KEY DETERMINANTS OF STUNTING IN RURAL INDONESIA: THE INFLUENCE OF ANTENATAL CARE, MATERNAL EDUCATION, AND MATERNAL ACTIONS

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ABSTRACT

Background: Stunting is a linear growth disorder in children, measured by height-for-age, with a Z-score of less than -2 SD according to WHO standards. Various factors, including low maternal education, infrequent prenatal care, low family income, lack of knowledge and preventive measures, and limited food availability cause this condition. Deliserdang Regency, notably the Dalu Sepuluh Community Health Centre, has a high prevalence of stunting, but in-depth studies on its risk factors have not been conducted. Objective: This study aims to analyze the ANC and maternal health to stunting in toddlers within the working area of the Dalu Sepuluh Health Centre, Deliserdang Regency. Method: This analytical research, using a cross-sectional design, involved 56 toddlers selected using purposive sampling. Data were collected through questionnaires, interviews, and anthropometric measurements, then analyzed using the Chi-square test and backwards logistic regression. Results: Factors that have a significant relationship with the incidence of stunting include maternal education (p=0.004), frequency of prenatal checkups (p=0.001), maternal knowledge (p=0.003), maternal attitude (p=0.023), and maternal actions (p=0.001). Conclusion: Stunting prevention requires interventions that focus on enhancing mothers' knowledge, attitudes, and behaviours, improving food access and availability, and optimizing prenatal care.

Keywords : *Stunting, Toddlers, Risk Factors, Maternal Actionc, ANC*

INTRODUCTION

Stunting in toddlers necessitates focused intervention as it might impede a child's physical and cognitive development. Stunting correlates with a heightened risk of morbidity and mortality, alongside impaired motor and cognitive development. Toddlers experiencing stunting face heightened risks of diminished cognitive capacity and productivity, as well as an elevated likelihood of developing degenerative diseases later in life [1,2.] Stunted youngsters are more prone to infectious infections, which jeopardizes their learning quality and increases their likelihood of absenteeism in school. Stunting elevates the risk of obesity, as individuals with reduced height typically possess a low optimal body weight. A modest weight increase of several kilograms might elevate an individual's Body Mass Index (BMI) over the normative threshold. Chronic overweight and obesity will elevate the risk of degenerative diseases [3,4.]

Stunting is defined as a height-for-age Z-score below -2 SD based on WHO growth standards. It is primarily associated with low birth weight, socioeconomic disadvantage, and short parental stature, and occurs in both urban and rural populations. Stunting typically begins early in life as a result of chronic undernutrition, reflects sustained linear growth restriction, and is difficult to reverse later, even with improved nutritional intake [5,6]. The etiologies of stunting in children are multifaceted. Factors contributing to stunting encompass inadequate mother education, advancing child age, impoverished households, breastfeeding length, maternal age below 20 years, absence of improved drinking water sources, low maternal BMI under 18.5, instances of diarrhoea, and paternal education along with residency in rural locations [7,8.]

National data indicate that stunting affects 33.7% of Indonesian children, with higher prevalence in households with ≥3 children under five, those with 5–7 members, children of mothers with <4 antenatal visits, and infants with birth weight < 2500 g. Major risk factors include non-exclusive breastfeeding, low socioeconomic status, preterm birth, short birth length, low maternal height, limited maternal education, poor sanitation, unsafe water, restricted healthcare access, and rural residence. Contributing behavioral factors include improper complementary feeding, low *Posyandu* utilization, poor environmental hygiene, and food taboos for pregnant women, nursing mothers, and toddlers. These findings underscore the multifactorial nature of stunting and highlight the need for integrated interventions targeting nutrition, health services, education, and sanitation. [9–11.]

The prevalence of stunting in toddlers in Indonesia decreased from 37.2% (2013) to 30.8% (2018). Meanwhile, in Deliserdang Regency, the prevalence of stunting in toddlers in 2023 was 33.8%. After searching using Publish or Perish software, research on the Risk Factors for stunting in toddlers in Deliserdang Regency has never been conducted. Although several studies have been conducted in different locations, the prevalence of stunting and Risk Factors cannot be accurately estimated. Meanwhile, in 2023, Deliserdang Regency became the locus of Stunting in North Sumatra. The unknown Risk Factors and trends in stunting prevalence in toddlers in Deliserdang Regency are the basis for this research.

