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Risk factors for severe stunted among Children aged 2-5 years with stunting in Pontianak City, Indonesia

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ABSTRACT

Background: Stunting is still a major public health in developing countries, including Indonesia. There are many predictors that might contribute to stunting, including child factors, mother factors, household factors, and community. This study focuses on children and mother level.
Aims: This study aimed to examine the factors associated with severe stunted among children aged 2 to 5 years old.
Methods: This study uses primary data in Pontianak City, Indonesia the data has been collected from January to February 2023. Respondents were selected by total sampling method. Univariate, bivariate, and multivariate have been done using STATA 17.
Results: The analysis data revealed that 75.98% of children were stunted and 24.20 were severe stunted. The factors including low birth weight and birth interval were found significantly associated with severe stunted, other independent variables did not have a correlation for being severe stunted.
Conclusion: According to children's factors and maternal factors, the variables of low birth weight and birth interval were found to correlate with being severe stunted.

Keywords*: Stunted; Severe stunted; Children under five; Pontianak City.*
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1. Introduction

Stunting among children under five years old is a significant public health issue globally, including in Indonesia and Asian countries (Correa, 2022; Mengesha et al., 2021). Stunting is defined as a condition where a child's height or length is significantly below the average for their age (De Onis & Branca, 2016). Stunting is thought to afflict about one-third of children under five worldwide, with a higher frequency in South Asian and sub-Saharan African low-resource nations (Mengesha et al., 2021). Stunting among children under five years old is a significant public health issue in Indonesia and Asian countries (Umar & Darajat, 2022). Stunting is defined as a child's length or height being below the acceptable standard values for their age (De Onis & Branca, 2016). In Indonesia, 30.8% of children under five experience stunting (Umar & Darajat, 2022). A number of clusters can be used to group elements related to stunting, such as

environmental factors, fetal growth restriction and preterm birth, adolescent motherhood and short birth intervals, maternal nutrition and infection, and child nutrition and infection (Danaei et al., 2016). It is associated with long-term consequences such as poor cognitive development, increased risk of chronic diseases, and reduced economic productivity (Lartey, 2015).

Understanding the factors related to severe stunting is crucial for developing effective interventions to address this problem. Numerous researches conducted in various nations have examined these variables, offering insightful information about the factors that contribute to severe stunting in children under the age of five. According to one Nigerian study, severe stunting in children under five was strongly correlated with elements including maternal education, home affluence, and access to improved drinking water sources (Akombi et al., 2017). Similarly, a study in Rwanda identified risk factors for stunting, including household wealth, maternal education, and access to improved sanitation facilities (Nshimyiryo et al., 2019). These findings highlight the importance of socioeconomic factors in determining the prevalence of severe stunting. Stunting in children under two years old was linked to maternal education, occupation, age at pregnancy, socioeconomic circumstances, and nutritional quality of pregnant women, according to another study done in Indonesia (Susyani et al., 2022). This suggests that improving maternal education and socioeconomic conditions can play a crucial role in preventing severe stunting in early childhood.

According to a study conducted in Nepal, stunting and severe stunting in children under the age of five were linked to variables like maternal education, household affluence, and birth problems (Tiwari et al., 2014). This highlights the importance of addressing both maternal and environmental factors in preventing severe stunting. The role of maternal factors in stunting was also highlighted in a study conducted in Ghana, which found that young maternal age was a risk factor for child undernutrition (Wemakor et al., 2018). Similarly, a study in Ethiopia reported that the quantity, frequency, and type of supplementary feeding, birth weight, sex, birth order, and disease conditions like diarrhea were strongly associated with stunting among under-five children (Fikadu et al., 2014). Additionally, research from Zambia and Bangladesh revealed that variables like the child's age and sex, the mother's age and educational attainment, her wealth, the availability of an improved drinking water source, the length of her breastfeeding, and her place of residence were predictive of stunting in children under five (Chowdhury et al., 2021; Mzumara et al., 2018). These findings emphasize the importance of addressing multiple factors at the individual, household, and community levels to prevent severe stunting.

