



Bivariate Analysis of the Correlation Between Determinants of Stunting in Toddlers

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Abstract

Background. Stunting is a persistent dietary issue that significantly affects physical growth, cognitive development, and future productivity in children.

Aims. This study is to examine the correlation between many variables and the prevalence of stunting in toddlers aged 6–59 months in Pekalipan Village, Cirebon City in 2025.

Methods. The research methodology employs an analytical design utilizing a bivariate approach. The association between independent variables (maternal education, maternal age, birth weight, exclusive breastfeeding, immunization completeness, history of infectious diseases, and feeding patterns) and the dependent variable (stunting) was analyzed using the Chi-square test and Odds Ratio (OR) calculations.

Result. The findings indicated a significant correlation between maternal education ($p=0.027$), maternal age at childbirth ($p=0.007$), birth weight ($p=0.015$), exclusive breastfeeding ($p=0.028$), history of infectious diseases ($p=0.036$), and feeding patterns ($p=0.018$) with the prevalence of stunting in toddlers. Simultaneously, full immunization did not demonstrate a significant correlation with stunting ($p=0.382$).

Conclusion. This study concludes that stunting is affected by multiple maternal, perinatal, and parenting factors; therefore, prevention strategies must be comprehensive, focusing on enhancing maternal education, ensuring nutritional adequacy during pregnancy, preventing infectious diseases, and adopting suitable feeding practices.

Keywords: stunting, toddlers, stunting determinants, bivariate analysis, child nutrition.



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INTRODUCTION

Stunting is closely related to child development, and its impact on growth is significant. Children who suffer from stunting have low levels of motor activity, delayed physical and mental development, and limited cognitive abilities. Delays in children's growth can be very risky if they occur during the critical phase, or golden period, when the child experiences a rapid growth rate that will be the foundation for later adolescence and adulthood. Impeded development in stunted children results from a restriction in cerebral growth, hindering the

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brain's capacity to generate positive stimuli for gross and fine motor abilities. Stunting is a chronic disorder; typically, a stunted child endures prolonged dietary shortages, resulting in impaired growth (Angita, 2020).

Stunting can be categorized into short-term and long-term effects. In the near term, stunting impedes the growth of children or toddlers, resulting in disruptions in cognitive and motor development, along with other health issues such as suboptimal height. In the long term, stunting can diminish IQ in maturity, hence impacting productivity. Furthermore, stunting impacts the nervous system and neuronal cells, leading to learning difficulties and heightened vulnerability to degenerative diseases, including diabetes, cardiovascular disease, stroke, and hypertension (Ministry of National Development Planning/Bappenas, 2018), as well as an increased risk of obesity (Rahman et al., 2023). Addressing stunting is not solely the responsibility of the government, but also of the entire Indonesian populace. The rationale is that the long-term consequences of stunting are profoundly damaging, impeding children's growth and development, adversely influencing emotional maturation, and potentially resulting in economic losses. Prevention of stunting begins with adequate nutrition during the first 1,000 days of life (Tusya et al., 2024).

Previous studies found maternal education, maternal age, birth weight, exclusive breastfeeding, vaccination completeness, history of infectious illnesses, and eating patterns as factors of stunting in toddlers. The optimal gestational age range for a mother is between 20 and 35 years. Pregnancy is deemed hazardous outside the age range of less than 20 years or greater than 35 years. This is due to the fact that between the ages of 20 and 35, women's reproductive systems and psychological preparedness are enough developed to safely endure pregnancy and labor. Conversely, individuals under 20 years of age exhibit suboptimal functioning of their reproductive organs. Simultaneously, the reproductive capacity of adults aged 35 years or older typically diminishes. Pregnant women over 35 years old had a 2.74-fold increased chance of delivering a stunted child compared to mothers aged 25-35 years. Elliott, 2019.

Mothers with limited educational attainment will struggle to obtain health education throughout pregnancy, childbirth, and lactation, such as the significance of fulfilling nutritional requirements throughout pregnancy and the necessity of exclusive nursing from birth until six months of age. Mothers with lesser educational attainment generally possess less insight and knowledge than those with higher educational attainment. The significance of education is evident in its influence on health, particularly on child nutrition. Educated mothers are more

inclined to embrace a healthy lifestyle and thus select more nutritious foods for their children (I. M. R. D. P. Putra et al., 2025).

Low Birth Weight (BBLR) is the primary risk factor contributing to stunting in toddlers. This results from intrauterine growth restriction encountered by BBLR infants in utero. Consequently, upon birth, BBLR infants typically exhibit diminished growth and development compared to their normal counterparts, frequently failing to attain their age-appropriate growth potential. (I. M. R. D. P. Putra et al., 2025).

Breast milk includes colostrum, which contains leukocytes that diminish as the infant continues to breastfeed. Moreover, breast milk delivers essential elements, including energy, significantly derived from proteins, carbs, and lipids. Breast milk contains essential nutrients for infants, including vitamin A, vitamin D, vitamin B6, calcium, iron, and zinc; deficiencies in any of these elements elevate the risk of adverse outcomes. Stunting, such as iron shortage, can adversely affect cognitive and physical development. Iron is essential for the distribution of oxygen to all bodily tissues. Disruption of oxygen delivery to bone tissue will impede healthy bone development. Consequently, toddlers with iron deficiency are at an elevated risk of developing stunting. (I. M. R. D. P. Putra et al., 2025).

