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Determinants of Stunting Among Children Aged 0-59 Months in Purwokerto Wetan: A Case-Control Study

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Abstrak:

Pendahuluan: Stunting masih menjadi permasalahan kesehatan masyarakat yang dapat memengaruhi pertumbuhan dan perkembangan anak dalam jangka panjang. Kejadian stunting dipengaruhi oleh berbagai faktor, meliputi faktor ibu, anak, sosial ekonomi, dan lingkungan. Kelurahan Purwokerto Wetan termasuk wilayah dengan prevalensi stunting yang relatif tinggi. Penelitian ini bertujuan untuk mengidentifikasi faktor risiko kejadian stunting pada balita usia 0-59 bulan di wilayah tersebut. **Metode:** Penelitian ini menggunakan desain analitik observasional dengan pendekatan *case-control*. Sampel berjumlah 156 subjek, terdiri dari 52 balita stunting dan 104 balita tidak stunting. Data dikumpulkan melalui wawancara terstruktur dan data sekunder. Analisis dilakukan secara univariat, bivariat (Chi-square), dan multivariat (regresi logistik berganda). **Hasil:** Analisis multivariat menunjukkan bahwa LiLA (Lingkar Lengan Atas) ibu saat hamil berhubungan signifikan dengan kejadian stunting (OR = 3.247; *p-value* = 0.027). Peran kader dalam skrining stunting juga berhubungan signifikan dengan kejadian stunting (OR = 3.172; *p-value* = 0.005). Variabel lain seperti pendidikan ibu, kunjungan ANC, berat badan saat lahir, pola pemberian makan, sanitasi, personal higiene, akses informasi kesehatan, pemanfaatan posyandu ILP, dan pendapatan keluarga tidak menunjukkan hubungan signifikan setelah dikontrol. **Kesimpulan:** LiLA ibu saat hamil dan peran kader menjadi determinan utama stunting. Penguatan intervensi gizi ibu dan skrining berbasis komunitas diperlukan untuk menurunkan prevalensi stunting.

Kata kunci: Balita; Kader; LiLA; Stunting

Abstract:

Introduction: Stunting remains a public health problem that can affect children's growth and development in the long term. The occurrence of stunting is influenced by multiple factors, including maternal, child-related, socioeconomic, and environmental factors. Purwokerto Wetan is one of the areas with a relatively high prevalence of stunting. This study aimed to identify the risk factors associated with stunting among children aged 0–59 months in this area. **Method:** This study used an observational analytic design with a case-control approach. A total of 156 subjects were included, consisting of 52 stunted children and 104 non-stunted children. Data were collected through structured interviews and secondary data sources. Data analysis was conducted using univariate analysis, bivariate analysis (Chi-square), and multivariate analysis (multiple logistic regression). **Result:** Multivariate analysis showed that maternal MUAC during pregnancy was significantly associated with stunting (OR = 3.247; *p-value* = 0.027). The role of cadre in stunting screening was also significantly associated with stunting (OR = 3.172; *p-value* = 0.005). Other variables, including maternal education, ANC visit, birth weight, feeding practices, sanitation, personal hygiene, access to health information, utilization of posyandu ILP, and family income, were not significantly associated after adjustment. **Conclusion:** Maternal MUAC during pregnancy and the role of cadre are key determinants of stunting. Strengthening maternal nutrition interventions and community-based screening is necessary to reduce the prevalence of stunting.

Keywords: *Cadre; Children; MUAC; Stunting*

1. Introduction

Stunting remains a formidable global public health concern, carrying substantial implications for child development, human capital formation, and enduring socioeconomic prosperity (1). Stunting is characterized by a child's height-for-score falling more than two standard deviations below the World Health Organization's (WHO) established growth standards (2). This condition is primarily attributable to a confluence of chronic undernutrition, recurrent infections, and inadequate psychosocial stimulation. In Indonesia, the Ministry of Health emphasizes that although not all short children are stunted, all stunted children exhibit impaired linear growth, making accurate diagnosis essential and typically requiring clinical assessment. The use of the Height-for-Age Z-score (HAZ) has become a standard indicator for identifying stunting severity, with score below -2 SD indicating stunting and below -3 SD indicating severe stunting (3). Overall, stunting represents a multifactorial growth disorder defined by standardized anthropometric indicators and influenced by complex nutritional and health-related factors.

