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Research article

Factors Associated With Stunting In The Working Area Of Batangan Community Health Center, Pati Regency

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Abstract

Stunting remains a major public health concern that may adversely affect children's growth and development and is associated with various biological, behavioral, and socioeconomic factors. This study aimed to identify factors associated with stunting among children aged 24–59 months in the working area of Batangan Primary Health Center, Pati Regency, Indonesia. A quantitative observational analytic study with a cross-sectional design was conducted involving 54 children. Data were analyzed using the Chi-square test. The results showed that 26 children (48.1%) experienced stunting. Significant associations were found between stunting and delivery method ($p = 0.004$), birth weight ($p = 0.037$), history of infectious diseases ($p = 0.037$), exclusive breastfeeding ($p < 0.001$), and family income ($p < 0.001$). In contrast, parenting style was not significantly associated with stunting ($p = 0.972$). Lack of exclusive breastfeeding demonstrated the highest reported odds ratio (OR = 45.833). These findings indicate that delivery method, birth weight, infectious disease history, exclusive breastfeeding, and family income are significantly associated with stunting. Strengthening maternal and child health services, promoting exclusive breastfeeding, preventing childhood infections, and supporting economically vulnerable families may contribute to stunting prevention efforts.

INTRODUCTION

Nutritional adequacy in children is one of the underlying factors contributing to the improvement in health status, as it plays an important role in supporting the optimal growth and development process. Inadequate fulfillment of nutritional requirements may affect children's growth and development; one manifestation can be seen through the incidence of stunting. This condition not only affects children's physical growth but also disrupts brain development and their cognitive function. Monitoring children's growth and preventing growth impairment must be carried out regularly and continuously from the earliest stages of life.[1]

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Stunting reflects impaired linear growth in children, which is anthropometrically indicated by a height-for-age value below the established growth standard. According to the height-for-age indicators, a toddler is classified as stunted if the height-for-age z-score (HAZ) is below −2 SD. This condition encompasses short stature and severe short stature classifications.[2] This condition is often influenced by inadequate nutrient intake for a prolonged period, which potentially results in long-term consequences for children's growth and development.

In Indonesia, stunting remains a health issue requiring serious attention, considering the incidence rate is still quite high. According to the data from SSGI in 2022, the national stunting rate remains at 21.6%, while the prevalence in Central Java Province is 20.08%. According to the results of SSGI in 2024, Pati Regency is still one of the regions requiring attention in preventing stunting, with a prevalence of 16.5%.[4] This finding emphasizes the need for continuous efforts to prevent stunting, one of which is understanding and identifying various factors contributing to the condition.

Stunting is not caused by a single factor, but rather the interaction of various conditions. Several factors that may play a role in this condition are nutritional adequacy, history of infection, exclusive breastfeeding practices, method of delivery, birth weight, parenting practice, and family's social and economic conditions.[5] These factors are interrelated and collectively contribute to determining children's growth conditions from the early stage of life to the toddler period.

The history of delivery and prenatal conditions is the initial determinant that may influence the risk of stunting. The method of delivery is suspected to be associated with children's growth through differences in colonization and development of gut microbiota during the early stage of life. Cesarean delivery has been reported to be associated with lower height-for-age z-scores compared to vaginal delivery, while LBW and preterm birth have also been associated with impaired growth.[5] Therefore, the history of pregnancy and delivery must be considered in identifying risk factors of stunting.

Nutritional status in children may be influenced by the history of infection, specifically diarrheal diseases and acute respiratory infections (ARIs), which are infectious conditions that often occur in this age group. Infections in children may impair nutrient absorption and further exacerbate their health conditions. Conversely, poor nutritional status causes an impaired immune system, so children are more susceptible to infections, ultimately resulting in a bidirectional relationship between infection and malnutrition.[5] The incidence of infection in children can also be influenced by environmental factors, specifically sanitation conditions and the availability and accessibility of adequate water sources.

Exclusive breastfeeding has an important role in supporting nutritional adequacy, while simultaneously providing immune protection in children during the 1,000 Days of Life. The duration of breastfeeding less than six months or not following the recommended breastfeeding practice are factors increasing the possibility of stunting in children. The study by Malinda and Maharani (2023) found that toddlers who do not receive exclusive breastfeeding are 3.7 times more likely to experience stunting than those who receive exclusive breastfeeding.[4] Thus, optimization of breastfeeding practice is one of the aspects that must be considered as an effort to prevent stunting in children.

