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Original Research

Association between maternal age, nutritional status, and toddler stunting

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ABSTRACT

Background: Stunting remains a major public health issue in Indonesia, with Central Kalimantan reporting prevalence rates higher than the national. Maternal risk factors—particularly age at pregnancy and nutritional status—are known contributors to stunting, yet their direct influence in regional contexts remains underexplored.

Objective: This study aimed to analyze the association between maternal age and maternal nutritional status during pregnancy with the incidence of stunting among toddlers.

Methods: A retrospective cross-sectional analytic study was conducted from August to October 2024, involving 83 toddlers selected via purposive sampling from a population of 481 registered at the health center. Data were collected from maternal and child health handbooks (KIA), focusing on maternal age at pregnancy, mid-upper arm circumference (MUAC), and toddler height-for-age z-scores. Chi-square tests were performed to assess associations between maternal variables and stunting, with a significance threshold of $p < 0.05$.

Results: The majority of mothers were aged 20–35 years (74.7%) and had normal nutritional status (72.3%). The prevalence of toddler stunting was 26.5%. A statistically significant association was found between maternal chronic energy deficiency (CED; MUAC < 23.5 cm) and toddler stunting ($p < 0.001$), with 87% of children born to CED mothers being stunted. However, maternal age showed no significant correlation with stunting ($p = 0.970$).

Conclusion: Maternal nutritional status during pregnancy, specifically CED, is significantly associated with toddler stunting, underscoring the need for targeted maternal nutrition interventions. Maternal age alone was not a significant factor in this cohort, suggesting other confounders may influence child growth.

1. Introduction

The prevalence of malnutrition and nutritional disorders among toddlers remains a significant public health concern in many developing countries, including Indonesia. According to the United Nations International Children's Emergency Fund (UNICEF), approximately one in three children under the age of five experiences impaired growth, most notably in terms of linear growth or height. In rural regions, the prevalence of stunting

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reaches nearly 40%, highlighting persistent disparities in nutritional access and health services (UNICEF-WHO-World Bank, 2021; United Nations Children's Fund (UNICEF) & World Health Organization (WHO), 2019; WHO-UNICEF-World Bank Group, 2023). The period from conception through the first two years of life is recognized as a critical phase for growth and development, often referred to as the "window of opportunity." This stage is marked by rapid physical and cognitive development, rendering it highly sensitive to nutritional deficits. Inadequate nutrition during this formative period can result in long-term adverse outcomes, including impaired physical growth, cognitive delays, and reduced academic performance during school age (eClinicalMedicine, 2023).

The nutritional status of pregnant women can be assessed using the Mid-Upper Arm Circumference (MUAC) indicator, as as has been done by Bari (2020). A MUAC measurement below 23.5 cm suggests insufficient protein and energy intake and is indicative of Chronic Energy Deficiency (CED). Pregnant women with CED, approximate 32% to 64.9%, face a heightened risk of delivering low birth weight (LBW) infants, which predisposes the child to impaired growth and future stunting (Afrinis et al., 2022; Wati et al., 2024). Based on routine health service reports from 2020 across 34 provinces in Indonesia, of the 4,656,382 pregnant women measured, approximately 451,350 (9.7%) had a MUAC below 23.5 cm.

Primary indicators used to assess the nutritional status of toddlers is the Height-for-Age Z-score (HAZ), which is commonly associated with stunting (Franco-Oliva et al., 2023; Kim et al., 2021). The HAZ reflects chronic nutritional deficiencies resulting from prolonged exposure to adverse conditions, including poverty, inadequate dietary intake, poor sanitation, and suboptimal health practices (Larson-Nath & Goday, 2019; O'Brien & Omer, 2019; Price et al., 2019; Reinhardt & Fanzo, 2014; Silpia et al., 2025). These factors collectively contribute to linear growth retardation in children. Stunting is diagnosed when a child's height or length, measured according to their age, falls below the World Health Organization (WHO) growth standards, specifically more than two standard deviations below the median (WHO, 2018). Chronic undernutrition during early childhood not only elevates the risk of morbidity and mortality but also impairs immune function, increases susceptibility to infectious diseases, and hinders optimal physical and cognitive development. Furthermore, stunted individuals are more likely to experience reduced productivity and poorer health outcomes in adulthood (Govender et al., 2021; Morales et al., 2023; Rodríguez et al., 2011).

