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Determinants of stunting among children aged 6–23 months in Bandung City: the role of maternal and child health factors

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ABSTRACT

Stunting is a global health problem that impacts children's physical growth, cognitive development, and future economic well-being. In Indonesia, although the prevalence of stunting has decreased, the incidence rate is still high, including in Bandung City. Maternal and child health factors play an important role in the incidence of stunting, but there is limited research on the interaction of these factors in an urban context. This study aims to analyze the influence of maternal and child health factors on the incidence of stunting in children aged 6-23 months in Bandung City. This study used a community-based cross-sectional design, involving 412 randomly selected children aged 6-23 months in Bandung City. The sample was collected using a multi-stage sampling technique. Data were collected through interviews using structured questionnaires and anthropometric measurements. Multivariate logistic regression was used to identify associations between maternal factors, child health, and the incidence of stunting. The prevalence of stunting in Bandung City was 35.0%. Analysis showed that factors associated with an increased risk of stunting included: having less than 4 antenatal visits (AOR=2.23), not exclusively breastfed (AOR=1.38), low birth weight (AOR=1.52), and history of infectious diseases (AOR=3.30). In addition, socioeconomic factors, such as low family income, also contributed significantly to the incidence of stunting (AOR=3.15). A correlation has been demonstrated between maternal and child health factors and the incidence of stunting in Bandung City. Policy recommendations include improving access to and quality of maternal health services, promoting exclusive breastfeeding, and nutrition counselling for low-income families.

INTRODUCTION

Stunting is a global health challenge that negatively impacts both the quality of life and human productivity, as it increases the risk of chronic diseases in adulthood and hampers cognitive development, leading to lower academic achievement and reduced economic capacity later in life.[1] WHO data shows that by 2022, around 22% of children under the age of five in the world will be stunted, making it one of the key indicators in achieving the Sustainable Development Goals (SDGs), particularly goal 2 on ending hunger and malnutrition.[2] In Indonesia, although the prevalence of stunting has significantly decreased from 30.8% in 2018 to 21.5% in 2023, it still remains above the WHO's recommended threshold of 20%, indicating a continued challenge in addressing the issue. West Java, as one of the provinces with the largest population, recorded an increase in stunting prevalence from 20.2% in 2022 to 21.7% in 2023, indicating that this issue is still a major concern.[3] In Bandung City, the prevalence of stunting has decreased from 28.12% in 2020 to 12.4% in 2024, but there are still sub-districts with high rates, such as Lengkong (14.35%) and Cibiru (13.18%).[4]

The government has made various efforts to address the issue of stunting, including the establishment of the National Movement for the Acceleration of Stunting Prevention (*Gerakan Nasional Percepatan Pencegahan Stunting*), the Healthy Indonesia Program with a Family Approach (*Program Indonesia Sehat dengan Pendekatan Keluarga*), and social assistance such as the Family Hope Program and Non-Cash Food Assistance (*Program Keluarga Harapan dan Bantuan Pangan Non-Tunai*). Additionally, improving maternal and child health services such as antenatal care (ANC) visits, fulfilling nutrition for pregnant women, and exclusive breastfeeding have become the main focus of the stunting prevention strategy.[5] However, various studies demonstrate that the implementation of this policy still faces obstacles at the local level, especially in accessing health services, nutrition education, and monitoring child growth in the community.[6]

Stunting has been demonstrated to exert a detrimental effect on children's health in the short term, as well as to engender a multitude of economic and social ramifications. Research has shown that stunted children are more prone to impaired cognitive development, developmental delays, and an elevated risk of non-communicable disease (NCD) in adulthood.[7] From an economic perspective, stunting contributes to reduced individual productivity and increases the risk of intergenerational transmission of poverty.[8] Various studies have identified factors that contribute to the incidence of stunting, including maternal age at pregnancy (<20 years), low levels of maternal education, lack of access to health services, and poor sanitation.[9] However, community-based studies in urban areas, such as Bandung City, remain limited in scope. These studies are further constrained by the fact that large cities exhibit distinct socio-economic characteristics compared to high prevalence areas, such as East Nusa Tenggara and Papua.[10]