Stunting is a persistent dietary challenge that continues to be a major public health concern in Indonesia and other developing nations. Prior research indicates that stunting is affected by a multitude of elements, encompassing maternal attributes, perinatal circumstances, parenting practices, children's health, and environmental and socioeconomic conditions. Maternal education is continuously associated with the prevalence of stunting due to its influence on nutritional understanding, parenting practices, and the utilization of health services. Mothers with poor educational attainment often possess a restricted comprehension of their children's nutritional requirements and effective parenting methodologies.

Maternal age at childbirth was recognized as a critical driver, with pregnancies occurring at <20 years and >35 years linked to a heightened chance of infants being born with suboptimal conditions, including low birth weight (LBW), which further exacerbated stunting. BBLR has been extensively documented as a direct risk factor for stunting, with reduced growth observable from the intrauterine era forward. Besides maternal and prenatal variables, exclusive breastfeeding practices and eating patterns are crucial in reducing stunting. Exclusive breastfeeding enhances immunity and safeguards children against infectious diseases. Simultaneously, inadequate management of MP-breastfeeding, encompassing kind, quantity, and frequency, may result baby nutrient deficits. Infectious disorders, such as diarrhea and

ISPA, are known to exacerbate children's nutritional condition by diminishing appetite and impairing vitamin absorption. Nonetheless, investigations into the correlation between vaccination completion and stunting persistently provide incongruous results. Certain studies indicate a correlation, however others conclude that immunization is not directly linked to stunting but instead has an indirect function in mitigating infectious illnesses. Previous research have generally investigated a limited number of partial or multivariate risk variables for stunting on a broad regional basis. Conversely, local community-based studies featuring an extensive bivariate analysis of diverse stunting factors are scarce.

Stunting continues to be a significant public health issue in Indonesia and other developing nations, resulting in severe short- and long-term effects on physical growth, cognitive development, and future productivity. Recent studies consistently demonstrate that stunting is a multifaceted illness, shaped by a confluence of maternal attributes, prenatal variables, child-feeding practices, infectious diseases, and socio-economic situations.

Prior research has recognized maternal education as a critical factor, since it influences nutritional knowledge, caregiving practices, and the use of health services. Maternal age during childbirth, especially pregnancies occurring before 20 years or after 35 years, is linked to increased chances of negative birth outcomes, such as low birth weight, which ultimately leads to stunting. Low birth weight (LBW) is acknowledged as a significant biological risk factor indicative of intrauterine growth restriction and is predictive of compromised linear growth in infancy and early childhood.

Moreover, exclusive breastfeeding and suitable feeding practices (MP-ASI) are fundamental elements of stunting prevention strategies, as they guarantee sufficient nutritional intake and safeguard children from infections throughout crucial growth phases. Infectious disorders, particularly diarrhea and acute respiratory infections, aggravate malnutrition by diminishing appetite and hindering nutritional absorption, thereby elevating the risk of stunting. Nonetheless, the evidence concerning the significance of full immunization remains incongruous. Although immunization is recognized for diminishing the burden of infectious diseases, numerous studies indicate that its impact on stunting may be indirect rather than causal. Many current studies utilize extensive, multivariate frameworks at provincial or national scales, thus constraining contextual comprehension at the community or village level.

State of the Art

Recent studies on stunting in toddlers consistently indicate that stunting is a multifactorial public health problem, influenced by maternal, perinatal, caregiving, and child health factors. Contemporary literature highlights several dominant determinants:

1. **Maternal Factors.** Maternal education and maternal age at childbirth are widely reported as significant predictors of child nutritional status. Higher maternal education improves health literacy, feeding practices, and utilization of health services, while pregnancies occurring at <20 years and >35 years are associated with higher risks of adverse birth outcomes.
2. **Perinatal Factors.** Low birth weight (LBW) is recognized as an early biological risk factor reflecting intrauterine growth restriction. Many studies confirm that LBW children are more vulnerable to impaired linear growth and long-term stunting.
3. **Infant Feeding and Parenting Practices.** Exclusive breastfeeding and appropriate complementary feeding (MP-ASI) are central in stunting prevention strategies. Proper feeding patterns ensure adequate nutrient intake during the critical growth period (0–24 months) and protect children from infection-related growth disruption.
4. **Child Health Factors.** Infectious diseases, especially diarrhea and acute respiratory infections (ARI), remain important contributors to stunting due to their effects on appetite, nutrient absorption, and metabolic demands.
5. **Role of Immunization.** Evidence regarding immunization completeness remains inconsistent. While immunization reduces disease burden, many studies indicate that its influence on stunting is indirect rather than causal.
6. **Methodological Trends.** Most previous research employs: Large-scale surveys, Multivariate regression models, Provincial or national datasets.

These approaches provide strong statistical generalization but often limit contextual understanding at the community level. Overall, the current state of research views stunting as a multidimensional phenomenon shaped by biological, behavioral, and socio-environmental factors.

LITERATURE REVIEW

The initial pregnancy at age 25 years or older substantially mitigates the incidence of stunting in neonates. A study encompassing 55 countries indicated that postponing the initial pregnancy until the ages of 27-29 can diminish infant mortality and health issues in children, including stunting, wasting, anemia, and diarrhea. Mothers who initiate their first pregnancy

between the ages of 27 and 29 typically have improved sanitary circumstances, elevated educational attainment, a more stable socioeconomic standing, a spouse, and reside in urban environments. Pumaika et al. (2022).

