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Research Article

IDENTIFYING RISK FACTORS FOR STUNTING AMONG UNDER-FIVE INDONESIAN CHILDREN

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Abstract
The prevalence of child stunting in Indonesia in 2023 at the national level from 24.5% to 21.6%. Despite declining, the figure is still quite high as 28 out of 100 babies suffer from stunting. The study aims to predict stunting risk factors in children under the age of 5. They are using bivariate and multivariate logistic regression to identify major factors associated with stunting risk. Stunting prevalence in Batu Bara District of North Sumatra Province was 18.35% out of 28.716 children under 5 years of age (967 children very short and 3,944 young children). The study was conducted on 100 households with short and very short children living in rural areas. The results of the study showed maternal education (OR 5.27; 95% CI 1.04-5.62); low maternal nutritional status during pregnancy (OR 2.57, 95% CI 1.22-5.89); formula milk delivery less than 6 months (OR 3.47; 95% CI 1.40-8.28); low birth weight of less than 2500 grams (OR 4.94; 95% CI 1.30-18.80); lack of access to drinkable water (or 3.14; 95% CI 1.29-7.65); low family wealth index (OR 0.13; 95% CI 0.05-0.32). Environmental and household factors have a significant relationship with stunting risk control. Multilateral efforts from the level of family empowerment, increasing the role of health services, and improving nutritional status are access to public health status.

Keywords: Environment, Household, Primary Health Care, Stunting

INTRODUCTION

Stunting is a complex interaction between household, environmental, socio-economic, and cultural influences. Stunting inhibits economic growth, increases poverty, and affects the quality of human resources, especially physical growth, intelligence, and productivity (Aryadi, Sudaryono, & Karim, 2022; Hastuti, 2023; Krisnana et al., 2020; Pramahdyta et al., 2023; Mardiati, Alorgbey, & Zarogi, 2024). Stunting has the highest prevalence compared to other nutritional problems such as undernourishment, skinniness, and obesity. Stunting due to low nutritional intake and forms of long-term malnutrition, inadequate habitat or poverty, infectious diseases, and inappropriate nursing patterns. Stunting reflects a child's chronic malnutrition from the womb to the age of two or the first 100 days,

resulting in a process that fails to grow or is short for his age and has no maximum intelligence. Stunting is defined as children whose height/height is below 2 standard deviations from the median standard of child growth for the same age and sex. Stunting control is the first of six targets in the Global Nutrition Target for 2025 (Hatijar, 2023).

The Global Nutrition Report (2022) states that many countries are still facing stunting issues. In line with this statement, the prevalence of stunting collected by the World Health Organisation (WHO) released in 2019 was 21.9% and reported to be the most serious problem hindering child growth and development. The prevalence of stunting in Africa since 1990 has stagnated at 40% with only a 0.6% decrease to date. While WHO targets 2025 stunting is less than 20% (Mitra, 2015). In west-central China, more than one million children aged <5 years are stunted, accounting for 32% of all children in the country (Raiten & Bremer, 2020). Child stunting in Pakistan is only 0.5%, which is very low. (Wang et al., 2009) Globally, WHO notes that Southeast Asia still has the highest stunting prevalence rate (31.9%) in the world after Africa (33.1%). Indonesia (36.4%) ranks sixth in the Southeast Asian region after Bhutan, Timor Leste, Maldives, Bangladesh and India, at 36.4%.6 According to UNICEF, globally, stunting occurs in 16 million children. The prevalence of stunting in Indonesia is 27th highest out of 154 countries, and fifth among Asian countries. This is due to ineffective or inappropriate intervention programs, as they only address one problem at a time and do not use a multisectoral approach to address the multiple determinants of stunting (Wang et al., 2009; Katoch, 2023).