Globally, stunting continues to be a key indicator of population health and development. Although prevalence has declined from 26.4% in 2012 to 23.2% in 2024, approximately 150 million children remain affected, highlighting the slow progress toward global nutrition targets (4). Similarly, the Joint Child Malnutrition Estimates reported a decline from 33% in 2000 to 22.3% in 2022, yet this reduction is insufficient to meet the Sustainable Development Goals (SDGs) target of 13.5% by 2030. The burden of stunting is disproportionately concentrated in Asia and Sub-Saharan Africa, where structural determinants such as poverty, food insecurity, limited healthcare access, and suboptimal caregiving practices persist (5). These disparities underscore ongoing debates regarding whether nutritional interventions alone are sufficient, or whether broader socioeconomic and environmental strategies are required to accelerate progress (6). Taken together, these findings indicate that global progress remains uneven and insufficient, requiring comprehensive and multisectoral approaches.

At the national level, Indonesia has demonstrated a consistent decline in stunting prevalence, reducing it from 37.6% in 2013 to 19.8% in 2024 (7). However, this figure remains above the national target of 14%, indicating unresolved public health challenges. Children aged 12–35 months exhibit increased vulnerability, emphasizing the importance of interventions during the first 1,000 days of life (1,6). In rapidly developing urban regions such as Purwokerto in Central Java, national trends intersect with local dynamics, including population density, urbanization, and variability in healthcare access. These contextual factors may influence both exposure to risk and the effectiveness of intervention programs.

At the subnational level, disparities become more apparent. In Banyumas Regency, stunting prevalence was reported at approximately 18.6% in 2022, lower than some high-burden districts but still indicative of a moderate public health issue (6). More concerning is the situation in Purwokerto Wetan, where local health center data indicate a rising trend in stunting cases, accompanied by high population density, suboptimal sanitation, and incomplete Open Defecation Free (ODF) coverage. These conditions highlight the complex interplay between environmental health and child nutrition. Moreover, gender disparities have been observed, with male children showing a higher susceptibility to stunting, a finding that aligns with some epidemiological studies but remains a subject of ongoing discussion.

Multiple factors contribute to stunting, as indicated by previous research. These determinants encompass maternal health, child-specific characteristics, household socioeconomic status, environmental conditions, and the availability of healthcare services (6). For example, a lack of family knowledge regarding nutrition and the critical first 1,000 days of life has been reported as a significant contributor to an increased risk of stunting (7). Most research studies stunting determinants in isolation, resulting in fragmented evidence. This approach is inadequate, especially in areas like Purwokerto, where multiple risk factors interact, potentially hindering public health efforts. Therefore, integrated, geographically-focused analyses simultaneously assessing multiple determinants within primary healthcare are crucial for fully understanding the complex nature of stunting (4,5).

Given these challenges, a more holistic understanding of stunting determinants at the local level is essential to inform targeted and effective interventions. This study aims to analyze the factors influencing stunting among children aged 0-59 months in Purwokerto Wetan, Purwokerto Timur, in 2025. This research employs a comprehensive methodology, integrating maternal, child, household, environmental, and healthcare parameters, to produce evidence-based recommendations for local health authorities. The outcomes are expected to enrich

academic discourse and inform practical strategies, thereby expediting the reduction of stunting toward national and global objectives. Ultimately, the study seeks to furnish context-specific evidence to facilitate the implementation of more efficacious local stunting reduction strategies.