Certain studies indicate variations in the risk of stunting according on gender. A cohort research in Ethiopia revealed that male infants between 6 and 12 months exhibited a twofold increased risk of developing stunting in comparison to female infants. Males are at a greater risk of experiencing stunting and being underweight compared to females. Studies in Sub-Saharan Africa reveal that preschool-age boys are more prone to stunting than girls, however the underlying cause remains unclear. (Savita & Amelia, 2020).

Infants with Low Birth Weight (LBW) typically exhibit decreased growth and development compared to those with normal birth weight. This results from the intrauterine growth retardation that BBLR infants have endured in utero, which persists postnatally, hindering or rendering unattainable their expected growth trajectory. Impact of BBLR on the prevalence of stunting. Most prominently observed throughout the initial six months of an infant's life, this phenomenon will persist in diminishing until the age of two. Nevertheless, if youngsters have sufficient nutritional intake and health is preserved, their body length growth might align with their age. (Agustina et al., 2022).

According to Government Regulation Number 20 of 2003, Article 1, the educational tiers in Indonesia comprise primary, secondary, and higher education. Basic education comprises nine years: six years of general education in elementary schools (SD) or their equivalent, followed by three years in junior high schools (SMP) or their equivalent. Subsequently, secondary education continues for three years in Senior High School (SMA) or an equivalent school. Higher education is structured by colleges and encompasses diploma, bachelor's, master's, specialist, and doctorate programs. The national education system predominantly emphasizes practical sciences pertinent to global management. (Aloma, 2023).

The mother's height affects the infant's birth size, thus influencing the postnatal growth trajectory. The mother's height correlates with the child's genetic potential for achieving adult height. In regions with elevated stunting rates, a mother's height indicates the stunting she endured throughout her early life. Socio-economic conditions can moderate the impact of intergenerational growth via non-genetic factors, such as maternal nutrition, disease history, stress, and parenting, which influence child growth. Nutritional factors can significantly influence growth attainment relative to genetic height potential, particularly in populations from developing nations. Consequently, the mother's stature not only signifies her hereditary

influences but also her nutritional background. Maternal height serves as a significant indicator for comprehending the intergenerational relationship of health status. A person's height signifies the cumulative impact of maternal health problems over her lifetime, particularly those shaped by social and environmental influences during childhood. Moreover, a confluence of genetic, environmental, and analogous epigenetic alterations between parents and offspring also influences their growth trajectories. Andari et al., 2020.

The quantity of children in a family influences the availability of food for that family. Children from low-income families with numerous offspring are likely to be at risk of stunting. Furthermore, the proximity of children's births significantly impacts the family's nutritional health. Parents have difficulties in child-rearing and struggle to provide a tranquil environment at home. Insufficient intervals between births can disrupt parenting, burden parents, and hinder appropriate child care. Stunting may arise when the interval between pregnancies is insufficient, impacting parental care for their offspring. Conversely, adequate spacing facilitates the mother's complete recovery post-childbirth. With optimal physical and mental well-being, moms will be more adept at implementing effective parenting strategies in child-rearing. (Wahyu et al., 2022).

During rapid growth phases, particularly between the ages of 1 and 2 years, children require immediate attention and stimulation to facilitate healthy brain development, alongside sufficient nutrition for physical growth. Subsequent children often encounter growth and developmental issues due to the escalating stress on parents with each additional offspring. Norfai and Abdullah, 2021.

Research indicates that mothers of toddlers frequently introduce breast milk to their infants prematurely for a variety of reasons. The termination of exclusive breastfeeding, together with the belief that the milk produced is inadequate or flows poorly, results in the infant becoming irritable. This circumstance ultimately motivates mothers to provide their children with supplementary nourishment. Administering breast milk to infants prematurely might precipitate numerous health complications, including an elevated risk of diarrheal infections, respiratory tract infections, allergies, and potential growth issues, due to the underdevelopment of the infant's digestive system. (Fitri & Ernita, 2019).

Toddlers who are exclusively breastfed and given additional diets tailored to their requirements can mitigate the risk of stunting. Exclusive breastfeeding throughout the first six months of life can enhance immunity, safeguarding infants against infectious diseases. Subsequently, at six months of age, the introduction of supplemental foods in adequate quantity,

frequency, and texture will fulfill children's nutritional requirements, therefore diminishing the risk of stunting. Wangiyana et al. (2021). Administration of MP-ASI is advised to commence punctually at 6 months of age. The MP-ASI must encompass a minimum of four distinct food categories, be administered at least thrice daily, and consistently uphold food cleanliness and safety standards during preparation. Yudianti et al. (2022).

Insufficient nutrition prior to a child's second birthday can impede their growth and development, potentially resulting in stunting in the long term. Children typically prefer snacks that are rich in fat, sugar, and salt. To facilitate children's adaptation to a nutritious diet, modifications must be implemented incrementally. One of the initial measures is to restrict their snack portions. For instance, if your youngster typically consumes potato chips thrice daily, decrease the frequency to twice daily. Optimal healthy snacks have carbohydrates, protein, fiber, and healthy fats, while exhibiting minimal sugar and salt content. Foods abundant in protein or fiber are highly advantageous for youngsters since they enhance digestion and cognitive function. Examples of suitable foods include wheat cereals, yogurt, and fruits. (Wahyuni et al., 2023).

