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Original Article

Exploring the influence of maternal and birth history on stunting in children under 5 years in Indonesia: evidence from the *Indonesia Family Life Survey*

Yudhistira Andarusukma, Rahma Adiba, Maria Galuh Kamenyangan Sari

Abstract

Background Indonesian children under the age of five are at risk of becoming stunted or severely stunted. Despite efforts to reduce stunting through improved nutrition, the condition persists, leading to long-term consequences such as impaired cognition and increased risk of chronic diseases.

Objective To explore maternal factors and childbirth history for stunting and severe stunting in children aged 6-59 months in Indonesia.

Methods This cross-sectional study used data from the 2014-2015 Indonesia Family Life Survey 5 (IFLS-5) to compare birth history (gender, gestational age, birth weight, birth order) and maternal factors (age at childbirth, employment, marital status, education, iron supplementation, antenatal care, height, smoking, pregnancy complications, exclusive breastfeeding, and duration) between stunting and non-stunting children. Descriptive analysis and logistic regression were applied on data related to maternal factors and childbirth history from 2,701 children aged 6-59 months.

Results We found a significant risk of stunting in children aged 12-23 months (P=0.002) and 48–60 months (P=0.031), maternal age at birth ≤20 years (P=0.025), maternal short stature (P<0.001), breastfeeding duration of 12-23 months (P<0.001) and >24 months (P<0.001), low birth weight (P=0.003), and being the second born or later (P=0.044). Meanwhile, a high maternal educational level (P=0.008) and sufficient iron supplementation during pregnancy (P=0.013) were associated with a reduced incidence of stunting or severe stunting.

Conclusion Maternal factors and birth history have a significant impact on the occurrence of stunting and severe stunting in Indonesian children. These findings highlight the need for targeted interventions addressing maternal and early-life factors to reduce the prevalence of stunting and severe stunting in Indonesia. **[Paediatr Indones. 2025;65:207-15; DOI: https://doi.org/10.14238/pi65.3.2025.207-15].**

Keywords: *malnutrition; child health; maternal health; Indonesia; IFLS*

Malnutrition, including stunting and severe stunting, in children under five years is a complex issue influenced by multiple interacting factors. These factors include the availability, accessibility, and utilization of food and healthcare services.[1] Stunting is a growth delay in children usually as a result of chronic malnutrition. It is estimated that 22.3% of children under five years worldwide experience stunting and many come from developing countries.[2] In Indonesia, a country with a population of 273.8 million, about 21.6% of children experience stunting.[3] This number has continuously decreased since 2019, yet remains high. While stunting affects height, the long-term effects are impaired cognition and increased risk of chronic disorders later in life that can lead to lower productivity and economic disadvantage.[4] When young children receive sufficient amounts of all essential nutrients, they can grow, develop, and learn

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From Faculty of Medicine, Universitas Sebelas Maret, Solo, Central Java, Indonesia.

Corresponding author: Yudhistira Andarusukma. Faculty of Medicine, Universitas Sebelas Maret, Solo, Central Java, Indonesia. Email: dr.andarusukma@gmail.com.

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to their full potential, maintain optimal physical and mental health, as well as lead more prosperous lives.[5]

Indonesia has developed several strategies to reduce stunting with a focus on improving nutrition, such as encouraging six months of exclusive breastfeeding, subsequent complementary food (*makanan pendamping ASI/MPASI*) intake , and regular growth monitoring. Even so, stunting is not only a problem of nutrition. There is no significant difference in nutritional status between stunted and normoheight children; nor did stunted children show visible signs of malnutrition or chronic infection.[6] Previous study identified other factors contributing to stunting, such as mother without formal education, mother in the middle age group (25-34), and lowest wealth index.[7]

The Indonesian Family Life Survey (IFLS) is a longitudinal survey conducted by *RAND Labor and Population* using a large cohort of Indonesian families.[8] This survey collects a variety of information within households such as indicators of economic well-being, education, and health status, to the process of decision-making.[8] Using the collected data from the latest IFLS 5 (2014-2015), we explored different factors that may contribute to stunting in Indonesia.