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According to the World Health Organization, the global prevalence of stunting reached 22% in 2020, affecting approximately 149.2 million children under the age of five (UNICEF-WHO-World Bank, 2021). In Indonesia, the stunting prevalence was reported at 21.6%, with the national target aiming to reduce this figure to 14,4% by 2029. Ministry of Health of the Republic of Indonesia indicate a downward trend in the percentage of children aged 0–59 months classified as severely or moderately stunted between 2013 and 2019. In 2013, the prevalence was recorded at 37.2%, decreasing to 27.7% by 2019—reflecting an average annual reduction of more than 1.5%. However, this progress experienced a temporary setback in 2020, with an increase to 31.8%, likely attributable to disruptions caused by the COVID-19 pandemic. Encouragingly, the prevalence declined again in 2021 to 24.4%. Despite these improvements, Indonesia's stunting rate remains above the WHO-recommended threshold of 20%. Notably, Central Kalimantan is one of the provinces in Indonesia with a stunting prevalence rate (23.5%) that exceeds the national average (21.5%) (Ministry of Health, 2023).

The prevalence of stunting in various districts and municipalities across Central Kalimantan exceeds the national average, underscoring the persistent public health challenges in the region. In Palangka Raya, stunting has emerged as a critical concern due to its profound implications for children's physical and cognitive development, as well as its long-term impact on the quality of human resources. According to the 2021 Indonesian Nutrition Status Survey, Palangka Raya ranked as the ninth-highest in stunting prevalence among Indonesian cities, with a rate of 25.2%. This figure rose to 27.8% in 2022, indicating that approximately one in four children in the city is affected by stunting (Ministry of Health, 2020, 2021). These rates remain significantly above the WHO's threshold of 20%, suggesting the need for intensified intervention strategies. In response, Petuk Katimpun Village has been designated as a priority locus for stunting intervention, particularly for toddlers identified as at-risk. This village falls under the jurisdiction of the Jekan Raya Community Health Center. As of July 2023, data from the Jekan Raya Health Center report that 18 children in Petuk Katimpun are classified as at risk for stunting.

Preventive strategies to combat stunting in Indonesia include the provision of iron and folic acid supplements for adolescent girls, routine maternal health check-ups, and the distribution of supplementary food packages for pregnant women to ensure adequate

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nutritional intake and optimal iron levels during pregnancy . For children aged 6–24 months, additional protein-rich foods such as eggs, fish, chicken, meat, and milk are also essential. These interventions are urgent and critical, as they are expected to significantly contribute to the reduction of stunting prevalence in the country (Ministry of National Secretariat, 2024). One of the major risk factors associated with stunting in early childhood is maternal age during pregnancy and the mother's nutritional status. Adolescent pregnancies, particularly those occurring before the age of 20, pose a higher risk of stunting in offspring due to intrauterine nutrient competition between the growing mother and the fetus. Additionally, younger mothers may lack sufficient knowledge and experience regarding proper child care and nutrition. According to the Central Statistics Agency, approximately 10.82% of women in Indonesia were married before the age of 18. Although this figure shows a declining trend, it remains a pressing public health issue due to its long-term health implications (Central Statistic Agency, 2021).

A preliminary survey conducted in June 2024 at the Karya Bersama Posyandu, operating under the Jekan Raya Health Center, identified 5 out of 45 toddlers aged 0–59 months with heights below the WHO standard for their age group, indicating stunting. Interviews with the mothers of the affected children revealed that three mothers were under the age of 20, while two were older than 20. Further examination of maternal nutritional status during pregnancy showed that two of the mothers had experienced CED, as indicated by a MUAC below 23.5 cm. This study aims to analyze the potential association between maternal risk factors (age and nutritional status during pregnancy) and the incidence of stunting in toddler.

