JOURNAL OF NUTRITION COLLEGE
Volume 12, Nomor 1, Tahun 2023, Halaman 42-52
Online di: http://ejournal3.undip.ac.id/index.php/jnc/
Submitted: 16 Agustus 2022
Accepted: 14 Februari 2023

A POOLED DATA ANALYSIS TO DETERMINE RISK FACTORS OF CHILDHOOD STUNTING IN INDONESIA

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ABSTRACT

Background: Stunting among children remains a public health concern in Indonesia, where the prevalence of stunting in rural areas is higher than in urban areas.
Objectives: This study aimed to analyze risk factors for stunting and severe stunting among children aged 0-59 months in rural and urban Indonesia.
Method: This cross-sectional study used pooled datasets from Indonesia's Basic Health Research in 2007, 2010, and 2013. Our study samples included 38,246 children aged 0-59 months whose height-for-age Z-score (HAZ) was between -5.99 and 5.99 standard deviations. The primary outcomes were stunting and severe stunting, whereas dependent variables included factors at the child, household, and community levels. We apply Stata 13 for univariate, bivariate, and multivariate analysis.
The prevalence of stunting and severe stunting was higher in rural than urban areas. On one hand, risk factors significantly associated with stunting and severe stunting in urban areas were low birth weight, maternal height, informal father's occupation, low economic level, and children from East Indonesia and Sumatra. Furthermore, the father's height was only associated with stunting, while the number of children >3 was only associated with severe stunting. On the other hand, risk factors age, low birth weight, maternal height, father's height, household member 5-9 people, middle and low economic level were significantly associated with stunting and severe stunting in rural areas. Moreover, poor WASH was only associated with stunting, while informal mother occupation, low father education, number of household members > 9 people, and living in Sumatra and East Indonesia were associated with severe stunting in rural areas.
Conclusion: Low birth weight, short parents, and economic income were risk factors for stunting and severe stunting children in urban and rural areas.

Keywords: Children; Pooled data; Risk factors; Stunting

INTRODUCTION

Stunted growth in children is an indicator of chronic malnutrition, defined by height-for-age Z-score (HAZ) less than minus two standard deviations (SD), while severe stunting is below minus three SD.[1] Children who suffer from stunting and severe stunting are shorter than normal, indicating cumulative linear growth retardation and its consequences.[2-3] The prevalence of stunting in Indonesia remains high due to chronic malnutrition, which is relatively hard to eradicate. Despite many specific and sensitive interventions to overcome this public health problem, Indonesia's Basic Health Research (NIHRD) revealed that stunting prevalence among children decrease from 2007, 2010, 2013, 2018 to 2021 whereas 36.8%[4], 35.6%[5], 37.2%[6], 30.8%[7], and 24.4%[8] respectively.

Under five children malnutrition is significantly linked to severe dysfunction, mental retardation, and poor ability to work,[9-11] all of which would place a significant financial burden on society.[11] Stunting related to abdominal obesity is characterized by increased waist circumference and is associated with a higher risk of glucose intolerance, diabetes mellitus, hypertension, stroke, heart disease, and disease complications.[12-13]

Several factors influence stunting, including social demographics such as education, occupation, economic level, number of household members, parity, housing, sanitation, water access, and residence. Other factors cover biological aspects such as lack of food intake and late breastfeeding initiation, size of birth, immunization, young mothers, and genetics. However, rural children were more disadvantaged with less access to nutritious food, transportation, communication, lack of sanitation, limited access to clean water and health facilities, and under-services of health providers.[8,14-15]

Research showed that Indonesian children who living in rural areas more likely to be stunted than they who living in urban areas AOR 1.73 CI95% (1.59–1.87) vs AOR 1.31 CI95% (1.21–1.42),[14] as well as in Tanzania (38.26% vs 25.65%),[16] Pakistan (68.6% vs 50.8%),[17] and Sierra Leone (Beta 31.6%,CI95% 29.8-33.2 vs Beta 24.0%, CI95% 21.6-26.1).[18] Understanding the factors of stunting in urban and rural settings might assist deploy the integrated interventions.

