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Maternal Age at Marriage and the Incidence of Stunting Among Children Under Five: A Cross-Sectional Study in Sleman Regency, Indonesia

Dewi Rokhanawati[1]*, Nidatul Khofiyah[1], Rhipiduri Rivanica[2], Kriska Afri Juliandari[3], Yuriska Verina[3]

[1] Midwifery Study Program, Faculty of Health Sciences, Universitas Aisyiyah Yogyakarta, Indonesia
[2] Midwifery Study Program, Faculty of Health and Technology, Universitas Aisyiyah Palembang, Indonesia
[3] Master of Midwifery Student, Faculty of Health Sciences, Universitas Aisyiyah Yogyakarta, Indonesia
*Corresponding author: dewirokhanawati@unisayogya.ac.id

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ABSTRACT

Stunting continues to be a significant public health concern in Indonesia and is strongly associated with maternal and reproductive determinants. One recognized factor contributing to stunting is early marriage, which may increase biological, psychosocial, and socioeconomic vulnerability among mothers. This study aimed to examine the relationship between maternal age at marriage and stunting among children under five in Sleman Regency, Indonesia, while accounting for selected maternal and child characteristics. A cross-sectional design was conducted from October to December 2025 across three primary health centers in Sleman, involving 60 mother–child pairs selected through total sampling. Stunting was defined as a height-for-age z-score below −2 standard deviations based on WHO criteria. Independent variables included maternal age at marriage, maternal sociodemographic characteristics, birth spacing, exclusive breastfeeding history, child sex, and health center coverage area. Data were analyzed using univariate, bivariate, and multivariate methods with Firth's logistic regression. Adjusted odds ratios with 95% confidence intervals were calculated, and model selection was guided by the Akaike Information Criterion. Stunting prevalence was 16.7%. Early maternal marriage, female sex, and inadequate birth spacing were significantly associated with higher stunting risk. These findings underscore the importance of delaying marriage and strengthening reproductive health interventions.

Keywords**:** toddler; mother; marriage; stunting; age at marriage

INTRODUCTION

Stunting poses a serious public health challenge because it compromises human capital by impairing physical growth, cognitive development, and adult productivity [1–3]. The World Health Organization (WHO) defines stunting as impaired growth and development in children under five years of age, characterized by a height-for-age z-score below −2 standard deviations from the WHO Child Growth Standards median, primarily due to chronic undernutrition, recurrent infections, and inadequate environmental conditions [4]. Globally, the prevalence of stunting declined from 26.3% in 2012 to 22.3% in 2022. However, Indonesia continues to report a relatively high prevalence, ranging from approximately 21% to 24% between 2021 and 2024, making stunting a persistent national priority [5–7]. Stunting increases morbidity and mortality risks and adversely affects motor development, cognitive performance, and work capacity in adulthood [5,6,8].

Previous studies have identified several contributing factors, including maternal nutritional status, inadequate infant and young child feeding, poor sanitation, recurrent infection, limited access to healthcare, and suboptimal caregiving practices [5,9–12]. These factors often interact across the life course, beginning before conception and continuing throughout pregnancy, infancy, and early childhood. Because of this complexity, stunting prevention requires attention not only to child feeding and infection control, but also to maternal and reproductive health conditions that may place children at elevated risk from the beginning of life.

In Indonesia, early marriage (<18 years) remains prevalent and contributes to food insecurity and an elevated risk of stunting among children. Early marriage reflects biological and psychological immaturity, lower educational attainment, limited access to health services, and household economic instability, all of which undermine caregiving quality and adequate child nutrition [13,14]. UNICEF ranks Indonesia among the countries with the highest prevalence of child marriage, with 20 of 38 provinces exceeding the national average through 2020 [15]. The government targets reductions in child marriage through the 2020–2024 National Medium-Term Development Plan, aligned with

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Sustainable Development Goal (SDG) 5.3 to eliminate this practice by 2030 [16]. These conditions may reduce maternal readiness for pregnancy and childcare, thereby increasing the likelihood of poor nutritional and developmental outcomes among children. Early marriage may also contribute to high-risk fertility patterns, including early childbearing and short birth intervals, both of which have been associated with impaired child growth [17,18].