In addition to socioeconomic and maternal factors, other studies have identified specific risk factors for severe stunting. For example, a study in Ethiopia found that children from educated and malnourished mothers, as well as those from less wealthy mothers, were more likely to be severely stunted (Hailu et al., 2020). According to a different study conducted in Rwanda, there is a higher chance of childhood stunting if a child has diarrhea, is male, older than 11 months, has a child impairment, and has two children under five (Kalinda et al., 2023). Environmental factors, such as sanitation and access to clean water sources, have also been identified as important determinants of severe stunting. A study in Zimbabwe highlighted the low micronutrient density and poor protein quality in cereal-based diets as contributing factors to stunting in resource-poor settings (Kairiza et al., 2020). Similarly, a study conducted in Bangladesh discovered a substantial correlation between stunting, wasting, and underweight in children under five and the availability of toilets, drinking water sources, residential locations, and socioeconomic position (Chowdhury et al., 2021).

In the Indonesian context, in order for nations to realize their full potential for productivity, stunting must be reduced, according to the World Bank's Human Capital Project. Indonesia's goal is to further reduce stunting to 14 percent by 2024. The country's coordinated efforts have reduced stunting rates

from 31.4 percent in 2018 to 21.6 percent in 2022 (World Bank, 2023). Government and non-profit organizations are collaborating to establish a program related to reducing the number of stunting among children in Indonesia. UNICEF Indonesia reported the double burden of malnutrition as a major program that needs to be solved immediately. In fact, in 2018 3 of 10 children under 5 years were stunted and 1 of 10 were wasted (UNICEF Indonesia, 2023). Moreover, an issue of overweight and obesity are also concerning. Among children of primary school age, 20% of them are overweight and 15% are obese (UNICEF Indonesia, 2023). Furthermore, two million children under 5 years suffer from severe acute malnutrition. In a specific area of Pontianak, West Kalimantan Province, compared to national data, in 2021 the prevalence of stunted children was 24.4% (Pemprof Kalbar, 2023). According to a study conducted in East Nusa Tenggara, children's age, mothers' level of education, and living in a rural location are the main causes of stunting (Suratri et al., 2023).

Overall, the factors related to severe stunting among children under 5 years old are multifaceted and include socioeconomic factors, maternal factors, environmental factors, and specific risk factors. Addressing these factors requires a comprehensive approach that includes improving maternal education, socioeconomic conditions, access to healthcare services, and environmental sanitation. Additionally, interventions should focus on promoting optimal breastfeeding practices, improving the quality and diversity of children's diets, and providing access to clean water sources. By addressing these factors, it is possible to reduce the prevalence of severe stunting and improve the health and well-being of children under 5 years old. This study aimed to explore the risk factors of severe stunted and severe stunted in Pontianak City, West Kalimantan Province, Indonesia.

2. Methods

Study design

This study used a cross-sectional time frame. The data collection has been done in 10 villages in 6 sub-districts in Pontianak City, West Kalimantan Province where stunting is the focus. Those locations such as Parit Tokaya, Benua Melayu Laut, Tambelan Sampit, Banjar Serasan, Saigon, Tanjung Hilir, Tanjung Hulu, Parit Mayor, Siantan Hulu dan Sungai Jawi. The data was collected during January to February 2023. Total sampling was used to select the respondents who were mothers of children aged 2 to 5 years old with diagnosed stunting. The final respondents who completely joined the interview were 687 mothers with children aged 2-5 years old.

Measurement

The dependent variable of this study is nutritional status which has two categories, such as stunted and severe stunted. To define severe stunted, authors used cut-off based on WHO recommendation Length/height-for-age <−3 SD of the median, and stunted used Length/height-for-age ≤−2 SD and ≥−3 SD of the median. The independent variable of this study includes the children's level and mother's level. The tool used in this study is a closed questionnaire.

Statistical techniques

Data analysis in this study includes univariate, bivariate, and multivariate. Univariate was used to describe the general information of respondents that presented in frequency and percentage. Bivariate analysis was done using Chi-square in order to test each independent variable and dependent variable. Multivariate analysis in this study is *binary logistic regression* because the dependent variable consists of dummy categories.

Ethical clearance

All the analysis was done by using STATA 17. This study including instruments and all procedure has been approved by Ethical Clearance No: 010/KEPK-FIKES/ UM PONTIANAK/ 2023.