Methods

The data used in this study were secondary data from the fifth wave of the IFLS, conducted by *RAND Labor and Population* in 2014-2015.[8] This longitudinal socioeconomic and health survey utilized a sample of households representing approximately 83% of the Indonesian population. The IFLS was approved by the *Institutional Review Boards* (IRB) in the United States (at RAND) and by the Universitas Gadjah Mada. During the fifth survey wave conducted from September 2014 to March 2015, 16,204 households with 50,148 individuals were interviewed.[8] The inclusion criteria were children aged 6 to 59 months at the time of the survey and maternal characteristics. The exclusion criterion was incomplete data. *WHO Child Growth Standards* for children aged 0-5 years in Indonesia were used to define stunting as having a height-for-age z-score below -2 for stunted and below -3 for severely-stunted.[9] We collected height and age data from the IFLS and inputted it into the *WHO Anthro Application*. Maternal and birth history characteristics were analyzed as potential risk factors for stunting and severe stunting. Gender, gestational age, birth weight, and birth order were categorized into birth history factors. Maternal factors included age at childbirth, employment status, marital status, education level, sufficient iron supplementation (≥90 tablets), antenatal care during pregnancy, height, smoking history, complications during pregnancy, as well as exclusive breastfeeding status and duration.

Descriptive statistics were used to summarize the characteristics of the individuals. Bivariate analysis with Chi-square test was done to evaluate relationships between the individuals' characteristics and stunting status. Multivariate analysis included the factors with P values ≤0.25 in the bivariate analysis. Multivariate logistic regression was then utilized to calculate odds ratios (ORs) with 95% confidence interval (CI). Results with P values <0.05 were considered to be statistically significant. Statistical analyses were conducted using *SPSS software version 29.0* for *Windows*.

Results

A total sample of 2,701 individuals with complete data was included in this study. The majority of children were aged 12-23 months (26.5%) and not stunted (66.1%) (**Table 1**). Overall, 22.3% of the children were stunted, and 11.7% were severely stunted. From the maternal factors, a high percentage of mothers were married (98.3%), had low educational level (83.4%), gave birth at maternal age >20 years (90.6%), received complete antenatal care (91.0%), and were non-smokers (99%). Approximately half of mothers (51.5%) were homemakers, and 54.4% received sufficient iron supplementation during pregnancy. Overall, 20.3% of mothers had short stature and 21.1% experienced complications during pregnancy. Most mothers exclusively breastfed their children (62.4%), with the prevalent duration being 12-23 months (42.2%). In terms of birth-history factors, approximately half of the children were male (51.9%), most were born within the normal range of gestational age (89.9%), had normal birth weight (90.0%), and were first-born (59.7%).