2. Materials and Methods

2.1 Study design

This study used an observational analytic design using a quantitative case-control approach and was conducted in Purwokerto Wetan Village, Purwokerto Timur Subdistrict, Banyumas Regency, Central Java, Indonesia, from November 2025 to February 2026. Population of this study is all children aged 0-59 months residing in Purwokerto Wetan Village, within the working area of Purwokerto Timur I Primary Health Center, based on 2025 data. The case population included 52 children aged 0-59 months who were stunted (height-for-age ≤ -2 SD), while the control group included 104 children with normal nutritional status (height-for-age ≥ -2 SD) in the same area. The inclusion criterion was children recorded in the 2025 data of Purwokerto Timur I Primary Health Center, whereas the exclusion criteria included incomplete height or age data and the presence of congenital abnormalities or chronic diseases that could affect growth. The sample consisted of 156 subjects with a case-to-control ratio of 1:2, including 52 stunted children and 104 non-stunted children. The case group was selected using total sampling, while the control subjects was chosen using purposive sampling based on the established parameters. The respondents were mothers of the selected children in both the case and control groups. The inclusion criteria for respondents included providing written informed consent, residing in Purwokerto Wetan Village for at least one year, having complete records of maternal MUAC and ANC examinations, and having a child aged 0–59 months in healthy condition. The exclusion criteria included inability to respond to questions due to cognitive or communication limitations and unwillingness to participate. The selection of case and control groups from the same population and geographic area with comparable age ranges was applied to minimize selection bias. The dependent variable was stunting status based on height-for-age with a Z-score < -2 SD according from WHO standards (8), while the independent variables included maternal MUAC during pregnancy, maternal education, ANC visit, birth weight, feeding practices, personal hygiene, family income, sanitation, utilization of posyandu ILP, the role of cadre, and access to health information.

2.2. Ethical statement

This study involved human subjects and was conducted in accordance with ethical research principles, emphasizing respect for participants' autonomy, safeguarding data privacy, and applying the principe of non-maleficence. All respondents provided written informed consent before any data were collected. This study was part of a Field Learning Practice (PBL) conducted by students of the Public Health Study Program, Faculty of Health Sciences, Universitas Jenderal Soedirman, with permission from Purwokerto Timur I Primary Health Center and relevant authorities in Purwokerto Wetan Village. The confidentiality of respondents was carefully protected, and all information obtained is used solely for research purposes.

2.3. Materials

Data were obtained through a structured questionnaire that had undergone a validation process, including respondent identity (mother), child identity, history of ANC visit, utilization of posyandu ILP, the role of cadre in stunting screening, feeding practices, personal hygiene, sanitation, and access to health information. Anthropometric measurements were conducted according to standard procedures based on WHO and the Indonesian Ministry of Health guidelines (9). Secondary data were obtained from records at Purwokerto Timur I Primary Health Center. The data produced and examined in this study are available from the corresponding author upon reasonable request. Several variables in the questionnaire such as the role of cadre, personal hygiene, sanitation, access to health information, and feeding practices were adapted from previously published studies and adjusted to the context of this research. Validity and reliability tests were conducted to ensure the appropriateness of the instrument. Validity testing was performed using the Pearson Product Moment correlation, while reliability testing used Cronbach's alpha coefficient with a value > 0.70, indicating that the instrument was valid and reliable.

2.4. Procedures

Data collection was carried out through face-to-face interviews with mothers of children under five using a structured questionnaire. Anthropometric measurement data were obtained from secondary data derived from posyandu activities in Purwokerto Wetan Village, within the working area of Purwokerto Timur I Primary Health Center. The research stages included sample selection, classification of case and control groups, collection of

primary and secondary data, and data verification through health records. Stunting was defined as a height-for-age Z-score below -2 standard deviations according to WHO criteria. The accuracy of the Z-score calculation was ensured through recalculation using the WHO AnthroPlus application.

