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Research article

The Relationship Between a History of Chronic Energy Deficiency and the Incidence of Stunting in Toddlers Aged 24-59 Months.

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ABSTRACT

Background: The prevalence of stunting in Indonesia is 43% among children aged 24-59 months and 41.2% among children aged 12-23 months. The prevalence of stunting in toddlers in West Sumatra in 2020 was 25.6%. The prevalence of stunting in toddlers in Padang City in 2021 was 22.6%. Stunting carries the risk of reduced intellectual potential and impaired growth. The purpose of this study was to determine the relationship between a history of anemia during pregnancy, chronic energy deficiency, and pre-pregnancy body mass index (BMI) with the incidence of stunting in toddlers aged 24-59 months in Balai Gadang Village, within the Air Dingin Community Health Center (Puskesmas) working area of Padang City in 2022.
Methods: The type and design of this study were descriptive analytical with a case-control design. This study was conducted in the Air Dingin Community Health Center working area of Padang City from January to March 2022. The population was 1,356 people and the sample size was 25. Sampling was carried out using a consecutive sampling technique. Data analysis was performed bivariately using the chi-square test.
Results: The results of this study indicate a relationship between a history of anemia and the incidence of stunting (p=0.000), a history of Chronic Energy Deficiency (p=0.000), and a history of pre-pregnancy body mass index (BMI) and the incidence of stunting (p=0.000).
Conclusion: The conclusion of this study is that there is a relationship between a history of anemia during pregnancy, Chronic Energy Deficiency, and pre-pregnancy BMI with the incidence of stunting.

INTRODUCTION

Stunting remains one of the most serious public health and nutritional problems globally. According to the World Health Organization (WHO), stunting is defined as a condition in which a child has a height-for-age Z-score below minus two standard deviations (< -2 SD) from the WHO Child Growth Standards median, reflecting chronic malnutrition and long-term growth failure. Stunting is not merely a matter of short stature; rather, it indicates prolonged nutritional deprivation, recurrent infections, and inadequate psychosocial stimulation occurring during critical periods of growth and development, particularly during the first 1,000 days of life—from conception to a child's second birthday.

Stunting is the most common form of malnutrition, including both protein-energy malnutrition and micronutrient deficiencies. It often begins in utero and continues during early childhood, closely related to maternal nutritional status before and during pregnancy, maternal body size, and fetal growth patterns. Poor maternal nutrition, including chronic energy deficiency (CED), anemia, and inadequate weight gain during pregnancy, can impair placental function and fetal growth, resulting in intrauterine growth

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restriction (IUGR) and low birth weight (Dian Isti Angraini, 2023). These conditions significantly increase the risk of growth faltering and stunting during infancy and toddlerhood. In children under 2–3 years of age, stunting reflects ongoing growth failure that may become largely irreversible if not addressed early.

In Indonesia, stunting remains a major nutritional problem. Data from the 2018 Basic Health Research (Riskesdas) show that the prevalence of stunting among children under five years old reached 43% in the 24–35 month age group and 41.2% in the 12–23 month age group. These figures indicate that nearly half of Indonesian children in these age groups experience chronic growth impairment. Although national strategies have been implemented to accelerate stunting reduction, disparities between provinces remain significant. In West Sumatra Province, the prevalence of stunting among toddlers in 2020 was 25.6% (Ministry of Health, 2022). Based on Nutritional Status Monitoring (PSG) data, the incidence of stunting increased from 30.6% in 2017, with 21.3% categorized as stunted and 9.3% as severely stunted.

The number of stunting cases in West Sumatra remains relatively high. Data from the West Sumatra Provincial Health Office indicate that the stunting rate reached 27.67%. Although this figure is below the national average, West Sumatra ranks third among provinces on Sumatra Island, surpassing neighboring Bengkulu and Jambi. This situation highlights the need for more focused and evidence-based interventions at the provincial and district levels Anggraini (Anggraini, 2020).

At the city level, the prevalence of stunting in Padang City in 2021 was 22.6% (Ministry of Health, 2022), an increase from 14.9% in 2018. According to data from the Padang City Health Office in 2021, the highest prevalence was recorded in the Air Dingin Community Health Center (Puskesmas) area, at 13.8%, consisting of 9.3% stunted and 4.5% severely stunted children. Within this area, Balai Gadang Village had the highest prevalence, at 4.2%. These data demonstrate that stunting remains a significant local public health issue requiring immediate attention.