Parenting practices reflect how parents fulfill their roles in meeting their children's needs, providing guidance, and providing care in everyday life.[6] Parenting implemented by parents generally can be

categorized into three types: authoritarian, permissive, and authoritative parenting. Each parenting style has its characteristics, particularly in setting boundaries, monitoring children, and meeting children's needs.[7] Parenting practice may influence children's eating habits and nutrient adequacy. Therefore, parenting practice is one of the aspects associated with the incidence of stunting. According to Dwi et al. (2020), poor parenting practice by mothers is associated with an increased risk of stunting, with children being 6.62 times more likely to experience stunting than children who receive better parenting practice. The results of the study by Midu *et al*. (2021) demonstrated that the quality of parenting to children is associated with the nutritional status among toddlers.[5,7]

A family's social and economic conditions, especially the level of income, also determine the ability to provide adequate food and meet children's nutritional needs.[8] The adequacy of family income in meeting daily needs must be considered based on the number of dependent household members. An increase in the number of family members will be followed by an increase in needs that must be met from the available income.[9] A family with better social and economic conditions tends to have greater opportunities to provide diverse foods and meet children's nutritional needs. Conversely, limited economic capacity can be one of the constraints in meeting children's nutritional intake optimally.[10] The results of the study by Sutarto *et al*. (2020) found that the proportion of children experiencing stunting tends to be higher than in families in low-income groups.[11]

Based on the preliminary data obtained from the Health Office of Pati Regency, an increasing trend of stunting cases is observed in *Kecamatan* (District) Batangan. Data from the Penimbangan Serentak Program recorded that the prevalence of stunting was 3.15% in 2022. This value increased to 5.30 in 2025, based on records from the electronic Community-Based Nutrition Recording and Reporting System (ePPGBM). This finding highlights the need for further identification of factors correlated with stunting in the working area of Puskesmas (Community Health Center) Batangan.

METHOD

This study used a quantitative method with analytic observation. A cross-sectional design was implemented. Moreover, the research site was in the working area of Puskesmas Batangan, Pati Regency. This study involved toddlers in the age range of 24–59 months registered at Puskesmas Batangan. The accessible population in this study was 111 toddlers aged 24–59 months, based on the data in Puskesmas Batangan. The sample size was determined by implementing the Slovin formula with a 10% margin of error. Based on the results of the calculation, the number of respondents required in this study was 53. Selecting respondents in this study was carried out randomly using the simple random sampling method.

The respondents were parents or children's caregivers. The inclusion criteria were having children aged 24–59 months who were registered and resided in the working area of Puskesmas Batangan, having a Maternal and Child Health (MCH) handbook with complete examination data, being involved in children's parenting, and stating their consent to participate in the study as respondents. The exclusion criteria in this study were respondents who have hearing or mental impairments, have limitations in reading and writing, choose to stop participating in this study, and are uncooperative during the study.

This study determined the method of delivery, birth weight, history of infection, exclusive breastfeeding, parenting practice, and family income level as independent variables. Moreover, the dependent variable that became the study outcome was the

incidence of stunting. The primary data collection was carried out directly through interviews with parents or primary caregivers using questionnaires. Information collected included the history of infection, exclusive breastfeeding, parenting practice, and family income. Meanwhile, data related to the history of delivery and birth weight were obtained from the Maternal and Child Health (MCH) handbook and interviews with respondents. Stunting status was determined by directly measuring children's height; the measurement results were then compared using the height-for-age (HAZ) index based on the Z-score.

After all data were obtained, data processing and analysis were conducted. Univariate analysis was used to describe the characteristics of each variable, while bivariate analysis was implemented to assess the relationship between independent variables and the incidence of stunting. The relationship between variables in bivariate analysis was tested using the Chi-square method. This study used a significance level of 0.05, with a 95% confidence level. The results of the analysis were considered statistically significant when the p-value was <0.05.