Diarrhea is a leading infectious disease that results in mortality. Moreover, Acute Respiratory Tract Infections (ARI) constitute a considerable mortality factor, particularly among children, and are frequently associated with malnutrition and stunting. ISPA is characterized as a contagious illness of the upper or lower respiratory tract. The disease spectrum ranges from asymptomatic to severe and fatal, influenced by the pathogen, environmental conditions, and host variables. Data indicates that diarrhea and ISPA are more prevalent in toddlers. Acute Respiratory Infection (ARI) is a predominant illness and the primary cause of mortality in children under the age of five. The incidence of ISPA is directly correlated with toddlers' nutritional state, and an elevated incidence of ISPA can exacerbate it. Pneumonia, a type of ISPA, is an acute infection of the lung tissue (alveoli) or bronchi (bronchopneumonia) induced by a virus. The disease can impact individuals of all ages; however, toddlers and children are most susceptible due to compromised host variables such as malnutrition and unsanitary conditions (Hidayani, 2020).

Despite several studies investigating factors associated with stunting, certain research gaps persist. Most prior research have focused on extensive multivariate analysis, so failing to adequately elucidate the direct relationship between stunting determinants at the level of small communities, such as urban villages.

The study's findings reveal discrepancies concerning the impact of vaccination completion on

the incidence of stunting. Certain studies have demonstrated a substantial correlation, but others have indicated none; therefore, further research is required to elucidate the function of immunization as a direct or indirect contributor to stunting.

Third, research that comprehensively combines maternal factors, prenatal influences, parenting behaviors, and the history of infectious diseases remains scarce, particularly concerning toddlers aged 6 to 59 months. This gap may render stunting therapies incomplete and less efficacious.

This work addresses the gap by meticulously examining the interactions among many stunting factors by bivariate analysis at the local level, so establishing a scientific foundation for the formulation of a more complete and sustainable stunting prevention plan.

Research Gap

Despite extensive research on stunting determinants, several gaps remain:

1. Limited community-level analysis. Most previous studies emphasize national or regional datasets and use multivariate models, leaving a gap in understanding how stunting determinants interact at the local community level, where interventions are implemented.
2. Inconsistent evidence on immunization and stunting. The contradictory findings across studies regarding immunization completeness highlight the need for further research to distinguish between direct and indirect effects of immunization on child growth.
3. Lack of holistic yet simple analytical approaches. Few studies integrate maternal, perinatal, feeding, and infectious disease factors within a single bivariate analytical framework, which is essential for identifying priority risk factors in resource-limited settings.

This study addresses these gaps by delivering a focused, integrative, and context-specific analysis that provides a strong scientific basis for targeted, multisectoral stunting prevention strategies at the community level.

METHODS

The association between dependent and independent variables was analyzed by bivariate analysis informed by established conceptual frameworks. Moreover, the acquired data is processed and presented in a tabular style. The statistical method employed in this bivariate analysis is the Chi-square test, utilizing the attainment of value. A P value of 0.05 is not a definitive threshold; if $P > 0.05$, it indicates a lack of correlation, whereas $P < 0.05$ signifies a significant relationship among maternal education, maternal age at childbirth, birth weight,

exclusive breastfeeding, complete immunization, history of infectious diseases, and feeding patterns with stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025 (Soamole & Dewi, 2024).

The following are the requirements set by the Najmah (2011) For the statistical test to be used:

1. The Fisher's exact test is used if the 2x2 table has an expected value of less than 5.
2. Continuity adjustments are made if the 2x2 table does not show an expected value of less than 5.
3. The "Person *Chi-square*" test is used if the table under consideration is larger than 2 x 2.

Regarding the specifics of decision-making in probabilistic situations, the following requirements should be considered when comparing p-values and α values:

1. If the p-value (sig) is larger than or equal to the alpha value ($\alpha = 0.05$), this signifies a link between the free and bound variables, leading to the rejection of the null hypothesis (H0).
2. If the p-value (sig) suggests no statistically significant link between the free and bound variables and is less than or equal to the alpha value ($\alpha = 0.05$), then the null hypothesis (H0) is accepted.

$$\text{Odds Ratio} : \frac{ad}{bc}$$

1. OR = 1. This shows that variables that have been evaluated and recognized as risk factors do not affect the likelihood of outcomes.
2. If the odds ratio (OR) is less than one, this suggests that the variable may be protective, lowering the incidence of disease.
3. A variable is considered a risk factor for the occurrence of a particular disease if the OR value is greater than 1.

Table 1. 2 x 2 contingencies for the population

Variable A	Variable B		Total
	1	2	
1	N11	N12	n1+
2	N21	N22	n2+
Total	n+1	n+2	N

DISCUSSION

The novelty of this study lies in a comprehensive community-based bivariate analysis of the relationship among various stunting determinants in toddlers aged 6–59 months. This study simultaneously examined maternal factors (maternal education and maternal age at childbirth), perinatal factors (birth weight), parenting practice factors (exclusive breastfeeding and feeding patterns), and child health factors (history of infectious diseases and completeness of immunization). In addition, this research provides the latest empirical contribution to the local context of Pekalipan Village, Cirebon City in 2025, which has been minimally reported in the literature. The finding that immunization completeness is not significantly associated with stunting, while other factors show a meaningful relationship, enriches the scientific discourse on the multifactorial nature of stunting and confirms that stunting interventions cannot rely on one aspect of health services alone. Thus, this study presents a contextual and relevant local perspective as the basis for planning stunting prevention interventions that are more targeted and based on community needs.