Stunting has both short-term and long-term consequences. In the short term, stunted children are more susceptible to infectious diseases due to compromised immune function. In the long term, stunting is associated with reduced cognitive development, lower educational achievement, decreased productivity in adulthood, and an increased risk of chronic diseases such as obesity, diabetes, and cardiovascular disorders (Muliani, 2023). Moreover, stunted girls are more likely to become short-statured mothers who are at higher risk of giving birth to low birth weight infants, thereby perpetuating an intergenerational cycle of malnutrition and poverty. Nutritional deficiencies during the “golden period” of growth have lasting effects throughout the life cycle (Wariyaka et al, 2023).

Several studies have identified maternal factors during pregnancy as important determinants of stunting. Research by Maulina (2021) demonstrated a significant association between a history of anemia during pregnancy and the incidence of stunting in toddlers aged 24–59 months. Similarly, research conducted in Mataram Ilir Village, Central Lampung Regency, found that toddlers born to mothers with chronic energy deficiency (CED) had a 2.2 times greater risk of experiencing stunting compared to those born to mothers without CED (Millward, 2017). These findings emphasize the importance of maternal nutritional status during pregnancy in influencing child growth outcomes.

Furthermore, research conducted by Irma at Dr. M. Soewandhie Regional Hospital in Surabaya showed that pre-pregnancy maternal body mass index (BMI) and weight gain during pregnancy were significantly associated with infant birth weight. Additional findings by Fitriani et al. (2024) indicated that pre-pregnancy BMI and gestational weight gain were significantly related to the incidence of stunting. Mothers with inadequate BMI before pregnancy or insufficient weight gain during pregnancy are more likely to deliver infants with suboptimal growth, increasing the risk of stunting during early childhood.

Considering the persistently high prevalence of stunting in the Air Dingin Community Health Center area, along with evidence linking maternal anemia, chronic energy deficiency, and pre-pregnancy BMI to child growth outcomes, it is essential to examine these maternal risk factors comprehensively. Understanding the relationship between a history of pregnancy anemia, chronic energy deficiency (CED), and pre-pregnancy BMI with the incidence of stunting in toddlers aged 24–59 months will provide valuable evidence for strengthening maternal and child health programs. Therefore, the author is interested in conducting a study at the Air Dingin Community Health Center entitled: “The Relationship between History of Pregnancy Anemia, CED, and Pre-Pregnancy BMI with the Incidence of Stunting in Toddlers Aged 24–59 Months.”

METHODS

This research is quantitative and descriptive analytical in nature, aiming to identify relationships between variables. The study used a case-control design. This study was conducted in the Air Dingin Community Health Center (Puskesmas) in Padang City from January to March 2022. Sampling was conducted using consecutive sampling with 25 respondents, with a significance level set at $p < 0.05$. The research process began with initial field observations and coordination with local community leaders. Questionnaire validation and reliability testing were conducted before the main data collection. Data collection was conducted through face-to-face interviews using a validated questionnaire. Completed questionnaires were checked for completeness before data entry. The data were then coded, entered, and analyzed in accordance with the research objectives. Ethical principles were applied throughout the research. Respondents were informed about the research objectives, procedures, potential benefits, and their right to withdraw at any time without consequences. Written consent was obtained from all participants before data collection. Respondent anonymity and data confidentiality were strictly maintained, and all data were used solely for research purposes.

RESULTS

Relationship between history of anemia during pregnancy and the incidence of *stunting* in toddlers aged 24-59 months

History of Anemia	Group				N	%	*p*
	No Stunting		Stunting				
	F	%	F	%			
Anemia	8	14	24	48	31	62	
Not anemic	17	36	1	2	19	38	0,000
Total	25	50	25	50	50	100	

Table 1. shows that stunting is more common in toddlers whose mothers have a history of anemia during pregnancy (48 %) compared to mothers who do not have a history of anemia during pregnancy (2%). Based on statistical tests, it can be concluded that there is a relationship between a history of anemia during pregnancy and the incidence of stunting ($p < 0.05$)

Relationship between history of CED during pregnancy and the incidence of stunting in toddlers aged 24-59 months.

