Infectious Diseases and Socio-Demographic Determinants of Stunting among Children Aged 6-24 Months: A Multivariable Analysis

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ABSTRACT

Background: *Stunting is a nutritional health issue in Indonesia. It results in growth and developmental disorders among children under five years. Numerous variables can contribute to stunting. This study aimed to determine the influence of a history of infectious diseases on stunting among children aged 6 to 24 months in the Turi Health Center working area, Sleman Regency, Special Region of Yogyakarta.*
Method: *This study employed a case-control design using purposive sampling. The study population consisted of children aged 6-24 months at Turi Primary Health Center, Sleman, Indonesia. A total of 100 respondents were assigned to the case and control groups. Participants were selected from medical records based on inclusion criteria. Data were collected through interviews with parents and medical record review. Anthropometric measurements were obtained from growth monitoring records and measured or confirmed by trained health workers using standardized length boards and calibrated scales. Data analysis used univariable, bivariable (Chi-square and OR), and multivariable logistic regression.*
Result: *The incidence of stunting was significantly associated with a history of infectious diseases and respiratory tract infections, with p-values of 0.000 for both variables. Multivariable analysis showed that Respiratory tract infection was the most dominant factor associated with stunting, with an OR of 5.370 (95% CI: 1.572-18.340; p = 0.007). Mother's education was also significantly associated with stunting, with an OR of 2.593 (95% CI: 1.208-5.565; p = 0.014). Children's age showed a borderline association with stunting, with an OR of 0.387 (95% CI: 0.150-0.999; p = 0.050).*

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INTRODUCTION

Stunting is a chronic form of undernutrition characterized by impaired linear growth beginning in the prenatal period and continuing through early childhood, particularly during the first 1,000 days of life. It results from prolonged inadequate nutritional intake and adversely affects physical growth, cognitive development, immune function, and long-term health outcomes. Early intervention and adequate nutrition are essential to promote optimal child growth and development.(1)

Stunting in children aged 6-24 months has significantly hampered their growth, leading to noticeable delays in physical development. This condition also heightens their vulnerability to various health problems and adversely affects long-term cognitive and motor skills, ultimately impairing their overall development and future potential.(2) This condition can also decrease their overall productivity as they grow older and make them more vulnerable to both infectious and non-communicable diseases. Addressing short-term stunting is crucial to ensure children develop properly, stay healthy, and have better opportunities for a successful future.(3) Stunting can lead to diabetes, hypertension, high cholesterol, and other health issues later in life. Furthermore, stunting children with rapid weight gain after age two significantly raise the risk of developing obesity later in life.(4)

In 2022, UNICEF revealed a sobering statistic: 149 million children under the age of five worldwide suffered from stunting growth. Tragically, nearly half of all child deaths during that year were connected to

undernutrition, highlighting the urgent need for improved nutrition programs and global efforts to combat childhood malnutrition and ensure healthier futures for the world's most vulnerable children.(5) Statistical data from the Basic Health Research (Riskesdas) show that the national prevalence of stunting climbed from 35.6% in 2010 to 37.2% in 2013. On the other hand, the prevalence of stunting continued to decline between 2018, 2021, and 2022 with percentages of 30.8%, 24.4%, and 21.6%, respectively. Nevertheless, further improvement was still needed to achieve the medium-term target of reducing stunting prevalence to 14.2% by 2029.(6)(7)(8)

The findings from the Indonesian National Status Survey (SSGI) 2022 showed that the prevalence of stunting in the Special Region of Yogyakarta (DIY) was 16.4%. This value was still above the national target of 14%, indicating that stunting remained a public health problem in the region.7 The prevalence of stunting children aged 0-59 months in Sleman Regency in 2022 was recorded at 15%. Five districts were identified as priority areas for stunting management, namely Minggir (13.16%), Turi (12.75%), Ngemplak I (12.63%), Pakem (11.80%), and Moyudan (9.91%). Turi was selected as the study area because it was included as one of the priority areas with ongoing stunting cases and was considered relevant to represent the study population in Sleman Regency.(9)(10)