Several empirical studies have reported that early marriage is associated with an increased risk of child undernutrition, including stunting. Longitudinal evidence from Indonesia shows that children born to parents who experienced child marriage are more likely to face food insecurity and adverse nutritional outcomes [13]. Other national studies have likewise shown that maternal age at marriage is significantly associated with child stunting in Indonesia [18–20]. These findings suggest that the relationship between early marriage and stunting may operate through multiple pathways, including maternal biological immaturity, adverse pregnancy outcomes, limited access to health services, and constrained household readiness to provide adequate care and nutrition.

Beyond age at marriage, multiple determinants influence stunting, including maternal nutritional status, caregiving practices, sanitation, access to healthcare, exclusive breastfeeding, and family social support. At the regional level, the Special Region of Yogyakarta has continued to report cases of adolescent childbirth (recorded 266 adolescent deliveries in 2024), with Sleman Regency accounting for a substantial proportion of these cases. This pattern indicates that adolescent reproductive vulnerability remains relevant in the local context and may have implications for child growth and nutrition. However, despite the policy importance of delaying age at marriage and strengthening adolescent reproductive health, district-level evidence examining the relationship between maternal age at marriage and stunting remains limited, particularly in Sleman Regency.

Although previous studies have examined early marriage and child nutritional outcomes in broader national or regional populations, few local studies have specifically assessed this relationship while also considering selected maternal and child characteristics in the Sleman setting. Therefore, this study aimed to examine the association between maternal age at marriage and stunting among children under five in Sleman Regency, Indonesia.

MATERIALS AND METHODS

This study employed a quantitative cross-sectional design conducted in October – December 2025 at three primary health centers in Sleman Regency: Sleman Primary Health Center, Gamping II Primary Health Center, and Mlati I Primary Health Center. The study population comprised all mothers with children under five years of age registered within the service areas of these health centers.

A total of 60 respondents met the inclusion criteria and were enrolled using total sampling. The inclusion criteria required mothers to have a child under five years of age, complete data on age at marriage, and willingness to participate. Mothers whose children had incomplete anthropometric data were excluded. Because this study used total sampling of all eligible respondents available during the study period, no separate a priori sample size calculation was performed.

The dependent variable was stunting status among children under five, defined by height-for-age (HAZ) with a z-score < -2 standard deviations according to WHO Child Growth Standards. Independent variables included maternal age at marriage (<20 years and ≥20 years), current maternal age, education level, employment status, household socioeconomic status, maternal body mass index (BMI), birth spacing, exclusive breastfeeding practice, child sex, and health center area.

Birth spacing was defined as the interval between the preceding live birth and the index child and categorized as at risk (<24 months) and not at risk (≥24 months), in accordance with the WHO recommendation that women should wait at least 24 months after a live birth before attempting the next pregnancy [21]. Household socioeconomic status was classified using the 2024 Provincial Minimum Wage of the Special Region of Yogyakarta (IDR 2,125,898), which was used as the income cut-off in this study [22].

Data were collected using structured questionnaires and direct anthropometric measurements. Univariate analysis was performed to describe respondent characteristics. Bivariate associations between categorical variables and stunting status were examined using the Chi-square test when assumptions were met and exact tests when expected cell counts were small. Numerical variables were compared using mean-based tests as appropriate. Multivariate analysis used Firth's logistic regression to reduce small-sample bias and potential data separation. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported, and model selection was guided by the Akaike Information Criterion (AIC). Statistical significance was set at $p < 0.05$.

This study received ethical approval from the Research Ethics Committee of Universitas 'Aisyiyah Yogyakarta, number 4866/KEP-UNISA/X/2025. All respondents were provided with information about the study and signed informed consent before data collection.