The correlation between maternal education and stunting in children aged 6 to 59 months.

The Chi-square test analysis yielded a p-value of 0.027 (<0.05) with an odds ratio of 1.087. This indicates a correlation between maternal education and stunting in toddlers aged 6 to 59 months in Pekalipan Village, Cirebon City, in 2025. The research indicates that children of mothers with poor educational attainment are at a greater risk of stunting than those of mothers with higher educational levels.

Table 1 The relationship between maternal education and *Stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City 2025

Mother's Education	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal							
	n	%	n	%	N	%		Lower	Upper	
Low	6	20,0	24	80,0	30	100	1,087	0,358	2,992	0,027
Height	23	18,7	100	81,3	123	100				

Table 2 indicates that 20.0% of respondents with low education (elementary-junior high) had stunted children, whereas 18.7% of moms with higher education (high school-college) report the same. The Chi-square test yielded a p-value of 0.027 (<0.05) with an odds ratio of 1.087. This indicates a correlation between maternal education and stunting in toddlers aged 6 to 59 months in Pekalipan Village, Cirebon City, in 2025.

The findings of this study align with Nurmalasari's (2020) research, which indicates a substantial correlation between mother education and stunting, corroborated by an analysis revealing a p-value of 0.000. The educational attainment, particularly that of the mother, profoundly influences the health of her family, encompassing the nutritional well-being of its members. Mothers significantly influence child-rearing, as they are the primary contributors to children's health, oversee household nutrition, and bear substantial responsibility for enhancing the family's nutritional status. Case Stunting among toddlers, it is more frequently observed among moms with limited educational attainment. This results from the public perception that education is not highly valued and the insufficient support from families in the pursuit of higher education. (Nurmalasari et al., 2020).

This research is not in line with the research Trisyani (2020) which states that there is no relationship between mother's education and *Stunting* in toddlers, which is strengthened by the results of analysis with the value of $p\ value = 0.107$. The role of a mother is very significant in the formation of a child's diet, because she is responsible for the provision of food by organizing the menu, shopping, cooking, preparing dishes, and serving food. Meanwhile, mothers who have higher education tend to work outside the home, so their children are often cared for by grandmothers or other family members. This condition results in mothers not being able to carry out their roles as well as possible (Trisyani et al., 2020).

Based on this description, it can be stated that maternal education affects the nutritional status, health and parenting of children. Therefore, mothers who are highly educated will be better at receiving information about their family's health and have a better mindset.

The relationship between maternal age at childbirth and *stunting* in toddlers aged 6-59 months.

The Chi-square test analysis yielded a p-value of 0.007 (<0.05) and an odds ratio of 1.022. This indicates a correlation between maternal age at childbirth and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025. Analysis of the data indicates that mothers under 20 years of age and over 35 years of age are at an increased risk of having a stunted kid.

Table 2 The relationship between the mother's age at childbirth and *Stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City 2025

The mother's age at the time of childbirth	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal					Lower	Upper	
	n	%	n	%	N	%				
Risky	5	19,2	21	80,8	26	100	1,022	0,309	2,893	0,007
No Risk	24	18,9	103	81,1	127	100				

Table 3 indicates that 19.2% of respondents in at-risk age groups (<20 years and >35 years) have stunted children, compared to 18.9% of respondents in non-at-risk age groups (20-35 years). The Chi-square test findings indicated $p = 0.007$ (<0.05) and an odds ratio (OR) of 1.022. This indicates a correlation between maternal age at childbirth and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025.

This study corresponds with the existing research. Ariati (2019) indicates a substantial correlation between maternal age at childbirth and stunting in toddlers. The test results corroborate this: Chi-Square Statistic = 4.14, p -value = 0.014. Pregnancy between the ages of 20 and 35 is deemed a safe interval due to the requisite physical and mental maturity for navigating the pregnancy and birthing processes. The reproductive system does not operate properly up to age 20, and after age 35, reproductive capacity generally diminishes. Elliott, 2019.

This finding is inconsistent with the existing study. L. A. Rahmawati (2020) asserts that there is no correlation between maternal age at childbirth and stunting in toddlers. The study supports this, producing a p -value of 0.503. The optimal age range for pregnancy is between 20 and 35 years. The rationale is that women within this age demographic typically exhibit greater dedication to nurturing, educating, and rearing children. Nonetheless, there remain women of that age who have not comprehended or applied appropriate parenting techniques. Particularly for the selection of appropriate nutrition for children (L. A. Rahmawati et al., 2020).

Mothers aged 20 to 35 years are deemed the optimal age for pregnancy. At that age, the reproductive organs are sufficiently developed, and the mother possesses the physical preparedness to endure pregnancy, childbirth, postpartum recovery, and child-rearing. Nonetheless, at that age, certain mothers have not completely adopted optimal parenting practices, particularly regarding infant nutrition.

The correlation between birth weight and stunting in children aged 6 to 59 months. The Chi-square test yielded a p-value of 0.015 (<0.05) and an odds ratio (OR) of 1.673. This signifies a correlation between birth weight and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, in 2025. The statistics indicate that children with a birth weight below 2500 grams are at an elevated risk of stunting.