While numerous studies have focused on high-prevalence areas like East Nusa Tenggara and Papua, community-based studies in urban areas such as Bandung City remain limited. Bandung City possesses unique socio-economic characteristics compared to areas with higher stunting rates. For example, Bandung City has easy access to health services, but at the same time faces challenges in food consumption patterns, sanitation, and economic disparities between areas. This study offers a novel contribution by integrating multiple maternal and child health factors, such as antenatal care, exclusive breastfeeding, low

birth weight, and infectious disease history into a comprehensive analytical model, a departure from previous studies that have addressed these factors separately. This integrated approach is particularly valuable in urban settings like Bandung, where socio-economic factors differ from those in high-prevalence regions. The model encompasses a range of factors, including antenatal care visits (ANC), exclusive breastfeeding, low birth weight (LBW), and a history of infectious diseases, which have been previously studied separately.[11,12] With a multivariate regression approach, this study is expected to provide a more comprehensive understanding of the relationships between these factors and the incidence of stunting.

Stunting remains a significant global health issue, with long-term implications for both child development and economic productivity. While global efforts continue to tackle this issue, local contexts such as urban areas like Bandung City present unique challenges and opportunities. This study aims to analyze the maternal and child health determinants influencing the incidence of stunting in children aged 6-23 months in Bandung City, offering evidence-based insights that can inform targeted interventions and public health policies at the local level. The findings will not only aid in optimizing maternal and child health programs but also enhance antenatal care services, expand exclusive breastfeeding initiatives, and strengthen community-based efforts to prevent stunting. By focusing on Bandung City, this study contributes to the development of a more contextualized, effective, and sustainable stunting prevention strategy that can also be applied to other urban areas facing similar challenges.

METHODS

Study design

A community-based cross-sectional study was conducted from June-August 2024. The Health Research Ethics Committee of Bhakti Kencana University has approved this study under the reference number 096/09.KEPK/UBK/VII/2024. All participants have voluntarily consented to take part in the research. Prior to the interview, each participant signed and completed a consent form.

Study area

Bandung City, as the capital of West Java and the third-largest city in Indonesia, is an ideal location for this research. With a population of over 3 million, it faces unique challenges related to stunting due to urban socio-economic disparities and varying access to healthcare services.

Study population

The target population consisted of children aged 6 to 23 months living in Bandung City. Children aged 6-23 months living in randomly selected households and present at the time of data collection constituted the study population in this study.

Sample size determination and sampling technique

The sample size was determined using A-priori sample size formulas for structural equation modeling, with a power of 80% and a 5% significance level, resulting in 412 respondents. Research participants were recruited using a multi-stage sampling technique. In the first stage, 10 sub-districts out of 30 were selected using the lottery method. Second, the sample size was allocated proportionally based on the number of households with children aged 6-23 months and a simple

random sampling technique was used to select children based on the existing sample frame from the Integrated Service Post. In households with two or more children aged 6-23 months, the youngest child was selected as the index child for measurement. The sampling method aimed to ensure a representative sample of children from various socio-economic backgrounds across different sub-districts of Bandung City.

Variables measurement

Height and weight: The height of infants aged 6-23 months was measured while lying down, to the nearest 0.1 cm, using a wooden board with a movable headpiece. In addition, the child's weight was measured using an electronic digital weight scale. Maternal height was measured in a standing position and measurements were taken by two data collectors holding a meter from the heel to the back of the head and measured to the nearest 0.1 cm.

Stunting: Height-for-age is a measure of linear growth retardation and cumulative growth deficit. Children who had a height-for-age Z (HAZ) value below minus two standard deviations (-2 SD) of the reference population median were considered stunted.

Data collection tools and procedure

The data were collected through house-to-house visits. The questionnaires were adapted from various types of literature and guidelines and prepared in the Indonesian language. The data were collected by anthropometric measurements (child height) and face-to-face interviews with eligible subjects using pre-tested, structured questionnaires. The questionnaire included detailed questions on socio-demographic factors (e.g., maternal education, family income) and key maternal and child health factors (e.g., antenatal care visits, exclusive breastfeeding practices, maternal health

history). Mothers were interviewed about their children using the questionnaire. To ensure data completeness, a systematic approach was applied to identify any missing data during the data collection process, and appropriate imputation techniques were applied where necessary.

