.01; 95%CI: 2.41–3.75). However, studies on father and both parental statures suffered from substantial heterogeneity, imprecision and mixed qualities, therefore, they should be cautiously interpreted.

Keywords: Stunting, Indonesia, parental stature, risk factor, systematic review

Introduction

Health is an investment for developing quality of human capital to be economically and socially productive and it has been an important measure of the human capital index [1]. The health development program of the Indonesian Ministry of Health aims to improve the standard of healthy living for every Indonesian to achieve the best possible health status. However, the high prevalence of stunting among Indonesian children under five years old has challenged the efforts to improve the life quality of human capital in the country [2]. Currently, stunting has been included in the list of strategic priority projects for the 2020-2024 National Medium-Term

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Development Plan with an allocated funding of 87 trillion rupiah with a target achievement of reducing the prevalence of stunting to 14% by 2024 [3].

Stunting is a health condition of toddlers characterized by body height being shorter than children of the same age [4]. Children are defined as stunted if their height-for-age is less than two standard deviations (SD) below the World Health Organization's (WHO) child growth standard median [5]. Usually, stunting begins to appear when a child has just entered the age of two [6]. In Indonesia, according to the Anthropometric Standards for the Assessment of Child Nutritional Status, a toddler is considered stunted if the child *Z*-score falls between -3 SD and less than -2 SD, and is classified as severely stunted if the score is below -3 SD [7]. The *Z*-score is calculated based on the length or height index for age, and a score of less than -3 SD indicates a significant deviation from the normal [7].

Indonesia has a high prevalence of stunting, with an average incidence of 36.4% in children under five, based on the data between 2005–2017 [8]. However, according to the Nutritional Status of Indonesian Toddlers survey in 2021, the prevalence of stunting has decreased to 24.4%, affecting 5.33 million children [9]. The survey collected data from 34 provinces and 514 districts/cities with a total of 153,228 children under five. The survey revealed that only one province had a good category (stunted <20% and wasted <5%), five provinces showed nutritional problems in the acute category (stunted <20% and wasted ≥5%), one was in the chronic category (stunted >20% and wasted <5%) and 27 others were in the chronic-acute category. The data indeed showed that stunting is a nationwide problem affecting almost all provinces in Indonesia [9].

The chronic impact of stunting on children can lead to sub-optimal learning capacity, confer a higher risk of obesity, and reduce productivity levels [10]. Short-term impacts of stunting include decreased cognitive and motor and verbal abilities as well as an increased risk of perinatal and neonatal death [11].

Stunting is conferred by multifactorial risks, including environment, nutritional intake and parental stature [12,13]. Parental height is a form of genetic expression which cannot be changed or modified and therefore this factor is directly passed down from parents to the children [13]. A study on the relationship between parental stature and the incidence of stunting in toddlers aged 6–23 months found that maternal height influenced stunting, while paternal height did not significantly affect the incidence of stunting [12]. In contrast, another study found that the father's height is one of the risk factors for stunting [13]. Unfortunately, a systematic review that summarizes and critically appraises the relationship between parental stature and the incidence of stunting in Indonesia is not available. The aim of this systematic review was to assess whether parental stature is a risk factor for stunting among Indonesian toddlers.

Methods

Study setting and search strategy

A systematic review with meta-analysis for quantitative studies was conducted. The protocol was in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) and the Joanna Briggs Institute (JBI) Manual for systematic review of etiology and risk factors [14].

The following electronic databases were used for the searches: MEDLINE (PubMed), Google Scholar and Mendeley. The combination of keywords as follows: “stunting” AND “parental stature” OR “*tinggi orang tua*” OR “*tinggi badan orang tua*” AND “Indonesia”. Keywords were searched in the title and abstract. The searches were limited to articles in English and Bahasa Indonesia.

Eligibility criteria

In this systematic review, studies were considered eligible if they reported the effect of parental stature on the incidence of stunting in Indonesia, including prospective and retrospective cohort, case-control and analytical cross-sectional studies. Only original articles were included. The target population was Indonesian toddlers under five years old living in Indonesia. Stunted

toddlers with congenital diseases, whose parents have achondroplasia, whose parents have mental disorders and those with evidence of an absent biological relationship were excluded.

Screening of studies

To conduct the screening process, the authors firstly removed all duplications. In the initial screening, the title and abstract of each remaining study were then checked individually. Finally, the full text of each study that passed the initial screening was read to determine its eligibility for inclusion in the systematic review.

Data extraction

After establishing the final set of included studies, an author (MPA) extracted the data independently according to the eligibility criteria using a standardized data extraction form. To ensure consistency and reliability, the data extraction form on the first ten included studies were pilot-tested. Another author (THS) checked the data extraction for clarity and completeness. Following independent data extraction, the authors (MPA and THS) met four times to resolve any discrepancies and reached a consensus.

Assessment of methodological quality

The quality of the included studies was assessed using JBI critical appraisal tool whereby a score was given for every one-star symbol, which indicate a "yes" response. If there were any discordant responses, two of the authors discussed to reach a consensus. Studies with scores above or equal to the median were considered high quality [15]. Based on this assessment, the studies were classified as either low, moderate (scored at median) or high quality.

Data synthesis

The meta-analysis method for quantitative studies was used to analyze the extracted data. Stunted toddlers were compared with non-stunted toddlers regarding the risk factors. The data was analyzed by combining similar data from all studies and the effect variable scale was in numerical data. The data was analyzed using Cochrane's RevMan 5.3.

Assessment of heterogeneity and identifying possible sources of heterogeneity

Variability among studies in a systematic review is referred to as heterogeneity. Clinical variation may cause heterogeneity if the exposure effect is influenced by factors that differ across studies, such as patient characteristics. In this systematic review, the heterogeneity analysis was conducted using the chi-squared statistics. Heterogeneity was considered substantial when the I^2 was 40% or above.

In cases where there was substantial heterogeneity between the studies, the maternal and paternal statures were examined separately as subgroups and sensitivity analysis was performed as attempts to identify possible sources of heterogeneity.

