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Revealing the Social and Reproductive Health Dimensions Associated with Stunting among Children 6 – 23 months in Urban Areas of Indonesia

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Abstract

Background: The prevalence of stunting in Indonesia has generally experienced a decline, although not significantly. The issue of stunting is not solely caused by a single, simple factor; rather, it is influenced by complex factors. This study aims to analyze the factors associating with stunting in urban areas across Indonesia.
Methods: This study used a cross-sectional survey approach. The data were from the 2023 Indonesian Health Survey. The sample in this study were children aged 6 to 23 months residing in urban areas across Indonesia. Multiple logistic regression analysis was used to examine the associate between the independent variables and the dependent variable.
Results: This study found that male (PR = 1.37), history of stunting at birth (PR = 1.41), low birth weight (PR = 2.13), history of tuberculosis (TB) (PR = 4.53) and family wealth status (PR = 2.28) were significantly associated with stunting status among children in urban areas. These factors were identified as key determinants, with their respective prevalence ratios indicating a substantial association with the prevalence of stunting in the population under study.
Conclusions: In the urban context, there are predictive factors of stunting prevalence that require serious attention, such as having a history of TB illness and poor environmental health conditions.

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INTRODUCTION

Routine antenatal care (ANC) is one of the most crucial preventive measures in reducing the risk of stunting. Mothers who regularly attend ANC visits have a 60% lower risk of giving birth to stunted children compared to those who do not. This is due to early detection of health problems that could affect both mother and child, such as anemia, hypertension, or gestational diabetes, which could worsen the child's nutritional condition (Arsenault et al., 2018). Moreover, monitoring the nutritional status of pregnant women plays a crucial role in ensuring that children are born with optimal weight, a protective factor against stunting.

Environmental infections, such as diarrhea and acute respiratory infections, also significantly associate to the prevalence of stunting. Children who experience more than three episodes of diarrhea annually have twice the risk of being stunted (Mandu et al., 2024). Infections like diarrhea, often caused by poor sanitation and unclean water, reduce children's ability to absorb nutrients, thereby worsening their nutritional status. Additionally, poor sanitation also contributes to higher stunting prevalences in rural areas compared to urban areas (Widyaningsih et al., 2022). Thus, efforts to improve sanitation and access to clean water are crucial in combating stunting.

High fertility rates also contribute to the prevalence of stunting, especially among mothers with many children. According to data from Statistics Indonesia, the Indonesia Total Fertility Rate (TFR) was 2.18 children per woman in 2020, a notable decrease from 2.41 in 2010 (Badan Pusat Statistik, 2023). Research published by Safitri et al. indicates that mothers with more children tend to have lower access to adequate nutrition and optimal healthcare, which exacerbates the risk of stunting (Safitri et al., 2021). Decreasing fertility rates, along with improved quality of life and better access to education and healthcare, statistically can reduce stunting. Fewer children in a family also allow mothers more time and resources to focus on childcare, including nutritious feeding practices (Fauziyah et al., 2023).

Socioeconomic factors play a vital role in determining the risk of stunting among children. Mothers with lower education levels and disadvantaged economic status have a higher risk of giving birth to stunted children. Educated mothers are more likely to understand the importance of balanced nutrition during pregnancy and in providing proper food to their children. In addition, better employment and income levels improve mothers' access to healthcare services, which can reduce the risk of the children getting stunted (Anjani et al., 2024; Hossain & Khan, 2018; Valentine Elfrida et al., 2024). Several studies show that mothers with low education and low income in rural areas are more likely to have stunted children (Valentine Elfrida et al., 2024; Widyaningsih et al., 2022), reflecting limited access to quality healthcare and difficulties in obtaining nutritious food.

In addition to education and income, the place of residence also affects stunting prevalence. In urban areas, with better access to healthcare and education, the prevalence of stunting is lower than in rural or poorly developed regions. Areas with poor sanitation show higher stunting prevalence up to 1.5 times compared to areas with good sanitation. Therefore, improving basic infrastructure, including sanitation and clean water access, is a crucial strategy in preventing stunting among children (Veramita Nanda Pradana et al., 2023).

Finally, optimal reproductive health, routine antenatal care, control of environment-related diseases, fertility rates, and socioeconomic factors are key determinants of stunting in Indonesia. However, it remains unclear how these variables specifically relate to stunting in urban areas. This study will focus on how family socio-demographics and maternal reproductive health associate stunting among children in urban Indonesia.