Data quality management

Pre-test questionnaires were administered to 5% of the sample in the same area of Bandung City. Weight scales were checked with zero readings after and before each child was weighed. Data collectors and supervisors underwent a comprehensive two-day training on anthropometric measurement techniques, effective interviewing, criteria for household selection, and ethical considerations when engaging with participants. In addition, a clear introduction was given to respondents on the aims and objectives of the study prior to data collection. Concurrently, constant, and close monitoring and on-the-spot checks were conducted throughout the data collection process. To improve observer reliability, inter-rater reliability was assessed periodically, and data collectors' performance was reviewed. This ensured consistency in anthropometric measurements and data collection techniques across all study sites.

Data processing and analysis

Data were verified, coded, and entered into Epi-Info software version 7. Sex, age, and weight data were transferred into WHO Anthro software using WHO standards with participant identification numbers to translate nutritional data into Z scores for the HAZ index. The data, including HAZ, were then exported to SPSS version 29 for analysis. A descriptive analysis was performed using frequencies and percentages. Bivariate analysis was performed to determine the association between stunting and associated factors, and variables selected for multivariate

analysis were those with a p-value <0.25 or variables that were substantial risk factors for stunting. Multivariable logistic regression analysis was used to adjust for possible confounding factors. The strength of the association was then determined by calculating adjusted odds ratios (AOR) with 95% confidence intervals (CI) and a P-value of 0.05. Lastly, the Hosmer-Lemeshow fit test was employed to assess the model's fit. For handling missing data, missing values were assessed, and when appropriate, standard imputation techniques were applied. Additionally, all data collectors underwent reliability assessments to ensure consistency across measurements, and discrepancies were resolved immediately by cross-checking with senior supervisors.

RESULTS

Socio-demographic characteristics

The prevalence of stunting was found to be 35.0% (95% CI: 30.4-39.6). This study included a total of 412 participants. Nearly half of the mothers were aged 20-35 years (49.5%), and 38.6% of mothers had completed high school, while the majority of mothers were not working (59.5%). Regarding fathers, 41.5% had completed high school, and most were employed (54.4%). Almost half of the respondents had a household income below the regional minimum wage of Bandung City (IDR 4,200,000), representing 51.9% of the sample (Table 1).

Table 1. Sociodemographic characteristics of children under 24 months of age (n=412)

Sociodemographics	Frequency	Percentage
Mother's age		
<20 years	48	11.7
20–35 years	204	49.5
> 35 years	160	38.8
Mother's education		
Primary school/no school	80	19.4
Middle School	148	35.9
High School	159	38.6
College	25	6.1
Mother's occupation		
Unemployed	245	59.5
Employed	167	40.5
Father's education		
Primary school/no school	56	13.6
Middle School	136	33.0
High School	171	41.5
College	49	11.9
Father's occupation		
Unemployed	188	45.6
Employed	224	54.4
Household Income		
Low	198	48.1
High	214	51.9

Maternal and Child Health

In terms of maternal health, 47.8% of mothers had a height of less than 150 cm, and 44.2% of mothers had completed the full antenatal care (ANC) schedule. Only 35.2% of mothers exclusively breastfed their children. Regarding child health, most children were aged 12-23 months (66.7%), 53.2% were girls, and 48.1% were born with low birth weight (LBW) (< 2,500 kg). More than half (51.5%) of the children had a history of infectious diseases (Table 2).

Table 2. Frequency distribution of maternal and child health under 24 months of age (n=412)

Maternal and child health	Frequency	Percentage
Maternal height		
< 150 cm	197	47.8
≥ 150 cm	215	52.2
ANC Visits		
< 4	182	44.2
≥ 4	230	55.8
Exclusively breastfed		
No	145	35.2
Yes	267	64.8
Child's age		
<12 months	137	33.3
12–23 months	275	66.7
Child's gender		
Girls	219	53.2
Boys	193	46.8
Birth weight		
LBW (< 2,500 g)	198	48.1
Normal (≥ 2,500 g)	214	51.9
History of infectious disease		
Yes	212	51.5
No	200	48.5

Effect of Sociodemographics on stunting

In the univariate logistic regression, the odds of stunting were significantly higher for children born to non-working mothers (COR= 2.86, 95%CI: 1.83-4.48), and those born to low-income families (COR= 4.35, 95%CI: 2.80-6.74). Children born to mothers aged <20 years and 20-35 years were more likely to be stunted compared to those born to mothers aged >35 years (AOR= 1.47, 95%CI: 0.41-5.28 and AOR= 1.26, 95%CI: 0.35-4.53, respectively). The wide confidence intervals for these odds ratios indicate a large degree of uncertainty, particularly for the younger maternal age group, where the data variability is higher.

