

Factors Associated with Stunting Incidence in Gemawang Sub-district, Temanggung Regency

Nissa Kusariana^{1*}, Nurhasmadiar Nandini², Nikie Astorina Yunita Dewanti³ and Lu'luil Ma'rifati¹

¹Department of Epidemiology and Tropical Disease, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia

²Department of Administration and Health Policy, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia

³Department of Environmental Health, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia,

Abstract. Despite various stunting prevention efforts implemented through policies and programs of the Regional Government and the Health Office of Temanggung Regency stunting cases in Temanggung Regency. This study aims to identify the factors associated with stunting in Gemawang Subdistrict, Temanggung Regency. This study used quantitative design with a cross-sectional approach. A total of 222 respondents who were mothers of toddlers participated in this study. The study found a significant relationship between low-birth weight (LBW) and stunting incidence in toddlers ($p = 0.001$). Other factors such as immunization status ($p = 0.859$), exclusive breastfeeding ($p = 0.460$), early initiation of breastfeeding ($p = 0.509$), formula feeding ($p = 0.884$), the presence of smokers at home ($p = 0.231$), history of infectious diseases ($p = 0.559$) and history of diarrhea ($p = 0.180$) showed no significant relationship with stunting incidence. Based on these findings stunting in Gemawang Subdistrict, Temanggung Regency, focus on monitoring and evaluating the nutritional status of pregnant women, as well as providing education on adolescent nutrition to prepare for pregnancy to prevent LBW, which is a key factor associated with stunting in toddlers.

1 Introduction

Stunting remains a major health problem for toddlers in Indonesia. According to Basic Health Research (*Riset Kesehatan Dasar/RISKESDAS*), the prevalence of stunting in Indonesia was 36.8% in 2007, 35.6% in 2010, and 37.2% in 2013. Despite a decrease to 30.8% in 2018 and 24.4% in 2021, [1,2], stunting continues to be a significant concern. The Indonesian government has set a target to reduce the prevalence of stunting to 14% by 2024, which requires an annual reduction of approximately 2.7%. [2,3]

In 2019, the proportion of stunting among toddlers in Central Java was 27.68%, which was higher than the national average. [4] One of the regencies in Central Java a high incidence of stunting is Temanggung Regency. In 2019, 13.3% of toddlers in Temanggung Regency were classified as having short stature. Between 2020 and 2021, the number of stunting cases in the regency increased to 7,143 toddlers, a major health problem in the regency. [5]

The COVID-19 pandemic likely exacerbated the situation, as it disrupted stunting prevention all cities and regencies in Indonesia. [6] In addition, the economic impact of the

* Corresponding author: nissakusariana@gmail.com

pandemic greatly affected household's ability to meet the nutritional needs of their children, especially toddlers. [6–8] Despite various stunting prevention efforts implemented through policies and programs of the Regional Government and the Health Office Temanggung Regency stunting cases in Regency. This study aims to identify factors associated with stunting in Gemawang Subdistrict, Temanggung Regency

2 Methods

This study used a quantitative design with a cross-sectional approach. This study was conducted in Gemawang Sub-district, Temanggung Regency, Central Java, Indonesia due to its high of stunting cases in 2021. The population comprised 1.823 mothers with toddlers aged between 6 and 59 months residing in Gemawang Subdistrict. The sample of this mothers with toddlers in a village that had been designated as a stunting locus. A total sample size of 222 respondents was calculated and obtained using the Raosoft. [9,10]

The dependent variable in this study was stunting, measured as the nutritional status of young children. The World Health Organization (WHO) growth standards, Height for age was used to determine stunting with Z-scores categorized as severe stunting (≤ -3.0 SD), stunting (-3.0 SD to -2.0 SD), and normal (≥ -2 SD). [11] The independent variables examined for their association with stunting included low birth weight (LBW), immunization status, exclusive breastfeeding, early initiation of breastfeeding, formula feeding, the presence of active smokers in the household, history of infectious diseases, and history of diarrhea. Additionally, this study described the characteristics of toddlers including age, sex, type of birth (vaginal or cesarean).