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The characteristics of respondents and shows that most children in this study were classified as non-stunted. The mean maternal age was slightly higher in the stunted group compared with the non-stunted group, whereas the mean age of children was relatively similar across both groups (Table 1).

Table 1. Characteristic of Respondents

Variable	Category	Stunting n (%)	Non-Stunting n (%)	Total n (%)	p-value
Stunting status		10 (16.7)	50 (83.3)	60 (100)	
Maternal age (years)	Mean ± SD	31.0 ± 6.02	28.4 ± 5.60	28.8 ± 5.70	
Maternal age at marriage	< 20 years	8 (80.0)	22 (44.0)	30 (50.0)	0.04
	≥ 20 years	2 (20.0)	28 (56.0)	30 (50.0)	
Maternal education	High	1 (10.0)	11 (22.0)	12 (20.0)	
	Middle	6 (60.0)	22 (44.0)	28 (46.7)	0.58
	Low	3 (30.0)	17 (34.0)	20 (33.3)	
Maternal employment	Not working	8 (80.0)	30 (60.0)	38 (63.3)	0.23
	Working	2 (20.0)	20 (40.0)	22 (36.7)	
Maternal BMI status	Normal	5 (50.0)	32 (64.0)	37 (61.7)	0.41
	Not normal	5 (50.0)	18 (36.0)	23 (38.3)	
Child age (months)	Mean ± SD	16.8 ± 14.76	18.1 ± 16.12	17.8 ± 15.79	
Child sex	Female	8 (80.0)	20 (40.0)	28 (46.7)	0.02
	Male	2 (20.0)	30 (60.0)	32 (53.3)	
Exclusive breastfeeding	No	4 (40.0)	21 (42.0)	25 (41.7)	0.91
	Yes	6 (60.0)	29 (58.0)	35 (58.3)	
Birth spacing	At risk	4 (40.0)	7 (14.0)	11 (18.3)	0.05
	Not at risk	6 (60.0)	43 (86.0)	49 (81.7)	
Household income (IDR)	≤ 2,125,898	7 (70.0)	25 (50.0)	32 (53.3)	0.25
	≥ 2,125,898	3 (30.0)	25 (50.0)	28 (46.7)	
Primary health center	Sleman	2 (20.0)	17 (34.0)	19 (31.7)	
	Gamping II	3 (30.0)	20 (40.0)	23 (38.3)	0.31
	Mlati I	5 (50.0)	13 (26.0)	18 (30.0)	

Source**:** Primary data, 2025

Regarding maternal age at marriage, a higher proportion of stunted children was observed among mothers who married before the age of 20 years. This difference indicates a statistically significant association between early maternal marriage and stunting. In contrast, maternal education level did not differ meaningfully between the stunted and non-stunted groups. In terms of socioeconomic status, stunting appeared more frequently among families with income below the minimum wage; however, this association was not statistically significant. A similar pattern emerged for maternal nutritional status based on body mass index (BMI), with no significant difference identified between groups.

Based on child characteristics, stunting was more prevalent among girls than boys, and this difference was statistically significant. Exclusive breastfeeding practice did not significantly differ between groups. The distribution of stunting cases across primary health center areas varied, but these differences were not statistically significant. Likewise, maternal employment status showed a higher proportion of stunting among non-working mothers, although the association was not significant. Birth spacing demonstrated a statistically significant association with stunting, with a higher proportion of stunting observed among children with at-risk birth spacing.

Overall, maternal age at marriage, child sex, and birth spacing were significantly associated with stunting, whereas maternal education, socioeconomic status, maternal nutritional status, exclusive breastfeeding, health center area, and maternal employment were not significantly associated in this study.