Table 3. Sociodemographic characteristics and incidence of stunting in children under 24 months of age (n=412)

Sociodemographics	Stunting		Unadjusted Odd Ratio (OR) [95%CI]	Adjusted Odd Ratio (OR) [95%CI]
	Yes	No		
Maternal age				
<20 years	15 (31.3)	33 (68.8)	0.909 (0.462-1.788)	1.477 (0.413-5.285)
20–35 years	68 (33.3)	136 (66.7)	0.738 (0.371-1.469)	1.268 (0.354-4.536)
> 35 years	61 (38.1)	99 (61.9)	1.00	1.00

Sociodemographics	Stunting		Unadjusted Odd Ratio (OR) [95%CI]	Adjusted Odd Ratio (OR) [95%CI]
	Yes	No		
Maternal education				
Primary school/no school	22 (27.5)	58 (72.5)	0.766 (0.421-1.394)	0.508 (0.108-2.385)
Middle School	49 (33.1)	99 (66.9)	0.563 (0.314-1.010)	0.253 (0.038-1.710)
High School	64 (40.3)	95 (59.7)	0.674 (0.260-1.748)	0.374 (0.062-2.247)
College	9 (36.0)	16 (64.0)	1.00	1.00
Maternal occupation				
Unemployed	108 (44.1)	137 (55.9)	2.868 (1.835-4.485)	1.865 (0.600-5.804)
Employed	36 (21.6)	131 (78.4)	1.00	1.00
Father's education				
Primary school/no school	14 (25.0)	43 (75.0)	0.687 (0.345-1.408)	0.927 (0.213-4.030)
Middle School	44 (32.4)	92 (67.6)	0.530 (0.268-1.045)	1.272 (0.207-7.823)
High School	66 (38.6)	105 (61.4)	0.483 (0.211-1.109)	0.970 (0.208-4.520)
College	20 (40.8)	29 (59.2)	1.00	1.00
Father's occupation				
Unemployed	68 (36.2)	120 (63.8)	1.104 (0.735-1.656)	1.053 (0.271-4.085)
Employed	76 (33.9)	148 (66.1)	1.00	1.00
Household income				
Low	102 (51.5)	96 (48.5)	4.351 (2.809-6.740)	3.150 (1.842-5.386)
High	42 (19.6)	172 (80.4)	1.00	1.00

Effect of maternal and child health on stunting

In the multivariable logistic regression, children born to mothers with incomplete ANC visits had higher odds of being stunted (AOR= 2.23, 95%CI: 1.35-3.67). Similarly, children who were not exclusively breastfed had higher odds of stunting (AOR= 1.38, 95%CI: 0.82-2.33).

It is important to note that the confidence interval for the breastfeeding variable is quite wide, indicating that the effect might not be as strong across all cases. The odds of stunting were significantly higher for children with low birth weight (AOR= 1.52, 95%CI: 0.90-2.57) and those with a history of infectious diseases (AOR= 3.30, 95%CI: 1.19-9.09).

Table 4. Maternal and child health and incidence of stunting in children under 24 months of age (n=412)

Maternal and child health	Stunting		Unadjusted Odd Ratio (OR) [95%CI]	Adjusted Odd Ratio (OR) [95%CI]
	Yes	No		
Maternal height				
< 150 cm	70 (35.5)	127 (64.5)	1.050 (0.700-1.575)	0.366 (0.104-1.288)
≥ 150 cm	74 (34.4)	141 (65.6)	1.00	1.00
ANC visit				
< 4	86 (47.3)	96 (52.7)	2.657 (1.752-4.028)	2.230 (1.353-3.676)
≥ 4	58 (35.2)	172 (74.8)	1.00	1.00
Exclusively breastfed				
No	76 (52.4)	69 (47.6)	3.223 (2.104-4.938)	1.388 (0.824-2.337)
Yes	68 (25.5)	199 (74.5)	1.00	1.00
Child's age				
<12 months	50 (36.5)	87 (63.5)	1.107 (0.721-1.698)	1.129 (0.531-2.401)
12–23 months	94 (34.2)	181 (65.8)	1.00	1.00