METHODS

This study aims to analyze the factors associating with stunting among children aged 6-23 months in urban areas of Indonesia. The sample was drawn from the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia/ SKI 2023), which used a multistage random sampling approach to ensure accurate representation across various urban regions of the country. The 2023 Indonesia Health Survey (Survei Kesehatan Indonesia/ SKI 2023) sample consisted of approximately 5,000–10,000 children under five, selected based on socio-economic characteristics, maternal health status, and environmental sanitation conditions.

This research adheres to ethical research standards, using anonymized data from the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia/ SKI 2023) to protect individual confidentiality. Access to the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia/ SKI 2023) data is available upon request to the Health Development Policy Agency of the Ministry of Health, Republic of Indonesia. The sample for this study includes children aged 6–23 months residing in urban areas of Indonesia. In this research, urban areas refer to administrative regions designated as “Kota” (city), not “Kabupaten” (regencies). The selected sample in this study was 4,038 children.

The dependent variable in this study was stunting status, which was measured using the height-for-age indicator based on the World Health Organization (WHO) growth standards. Meanwhile, the independent variables include various child and household characteristics. The sex of the child was categorized as male (coded as 1) and female (coded as 2). The history of stunting at birth was assessed by measuring the infant's birth length and comparing it to the WHO standard for infants aged 0 months; a code of 1 was given for children identified as stunted at birth and 0 for those not stunted. Low Birth Weight (LBW) was defined as a birth weight below 2,500 grams (coded as 1), while those weighing 2,500 grams or more were coded as 0. The number of household members refers to the total individuals living under the same roof, as recorded in the family registration card, and the number of children under five in the household was also considered.

Maternal education was classified into three levels: low (coded as 1), secondary (coded as 2), and higher education (coded as 3). Other variables included the maternal working status, maternal marital status, premature birth, first pregnancy, and the quality of ANC. The study also examined whether the child had experienced diarrhea or Acute Respiratory Infections (ARI) in the last month, with responses coded as 1 for “yes” and 0 for “no.” Additional variables included the history of pneumonia, and a record of pulmonary tuberculosis (TB) within the past year (also coded as 1 for “yes” and 0 for “no”).

A child's immunization status was determined by whether they had received all basic immunizations recommended for their age (coded as 1 for complete, and 0 for incomplete). Exclusive breastfeeding status was also recorded, with a value of 1 indicating the child was exclusively breastfed and 0 otherwise. The assessment of drinking water sources involved evaluating whether the primary source was safe (coded as 0), such as packaged, piped, or protected sources, or unsafe (coded as 1), such as surface water, rainwater collection, or unprotected wells. The family’s wealth status was determined using a five-quintile wealth index, which considered household assets like radio, television, refrigerator, bicycle, motorcycle, or car, and housing features such as electricity, flooring material, wall and roofing type, water source, toilet facilities, and bedroom availability. These variables were categorized from the lowest (Q1) to the highest wealth quintile (Q5).

The frequency of height measurement was categorized as routine (coded as 0) or not routine (coded as 1) based on whether the child’s height was measured regularly in the last six months. The Minimum Dietary Diversity (MDD) Score was calculated from a 24-hour dietary recall of the children. The score reflects the number of food groups consumed out of eight WHO/UNICEF-recommended categories: grains, roots, and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A-rich fruits and vegetables; other fruits and vegetables; and breastmilk (World Health Organization & United Nations Children’s Fund (UNICEF), 2021). Each group consumed at least once in the past 24 hours was scored as 1, with total scores ranging from 0 to 8.

Statistical analysis in this study employed logistic regression to identify dominant determinants of stunting, including maternal nutritional intake, frequency of ANC visits, and socioeconomic factors. Further analysis used weighting adjustment to ensure the representativeness of the national sample, encompassing 300 randomly selected clusters from 34 provinces across Indonesia.

RESULTS AND DISCUSSIONS

Respondent Characteristics

Table 1 showed the results of bivariate and multivariate logistic regression analysis. The dependent variable in this analysis was stunting status of children, while the independent variables include sex, history of stunting at birth, low birth weight, number of household members, number of children under five in the household, maternal education level, maternal working status, maternal marital status, premature birth, first pregnancy, quality of ANC, history of diarrhea, ARI, pneumonia, pulmonary tuberculosis (TB), immunization completeness, exclusive breastfeeding, source of drinking water, wealth index (in quintiles), frequency of height measurement, and MDD score. The hypothesis was tested at a 5% significance level (p-value < 0.05).