Gender, complications during pregnancy, and

Table 1. Baseline characteristics of the study population

Characteristics	Total (N=2,701)	Stunted & severely stunted (n=914)	Not stunted (n=1787)	P value
General characteristics				
Height (cm)				
Weight-for-age z-score, n(%)				
Not stunted	1,785 (66.1)			
Stunted	601 (22.3)			
Severely stunted	315 (11.7)			
Age of child, n(%)				
6-11 months	329 (12.2)	72 (7.9)	257 (14.4)	<0.001*
12-23 months	717 (26.5)	300 (32.8)	417 (23.3)	
24-35 months	517 (19.1)	161 (17.6)	356 (19.9)	
36-47 months	548 (20.3)	180 (19.7)	368 (20.6)	
48-60 months	590 (21.8)	201 (22.0)	389 (21.8)	
Maternal characteristics				
Employment status, n(%)				
Homemaker	1,390 (51.5)	500 (54.7)	890 (49.8)	0.016*
Employed	1,311 (48.5)	414 (45.3)	897 (50.2)	
Marital status, n(%)				
Married	2,654 (98.3)	894 (97.8)	1,760 (98.5)	0.20*
Unmarried	47 (1.7)	20 (2.2)	27 (1.5)	
Educational level, n(%)				
High school or above	449 (16.6)	115 (12.6)	334 (18.7)	<0.001*
Below high school	2,252 (83.4)	799 (87.4)	1,453 (81.3)	
Age at childbirth, n(%)				
<20 y.o.	253 (9.4)	106 (11.6)	147 (8.2)	<0.001*
≥20 y.o.	2,448 (90.6)	808 (88.4)	1,640 (91.8)	
Iron supplementation during pregnancy, n(%)				
≥90 tablets	1,470 (54.4)	453 (49.6)	1,017 (56.9)	<0.001*
<90 tablets	1,231 (45.6)	461 (50.4)	770 (43.1)	
Antenatal care during pregnancy, n(%)				
Complete	2,459 (91.0)	814 (89.1)	1,645 (92.1)	0.01*
Incomplete	242 (9.0)	100 (10.9)	142 (7.9)	
Height, n(%)				
<145cm	548 (20.3)	229 (25.1)	319 (17.9)	<0.001*
≥145	2,153 (79.7)	685 (74.9)	1,468 (82.1)	
Smoking status, n(%)				
Smokers	27 (1.0)	5 (0.5)	22 (1.2)	0.09*
Non-smokers	2,674 (99.0)	909 (99.5)	1,765 (98.8)	
Complications during pregnancy, n(%)				
Present	569 (21.1)	190 (20.8)	379 (21.2)	0.80
Absent	2,132 (78.9)	724 (79.2)	1,408 (78.8)	
Exclusive breastfeeding, n(%)				
Yes	1,685 (62.4)	610 (66.7)	1,075 (60.2)	0.001*
No	1,016 (37.6)	304 (33.3)	712 (39.8)	
Breastfeeding duration, n(%)				
<6 months	336 (12.4)	72 (7.9)	264 (14.8)	<0.001*
6-12 months	466 (17.3)	114 (12.5)	352 (19.7)	
<12 to 24 months	1,139 (42.2)	456 (49.9)	683 (38.2)	
>24 months	760 (28.1)	272 (29.8)	488 (27.3)	
Birth history characteristics				
Gender, n(%)				
Female	1,298 (48.1)	425 (46.0)	873 (48.3)	0.25
Male	1,403 (51.9)	499 (54.0)	934 (51.7)	

Table 1. Baseline characteristics of the study population (continued)

Characteristics	Total (N=2,701)	Stunted & severely stunted (n=914)	Not stunted (n=1787)	P value
Gestational age, n(%)				
Preterm	238 (8.8)	80 (8.8)	158 (8.8)	0.912
Full term	2,427 (89.9)	823 (90.0)	1,604 (89.8)	
Post term	36 (1.3)	11 (1.2)	25 (1.4)	
Birth weight, n(%)				
Low (<2,500g)	166 (6.1)	77 (8.4)	89 (5.0)	<0.001*
Normal (2,500-4,000g)	2,430 (90.0)	818 (89.5)	1,612 (90.2)	
High (>4,000g)	105 (3.9)	19 (2.1)	86 (4.8)	
Order of birth, n(%)				
Firstborn	1,612 (59.7)	530 (58.0)	1,082 (60.5)	0.19*
Second born or above	1,089 (40.3)	384 (42.0)	705 (39.5)	

