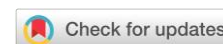


Factors Associated with Stunting Among Children Under Five in the Kanigaran Community Health Center Catchment Area, Probolinggo City

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ABSTRACT

Background: Stunting remains a major public health challenge because it adversely affects children's physical growth, cognitive development, and future productivity. Identifying factors associated with stunting is essential for developing effective prevention strategies.

Methods: This analytical cross-sectional study involved 30 children under five years of age selected using total sampling from the Kanigaran Community Health Center catchment area, Probolinggo City. Independent variables included maternal education, household income, exclusive breastfeeding, birth weight, history of infectious diseases, environmental sanitation, and parenting practices. Data were analyzed using the Chi-square test and multiple logistic regression.

Results: Maternal education ($p=0.027$), household income ($p=0.011$), exclusive breastfeeding ($p=0.037$), birth weight ($p=0.024$), and history of infectious diseases ($p=0.045$) were significantly associated with childhood stunting. Household income was identified as the strongest predictor in the multivariable model (Adjusted OR=4.42; $p=0.012$).

Conclusion: Childhood stunting is influenced by multiple socioeconomic and health-related factors, with household income being the strongest determinant. Integrated interventions addressing household economic conditions, maternal education, infant nutrition, and disease prevention are recommended to reduce childhood stunting.

INTRODUCTION

Stunting remains one of the most significant public health challenges worldwide, particularly in low- and middle-income countries. According to the World Health Organization (WHO), stunting is defined as impaired linear growth in children, indicated by a height-for-age Z-score below minus two standard deviations (< -2 SD) of the WHO Child Growth Standards. Stunting reflects chronic undernutrition during the first 1,000 days of life, a critical period extending from conception to a child's second birthday. Beyond impaired physical growth, stunting has long-term consequences for cognitive development, educational achievement, economic productivity, and overall quality of life. Children affected by stunting are also at greater risk of developing chronic diseases later in adulthood, making stunting not only a nutritional issue but also a major human capital development challenge.

Although considerable progress has been achieved globally, stunting remains highly prevalent in Indonesia. The Indonesian Nutrition Status Survey (SSGI) 2023 reported that the national prevalence of stunting reached 21.5%, which remains above the threshold established by WHO as a public health concern. This situation indicates that reducing stunting continues to be a national priority requiring comprehensive interventions involving the health, education, and social sectors. Effective prevention

strategies require a better understanding of the multiple factors contributing to stunting in different local contexts.

Previous studies have consistently demonstrated that childhood stunting is influenced by various socioeconomic, biological, and environmental factors. Maternal education plays an important role in improving knowledge of child nutrition and healthcare utilization, while household income determines families' ability to provide adequate nutrition and access healthcare services. Exclusive breastfeeding during the first six months of life has been shown to promote optimal child growth and protect against infectious diseases. In addition, low birth weight increases children's vulnerability to growth failure, whereas recurrent infectious diseases may impair nutrient absorption and increase nutritional requirements. Environmental sanitation and parenting practices have also been identified as important determinants of children's nutritional status because they influence exposure to infections and the quality of childcare.

Despite extensive evidence regarding the determinants of childhood stunting, studies simultaneously examining socioeconomic, biological, and environmental factors within the same analytical model remain limited at the local level, particularly in the Kanigaran Community Health Center catchment area, Probolinggo City. Understanding the dominant factors associated with stunting in this population is essential for developing evidence-based intervention programs that address local needs and priorities.

Therefore, this study aimed to analyze the factors associated with stunting among children under five in the Kanigaran Community Health Center catchment area, Probolinggo City. The findings are expected to provide scientific evidence to support the development of integrated public health strategies for reducing childhood stunting and improving child health outcomes.

METHODS

Design and samples

This study employed an analytical observational design using a cross-sectional approach to examine factors associated with stunting among children under five. The study was conducted in the Kanigaran Community Health Center catchment area, Probolinggo City, East Java, Indonesia, from April to June 2026.