In Table 1, it was found that sex appears to play a role in the incidence of stunting, where male children were more likely to experience stunting (17.6%) compared to female children (12.8%). Children with a history of stunting at birth were also more vulnerable to experiencing stunting again (27.6%) compared to those who were not stunted at birth (14.0%). Furthermore, children born with low birth weight had a higher prevalence of stunting (31.9%) than those with normal birth weight (14.1%), emphasizing the critical influence of maternal nutrition during pregnancy on the child's postnatal growth. A similar pattern was observed among children born prematurely, with 21.3% experiencing stunting, compared to only 14.6% among those born at term.

As other research has explained, low birth weight increases the risk of stunting by 4.94 times (OR: 4.94; 95% CI: 1.30–18.80) (Ayu et al., 2024). Additionally, children who were born prematurely and small for gestational age (preterm SGA) had a 4.51 times higher risk of stunting (95% CI: 3.42–5.93) (Danaei et al., 2016). The child's age also shows a positive relationship with stunting, where children aged 13–24 months had a 2.48 times higher risk of being stunted (AOR: 2.481; 95% CI: 1.714–3.593) (Siddiqa et al., 2023).

Children with poor nutritional status often have weakened immune systems, making them more susceptible to infectious diseases. This cycle worsens their health conditions and increases the likelihood of stunting (Sutia, 2022). Chronic illnesses such as anemia were also associated with stunting. Iron deficiency due to anemia can disrupt a child's linear growth, as iron is essential for the development of bones, muscles, and other body tissues (Eldrian et al., 2023). Gastrointestinal infections reduce the body's ability to absorb key nutrients such as proteins, vitamins, and minerals. During illness, the body requires more energy to fight infections, but undernourished children are unable to meet these demands. Recurrent infections cause chronic inflammation that hampers the child's linear growth (Sutia, 2022).

The multivariate logistic regression analysis identifies several significant factors that associate with the prevalence of stunting among children, namely male (PR = 1.37), history of stunting at birth (PR = 1.41), low birth weight (PR = 2.13), history of pulmonary TB (PR = 4.53), and wealth status (PR = 2.28) as dominant predictors. While the other independents did not significantly associate with stunting. The result showed that the probability > LR was 0.000. and the Adjusted Pseudo R2 was 0.007. A p-value of 0.000 (typically < 0.001) indicates that the model is statistically significant, meaning at least one predictor significantly contributes to explaining the outcome variable. A value of 0.007 is very low, indicating that the model explains only 0.7% of the variability in the outcome.

Table 1. Result of Bivariate and Multivariate Analysis

Variable	Bivariate analysis					Multivariate analysis		
	Stunting		Not Stunting		p-value	PR	95% CI	p-value
	n	%	n	%				
Sex								
Male	374	17.6	1750	82.4	0.006	1.37	1.09 - 1.73	0.006
Female	245	12.8	1669	87.2		1	(base)	-
History of Stunting at Birth								
Stunted	106	27.6	278	72.4	<0.001	1.41	1.02 - 1.95	0.038
Not Stunted	513	14.0	3141	86		1	(base)	-
Low Birth Weight								
Low birth weight	86	31.9	184	68.1	<0.001	2.13	1.48 - 3.06	<0.001
Normal birth weight	533	14.1	3235	85.9		1	(base)	-
Number of Household Members								
>4	322	17.9	1470	82.1	0.007	1.32	1.03 - 1.68	0.026
≤4	297	13.2	1949	86.8		1	(base)	-
Number of Children Under Fives in the Household								
>1	191	16.7	956	83.3	0.363	1.02	0.78 - 1.34	0.873
1	428	14.8	2463	85.2		1	(base)	-
Maternal Education Level								
Low	63	17.2	309	82.8	0.212	1	0.67 - 1.50	0.993
Secondary	424	16	2224	84		1.02	0.75 - 1.40	0.9
High	132	12.9	886	87.1		1	(base)	-
Maternal Working Status								
Not working	407	15.6	2202	84.4	0.706	1	(base)	-
Working	212	14.9	1217	85.1		1.08	0.82 - 1.43	0.579
Maternal Marital Status								
Divorced	13	24.8	40	75.2	0.182	1.41	0.77 - 2.57	0.267
Married	606	15.2	3379	84.8		1	(base)	-
Premature Birth								
Yes	98	21.3	364	78.7	0.012	1.02	0.78 - 1.35	0.875
No	521	14.6	3055	85.4		1	(base)	-
First Pregnancy								
No	502	15.9	2648	84.1	0.179	1	(base)	-
Yes	117	13.2	771	86.8		0.9	0.67 - 1.21	0.485
Quality of ANC								
Poor	420	16.2	2178	83.8	0.211	1.02	0.79 - 1.30	0.899
Good	199	13.8	1241	86.2		1	(base)	-
History of Diarrhea								
Yes	61	20.1	244	79.9	0.13	1.28	0.87 - 1.89	0.214
No	558	14.9	3175	85.1		1	(base)	-
History of ARI								
Yes	34	13.6	215	86.4		0.86	0.52 - 1.41	0.545
No	585	15.4	3204	84.6	0.608	1	(base)	-
History of Pneumonia								
Yes	18	16.5	90	83.5	0.845	0.97	0.43 - 2.18	0.946
No	601	15.3	3329	84.7		1	(base)	-
History of Pulmonary TB								
Yes	8	57.5	6	42.5	0.015	4.53	2.10 - 9.77	<0.001
No	611	15.2	3413	84.8		1	(base)	-
Immunization Completeness								
Incomplete	422	16.1	2200	83.9	0.277	1.05	0.81 - 1.35	0.703
Complete	197	13.9	1219	86.1		1	(base)	-