Examining the difference of determinants for stunting and severe stunting in rural and urban areas is crucial to formulate appropriate intervention strategies and public health policies to reduce nutritional issues and morbidity. Therefore, this research aimed to analyze the risk factors for stunting and severe stunting among children aged 0-59 months in rural and urban Indonesia using pooled data from Indonesia's Basic Health Research in 2007, 2010, and 2013.

METHODS

The study was a cross-sectional design using pooled secondary data of Indonesia's Basic Health Research in 2007, 2010, and 2013. We search every province in Indonesia for toddlers to sign up, and the total number of toddlers signed up in 2007, 2010, and 2013 was 4,616, 10,470, and 23,160 respectively. These community-based surveys were designed by the National Institute of Health Research and Development of the Indonesian Ministry of Health to monitor multiple health indicators for achieving the Millennium Development Goals (MDGs), then continued by Sustainable Development Goals (SDGs).

For this study, we included children aged 0-59 months who had complete data of variables and HAZ between -5.99 and 5.99 as many as 38,246 children. Dependent variables were stunting and severe stunting. Stunting was defined by HAZ between -2 SD until -3 SD and severe stunting if HAZ below -3 SD.[19] In Basic Health Research, children below 24 months were measured the body length using a portable length board, while for children above 24 months were measured the height using a stadiometer.

We identified independent variables into individual, household, and community levels. Based on individual level, stunting were associated with sex (girl vs boy), age (<24 months vs≥24 months), and birth weight (low if <2,500 g and normal if ≥2,500 g).[20] While household level showed that factors determine stunting children were mother's age (<20 years, 20-35 years, >35 years), parental height (short mother if <150 cm and short father if <160 cm),[21] parental education (low if junior high school and below, middle if senior high school, and high if the college or above),[22] and occupation (formal if civil servants, army, police, private sectors and non-formal if labourers, farmers, and none if jobless). Household factors covered the number of household members (<5; 5-9; >9), the number of children (1, 2, ≥3), economic status (low if quintile 1 and 2, middle if quintile 3, high if quintile 4 and 5), and WASH (good vs. poor). We constructed a WASH (water and sanitation hygiene) variable based on the aggregate of water (access of fewer than 100 meters and less than 30 minutes, availability of 40 L per capita per day, physical quality, and sources), waste, and waste management. Meanwhile, the community factor related to stunting children was isles (Java-Bali, Sumatra, East Indonesia).

We analyzed data using STATA version 13. The univariate analysis described the characteristics of the studied variables. Bivariate analysis using univariate logistic regression explained the cross-tabulation association between the variables. We included all variables with $p<0.25$ for multiple logistic regression analysis. Finally, we selected the final model by stepwise backward elimination. The collinearity test was applied to avoid any bias. An association was considered significant when $p<0.05$. This study was ethically approved by the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Gadjah Mada University – Dr Sardjito General Hospital (reference number: KE/FK/0099/EC/2017).

RESULTS

A total of 38,246 children participated in this study consisting of children observed in 2007, 2010, and 2013 as many as 4,616, 10,470, and 23,160 children respectively. The prevalence of stunting in the rural was 27.2%, 40.5%, and 37.1%, in 2007, 2010, and 2013 respectively. At the same time, stunting prevalence in the urban was 25.7%, 33.2%, and 30.1%.

Table 1 presents the characteristics of stunted and severely stunted children in urban and rural Indonesia. Most rural and urban children were older (24-59 months), born with normal weight and received vitamin A supplementation. Most mothers were aged 20-35 years, >150 cm in height, and housewives; meanwhile, more than half of their fathers worked in informal sectors. As detail depicted in Table 1.

Table 1. Characteristics of the study sample of children aged 0-59 months (n= 38.246) in rural and urban Indonesia

