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Original Article

Factors Associated with Stunting among Children Under Five: a Cross-Sectional Study in Southwest Papua, Indonesia

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ABSTRACT

Background: one of the most worrying long term impacts of child marriage is the high rate of stunting among under-fives which is still prevalent in many areas, including in Southwest Papua. This study aims to analyze the associative relationship between stunting and child marriage in Klalin District, Sorong Regency, Southwest Papua.
Methods: a cross-sectional approach was adopted for this research, and the research was performed from June to September 2025. The research involved 113 families selected with cluster sampling techniques at 4 areas in Klalin District using the Lameshow formula. Chi-square and multiple binary regression analyses were applied in this study.
Results: most mothers who married under 18 years old had a junior high school education (41.6%) and were not employed (52.2%). In multivariate analysis, maternal age under 18 years was significantly associated with stunting (AOR = 2.72; 95% CI: 1.17–6.32; p = 0.020). Low maternal education was also significantly associated with stunting (AOR = 1.69; 95% CI: 1.16–2.47; p = 0.007), while maternal occupation was not significantly associated with stunting (AOR = 1.15; 95% CI: 0.93–1.41; p = 0.198).
Conclusion: Child marriage among girls under 18 is prevalent in Southwest Papua and is significantly associated with low maternal education, which is also associated with an increased risk of stunting in children. These findings suggest that stunting prevention strategies should prioritize efforts to delay the age of marriage and improve women's educational attainment, alongside initiatives to enhance women's economic opportunities.

INTRODUCTION

Stunting is a chronic nutritional condition that affects physical growth and brain development in children and increases the risk of metabolic diseases in adulthood (Sartika et al., 2021). The long-term consequences of stunting among children under five can negatively influence health status throughout the life course (Laksono, Sukoco, Rachmawati, & Wulandari, 2022). According to the Global Nutrition Report 2022, approximately 148.1 million children under five worldwide (22.3%) suffer from stunting, with the highest burden observed in Asia (52%) and Africa (43%). In Indonesia, data from the Indonesian Health Survey reported a stunting prevalence of 21.5% in 2023 (Kemenkes RI., 2023), while the Indonesian Nutrition Status Survey reported a prevalence of 19.8% in 2025 (kemenkes RI, 2025). However, the prevalence of stunting in

Southwest Papua remains substantially higher, reaching 30.5%. Data from the first quarter of the Electronic Community-Based Nutrition Recording and Reporting system indicated that 668 children were stunted, of which 296 children (44%) were from Sorong Regency (Papua Barat Daya, 2024).

Stunting is influenced by multiple interrelated factors, one of which is child marriage. Early marriage has harmful consequences for women and children, as nearly 90% of girls who marry before the age of 18 give birth during adolescence, a period when they are often not physically or emotionally prepared for motherhood (Bari, K., Sadik, F., Faraz, 2025). Globally, child marriage defined as marriage before the age of 18 remains a critical social issue, particularly in developing countries (Hossain, Ripon, Tareq, Rokunuzzaman, & Sharma, 2025). Previous studies have shown a significant association between maternal age and stunting. For example, Sulistyawati et al. (2024) reported that teenage mothers accounted for 17.7% of stunting cases, with maternal age showing a significant associated with stunting incidence ($p = 0.003$) (Sulistyawati, Melinda, & Ratnasari, 2024). Similarly, early marriage has been identified as a major contributor to stunting, with adolescent marriage increasing the risk more than sixfold (POR = 6.218) (Sutinbuk et al., 2013). Beyond health outcomes, child marriage also poses serious human rights concerns and long-term social consequences (Saputra et al., 2024).

In Indonesia, child marriage remains a complex social problem, particularly in eastern regions such as Southwest Papua. Data from the Central Bureau of Statistics indicate that 3.40% of women aged 20–24 years in Southwest Papua were married before the age of 18 (Statistik, 2023). Traditional socio-cultural norms that support early marriage, especially for girls, contribute significantly to this practice. These conditions are further exacerbated by limited access to education, resulting in inadequate knowledge of reproductive health, nutrition, and child care among adolescent mothers. Maternal education plays a crucial role in child nutrition, as educated mothers are better able to make informed decisions regarding food selection and child feeding practices (Sutinbuk et al., 2013). Working women face complex challenges in caring for children, providing nutrition, and raising children (Supadmi et al., 2024). The employment status of mothers is a contributing factor to stunting in children, particularly in low-income households (Wulandari et al., 2025).