Results

Study selection

In total, 1,020 studies were identified, of which 137 were excluded due to duplication and 847 were excluded after screening the titles and abstracts. The full texts of the remaining 36 studies were assessed for eligibility, of which nine studies did not provide clear data and were subsequently excluded from the meta-analysis. The excluded nine studies could not provide the necessary data despite requests for clarification. A total of 27 studies [12,25-50] were included in the data extraction and analysis. Out of total, 14 case-control studies [12,27,28,38-48] and 13 cross-sectional studies [25,26,29-37,49,50]. The search and screening process followed the PRISMA, and the flowchart is presented in **Figure 1**. An overview of the characteristics of the included studies, including socioeconomic status, gender the parents' profession and education level are presented in **Table 1**.

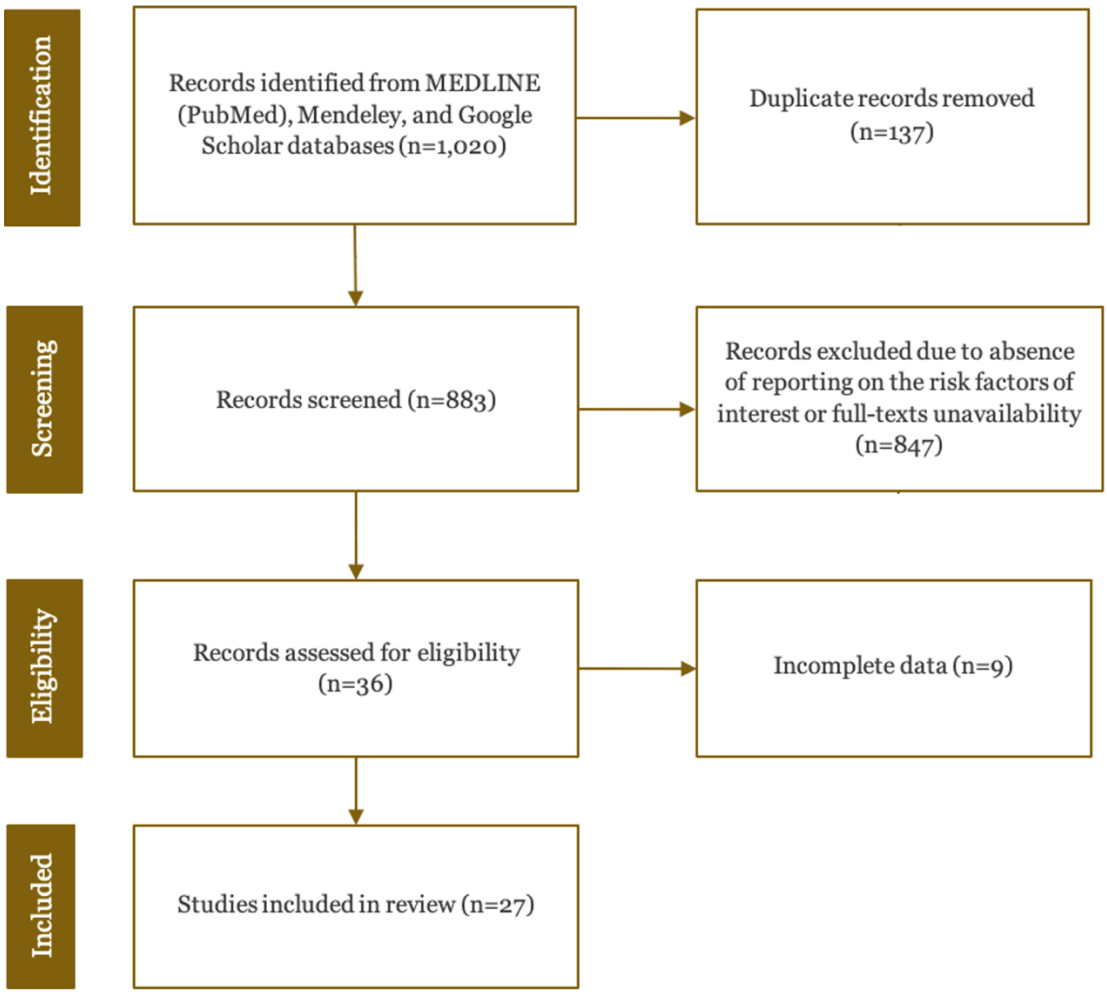


Figure 1. PRISMA flow diagram of study selection.

Table 1. Demographic data of the family of the included 27 studies

Variable	Category, *n* (%)		
	Stunting	Non-stunting	No information
Socioeconomic status of the family			2,767 (36.7)
High	755 (10.03)	1,277 (16.9)	
Low	1,257 (16.6)	1,466 (19.4)	
Gender of the toddler			4,905 (65.2)
Male	723 (9.6)	602 (8.0)	
Female	609 (8.2)	683 (9.2)	
Mother's employment status			6,128 (81.4)
Employed	319 (4.2)	372 (4.9)	
Unemployed	293 (3.9%)	410 (5.4)	
Mother's education level			6,060 (80.5)
High	1,080 (14.3)	1,655 (22.0)	
Low	1,565 (20.8)	1,760 (23.3)	
Father's employment status			7,176 (95.4)
Employed	173 (2.2)	173 (2.2)	
Unemployed	0 (0.0)	0 (0.0)	
Father's education level			5,421 (72.06)
High	354 (4.7)	608 (8.0)	
Low	499 (6.6)	640 (8.5)	

Assessment of methodological quality

Among 14 case-control studies [12,27,28,38-48], three were assessed as having low [38,41,42], three as moderate [12,28,48] and eight as high quality [27,39,40,43-47]. Among the 13 cross-

sectional studies [25,26,29-37,49,50], five were assessed as having low quality [25,29,30,32,50], four had moderate quality [26,35-37] and four had high quality [31,33,34,49].

Association between parental stature and the incidence of stunting

The effects of maternal and paternal height on stunting among toddlers in Indonesia are presented in forest plots. The data analysis was conducted using two statistical models: the fixed-effect (**Figure 2**) and the random-effects model (**Figure 3**). The random-effect model was also utilized due to significant heterogeneity despite the significant results of data synthesis (p<0.05 and I^2 >50%).