Characteristics	Urban (n= 20,021)						Rural (n= 18,225)					
	Severe stunting		Stunting		Normal		Severe stunting		Stunting		Normal	
	n	%	n	%	n	%	n	%	n	%	n	%
Child												
Age (months)												
0-23	1408	45.6	1208	38.1	5995	43.6	1247	37.1	1592	45.3	5630	49.6
24-59	1678	54.4	1965	61.9	7767	56.4	2117	62.9	1921	54.7	5718	50.4
Sex												
Female	661	49.0	588	51.0	2644	48.9	609	50.5	691	48.8	2293	50.4
Male	688	51.0	566	49.0	2764	51.1	596	49.5	726	51.2	2260	49.6
Birth weight												
Low	215	7.0	215	6.8	614	4.5	228	6.8	213	6.1	512	4.5
Normal	2871	93.0	2958	93.2	13148	95.5	3136	93.2	3300	93.9	10836	95.5
Vitamin A supplementation												
No	817	26.5	693	21.8	3473	25.2	810	24.1	891	25.4	3049	26.9
Yes	2269	73.5	2480	78.2	10289	74.8	2554	75.9	2622	74.6	8299	73.1
Maternal												
Mother's age (years)												
<20	50	1.6	37	1.2	107	0.8	48	1.4	64	1.8	189	1.7
20-35	2281	73.9	2293	72.3	10064	73.1	2448	72.8	2606	74.2	8428	74.2
>35	758	24.5	843	26.5	3591	26.1	868	25.8	843	24.0	2736	24.1
Mother's height												
Short	1119	36.3	1373	43.3	4091	29.7	1620	48.2	1607	45.7	4056	35.7
Normal	1967	63.7	1800	56.7	9671	70.3	1744	51.8	1906	54.3	7292	64.3
Mother's education												
Low	816	26.4	878	27.6	2976	21.6	1629	48.4	1737	49.4	5111	45.0
Middle	712	23.1	776	24.5	2787	20.3	848	25.2	860	24.5	2864	25.3
High	1558	50.5	1519	47.9	7999	58.1	887	26.4	916	26.1	3373	29.7
Mother's occupation												
None	1969	63.8	2053	64.7	8726	63.4	1872	55.6	1904	54.2	6562	57.8
Informal	777	25.2	784	24.7	3060	22.2	1295	38.5	1423	40.5	3942	34.7
Formal	340	11.0	336	10.6	1976	14.4	197	5.9	186	5.3	844	7.5
Paternal												
Father's height												
Short	947	30.7	999	31.5	3148	23.1	1345	40.0	1394	39.7	3586	31.6
Normal	2139	69.3	2174	68.5	10578	76.9	2019	60.0	2119	60.3	7762	68.4
Father's education												
Low	760	24.6	839	26.4	2756	20.0	1630	48.5	1720	49.0	4975	43.8
Middle	644	20.9	678	21.4	2398	17.4	738	21.9	784	22.3	2560	22.6
High	1682	54.5	1656	52.2	8608	62.6	996	29.6	1009	28.7	3813	33.6
Father's occupation												
None	71	2.3	58	1.8	310	2.2	63	1.9	64	1.8	237	2.1
Informal	2222	72.0	2294	72.3	8913	64.8	2955	87.8	3074	87.5	9531	84.0
Formal	793	25.7	821	25.9	4539	33.0	346	10.3	375	10.7	1580	13.9
Household												
Number of children												
>3	156	2.4	106	1.6	432	1.7	54	1.6	70	2.0	209	1.8
2-3	1358	20.6	1327	20.3	5063	20.2	686	20.4	725	20.6	2146	18.9
1	5085	77.0	5104	78.1	19414	78.1	2624	78.0	2718	77.4	8993	79.3
Number of the household												
>9	18	0.6	12	0.4	54	0.4	20	0.6	32	0.9	63	0.6
5-9	1311	42.5	1346	42.4	5636	41.0	1511	44.9	1593	45.4	4783	42.1
<5	1757	56.9	1815	57.2	8072	58.6	1833	54.5	1888	53.7	6502	57.3
Economic level												
Low	803	26.0	807	25.4	2601	18.9	1729	51.4	1888	53.7	5164	45.5
Middle	677	21.9	707	22.3	2544	18.5	738	21.9	701	20.0	2397	21.1
High	1606	52.1	1659	52.3	8617	62.6	897	26.7	924	26.3	3787	33.4
WASH												
Poor	2689	87.1	2832	75.1	11785	85.6	3424	97.5	3289	97.8	1091	96.1
Good	397	12.9	941	24.9	1977	14.4	89	2.5	75	2.2	438	3.9
Community												
Isles												
Java and Bali	1325	42.9	1356	42.7	6310	45.9	940	27.9	883	25.1	3174	28.0
Sumatra	969	31.4	913	28.8	4073	29.6	1130	33.6	1396	39.8	4231	37.3
East Indonesia	792	25.7	904	28.5	3379	24.6	1294	38.5	1234	35.1	3943	34.8