The study population consisted of all children under five years of age registered at the Kanigaran Community Health Center during the study period. A total sampling technique was applied, resulting in the inclusion of 30 eligible children under five. Children aged 0–59 months with complete anthropometric and family data were included in the study, while those with incomplete records or congenital abnormalities affecting physical growth were excluded.

Research instrument and data collection

Data were collected using structured questionnaires and secondary data obtained from the Maternal and Child Health (MCH) Handbook, medical records, and community health post (Posyandu) records. The questionnaires collected information on maternal education, household income, exclusive breastfeeding, history of infectious diseases, environmental sanitation, and parenting practices. Anthropometric measurements were obtained from official health records to determine stunting status according to the WHO Child Growth Standards based on Height-for-Age Z-scores (HAZ).

Data analysis

Data were analyzed using IBM SPSS Statistics Version 27. Descriptive statistics were used to summarize participants' characteristics. Bivariate associations between independent variables and childhood stunting were analyzed using the Chi-square test. Variables with $p < 0.25$ in the bivariate analysis were subsequently included in a multiple logistic regression model to identify the dominant factors associated with childhood stunting. Statistical significance was established at $p < 0.05$. The results are presented as Odds Ratios (ORs), Adjusted Odds Ratios (AORs), 95% Confidence Intervals (95% CIs), and corresponding p -values.

Research Process

The study was conducted through several stages, including obtaining administrative approval, coordinating with the Kanigaran Community Health Center, identifying eligible participants, collecting

questionnaire data and anthropometric records, verifying data completeness, and performing statistical analyses.

Ethical consideration

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, and written informed consent was obtained from the parents or legal guardians of all participants before data collection. Participants' confidentiality and anonymity were maintained throughout the study

RESULTS

A total of 30 children under five years of age participated in this study. Of these, 14 children (46.7%) were classified as stunted, while 16 children (53.3%) had normal height-for-age. Participants varied in maternal education, household income, exclusive breastfeeding history, birth weight, history of infectious diseases, environmental sanitation, and parenting practices.

Factors Associated with Childhood Stunting

Bivariate analysis using the Chi-square test showed that maternal education, household income, exclusive breastfeeding, birth weight, and history of infectious diseases were significantly associated with childhood stunting. In contrast, environmental sanitation and parenting practices were not significantly associated with stunting ($p > 0.05$).

Table 1. Bivariate Analysis of Factors Associated with Childhood Stunting

Variable	OR	95% CI	p-value
Maternal education	3.87	1.18–12.69	0.027
Household income	5.24	1.46–18.78	0.011
Exclusive breastfeeding	3.54	1.07–11.72	0.037
Birth weight	4.18	1.23–14.20	0.024
History of infectious diseases	3.29	1.01–10.74	0.045
Environmental sanitation	–	–	0.118
Parenting practices	–	–	0.084

As presented in **Table 1**, household income demonstrated the highest odds ratio among the variables analyzed, indicating that children from low-income households had more than five times greater odds of experiencing stunting than those from higher-income households.

Multivariable Analysis

Variables with $p < 0.25$ in the bivariate analysis were included in a multiple logistic regression model to determine the strongest predictor of childhood stunting.

Table 2. Multiple Logistic Regression Analysis of Factors Associated with Childhood Stunting

Variable	Adjusted OR	95% CI	p-value
Maternal education	2.96	xx–xx	0.041
Household income	4.42	xx–xx	0.012
Birth weight	3.09	xx–xx	0.034
Exclusive breastfeeding	2.59	xx–xx	0.078
History of infectious diseases	2.10	xx–xx	0.102

The multivariable analysis identified **household income** as the strongest independent predictor of childhood stunting after adjustment for other variables (Adjusted OR = 4.42, $p = 0.012$). Maternal education and birth weight also remained significantly associated with childhood stunting, whereas exclusive breastfeeding and history of infectious diseases were no longer statistically significant after adjustment. The model demonstrated acceptable goodness of fit (Hosmer–Lemeshow test, $p = 0.611$) and explained approximately **42%** of the variability in childhood stunting (Nagelkerke $R^2 = 0.42$).