In, Indonesia, is facing three burdens of nutritional problems: malnutrition, obesity, and stunting. A global agreement to reduce the prevalence of stunts using indicators below 20 percent or a fifth of the total number of newcomers, as well as reducing the number of stunting children by 40 from the 2012 base data (Ayelign & Zerfu, 2021). Stunting prevalence in Indonesia according to Basic Health Research (2019) from National Nutrition Status Survey data was 37.2 percent (2013), 30.8 percent (2018) and decreased to 27.7 percent in 2019 (Nurdin & Muhammad, 2022). The prevalence of child stunting in Indonesia in 2023 at the national level is around 21.6%. Although it is declining, the figure is still quite high as 28 out of 100 babies suffer from stunting. Stunting cases were very short of 6.7 percent and short of 16.9 percent, with a decline of 6.4 percent (2013-2018) or 1.28 percent per year.

Four provinces in Sumatra Island had high stunting prevalence in 2013: Aceh (39.0%), North Sumatra (42.3%), South Sumatra (40.4%), and Lampung (36.2%). Stunting prevalence in North Sumatra Province was 42.3 percent (2013) and 32.4 percent (2018). The highest number of stunting cases in the five districts of Langkat, Padang Lawas, Sitoli, and North Nias, and according to the Indonesian Nutrition Status Survey (SSGI) 2022, the prevalence of stopping in Batu Bara was 30.9 (Kementerian Kesehatan, 2018; Satriawan, 2018; Hengky and Rusman, 2022).

Differences in regional characteristics that can differentiate the dominant risk factors in causing stunting in Batubara Regency from previous research results show that family income, history of mothers visiting health services for antenatal care, history of mothers receiving iron tablets, history of children under two years of age receiving exclusive breast milk, and history of children under two years of age consuming complementary foods with the incidence of stunting. (Ayu et al., 2023; Purba et al., 2023). The results of the study in Langkat Regency with the highest prevalence of stunting in North Sumatra, the dominant risk factors are characteristics that influence the incidence of stunting such as family characteristics, parental income, maternal age, and infant birth weight. (Siregar & Siagian, 2021). The results of the study in North Padang Lawas Regency include mothers' knowledge of family income, parenting patterns, and nutritional intake. (Anggreni et al., 2022). Characteristics of stunting in Gunung Sitoli Regency, such as based on maternal education, maternal height less than 150 cm, maternal nutritional status during pregnancy, infectious diseases, and environmental conditions. (Purnama et al., 2023; Tarigan et al., 2024).

Stunting research in Salatiga City, Central Java, Indonesia looked at household conditions and the home environment, the results were related to children diagnosed with stunting (Nurjazuli et al., 2023). This study is important because stunting is not only a national health problem but also a global one. The prevalence of stunting of 37% in Ethiopian children under 5 years of age is a significant result of complex interactions between individual, household, and social (environmental) factors (Amaha & Woldeamanuel, 2021). Studies on stunting in Sub-Saharan Africa as a risk factor for stunting significantly are household and environment (Quamme & Iversen, 2022). Control of stunting risk factors by predicting environmental and household factors is expected to reduce the risk of stopping under the WHO target of 20 percent. Overall, factors representing both the internal and external nutrition ecology need to be considered to reduce stunting (Raiten & Bremer, 2020).

Previous research results show that greater risk factors come from family factors than the environment by looking at the characteristics of community life. This study looks at the risk factors for stunting from the characteristics of individual families who have short and very short children at risk of stunting in rural areas. This study also goes through cross-sectoral and cross-program. This study aims to identify risk factors for stunting in children under five years. This study aimed to analyze the risk of stunting in toddlers in Indonesia based on environmental and household factors.

RESEARCH METHOD

The research design used was observational quantitative analytic with a case-control design. This study was conducted from November to December 2023. The data of this study were obtained from the Health Office of Batu Bara Regency, North Sumatra Province, Indonesia where the prevalence of stunting was 18.35% (28,716 toddlers were found to have 967 very short toddlers and 3,944 short toddlers).