3. Results

The general characteristics of respondents

Univariate analysis in this study explains the frequency distribution of children with stunting characteristics and the potential predictors. In Table 1. Among all stunted children, there are 165 of 687 children who were severely stunted (24.20%). According to the birth interval between childbirth and the previous birth, it was revealed that the majority of children were born in intervals of 2 years or more with another birth (73.80%). Moreover, the gestation data showed the majority of children were born at enough months of gestation (93.16%). The mother reported that the children were born with enough or more birth weight (83.84%) and enough birth height (55.75%). Based on the mother's history of chronic lack of energy, the mother reported did not have (87.34%). The majority of mothers practiced exclusive breastfeeding (80.20%) and were in age less than 20 years old or more than 35 years old when pregnant (80.35%). Furthermore, it also described that most of the mothers had a weight of 150 cm or higher (66.81%), did not have a history of anemia (65.36%), and did not complete all immunizations (56.62%).

Table 1. The General Information of Children

Variables (n=687)	Frequency	Percentage
Stunting		
Severely Stunted	165	24.20
Stunted	522	75.98
Birth interval		
< 2 years	180	26.20
≥ 2 years	507	73.80
Premature when born		
Yes	47	6.84
No	640	93.16
Low birth weight		
Yes	111	16.16
No	576	83.84
Birth height		
< 48 cm	304	44.25
≥ 48 cm	383	55.75
History of chronic lack of energy		
Yes	87	12.66
No	600	87.34
Exclusive Breastfeeding		
Yes	136	19.80
No	551	80.20
Age when pregnant (year)		
< 20^{th} or >35^{th}	552	80.35
20-35	135	19.65
Mother's height		
< 150 cm	228	33.19
≥ 150 cm	459	66.81
Mother's History of Anemia		
Yes	238	34.64
No	449	65.36
Complete all immunization		
No	389	56.62
Yes	298	43.38
Total	687	100.0

The correlation between each independent variable and stunted

Table 2 below shows the result of the Chi-square test by bringing each potential predictor associated with severe stunted. It showed that some variables including birth interval, premature birth, low birth weight, and birth height have strong associations (*p-value <0.001*) with severe stunted. Moreover, another variable has a moderate association (*p-value <0.01*), including exclusive breastfeeding, and a low association (*p-value <0.05*) including the history of chronic lack of energy. However, some other variables were not significantly associated with nutritional status (*p-value>0.05*), including age when pregnant, mother's height, history of anemia, and completeness of immunizations.

Table 2. The result of bivariate analysis using the Chi-square test

Variables	Nutritional status		*p-value*
	Severe stunted (%)	Stunted (%)	
Birth interval			< 0.001***
< 2 years	61 (33.89)	119 (66.11)	
≥ 2 years	104 (20.51)	403 (79.49)	
Premature when born			< 0.001***
Yes	27 (57.45)	20 (42.55)	
No	138 (21.56)	502 (78.44)	
Low birth weight			< 0.001***
Yes	62 (55.86)	49 (44.14)	
No	103 (17.88)	473 (82.12)	
Birth height			< 0.001***
< 48 cm	95 (31.25)	209 (68.75)	
≥ 48 cm	70 (18.28)	313 (81.72)	
History of chronic lack of energy			0.014*
Yes	30 (34.48)	57 (65.52)	
No	135 (22.50)	465 (77.50)	
Exclusive Breastfeeding			0.006**
Yes	45 (33.09)	91 (66.91)	
No	120 (21.78)	431 (78.22)	
Age when pregnant (year)			0.586
< 20^{th} or >35^{th}	135 (24.46)	417 (75.54)	
20-35	30 (22.22)	105 (77.78)	
Mother's height			0.814
< 150 cm	56 (24.56)	172 (75.44)	
≥ 150 cm	109 (23.75)	350 (76.25)	
Mother's History of Anemia			0.730
Yes	59 (24.79)	179 (75.21)	
No	106 (23.61)	343 (76.39)	
Complete all immunization			0.085
No	103 (26.48)	286 (73.52)	
Yes	62 (20.81)	236 (79.19)	