A validated predictive model offers a comprehensive understanding of the determinants of stunting (Ahmed et al., 2025). Although numerous studies have examined the association between child marriage and stunting at national and provincial levels, evidence at the district level remains limited, particularly in Southwest Papua. Klalin District, located in Sorong Regency, is characterized by high rates of early marriage, limited access to education, and persistent traditional socio-cultural norms. Despite the high prevalence of both child marriage and stunting in this area, empirical data examining their predictive relationship at the local level are scarce. District-specific evidence is essential to inform targeted public health interventions and policy implementation. Therefore, this study aims to analyze the associative relationship between stunting and child marriage in Klalin District, Sorong Regency, Southwest Papua. This research will use multivariable regression to identify factors associated with stunting in the district, with a focus on how maternal age, education, and occupation contribute to stunting outcomes. The findings from this study will offer valuable insights to guide interventions aimed at reducing stunting rates in similar socio-cultural settings. Associated factors will be used to assess the strength of these relationships.

METHODS

This study employed a cross-sectional analytical design and was conducted from June to September 2025 in four areas within Klalin District, located in the working area of the Malawili Health Center, Sorong Regency, Southwest Papua Province. The study aimed to analyze the relationship between maternal age at marriage, maternal education level, maternal employment status, and stunting prevalence among children under five in Klalin District.

The initial sample consisted of 113 children identified as potentially stunted based on local community records. Upon measurement of height-for-age using WHO growth standards, 73 children were confirmed as stunted (HAZ < −2 SD). Height was measured using a standardized

stadiometer to the nearest 0.1 cm by trained health staff. Duplicate measurements were taken, and the average was recorded. For multivariate logistic regression analysis, only children confirmed as stunted were included. Non-stunted children (n = 40) are reported in descriptive statistics for reference but were not part of the analytical model.

A cluster sampling technique was used due to the geographic distribution of the population. Four areas within the Malawili Health Center's working area were selected as clusters, and within each selected cluster, households were listed and numbered. The number of households sampled per cluster was proportional to the cluster population. Households were then selected using simple random sampling from the list. The minimum sample size was calculated using the Lemeshow formula for cross-sectional studies, with a 95% confidence level and a 5% margin of error, based on regional stunting prevalence data. A total of 113 families met the inclusion criteria.

Inclusion criteria were mothers with children under five years of age (0–59 months), residing in Klalin District within the Malawili Health Center's working area, with known history of maternal age at marriage, and who were willing to participate in the study. Exclusion criteria included mothers whose children had congenital or chronic medical conditions, children not living with their biological mothers, and respondents who were unwilling to participate in the study.

The dependent variable was stunting status among children under five years of age, defined as HAZ < −2 SD according to WHO standards. Independent variables included maternal age at marriage, maternal education level, and maternal employment status. Child marriage was defined as marriage occurring before the age of 18, in accordance with UNICEF standards and Indonesian Law No. 16 of 2019 concerning marriage. Maternal education was coded ordinally, with higher values indicating lower educational attainment. Maternal education was coded ordinally with higher values indicating lower education; treated as an ordinal variable in logistic regression to assess linear trend. Maternal employment status was categorized into four groups: farmers/fishermen, private employees, self-employed, and not working, with 'not working' as the reference category. This variable was treated as categorical in the logistic regression analysis.

Data were collected using a structured questionnaire developed based on relevant literature. The questionnaire was pre-tested for validity and reliability before use in data collection at the Kaili Health Center, Sorong Regency. Content validity was assessed through expert judgment, and reliability testing showed acceptable internal consistency with a Cronbach's alpha greater than 0.70. Data analysis was conducted using statistical software. Descriptive statistics were used to summarize the respondent characteristics. Bivariate analysis using the Chi-square test was performed to assess associations between independent variables and stunting status. Variables with p-values <0.25 in bivariate analysis were included in multiple binary logistic regression analysis to control for potential confounders. Statistical significance was set at $p < 0.05$. In the logistic regression model, key confounders such as child age, child sex, household income, sanitation, infections, and birthweight were not included due to limited data availability. Therefore, the analysis should be interpreted with caution, and these findings cannot be regarded as causal. Future research should aim to control for these confounding factors to better understand the relationship between maternal characteristics and child stunting. The analysis did not account for design effect or sampling weights; therefore, variance estimates may be underestimated, and results should be interpreted with caution. No model diagnostics were conducted; therefore, the model's goodness-of-fit could not be assessed, and results should be interpreted with caution.

This study received ethical approval from the Health Research Ethics Committee under reference number DP.04.03/F.LIII.13.a./332/2025. Written informed consent was obtained from all participants prior to data collection. Participants were informed about the study's objectives, procedures, voluntary participation, confidentiality of data, and their right to withdraw from the study at any time without penalty.

RESULTS

1. Socio-demographic Characteristics Of Mothers

The characteristics of respondents based on child marriage, maternal education, and maternal occupation are presented in table 1.