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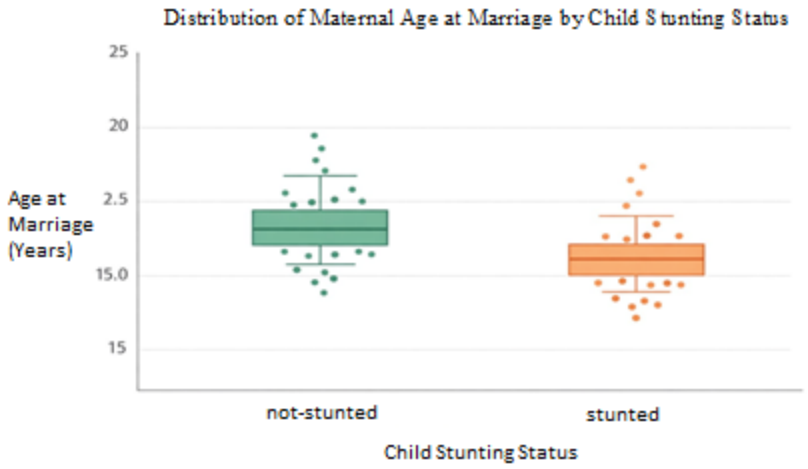

Figure 1. Distribution of Maternal Age at Marriage by Child Stunting Status

Figure 1 shows that the median maternal age at marriage was lower among mothers of stunted children than among mothers of non-stunted children. This visual pattern is consistent with the bivariate finding that earlier maternal age at marriage was associated with a higher proportion of stunting.

Table 2. Analysis of the Association Between Participant Characteristics and Child Stunting Status

Variable	Category	Stunting n (%)	Non-Stunting n (%)	95% CI	p-value
Maternal age		31.0 ± 6.02	28.4 ± 5.60	27.38–30.32	0.194[a]
Maternal age at marriage	<20 years	8 (80.0)	22 (44.0)	1.17–2.82	0.037[b]
	≥20 years	2 (20.0)	28 (56.0)		
Maternal education	High	1 (10.0)	11 (22.0)	0.34–19.12	0.356[b]
	Secondary	6 (60.0)	17 (34.0)		
	Low	3 (30.0)	22 (44.0)	0.21–15.41	0.592[b]
Maternal employment status	Unemployed	8 (80.0)	30 (60.0)	0.91–1.96	0.231[b]
	Employed	2 (20.0)	20 (40.0)		
Maternal BMI status	Abnormal	5 (50.0)	18 (36.0)	0.67–2.86	0.406[b]
	Normal	5 (50.0)	32 (64.0)		
Child age		16.8 ± 14.75	18.1 ± 16.12	13.78–21.30	0.820[a]
Child sex	Female	8 (80.0)	20 (40.0)	1.26–3.17	0.021[b]
	Male	2 (20.0)	30 (60.0)		
Breastfeeding	Not given	4 (40.0)	21 (42.0)	0.34–3.40	0.907[b]
	Given	6 (60.0)	29 (58.0)		
Birth spacing	At risk	4 (40.0)	7 (14.0)	1.00–8.77	0.049[b]
	Not at risk	6 (60.0)	43 (86.0)		
Economic status	≤2,125,898	7 (70.0)	25 (50.0)	0.86–2.29	0.250[b]
	≥2,125,898	3 (30.0)	25 (50.0)		
Primary Health Center	Sleman	2 (20.0)	17 (34.0)	0.23–6.67	0.803[b]
	Gamping II	3 (30.0)	20 (40.0)		
	Mlati I	5 (50.0)	13 (26.0)	0.58–11.92	0.210[b]

Notes**:** [a] Independent samples t-test; [b] Chi-square or exact test, as appropriate
Source**:** Primary data, 2025

Table 2 shows that maternal age at marriage, child sex, and birth spacing were significantly associated with stunting in the bivariate analysis. Children born to mothers who married before the age of 20 years had a higher proportion of stunting than those whose mothers married at age 20 years or older (p = 0.037). Girls also showed a higher proportion of stunting than boys (p = 0.021). In addition, children with at-risk birth spacing had a higher

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proportion of stunting than those with non-risk birth spacing (p = 0.049). Other variables, including maternal education, employment status, BMI, economic status, exclusive breastfeeding, and health center area, were not significantly associated with stunting.