Table 3 The relationship between birth weight and *Stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City 2025

Birth weight	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal					Lower	Upper	
	n	%	n	%	N	%				
BBLR	3	27,3	8	72,7	11	100	1,673	0,396	6,678	0,015
Normal	26	18,3	116	81,7	142	100				

Table 4 indicates that children with low birth weight (BBLR <2500 g) exhibit a stunting rate of 27.3%, whereas those with normal birth weight (>2500 g) demonstrate a stunting rate of 18.3%. The Chi-square test findings indicated p = 0.015 (<0.05) and an odds ratio (OR) of 1.673. This signifies a correlation between birth weight and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, in 2025.

This study corresponds with the existing research. Dwi Putri and Tiara Levia (2022) reveal a substantial correlation between birth weight and stunting in toddlers. The analytical results indicate a p-value of 0.012. Birth weight is a contributing factor to stunting, as it serves as a predictor of children's growth into adulthood and reflects the nutritional status the fetus receives in utero. In poorer nations, low birth weight persists as a critical issue associated with dietary inadequacies. Low birth weight denotes infants weighing under 2,500 grams, irrespective of gestational age. Low birth weight is a critical determinant that elevates the risk of stunting in children, and the substantial incidence of infants born with low body weight is projected to exacerbate the prevalence of stunting in Indonesia. (Dwi Putri and Tiara Levia, 2022).

This finding is inconsistent with the existing study. Augustine (2022) asserts that there is no correlation between birth weight and stunting in toddlers. The study supports this, producing a p-value of 0.125. Infants with low birth weight (LBW) exhibit slower growth and development compared to those born at normal weight. BBLR infants endure diminished intrauterine growth from the womb, a condition that persists postnatally, resulting in challenges

that prevent them from achieving age-appropriate growth rates. Low birth weight (LBW) significantly influences the incidence of stunting, particularly during the initial six months postnatally, with a decline observed by 24 months of age. Nonetheless, if the infant receives adequate nutrition and maintains good health, the acceleration of body length growth might align with the child's age. (Agustina et al., 2022).

This description indicates that birth weight significantly influences the incidence of stunting. Nonetheless, if the child obtains adequate nutrients, his growth will be more accelerated and aligned with his age.

The correlation between exclusive breastfeeding and stunting in children aged 6 to 59 months

The Chi-square test yielded a p-value of 0.028 (<0.05) and an odds ratio of 0.875. This is a correlation between exclusive breastfeeding and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025. The findings indicates that toddlers who do not receive exclusive breastfeeding are at a greater risk of stunting compared to those who do.

Table 4. The relationship between exclusive breastfeeding and *Stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City 2025

Exclusive breastfeeding	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal							
	n	%	n	%	N	%		Lower	Upper	
Not Exclusive	8	20,5	31	79,5	39	100	0,875	0,362	6,678	0,028
Exclusive	21	18,4	93	81,6	114	100				

Table 5 indicates that children who are exclusively breastfed exhibit a stunting rate of 18.4%, whereas those who are not exclusively breastfed have a stunting rate of 20.5%. The Chi-square test findings indicated $p = 0.028 (< 0.05)$ and $OR = 0.875$. This is a correlation between exclusive breastfeeding and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025.

This study corresponds with the existing research. Fitri and Ernita (2019) asserted a correlation between exclusive breastfeeding and stunting in toddlers. Breast milk constitutes the optimal nourishment for infants post-delivery. Breast milk has numerous advantages for nourishment, immunity, psychological development, economic factors, and additional aspects. The inadequate rate of exclusive breastfeeding is a contributing factor to the prevalence of

stunting in children under five, originating from historical circumstances and affecting the child's future. Conversely, effective nursing will aid in preserving the child's nutritional equilibrium, therefore facilitating normal and optimal growth in youngsters (Fitri & Ernita, 2019).

This research contradicts the findings of Hikmahrachim (2020), which asserts that there is no correlation between exclusive breastfeeding and stunting in toddlers. The analysis results are corroborated by a p-value of 0.661. This study demonstrated that exclusive breastfeeding was not associated with the occurrence of stunting in children in Bogor Regency. This study identified an interaction indicating that exclusive breastfeeding may contribute to the prevention of stunting in moms aged over 30 years. These findings indicate that breast milk solely serves to prevent stunting, with its efficacy varying based on community conditions. Certain experts contend that the influence of exclusive breastfeeding on stunting is attributable not to the nutrition ingested, but to measures taken to avert infection. A pertinent theory is the model suggested by experts, which asserts that exclusive breastfeeding alone is inadequate to mitigate stunting and must be complemented by enhanced socioeconomic conditions, elevated education levels, improved infectious disease management, and women's empowerment (Hikmahrachim et al., 2020).

According to this statement, breast milk is the optimal source of nutrition for infants. Breastfeeding offers advantages such as enhanced immunity, psychological benefits, and economic savings, among others. Exclusive breastfeeding may contribute to the prevention of stunting in toddlers. Consequently, toddlers who do not receive exclusive breastfeeding will exhibit increased vulnerability to illness.

The correlation between full immunization and stunting in children aged 6 to 59 months

The Chi-square test analysis yielded a p-value of 0.382, which above 0.05, and an odds ratio of 0.611. This indicates an absence of correlation between immunization completeness and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, in 2025. The statistics indicate that the completeness of immunization is not correlated with stunting in toddlers.