There were significant effects of both mother's and father's heights on incidence of stunting (**Figure 2** and **Figure 3**). However, the studies included in the analysis had mixed levels of quality. Among the studies focused on maternal stature, eight [25,29,30,32,38,41,42,50], seven [12,25,28,30,32,48,50] and 12 studies [27,31,33,34,39,38,43-47,49] had low, moderate and high quality, respectively. For the studies on paternal stature, two were of moderate [12,26] and three were of high quality [39,47,40]. Moreover, all analyses showed substantial heterogeneity, with I^2 ranging from 69% to 81%. In addition, the random-effects approach for the effect of the father's stature showed imprecision, as evidenced by the wide 95% confidence interval (95%CI) (1.71 to 15.86). Therefore, caution is necessary when interpreting the results.

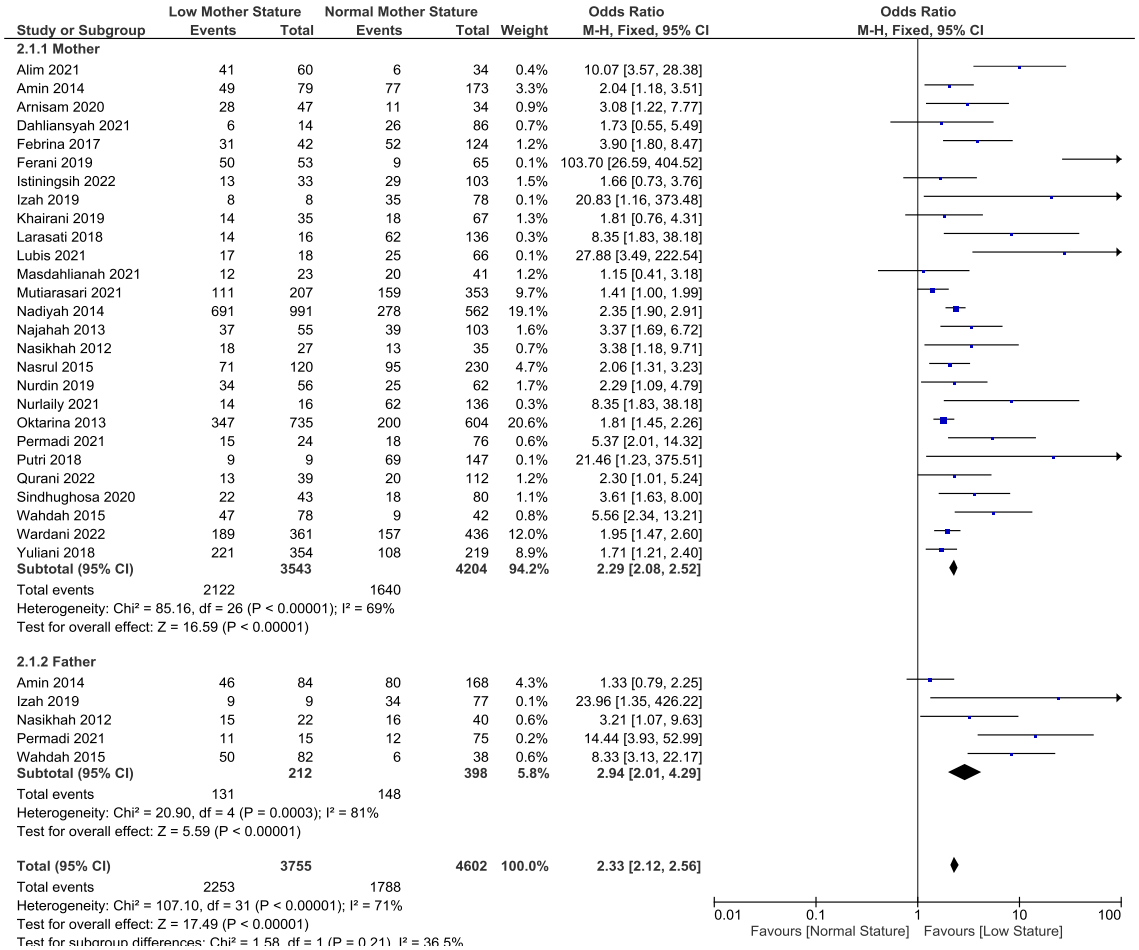


Figure 2. Association between mother and father height with stunting at toddler age (fixed effect).

Sensitivity analysis

Due to substantial heterogeneity in our analysis, we did the sensitivity analyses to identify possible sources of heterogeneity. The sensitivity analyses were conducted based on four factors of exclusion: (a) to exclude the studies that are not statistically significant; (b) to exclude the studies with totals in low- and normal-parental-stature groups of less or more than 100 each; (c) to exclude the studies conducted in Java or outside Java; and (d) to exclude the studies of low and moderate quality studies.

Exclusion of studies that are not statistically significant

Statistical significance was determined based on the *p*-value and the 95%CI and studies that had no statistically significant results were excluded. Among the studies four were excluded for maternal stature [27,31,36,42] and one was excluded on paternal stature [12] (**Figure 4**). Heterogeneity was not improved after the exclusion of studies with non-significant results. This sensitivity analysis showed that studies with non-significant results are not the source of heterogeneity.