Table 3. Multivariate Logistic Regression Analysis Using Firth's Approach (Adjusted Odds Ratios)

Variable	Model 1 aOR (95% CI)	Model 2 aOR (95% CI)	Model 3 aOR (95% CI)	Model 4 aOR (95% CI)	Model 5 aOR (95% CI)	Model 6 aOR (95% CI)
Maternal age at marriage (<20 years)	4.31 (0.95–19.59)	5.82* (1.21–28.00)	4.72* (1.01–22.00)	4.89* (1.00–23.81)	3.84 (0.84–17.67)	6.35* (1.11–36.20)
Maternal age (years)	–	1.11 (0.99–1.24)	–	–	–	1.11 (0.97–1.27)
Maternal employment (employed)	–	–	0.37 (0.08–1.78)	–	–	0.55 (0.11–2.79)
Child sex (male)	–	–	–	0.18* (0.04–0.86)	–	0.21 (0.04–1.10)
Birth spacing (short/suboptimal)	–	–	–	–	3.45 (0.79–15.10)	1.23 (0.20–7.67)
N	60	60	60	60	60	60
AIC	51.00	44.14	50.62	46.77	50.12	42.54

Source**:** Primary data, 2025
Note:
aOR = Adjusted Odds Ratio; CI = Confidence Interval; AIC = Akaike Information Criterion.
Significant at p < 0.05.

Table 3 presents the multivariable analysis using Firth's logistic regression. In Model 1, maternal age at marriage below 20 years was associated with higher odds of stunting, although the confidence interval included unity. After adjustment for maternal age in Model 2, the association became statistically significant. The association remained significant in Models 3 and 4 after additional adjustment for employment status and child sex. In Model 5, the inclusion of birth spacing attenuated the association between early marriage and stunting. In the final model (Model 6), maternal age at marriage below 20 years remained significantly associated with higher odds of stunting (aOR = 6.35; 95% CI: 1.11–36.20).

Based on the lowest Akaike Information Criterion (AIC), Model 6 demonstrated the best fit, balancing model complexity and explanatory power. Substantively, the final model indicates that mothers who married before age 20 had approximately sixfold higher odds of having a stunted child compared with those who married at age ≥20 years, after adjustment for key covariates.

DISCUSSION

This study demonstrates that maternal age at marriage below 20 years was significantly associated with stunting among children under five in Sleman Regency, even after adjusting for maternal age, employment status, child sex, and birth spacing. This finding aligns with previous evidence indicating that adolescent marriage increases the risk of impaired child growth due to maternal biological, psychosocial, and economic immaturity [19,20,23]. Pregnancy before the age of 20 is associated with higher risks of maternal anemia, intrauterine growth restriction, preterm birth, low birth weight, and obstetric complications, all of which contribute to subsequent stunting [24]. In addition, mothers who marry early may enter parenthood with limited autonomy, lower educational attainment, and reduced access to reproductive and maternal health services, which may further compromise their readiness to provide adequate care during the critical early years of child development [25].

Child sex was also significantly associated with stunting, with girls exhibiting a higher risk than boys. This finding should be interpreted cautiously because the literature on sex differences in stunting is inconsistent [26]. Several studies have reported that boys are more biologically vulnerable to growth faltering and infectious morbidity during early life, whereas others have shown context-specific variations that may reflect differences in caregiving patterns, food allocation, health-seeking behavior, or sociocultural norms [27,28]. In the present study, the higher proportion of stunting among girls may reflect local household dynamics or sample-specific variation rather than a universal

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biological pattern. Given the relatively small sample size, this finding should not be overgeneralized and warrants further investigation in larger studies conducted in similar settings.