A normality test was performed using the Kolmogorov-Smirnov test, with Lilliefors Significance Correction to ensure that the data were normally distributed. With a sample size of 222, the test yielded a Kolmogorov-Smirnov statistic of 0.082 and a p-value of 0.166, suggesting that the data were normally distributed ($p > 0.05$).

Descriptive statistics and chi-squared analysis were performed using IBM SPSS (version 16.0). This study received approval from the Health Research Ethics Committee of the Faculty of Public Health, Universitas Diponegoro with a certificate number 186/EA/ KEPK-FKM/2022.

3 Results And Discussion

3.1 Characteristics of Toddlers

Table 1 shows that the majority of respondents had toddlers aged between 12 and 23 months (21.20%) and between 24 and 35 months (21.20%). More than half of the toddlers were male (53.20%) and most were born through a vaginal birth (78.80%).

In this study, 30.60% of toddlers experienced stunting, and 10.80% were born with a low birth weight (LBW). In addition, 21.20% of toddlers had not received complete immunizations. Most mothers (90.50%) had provided exclusive breastfeeding for their toddlers and the majority of mothers (86%) initiated early breastfeeding. However, a significant number of mothers (45.90%) still gave formula milk to their toddlers (Table 1). In terms of health conditions, most toddlers (57.20%) had experienced infectious diseases, while only a small number of toddlers (4.5%) had suffered from diarrhea. Furthermore, most toddlers (84.20%) lived in households with family members who were active smokers.

Table 1. Frequency distribution of characteristics of the toddlers

Variables	N = 222	%
Age		
0 – 11 months	46	20.70
12 – 23 months	47	21.20
24 – 35 months	47	21.20
26 – 47 months	45	20.30
48 – 60 months	37	16.70
Sex		
Male	118	53.20
Female	104	46.80
Type of birth		
Vaginal birth	175	78.80
Caesarean birth	47	21.20
Stunting		
Yes	68	30.60
No	154	69.40
LBW		
Yes	24	10.80
No	198	89.20
Immunization		
Not complete	47	21.20
Complete	175	78.80
Exclusive breastfeeding		
No	21	9.50
Yes	201	90.50
Early Initiation of breastfeeding		
No	31	14.00
Yes	191	86.00
Formula milk		
Yes	102	45.90
No	120	54.10
Active smokers in the household		
Yes	187	84.20
No	35	15.80
History of infectious diseases		
Yes	127	57.20
No	95	42.80
History of diarrhea		
Yes	10	4.50
No	212	95.50
Total	222	100.00

3.2 Height for Age Based on Age

Table 2 shows that stunting cases with very short stature were mostly found in toddlers aged between 36 and 47 months (15.60%), while stunting cases with short stature were mostly found in toddlers aged between 24 and 35 months (29.80%).

Table 2. Frequency distribution of stunting category based on age

Age (months)	Height for Age									
	Very short		Short		Normal		Tall		Total	
	N	%	N	%	N	%	N	%	N	%
0-11	5	10.90	7	15.20	28	60.90	6	13.00	46	100.00
12-23	4	8.50	9	19.10	32	68.10	2	4.30	47	100.00
24-35	6	12.80	14	29.80	27	57.40	0	0.00	47	100.00
36-47	7	15.60	6	13.30	32	71.10	0	0.00	45	100.00
48-60	2	5.40	8	21.60	27	73.00	0	0.00	37	100.00

3.3 Stature per Age Based on Sex

Table 3 shows that stunting cases in toddlers with short stature (26%) and very short stature (11.50%) were mostly found in female toddlers.

Table 3. Frequency distribution of stunting category based on sex

Sex	Height for Age									
	Very short		Short		Normal		Tall		Very tall	
	N	%	N	%	N	%	N	%	N	%
Male	12	10.20	17	14.40	82	69.50	7	5.90	118	100.00
Female	12	11.50	27	26.00	64	61.50	1	1.00	104	100.00

3.4 Factors Related to Stunting

Table 4 showed a significant relationship between LBW and stunting in toddlers in Gemawang Sub-district, Temanggung Regency ($p = 0.001$). However, no significant relationships were found between stunting and other factors, such as immunization ($p = 0.859$), exclusive breastfeeding ($p = 0.460$), early initiation of breastfeeding ($p = 0.509$), formula feeding ($p = 0.884$), the presence of active smokers (p - value 0.231), history of infectious diseases ($p = 0.559$), and history of diarrhea ($p = 0.180$).