**p-value <0.05, **p-value <0.001, ***p-value <0.001*

Multivariate Analysis

Table 3 below describes the result of multivariate analysis using binary logistic regression. It was shown that, after adjusting to all independent variables, compared to children with enough birth weight, the variables of having low birth weight were 4.26 times more likely and strongly associated with severe stunted (*p-value* <0.001). Additionally, compared to children born with 2 year or more birth interval, children born with less than a 2-year birth interval had a 45% increasing probability of having severe stunted. However, after adjusting to all predictors the variables of premature when born, birth height, history of chronic lack of energy, exclusive breastfeeding, age when pregnant, mother's height, mother's history of anemia, and completeness of immunizations were found not significantly associated

with having severe stunted *(p-value>0.05).*

Table 3. The result of multivariate analysis using binary logistic regression

Variables	AOR	95% Confidence Interval (Lower – Upper)	*p-value*
Birth interval (ref: ≥ 2 years)			
< 2 years	0.55	0.37 – 0.81	**0.002****
Premature when born (ref: No)			
Yes	1.91	0.93 – 3.92	0.080
Low birth weight (ref: No)			
Yes	4.26	2.55 – 7.13	**0.000*****
Birth height (ref: ≥ 48 cm)			
< 48 cm	1.22	0.81 – 1.84	0.334
History of chronic lack of energy (ref: No)			
Yes	1.64	0.95 – 2.84	0.075
Exclusive Breastfeeding (ref: Yes)			
No	1.51	0.96 – 2.38	0.074
Age when pregnant (year) (ref: 20-35)			
< 20^{th} or >35^{th}	0.68	0.41 – 1.21	0.131
Mother's height (ref: ≥ 150 cm)			
< 150 cm	0.94	0.63 – 1.41	0.757
Mother's History of Anemia (ref: No)			
Yes	0.94	0.63 – 1.41	0.757
Complete all immunizations (ref: Yes)			
No	1.33	0.91 – 1.97	0.143

**p-value <0.05, **p-value <0.001, ***p-value <0.001*
LR chi2 (10) = 85.73
Prob > chi2 = 0.000
Pseudo R2 = 0.1132
Log likelihood = -335.86

4. Discussion

According to the result in the previous section, the factors associated with severe stunted was low birth weight and birth interval. This finding was in line with the studies in developing countries (Danaei et al., 2016). Several factors have been identified as being associated with stunting among children under five years old. Fetal growth restriction and preterm delivery, teen pregnancy and short birth intervals, environmental factors, maternal nutrition and infection, and child nutrition and infection are some of the clusters into which these factors might be divided (Danaei et al., 2016). Maternal nutrition and infection play a crucial role in the development of stunting, as poor maternal nutrition and infections during pregnancy can lead to fetal growth restriction and preterm birth, which are risk factors for stunting (Danaei et al., 2016). Teenage motherhood and short birth intervals are also associated with stunting, as these factors can lead to inadequate maternal nutrition and care during pregnancy (Danaei et al., 2016). Child nutrition and infection are important factors in the development of stunting. Inadequate nutrition, including insufficient intake of essential nutrients, can contribute to stunting (Marume et al., 2023). Additionally, frequent infections, such as diarrheal and worm infections, can impair nutrient absorption and utilization, leading to stunting (Marume et al., 2023). Stunting is also influenced by environmental variables, including hygienic conditions, access to clean water, and cleanliness habits. Lack of access to sanitary facilities and clean water can raise the risk of illnesses, which can lead to stunting (Shofifah et al., 2022). Other factors associated with stunting include low birth weight, low socioeconomic status, inadequate breastfeeding practices, and poor dietary quality (Marume et al., 2023). Due to its reflection of insufficient fetal growth and development, low birth

weight is a major risk factor for stunting (Marume et al., 2023). Socioeconomic factors, such as low income and low maternal education, are also associated with stunting, as they can limit access to nutritious food and healthcare (Marume et al., 2023). Inadequate breastfeeding practices, including early cessation of breastfeeding and lack of exclusive breastfeeding, can contribute to stunting (Marume et al., 2023). Poor dietary quality, including insufficient intake of essential nutrients, can also contribute to stunting (Marume et al., 2023).