*included in the multivariate model

gestational age did not show statistically significant differences between the stunted and non-stunted groups. Age of child, employment and marital status, maternal educational level, age at childbirth, iron supplementation during pregnancy, birth weight, as well as birth order were potential risk factors for stunting and severe stunting incidence based on bivariate analysis. In the multivariate model, child age 12-23 months (OR 1.93; 95%CI 1.27 to 2.93; P=0.002) and 48-60 months (OR 1.60; 95%CI 1.04 to 2.46; P=0.031), maternal age at birth ≤20 years (OR 1.38; 95%CI 1.04 to1.84; P=0.025), maternal short stature (OR 1.50; 95%CI 1.21 to 1.85; P<0.001), breastfeeding duration of 12-23 months (OR 1.99; 95%CI 1.43 to 2.78; P<0.001) and >24 months (OR 1.98; 95%CI 1.40 to 2.80; P<0.001), having a low birth weight (OR 1.64; 95%CI 1.18 to 2.28; P=0.003), and being the second born or above (OR 1.20; 95%CI 1.01 to 1.43; P=0.044) were significantly associated with higher incidence of stunting or severe stunting. Meanwhile, high maternal educational level (OR 0.72; 95%CI 0.56 to 0.92; P=0.008) and sufficient iron supplementation (≥90 tablets) during pregnancy (OR 0.81; 95%CI 0.68 to 0.96; P=0.013) were associated with lower incidence of stunting or severe stunting (**Table 2**). The goodness-of-fit P value of the model was 0.149, with an R-squared value of 8.1%.

Discussion

The first 1,000 days are crucial for child development and vital to identify when children are most at risk for stunting or severe stunting. Of the 2,701 pediatric subjects, 12.2% were 6 to 11-month-old, 26.5% were 12 to 23-month-old, 19.1% were 24 to 35-month-old, 20.3% were 36 to 47-month-old, and 21.8% were 48 to 60-month-old. Chi-square test revealed a statistically significant association between age of child and risk of stunting (P<0.001). Multivariate regression analysis also showed that children aged 12-23 months were 1.93 times (P=0.002) and aged 48-60 months were 1.60 times (P=0.031) at higher risk of stunting than children aged 6-11 months. Multivariate logistic regression (**Table 2**) revealed that the risk of stunting increased during the transition period from exclusive breastfeeding to complementary feeding. During the first 6 months, a normal infant's nutritional requirements can be met by breastfeeding alone; after that, it may not suffice. Children aged 12-23 months in Indonesia had a significantly higher probability of experiencing stunting compared to those aged less than 12 months.[10] Poor food environments, inadequate feeding practices, and household income poverty drive severe child food poverty. Globally, millions of parents struggle to provide the nutritious, diverse foods young children need for growth and development. Growing inequities, conflict, climate crises, rising food prices, an overabundance of unhealthy foods, harmful food marketing, and poor feeding practices are trapping millions of children in food poverty. Poor feeding practices and beliefs about what and how much young children should eat are often passed down through generations and peers, particularly in the absence of accurate information, counseling, and support for parents and families.[5]

Table 2. Analysis of maternal and birth history factors with stunting or severe stunting