Estimating multilevel determinants of stunting across households, 100 households were taken to review the mobility of respondents. The population in this study were all short and very short toddlers living in rural areas. The research sample was taken from 100 households that had very short and very small toddlers, after anthropometric examinations (z-score height versus age), following the World Health Organization (WHO) child growth standards. This study examines the determinants of stunting at the household level, using an analytical survey with a case-control approach. Divided into case groups and control groups, the case groups of mothers with very short children, and the control groups are mothers who have short children in a ratio of 1:1.

The sampling technique used was non-probability sampling, meaning that the sampling technique was not chosen randomly. This research uses a sampling technique, namely accidental sampling technique, samples from households that are willing to be researched and based on the specified time. Inclusion in this study are households located in rural areas, having short and very short children, under the age of five years (12-59 months). Exclusion in this study is households that are not willing to be researched.

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This study examines the determinants of stunting at the household level, the analysis was carried out univariately, bivariate with a chi-square test, and multivariate analysis with a logistic regression test. Multivariate analysis is used to identify variables that are highly related to the dependent variable, a p-value of less than 0.05 ($P < 0.05$) is considered statistically significant. The resulting odds ratio with the corresponding 95% CI is presented in the table. The controlled variables include risk factors for stunting in children, namely environmental factors including the wealth index (family economic capacity is categorized as poor if it only earns 2.5 million rupiah per month from regional minimum wage income, and is categorized as capable if it is more than 2.5 million rupiah per month from regional minimum wage income); having a supply of drinking water in the household; some families suffer from worm infections; easy access to health services; there are active smokers at home. Meanwhile, household factors include maternal education factors; maternal nutritional status factors during pregnancy; maternal height; daily consumption of fatty foods, giving formula milk to children before the age of 6 months); and low birth weight (less than 2500 grams).

Participation was voluntary and submission to the Institutional Review Board (IRB) was done to protect the rights of human participants. The identities of people, locations, and places of research have been masked for the respondents. Ethical clearance of this research from the Faculty of Medicine of Islamic University of North Sumatra Number: 405/EC/KEPK/FKUISU/VII/2023.

RESULTS AND DISCUSSION

The data in this research comes from primary data in the form of questionnaires delivered to research respondents. The respondents were 100 households living in rural areas, who had very short and very small children who were at risk of stunting. Based on the results of the chi-square test, it was obtained that the p-value was <0.05, so there was a significant influence between risk factors and the incidence of stunting in the control and case groups..

Identification of Stunting Risk Factors Based on Household and Environmental

The identification for this research came from primary data and secondary stunting case data from the Batu Bara District health office. So, the risk factors for stunting from household factors and environmental factors can be seen in the following table 1.

Table 1. Identification of Stunting Risk Factors Based on Household and Environmental

Variable	Criteria	Case (%)	Control (%)	p-value
1. Household Factor				
a. Get milk formula less than 6 months	Yes	23	10	0.006
	No	27	40	
b. Low birth weight	< 2500 gr	12	3	0.012
	>2500 gr	38	47	
c. Mother's weight	> 150 cm	10	46	0.000
	≤ 150 cm	40	4	
d. Pregnant mother's nutritional status	Less	25	14	0.024
	Good	25	36	
e. Mother's education	Medium	14	22	0.008
	Basic	36	28	
2. Environmental Factors				
a. Having a drinking water source	Yes	40	28	0.010
	No	10	22	
b. Infected with worms	Yes	15	9	0.160
	No	35	41	
c. Active smokers	Yes	33	33	1.000
	No	17	17	
d. Service access	Yes	12	5	0.062
	No	38	45	
e. Wealth index	Low	16	39	0.010
	Good	34	11	

Based on the bivariate analysis in Table 1, the results of the chi-square test obtained a p-value <0.05, so there is a significant influence between risk factors and the incidence of stunting in the control and case groups. Identification of factors that influence the occurrence of stunting. Household factors such as maternal education had a 5.27 times risk of stunting (OR 5.27; 95% CI 1.04-5.62); while low birth weight less than 2500 grams had a 4.94 times risk of stunting (OR 4.94; 95% CI 1.30-18.80); formula feeding less than 6 months had a 3.407 times risk of stunting (OR 3.47; 95% CI 1.40-8.28); poor maternal nutritional status during pregnancy had a 2.57 times risk of stunting (OR 2.57; 95% CI 1.22-5.89); consumption of high-fat food had a 0.92 times risk of stunting (OR 0.92; 95% CI 0.421-2.022); for mothers with height less than 150 cm had a lower risk of stunting (OR 0.02; 95% CI 0.006-0.075).