This study aimed to analyze the risk factors contributing to stunting among toddlers in Deliserdang Regency, emphasizing the pivotal role of parents—particularly mothers—in both prevention and mitigation efforts. Parental characteristics such as education, occupation, nutritional knowledge, and family size were found to correlate with stunting incidence, largely because they influence household food allocation and, consequently, toddler dietary intake. Numerous studies have consistently demonstrated a link between food consumption patterns and childhood stunting. Stunting represents chronic malnutrition and serves as a long-term indicator of growth deficits, ultimately impairing optimal organ development. Its effects are far-reaching, encompassing delayed cognitive development, compromised physical health, elevated morbidity, reduced productivity, slower economic progress, increased poverty, and widened social inequality. As such, stunting poses a significant barrier to achieving children's full growth and developmental potential. [11–13.] This research aims to furnish empirical information to underpin data-driven policies and enhance integrated initiatives designed to mitigate stunting. Aligned with the Sustainable Development Goals (SDGs), where the reduction of stunting is a vital objective for promoting health and well-being among children in poor nations, the findings of this study may serve as a paradigm for other places with analogous issues.

METHOD

Research Design

This research was an analytical study with a cross-sectional design that aims to analyze the relationship between various risk factors and stunting in toddlers. The cross-sectional approach was chosen because it effectively depicts the relationship between variables at a specific point in time.

Population and Sample

The study population consisted of all toddlers residing in the Dalu Sepuluh Community Health Centre (Puskesmas) area in Deliserdang Regency. From this population, 56 toddlers were selected as samples using purposive sampling, which selects respondents based on specific criteria aligned with the research objectives. The mothers of the selected toddlers were the respondents, as they are considered to have the most comprehensive information regarding their children's health history and parenting patterns. **The sample size of 56 toddlers** was determined using a purposive sampling technique, focusing on areas with the highest reported prevalence of stunting to ensure the representation of key risk factors. This sample size was considered sufficient to achieve the minimum power required for the planned statistical analyses.

The study population consisted of mothers with toddlers aged 6–59 months residing in the working area of the Dalu Sepuluh Community Health Centre. Subjects were selected based on specific criteria. **The inclusion criteria** were: (1) toddlers aged 6–59 months, (2) living with their biological mother, and (3) having resided in the area for at least 6 months. **The exclusion criteria** included: (1) toddlers with severe congenital diseases or chronic illnesses that significantly affect growth, and (2) incomplete medical record data or questionnaires.

Data Collection Instruments

Data collection was conducted from March to July 2025. Primary data were collected through interviews using a structured questionnaire that contained information on the characteristics of mothers, fathers, and children, including age, education, occupation, number of family members, knowledge, attitudes, practices, medical history, consumption patterns, and sanitation conditions. Secondary data were taken from Community Health Centre reports regarding the prevalence of stunting in the area. Child nutritional status was determined through anthropometric measurements, namely height for age, which were then compared with WHO standards. To ensure the validity, completeness, and accuracy of the data, a technical person in charge checked them.

Data analysis

Data analysis was conducted with the SPSS software in three phases. The initial phase was univariate analysis to delineate the frequency distribution of each variable. The second stage entailed bivariate analysis employing the Chi-square test to ascertain the link between the independent variables and the prevalence of stunting, as well as computing the Odds Ratio (OR) at a significance threshold of $p < 0.05$. The third stage was multivariate analysis with the Backward logistic regression method to ascertain the factors most influential on the incidence of

stunting. Data were analyzed using SPSS. Bivariate analysis was conducted using the **Chi-square test** to determine the relationship between independent and dependent variables. To ensure the validity of the test, the assumption of expected counts (≥5 in all cells) was checked. In cases where this assumption was not met (cells with expected counts <5 exceeding 20%), Fisher's Exact Test was used as an alternative. The strength of the association was measured using the Odds Ratio (OR) with a 95% Confidence Interval (CI). Finally, multivariate analysis using backward logistic regression was performed to identify the most dominant determinant factors. This study has obtained ethical approval, reference number No.01.26.1192/KEPK/POLTEKKES KEMKES MEDAN 2025.