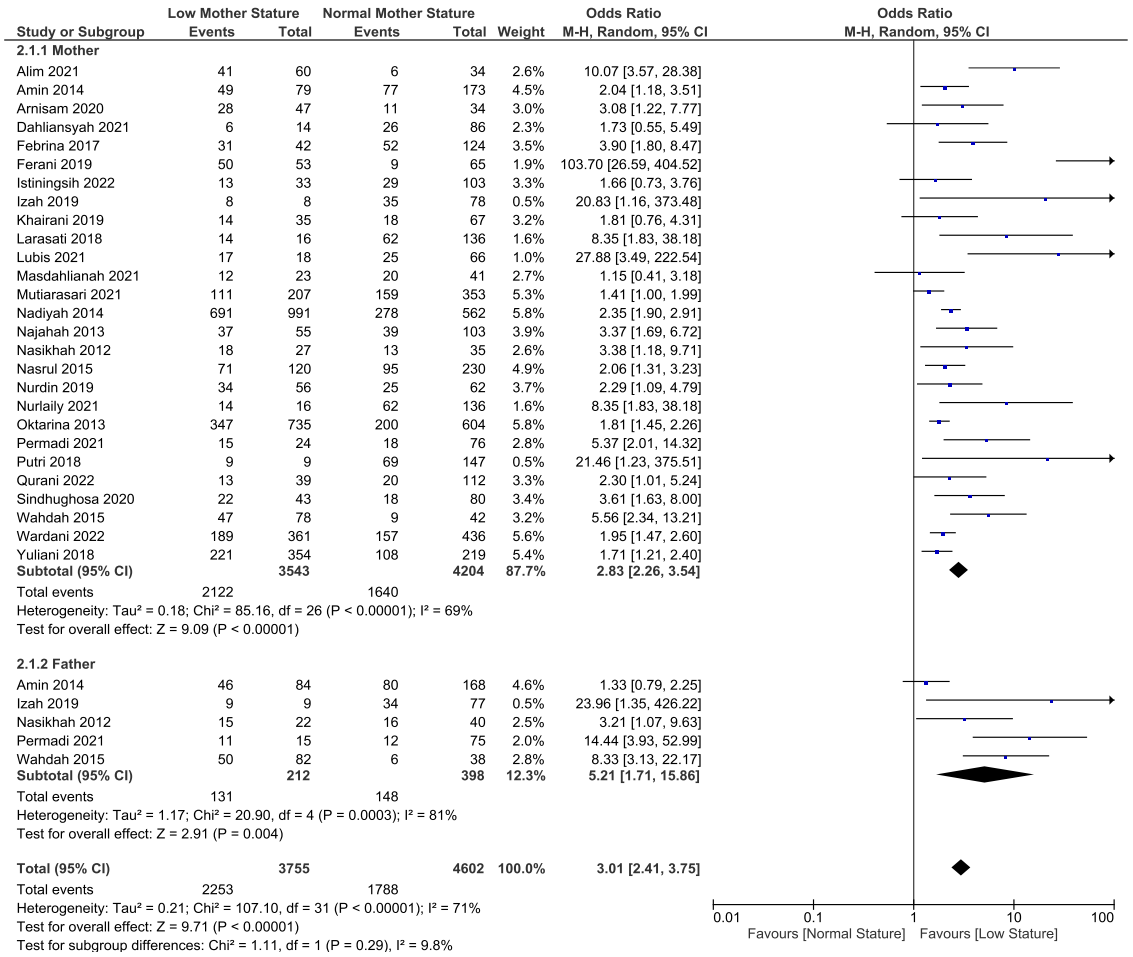


Figure 3. Association between mother and father height with stunting at toddler age (random effect).

Exclusion of studies with totals in low- and normal-parental-stature groups of less or more than 100 each

The total sample means the number of sample of parents with low stature on stunting and non-stunting and for mother with normal stature. Sensitivity analysis on this variable was performed in two ways: (a) by including only studies with totals low- and normal-parental-stature above 100 each (15 studies with <100 participants in each group were excluded [12,26,28,30,32,38-40,44-50]) and (2) by including only studies with totals low-and normal-parental-stature below 100 each (six studies with >100 participants were excluded [25,29,33,35,37,41]. All studies on the father's height showed less than 100 participants in each group.

When the studies with sample sizes of above 100 were separately analyzed, the heterogeneity (I^2) was improved to 32%, which was non-substantial with OR 1.92 (95%CI: 1.71–2.15) (**Figure 5**). This demonstrated that studies with small sample sizes (<100 in each group) have become a source of heterogeneity. This result was applicable only to the effect of the mother's height because all studies on the father's height were excluded. When the studies with sample sizes below 100 were analyzed separately, the heterogeneity (I^2) remained prominent. This demonstrated that studies with larger sample sizes (>100 in each group) were not the source of heterogeneity.