Table 4. Relationship between stunting and other factors

Factors	F		Stunting				p-value
			Yes		No		
	n	%	n	%	N	%	
LBW							
Yes	24	10.80	15	62.50	9	37.50	0.001
No	198	89.20	53	26.80	145	73.20	
Immunization							
Not complete	47	21.20	15	31.90	32	68.10	0.859
Complete	175	78.80	53	30.30	122	69.70	
Exclusive breastfeeding							
Yes	201	90.50	60	29.90	141	70.10	0.460
No	21	9.50	8	38.10	13	61.90	
Early initiation of breastfeeding							
Yes	191	86.00	59	30.90	132	69.10	0.509
No	31	14.00	9	29.00	22	71.00	

Factors	F		Stunting				p-value
			Yes		No		
	n	%	n	%	N	%	
Formula feeding							
Yes	102	45.90	32	31.40	70	68.60	0.884
No	120	54.10	36	30.00	84	70.00	
Active smokers in the household							
Yes	187	84.20	54	28.90	133	71.10	0.231
No	35	15.80	14	40.00	21	60.00	
History of infectious diseases							
Yes	127	57.20	41	32.30	86	67.70	0.559
No	95	42.80	27	28.40	68	71.60	
History of diarrhea							
Yes	10	4.50	5	50.00	5	50.00	0.180
No	212	95.50	63	29.70	149	70.30	

The findings of this study indicated a significant relationship between LBW and stunting in toddlers in Gemawang Sub-district, Temanggung Regency. The high prevalence of LBW in Indonesia is suspected to contribute to the high incidence of stunting cases. Several studies have identified LBW as a strong risk factor for stunting in toddlers aged 12 months. [12–14] Other studies have shown that toddlers with LBW are 25 times more likely to experience stunting compared to with a normal baby weight ($\geq 2,500$ grams). [12–14]

Malnutrition can begin in utero and continue in the early days after birth. However, stunting is typically not detected until the child is two years old. Malnutrition that occurs during pregnancy can result in LBW and underweight babies are more prone to malnutrition in early childhood. This affects their ability to store nutrients used for growth. Depleted nutrients lead to reduced tissue, low hemoglobin levels, low serum vitamin A and carotene and increased lactic acid and pyruvate, all of which contribute to stunting in toddlers. [12,13,15]

This condition is often the result of intrauterine growth retardation (IUGR), which slows down the growth and development of LBW babies compared to those born with normal weight. As a result, they often fail to meet the developmental milestones expected for their age. Growth retardation is associated with brain development, as somatic growth occurs before 20 weeks of gestation. [13,16–18]

Birth weight is closely related to maternal health and nutrition both before and during pregnancy. Adequate maternal health and nutrition during adolescence plays a critical role in maternal health and nutrition during pregnancy. [19,20] Toddlers born with LBW experience delayed growth and development during pregnancy and may also suffer from digestive disorders post-birth. Digestive disorders in LBW babies are caused by their reduced capacity to absorb fats and digest proteins. This condition leads to nutrient deficiencies that increase the likelihood of stunting in toddlers. [14,17,18,21,22]

Even though no significant relationship between immunization and stunting was found, some toddlers in Gemawang Sub-district who had not received complete immunizations experienced stunting. Immunization prevents infectious diseases and strengthens the immune system, which is especially important for toddlers at risk of stunting. [23–25]

This study also found that many stunted toddlers did not receive exclusive breastfeeding. Exclusive breastfeeding has been shown to reduce the risk of stunting by two times, especially during the first 1,000 days of life. [12,25–27] Infectious diseases such as diarrhea

can also influence stunting in toddlers. A relationship between diarrhea and stunting was found in this study, many stunted toddlers had a history of diarrhea. Toddlers who often experience diarrhea are four times more likely to experience stunting. This is because malnutrition can interfere with nutrients absorption and increase the risk of contracting infectious diseases in toddlers. [27,28]