Maternal and child health	Stunting		Unadjusted Odd Ratio (OR) [95%CI]	Adjusted Odd Ratio (OR) [95%CI]
	Yes	No		
Child's Gender				
Girls	77 (35.2)	142 (64.8)	1.020 (0.680-1.530)	0.483 (0.162-1.437)
Boys	67 (34.7)	126 (65.3)	1.00	1.00
Birth weight				
LBW (< 2,500 g)	86 (43.4)	112 (56.6)	2.065 (1.368-3.119)	1.522 (0.900-2.574)
Normal (≥ 2,500 g)	58 (27.1)	156 (72.9)	1.00	1.00
History of infectious disease				
Yes	104 (49.1)	108 (50.9)	3.852 (2.484-5.974)	3.301 (1.198-9.094)
No	40 (20.0)	160 (80.0)	1.00	1.00

DISCUSSION

The study revealed that 35.0% of children aged 0-23 months were affected by stunting. Stunting, an indicator of chronic malnutrition, has been associated with developmental delays, inadequate psychosocial stimulation, long-term academic difficulties, and stunted life potential.[13,14] The repercussions of these factors have been shown to impede progress in achieving the Sustainable Development Goals (SDGs). Consequently, addressing child nutrition is imperative to support health, education, and economic development agendas at both the national and global levels. The prevalence of stunting in this study is classified as "very serious" or "critical" in the study areas, according to the WHO classification. This indicates that stunting is a significant public health challenge in Indonesia.[15] The results of this study are consistent with the national prevalence of stunting of 21.5% among children under the age of five in 2023.[16] This rate is higher than the global stunting prevalence of 22.3% (21.8% - 22.9%) reported in 2022.[17] In addition, the prevalence of stunting noted in this study was higher compared to the prevalence of stunting observed in Ghana, where the reported rate was lower at 12.5%. Research conducted in low- and lower-middle income African countries found that 31.28% of children under five years of age were stunted.[18,19] This discrepancy in stunting prevalence may be largely influenced by local socio-economic factors, cultural practices, and healthcare infrastructure, which differ significantly across regions. Differences in child feeding practices, access to healthcare services, and public health initiatives also contribute to varying stunting rates. These factors underline the importance of tailoring interventions to local contexts. Moreover, variations in sample size, dietary habits, infant and young child feeding policies, and differing levels of education and culture play significant roles. Risk factors such as low birth weight, exclusive breastfeeding, history of infectious diseases, maternal education, socioeconomic status, and maternal knowledge of nutrition further contribute to the incidence of stunting across different regions of Indonesia.[20–22]

The present study found that children born to mothers under the age of 20 have a greater chance of being stunted. This finding aligns with the conclusions of previous studies, which have demonstrated that young maternal age at delivery is associated with an elevated risk of stunting in children. This phenomenon is often attributed to a combination of factors, including limited nutritional knowledge, suboptimal nutritional status during pregnancy, and limited access to maternal and child health services.[23,24] In the urban context of Bandung City, challenges such as limited access to health services for pregnant adolescents and a lack of nutrition education exacerbate this issue. While health facilities may be more accessible in urban areas compared to rural ones, young mothers in cities often face cultural and

economic barriers that prevent them from utilizing these services effectively. Other studies have shown that younger mothers tend to experience limitations in providing good parenting and optimal child nutrition, thus increasing the risk of stunting.[25] In Bandung City, this factor is further exacerbated by urban challenges, such as limited access to health facilities for pregnant adolescents and lack of education on nutrition during pregnancy. Thus, interventions that target nutrition education for adolescent girls are needed to reduce the prevalence of stunting.