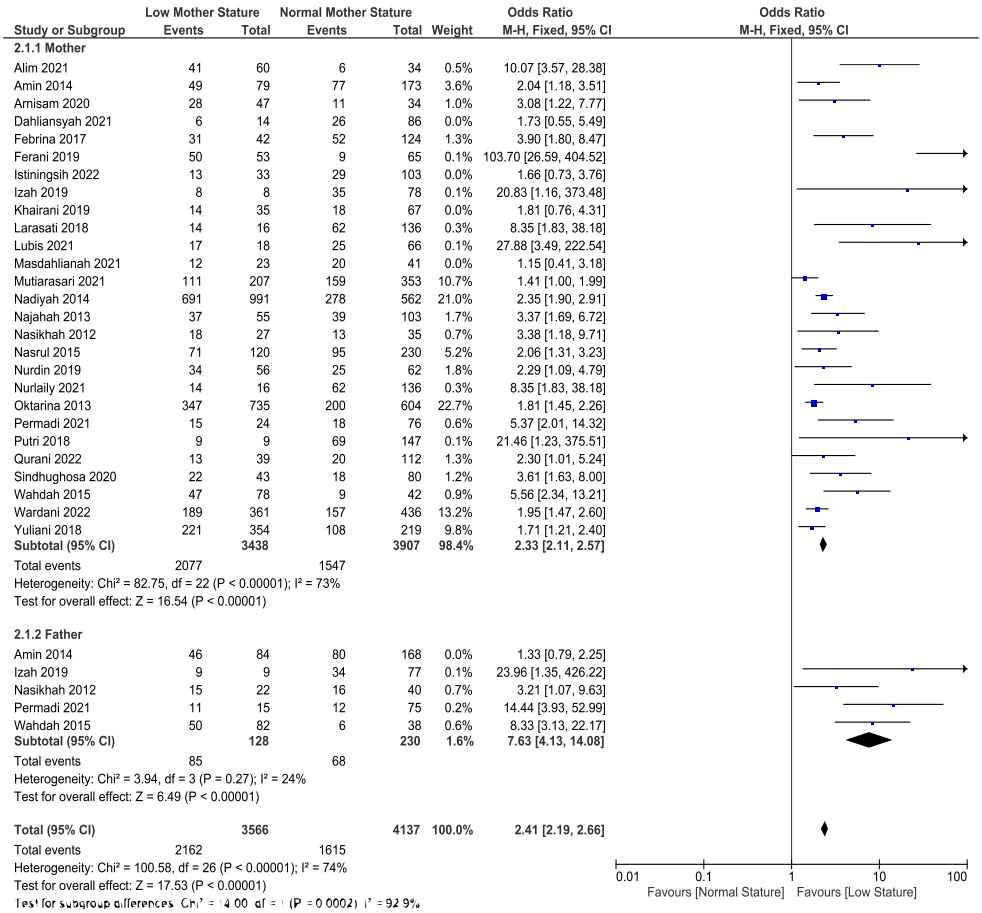


Figure 4. Sensitivity analysis by excluding studies with non-significant effects.

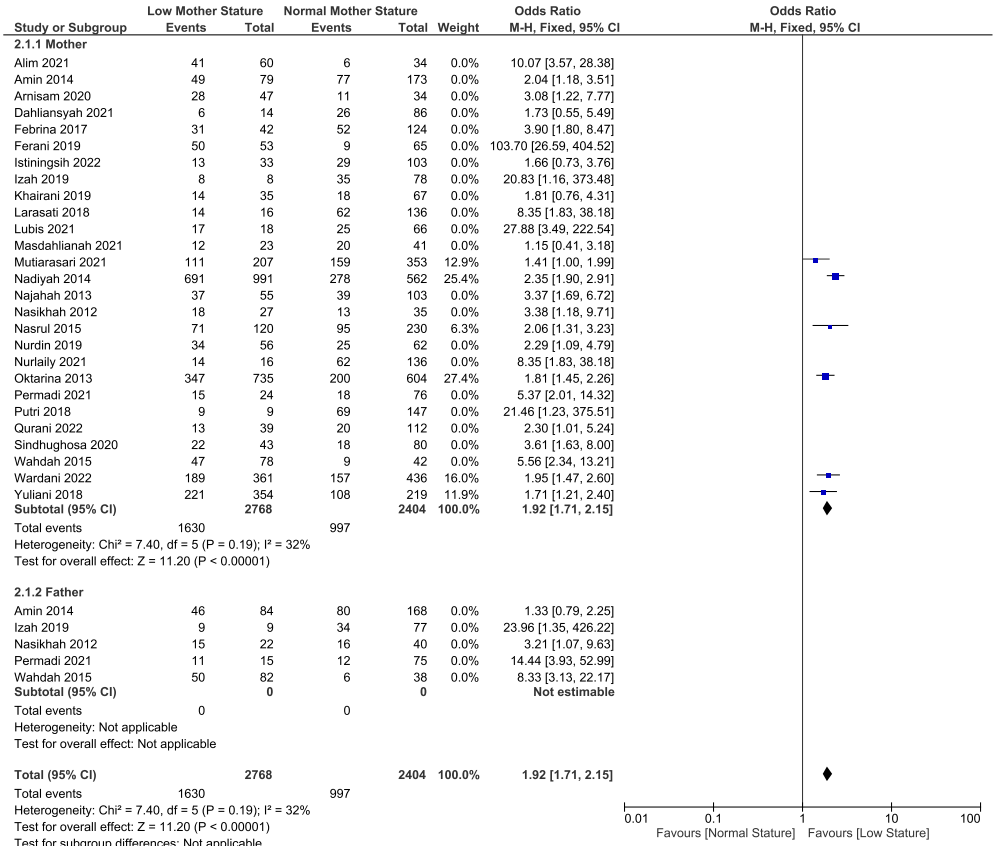


Figure 5. Sensitivity analysis by excluding studies with totals in low- and normal-mother-stature groups of less than 100 each.