Table. 1 Respondent Characteristics

Respondent Characteristics	n	%
Child Marriage		
< 18 years	68	60.2
> 18 years	45	39.8
Maternal Education		
Not in school	15	13.3
Elementary school	20	17.7
Junior high school	47	41.6
High school	31	27.4
Maternal Occupation		
Farmers / fishermen	41	36.3
Private	11	9.7
Self-employed	2	1.8
Not working	59	52.2
Child Stunting		
Stunted	73	64.6
Not Stunted	40	35.4

From table 1, the majority of mothers married under 18 years (60.2%), had junior high school education (41.6%), and were not employed (52.2%). The proportion of stunted children under five was (64.6%). A total of 113 children were included in the study, all of whom were diagnosed with stunting. Among the sample, 40 children were classified as not stunted based on their height-for-age z-scores

2. Bivariate Analysis: Relationship Between Variables and Stunting

The bivariate relationship between child marriage, maternal education, maternal occupation, and stunting is presented in table 2.

Table. 2 Relationship Between Predictors and Stunting

Variable	Stunting				Total		p-value
	Stunting		Not Stunting				
	n	%	n	%	n	%	
Mother's Age							0.042
< 18 years old	49	72.1	19	27.9	68	60.2	
> 18 years old	24	53.3	21	46.7	45	39.8	
Mother's Education							0.030
Not in school	12	80.0	3	20.0	15	13.3	
Elementary School	17	85.0	3	15.0	20	17.7	
Junior High School	29	61.7	18	38.3	47	41.6	
High School	15	48.4	16	51.6	31	27.4	
Mother's Occupation							0.049
Farmer/Fisherman	29	70.7	12	29.3	41	36.3	
Self-employed	2	100.0	0	0.0	2	1.8	
Private	10	90.9	1	9.1	11	9.7	
Not Working	32	54.2	27	45.8	59	52.2	

Bivariate analysis using chi-square tests indicated that child marriage, maternal education, and maternal occupation were significantly associated with stunting ($p < 0.05$). Mothers who gave birth under 18 years had a higher proportion of stunted children

(72.1%) compared to mothers who gave birth over 18 years (53.3%). Lower maternal education was associated with higher stunting prevalence, and maternal occupation also showed significant differences in stunting proportions.

3. Multivariate Analysis: Predictive Factors of Stunting

To control for confounding variables, multiple binary logistic regressions were conducted. The results are shown in Table 3.

Table 3. Logistic Regression Analysis of Stunting Incidence

Variable	B	Exp(B)	95% C.I	p-value
Mother's Age	1.000	2.719	1.170-6.318	0.020
Mother's Education	0.524	1.689	1.156-2.467	0.007
Mother's Occupation	0.136	1.146	0.931-1.409	0.198
Constant (intersept)	4.653	0.010		0.000

The multivariate logistic regression analysis showed that children of mothers who married before 18 years of age had higher odds of stunting compared to children of mothers who married at 18 years or older (OR = 2.719; 95% CI: 1.170–6.318; p = 0.020). Children of mothers with lower educational attainment also had higher odds of stunting. Specifically, children of mothers who had not attended school (OR = 9.576; 95% CI: 1.905–48.126; p = 0.006) or completed only elementary school (OR = 8.151; 95% CI: 1.732–38.365; p = 0.008) had significantly higher odds of stunting compared to children of mothers who completed high school. Maternal occupation was not independently associated with stunting (farmers/fishermen, private employees, or self-employed versus not working; all p > 0.05), but this variable is reported here for completeness.

These findings indicate that maternal age at marriage and maternal education are important predictors of stunting among children under five in Klalin District, while maternal occupation does not independently predict stunting when controlling for other factors.

It is important to note that this analysis was conducted exclusively for children identified as stunted (with height-for-age Z-scores < −2 SD). Children who were not stunted only appear in the descriptive findings and were not included in the multivariate regression analysis.

DISCUSSION

Interpretation of Key Findings

This study found that the majority of child marriages occurred at <18 years old (60.2%), most mothers attained education up to the junior high school level (41.6%), and most mothers did not work (52.2%). Bivariate analysis identified significant associations between child marriage (p=0.042), maternal education (p=0.030), and maternal occupation (p=0.049) with stunting prevalence in Klalin District.

Multivariate logistic regression showed that maternal age at marriage and maternal education were significantly associated with stunting, while maternal occupation was not (p=0.198). Children of mothers who married under 18 had 2.7 times higher odds of being stunted compared with children of mothers who married at ≥18 years (OR = 2.719; 95% CI: 1.170–6.318). Children of mothers with lower education had approximately 1.7 times higher odds of stunting compared with children of mothers with higher education (OR = 1.689; 95% CI: 1.124–2.538). Maternal age at marriage and education remained associated with stunting even after controlling for maternal occupation.

Stunting is influenced by multiple factors including child age, sex, birthweight, infections, sanitation, household wealth, and maternal nutrition. As these variables were not fully accounted for, the observed associations may be subject to residual confounding, and causal inferences cannot be made.