Variable	Bivariate analysis					Multivariate analysis		
	Stunting		Not Stunting		p-value	PR	95% CI	p-value
	n	%	n	%				
Exclusive Breastfeeding								
Yes	363	15.5	1979	84.5	0.833	1	(base)	-
No	256	15.1	1440	84.9		0.93	0.75 - 1.16	0.523
Source of Drinking Water								
Unsafe	13	17.6	62	82.4	0.632	1.02	0.58 - 1.81	0.94
Safe	606	15.3	3357	84.7		1	(base)	-
Wealth Index (in quintiles)								
Q1 (Poorest)	74	26.2	211	73.8	<0.001	2.28	1.49 - 3.48	<0.001
Q2	141	21.5	516	78.5		2.04	1.44 - 2.90	<0.001
Q3	171	15.5	932	84.5		1.44	1.04 - 1.99	0.027
Q4	89	13.1	588	86.9		1.20	0.78-1.85	<0.001
Q5 (Richest)	144	10.9	1173	89.1		1	(base)	-
Frequency of Height Measurement								
Regular	420	15.8	2229	84.2	0.413	1	(base)	-
Irregular	199	14.4	1190	85.6		0.89	0.71 - 1.11	0.303
MDD Score								
Not MDD	222	16.4	1132	83.6	0.388			
Minimum	397	14.8	2287	85.2				
Total MDD Score	Mean	SD	Mean	SD		0.99	0.93 - 1.06	0.849
	4.95	0.11	5.07	0.05	0.337			
Constant (multivariate)						0.07	0.04 - 0.12	<0.001

Socio-demographic and Maternal Factors

The living environment where a child grows and develops also associates with the prevalence of stunting (Tahangnacca et al., 2020). As shown in Table 1, children living in households with more than four members were more likely to experience stunting (17.9%) compared to those in smaller household members (13.2%). This may due to limited resources in larger families, both in terms of food availability and attention to child health.

Maternal age at childbirth also plays a significant role, with adolescent pregnancies increasing the risk of stunting. This is often associated with nutritional competition between the growing adolescent mother and the fetus. Global studies have identified that short birth intervals and adolescent pregnancies contribute to 1.9% of global stunting cases (0.86 million cases, 95% CI: 0.77 million–0.95 million) (Danaei et al., 2016).

Maternal education level also reveals a clear pattern. As found in this study, children of mothers with low education levels experienced higher rate of stunting (17.2%) compared to those of highly educated mothers (12.9%). This indicates that mothers with higher level of education may have better understanding of nutrition and health in supporting child growth. Parental education, particularly maternal, is crucial in preventing stunting. Parents with higher level of education are more likely to have better knowledge of child nutrition and health, allowing them to make more informed decisions regarding the provision of nutritious food (Hossain & Khan, 2018). Maternal education level showed an inverse relationship with stunting, with children of highly educated mothers being at lower risk (AOR: 0.584; 95% CI: 0.424–0.806) (Ayu et al., 2024). Maternal age was also statistically associated, with mothers younger than 20 years at childbirth being at higher risk of having stunted children (Tahangnacca et al., 2020).