Risk factors that contribute to the millions determinants of stunting in children under 5 years worldwide are children's age, gender, children's birth weight, exclusive breastfeeding, maternal education, maternal age, and family income.(11)A previous study has identified several factors significantly associated with stunting among children under five, including children's age, birth interval, breastfeeding and feeding practices, nutritional adequacy, and health-related conditions such as malaria, recurrent diarrhea, and other infections. Parental demographic and socioeconomic characteristics, including household size, parenting practices, and employment status, have also been reported as significant determinants.(12)

Parents play a crucial role in providing care and meeting the nutritional needs of children, who still require attention for growth and development. If parents have a good understanding of stunting and its dangers for children aged 1-3 years, they will be more motivated to prevent it and will have a better grasp of how to prevent disease and ensure good nutrition for their children.(13) Furthermore, a previous study on feeding patterns and their effects on stunting found that parental or caregiver feeding practices and a history of infectious diseases influenced the occurrence of stunting in children. The relevance of a history of infectious diseases to stunting was explained by its biological impact: appetite-reducing infection, impaired nutrient absorption, and increased metabolic demands, thereby diverting nutrients away from growth processes toward immune responses and recovery. Consequently, children who had experienced infections, particularly acute respiratory infections and diarrhea were more likely to develop stunting.(14)

Despite numerous studies examining determinants of stunting in Indonesia, evidence focusing specifically on children aged 6–24 months and simultaneously evaluating infectious diseases and socio-demographic factors through multivariable analysis remains limited. Identifying the dominant factors associated with stunting in this critical age group is essential for developing targeted and effective intervention strategies.(15) This study aimed to identify factors associated with stunting, including the history of infectious diseases, in children aged 6-24 months in the Turi Health Center working area after controlling for potential confounders. Understanding factors that might have influenced stunting among children aged 6-24 months was important for improving child health outcomes and reducing the burden on the health system, and the novelty of this study lay in its identification of the most dominant risk factors for stunting after controlling for confounders, including infectious diseases and socio-demographic factors, using multivariable analysis in a local high-priority setting.

METHOD

This study was carried out in Yogyakarta, which is within the working area of the Turi Health Center in Sleman Regency. The study used a case-control design with a retrospective approach and applied a purposive sampling technique. Purposive sampling was selected to ensure that participants met specific inclusion criteria, particularly children aged 6-24 months with clearly identified stunting status (case and control groups) and complete health records, including a history of infectious diseases. This approach allowed the researchers to obtain relevant and comparable data between groups. However, the use of purposive sampling might have limited the generalizability of the findings, as the sample might not have fully represented the broader population. Despite this limitation, the technique enhanced the internal validity of the study by focusing on participants who were most relevant to the research objectives and by ensuring data completeness for the variables analyzed.(16) This analytical observational study included 100 children aged 6-24 months attending Turi Health Center. Participants were classified as case and control groups based on

predefined health criteria. Informed consent was obtained from parents to facilitate data collection and analysis of potential risk factors within this age group. Participants had been selected from child health registers and medical record lists at the Turi Health Center, where eligibility screening had been conducted based on the inclusion criteria before recruitment.

Data were collected using a validated questionnaire that had been previously tested for validity and reliability in earlier studies to ensure that it accurately measured the intended variables and produced consistent results. The questionnaire included respondent characteristics, child anthropometric measurements, exclusive breastfeeding practices, and a history of infectious diseases within the past six months. The dependent variable in this study was stunting status among children aged 6-24 months, while the independent variables included child characteristics (age, sex, and duration of breastfeeding), history of infectious diseases (including diarrhea, respiratory tract infection, pneumonia, measles, worm infection, chickenpox, dengue fever, skin infection, and sepsis), and parental characteristics (father's education, mother's education, father's occupation, and mother's occupation). Infectious disease history was defined as the occurrence of any infectious disease experienced by the child within the past six months.