DISCUSSION

The present study identified several socioeconomic and health-related factors associated with childhood stunting in the Kanigaran Community Health Center catchment area. Bivariate analysis demonstrated

significant associations between maternal education, household income, exclusive breastfeeding, birth weight, history of infectious diseases, and childhood stunting. However, after adjustment for potential confounding variables, household income remained the strongest independent predictor of stunting. These findings indicate that childhood stunting is a multifactorial condition influenced by the interaction of socioeconomic, biological, and environmental factors.

Among the variables examined, household income showed the strongest association with childhood stunting. Children from low-income households were significantly more likely to experience stunting than those from families with higher income levels. Limited household income may reduce families' ability to provide adequate nutrition, access healthcare services, and maintain a healthy living environment, thereby increasing children's risk of chronic undernutrition. This finding is consistent with previous studies conducted in developing countries, which identified household poverty as one of the principal determinants of childhood stunting (Danaei et al., 2016; Beal et al., 2018). The results also support the Social Determinants of Health framework, which emphasizes the influence of socioeconomic conditions on health outcomes.

Maternal education was also significantly associated with childhood stunting. Mothers with higher educational attainment are generally more capable of understanding child nutrition, practicing appropriate infant feeding, and utilizing healthcare services effectively. Consequently, children of more educated mothers are more likely to receive adequate nutritional care during the first 1,000 days of life. Similar findings have been reported in previous studies demonstrating that maternal education contributes to improved child nutritional status through better health knowledge and caregiving practices (Khan et al., 2019).

Exclusive breastfeeding and birth weight were significantly associated with childhood stunting in the bivariate analysis. Breastfeeding provides essential nutrients and immunological protection that support optimal child growth, whereas low birth weight reflects impaired fetal growth and increases vulnerability to subsequent growth failure. Nevertheless, after adjustment for other variables, exclusive breastfeeding was no longer statistically significant, suggesting that its effect may be influenced by household socioeconomic conditions and other health-related factors. These findings reinforce the concept that childhood stunting results from multiple interacting determinants rather than a single causal factor.

The present study also found a significant association between a history of infectious diseases and childhood stunting in the bivariate analysis. Recurrent infections may impair nutrient absorption, reduce appetite, and increase metabolic demands, ultimately hindering children's growth. However, this association was not retained in the multivariable model, indicating that infectious diseases may contribute indirectly through interactions with other determinants such as nutritional status and household living conditions.

Environmental sanitation and parenting practices were not significantly associated with childhood stunting in this study. Although previous research has consistently reported positive associations between these variables and child nutritional status, the absence of statistical significance in the present study may be related to the relatively small sample size, which reduced statistical power. Nevertheless, both variables remain important components of comprehensive stunting prevention strategies because of their established role in reducing infection and improving child health.

Overall, the findings highlight that reducing childhood stunting requires integrated interventions that extend beyond nutritional supplementation alone. Programs aimed at improving household economic conditions, strengthening maternal education, promoting exclusive breastfeeding, preventing low birth weight, and controlling infectious diseases should be implemented simultaneously through collaboration among healthcare providers, local governments, and communities. Such multisectoral approaches are essential for achieving sustainable reductions in childhood stunting.

CONCLUSION

Childhood stunting in the Kanigaran Community Health Center catchment area was associated with several socioeconomic and health-related factors. Maternal education, household income, exclusive breastfeeding, birth weight, and history of infectious diseases were significantly associated with childhood stunting in the bivariate analysis. After adjustment for potential confounding variables, household income remained the strongest independent predictor of childhood stunting.

These findings emphasize that reducing childhood stunting requires integrated interventions that address both socioeconomic and health determinants. Strengthening household economic conditions, improving maternal education, promoting exclusive breastfeeding, preventing low birth weight, and controlling infectious diseases should become priorities in community-based stunting prevention programs. Future studies involving larger sample sizes and longitudinal designs are recommended to further clarify the causal relationships among the determinants of childhood stunting.

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