Tables 2 and 3 showed bivariate and multivariate results of risk factors for stunting and severe stunting in urban and rural areas, respectively. The bivariate analysis showed that stunting in urban areas were caused by older aged (OR 1.25, CI95%1.16-1.35), LBW (OR 1.56 CI95%1.33-1.83), maternal aged < 20 years old (OR 1.52 CI95%1.04-2.21), short mother (OR 1.80 CI95% 1.67-1.95), middle and low mother education (OR 1.47 CI95%1.33-1.62 and 1.55 CI95%1.42-1.71), mother occupation in informal sector (OR 1.51 CI95%1.31-1.74) and housewife (OR 1.39 CI95%1.22-1.56), short father (OR 1.53 CI95%1.40-1.66), middle low father education level (OR 1.47 CI95%1.33-1.63 and 1.58 CI95%1.44-1.74), father occupation in informal sector (OR 1.42 CI95%1.31-1.55), middle low economic level (OR 1.44 CI95%1.31-1.60 and 1.61 CI95%1.47-1.77), poor WASH (OR 1.39 CI95%1.23-1.57), and living in East Indonesia (OR 1.24 CI95%1.13-1.37). While severe stunting in urban areas were related to LBW (OR 1.60 CI95%1.37-1.80), short mother (OR 1.25 CI95%1.13-1.33), father occupation in informal sector (OR 1.17 CI95%1.07-1.29), number of children >3 (OR 1.64 CI95%1.27-2.13), middle low economic level (OR 1.17 CI95%1.07-1.29 and 1.44 CI95%1.29-1.60), living in Sumatra and East Indonesia (OR 1.19 CI95%1.08-1.31 and 1.11 CI95%1.01-1.23). As detailed depicted in Table 2.

The bivariate analysis showed that stunting in rural areas were caused by older aged (OR 1.67, CI95%1.55-1.81), LBW (OR 1.54 CI95%1.31-1.81), short mother (OR 1.67 CI95% 1.55-1.81), middle and low mother education (OR 1.13 CI95%1.01-1.25 and 1.21 CI95%1.11-1.33), mother occupation in informal sector (OR 1.22 CI95%1.04-1.44) and housewife (OR 1.41 CI95%1.19-1.66), short father (OR 1.44 CI95%1.33-1.36), middle low father education level (OR 1.10 CI95%1.03-1.21 and 1.25 CI95%1.15-1.37), jobless father (OR 1.41 CI95%1.25-1.60), number of children 2-3 persons (OR 1.09 CI95%1.00-1.21), number of household member 5-9 persons (OR 1.75 CI95%1.14-2.68), middle low economic level (OR 1.41 CI95%1.29-1.55 and 1.30 CI95%1.16-1.45), poor WASH (OR 1.76 CI95%1.38-2.26), and living in East Indonesia (OR 1.11 CI95%1.01-1.21). While severe stunting in rural were older aged (OR 1.18, CI95%1.19--1.28), male (OR 1.12 CI95% 1.04-1.21), LBW (OR 1.37 CI95%1.16-1.61), short mother (OR 1.52 CI95% 1.41-1.63), middle and low mother education (OR 1.25 CI95%1.14-1.37 and 1.11 CI95%1.00-1.23), mother occupation in informal sector (OR 1.64 CI95%1.38-1.94) and housewife (OR 1.32 CI95%1.15-1.56), short father (OR 1.43 CI95%1.32-1.54), middle low father education level (OR 1.16 CI95%1.04-1.29 and 1.31 CI95%1.20-1.43), jobless father (OR 1.36 CI95%1.21-1.53), number of children 2-3 persons (OR 1.12 CI95%1.01-1.23), number of household member 5-9 persons (OR 1.15 CI95%1.06-1.24) and >9 persons (OR 1.75 CI95%1.06-1.23), middle low economic level (OR 1.20 CI95%1.07-1.34 and 1.50 CI95%1.37-1.64), poor WASH (OR 1.55 CI95%1.25-1.95), and living in Sumatra and East Indonesia (OR 1.19 CI95%1.08-1.31 and 1.12 CI95%1.02-1.24).