The result of this research, in the urban context, showed that ANC visits did not significantly associated with stunting. This means that whether mothers attended ANC regularly and in accordance with recommendations, or received inadequate ANC, it was not associated with the prevalence of stunting. This finding differs from previous studies that did not consider place of residence. For instance, one study found that inadequate ANC visits increased the risk of stunting by 8.23 times (OR: 8.23; 95% CI: 2.72–20.18) (Fikrie et al., 2024).

Low household income and inadequate family food allocation were associated with higher risk of stunting among children. Higher household income (b = -1.85; 95% CI = 0.05 to 0.50; p = 0.002) and adequate family food allocation (b = -2.26; 95% CI = 0.03 to 0.37; p < 0.001) reduced the risk of stunting. Low socioeconomic status consistently associates with an increased risk of stunting, with a low wealth index significantly raising the risk of stunting (OR: 0.13; 95% CI: 0.05–0.32) (Ayu et al., 2024).

However, maternal working status did not show a significant difference. As shown in Table 1, the stunting rate among children of working mothers (14.9%) was nearly the same as among those of non-working mothers (15.6%), indicating that both groups face similar challenges in providing adequate nutrition for their children. In terms of marital status, Table 1 revealed that children of divorced mothers had a higher rate of stunting (24.8%) compared to those whose mothers were married (15.2%). This may be linked to economic challenges and limited social support following divorce.

Parent’s higher level of education is often associated with better income and broader access to resources, including nutritious food and healthcare, which can help reduce the risk of stunting (Mukhaira et al., 2024). Paternal education also plays an important role in preventing stunting. Fathers with higher education levels tend to have better jobs and higher income, which can enhance a family’s ability to afford more nutritious food (Mukhaira et al., 2024). Overall, parental education and employment have a complex influence on children’s nutritional status. Higher education generally correlates with better nutritional knowledge and wider access to resources, while parental employment can affect the time spent on childcare and parenting practices.

Several studies have shown that short maternal height (<145 cm) increases the risk of stunting in children by 2.13 times (95% CI: 2.10–2.16) (Danaei et al., 2016; Pangestuti et al., 2023). Poor maternal nutritional status during pregnancy also increases the risk of stunting by 2.57 times (95% CI: 1.22–5.89) (Ayu et al., 2024). Meanwhile, the consumption of iron supplements during pregnancy has a protective effect against stunting (AOR: 0.795; 95% CI: 0.637–0.992) (Siddiqa et al., 2023).

Families with many children have a higher risk of stunting. This was because family resources, including food and attention, were spread more thinly among the children, so each child may did not receive adequate nutrition for optimal growth (Valentine Elfrida et al., 2024). Suboptimal parenting in families with many children can contribute to the occurrence of stunting. Parents may struggle to divide time and resources evenly among their children, which affects the quality of care and nutrition each child receives (Fauziyah et al., 2023).

Regular and high-quality ANC visits are vital for detecting maternal and fetal health issues early, including nutritional deficiencies that can impact fetal growth. When ANC is unstandardized or inadequate, it can increase the risk of stunting among children (Zamzamy et al., 2024). Quality ANC also educates pregnant women about the importance of proper nutrition during pregnancy, directly influencing the child's nutritional status. Nutritional deficiencies during this period can heighten a child's risk of stunting (Amalia D et al., 2025). Research consistently showed a link between inadequate ANC visits and a higher incidence of stunting. For instance, one study revealed that mothers with poor ANC attendance were 9,400 times more likely to have stunted children compared to those with adequate ANC (OR: 9,400) (Yenita & Ruwaida, 2021).

Environmental and Disease Factors

This study revealed that children who used unsafe drinking water sources experienced higher rate of stunting (17.6%) compared to those using safe water sources (15.3%). This suggests that sanitation and the quality of drinking water can affect child growth. Other studies have shown that Water, Sanitation, and Hygiene (WASH) factors have a strong impact on stunting. Poor source of drinking water was found to increase the risk of stunting dramatically, by as much as 109.44 times (OR: 109.44; 95% CI: 32.67–303.01). Conversely, handwashing after using the toilet reduces the risk of stunting by 88.1% (OR: 0.119) (Fikrie et al., 2024). Households with inadequate latrines and untreated water sources show increased stunting risks (Dorsey et al., 2018). Access to safe drinking water also has a significant impact (OR: 3.14; 95% CI: 1.29–7.65) (Ayu et al., 2024).