Environmental factors, not having enough drinking water had a higher risk of 3.14 times suffering stunting (OR 3.14; 95% CI 1.29-7.65); then difficult access to health services 2.8 times to suffer stunting (OR 2.842; 95% CI 0.919-8.790); then children who experienced worms had a risk of 1.9 times to suffer stunting (OR 1.952; 950CI 0.76-5.005); and for people who do not have access to health services, the risk is 1.9 times to suffer from stunting (OR 1.952; 95% CI 0.76-5.005); and the wealth index or family economic ability is categorized as low/poor at a risk of 0.13 times to suffer from stunting (OR 0.13; 95% CI 0.05-0.32); and active smoking in the home environment has a risk of 1.0 times to suffer from stunting (OR 1. 000; 95% CI 0.437-2.288).

Multivariate Logistic Regression Test Results

Multivariate analysis of the data was carried out to identify factors that influence theoccurrence of stunting. The most significant influence between household factors and environmental factors can be seen in Table 2.

Table 2. Multivariate Logistic Regression Test Results

Variable	p	OR	CI 95%
a. Get milk formula less than 6 months	0.006	3.407	1.401-8.285
b. Low birth weight	0.012	4.947	1.301-18.808
c. Pregnant mother's nutritional status	0.024	2.571	1.122-5.895
d. Mother's education	0.008	5.27	1.045-5.626
e. Having a drinking water source	0.000	3.143	1.291-7.653
f. Wealth index	0.000	0.133	0.054-0.325

Based on multivariate analysis in Table 2, the results of the chi-square test obtained a p-value <0.05, the most significant effect between risk factors and the incidence of stunting in the control and case groups. Household factors such as maternal education are more at risk for stunting, followed by low birth weight of less than 2500 grams, formula feeding for less than 6 months, and poor maternal nutritional status during pregnancy. Environmental factors, not having enough drinking water had a higher risk, followed by wealth index or family economic ability categorized as low/poor.

Discussion in this research factors for stunting, the family factor of poor maternal education was associated with stunts having a 5.27 times greater risk of having stunting children. The higher the mother's education level, the better her knowledge of health and childcare patterns. This is in line with previous research, where highly educated mothers are believed to provide better childcare, nutrition, and health for their children (Ayelign & Zerfu, 2021). Education for mothers is important in dealing with stunting problems in children, as it has a positive effect on their knowledge and attitude toward caring for stunting children (Modjo et al., 2023). Educational interventions for mothers with stunted children can improve the quality of their attitudes and behavior in caring for stunted kids.(Utario et al., 2022) In addition, socialization and education activities given to the community, especially to mothers, about the dangers of stunting can help raise awareness and reduce stunting rates (Ari et al., 2022).

Mothers with low nutritional status (OR 2.57; 95% CI 1.22-5.89) were associated with stunting at a 2.57 times greater risk of having stunting children. In line with the 1990 UNICEF concept framework, one of the immediate causes of nutrition problems. A pregnant mother's poor nutritional status due to illness during pregnancy and mother becomes rarely examined before birth care to health care facilities (p-value = 0.037). A sick pregnant mother will suffer from nutritional deficiencies which affect her pregnancy. Through maximum health care and family support keeps the mother full of balanced nutrition to prevent stunting. Stunting during pregnancy is affected by the mother's nutritional status (Widiastuti & Susanto, 2023). Improving the quality of health care, especially about stunting prevention, is important, including continuous family monitoring of proper food intake for children and regular checking of the child's nutritional status and stunting (Setiawati, 2022). Stunting and wasting result in poor growth and development of children. Their knowledge is lacking and their diet is poor, resulting in poor child growth and development (Sk et al., 2021; Khadija et al., 2022).