In general children who lived both in urban and rural areas, older age, boys, and low birth weight were more likely to experience stunting and severe stunting than the younger girls and born with normal birth weight. Meanwhile, urban, and rural children whose parents had short stature and low education level, from households with low economic status, poor WASH, >5 household members, and >1 child were more likely to experience stunting and severe stunting. Conversely, younger children, girls, and normal birth weight were less likely to be stunted or severely stunted.

We found that the most substantial determinant factors for stunting and severe stunting in rural and urban areas were comparable in multivariate results, including low birth weight, short stature parent, and low and middle economic level (Table 3).

The result showed that determinant risk factors strongly associated with stunting among children in rural areas were aged ≥24 months, low birth weight, short stature parents, low and middle economic income, and WASH. Meanwhile, in severe stunting, the risk factors included low birth weight, short stature parents, household members more than nine, and middle economic income. In the urban areas, stunting children were determined by low birth weight, short stature parents, and low- and middle-economic income. In contrast, stunting children were determined by all risk factors for severe stunting except the number of children (>3). The prevalence of stunting and severe stunting in Indonesia's urban and rural areas was driven by low birth weight, short mother and father, and low economy. Furthermore, the number of household members played a role as a determinant factor of severely stunting children in rural areas. Conversely, the number of children was the risk factor for severe stunting in urban areas.

Table 2. Bivariate and multivariate results of risk factors for stunting and severe stunting among children aged 0-59 months in urban Indonesia

Characteristics	Urban							
	Stunting				Severe stunting			
	OR	95% CI	AOR	95% CI	OR	95% CI	AOR	95% CI
Child								
Age (months)								
0-23	1.00		1.00		1.00			
24-59	1.25*	1.16-1.35	1.31*	1.21-1.42	1.00	0.85-1.00		
Sex								
Female	1.00				1.00			
Male	0.96	0.89-1.04			1.10	0.93-1.10		
Birth weight								
Normal	1.00		1.00		1.00		1.00	
Low	1.56*	1.33-1.83	1.42*	1.21-1.68	1.60*	1.37-1.88	1.50*	1.27-1.76
Vitamin A supplementation								
Yes	1.00				1.00			
No	0.83*	0.75-0.91			0.92	0.84-1.01		
Maternal								
Mother's age (years)								
20-35	1.00				1.00			
<20	1.52*	1.04-2.21			2.06*	1.47-2.90		
>35	1.03	0.94-1.12			0.93	0.85-1.02		
Mother's height								
Normal	1.00		1.00		1.00		1.00	
Short	1.80	1.67-1.95	1.66*	1.53-1.79	1.34*	1.24-1.46	1.23*	1.13-1.33
Mother's education								
High	1.00				1.00			
Middle	1.47*	1.33-1.62			1.31*	1.18-1.45		
Low	1.55*	1.42-1.71			1.41*	1.28-1.55		
Mother's occupation								
Formal	1.00		1.00		1			
Informal	1.51*	1.31-1.74	1.18*	1.01-1.37	1.47*	1.28-1.70		
None	1.39*	1.22-1.56	1.13	0.99-1.29	1.31*	1.16-1.48		
Paternal								
Father's height								
Normal	1.00		1.00					
Short	1.53*	1.40-1.66	1.38*	1.26-1.50				
Father's education								
High	1.00				1.00			
Middle	1.47*	1.33-1.63			1.37*	1.24-1.52		
Low	1.58*	1.44-1.74			1.41*	1.28-1.55		
Father's occupation								
Formal	1.00		1.00		1.00		1.00	
Informal	1.42*	1.31-1.55	1.15*	1.04-1.27	1.42*	1.31-1.56	1.17*	1.07-1.29
None	1.03	0.77-1.33	0.86	0.64-1.16	1.31*	1.00-1.72	1.13	0.86-1.48
Household								
Number of children								
1	1.00				1.00		1.00	
2-3	0.94	0.85-1.04			1.00	0.88-1.07	0.95	0.87-1.05
>3	0.99	0.73-1.35			1.73*	1.34-2.22	1.64*	1.27-2.13
Number of the household								
<5	1.00				1.00			
5-9	1.06	0.98-1.15			1.07	0.98-1.16		
>9	1.00	0.53-1.85			1.53	0.89-2.62		
Economic level								
High	1.00		1.00		1.00		1.00	
Middle	1.44*	1.31-1.60	1.30*	1.18-1.44	1.43*	1.29-1.58	1.17*	1.07-1.29
Low	1.61*	1.47-1.77	1.42*	1.28-1.57	1.61*	1.51-1.82	1.44*	1.29-1.60
WASH								
Good	1.00		1.00		1.00			
Poor	1.39*	1.23-1.57	1.17*	1.03-1.33	1.14*	1.01-1.27		
Community								
Isles								
Java and Bali	1.00		1.00		1.00		1.00	
Sumatra	1.04	0.95-1.14	1.11*	1.01-1.22	1.13*	1.04-1.24	1.19*	1.08-1.31
East Indonesia	1.24*	1.13-1.37	1.23*	1.12-1.36	1.12*	1.01-1.23	1.11*	1.01-1.23