Several childhood illnesses were also associated with the risk stunting. Children with a history of diarrhea had higher rate of getting stunting (20.1%) than those without (14.9%), indicating that infections can disrupt nutrient absorption and impact child growth. Meanwhile, other infectious diseases such as ARI and pneumonia did not show significant differences in stunting prevalence. Children with ARI had the rate of stunting (13.6%) compared to 15.4% in those without ARI; similarly, the stunting rate among children with pneumonia was 16.5%, versus 15.3% in those without, suggesting these conditions may not be major contributors to stunting.

Infectious diseases, particularly diarrhea, are critical determinants of child health. Globally, diarrhea is responsible for 5.8 million cases of stunting (95% CI: 2.4 million–9.2 million), making it the third leading risk factor for stunting (Danaei et al., 2016). Children with a history of chronic diarrhea are 6.56 times more likely to experience stunting (OR: 6.56; 95% CI: 3.33–13.01; p < 0.001), and it remains a dominant risk factor (OR: 5.41; 95% CI: 2.20–13.29; p < 0.001) (Dorsey et al., 2018; Habimana & Biracyaza, 2019; Wicaksono et al., 2021). A study in Indonesia found that children aged 24–36 months who frequently suffered from infectious diseases were 4.2 times more likely to be stunted compared to those with fewer infections (p = 0.001; OR: 4.200; 95% CI: 1.760–10.020) (Black et al., 2013; Sutia, 2022).

Upper respiratory tract infections also increase the risk of stunting by 3.47 times (OR: 3.47; 95% CI: 1.89–6.35; p < 0.001) (Habimana & Biracyaza, 2019). Repeated infections can lead to nutrient malabsorption and elevated metabolic demands, both of which contribute to stunting. One particularly important disease determinant is pulmonary TB. The link between stunting and pulmonary TB is striking: 57.5% of children with a history of pulmonary TB were stunted, compared to just 15.2% among those without history of pulmonary TB. This highlights the significant impact that pulmonary TB can have on a child's nutritional status.

Additionally, immunization completeness was also associated with the risk of stunting. As shown in Table 1, children with incomplete immunizations had higher rate of stunting (16.1%) than those who were complete immunized (13.9%). This suggests that immunization may play a role in preventing infections that could hinder a child's growth. A study in Jatinegara, East Jakarta, found that 47.3% of children who had incomplete immunization, 84.6% of those children were stunted. Statistical analysis indicated that immunization plays a role in preventing stunting among children aged 1–5 years (p < 0.001) (Danaei et al., 2016). A meta-analysis involving 12 cross-sectional studies from Asia and Africa found that measles vaccination reduced the risk of stunting in children under five (aOR = 0.59; 95% CI: 0.27–1.29; p = 0.190) (Pramono et al., 2024).

Infectious diseases such as diarrhea, ARI, and other illnesses are closely linked to the prevalence of stunting. Infections disrupt nutrient absorption in the digestive tract, leading to chronic malnutrition. Studies have shown that children who frequently suffer from diarrhea or ARI are at a higher risk of experiencing stunting compared to healthy children. Poor sanitation and exposure to pathogens cause chronic damage to the small intestine. Research indicates that a history of infectious diseases in children is significantly associated with stunting.

Environmental enteropathy hinders nutrient absorption and increases the risk of stunting. Children living in environments with poor sanitation are more vulnerable to environmental enteropathy and other infectious diseases (Mbuya & Humphrey, 2016; Ngure et al., 2014).

Feeding and Breastfeeding Practices

One of the most associated factors in the prevalence of stunting was the family's economic condition. As shown in Table 1, children from the poorest wealth index (Q1) had the highest rate of stunting (26.2%), while those from the wealthiest households (Q5) had the lowest (10.9%). This indicates that access to nutritious food, healthcare services, and a healthy living environment was significantly influenced by the family's economic status (Wicaksono et al., 2021).