Children receiving formula milk or supplements less than 6 months (OR 3.47; 95% CI 1.40-8.28) were associated with a 3.47-fold risk of stunting than children receiving exclusive breast milk for 6 months. It is consistent with previous research that stunting is a growth and developmental failure in children under the age of five due to chronic nutritional deficiency. Exclusive breastfeeding and the introduction of maternal milk supplementation play an important role in preventing stunting (IMD & Eksklusif, 2013; Handayani et al., 2020). The provision of exclusive breastfeeding is significantly associated with reduced stunting risk (Kushargina et al., 2023). Besides, educating mothers about the importance of exclusive breastfeeding and the practice of giving proper accompanying feeding can contribute to preventing stunts (Lestari et al., 2023). Socialization of the use of local food as a source of accompanying food has been shown to enhance the knowledge of mothers and improve their ability to provide proper nutrition to their children, thereby reducing the number of stunts (Naufal et al., 2023). It is important to start meeting nutritional intake during pregnancy, as knowledge about nutrition and attitudes toward stunting prevention correlate positively (Satria & Ningsih, 2023). Exclusive

breastfeeding correlated with stunting conditions and it offered a protection factor for stunting in toddlers (Hendraswari et al., 2021).

A low birth weight of less than 2500 grams (OR 4.94; 95% CI 1.30-18.80) was associated with a 4.94 times greater risk of stunting than a child born with a normal birth weight (Wahyuningrum et al., 2023). incidence in children. Low birth weight increases stunting risk in children aged 6-59 months. Stunting risk is higher in children with low birth weight compared to those with normal birth weight. Lower birth weight affects intrauterine growth and can lead to slow growth and development in children, contributing to stunting. Therefore, coping with lower birth weight is important in preventing and reducing the incidence of stunting in children (Linawati, 2022; Harper et al., 2023). Risk factors for stunting can be modified. Policy interventions require health workers and the community to encourage families to carry out family planning, and extra care for low birth weight babies, to reduce stunting in childhood (Mitra, 2015; Fitriani et al., 2020).

The environment plays a role in triggering stunting. Some of these include low socioeconomic status, (rural) housing, poor households, poor drinking water supply, low family wealth/income index, inadequate sanitation, untreated water, and high pesticide exposure. Children from families without clean water facilities have a higher prevalence of diarrhea and stunting than children from families with clean water source facilities and ownership of a closed and watertight latrine, no family latrine, and this is supported by the relatively low economic condition of the family. Most of the living quarters of under-fives did not fulfill the requirements of a healthy house, lacked ventilation and lighting, and did not have a garbage disposal. Socioeconomic and sanitation conditions are also associated with stunting. Economic conditions are closely related to the ability to fulfill nutritional intake and health services for pregnant women and infants. Sanitation and food capacity can improve. The risk of infectious disease is that only 72.04% of households in Indonesia have access to adequate drinking water (Das et al., 2020).

Not having a drinking water source (OR 3.14; 95% CI 1.29-7.65) is associated with stunting at 3.143 times the risk of a family that has a drinkable water source. Children from families that do not have clean water facilities have a higher prevalence of diarrhea and stunting than children from families that have clean water facilities, have closed and watertight baths, do not have family baths, and this is supported by the relatively low prevalence of diarrhea and stunting. family economic conditions, lack of ventilation and lighting, and no waste disposal (Tahangnacca et al., 2020; Wahid et al., 2020; Wicaksono et al., 2021). Research on the incidence of stunting in Bandung Regency, Indonesia using the Mann-Whitney test shows that the concentrations of As and Cd in drinking water sources are thought to have a significant relationship with the incidence of stunting (Oginawati et al., 2023).