Anthropometric data had been obtained from routine child growth monitoring records at the health center and, when necessary, had been confirmed through direct measurements performed by trained health workers (midwives and nutrition staff) using standardized infant length boards and calibrated weighing scales to ensure accuracy and consistency. Univariate analysis was conducted to describe sample characteristics, while bivariate analysis employed the Chi-square test and odds ratios to assess associations between variables. Multivariate logistic regression was performed to identify independent predictors and control for potential confounders. All statistical analyses were carried out using SPSS version 25.

The variables in this study were defined as follows. Stunting status was defined as a condition in which a child's height-for-age was below the WHO standard (< -2 SD). Children's age was categorized as 6-12 months and 13-24 months. Children's sex was classified as male or female. Duration of breastfeeding referred to the length of breastfeeding provided and was categorized as <6 months and 6-24 months. A history of infectious diseases was defined as any occurrence of infectious illness experienced by the child within the past six months, including diarrhea, respiratory tract infection, pneumonia, measles, worm infection, chickenpox, dengue fever, skin infection, and sepsis. Diarrhea was defined as the occurrence of loose or watery stools at least three times per day. Respiratory tract infection was defined as an infection affecting the upper or lower respiratory system, such as cough, cold, or breathing difficulties. Pneumonia was defined as a severe lung infection causing inflammation of the alveoli. Measles was defined as a viral infection characterized by high fever and a skin rash. Worm infection was defined as an intestinal parasitic infection caused by helminths. Chickenpox was defined as a viral infection characterized by an itchy vesicular rash. Dengue fever is defined as a mosquito-borne viral infection caused by the dengue virus.

Skin infection was defined as an infection of the skin characterized by redness, pus, or lesions. Sepsis was defined as a life-threatening systemic response to infection. Father's and mother's education levels were categorized as low (no formal education-primary school), middle (junior high school-senior high school), and high (college/university education). Fathers' and mothers' occupations were categorized as employed or unemployed. The severity of infectious diseases could not be assessed in this study because the data were obtained from medical records, which only documented the presence or absence of infection without any detailed clinical severity classification.

Ethical approval for this study was obtained from the Ethics Committee of Yogyakarta Health Polytechnic with approval number DP.04.03/e-KEPK.1/460/2026, dated March 11, 2026. The study was subsequently conducted in accordance with ethical principles, and informed consent was obtained from all parents or legal guardians prior to data collection.

RESULT AND DISCUSSION

Table 1 shows the number of respondents in the study, which was 100 children aged 6-24 months, consisting of the case group (stunting) and the control group (non-stunting). Based on age distribution, the majority of respondents were aged 13-24 months (62%). In the case group, the proportion of children aged 13-24 months was higher (74%) compared to those aged 6-12 months (26%). The distribution of respondents' gender was balanced between male and female (50% each), with relatively equal proportions in the case and control groups. Based on the duration of breastfeeding, most respondents were breastfed for 6-24 months (94%). In both the case and control groups, children were breastfed for 6-24 months, representing 96% and 92%, respectively. This distribution indicated that most children in this study were breastfed for the recommended

duration of 6 months. Most respondents had no history of infectious diseases (54%). However, the distribution of infectious disease history showed a higher proportion in the case group than in the control group. The majority of fathers (73%) and mothers (69%) had secondary education and graduated from high school. All fathers were employed (100%), while the majority of mothers were unemployed (81%).

Table 2 shows that a history of infectious diseases and respiratory tract infection in the last 6 months were related to stunting in children aged 6-24 months. The statistical test result found a p-value <0.05. The majority of stunting children had infectious diseases (64%). A significant correlation is inferred between the incidence of stunting and a history of infectious diseases, with a p-value of 0.000. Likewise, the incidence of stunting related to respiratory tract infections resulted in a value of p=0.000.