RESULTS AND DISCUSSION (12pt)

RESEARCH RESULTS

This research was carried out in the Dalu Sepuluh Community Health Centre region to ascertain the distribution of risk factors associated with stunting.

Table 1: Distribution of stunting incidents in the working area of the Dalu Sepuluh Community Health Center

Variables	Description	Stunting		No Stunting		total	P-value
		n	%	n	%		
Mother's Age	<20 years	0	0.0	1	3.6	1	0.227[a]
	20-30 years	14	50.0	17	60.7	31	
	31-40 years	11	39.3	10	35.7	21	
	>49 years	3	10.7	0	0.0	3	
Mother's Education	Junior High School or Equivalent	6	21.4	0	0.0	6	0.004[a,b]
	High School Equivalent	22	78.6	23	82.1	45	
	Bachelor/Diploma	0	100	5	17.9	5	
How many times should	Never	11	39.3	0	0.0	11	0.001[a,b]
	1 time	8	28.6	1	3.6	9	
	2 times	9	32.1	26	92.9	35	

a midwife check you?	4.00	0	0.0	1	3.6	1	
Mother's Knowledge	Enough	1	3.6	22	78.6	23	0.001[a,b]
	Not enough	27	96.4	6	21.4	33	
Mother's Attitude	Enough	0	0.0	10	35.7	10	0.001[a,b]
	Not enough	28	100.0	18	64.3	46	
Mother's Actions	Enough	1	3.6	17	60.7	18	0.001[a,b]
	Not enough	27	96.4	11	39.3	38	

[a]*chi Square test; bsignificant p<0.05*

The results indicated that maternal education, prenatal checkups, family income, parity, household size, food access, and maternal knowledge–attitude–practice significantly affect stunting incidence. More frequent antenatal visits and better nutritional knowledge are linked to lower stunting rates. Families with moderate income (Rp2,000,000–4,000,000), 4–5 household members, and regular food access demonstrated better outcomes, while multiparous mothers and those with inadequate attitudes or practices showed higher stunting prevalence. The p-values confirm that education, income, and maternal behavior are key determinants in preventing stunting.

Table 2: Results of logistic regression analysis

Variables	**B**	**SE**	**Wald**	**df**	**Sig.**	**Exp(B)**
Mother's Education	12,064	28,615,115	11,018	1	0.001	173,433,526
How many times should a midwife check you?	21,811	13,395,216	23,729	1	0.000	2,968,834,920,061
Mother's Knowledge	60,465	20,979,034	32,538	1	0.000	181,745,683,993,892,000,000,000,000,000
Mother's Attitude	22,676	25,580,694	12,174	1	0.000	7,051,106,944,319

Mother's Actions	38,991	27,154,793	20,959	1	0.000	85,799,770,347,070,500,000

Caption: Logistic Regression test using the Backwards Stepwise method (Likelihood Ratio)

The analysis showed that maternal education, prenatal checkups, maternal health, number of children, family size, food availability, and maternal knowledge–attitude–practice (KAP) significantly influence stunting. Higher education, regular antenatal care, and good maternal health lower stunting risk, while having more children increases it. Adequate food availability and positive maternal KAP strongly protect against stunting, with all variables showing statistical significance ($p < 0.05$).

Table 3. Odds Ratio (OR) and 95% Confidence Interval (CI) of Maternal Determinants for Stunting Incidence

Variables	**OR**	**95% (CI)**	**P-value**
Mother's Education	12,30	1.54 – 98.12	0.004
How many times should a midwife check you?	14,25	3.65 – 55.62	0.001
Mother's Knowledge	99	10.74 – 912.43	0.001
Mother's Attitude	15,56	1.84 – 131.25	0.001
Mother's Actions	41,73	4.88 – 356.54	0.001

The analysis showed that variable presents the highest Odds Ratio, indicating that mothers with inadequate knowledge are significantly more likely (approximately 99 times higher risk) to have stunted children compared to those with sufficient knowledge. Acting as a dominant determinant with an OR of 41.73, the data showed that 96.4% of stunting cases occurred among mothers who failed to implement adequate preventive measures and according to Antenatal Care (ANC), it showed that mothers who never attended or only attended one prenatal checkup have a 14.25 times higher risk of having a stunted child compared to those who completed at least two visits.