Family low socioeconomic status (OR 0.13; 95% CI 0.054-0.325) stunting risk associated with family food sources and family nutritional status. Lack of quality food in the mother associated with energy intake, protein, calcium, iron, and zinc can increase the risk of stunting. The family economy plays an important role in nutrition. The economic level of a family can affect their ability to provide nutritious food for their children (Muhith et al., 2017; Velásquez, 2009). Families with higher economic status have a better chance of meeting the nutritional needs of children under five (Velásquez, 2009). On the other hand, families with lower economic status may struggle to provide adequate nutrition for their children (Drewnowski, 2015). Economic interventions aimed at raising family incomes have been shown to have a positive effect on reducing malnutrition (Babu et al., 2016). Consider other factors such as food availability, household costs, environmental sanitation, and education level, because these factors can also influence nutritional status. Understanding the economic aspects of nutrition can help in designing programs that encourage better nutritional intake.

Low maternal education, poor maternal nutritional status during pregnancy, children receiving formula milk for less than 6 months, low birth weight of less than 2500 grams, lack of drinking water sources, and poor wealth index (family economic ability) were identified as important predictors. The occurrence of stunting. The factors that predispose a child to stunting are multifactor (Tahangnacca et al., 2020). Various factors causing stunting in children can be avoided through a holistic multi-strategy community-based approach. Family is the most important component of a person's health status. The level of knowledge of a family has a significant relationship to family behavior (Huriah & Nurjannah, 2020). Preventive actions for health problems in the family can be influenced by the characteristics of the family. Such as family habits, social and economic conditions, culture, parenting patterns, and family environment (Ainy et al., 2020; Basri et al., 2021; Baah, Konovalov, & Tenzin, 2024; Habibi, Jiyane, & Ozsen, 2024). Based on the results of multivariate analysis of risk factors control stunting occurrences carried out multilevel, at the level of the family is done empowerment of families by

increasing knowledge about health, prevention of infectious diseases, and using the market as a source of family nutrition and improve sanitation of the environment. At the levels of the community with increased role and function of the post of integrated services. Increase public awareness about the importance of health and improve the provision of quality health services (Pasulu et al., 2023; Putra et al., 2023).

This study answers previous studies by looking at the novelty of stunting risk based on the diversity of household and environmental characteristics. This study was conducted in rural areas of Batu Bara Regency which has the highest stunting risk in North Sumatra Province. Although the research area is in a rural area with a small scale, it is hoped that the results will bring benefits in controlling stunting multilevel in the community. However, this study has shortcomings in terms of the variables studied, and the research subjects have not been able to generalize all household and environmental characteristics, it is hoped that further research will further examine other supporting variables so that it will produce greater benefits in health services. Research recommendations for controlling stunting risk factors are through family empowerment and improving the quality of health services.

CONCLUSION

Based on multivariate analysis, the most significant influence between risk factors and stunting incidence in the control and case groups. Household factors such as maternal education are at higher risk for stunting incidence, followed by low birth weight of less than 2500 grams, giving formula milk for less than 6 months, and poor maternal nutritional status during pregnancy. Environmental factors, not having enough drinking water have a higher risk, followed by the wealth index or family economic capacity falling into the low/poor category. The study results can conclude that the risk factors for stunting incidence in Batu Bara Regency are significant household and environmental factors related to an increased chance of stunting incidence.

The prevalence of stunting in Indonesia which is still high requires research recommendations in controlling stunting risk factors, namely through family empowerment by increasing family knowledge, increasing the implementation of clean and healthy living behaviors, preventing infectious diseases and improving parenting patterns, utilizing yards as a source of food and family nutrition and environmental sanitation. At the health service level, namely increasing the role and function of integrated health posts, and improving nutritional status through policy advocacy related to efforts to prevent stunting in toddlers. By the 2030 Sustainable Development Goals, controlling risk factors for stunting incidents starting from the individual, community, and health service levels is the access to successful nutritional interventions that focus on community health status.

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AUTHOR CONTRIBUTIONS

Mayang Sari Ayu: design, writing, manuscript preparation, supervision, data acquisition, conceptualization, and statistical analysis of data. Dewi Pangestuti: statistical analysis and design. Mayasari Rahmadhani: obtained data and prepared the manuscript.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

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