AOR: adjusted odds ratios; *: p<0.05

Table 3. Bivariate and multivariate results of risk factors for stunting and severe stunting among children aged 0-59 mmonths in rural Indonesia

Characteristics	Rural							
	Stunting				Severe stunting			
	OR	95% CI	AOR	95% CI	OR	95% CI	AOR	95% CI
Child								
Age (months)								
0-23	1.00		1.00		1.00		1.00	
24-59	1.67*	1.55-1.81	1.73*	1.59-1.87	1.18*	1.10-1.28	1.22*	1.13-1.32
Sex								
Female	1.00				1.00		1.00	
Male	1.03	0.96-1.12			1.12*	1.04-1.21	1.14*	1.06-1.23
Birth weight								
Normal	1.00		1.00		1.00		1.00	
Low	1.54*	1.31-1.81	1.46*	1.24-1.72	1.37*	1.16-1.61	1.31*	1.11-1.55
Vitamin A supplementation								
Yes	1.00				1.00			
No	0.86*	0.79-0.94			0.92	0.84-1.01		
Maternal								
Mother's age (years)								
20-35	1.00				1.00			
<20	0.87	0.63-1.21			1.09	0.82-1.45		
>35	1.01*	1.00-1.19			1.00	0.91-1.09		
Mother's height								
Normal	1.00		1.00		1.00		1.00	
Short	1.67*	1.55-1.81	1.64*	1.51-1.77	1.52*	1.41-1.63	1.44*	1.33-1.55
Mother's education								
High	1.00				1.00			
Middle	1.13*	1.01-1.25			1.25*	1.14-1.37		
Low	1.21*	1.11-1.33			1.11*	1.00-1.23		
Mother's occupation								
Formal	1.00				1.00		1.00	
Informal	1.22*	1.04-1.44			1.64*	1.38-1.94	1.26*	1.11-1.58
None	1.41*	1.19-1.66			1.32*	1.15-1.56	1.13	0.96-1.35
Paternal								
Father's height								
Normal	1.00		1.00		1.00		1.00	
Short	1.44*	1.33-1.56	1.35*	1.24-1.46	1.43*	1.32-1.54	1.33*	1.23-1.44
Father's education								
High	1.00				1.00		1.00	
Middle	1.10*	1.03-1.21			1.16*	1.04-1.29	1.06	0.95-1.18
Low	1.25*	1.15-1.37			1.31*	1.20-1.43	1.01*	1.01-1.22
Father's occupation								
Formal	1.00				1.00			
Informal	1.21	0.89-1.64			1.14	0.84-1.53		
None	1.41*	1.25-1.60			1.36*	1.21-1.53		
Household								
Number of children								
1	1.00				1.00			
2-3	1.09*	1.00-1.21			1.11	0.84-1.46		