B. DISCUSSION

Relationship between Mother's Education Level and the Incidence of Stunting

Research in the Dalu Sepuluh Community Health Centre (Puskesmas) area revealed a significant association between maternal education and stunting incidence ($p = 0.004$, $p < 0.05$). Lower maternal education was linked to a higher risk of stunting, with 21.4% of cases occurring among mothers with junior high school education and 78.6% among those with a high school education. Notably, no stunting cases were reported among children of mothers with bachelor's or diploma degrees, 17.9% of whom had children with normal nutritional status. These findings corroborate previous studies [14–16], that identify maternal education as a critical determinant of child nutritional outcomes. Higher education enhances mothers' capacity to understand nutritional requirements, adopt appropriate feeding practices, maintain hygiene, and access health services. Therefore, stunting prevention strategies should integrate efforts to improve maternal education and parenting skills, particularly in regions with low educational attainment.

The Relationship between the Frequency of Examination by Health Workers (Midwives) and the Incidence of Stunting

The study also revealed a strong association between the frequency of prenatal checkups and stunting ($p = 0.001$). Among mothers who never attended midwife-led antenatal care, 39.3% of children were stunted, with none having normal nutritional status. Even a single prenatal visit resulted in a relatively high stunting prevalence (28.6%), whereas two visits correlated with 92.9% of children having good nutritional status. This demonstrates that regular prenatal care reduces stunting risk by allowing early detection of pregnancy complications, nutritional counseling, and supplementation. This aligns with previous studies [17,18], which state that inadequate utilization of maternal health services is linked to low birth weight, preterm birth, and early malnutrition. Strengthening antenatal care coverage, community health education, and the role of village midwives is essential for improving maternal and child outcomes.

The Relationship between Mothers' Knowledge, Attitude, and Actions and the Incidence of Stunting

Maternal knowledge, attitudes, and actions (KAP) demonstrated a strong and consistent association with the incidence of stunting ($p = 0.001$). Only 3.6% of stunted children were born

to mothers with adequate knowledge, compared to 81.8% among mothers with low knowledge, indicating that insufficient understanding contributes to poor feeding practices, delayed health-seeking, and limited use of health services (Prasetyo et al., 2023; Saleh et al., 2021; Ufthoni et al., 2022). Attitudinal factors were equally significant, with all stunted children having mothers who exhibited poor attitudes toward stunting prevention, supporting the Health Belief Model's premise that attitudes strongly influence health behaviors [28]. Most importantly, maternal actions emerged as the dominant determinant, with 96.4% of stunted children having mothers who failed to implement adequate preventive measures, including appropriate breastfeeding, complementary feeding, regular growth monitoring, immunization, hygiene maintenance, and timely medical care [5,29,30]. These findings underscore that knowledge and attitudes must be translated into concrete behaviors through practical parenting training, behavior change communication, and community-based support systems to effectively reduce stunting prevalence.

CONCLUSION AND SUGGESTIONS

This study concludes that stunting among toddlers in the Dalu Sepuluh Puskesmas area is strongly influenced by maternal and household factors, including maternal education, frequency of prenatal care, and maternal knowledge–attitude–practice (KAP). Among these, maternal behavior (knowledge, attitudes, and actions) emerged as the most critical determinant. Mothers who possess knowledge but do not translate it into practical action remain at high risk of having stunted children. Thus, a comprehensive approach is needed, integrating nutrition, health services, education, economic empowerment, and behavioral interventions. Community-based strategies, parenting classes, and health cadre involvement are crucial to achieving sustainable stunting reduction and improving child growth outcomes.

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