Infectious diseases are a direct contributing factor to stunting in children under 5 years. Infections can reduce a child's food intake, interfere with the absorption of nutrients, and redirect essential nutrients from growth processes to tissue repair. As a result, children may have nutrient deficiencies that hinder their development. Another case-control study among children aged 12-59 months in Sambas Regency, Indonesia, examined the relationship between infectious diseases, water access, hygiene practices, sanitation, and stunting. The study found that toddlers who had experienced an infectious disease within the past month were 4 times more likely to be stunting compared to those without such a history (OR = 4.194; 95% CI: 1.938-9.073).(17)

Infectious diseases such as respiratory infections, diarrhea, and parasitic worms significantly impede the growth and development of children under five years of age. These illnesses often lead to malnutrition, delayed physical growth, and developmental setbacks. Children without proper immunizations are particularly vulnerable, experiencing higher rates of infection and subsequent stunting. Up to 50% of toddlers are affected. Prolonged illness duration further exacerbates these issues, weakening the immune system and reducing opportunities for proper nutrition and learning. Addressing immunization coverage and improving sanitation are vital steps to ensure healthier growth outcomes for young children. Additionally, the majority of toddlers experienced frequent illness, which meant they were getting sick three or more times per month. Children with infectious diseases for a longer duration of time are more likely to experience stunting, as well as sequelae due to the general infection, which weakens the child's physical condition.(18)

Table 1. Distribution of Respondent's characteristics

Respondent's Characteristics	Stunting		Not Stunting		Total	
	f	%	f	%	N	%
Children's age						
6-12 months	13	26	25	50	38	38
13-24 months	37	74	25	50	62	62
Duration of breastfed						
<6 months	2	4	4	8	6	6
6-24 months	48	96	46	92	94	94
Infection disease						
With infectious disease	32	64	14	28	46	46
Without infectious disease	18	36	36	72	54	54
Father's education						
Low	3	6	1	2	4	4
Middle	39	78	34	68	73	73
Hight	8	16	15	30	23	23
Mother's education						
Low	4	8	0	0	4	4
Middle	36	72	33	66	69	69
Hight	10	20	17	34	27	27
Mother's occupation						
Employed	12	24	7	14	19	19
Unemployed	38	76	43	86	81	81

Table 2. Association between infectious diseases and stunting incidence

Variables	Stunting		Not Stunting		P-value	OR	95% CI	
	f	%	f	%			Lower	Upper
Infection diseases								
With infectious diseases	32	64	14	28	0,000*	4.571	1.963	10.646
Without infectious diseases	18	36	36	72				
Diarrhea								
With Diarrhea	11	22	8	16	0,610	1.481	0.540	4.064
Without Diarrhea	39	78	42	84				
Respiratory tract infection								
With a respiratory tract infection	19	38	4	8	0,000*	7.048	2.187	22.720
Without a respiratory tract infection	31	62	46	92				
Pneumonia								
With Pneumonia	6	12	2	4	0,269	3.273	0.627	17.071
Without Pneumonia	44	88	48	96				
Measles								
With Measles	2	4	1	2	1.000	2.042	0.179	23.266
Without Measles	48	96	49	98				
Worms								
With Worms	0	0	0	0	-	-	-	-
Without Worms	50	100	50	100				
Chicken pox								
With Chicken pox	1	2	1	2	1.000	1.000	0.061	16.444
Without Chicken pox	49	98	49	98				
Dengue fever								
With Dengue fever	0	0	0	0	-	-	-	-
Without Dengue fever	50	100	50	100				
Skin infection								
With Skin infection	2	4	3	6	1.000	0.653	0.104	4.085
Without Skin infection	48	96	47	94				
Sepsis								
With Sepsis	0	0	1	2	1.000	2.020	1.656	2.465
Without Sepsis	50	100	49	98				

Table 3. Multivariable analysis of infectious diseases and socio-demographic factors associated with stunting incidence (logistic regression)