2. Method

Research Design

This study employed a quantitative analytic design using a retrospective cross-sectional approach, aiming to evaluate the relationship between maternal age at pregnancy and maternal nutritional status with the incidence of stunting in children under five. This design allows researchers to observe and analyze data at a single point in time by utilizing historical information documented in the Maternal and Child Health (Id: Kesehatan Ibu dan Anak [KIA]) handbook, making it suitable for identifying patterns of association between variables without requiring long-term follow-up. The cross-sectional approach is widely used in community epidemiology due to its efficiency in terms of time and resources, and it provides

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a strong initial framework for establishing causal hypotheses for future research (Setia, 2016). The study was conducted in the service area of Jekan Raya Public Health Center, one of the priority stunting loci in Palangka Raya City, during the period from August to October 2024.

Participant

The participants in this study consisted of toddlers registered in the health records of Jekan Raya Community Health Center as of June 2024, with a total population of 481 children. This population was selected as it represents a local community with a significant and well-documented stunting burden in the primary health information system. Population determination was based on data completeness, administrative feasibility, and epidemiological relevance to stunting issues in the study area. The minimum sample size was calculated using an online Slovin's formula calculator with a 10% margin of error, yielding a minimum required sample of 83 participants (Mukti, 2025). Sampling was conducted using a non-probability sampling approach with purposive sampling technique, selected due to resource limitations and the need to meet specific research criteria. The inclusion criteria comprised toddlers aged 24-59 months who were officially registered at Jekan Raya Community Health Center in 2024 and possessed a complete KIA book documenting pregnancy history and maternal nutritional status. Exclusion criteria were applied to minimize confounding variables, including toddlers who had relocated outside the health center's service area, had a history of height-boosting supplement consumption, were born prematurely (<37 weeks gestation) or with low birth weight (<2.5 kg), had congenital conditions or chronic illnesses affecting growth, or lacked complete anthropometric data in their KIA book. These measures were implemented to ensure sample homogeneity and isolate the relationship between maternal age during pregnancy and stunting outcomes.

Data Collection

The data collection method involved structured documentation and retrospective observation of primary and secondary data obtained from official records, specifically the KIA book. The primary instrument used was a pre-designed and content-validated checklist form, reviewed by public health experts. Researchers directly extracted data from the KIA books of mothers selected as study participants, which contained comprehensive information on maternal age at pregnancy, MUAC, and child anthropometric status based on height-for-age (H/A) indicators. Maternal age was categorized as high-risk (<20 or >35 years) or low-risk (20–

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35 years). Maternal nutritional status was classified as CED if MUAC was <23.5 cm; otherwise, it was considered non-CED (normal). Child nutritional status was determined using WHO classification based on H/A Z-scores, where a value < -2 SD was categorized as stunting, while ≥ -2 SD was classified as normal.

Data Analysis

The data processing commenced with thorough editing to examine completeness and consistency, with any incomplete or anomalous data flagged and reverified against the original KIA book records. Subsequently, categorical variables were systematically coded into numerical values: maternal age risk was coded as 0 for high-risk and 1 for low-risk; maternal nutritional status was coded as 0 for CED and 1 for normal; and child stunting status was coded as 0 for stunted and 1 for normal. Descriptive statistics were generated to present frequency distributions of these nominal variables. For inferential analysis, bivariate associations between maternal characteristics (age risk and nutritional status) and child stunting outcomes were examined using Pearson's chi-square test in SPSS version 26, with the threshold for statistical significance set at $p < 0.05$. This analytical approach ensured rigorous examination of potential risk factors for stunting while maintaining methodological consistency with epidemiological research standards. The use of standardized coding and statistical procedures enhanced the reliability and reproducibility of the study findings.