2.5. Statistical Analysis

The data were analysed using the Statistical Package for the Social Sciences (SPSS) using the Statistical Package for the Social Sciences (SPSS), IBM SPSS Statistics version 21. Univariate analysis was used to describe the distribution of each study variable. Bivariate analysis was conducted using the Chi-square test was performed to evaluate the relationship between independent variables and stunting incidence. Variables with *p-value* < 0.25 were included in the multivariate analysis using multiple logistic regression to determine dominant factors. Before conducting the analysis, data distribution was assessed using a normality test. Normality testing was also applied to the variables the role of cadre in stunting screening and access to health information, as the instruments for these variables were developed by the researchers. The results were presented as odds ratios (OR) with corresponding 95% confidence intervals (CI), and a *p-value* of less than 0.05 was considered statistically significant.

3. Results

3.1. Respondent Characteristics

The data for this study were collected from 156 actively participating respondents. The presentation of the respondent profile is intended to provide a demographic overview relevant to the focus of the study. Detailed information regarding the respondents age groups and jobs is summarized in **Table 1**. as follows:

Table 1. Respondent Characteristics by Age and Jobs

Characteristics		Frequency	%
Age of Mother			
a.	Minimum (18 Years)	1	0.64
b.	Minimum Range (19 - 26 Years)	34	21.79
c.	Average (27 Years)	13	8.33
d.	Maximum Range (28 – 47 Years)	107	68.59
e.	Maximum (51 Years)	1	0.64
Job			
a.	Civil Servant (PNS)	3	1.9
b.	Entrepreneur	26	16.7
c.	Labor	10	6.4
d.	Housewife	103	66
e.	Other Jobs (Private-sector employees, doctors, midwives, teachers, etc.)	14	9

Based on **Table 1**., there were 156 respondents within the age range of 18-51 years. The jobs characteristics of the respondents were predominantly housewives, accounting for 103 respondents (66%). This was followed by self-employed respondents at 26 (16.7%), laborers at 10 (6.4%), Civil Servants at 3 (1.9%), and other professions-such as private employees, doctors, midwives, teachers, etc at 14 respondents (9%).

3.2. Univariate Analysis

Based on **Table 2**., the majority of respondents in both the case and control groups were not stunted. The majority of respondents also had mothers with high levels of education, adhered to ANC visits, and had normal birth weights. In addition, most respondents demonstrated appropriate feeding practices, good personal hygiene and sanitation, family incomes above the minimum wage, active participation in Posyandu ILP services, the role of cadre in stunting screening, and access to health information.

Table 2. Results of the Univariate Analysis

Variable	Case		Control	
	n	%	n	%
Maternal MUAC During Pregnancy				
Chronic Energy Deficiency (CED)	12	23.1	7	6.7
Non-CED	40	76.9	97	93.3
Total	52	100	104	100
Maternal Education				
Low	14	26.9	24	23.1
High	38	73.1	80	76.9
Total	52	100	104	100
ANC Visit				
Non Adherent	1	1.9	2	1.9
Adherent	51	98.1	102	98.1
Total	52	100	104	100
Birth Weight				
Low Birth Weight (LBW)	9	17.3	12	11.5
Normal Birth Weight	43	82.7	92	88.5
Total	52	100	104	100
Feeding Practice				
Inadequate	5	9.6	10	9.6
Adequate	47	90.4	94	90.4
Total	52	100	104	100
Personal Hygiene				
Poor	13	25	13	12.5
Good	39	75	91	87.5
Total	52	100	104	100
Family Income				
Below Minimum Wage	26	50	44	42.3
Above Minimum Wage	26	50	60	57.7
Total	52	100	104	100
Sanitation				
Poor	15	28.8	28	26.9
Good	37	71.2	76	73.1
Total	52	100	104	100
Utilization of Posyandu ILP				
Inactive	9	17.3	7	6.7
Active	43	82.7	97	93.3
Total	52	100	104	100
The Role of Cadre in Stunting Screening				
Not Participating	20	38.5	15	14.4
Participating	32	61.5	89	85.6
Total	52	100	104	100
Access to Health Information				
No Access	24	46.2	37	35.6
Have Access	28	53.8	67	64.4
Total	52	100	104	100

3.3 Bivariate Analysis

Table 3. Summary of Bivariate Analysis Results.