The findings indicate that children of non-working mothers are more susceptible to stunting compared to children of working mothers. This observation is corroborated by extant research, which demonstrates that working mothers possess superior economic resources, enabling them to procure nutritious food and enhance their family's well-being.[26] However, the ability of working mothers to balance employment with childcare remains a significant challenge in urban settings like Bandung, where high living costs may force mothers into longer working hours, reducing their time for proper childcare and feeding practices. Extant research has demonstrated that maternal employment can have adverse consequences if it is not balanced with sufficient time to care for children and provide adequate nutrition.[27,28] In Bandung City, a significant proportion of unemployed mothers hail from families with limited educational attainment, which may lead to a dearth of knowledge regarding child nutrition and health. Consequently, policies that promote maternal economic empowerment without sacrificing childcare time emerge as a promising solution to address stunting.

The study's findings indicate that children from low-income families are more susceptible to stunting. This observation aligns with the findings of numerous studies that demonstrate a direct correlation between economic deprivation and the quality of food consumed by children, as well as their access to healthcare services.[29,30] A body of research has indicated that even minor increases in family income can result in a decline in the prevalence of stunting.[31,32] In Bandung City, disparities in income across different sub-districts contribute to varying rates of stunting. While some areas of the city have higher incomes and better access to health services, other areas, particularly those on the city's outskirts, face significant challenges in food security and healthcare access. High economic inequality in Bandung has been identified as a major factor contributing to disparities in child nutrition. Families with low incomes often rely on inexpensive, yet nutritionally deficient, food options, further exacerbating the risk of stunting. Additionally, limited access to clean water and adequate sanitation has been shown to increase stunting rates.[33] Consequently, the implementation of targeted social assistance programs aimed at enhancing the food security and nutrition of poor families is imperative to prevent stunting.[33]

Children born to mothers with incomplete antenatal care (ANC) visits are more likely to be stunted. This is due to the lack of monitoring of maternal and fetal health during pregnancy, which contributes to low birth weight (LBW) and infant nutrition problems. These results are consistent with previous research showing that suboptimal ANC visits increase the risk of LBW and nutritional deficiencies that impact child growth.[34–36] In urban areas like Bandung, although healthcare services are more accessible compared to other regions of Indonesia, challenges such as overcrowding and insufficient patient education still exist, limiting the effectiveness of antenatal care (ANC).

Disparities in the quality of ANC services persist, and ensuring that pregnant women receive comprehensive services with adequate education on nutrition is crucial to reducing stunting rates. Studies have shown that mothers with limited educational attainment and restricted access to healthcare are disproportionately susceptible to delivering low-birthweight (LBW) infants, which, in turn, elevates the likelihood of stunting among their offspring.[37]

Children who are not exclusively breastfed for the first six months of life are more prone to stunting. Breast milk contains essential nutrients that support optimal growth and protection from infections. These results are consistent with previous studies that have found that exclusive breastfeeding has a protective effect on the risk of stunting.[1,36,38] In Bandung City, socio-economic factors and cultural beliefs significantly influence breastfeeding practices. Some mothers, especially those in lower-income households, may return to work early, reducing the time available for exclusive breastfeeding. Additionally, a lack of education regarding the significance of exclusive breastfeeding further contributes to its early discontinuation. In Bandung, the level of breastmilk exclusivity remains heterogeneous, with a variety of cultural and socio-economic factors impacting maternal breastfeeding patterns. Increasing workplace support for breastfeeding mothers and raising awareness about the importance of breastfeeding are essential strategies. Education-based interventions can help increase exclusive breastfeeding rates, thereby reducing the risk of stunting.[38]

Children with low birth weight (LBW) have a higher risk of stunting due to intrauterine growth restriction, which impacts long-term child development. Research shows that LBW is associated with an increased risk of stunting. Another study in Indonesia found that mothers who attended fewer than four antenatal care (ANC) visits during pregnancy increased the risk of LBW by 1.86 times, which in turn increased the prevalence of stunting.[34] Meanwhile, other studies have shown that mothers with low education levels and poor socioeconomic conditions are more likely to give birth to LBW babies, which in turn increases the likelihood of stunting.[37] In Bandung City, the prevalence LBW remains high, particularly in areas with low socioeconomic status. A multitude of factors, including inadequate maternal nutrition and exposure to infections during pregnancy, have been identified as contributing to the increased risk of LBW, which, in turn, can adversely impact child growth. Studies have demonstrated that nutritional interventions during pregnancy, such as iron and folic acid supplementation, can effectively reduce LBW rates and mitigate the risk of stunting in offspring.[39]