Ethical Consideration

This study received ethical approval from the Research Ethics Committee of Sari Mulia University (Approval Letter No: 415/KEP-UNISM/VIII/2024), confirming that all research procedures were deemed ethically appropriate for implementation. This ethical clearance serves as a crucial foundation to ensure the research adheres to bioethical principles, including respect for persons, beneficence, non-maleficence, and justice.

3. Result

Characteristics of Participant

The characteristics of study participants are presented in Table 1. The table displays the categorical distribution of maternal age risk, nutritional status, and their association with toddler stunting prevalence. As shown, the majority of mothers fell within the low-risk age category (74.7%) and had normal nutritional status (72.3%), while 26.5% of toddlers were classified as stunted.

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Table 1. Distribution of maternal characteristics and toddler nutritional status (n =83)

Variable	Frequency	Percentage
Maternal Age		
High risk (< 20 years & > 35 years)	21	25,3
Low risk (20-35 years)	62	74,7
Maternal Nutritional Status		
Chronic Energy Deficiency	23	27,7
Non Chronic Energy Deficiency	60	72,3
Toddler Nutritional Status		
Stunted	22	26,5
Normal	61	73,5
Total	83	100

Association of Maternal Risk Factors and Toddler Stunting

Table 2 presents the bivariate analysis of maternal risk factors associated with toddler stunting. The results demonstrate a statistically significant association between maternal chronic energy deficiency and stunting (p<0.001), while maternal age showed no significant correlation (p=0.970). Notably, 87% of toddlers born to mothers with chronic energy deficiency were stunted, compared to only 3.3% in the non-deficient group.

Table 2. Association of maternal risk factors and toddler stunting

Variabel	Nutritional Status				Total		P Value	OR	95% CI
	Stunting		Normal						
	n	%	n	%	n	%			
Age history									
High risk	5	23.8	16	76.2	21	100	0.970	0.83	0.26-2.61
Low risk	17	27.4	45	72.6	62	100			
Total	22	26,5	61	73.5	83	100			
Nutritional status									
CED	20	87.0	3	13.0	23	100	<0.001	193.33	30.1-1241.94
Non CED	2	3.3	58	96.7	63	100			
Total	22	26.5	61	73.5	83	100			

Notes: n is case frequencies; % case percentages; CED is chronic energy deficiency

4. Discussion

The results of the study show that the majority of respondents had mothers within the low-risk age range (20–35 years), accounting for 74.7%. This indicates that most mothers in the study were within the ideal reproductive age, which biologically poses a lower risk for health complications during pregnancy and childbirth. However, despite the majority being in the low-risk category, 25.3% of mothers were classified as high-risk due to their age,

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warranting special attention in maternal health interventions. This is because previous studies have shown that maternal age that is too young (<20 years) or too old (>35 years) can increase the risk of pregnancy complications and adversely affect child growth (Kurniawati et al., 2022).

In addition, most mothers had normal nutritional status (non-CED), with a percentage reaching 72.3%. This suggests that the majority of respondents had adequate nutritional intake during pregnancy and breastfeeding, supporting optimal child growth and development. However, 27.7% of mothers experienced CED, which may negatively affect the quality of breast milk and the child's nutrient intake. This condition requires attention, as maternal nutritional status is closely related to the risk of stunting in children. Several studies have reported that maternal nutritional status during pregnancy significantly increases the risk of maternal mortality, affects child growth, leads to low birth weight, anemia, and stunting. It is noted that 40% of low birth weight cases and 85% of stunting in children are caused by maternal CED (Fitriani et al., 2020; Kulasekaran, 2012; Wiyono et al., 2020).

The prevalence of stunting among children under five in this study was 26.5%, a relatively high figure, although lower than Indonesia's national target of 14.4% by 2029. The findings also show that the proportion of stunting cases corresponds to the prevalence of high-risk maternal age (25.3%) and maternal chronic energy deficiency (27.7%). This indicates a potential association between these two variables that warrants further analysis.