Table 5 The relationship between immunization completeness and *stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025

Immunization completeness	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal					Lower	Upper	
	n	%	n	%	N	%				
Incomplete	5	26,3	14	73,7	19	100	0,611	0,195	1,951	0,382
Complete	24	17,9	110	82,1	134	100				

Table 6 indicates that 17.9% of fully immunized children are stunted, whereas 26.3% of partially immunized children are stunted. The Chi-square test findings indicated $p = 0.382$ (>0.05) and an odds ratio (OR) of 0.611. This indicates an absence of correlation between immunization completeness and stunting in toddlers aged 6-59 months in Pekalipan Village, Cirebon City, in 2025.

This study corresponds with the existing research. Vasera & Kurniawan (2023) assert that the completeness of immunization is not associated with stunting in toddlers. The analysis results corroborate this, revealing a p-value of 0.12. The research findings indicate that young infants with full basic immunization are less prone to stunting compared to those with partial immunization. Nevertheless, among children with insufficient immunization, some exhibit normal physical development, although those with complete immunization have also encountered stunting. Health services indirectly influence the prevalence of stunting, as immunization constitutes a type of health service. Immunization is a measure implemented to enhance the body's immunity against specific diseases. (Vasera & Kurniawan, 2023).

This finding is inconsistent with the existing study. Zuhrotunida (2024) suggests a correlation between immunization completion and stunting in children. The value analysis results are corroborated by a p-value of 0.000. Immunization is among the most efficacious strategies to prevent disease transmission and mitigate morbidity and mortality rates in children and toddlers. The advantages of immunization may not be immediately evident or perceptible. The primary benefit of immunization is its capacity to diminish the incidence and mortality associated with preventable illnesses and disorders through vaccination. Immunization safeguards not only individuals but also society at large. Immunization is the most effective health intervention in preventive strategies. Moreover, immunization can be regarded as an investment in future health, as it provides protection against infectious diseases. Immunization provides individuals with protection and diminishes the likelihood of illness, hence potentially lowering medical expenses. (Zuhrotunida et al., 2024).

According to the aforementioned statement, immunization serves as a method to avert illness transmission. Immunized children exhibit a negligible risk of stunting. Nonetheless, certain children continue to endure stunting, attributable to several factors like economic conditions, environmental sanitation, and nutritional consumption, among others.

The correlation between the historical prevalence of infectious illnesses and stunting in children aged 6 to 59 months

The Chi-square test analysis yielded a p-value of 0.036 (<0.05) with an odds ratio of 1.474. This indicates a correlation between the history of viral infections and stunting in children aged 6-59 months in Pekalipan Village, Cirebon City, 2025. Analysis of this data indicates that toddlers with a history of infection are at an elevated risk of stunting compared to those without such a history.

Table 6 The relationship between the history of infectious diseases and *stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025

History of infectious diseases	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal					Lower	Upper	
	n	%	n	%	N	%				
Yes	3	25,0	9	75,0	12	100	1,474	0,383	6,497	0,036
No	26	8,4	15	81,6	142	100				

Table 7 indicates that children with a history of infectious disorders exhibit a stunting rate of 25.0%, whereas those without such a history demonstrate a stunting rate of 18.4%. The Chi-square test findings indicated p = 0.036 (< 0.05) and an odds ratio of 1.474. This indicates a correlation between the historical prevalence of viral diseases and stunting in children aged 6-59 months in Pekalipan Village, Cirebon City, 2025.

The findings of this study align with the research. Subroto (2021) indicates a correlation between the infected individual's history and stunting in children. The analysis produced a p-value of 0.000, supporting this conclusion. Infectious infections are a primary contributor to stunting. The correlation between infectious diseases and nutritional adequacy is significant. The presence of infectious infections will exacerbate the condition in cases of malnutrition. Malnourished toddlers exhibit increased vulnerability to infectious illnesses. Consequently, addressing infectious disorders at an early age can facilitate nutritional enhancement by ensuring that dietary intake meets toddlers' requirements. Children enduring prolonged

infectious infections are at an increased risk of acquiring stunting. They are also more prone to enduring persistent complications from infection, which can exacerbate the child's physical condition. A further significant aspect is cleanliness behaviors. Toddlers consuming food with inadequate cleanliness are at an elevated risk of contracting infectious diseases. This viral condition typically presents with reduced appetite and vomiting, resulting in insufficient nutritional intake for children. This scenario will ultimately impede the child's development. Subroto et al. (2021).

The results of this study are inconsistent with those of Khairani & Effendi (2020), who found no relationship between a history of infectious diseases and stunting in toddlers. The analysis produced a p-value of 0.228, supporting this conclusion. The study's results demonstrate that the prevalence of stunting is significantly greater among children with a history of infectious infections compared to those without such a history. Bivariate analysis revealed a substantial inverse correlation between a history of infectious disease and the incidence of stunting at the Posyandu in Ratu Samban District, Bengkulu City. A history of infectious disease did not influence the prevalence of stunting in toddlers at the Posyandu, Ratu Samban District, Bengkulu City (Khairani & Effendi, 2020).

A history of infectious illnesses is a direct factor contributing to stunting in toddlers. Consequently, there is a necessity for expedited treatment to enhance children's nutrition. Toddlers enduring prolonged infectious infections are at an elevated risk of stunting.

The correlation between dietary habits and stunting in children aged 6 to 59 months

The Chi-square test yielded a p-value of 0.018 (<0.05) and an odds ratio (OR) of 1.377. This signifies a correlation between feeding practices and stunting in children aged 6-59 months in Pekalipan Village, Cirebon City, in 2025. The statistics indicate that children with inadequate feeding practices are at an elevated risk of stunting.