RESULTS

54 children aged 24–59 months and their parents and caregivers were the respondents in the study conducted in the working area of Puskesmas Batangan, Pati Regency. Data analysis was conducted to provide an overview of the respondents' characteristics, the distribution patterns of each variable, and the relationship between research factors and the incidence of stunting.

Referring to Table 1, the largest age group of parents is 26–33 years, with 26 respondents (48.1%). Based on gender, female respondents were the most dominant group, with 42 respondents (77.8%). Respondents mostly had four family members, with 18 respondents (33.3%). Based on education characteristics, the majority of respondents had completed senior high school or its equivalent, with 21 respondents (38.9%). Meanwhile, based on occupational status, there were 15 unemployed respondents (27.8%).

As shown in the table, toddlers aged 24–35 months are the largest group, with 21 children (38.9%). Based on gender, 21 children were male, with a proportion of 42.6%.

Table 3 shows that the mean age of parents is 30.13±4.98 years. The mean number of family members was 3.76±1.06, while the mean family income was IDR 1,452,573±1,245,248. Based on the characteristics of toddlers, the mean age was 40.85±9.32 months. The mean birth weight was 2,942±0.634 grams, while the mean body height measurement was 96.20±4.82 cm.

In the univariate analysis, each variable was described based on its distribution. Variables analyzed were the method of delivery, birth weight, history of infection, exclusive breastfeeding, parenting practice, the level of family income, and stunting status. Referring to Table 4, the majority of toddlers in this study were delivered through spontaneous vaginal delivery, with 43 children (79.6%). 35 toddlers (64.8%) were recorded to have normal birth weight, while 30 toddlers (55.6%) did not have a history of infection. Of all respondents, there were 29 toddlers (53.7%) who received exclusive breastfeeding. Related to parenting practice, the largest number was in the authoritarian category, with 25 respondents (46.3%). Meanwhile, according to the income level, the majority of families were included in the low-income group, with 27 respondents (50.0%). The results of measurement showed that the majority of toddlers had a height ranging from 94 to 101 cm, with 34 children (63.0%). Based on the growth status, 28

toddlers (51.9%) were classified as not stunted.

The data shows that the incidence of stunting was more frequently found in toddlers delivered through spontaneous vaginal delivery, with 25 children (58.1%). Meanwhile, among children with a history of cesarean delivery, there was 1 child (9.1%) with stunting. According to the analysis using the Chi-square test, delivery method showed a statistically significant association with the incidence of stunting, with p=0.004 and an OR of 0.072. Table 6 shows that stunting was found in 12 toddlers (75%) with LBW, 13 toddlers (37.1%) with normal birth weight, and 1 toddler (33.3%) with high birth weight. There was a significant relationship. As shown in Table 6, stunting was found in 12 toddlers (75%) with a history of low birth weight (LBW). In children with normal birth weight, 13 toddlers (37.1%) were found to have stunting status, while 1 child had high birth weight. The results of the analysis showed a significant relationship between birth weight and stunting (p=0.037). Compared to the LBW group, toddlers with normal birth weight had an OR value of 0.167, while the group with high birth weight showed an OR of 0.846.

Stunting was found in 20 toddlers (66.7%), without a history of infection. Among children with infrequent infection, there were 4 toddlers (80%) with stunting, while 2 toddlers (10.5%) were found to have frequent infection. Analysis using the Chi-square test demonstrated that the history of infection had a statistically significant association with the incidence of stunting, with a p-value of 0.037. The frequent-infection group, as the reference group, obtained an OR value of 1.470 in toddlers with the history of infrequent infection, while children with no history of infection had an OR of 9.271. 22 toddlers (88%) who did not receive exclusive breastfeeding experienced stunting, while there were 4 toddlers (13.8%) who received exclusive breastfeeding. The results of the Chi-square test showed a significant relationship between exclusive breastfeeding and stunting (p<0.001), with OR=45.833.

Stunting was found in 12 toddlers (48%) with authoritarian parenting, 15 toddlers (45.5%) with permissive parenting, and 9 toddlers (50%) with democratic parenting. There was no significant relationship between parenting and stunting (p=0.972). Compared to democratic parenting, the OR of permissive parenting was 1.083 and authoritarian parenting was 1.200.