The Chi-square test conducted in this study revealed a statistically significant association between maternal chronic energy deficiency (CED) and stunting in children under five ($p < 0.001$). This finding aligns with numerous previous studies indicating that maternal nutritional status, particularly in cases of CED, greatly influences child growth (Asna & Syah, 2023). Specifically, this study found that 87% of children born to mothers with CED were stunted, whereas only 3.3% of children from mothers without CED fell into the stunted category. This strengthens the evidence that maternal nutrient deficiencies can disrupt the supply of essential nutrients during pregnancy and breastfeeding, thereby impacting fetal and child growth. Factors such as age, dietary patterns, personal hygiene, and infections also contribute to maternal nutritional status, which ultimately affects child growth and the incidence of stunting (Prameswari, 2024).

On the other hand, maternal age did not show a significant correlation with stunting (p

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= 0.970), whether in the high-risk age groups (<20 or >35 years) or in the low-risk group (20–35 years). This result contrasts with some previous studies that reported high-risk maternal age to be associated with impaired child growth (Lathifah et al., 2024; Sani et al., 2020). The lack of a significant relationship in this study may be due to confounding factors such as access to healthcare services or differences in socioeconomic status, which were not controlled for in this analysis.

The high proportion of stunting among children born to mothers with CED (87%) underscores the urgent need for prioritizing maternal nutrition interventions in stunting prevention programs. Chronic energy deficiency in pregnant women can negatively affect fetal development, leading to potential health problems in children, including low birth weight, impaired immune function, and increased vulnerability to infections, which ultimately influence their nutritional status and long-term health outcomes (Kuntari et al., 2024; Putri & Salsabila, 2023). Therefore, nutritional supplementation programs, education on balanced diets, and monitoring of maternal nutritional status need to be strengthened, especially in regions with high CED prevalence. Furthermore, a family-based approach is essential to ensure adequate nutritional intake during the first 1,000 Days of Life. Interventions aimed at improving maternal nutrition have been shown to yield positive outcomes, as evidenced by programs that successfully enhanced awareness and dietary behavior among pregnant women (Fibrila et al., 2024; Yuliantie et al., 2024).

This study has several limitations that need to be acknowledged. First, the cross-sectional design does not allow researchers to establish causal relationships between independent variables (maternal age and nutritional status) and toddler stunting. Second, the retrospective nature of the data relying on health records (KIA) may introduce information bias if documentation was incomplete or inaccurate. Third, the relatively small sample size (83 respondents) and use of purposive sampling may limit the generalizability of the findings. Fourth, the study did not control for potential confounding factors such as socioeconomic status, parenting practices, healthcare access, and recurrent infections in toddlers, which might influence the outcomes.

Based on the research findings, several recommendations can be proposed included specific nutritional interventions, including supplementation programs and monitoring of maternal CED status, should be intensified, particularly in high-stunting prevalence areas,

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with priority given to education about balanced diets during pregnancy and lactation. A holistic approach integrating sensitive interventions such as sanitation improvements, clean water access, and reproductive health education for adolescents is needed to prevent early pregnancies. Further research should employ longitudinal designs with larger samples and strict control of confounding variables, while qualitative studies could explore socio-cultural determinants of stunting. Multisectoral collaboration between local and national governments must be strengthened to coordinate health, education, and social welfare sectors for sustainable stunting prevention programs.

5. Conclusion

This study confirms that maternal nutritional status (CED) during pregnancy is significantly associated with toddler stunting, while maternal age showed no significant correlation. These findings underscore the importance of targeted nutritional interventions for pregnant women as a primary stunting prevention strategy. However, given the multifactorial nature of stunting, a comprehensive approach addressing health, environmental, and socioeconomic aspects remains essential to achieve national stunting reduction targets. The study results can serve as a foundation for developing more focused public health policies and programs.

6. Conflict of interest

All authors declare no conflict of interest.

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