Non-optimal birth spacing was likewise associated with increased stunting risk, potentially mediated by household resource competition, inadequate maternal nutritional recovery, and limited caregiving capacity [29–31]. This finding is plausible because when children are born too close together, maternal time, attention, and household food resources may become more constrained, thereby reducing the quality of care available for each child. In such circumstances, limited caregiving capacity and suboptimal feeding practices may further constrain child nutritional adequacy and growth, as suggested by previous studies on maternal feeding behavior and child nutrition outcomes [32,33]. After adjustment in the multivariable models, the association between early marriage and stunting was attenuated when birth spacing was included, suggesting that reproductive timing may contribute to the observed relationship. However, this pattern should be interpreted as statistical adjustment rather than evidence of mediation, because the present study was not designed to formally test mediation pathways.

Maternal education, household economic status, maternal nutritional status (BMI), exclusive breastfeeding, and maternal employment were not significantly associated with stunting in this study. These non-significant findings may partly reflect the relatively small sample size and the limited variability of several respondent characteristics within the study population. Nevertheless, these factors remain conceptually important. Previous studies have shown that maternal knowledge of balanced nutrition, maternal feeding practices, and caregiver perceptions may substantially influence child nutritional outcomes, even when broader socioeconomic characteristics do not differ significantly between groups [25,34]. This suggests that maternal reproductive factors such as early marriage may operate alongside more proximal determinants related to caregiving capacity, nutrition literacy, and child-feeding behavior.

The findings of this study have important practical implications. Because early marriage and non-optimal birth spacing were associated with stunting risk, prevention strategies should not be limited to child nutrition interventions alone. They should also include efforts to delay age at marriage, strengthen adolescent reproductive health education, improve access to family planning, and support maternal readiness for childcare. Community-based counseling, premarital education, Posyandu strengthening, and primary healthcare interventions may be particularly relevant in translating these findings into local prevention strategies [31,34].

This study has several limitations. First, the cross-sectional design precludes temporal interpretation and does not allow causal inference. Second, the relatively small sample size may have reduced the precision of the effect estimates, as reflected by the wide confidence intervals in the multivariable analysis. Third, the study was conducted in a single district, which may limit the generalizability of the findings to other settings with different sociodemographic or epidemiological characteristics. This issue is particularly relevant because the prevalence of stunting observed in this study was lower than the national average reported in recent years. Fourth, several variables, including maternal age at marriage and household income, were self-reported and therefore may be subject to recall bias or social desirability bias.

Overall, the findings underscore the importance of maternal reproductive factors, particularly early marriage, in shaping stunting risk among children under five. Effective prevention strategies should therefore prioritize delaying age at marriage, strengthening adolescent reproductive health education, promoting optimal birth spacing, and improving maternal nutrition literacy through counseling and community-based health programs. At the same time, interventions should address misconceptions about stunting and reinforce evidence-based caregiving and feeding practices in order to support healthier child growth trajectories.

CONCLUSION AND RECOMMENDATION

Maternal age at marriage below 20 years was significantly associated with stunting among children under five in Sleman Regency. These findings highlight the importance of addressing maternal reproductive vulnerability as part of stunting prevention efforts. Interventions should target adolescent girls, couples of reproductive age, mothers of young children, health workers, and community leaders through coordinated actions at the community, primary healthcare facility, and district health office levels. Relevant strategies may include premarital counseling, adolescent reproductive health education, strengthening Posyandu-based nutrition promotion, and family planning services through BKKBN and primary healthcare programs to support optimal birth spacing.

AUTHOR'S CONTRIBUTION STATEMENT

Dewi Rokhanawati conceptualized and designed the study and supervised the overall research process. Nidatul Khofiyah contributed to study design, data interpretation, and manuscript drafting. Rhipiduri Rivanica contributed to data analysis and manuscript review. Kriska Afri Juliandari and Yuriska Verina were involved in data collection, data management, and initial manuscript preparation. All authors read and approved the final version of the manuscript.

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CONFLICT OF INTEREST

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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