Table 10 shows that the incidence of stunting is mostly found in families with low income (77.8%) compared to middle income (23.5%) and high income (10%). There was a significant relationship between family income and stunting (p<0.001). Compared to the low-income group, the middle-income group had an OR of 0.032, and the high-income group had an OR of 0.361.

Table 1 The Characteristics of Respondents' Parents (n=54)

Characteristics	f	%
Age		
18-25 years	12	22.2
26-33 years	26	48.1
34-40 years	16	29.6
Gender		
Male	12	22.2
Female	42	77.8
Family Member		
2	9	16.7
3	11	20.4
4	18	33.3
5	16	29.6
Education Level		
Elementary School	10	18.5
Junior High School	13	24.1
Senior High School	21	38.9
Higher Education	10	18.5
Occupation		
Unemployment	15	27.8
Worker	14	25.9
Fisherman	4	7.4
Trader	11	20.4
Private Employee	4	7.4
Civil Servant	6	11.1

Table 2 The Characteristics of Toddlers Based on Age and Gender

Characteristics	f	%
Age of Toddler		
24-35 months	21	38.9
36-47 months	16	29.6
48-59 months	17	31.5
Gender		
Male	31	57,4
Female	23	42.6

Table 3 The Characteristics of Respondents Based on Numeric Variable

Characteristics	MeanSD	Min-Max
Parents' Age	30.13 ± 4.98	21–40
Family Member	3.76 ± 1.06	2–5
Income Level	1,452,573 1,245,248	311,952 - 4,059,374
Age of Toddler	40.85 ± 9.32	26–57
Birth Weight (g)	2,942 0.634	1,700 - 4,200
Height (cm)	96.20 ± 4.82	86–109

Table 4 The Characteristics Based on Parents and Toddlers

Characteristics	Indicators	f	%
Parents	Method of Delivery		
Parents	SC	10	18.5
Parents	Spontaneous	43	79.6
Parents	Income Level		
Parents	Low	27	50.0
Parents	Middle	17	31.5
Parents	High	10	18.5
Parents	Parenting		
Parents	Authoritarian	25	46.3
Parents	Permissive	11	20.4
Parents	Democratic	18	33.3
Toddler	Birth Weight		
Toddler	LBW	16	29.6

Characteristics	Indicators	f	%
Toddler	Normal	35	64.8
Toddler	High	3	5.6
Toddler	History of Infection		
Toddler	Often	19	35.2
Toddler	Rarely	5	9.3
Toddler	Never	30	55.6
Toddler	Exclusive Breastfeeding		
Toddler	No Exclusive Breastfeeding	25	46.3
Toddler	Exclusive Breastfeeding	29	53.7
Toddler	Body Height		
Toddler	86-93 cm	13	24.1
Toddler	94-101 cm	34	63.0
Toddler	102-109 cm	7	13.0
Toddler	Stunting Status		
Toddler	Stunting	26	48.1
Toddler	Not Stunting	28	51.9

Table 5 The Influence of Delivery Method on the Incidence of Stunting.

Category	Stunting Status (%) Stunting	Stunting Status (%) Not Stunting	P-value	Odd ratio
Method of Delivery				
SC	1 (9.1)	10 (90.9)	0.004	0.072
Spontaneous	25 (58.1)	18 (41.9)		
Birth Weight				
LBW	12 (75)	4 (25)		
Normal	13 (37.1)	22 (62.9)	0.037	0.167
High	1 (33.3)	2 (66.7)		0.846
Birth Weight				
Often	2 (10.5)	17 (89.5)		
Rarely	4 (80)	1 (20)	0.037	1.47
Never	20 (66.7)	10 (33.3)		9.271
Method of Delivery				
No Breastfeeding	22 (88)	3 (12)	0.000	45.833
Exclusive Breastfeeding	4 (13.8)	25 (86.2)		
Birth Weight				
Authoritarian	12 (48)	13 (52)		
Permissive	5 (45.5)	6 (54.5)	0.972	1.083
Democratic	9 (50)	9 (50)		1.200
Level of Family Income				
Low	21 (77.8)	6 (22.2)		
Middle	4 (23.5)	13 (76.5)	0.00	0.032
High	1 (10)	9 (90)		0.361