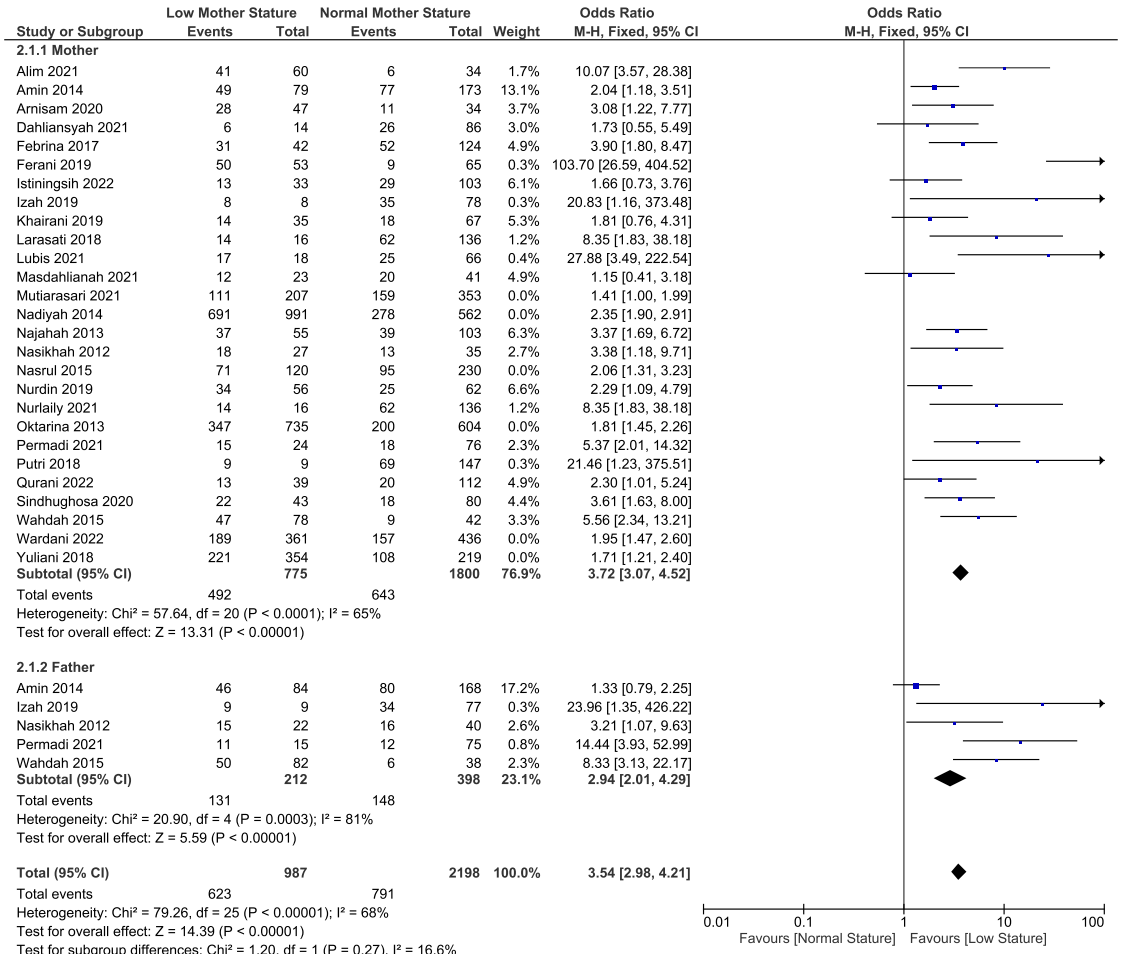


Figure 6. Sensitivity analysis by excluding studies with totals in low- and normal-mother-stature groups of more than 100 each.

Exclusion of studies in Java or non-Java region only

Because people on Java have better access to both education and health services compared to people outside Java, we also did the sensitivity analysis by excluding studies using non-Java [27,28,38,41-43,46] and Java setting [12,39,40,44,45,47,48] and the results are presented in **Figure 7**. Heterogeneities remained after the exclusion of studies, which indicated that geographic origins (Java vs. Non-Java) were not a source of heterogeneity.

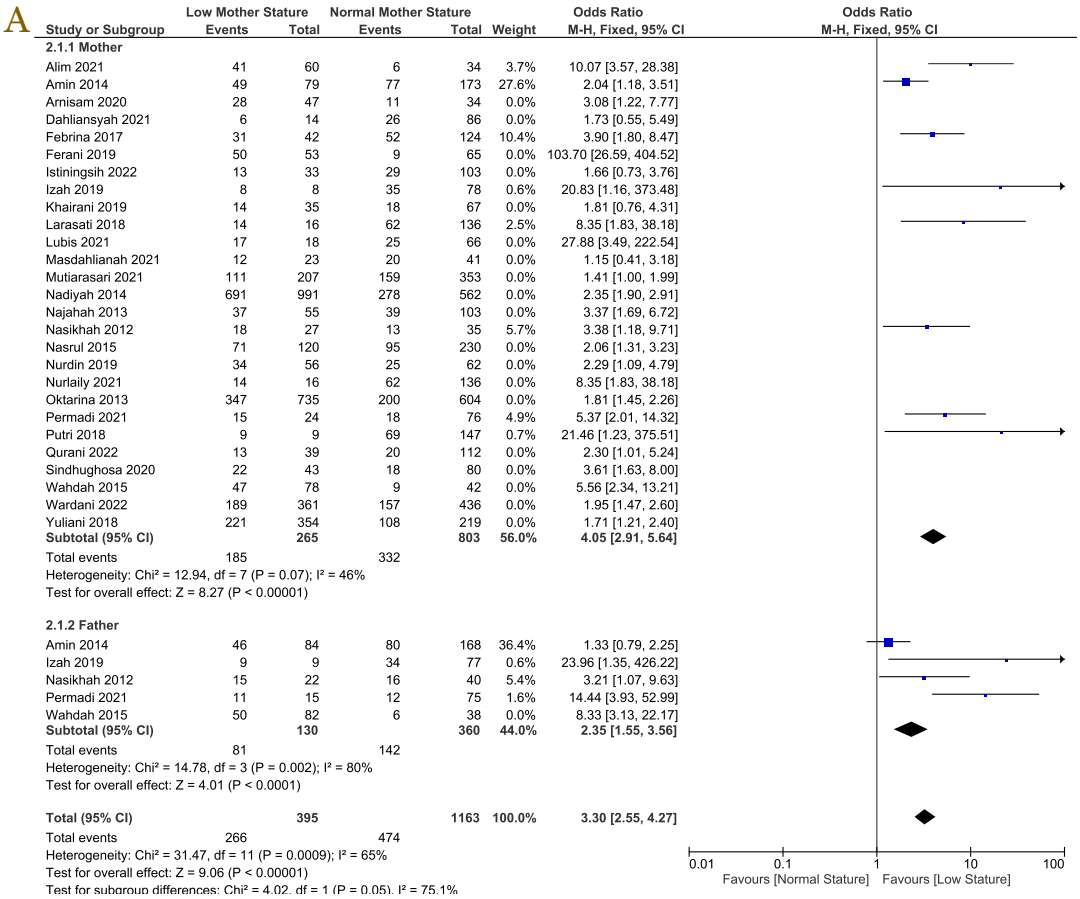
Exclusion of studies with low and moderate quality

The next sensitivity analysis excluded studies with low and moderate qualities [12,25,26,28-30,32,35-37,38,41,42,48,50] (**Figure 8**). The sensitivity analysis showed that heterogeneity remained substantial after excluding low and moderate quality studies, which means that these studies seemed not the source of heterogeneity. Therefore, based on five variables studied in sensitivity analysis, the studies with smaller sample sizes were the source of heterogeneity.

Risk of publication bias

The sensitivity analyses revealed that small sample size contributed to heterogeneity, indicating a small-study effect. The most well-known explanation of the small-study effect is publication bias, where studies tend to include only positive findings. This possibility may influence the result or the combined effect size in data synthesis of the effect of parental stature on the incidence of stunting. A funnel plot was drawn to picture the risk of publication bias further (**Figure 9**). Our data indicated that 16 studies on the right side of the triangle and 11 on the left side. This asymmetrical scatter indicated a high risk of publication bias.