Variables	P-value	OR	95%CI	
			Lower	Upper
Children's age	0.050	0.387	0.150	0.999
Infectious Diseases	0.276	1.830	0.616	5.436
Respiratory tract infection	0.007	5.370	1.572	18.340
Mother's Education	0.014	2.593	1.208	5.565
Mother's Occupation	0.073	3.338	0.895	12.441
Constant	0.008	0.004	-	-

A multivariable statistical analysis was conducted using binary logistic regression to control for potential confounding variables and to identify the most dominant factors associated with stunting among children aged 6 to 24 months. This model was chosen because the dependent variable (stunting status) was dichotomous (stunting and not stunting). The independent variables included in the model were selected based on their theoretical relevance and previous evidence, which suggested that infectious diseases and socio-demographic factors (such as age, parental education, and maternal occupation) may influence child growth outcomes. The model's goodness of fit was assessed using the Nagelkerke R Square, and its value was reported below the table to indicate the proportion of variation in stunting that was explained by the included predictors. The final model showed a Nagelkerke R Square value of 0.321, indicating that 32.1% of the variation in stunting incidence had been explained by the variables included in the model.

Table 3 demonstrates a significant association between respiratory tract infection and stunting among children aged 6 to 24 months. The dependent variable in the logistic regression model was stunting status, coded as 1 for stunting and 0 for not stunting, while the main independent variable, respiratory tract infection, was coded as 1 for presence of infection and 0 for absence of infection. Other

variables such as children's age, parental education, and maternal occupation were included to control for potential confounding effects.

The study analyzed the relationship between several variables and stunting incidence, including children's age, infectious diseases, respiratory tract infection, father's education, mother's education, and mother's occupation. Children's age were categorized as 6-12 months = 1 and 13-24 months = 2, while infectious diseases and respiratory tract infection had been coded as 1 = With and 0 = Without. Father's and mother's education levels were categorized as low = 1, middle = 2, and high = 3, and mother's occupation were coded as 1 = employed and 0 = unemployed. The multivariable analysis were developed from the results of the bivariate analysis, in which variables with a p-value < 0.25 had been selected and included in the logistic regression model to control for potential confounding factors. The final multivariable model were then analyzed using the same coding scheme as described above to determine the adjusted association between each independent variable and stunting incidence..

The results of the model showed that respiratory tract infection was significantly associated with stunting, with an odds ratio (OR = 5.37; 95% CI: 1.572-18.340; p = 0.007), indicating that children who had experienced respiratory tract infections had 5.37 times higher odds of being stunting compared to those without such infections after adjustment for other variables. Since the confidence interval did not include 1 and the p-value was below 0.05, this association was considered statistically significant, suggesting that respiratory tract infection had been an independent predictor of stunting in this study population after controlling for other factors in the model. The strong association highlighted the importance of preventing and managing respiratory infections during early childhood. These findings were consistent with previous research conducted by Faridan et al. (2021), which also reported the negative impact of respiratory infections on child growth. Addressing respiratory health was considered important in reducing the risk of stunting among young children and in supporting integrated child health interventions.(19)

Infection can disrupt children's dietary patterns, as illness is often associated with decreased appetite and inadequate nutrient intake. In addition, inflammatory responses during infection may interfere with growth hormone activity through insulin-like growth factor-1 (IGF-1) resistance, thereby impairing linear growth.19Similarly, Adila (2021) reported that acute respiratory infection is associated with an increased risk of stunting due to elevated energy demands for immune responses and tissue repair. Prolonged or recurrent infections may further exacerbate nutritional deficits, ultimately increasing the risk of impaired linear growth and stunting among children under five.(20)