Characteristics	Rural							
	Stunting				Severe stunting			
	OR	95% CI	AOR	95% CI	OR	95% CI	AOR	95% CI
>3	0.88	0.65-1.19			1.12	1.01-1.23		
Number of the household								
<5	1.00		1.00		1.00		1.00	
5-9	1.75*	1.14-2.68	1.13*	1.05-1.23	1.15*	1.06-1.24	1.11*	1.02-1.19
>9	1.13	0.68-1.87	1.13	0.68-1.89	1.75*	1.06-1.23	1.66*	1.07-2.56
Economic level								
High	1.00		1.00		1.00		1.00	
Middle	1.41*	1.29-1.55	1.25*	1.11-1.39	1.20*	1.07-1.34	1.35*	1.23-1.48
Low	1.30*	1.16-1.45	1.33*	1.21-1.46	1.50*	1.37-1.64	1.13*	1.01-1.26
WASH								
Good	1.00		1.00		1.00			
Poor	1.76*	1.38-2.26	1.45*	1.12-1.87	1.55*	1.25-1.95		
Community								
Isles								
Java and Bali	1.00				1.00		1.00	
Sumatra	0.91*	0.82-0.99			1.19*	1.08-1.31	1.26*	1.14-1.38
East Indonesia	1.11*	1.01-1.21			1.12*	1.02-1.24	1.11*	1.01-1.23

Table 3 Continued
AOR: adjusted odds ratios; *: p<0.05

The result showed that determinant risk factors strongly associated with stunting among children in rural areas were aged ≥24 months, low birth weight, short stature parents, low and middle economic income, and WASH. Meanwhile, in severe stunting, the risk factors included low birth weight, short stature parents, household members more than nine, and middle economic income. In the urban areas, stunting children were determined by low birth weight, short stature parents, and low- and middle-economic income. In contrast, stunting children were determined by all risk factors for severe stunting except the number of children (>3). The prevalence of stunting and severe stunting in Indonesia's urban and rural areas was driven by low birth weight, short mother and father, and low economy. Furthermore, the number of household members played a role as a determinant factor of severely stunting children in rural areas. Conversely, the number of children was the risk factor for severe stunting in urban areas.

In 2013, The World Health Assembly stated that scaling up nutrition during the first 1000 days of life through specifics and sensitive intervention was the most cost-efficient period to eradicate the stunting of children, optimum brain development, prevent degenerative diseases in adulthood, and encourage the best human resources for developing the nations[29] as well as a previous study proved.[30-31] So that, interventions for stunting and severe stunting children in both rural and urban areas will be more effective in the first 1000 days as a period that is

DISCUSSION

The prevalence of children's stunting and severe stunting in rural areas was higher in urban areas. These findings were consistent with the previous studies in Tanzania,[16] Sierra Leone,[18] Nigeria,[18] Bangladesh,[23] and Cambodia.[24] This finding both in rural and urban areas supported previous studies regarding the relationship between low birth weight and stunting.[25-26] Low birth weight is caused by chronic malnutrition during pregnancy with short- and long-term consequences. Early short-term effects of stunting is increasing infection risk, morbidity and mortality, recurrent infection, low cognitive scores, and short stature in children and adolescents.[27] Consequently, the long-term effects are short-statured adults, loss of high education chance, low productivity, low income, risk of metabolic syndrome such as obesity, hypertension, stroke, hyperlipidemia, cancer, coronary health diseases, and even intergenerational poverty.[28] considered a golden opportunity and crucial for the development of an individual's brain.

Results showed that parents' heights were determinants for stunting and severe stunting in rural and urban areas. This study found that many children lived in a suboptimal environment, with most children in both rural and urban areas living with inadequate water access, poor hygiene, and sanitation. Some studies showed that parents' height was consistently a factor to determine stunting in children.[32] Mothers are important in influencing

childhood through the fetal environment. In line with previous research that short mother were more likely to have stunted among Brazilian children (OR:1.22, 95%CI:1.07–1.38),[33] among Indonesian children (AOR: 12, CI95%: 1.09-1.52) (21), and among Ethiopian children (OR 2.5).[34] Children need a pleasant environment to support optimal growth,[35] where mothers have an essential role in providing enough nutrition for healthy growth and development for children.[36] These include adequate clean water access,[27] avoidance of smoke pollution,[37] adequate food intake,[15] vaccination and prevention of recurrent infections, and early breastfeeding,[27] appropriate breast milk and complementary feeding, micronutrient supplementation, and general well-being.[30,38] If the main factors for limiting growth can be eliminated, then underprivileged children can still grow optimally as normal ones.