Stunting has been found to be predicted by a number of child-related characteristics, such as the child's age, length at birth, weight at birth, weight-for-age outcome, breastfeeding status, number of meals, dietary quality, hunger, and presence of worm and diarrheal diseases (Marume et al., 2023). Maternal factors such as age, education, occupation, and HIV status also play a role in stunting (Marume et al., 2023). Household and socio-cultural factors, such as income status, access to safe water and toilets, health clubs, and maternal support in infant feeding, are also significant predictors of childhood stunting (Marume et al., 2023). Additional risk factors for stunting have been found by other research, such as poor levels of education among fathers, maternal heights under 150 cm, high-risk maternal age, low birth weight, and a history of infectious diseases (Fikadu et al., 2014; Manggala et al., 2018). The consumption of animal-sourced foods, child underweight status, and income type have also been associated with stunting (Umwali et al., 2022). It is important to note that stunting has long-term consequences for children's health, well-being, and productivity (Correa, 2022). Stunted children are more susceptible to infections and are at a higher risk of cognitive, motor, and language impairments (Park et al., 2019). Stunting also has economic implications, as it can lead to decreased productivity and increased risk of chronic diseases in adulthood (McGovern et al., 2017; Nasser et al., 2022).

It is crucial to remember that stunting is a complicated problem affected by a variety of variables, some of which may interact with one another. For instance, fetal growth and development can be impacted by maternal nutrition and infection, which can subsequently have an effect on child nutrition and infection (Danaei et al., 2016). Additionally, socioeconomic factors can influence access to nutritious food and healthcare, which can in turn affect child nutrition and infection (Marume et al., 2023). Efforts to reduce stunting should focus on improving maternal nutrition and infection control, promoting optimal child nutrition and reducing the burden of childhood illnesses, and addressing environmental factors such as access to safe water and sanitation (Danaei et al., 2016). Additionally, interventions targeting household and socio-cultural factors, such as improving income status and maternal support in infant feeding, can also contribute to reducing stunting (Marume et al., 2023).

In conclusion, stunting among children under five years old in Indonesia and Asian countries is a complex issue influenced by various factors. This current study revealed the factors such as birth interval and low birth weight are the main risk factors of severe stunted in Pontianak City. Maternal nutrition and infection, adolescent pregnancy and short intervals between pregnancies, fetal growth restriction, preterm birth, child nutrition and infection, environmental factors, low birth weight, socioeconomic status, breastfeeding practices, and nutritional quality are additional contributors. Efforts to address stunting should focus on improving maternal nutrition and healthcare, promoting exclusive breastfeeding, improving access to nutritious food, implementing effective water, sanitation, and hygiene practices, and addressing socioeconomic factors. By addressing these factors comprehensively, it is possible to reduce the prevalence of stunting and improve the health and well-being of children in Indonesia and Asian countries. In conclusion, stunting among children under five years old is a significant public health issue in Indonesia and Asian countries. Numerous elements, such as those pertaining to children, mothers, households, and societies, have an impact on it. Efforts to reduce stunting should focus on addressing these factors through interventions that improve maternal and child nutrition, reduce the burden of childhood illnesses, and improve access to safe water and

sanitation. These interventions have the potential to improve the health, well-being, and productivity of children in these countries.

5. Conclusion

Stunting is a major public health issue in developing countries, including Indonesia. In high-risk areas of stunting in Pontianak City, Indonesia it was found 75.98% of children with a high risk of stunting were severe stunted, and 24.20% were stunted. According to children's factors and maternal factors, the variables of low birth weight and birth interval were found to correlate with being severely stunted. However, other variables observed in this study did not significantly correlated with being severe stunted including premature when born, birth height, history of chronic lack of energy, exclusive breastfeeding, age when pregnant, mother's height, mother's history of anemia, and completion of all immunizations.

These findings may lead to policy recommendations to encourage women to have at least two years of birth interval and increase intake of nutritious food during pregnancy to prevent low birth weight. All other stakeholders also need to promote and educate women and family members about the prevention of stunting starting from the pregnancy period.

Conflict of Interest

The authors declare no conflicts of interest for the results. The authors received financial support from the National Research and Innovation Agency (BRIN) in collaboration with the Education Fund Management Agency (LPDP), to conduct the research.

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