A



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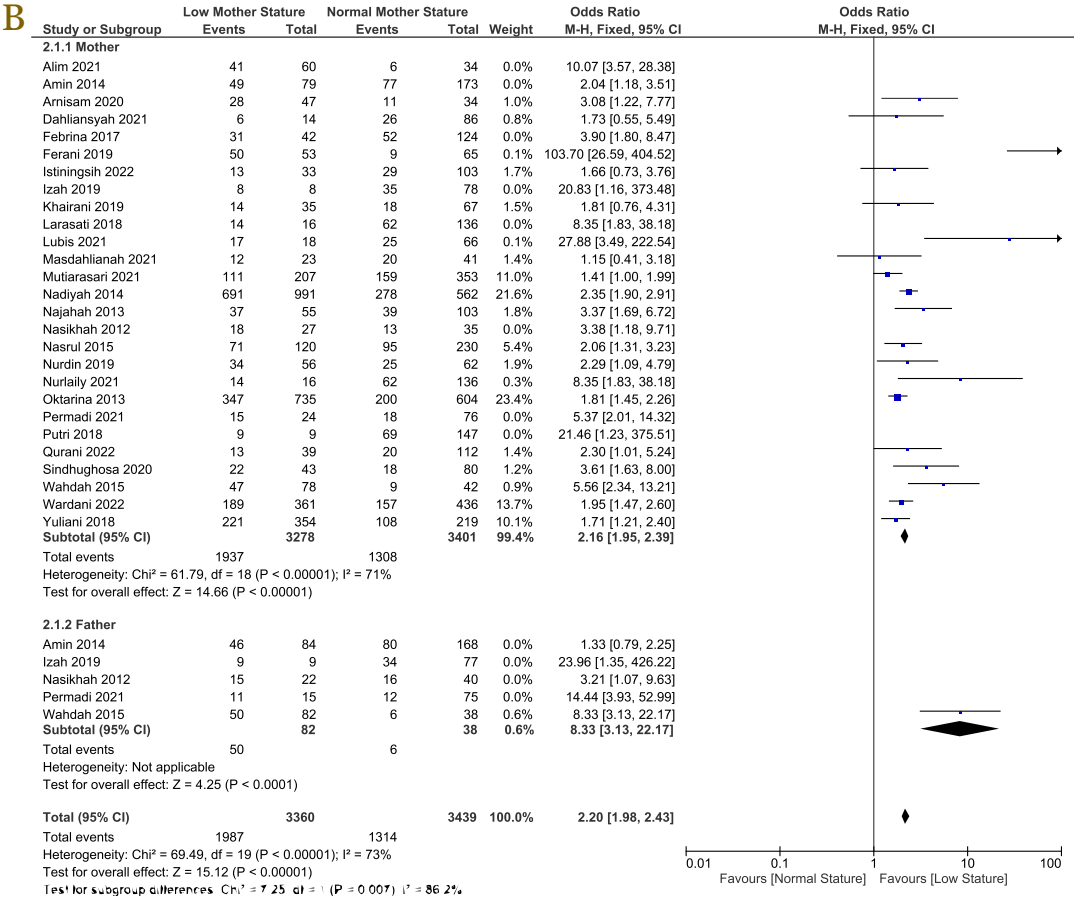

Figure 7. Sensitivity analysis by excluding studies taking non-Java (A) and Java (B) regions as the setting.