DISCUSSION

The analysis of the study showed a significant association between method of delivery and the incidence of stunting (p=0.004). The proportion of stunting was higher among toddlers with the history of spontaneous vaginal delivery than those with the history of cesarean section (CS), with an OR of 0.072 for SC group.[12] This result is supported by the study by Saaka and Hammond, who found a relationship between the method of delivery and children's linear growth. A similar finding is also reported in the National Family Health Survey (NFHS-5) in India, showing that the prevalence of stunting tends to be lower among children with vaginal delivery than children with cesarean section (CS) delivery.[13,14] Differences in the method of delivery are hypothesized to be associated with infant growth, potentially through variations in the development and colonization of gut microbiota during the early stage of life.[15] Theoretically, vaginal delivery allows infants to be exposed to

maternal microorganisms, which may contribute to the development of gut microbiota. Conversely, cesarean section (CS) delivery may result in a different composition of gut microbiota colonization, thereby potentially affecting immune system maturation, intestinal mucosal condition, and nutrient metabolism.[16] Furthermore, in some cases, delivery through CS may result in a delayed initiation of breastfeeding. This may be influenced by postpartum pain, the effect of anesthesia, and delayed mother–infant skin-to-skin contact, potentially influencing nutritional adequacy during the early stage of life.[17] However, the relationship between the method of delivery and stunting cannot be interpreted as a direct causal relationship. Children's growth is the result of various interrelated factors, including prenatal condition, nutritional adequacy, the occurrence of infection, parenting patterns, and family's socio-economic status.[18]

Data analysis showed a significant correlation between birth weight and the incidence of stunting (p=0.037). The proportion of stunting is higher among toddlers with a history of LBW, while the group with normal birth weight has an OR value of 0.167 compared to the LBW group.[19] The findings of this study support the results of previous studies, which reported that infants with LBW tend to have lower linear growth during childhood. This condition may also increase the likelihood of impaired growth over the long term.[20] A study related to the catch-up growth process shows that LBW infants do not always achieve optimal catch-up growth after birth. Catch-up growth is influenced by various conditions, including nutritional adequacy, health status, and exposure to infectious disease.[21] From a physiological perspective, low birth weight may indicate impaired growth during the intrauterine period. This condition may result from inadequate maternal oxygen and nutrient supply to the fetus, leading to lower energy reserves at birth and reduced growth potential.[22] Besides having limited energy reserves, infants with LBW are at risk of experiencing various conditions that may impair nutritional intake, such as breastfeeding difficulties, infection, and metabolic disorders. These conditions ultimately may result in nutrient intake that is insufficient to meet the requirements for optimal growth.[23] This condition may impair the potential for adequate catch-up growth. As a result, growth restriction that has occurred during the intrauterine period may persist after birth, potentially leading to impaired linear growth and increasing the risk of stunting.[24]

The analysis of the study showed a significant relationship between the history of infection and the incidence of stunting (p=0.037). However, this relationship did not show a linear pattern, as the proportion of stunting was higher among children who never or rarely experienced infection than those who frequently experienced infection.[25] This finding does not entirely align with the previous findings, which have more frequently reported an association between recurrent infections, specifically ARIs and diarrheal disease, and increased risk of growth impairment in children.[26] The relationship between infection and malnutrition is reciprocal. Children with poor nutritional condition tend to be more susceptible to infection, while recurrent infections may further decrease nutritional status and impair children's growth.[27] Infection theoretically may affect children's growth through several mechanisms, including reduced appetite, increased metabolic demands, nutrient losses, and impaired nutrient absorption, particularly in the case of gastrointestinal infection.[28] Repeated exposure to infection may cause prolonged inflammation and impair intestinal mucosal function. These conditions may subsequently reduce the body's ability to absorb nutrients and impair children's linear growth.[29] The discrepancy between the results of the study and the existing theory may be influenced by several limitations and confounding factors. The use of cross-

sectional design, the assessment of the history of infection based on respondents' information, and the potential for recall bias may influence the results of the study. Moreover, sanitation conditions, immunization status, nutritional condition, and access to healthcare services may also contribute to the differences in findings.[30]