Research indicates that lower maternal education significantly heightens the risk of child stunting, with an odds ratio of 2.593 and a p-value of 0.014. This finding underscores the critical influence that maternal knowledge and awareness have on child-rearing practices, including proper feeding, nutrition, and hygiene. Maternal education influences mothers' ability to access, understand, and apply health and nutrition information. Mothers with higher educational attainment tend to adopt better feeding practices, seek healthcare services more appropriately, and maintain healthier household environments, which collectively contribute to improved child growth outcomes.(21) Mothers with limited education may lack access to essential health information, leading to inadequate nutrition and poor hygiene practices that contribute to growth retardation. Improving maternal education is vital for reducing stunting rates and promoting healthier childhood development. (22) Families hold a key role in both preventing and managing stunting across all stages of life from the fetal period, infancy, and childhood, to adolescence, marriage, and pregnancy.(23) Family empowerment programs that focus on nutrition education, child feeding practices, and infection prevention have been shown to improve growth outcomes among children during the first 1,000 days of life.(24)

Parental involvement plays a critical role in preventing stunting. Mothers contribute through healthy lifestyle practices, proper nutrition, and maintaining hygiene, while fathers provide support that reinforces positive child-care behaviors and strengthens parent-child bonding. Parental involvement extends beyond maternal caregiving and includes fathers' active participation in child feeding, health-seeking behavior, and emotional support. Studies have shown that stronger family support and father involvement contribute to better nutrition practices during the first 1,000 days of life, thereby reducing the risk of stunting among children.(21) Parents with adequate knowledge of stunting prevention are more likely to adopt protective behaviors. A 2021 study reported that mothers with only primary education had a higher risk of having stunting children under two years compared to those with higher educational attainment.(25)

Maternal education is also closely related to socioeconomic conditions that influence food security and access to healthcare resources. Families with better educational backgrounds often have improved economic opportunities, allowing them to provide adequate dietary intake and supportive living environments for children.

Knowledge regarding exclusive breastfeeding, complementary feeding practices, and child nutrition management further strengthens the prevention of chronic undernutrition during the critical growth period.(26) In addition, education supports mothers in balancing caregiving responsibilities and other roles, including employment outside the home. Mothers with higher education levels tend to adopt more effective parenting strategies, ensure appropriate nutritional intake, and maintain consistent childcare practices despite occupational demands. Therefore, strengthening maternal education and health education programs remains an essential strategy for reducing stunting through improved parenting practices, nutritional fulfilment, and prevention of childhood infections during the first 1000 days of life.(27)

Other variables such as diarrhea, pneumonia, measles, and socio-demographic factors (including father's education, mother's education, and mother's occupation) were not significantly associated with stunting in the multivariable model. This might have occurred because, after adjustment for other variables, their independent effects had become weaker or had been overshadowed by the stronger influence of respiratory tract infection. Respiratory tract infection may have shown a more consistent and frequent occurrence, leading to a greater impact on child nutritional status through reduced appetite, increased metabolic demand, and impaired nutrient utilization. In addition, the lack of significance in some variables might have been influenced by the small number of cases in certain categories, such as measles, sepsis, and worm infection, which reduced the statistical power to detect meaningful associations.

This study has several limitations. First, the retrospective case-control design relied on secondary data from health records, which might have led to incomplete or inaccurate documentation and potential information bias. Second, the severity and duration of infectious diseases could not be fully assessed in detail. Third, the relatively small sample size and the use of purposive sampling limited the generalizability of the findings to the wider population. Fourth, other potential confounding factors, such as dietary intake, household socioeconomic status, and environmental sanitation, were fully controlled in the analysis.

CONCLUSION

Respiratory tract infection is significantly associated with stunting among children aged 6 to 24 months (OR = 5.37), indicating that children who had a history of respiratory tract infection within the past six months had 5.37 times higher odds of being stunting compared to children without such a history. Maternal education was also a significant factor (OR = 2.59), showing a higher risk of stunting in children of mothers with lower education. Children's age showed a borderline significant association (p = 0.050; OR = 0.387), while other variables were not significant in the multivariable analysis. To address these findings, it was essential to promote effective infection prevention measures, such as good hygiene practices, vaccination, and proper nutrition.

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Conflict of Interest

The researchers state no conflict of interest.

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