In terms of dietary patterns, dietary diversity also plays a role in preventing stunting. Table 1 revealed that children whose dietary patterns did not meet the minimum standard (Not MDD) were more likely to experience stunting (16.4%) compared to those with a more diverse minimum dietary pattern (14.8%). Additionally, the average dietary diversity score was higher among children who were not stunted (5.07) than those who were stunted (4.95). However, in this study, the association between dietary diversity and stunting was not statistically significant. In otherwise, previous studies have shown that consuming a more varied diet can help prevent chronic malnutrition. Children who consumed fewer than four food groups had a 1.814 times higher risk of stunting (95% CI: 0.903–3.191) (Fikrie et al., 2024). A study in Guatemala also demonstrated that dietary diversity has a significant effect of stunting, with children who consumed fewer than four food groups having a higher risk of stunting (Kragel et al., 2020).

In urban settings, the practice of exclusive breastfeeding did not show a significant impact on stunting. This finding may be attributed to multiple factors influencing child health and nutrition in urban environments. Access to healthcare services, economic conditions, maternal education, and dietary diversity may play larger roles in preventing stunting than exclusive breastfeeding alone (Demsa Simbolong & Nurlita Putri, 2024; Nuriyana & Anggorowati, 2024). These results may differ due to the exclusion of residential factors in previous studies. Other research has shown that exclusive breastfeeding during the first six months of life is critically important. Children who were not exclusively breastfed had a 9.44 times higher risk of stunting (OR: 9.44; 95% CI: 4.28–20.7) (Danaei et al., 2016). Children who were never breastfed had a 3.83 times higher risk of stunting (95% CI: 1.28–8.95), and delayed initiation of complementary feeding increased the risk of stunting by 2.782 times (Fikrie et al., 2024). Inadequate complementary feeding practices also raised the risk of stunting. Insufficient caloric intake was associated with a 2.37 times higher risk of stunting (OR: 2.37; 95% CI: 1.32–4.27; p = 0.004) (Habimana & Biracyaza, 2019).

The Associate of Child Factors on Stunting

Findings from this multivariate logistic regression analysis showed that sex and a history of stunting at birth played a significant role in the occurrence of stunting among children. Male children may be more vulnerable to stunting due to biological factors such as differences in metabolism and nutritional needs, as well as social and cultural factors that influence diet and childcare (Thompson, 2021). Fetal growth restriction (FGR) and premature birth are the strongest global determinants of stunting. Children who were born full-term but small for gestational age (SGA) have the highest risk of stunting, with 10.8 million stunting cases (95% CI 9.1 million–12.6 million) out of the total 44.1 million global cases attributed to this condition (Danaei et al., 2016). Research in Indonesia also showed that children with a history of low birth weight were at higher risk of stunting. Overall, the cluster of risk factors related to fetal growth restriction and premature birth (SGA; preterm, appropriate for gestational age/PAGA) is the strongest determinant of stunting, contributing to 32.5% of global stunting prevalence (14.4 million cases, 95% CI 12.6 million–16.2 million) (Danaei et al., 2016).

Studies showed that children with a history of low birth weight were at higher risk of stunting. A meta-analysis found that children with low birth weight have a 2.19 times higher risk of stunting compared to children born with normal birth weight (aOR = 2.19; 95% CI = 1.77-2.69; p < 0.001) (Ode et al., 2022). Low birth weight can affect a child's growth because babies with low birth weight often struggle to achieve optimal growth during the first two years of life. This growth failure can lead to stunting (Winowatan et al., 2019). Although many studies found a significant association between low birth weight and stunting, other studies have found no meaningful association. This suggests that the relationship between low birth weight and stunting may be influenced by other factors such as the environment, nutrition, and maternal health during pregnancy (Ramadhan et al., 2023).

CONCLUSION

This research has indicated that the prevalence of stunting among children was associated by both individual and environmental factors. In the context of urban area, individual factors that significantly associated with stunting include sex, health history, and low birth weight, with male children and those born with low birth weights being more susceptible. Family socioeconomic status also played a crucial role, with lower socioeconomic households facing higher risk of stunting due to social inequality and limited access to nutrition and healthcare. Furthermore, illnesses such as pulmonary TB demonstrated that poor environmental health also affect nutritional problems. This study recommends integrated interventions that focus on improved nutrition, healthcare access, and education for at-risk families. A holistic collaborative approach is essential to effectively address stunting and improve children's health and quality of life. This study provides an empirical basis for effective public health policies in Indonesia by emphasizing integrated interventions that consider social, economic, and reproductive health factors.

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