4 Conclusion

In conclusion, this study found a significant relationship between LBW and stunting in toddlers in Gemawang Sub-district, Temanggung Regency ($p = 0.001$). However, no significant relationships were found between stunting and other factors, such as immunization ($p = 0.859$), exclusive breastfeeding ($p = 0.460$), early initiation of breastfeeding ($p = 0.509$), formula feeding ($p = 0.884$), the presence of active smokers ($p = 0.231$), infectious diseases ($p = 0.559$), and diarrhea ($p = 0.180$). To prevent stunting in Gemawang Subdistrict, it is necessary to monitor and evaluate the nutritional status of pregnant women and ensure their nutritional needs are met. In addition, educating teenage girls (future mothers) about proper nutrition is to reducing the risk of LBW.

We would like to express our gratitude to the Heath Office of Temanggung Regency,, the Gemawang Health Center, and the community in Gemawang Subdistrict for their support in this study. We also thank the Faculty of Public Health, Universitas Diponegoro for funding this study (number: 019/UN7.5.9.2/HK/2022).

References

- 1 Kementerian Kesehatan RI, Profil Kesehatan Indonesia 2021, 2021.
- 2 Kementerian Kesehatan RI, Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) Tingkat Nasional, Provinsi, Dan Kabupaten/Kota Tahun 2021, 2021.
- 3 Dimas Bayu, Prevalensi Stunting di Indonesia Capai 24,4% pada 2021, Prevalensi Stunting Di Indonesia Capai 24,4% Pada 2021. DataIndonesia.Id (2022).
- 4 Dinas Kesehatan Provinsi Jawa Tengah, Profil Kesehatan Provinsi Jawa Tengah Tahun 2018, 2018.
- 5 Dinas Kesehatan Kabupaten Temanggung, Laporan Rutin Dinas Kesehatan Kabupaten Temanggung, 2021.
- 6 Tisna Yanti and DiahAdni Fauziah, The Effect of Family Income on Stunting Incident in Preschool Children at Bogor City During COVID-19 Pandemic, *Indian J Public Health Res Dev* **12**, 407 (2021).
- 7 N. Akseer, G. Kandru, E. C. Keats, and Z. A. Bhutta, COVID-19 pandemic and mitigation strategies: Implications for maternal and child health and nutrition, *American Journal of Clinical Nutrition* **112**, 251 (2020).
- 8 S. Osendarp et al., The COVID-19 Crisis will Exacerbate Maternal and Child Undernutrition and Child Mortality in Low- and Middle-income Countries, *Nat Food* **2**, 476 (2021).
- 9 Raosoft, *Raosoft Sample Size Calculator*, <http://www.raosoft.com/samplesize.html>.
- 10 P. Modjadji, L. N. Masilela, L. Cele, M. Mathibe, and P. M. Mphekgwana, Evidence of Concurrent Stunting and Obesity among Children under 2 Years from Socio-Economically Disadvantaged Backgrounds in the Era of the Integrated Nutrition Programme in South Africa, *Int J Environ Res Public Health* **19**, (2022).
- 11 A. D. Laksono, N. E. W. Sukoco, T. Rachmawati, and R. D. Wulandari, Factors Related to Stunting Incidence in Toddlers with Working Mothers in Indonesia, *Int J Environ Res Public Health* **19**, 10654 (2022).
- 12 B. G. Nainggolan and M. Sitompul, Hubungan Berat Badan Lahir Rendah (BBLR) Dengan Kejadian Stunting Pada Anak Usia 1-3 Tahun, *Nutrix Journal* **3**, 36 (2019).
- 13 D. Nasution, D. Siti Nurdianti, and E. Huriyati, Berat Badan Lahir Rendah (BBLR) dengan Kejadian Stunting Pada Anak Usia 6-24 Bulan, *Jurnal Gizi Klinik Indonesia* **11**, (2014).
- 14 S. Tia Tamy, H. Wahyu Nugroho, R. Syuadzah, and D. Kartikawati, The Associations between Anemia, Stunting, Low Birthweight, and Cognitive Ability in Indonesian Children: An Analysis from Indonesian Family Life Survey, *Journal of Maternal and Child Health* **05**, 402 (2020).