Table 7 The relationship between feeding patterns and *stunting* for toddlers aged 6-59 months in Pekalipan Village, Cirebon City, 2025

Feeding patterns	Nutritional Status				Total		OR	(95% CI)		P value
	Stunting		Normal							
	n	%	n	%	N	%		Lower	Upper	
Inappropriate	26	19,5	107	80,5	133	100	1,377	0,385	5,422	0,018
Precise	3	15,0	17	85,0	20	100				

Table 8 indicates that children with inadequate feeding patterns exhibit a stunting rate of 19.5%, whereas those with appropriate diets demonstrate a stunting rate of 15.0%. The Chi-square test yielded a p-value of 0.018 (<0.05) and an odds ratio of 1.377. This signifies a correlation between feeding practices and stunting in children aged 6-59 months in Pekalipan Village, Cirebon City, in 2025.

This study corresponds with Andolina's (2023) findings, which demonstrate a correlation between feeding practices and stunting in toddlers. The analysis produced a p-value of 0.001, supporting this conclusion. Optimal and balanced nutrition can be attained by focusing on a dietary strategy that addresses children's nutritional requirements. This seeks to preserve and rehabilitate children's health through the nutrients included in their diet, which significantly influence their well-being, as supplied by their parents. Proper nutrition is essential for optimal growth, development, and both physical and cognitive advancement throughout all age groups, including infants and children. Field observations revealed that numerous children under five do not obtain an adequate food, resulting in substantial growth deviations from the z-score at the posyandu (Andolina et al., 2023).

The findings of this study are inconsistent with the research. D. Rahmawati (2024) asserts that there is no correlation between eating practices and stunting in toddlers. The analysis produced a p-value of 0.840, supporting this conclusion. No correlation between eating practices and the prevalence of stunting was observed in children aged 1 to 5 years in this study, potentially attributable to the good quality of food provided to the respondents. Moreover, numerous parents participating in the study have adopted feeding techniques suitable for their child. This study identifies improper feeding patterns, as evidenced by feeding frequency indicators, as a factor contributing to stunting in children whose parents do not adhere to appropriate practices. This may occur due to parents lacking a defined feeding schedule. Stunting may be induced by the actions of the mother or caregiver, who tends to feed in accordance with the child's preferences, resulting in an inconsistent quantity and variety of food provided. Consequently, these children under five are at significant risk of developing stunting. (D. Rahmawati et al., 2024).

It might be asserted that sufficient nutritional requirements can be met by considering dietary habits. meals patterns encompass the food type, quantity, and frequency of meals.

The novelty of this study lies in its comprehensive community-based bivariate analysis that simultaneously examines maternal, perinatal, caregiving, and child health determinants of stunting among toddlers aged 6–59 months in Pekalipan Village, Cirebon City.

Specifically, this research offers three novel contributions:

1. Local-level empirical evidence. The study provides updated, context-specific data from a small urban village setting that has been underrepresented in prior stunting research.
2. Integrated determinant analysis using a bivariate approach. Unlike studies that focus on isolated or limited factors, this research evaluates multiple determinants concurrently—maternal education, maternal age, birth weight, exclusive breastfeeding, feeding patterns, infectious disease history, and immunization status—allowing a clearer understanding of direct relationships with stunting.
3. Clarification of immunization's role. The finding that immunization completeness is not significantly associated with stunting, while other factors are, adds important evidence to ongoing scientific debate and reinforces the concept that stunting prevention cannot rely solely on health service coverage.

This journal article contributes novel insights in several important aspects:

1. Community-Based Empirical Evidence. The study provides updated and localized data from Pekalipan Village, Cirebon City (2025), a setting that has been minimally represented in national stunting research. This strengthens contextual relevance for local intervention planning.
2. Integrated Determinant Analysis Using Bivariate Methods. Unlike studies that focus on isolated variables, this research simultaneously examines: Maternal education, Maternal age at childbirth, Birth weight, Exclusive breastfeeding, Feeding patterns, History of infectious diseases, Immunization completeness within a single analytical framework, allowing clearer identification of direct relationships.
3. Clarification of Immunization's Role. The finding that immunization completeness is not significantly associated with stunting, while other factors are, provides important empirical evidence for ongoing scientific debates. It reinforces the view that stunting prevention cannot rely solely on health service coverage.
4. Practical Orientation for Local Policy. By focusing on simple bivariate relationships, the study generates findings that are easily interpretable by local health workers and policymakers, enhancing its practical applicability.

Thus, the novelty lies in its contextual, integrative, and practice-oriented approach to analyzing stunting determinants.

CONCLUSION

The bivariate analysis results indicate a significant correlation between the incidence of stunting in toddlers aged 6–59 months in Pekalipan Village, Cirebon City in 2025 and several determinant factors, including maternal education, maternal age at birth, birth weight, exclusive breastfeeding, history of infectious diseases, and feeding patterns. Mothers with limited education, advanced maternal age (under 20 years or over 35 years), and toddlers with low birth weight, a history of infectious infections, lack of exclusive breastfeeding, and inadequate feeding practices are at an elevated risk of stunting. The completeness of immunization is not significantly correlated with the incidence of stunting, indicating that stunting is a complex disorder influenced by multiple facets of health services. Consequently, stunting prevention necessitates a comprehensive and sustainable strategy that encompasses enhancing maternal education and awareness, optimizing nutritional status throughout pregnancy, managing infectious infections, and adopting feeding methods that correspond with toddlers' nutritional requirements.

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