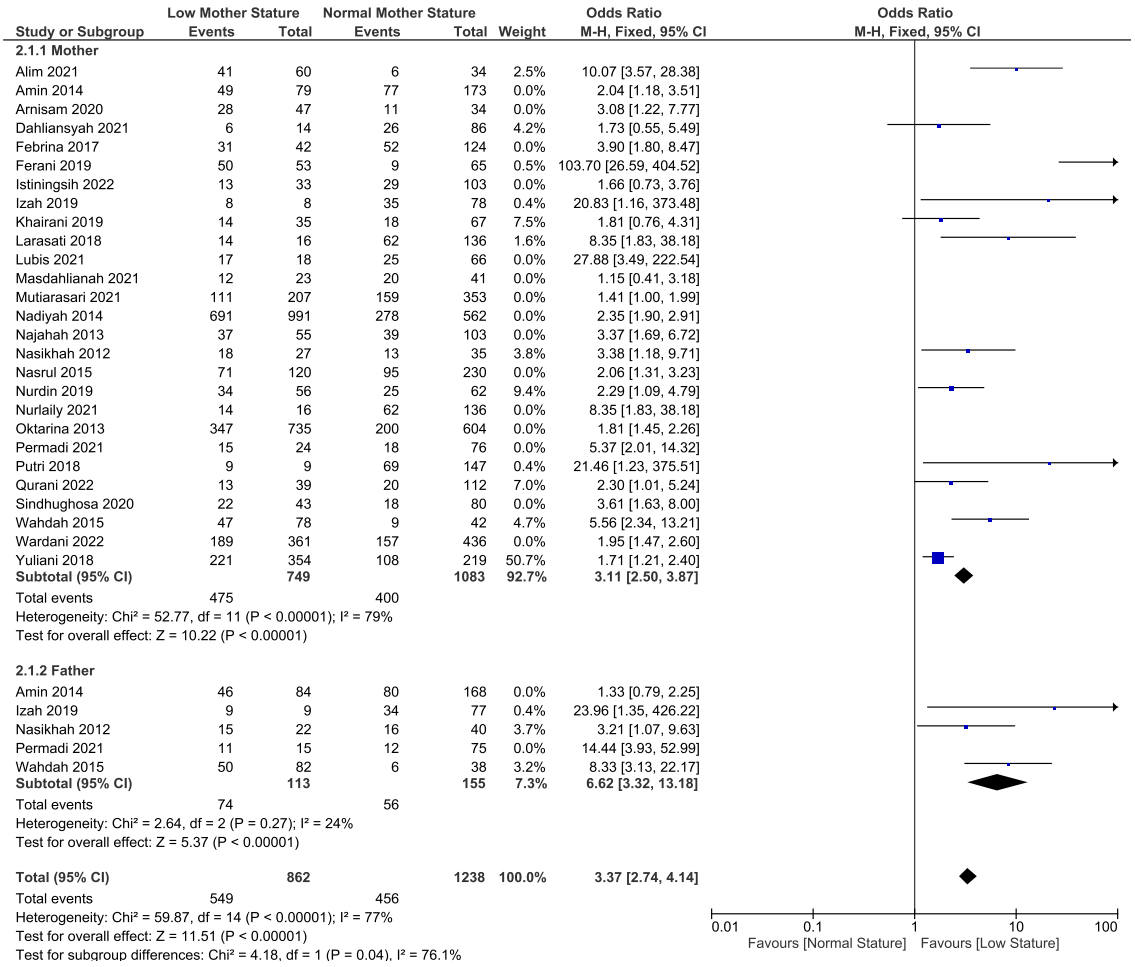

Figure 8. Forest plot of sensitivity analysis by excluding low and moderate quality studies.

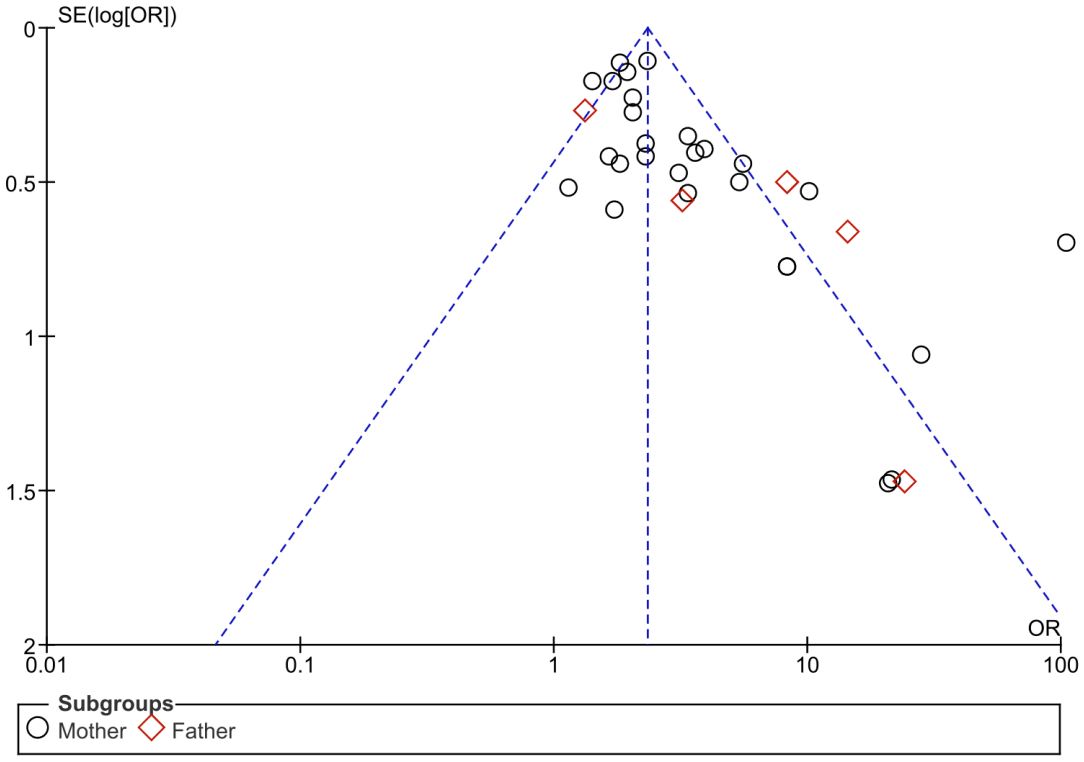

Figure 9. Funnel plot of data synthesis from the effect of parental stature on stunting among Indonesian toddlers.

Discussion

The findings of this present systematic review suggest that parental height is a risk factor for stunting in Indonesian population, with significant effects seen for maternal stature. These findings are consistent with previous studies showing parental height as a significant risk factor for stunting in young children [4,16]. However, caution should be exercised when interpreting the results of studies examining the effects of paternal stature and both parental stature on stunting, as these studies may suffer from imprecision, heterogeneity and low quality. There was also a high risk of publication bias among studies examining parental stature and stunting in Indonesia.

Our study highlights the need for a continuous monitoring of children's height and the implementation of interventions that address environmental factors contributing to stunting, such as access to adequate nutrition and healthcare [18,19] to reduce the prevalence of stunting in Indonesia which resonates with Indonesian Medium-Term Development Plan 2020–2024. Future studies may benefit from addressing the limitations identified in this review, such as the need for more extensive and higher-quality studies that account for potential confounding factors. Additionally, the use of standardized methods for measuring height and the inclusion of diverse populations may enhance the generalizability of findings.

Overall, this systematic review highlights the need for continuous efforts to address the complex and multifactorial nature of stunting in Indonesia. Furthermore, it also underscores the importance of conducting high-quality systematic reviews to accurately assess the evidence base for interventions aimed at reducing stunting in young children. By identifying parental stature as a potential risk factor for stunting, the findings of this study provide important insights for policymakers, healthcare providers, and researchers working towards the goal of reducing the burden of stunting in Indonesian population.

Conclusions

Our systematic review indicates that parental height may be associated with the incidence of stunting of toddlers in Indonesia. While the finding showed a significant effect of maternal stature (OR 1.92 with 95%CI: 1.71–2.15), paternal stature (OR 5.21; 95%CI: 1.71–15.86) and both parental stature (OR 3.01 with 95%CI: 2.41–3.75) on the incidence of stunting among toddlers in the country, it should be cautiously interpreted primarily because of imprecision, substantial heterogeneity with unidentified source and mixed qualities of studies. Our systematic review also reveals a high risk of publication bias among studies reporting the effect of parental stature on the incidence of stunting in Indonesia.

Ethics approval

Not required.

Acknowledgments

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Competing interest

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

How to cite

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