- 15 F. C. Murti, S. Suryati, and E. Oktavianto, Hubungan Berat Badan Lahir Rendah (BBLR) Dengan Kejadian Stunting Pada Balita Usia 2-5 Tahun Di Desa Umbulrejo Kecamatan Ponjong Kabupaten Gunung Kidul, *Jurnal Ilmiah Kesehatan Keperawatan* **16**, 52 (2020).
- 16 Anggraeni Indah Kusumaningrum and Menik Sri Daryanti, Chronic Energy Deficiency During Pregnancy with Baby Low Birth Weight in Temanggung Health Center, *Menara Jurnal of Health Science* **1**, 72 (2022).
- 17 T. Aisyah Putri, D. Anindita Salsabilla, and R. Kurniawan Saputra, The Effect of Low Birth Weight on Stunting in Children Under Five: A Meta Analysis, *Universitas Sebelas Maret Meta-Analysis* **06**, 496 (2021).
- 18 M. R. K. Chowdhury, M. S. Rahman, B. Billah, R. Kabir, N. K. P. Perera, and M. Kader, The prevalence and socio-demographic risk factors of coexistence of stunting, wasting, and underweight among children under five years in Bangladesh: a cross-sectional study, *BMC Nutr* **8**, (2022).
- 19 M. Beniko, A. Mongkolchat, J. Chompikul, and R. Phuphaibul, Relationship between child rearing and child nutritional status during the first year of life in Thailand, *Journal of Public Health and Development* **14**, 3 (2016).
- 20 M. Anismuslim, H. Pramodyo, S. Andarini, and S. -, The Effect of Sanitation Risk on Toddler Stunting Incident with Geographically Weighted Regression Approach in Malang Regency, Indonesia, *Journal of Public Health and Development* **21**, 90 (2023).
- 21 N. K. Aryastami, A. Shankar, N. Kusumawardani, B. Besral, A. B. Jahari, and E. Achadi, Low birth weight was the most dominant predictor associated with stunting among children aged 12-23 months in Indonesia, *BMC Nutr* **3**, (2017).
- 22 Shalza Ellian Farthur Ihza, Dina Rahayuning Pangestuti, Alfi Fairuz Asna, and Naintina Lisnawati, Nutritional Status and Motor Development of Toddlers Aged 24-59 Months in Agricultural Area of Semarang District, *Amerta Nutrition* **8**, 199 (2024).
- 23 J. Hadisuyitno and B. Doddy Riyadi, Determinant Factors of Stunting Events of Toddler in Batu City Indonesia, *Systematic Reviews in Pharmacy* **12**, 231 (2021).
- 24 Amanat Ali, Current Status of Malnutrition and Stunting in Pakistani Children: What Needs to Be Done?, *J Am Coll Nutr* **40**, 180 (2021).
- 25 Nilatul Izaha, Evi Zulfianab, and Nora Rahmanindar, Analisis Sebaran dan Determinan Stunting Pada Balita Berdasarkan Pola Asuh (Status Imunisasi dan Pemberian Asi Eksklusif), *Jurnal Ilmu Keperawatan Dan Kebidanan* **11**, 27 (2020).
- 26 M. Kashaki, F. M. Samghabadi, and A. Bordbar, Effect of Fortification of Breast Milk in Conjugation with Protein Supplement on Neurodevelopment of Preterm Low Birth Weight Infants at 3 Years, *Med Arch* **73**, 344 (2019).
- 27 Djuhadijah Saadong, Suriani B, Nurjaya, and Subriah, BBLR, Pemberian Asi Eksklusif, Pendapatan Keluarga, Dan Penyakit Infeksi berhubungan Dengan Kejadian Stunting, *Jurnal Kesehatan Manarang* **7**, 52 (2021).
- 28 G. Apriluana and S. Fikawati, Analisis Faktor-Faktor Risiko terhadap Kejadian Stunting pada Balita (0-59 Bulan) di Negara Berkembang dan Asia Tenggara, *Media Penelitian Dan Pengembangan Kesehatan* **28**, 247 (2018).