The findings showed that low- and middle-income families are more likely to have stunted and severely stunted children in urban and rural areas. Unfortunately, low-income families tend to give birth within intergenerational poverty with severe health consequences, including poor caring and poor nutrition.[33,39] As a result, a cycle develops where children's cognitive, motoric, social, and emotional skills cannot develop optimally, resulting in poor learning performance at school, a lack of ability to compete to get higher education, and obtain decent work. Besides, low-income families are associated with limited access to basic needs, including food, health, education, and recreation facilities. At the same time, they also experience a lack of social support and networking, poor housing, and lousy sanitation.[40-41]

Economic growth is the most effective effort to eradicate malnutrition, especially in developing countries. Economic growth can reduce poverty, increase household income, and open better jobs and public services, including health facilities.[23,42] In Indonesia, economic development has occurred rapidly, but unfortunately, the growth was not equitable between isles, urban and rural areas. As many as 80% of economic growth was focused on Java-Bali then as a result, many people experience poverty in the eastern parts of Indonesia. This inequity is seen in the disparity of stunting prevalence in different areas in Indonesia.

Previous studies found that crowded households had moderate risk factors for stunted children.[41,43] In this study, household members of >9 people were linked to severe stunting and stunting in rural areas but not in urban areas. Urban adult family members were assumed to have income and family concepts, which were relatively flexible, including physical absence, interaction, and geographical boundaries. Conversely, the extended family concept in rural areas required other family members' presence, which might burden the head of the family. Additionally, poverty may have low interaction with malnutrition among young children. However, the structure and number of family members were related to child health and growth. The risk of malnutrition among children under five rose with increased household members and children under five,[44] among three or more children living in the same household the risk of stunting increased by 30%.[45] This pattern was related to improper food distribution, less time for mothers to pay attention to each child, and others distributing household resources that lead to sub optimum nutritional status.[44-45] On the other hand, the family environment has a significant impact on the physical and mental development children, especially for infants and younger children.[44]

We found several limitations in this study. Firstly, the survey design did not conclude any causal-effect relationship between independent and dependent variables. Secondly, the surveys were limited by the unavailability of infant and young child feeding data. For this issue, we could not control any confounding variable related to breastfeeding or feeding practices. Nonetheless, this study used large-scale national data from surveys conducted by the Ministry of Health of Indonesia, which was adequate in sample sizes. This study's findings can be generalized to the population of children under-five years in Indonesia and other nations with similar settings.

Strength and Weakness

One of the qualities of this review is the representativeness of the information from the multistage inspecting procedure utilized, which makes the discoveries of the review to be pertinent to the review populace and as well generalizable whenever applied to comparable populaces. Another strength is pooled data analysis provides many observations, increases the degree of freedom, data has great variability, reduces collinearity, and also provide dynamic change inference information. An important limitation is income data based on assets belonging (in Riskesdas 2013), so it cannot describe the actual income directly related to food expenditure.

Conclusions

Stunting and severe stunting among Indonesian children under-fives in rural and urban areas share similar risk factors. In general, low birth weight, short stature parents, low educational attainment of parents, poor households, mothers' occupation in informal sectors or without a job, fathers'

employment in informal sectors, poor WASH, and resided outside Java and Bali were associated with stunting and severe stunting in rural and urban Indonesia. Further studies that address infant and young child feeding practices are of high importance to deepening our understanding of childhood stunting in Indonesia. Efforts to improve chronically undernourished children's nutrition and health status may focus on specific interventions such as nutrition during the pre-and postnatal period for both mothers and children and sensitive interventions covering socio-economic and environmental factors.

In addition, we propose that reducing stunting in children necessitates cross-program and sectoral coordination via sensitive and specifics interventions, particularly in 1000 early day life. Further, developing the nation's economy and providing equal health services in both urban and rural areas is essential.

Acknowledgement

The authors thank the National Institute of Health Research and Development for providing 2007, 2010 and 2013 Indonesia Basic Health Research (Riskesdas) data.

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