Comparison with Previous Studies

Cultural norms favoring early marriage, gender role expectations, and limited access to education indirectly influence child stunting by delaying maternal empowerment and reducing knowledge on child nutrition and care practices. Children under five are more likely to experience stunting depending on their mother's age at marriage, which represents a long-term nutritional challenge (Loihala et al., 2023; Tengjaya, A. A. A., Nai, H. M. E., & Purnawijayanti, 2025). Early maternal marriage frequently results in adolescent pregnancy, which increases the associated with complications such as low birth weight, maternal undernutrition, and insufficient childcare knowledge (Fonseka et al., 2022; UNICEF, 2020), These factors form a plausible causal pathway linking child marriage to stunting. Previous studies also report that early maternal marriage is associated with higher rates of stunting and underweight children under five (Čvorović, 2022; Khan et al., 2024).

Maternal education influences child nutrition through knowledge, caregiving practices, and access to resources. Children of mothers with lower education levels are at greater associated with stunting due to reduced awareness of dietary diversity, hygiene practices, and health services (Loihala et al., 2024; Wahyuni, Murti, & Adriani, 2023).

Maternal employment has both potential benefits and drawbacks. Employment may increase household income, improving access to food and healthcare. Conversely, it may reduce maternal caregiving time, increasing reliance on alternative childcare arrangements, which can negatively affect child nutrition (Rahayuwati et al., 2023; Wulandari et al., 2025). In our study, maternal occupation was not a significant predictor of stunting in multivariate analysis (p=0.198, OR=1.146, 95% CI: 0.931–1.409).

The high prevalence of child marriage in Klalin District is influenced by persistent traditional norms favoring early marriage for girls, gender role expectations, and limited access to education. These socio cultural factors indirectly contribute to stunting by reducing maternal knowledge and delaying empowerment for childcare and nutrition decision-making. Interventions should consider these local contextual factors to improve effectiveness. Research results show consistent with those reported by Dewi et al (2023) confirmed that early marriage is significantly correlated with poor health and nutritional condition, which encompasses the likelihood of stunting among children born (Dewi, Rahmiati, & Solehah, 2023). Growth patterns in children, Hasniati et al. (2023), in their research on Child Growth, found that offspring of mothers who married at a young age exhibited increased vulnerability to physical growth impairment at 2 years of age, indicating the long-term impact of child marriage on the next generation (Hasniati, Syahriani, Nurbaya, Fitriani, & Asnuddin, 2023). Qualitative study by Ulfa, Nugroho (2020), the study identified early marriage, low education levels, and family economic difficulties as the primary factors contributing to stunting. In the study, it was found that most women in the study area were married at the age of 18, with some of them even marrying below that age. This condition is exacerbated by the couple's lack of knowledge about parenting, as well as economic inability, characterized by the absence of a permanent job or a decent place to live (Ulfah & Nugroho, 2020).

Implications for Public Health

The study emphasizes that early maternal marriage and low maternal education are key determinants of stunting among children under five. Public health efforts should focus on delaying marriage, promoting female education, and enhancing maternal economic empowerment. These integrated strategies can improve child nutrition and overall growth outcomes.

Limitations and Cautions

This study has several limitations. The cross-sectional design limits causal inference, and observed associations cannot be interpreted as definitive causal relationships. Self-reported maternal age at marriage may introduce recall bias, and selection bias may arise from the sampling approach. Additionally, unmeasured confounders, such as household income, access to health services, and maternal nutrition, could influence stunting outcomes. The treatment of

maternal occupation as a single variable may not fully capture occupational heterogeneity and could limit the interpretation of its association with stunting. Finally, findings are limited to Klalin District and may not be generalizable to other regions with different socio cultural characteristics. Due to the cross-sectional design and unmeasured confounders, causality cannot be inferred, and the observed associations should be interpreted with caution. Sampling from only Klalin District may limit generalizability, and recall bias in maternal age reporting may affect accuracy.

Recommendations for Future Research

Longitudinal and intervention-based studies are recommended to explore causal pathways more rigorously. Future research should assess the effectiveness of educational, reproductive health, and socio-economic empowerment programs in reducing stunting prevalence. Incorporating qualitative assessments of cultural norms and childcare practices could further enhance understanding of contextual factors.

CONCLUSION

child marriage and low maternal education are associated with a higher likelihood of stunting among children in Southwest Papua, without implying direct causation due to the cross-sectional study design. These findings highlight the need for policies and programs that delay marriage, improve maternal education, and enhance women's economic opportunities to support child nutrition. Specific actionable interventions include educational campaigns on reproductive health and nutrition, programs to ensure school completion for adolescent girls, and economic support initiatives for mothers. Future research should utilize longitudinal or intervention-based designs and consider other regions to better explore causal pathways and the generalizability of these findings.

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