Variables (ref *vs.* risk)	Bivariate		Multivariate[a]		
	Crude OR	P value	Adjusted OR[b]	95%CI	P value
Age of child					
6-11 months	Ref	Ref			
12-23 months	2.57	<0.001	1.93	1.27 to 2.93	0.002*
24-35 months	1.61	0.003	1.43	0.93 to 2.22	0.108
36-47 months	1.75	<0.001	1.49	0.96 to 2.30	0.073
48-60 months	1.84	<0.001	1.60	1.04 to 2.46	0.031*
Maternal characteristics					
Employment status					
Homemaker	Ref	Ref			
Employed	1.22	0.016	1.10	0.92 to 1.30	0.31
Marital status					
Married	Ref	Ref			
Not married (divorced, widowed)	0.69	0.21	0.65	0.35 to 1.20	0.164
Educational level					
Low (≤12 years)	Ref	Ref			
High (>12 years)	0.63	<0.01	0.72	0.56 to 0.92	0.008*
Age at childbirth					
Sufficient (≥20 y.o.)	Ref	Ref			
Young (<20 y.o.)	1.46	0.005	1.38	1.04 to 1.84	0.025*
Iron supplementation during pregnancy					
Low (<90 tablets)	Ref	Ref			
Sufficient (≥90 tablets)	0.74	<0.001	0.81	0.68 to 0.96	0.013*
Antenatal care during pregnancy					
Incomplete	Ref	Ref			
Complete	0.70	0.01	0.77	0.58 to 1.02	0.069
Height					
Normal	Ref	Ref			
Short stature (<145cm)	1.54	<0.001	1.50	1.21 to 1.85	<0.001*
Smoking status					
Non-smoker	Ref	Ref			
Smoker	0.44	0.1	0.45	0.17-1.22	0.115
Exclusive breastfeeding					
No	Ref	Ref			
Yes	1.33	<0.001	1.12	0.92 to 1.36	0.267
Breastfeeding duration					
<6 months	Ref	Ref			
6-11 months	1.19	0.32	1.33	0.88 to 2.01	0.179
12-23 months	2.45	<0.001	1.99	1.43 to 2.78	<0.001*
>24 months	2.04	<0.001	1.98	1.40 to 2.80	<0.001*
Birth history characteristics					
Birth weight					
Normal	Ref	Ref			
Low	1.71	<0.001	1.64	1.18 to 2.28	0.003*
High	0.44	0.001	0.40	0.24 to 0.67	<0.001*
Order of birth					
Firstborn	Ref	Ref			
Second born or above	1.11	0.19	1.20	1.01 to 1.43	0.044*

[a]Goodness-of-fit P value of final model: 0.149; pseudo-R-squared: 8.1%; b final multivariate model; *P<0.05 at the 5% level of significance.

In the broader context, suboptimal growth may arise from challenges in transitioning from breastfeeding to complementary feeding, insufficient food supply, inappropriate child-feeding practices, and

food insecurity.[11] Our study suggests that prolonged breastfeeding is a risk factor for stunting. Breastfeeding for 12-23 months (OR 1.99; P<0.001) or over 24 months (OR 1.98; P<0.001) significantly correlated with increased stunting. A previous study also reported similar findings, showing a significant relationship between breastfeeding in the second and third year of life with stunting and severe stunting.[12] A study hypothesized from the perspective of impoverished households in Thailand that the poorest families might not have access to the resources needed to provide adequate complementary foods for their children after the initial six months of exclusive breastfeeding.[13] Breastfeeding continues as the only feasible option in the poorest families, yet its nutrients may not meet the growing demands of children as they age.[13]

Having a higher level of maternal education could be viewed as a potential protective factor against stunting (OR 0.72; P=0.008). The Indonesian government (2019) recognized education as a crucial indirect factor influencing nutritional intake and mother-child health in stunting prevention.3 Education likely plays an important role because more educated mothers have access to relevant health-related information for better child-care practices. Children of less-educated mothers faced greater health risks, fewer health-promoting factors, worse social support, and higher medical care consumption than children with higher-educated mothers.[14]

Younger maternal age was associated with higher risk of having stunted children (OR 1.38; P=0.025), with decreased risk as age increased. Adolescents (11-19 years) require higher nutritional intake than adults. This age period is important since it marks the development of physical and neurological maturation, including brain function.[15] Undernutrition in adolescents is very prevalent in low to middle-income countries; one in four adolescents in Indonesia suffers from anemia.[16] This might explain why children with mother ≤20 years have higher risk of becoming stunting. Younger maternal often corresponds with lower maternal body mass index (BMI) and weight than adult mothers, as shown in a cross-sectional study from Bangladesh.[17] Adolescent pregnancy also increases the risk of undernutrition, leading to poor fetal growth. *World Health Organization* (WHO) even released guideline to prevent adolescent pregnancies highlighting the potential adverse outcomes associated with younger maternal age.[18]