History of CED	Group				N	%	*p*
	No Stunting		Stunting				
	F	%	F	%			
Chronic Energy Deficiency (CED)	0	0	24	22	22	44	0,000
Not CED	25	50	1	3	28	56	
Total	25	50	25	50	50	100	

Table 2. shows that stunting is more common in toddlers whose mothers have a history of CED (44%) compared to mothers who do not have a history of CED (6 %). Based on statistical tests, it can be concluded that there is a relationship between a history of CED during pregnancy and the incidence of stunting ($p < 0.05$).

Relationship between pre-pregnancy BMI and the incidence of stunting in toddlers aged 24-59 months

BMI	Group				N	%	*p*
	No Stunting		Stunting				
	F	%	F	%			
Thin	4	8	11	22	14	28	
Normal	8	16	12	24	27	54	
Overweight	13	26	1	2	8	16	0,000
Obesity	0	0	1	2	1	2	
Total	25	50	25	50	50	100	

Table 3. shows that stunting incidents occur more frequently in toddlers whose mothers have a normal pre-pregnancy BMI (24 %) compared to toddlers whose mothers have a thin pre-pregnancy BMI (22 %), excessive pre-pregnancy BMI (1 %) and obese pre-pregnancy BMI (1%). Based on statistical tests,

it can be concluded that there is a relationship between pre-pregnancy BMI history and stunting incidents ($p < 0.05$)

DISCUSSION

History of Anemia in Pregnancy

The study conducted in the Air Dingin Community Health Center work area found that stunting was more common among toddlers whose mothers had a history of anemia during pregnancy than among those whose mothers did not. Statistical analysis showed a significant relationship between maternal anemia during pregnancy and the incidence of stunting ($p < 0.05$).

These findings are consistent with previous studies. Research by Tosepu et al. (2022) in Rwanda reported that anemia during pregnancy was associated with stunting. Similarly, Zahtamal (2024), in a study at the Gedangsari II Community Health Center in Gunung Kidul, found a significant association between maternal anemia and stunting. Anggraini (2020), in a study conducted at the Pademangan Barat I Community Health Center, also identified a significant relationship, particularly when examining anemia in the third trimester of pregnancy. According to this study, third-trimester anemia is often caused by inadequate nutritional intake, which disrupts fetal growth and development and increases the risk of low birth weight (LBW). LBW is widely recognized as being closely associated with stunting, as noted by the World Health Organization (2025).

Further supporting evidence comes from Qoni'ah et al (2026) research in the Pranggang Community Health Center area, Kediri Regency, a designated stunting locus. The study found a significant relationship between a history of anemia during pregnancy and stunting among toddlers aged 24–59 months. Uncontrolled anemia during pregnancy was shown to negatively affect pregnancy outcomes, increasing the risk of stunting. These findings align with the framework of Bappenas (2018), which states that stunting results from the accumulation of multiple risk factors affecting a child's growth and development during the first 1,000 days of life, beginning in the womb.

Physiological hypervolemia during pregnancy increases with gestational age. If this condition is not balanced by adequate iron intake, it may lead to anemia. Maternal anemia reduces the supply of iron and oxygen to the fetus, impairing fetal growth and increasing the risk of stunting. Iron plays a crucial role in hemoglobin formation, which is responsible for oxygen transport throughout the body. Iron deficiency can disrupt fetal metabolic processes, which are essential for bone mineralization beginning in the first trimester. Iron deficiency during pregnancy increases the risk of prematurity, low birth weight, and low birth length, all of which are associated with stunting (Soliman, 2021).

The findings demonstrate a clear relationship between maternal anemia during pregnancy and stunting in toddlers. Adequate maternal iron levels contribute to optimal fetal growth and development, while iron deficiency impairs oxygen transport and metabolic processes, adversely affecting the fetus. Additionally, questionnaire data indicated that other maternal factors such as age at first pregnancy and a history of bleeding may also influence the incidence of stunting.

History of CED in Pregnancy

The study conducted in the Air Dingin Community Health Center work area found that stunting was more common among toddlers whose mothers had a history of chronic energy deficiency (CED) during pregnancy than among those whose mothers did not. Statistical analysis showed a significant relationship between a history of CED in pregnancy and the incidence of stunting ($p < 0.05$).