Based on the results of the analysis, there is a very significant relationship between exclusive breastfeeding and the incidence of stunting (p<0.001). Children who do not receive exclusive breastfeeding had a higher proportion of stunting, with an OR value of 45.833 compared to children who receive exclusive breastfeeding.[31] This result aligns with previous studies, showing that optimal breastfeeding is associated with better child growth by meeting nutritional requirements and protecting against various infectious diseases.[32] Another study also found that appropriate breastfeeding practice and complementary feeding practice play an important role in maintaining optimal child growth, while inadequate breastfeeding may increase the risk of growth impairment.[33] Physiologically, breastmilk contains nutrients, immunological factors, and various bioactive components that support growth and protect infants against infection during the early stage of life.[34] Immunoglobulins, lactoferrin, lysozyme, and oligosaccharides in breastmilk also help maintain gastrointestinal health and form gut microbiota that supports nutrient absorption and immune system development.[35] Thus, failure of exclusive breastfeeding may increase the risk of infection and inadequate nutrient intake, which cumulatively may impair linear growth and increase the prevalence of stunting.[36]

The results of the study showed that there is no significant relationship between parenting pattern and the prevalence of stunting (p=0.972), although stunting was found in all parenting style groups with relatively similar proportions.[37] This finding is different from a study by Dwi et al., which reported the relationship between the quality of parenting and the prevalence of stunting, and another study showing that suboptimal parenting tends to be found in children with lower nutritional status.[38],[39] Theoretically, parenting can influence children growth through feeding practice, meeting nutritional requirements, hygiene, infection prevention, the utilization of health services, and children development stimulation.[40] Suboptimal parenting may result in inappropriate feeding practices, leading to inadequate intake of energy, protein, and micronutrients, and in the long term impairing linear growth.[41] However, parenting practices do not act as a single factor, as stunting is also influenced by maternal nutritional status, birth weight, exclusive breastfeeding, family income, infection, sanitation, and the quality of food intake.[42] Thus, the absence of a significant relationship in this study may indicate that the influence of parenting practices on stunting may be influenced by other factors that are more dominant in the study population.

The results of the study showed a significant relationship between family income and the prevalence of stunting (p<0.001), with the highest proportion of stunting found in lower-income families, and lower OR values were found in middle- and high-income groups compared to lower-income groups.[43] These results align with previous studies, showing that household socio-economic condition is one of the factors associated with the prevalence of stunting, particularly through their influence on food security, the quality of food, access to health services, and environmental conditions.[44] A study on household food security also shows that limited economic capacity may increase the risk of growth impairment in children due to the inability to meet food needs consistently.[45] Theoretically, family income determines a household's ability to obtain a diverse and nutritious diet, especially sources of protein, vitamins, and

minerals required for children's growth.[46] Low income may also limit access to health services, clean water, sanitation, and resources for the prevention and treatment of infectious diseases, which indirectly may worsen children's nutritional status.[47] This condition shows that economic constraints may influence stunting through the combination of poor dietary intake, poor food security, exposure to diseases, and an environment that does not support children's growth.[48]

This study has several limitations, including the use of a questionnaire to obtain data that could give rise to recall bias, especially in the history of infection and exclusive breastfeeding. Moreover, the limited sample size in a single working area of Puskesmas may cause the results of the study to be interpreted carefully and may not be generalized to a population with different characteristics. This study also did not control for all confounding factors, including maternal nutritional status during pregnancy, parents' height, environmental sanitation, and children's daily dietary pattern, which potentially affect the prevalence of stunting.

CONCLUSION

According to the results of the study, it can be concluded that an association was observed between the method of delivery, birth weight, history of infection, history of exclusive breastfeeding, and family income and the prevalence of stunting among toddlers in the study area. Meanwhile, family parenting was not significantly associated with the prevalence of stunting. These findings show that stunting is a multifactorial condition influenced by various factors from the early stage of life to household socio-economic conditions. Therefore, an effort to prevent stunting should be carried out comprehensively through optimizing maternal health and nutrition, preventing LBW, exclusive breastfeeding, preventing infection, meeting children's nutritional needs, improving socio-economic conditions, and continuously monitoring child growth.

CONFLICTS OF INTEREST

The authors declare that none of them had any conflict of interest.

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