Variable	OR	95% CI	*p*	Result
Maternal MUAC during Pregnancy	4.157	1.526 -11.326	0.007	Association
Maternal Education	1.228	0.572-2.636	0,742	No Association
ANC Visits	1.000	0.089-11.290	1.000	No Association
Birth Weight	1.605	0.629 – 4.096	0.455	No Association
Feeding Practice	1.000	0.323 – 3.093	1.000	No Association
Personal Hygiene	2.333	0.992 – 5.489	0.081	No Association

Variable	OR	95% CI	*p*	Result
Family Income	1.364	0.699 – 2.661	0.459	No Association
Sanitation	1.100	0.525 – 2.306	0.949	No Association
Utilization of Posyandu ILP	2.900	1.014 – 8.296	0.076	No Association
The Role of Cadre in Stunting Screening	3.708	1.697 – 8.105	0.001	Association
Access to Health Information	1.552	0.789 – 3.055	0.270	No Association

In **Table 3**., the summary of bivariate analysis results, the variables associated with stunting incidence are mother's MUAC during pregnancy and the role of cadre. The variables to be included in the multivariate analysis using logistic regression are those that, based on the bivariate analysis results, have a *p*-value ≤ 0.25. These variables are the mother's MUAC during pregnancy, personal hygiene, the role of cadre in stunting screening, and utilization of Posyandu ILP. These four variables will be analysed together regarding the occurrence of stunting.

3.4 Multivariate Analysis

The multivariate analysis was conducted to identify the most dominant factors influencing the incidence of stunting among children aged 0-59 months. Variables with a *p-value* ≤ 0.25 in the bivariate analysis were included in the initial logistic regression model. **Table 4** presents the initial multivariate model:

Table 4. Initial Multivariate Model.

No.	Variable	AOR (95% CI)	*p-value*
1.	Maternal MUAC during Pregnancy	3.092 (1.048-9.123)	0.041
2.	The Role of Cadre in Stunting Screening	2.896 (1.263-6.642)	0.012
3.	Birth Weight	1.921 (0.706-5.227)	0.201
4.	Utilization Posyandu ILP	2.475 (0.789-7.769)	0.120
5.	Personal Hygiene	1.958 (0.775-4.946)	0.155

The initial model included five variables: maternal MUAC during pregnancy, the role of cadre in stunting screening, birth weight, utilization of Posyandu ILP, and personal hygiene. Birth weight was included in the multivariate analysis despite not meeting the *p-value* ≤ 0.25 criterion, as it is theoretically and empirically recognized as an important risk factor for stunting. Therefore, it was retained in the initial model to control for potential confounding effects. Variables were removed sequentially using backward selection based on the largest p-values. After adjustment, maternal MUAC during pregnancy and the role of cadre in stunting screening remained in the final model because both were statistically significant (Table 5):

Table 5. Final Multivariate Analysis Model

No.	Variabel	AOR (95% CI)	p-value
1.	Maternal MUAC during Pregnancy	3.247 (1.142-9.237)	0.027
2.	The Role of Cadre in Stunting Screening	3.172 (1.416-7.015)	0.005

Source: Processed Primary Data, 2026

Based on **Table 5**, the factors significantly and most strongly associated with the incidence of stunting among children aged 0-59 months in Purwokerto Wetan Subdistrict are the mother's MUAC during pregnancy and the role of role cadre in stunting screening. Infants born to mothers with Chronic Energy Deficiency (CED) status have a 3.247 times higher risk of stunting compared to infants born to mothers with non-CED nutritional status (AOR = 3.247; 95% CI = 1.142–9.237). Additionally, community health workers who were less supportive of stunting screening increased the risk of stunting in infants by 3.172 times compared to those who supported stunting screening (AOR = 3.172; 95% CI = 1.416-7.015).