These findings are consistent with previous studies. Wati et al (2023) reported a significant association between CED in pregnant women and stunting among toddlers aged 24–59 months. Similarly, Syahrianti (2023) found a significant relationship between maternal CED and stunting, with CED status identified as the dominant variable in multivariate analysis. Yuliastanti (2023) also demonstrated a relationship between maternal nutritional status during pregnancy (chronic energy deficiency) and stunting.

Chronic energy deficiency during pregnancy results in inadequate nutrient reserves to meet the physiological demands of pregnancy and fetal growth. Although the fetus has high developmental plasticity and can adapt to environmental changes, malnutrition in utero and during early life may trigger adaptive responses, including slowed growth and reduced cell number and development. These adaptations can manifest later in life as short stature and increase the risk of stunting.

Payanadi (2024) further explained that mothers who experience CED during pregnancy are more likely to give birth to low birth weight infants, which contributes to the development of stunting. A case-control study by Novelia et al. (2021) also found a significant association between maternal CED during

pregnancy and stunting in toddlers, showing that pregnant women with CED are at greater risk of having stunted children.
Overall, the findings confirm a significant relationship between maternal CED during pregnancy and stunting in toddlers. These results highlight the importance of maintaining adequate maternal nutritional status during pregnancy, as poor nutrition increases the risk of adverse outcomes such as low birth weight and stunting. Additionally, questionnaire data indicated that other maternal characteristics such as age at first pregnancy and number of childrenmay also influence the incidence of stunting

History of Body Mass Index Before Pregnancy
The study conducted in the Air Dingin Community Health Center work area found that stunting was more common among toddlers whose mothers had either a low (underweight) or high (overweight/obese) pre-pregnancy body mass index (BMI). Statistical analysis indicated a significant relationship between pre-pregnancy BMI and the incidence of stunting ($p < 0.05$).
These findings are consistent with previous research. Qoni'ah (2026) reported that most respondents had a low BMI and concluded that maternal underweight status was associated with an increased risk of stunting. Similarly, research by Soliman (2021) at Dr. M. Soewandhie Regional General Hospital in Surabaya found a significant relationship between excessive pre-pregnancy BMI and stunting.
According to Novelia et al. (2021), BMI serves as an indicator of maternal nutritional status before pregnancy and can help predict pregnancy outcomes. Pre-pregnancy weight is an important clinical parameter for estimating birth weight. Mothers who are underweight or experience insufficient weight gain are more likely to deliver low birth weight (LBW) infants. LBW is a known risk factor for stunting. The Ministry of Health of the Republic of Indonesia (2024) states that maternal nutritional status is a key determinant of fetal growth and overall child health. Malnutrition during pregnancy increases the risk of LBW, prematurity, congenital abnormalities, and stunting.
BMI is an indicator used for adults over 18 years of age and is not sex-specific. In Indonesia, a normal BMI ranges from 18.5 to 25.0. Mothers with a BMI below 18.5 are classified as underweight and are at risk of delivering malnourished or LBW infants, which increases the likelihood of stunting. Conversely, mothers with a BMI above the normal range (overweight or obese) are at increased risk of complications such as gestational diabetes, preeclampsia, and fetal macrosomia. These conditions can also negatively affect fetal growth and may contribute to stunting.
In conclusion, the findings demonstrate a significant relationship between maternal pre-pregnancy BMI and stunting in toddlers. Both undernutrition and overnutrition before pregnancy can adversely affect fetal growth and development. Therefore, maintaining a normal BMI prior to pregnancy is essential to support optimal maternal and child health and to reduce the risk of stunting during the first 1,000 days of life.

CONCLUSION

There is a significant relationship between a history of anemia during pregnancy and the incidence of stunting among toddlers aged 24–59 months in Balai Gadang Village, within the working area of the Air Dingin Community Health Center, Padang, in 2022.
There is a significant relationship between a history of chronic energy deficiency (CED) during pregnancy and the incidence of stunting among toddlers aged 24–59 months in Balai Gadang Village, within the working area of the Air Dingin Community Health Center, Padang, in 2022.
There is a significant relationship between pre-pregnancy body mass index (BMI) and the incidence of stunting among toddlers aged 24–59 months in Balai Gadang Village, within the working area of the Air Dingin Community Health Center, Padang, in 2022

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CONFLICTS OF INTEREST

No conflicts of interest were disclosed by the writers of this work

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