Our findings showed that sufficient iron supplementation - defined as receiving at least 90 tablets during pregnancy - reduced the odds of stunting (OR 0.81; P=0.013). Daily oral supplementation of iron and folic acid could be one of the most cost-effective solutions to improve infant linear growth and reduce the risk of complications during and after pregnancy. Similarly, the risk of stunting increased three times in children of mothers who did not receive iron supplementation during pregnancy.[19] Additionally, antenatal iron and folic acid (IFA) supplementation reduced the risk of stunting in children under two years old by 8% and of severe stunting by 9%.[20]

In Indonesia, at least 59 million adults (39.6%) are considered short-statured,[21] while our data indicated that at least 20% of mothers were short-statured (<145 cm) (**Table 1**). Nevertheless, short maternal height was a strong predictor of stunting based on our findings (OR 1.50; P<0.001). Parental height could reflect various exposures during early life, and it can negatively affect child growth via various pathways, such as maternal health, biomechanical and biological mechanisms, and other social-economic-political-emotional (SEPE) factors.[22] This result was also found in Ethiopia where mothers under 150 cm had 2.5 higher odds of having a stunted child.[23] Low birth weight infants of short-statured mothers were also more likely to experience stunting and slower postnatal growth.[24] This suggests that the risk of stunting may be passed down through generations.[22]

We found that the odds of stunting were 1.64 times higher in infants born with LBW (P=0.003) and lower in infants born with high birth weight (OR 0.40; P<0.001). Low birth weight can result from a combination of complex factors, including inadequate sanitation, nutrition and supplementation during pregnancy, as well as maternal age, education level, and literacy skill.[25] A study in 2017 showed similar findings: infants born with LBW were 1.74 times more likely to be stunted.[26] Data suggest that both preterm and LBW infants are at increased risk for infection and infection-related mortality.[27]

The influence of birth order and the risk of stunting may be explained from several perspectives. A study from Bangladesh found a decline in antenatal and postnatal visits with increasing birth order.[28] This

implies that parents are more conscientious about their firstborn child due to inexperience than they are for later children. In our study, a second-born or above had a slightly increased risk of stunting (OR 1.20; P=0.044). Similar findings were observed in other developing countries like Nepal, India, Pakistan, and Sri Lanka (AOR 1.37; 95%CI 1.16 to 1.61).[29] Being born later also meant decreased household allocation for each family member, but being born into a wealthy family can compensate for the risk of stunting by up to 39%.[28] The birth order risk was only valid if siblings were born within three years of each other and they advised more research focused on increasing birth interval.[30]

The strength of our study was that we analyzed both maternal factors and birth history to give a holistic view of stunting. Second, we used data from the IFLS-5, which included a large cohort of samples. This study has several limitations that should be considered when interpreting the results. First, the use of retrospective data limits the ability to directly observe or verify certain variables, such as maternal nutritional status or precise feeding practices, which may introduce recall bias. Additionally, this study may not accurately reflect the current prevalence of stunting in Indonesia. The cross-sectional nature of the data further limits the ability to infer causal relationships between the identified risk factors and stunting. Although multivariate logistic regression was used to adjust for potential confounders, unmeasured factors like genetic predispositions or environmental conditions may have influenced the outcomes. It is also important to note that the study was conducted before the COVID-19 pandemic, so some variables might need adjustments to remain relevant in today's context. Lastly, certain variables that were significant in bivariate regression did not maintain significance in multivariate analysis, highlighting the need for further research with larger datasets and additional confounding factors.

Important risk factors in stunted cases consisted of maternal, pregnancy, and psychosocial factors. Age 12 months or older, mother being employed, low level maternal education, maternal age <20 years, iron supplementation <90 tablets during pregnancy, birth weight <2,500g, and second or above birth order were all significant risk factors for stunting. In risk strength order, longer breastfeeding duration (≥ 12 months), younger maternal age (<20 years), and low birth weight had the strongest significant associations with stunting. The findings underscore the importance of comprehensive interventions that address nutritional intake as well as maternal health, education, and socioeconomic factors to effectively reduce stunting and severe stunting rates in the future.

Conflict of interest

None declared.

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