4. Discussion

This study highlights two key findings as the most significant determinants of stunting among children aged 0-59 months in Purwokerto Wetan, namely maternal mid-upper arm circumference (MUAC) during pregnancy and the role of cadre in stunting screening. Maternal MUAC reflects chronic energy deficiency and serves as a strong indicator of maternal nutritional status, which directly influences fetal growth and subsequent child development. Mothers with inadequate MUAC are more likely to have limited nutrient reserves, leading to suboptimal intrauterine conditions and an increased risk of growth restriction that persists into early childhood. Field findings provide important context for this association. Several mothers with MUAC < 23.5 cm experienced pregnancy at a relatively young age of approximately 18 years, when they may still be in a growth phase. This condition creates competition for nutrient requirements between the mother and the fetus. In addition, non-normal body mass index (BMI) before and during pregnancy, combined with socioeconomic constraints, contributes to inadequate dietary quality, particularly low intake of animal protein. These conditions limit maternal nutrient reserves during pregnancy and increase the risk of impaired fetal growth. Taken together, these findings highlight that maternal MUAC captures not only biological vulnerability but also underlying socioeconomic constraints that shape maternal nutrition during pregnancy.

From a life-course perspective, these findings align with the Developmental Origins of Health and Disease (DOHaD) framework, which emphasizes the long-term impact of maternal conditions on child health outcomes (10). These results are consistent with previous studies, such as Maryanti et al. (2025), who reported that mothers with chronic energy deficiency have a higher proportion of stunted children, and Sugianti et al. (2023), who found that mothers with MUAC < 23.5 cm during pregnancy were significantly more likely to have stunted children compared to those with normal nutritional status (11,12). At the community level, the role of cadre emerged as a critical determinant. Field observations indicate that cadre involvement in stunting screening has not been fully optimized, particularly in delivering nutrition education, conducting routine growth monitoring, and ensuring complete and consistent recording and reporting. Some cadres did not consistently document key growth indicators such as height, MUAC, and head circumference, nor regularly update records in the Maternal and Child Health (MCH) handbook. This condition limits caregivers' access to accurate information regarding child growth status and delays early detection and appropriate intervention. This finding is in agreement with Damayanti et al. (2022), who noted that the active role of cadres is essential in stunting prevention (13), and supports the Community Health Model, which highlights the importance of community-based health workers in strengthening primary healthcare systems and improving child health outcomes (14).

Several variables analysed in this study, including maternal education, ANC visit, birth weight, feeding practices, personal hygiene, family income, sanitation, utilization of posyandu ILP, and access to health information, were not significantly associated with stunting. This finding can be explained by the relatively homogeneous characteristics of respondents, particularly in education level, healthcare utilization, and environmental conditions, which reduce variability between case and control groups. In addition, some variables may not fully capture quality dimensions, such as the content of ANC services or the depth of health information received, while others may influence stunting indirectly through more proximal determinants such as maternal nutritional status. Despite its contributions, this study has several limitations that warrant consideration. The case-control design is subject to recall bias, particularly for self-reported variables such as feeding practices and personal hygiene. The study was conducted in a specific geographic area with a relatively limited sample size, which may restrict the generalizability of the findings. Furthermore, residual confounding from unmeasured variables cannot be ruled out. Future research using longitudinal designs and more diverse populations is essential to strengthen causal inference and to further elucidate behavioral and environmental pathways influencing stunting.

5. Conclusions

This study found that maternal MUAC during pregnancy and the role of cadre in stunting screening were significantly associated with stunting among children aged 0-59 months in Purwokerto Wetan. Other variables, including maternal education, ANC visit, birth weight, feeding practices, sanitation, personal hygiene, access to health information, utilization of posyandu ILP, and family income, were not significantly associated after adjustment. These findings highlight the importance of maternal nutritional status and community-based screening in addressing stunting.

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