Children who often experience infectious diseases, such as diarrhea or respiratory infections, are more prone to stunting due to impaired absorption of nutrients and increased energy needs due to infection. These results are in line with research that found that a history of infection is closely related to the incidence of stunting.[7,40,41] In Bandung, sanitation and access to clean water remain a challenge in some areas. These factors worsen children's health conditions and increase the incidence of infectious diseases that contribute to stunting. Other studies in Indonesia have also highlighted the importance of interventions in the sanitation and environmental hygiene sectors in stunting prevention efforts.[42]

Based on the results of this study and findings in the field, factors such as incomplete ANC visits, not being exclusively breastfed, low birth weight, and a history of infectious diseases significantly contribute to the incidence of stunting in children. This is reinforced by previous studies, which show that socioeconomic factors, access to health services, and

parenting play an important role in the prevention of stunting.[43,44] To address this issue, it is imperative to implement interventions that include improving access to maternal and child health services, promoting exclusive breastfeeding, improving maternal nutrition, and improving environmental hygiene to prevent infectious diseases that can impact child growth. Addressing these factors requires a multifaceted approach that is sensitive to the local context, including socio-economic conditions, healthcare access, and cultural practices.

This study has several strengths, including a community-based cross-sectional design that allows for a clearer understanding of the prevalence and determinants of stunting in Bandung City. The use of multivariate logistic regression analysis allowed for a more valid identification of factors associated with stunting, and the representative population provided a more generalized picture. However, this study also has limitations. The cross-sectional design could not identify cause-and-effect relationships, and the interview-dependent data were subject to reporting bias. In addition, the measurement of children's nutritional status only used the HAZ Z-score, which is limited in describing overall nutritional status. This study was also only conducted in Bandung City, so the results may not be fully generalizable to other areas, and environmental factors such as water quality and sanitation have not been considered in depth.

CONCLUSION

This study shows that maternal and child factors significantly contribute to the incidence of stunting in children aged 6-23 months in Bandung City. A multitude of maternal sociodemographic factors have been demonstrated to increase the risk of stunting in children. These factors include young maternal age at childbirth, employment that does not support economic access, and low levels of education and family income. Furthermore, inadequate antenatal care has been associated with an increased risk of low birth weight (LBW), a major factor to stunting. Lack of exclusive breastfeeding and a history of recurrent infectious diseases have also been shown to negatively impact child growth. The findings of this study align with national strategies and international goals, such as the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being). These SDGs emphasize the importance of improving child nutrition and reducing stunting. To address these issues, the government should prioritize enhancing antenatal care (ANC) services, including regular screening and counseling for pregnant women. Nutritional supplementation programs should be expanded, and immunization coverage should be increased to prevent low birth weight (LBW) and childhood infections. Additionally, improved sanitation facilities should be provided in vulnerable areas. Nutrition and reproductive health education for pregnant women should be expanded, while support for exclusive breastfeeding should be strengthened with policies that support breastfeeding mothers. In addition, social assistance and economic empowerment programs should be expanded to ensure families' access to adequate nutrition. An integrated multi-sectoral approach will contribute to reducing stunting in Bandung City and support broader efforts to meet the Global Nutrition Targets set by the World Health Assembly (WHA) and related international frameworks.

AUTHOR CONTRIBUTIONS

Muzayyana Muzayyana: Conceptualization, Methodology, Data Curation, Writing – Original Draft. Alhidayah Alhidayah: Investigation, Data Curation, Writing – Original Draft. Sitti Nurul Hikma Saleh: Investigation, Validation, Writing – Review & Editing. St. Rahmawati Hamzah: Investigation, Formal Analysis, Writing – Review & Editing. Hafsia Khairun Nisa Mokodompit: Resources, Data Curation, Visualization. Hairil Akbar: Supervision, Methodology, Writing – Review & Editing. Yanyan Mulyani: Supervision, Project Administration, Writing – Review & Editing.

ETHICAL CONSIDERATION

This study has received ethical approval from the Health Research Ethics Committee, Bhakti Kencana University, with approval number 096/09.KEPK/UBK/VII/2024, dated 15 April 2024. All procedures conducted in this study were in accordance with the ethical standards of the institutional research committee.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript

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