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The dominant factors associated with stunting among two years children in five provinces in Indonesia

Faktor-faktor dominan yang berhubungan dengan stunting pada baduta di lima provinsi di Indonesia

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Abstract

Stunting is a significant malnourishment problem in Indonesia. The 2021 Indonesian Nutritional Status Study (SSGI) reported that there are five provinces with a high prevalence of stunting (>30%). Age under two years (old age) is the golden period during which children overgrow, and malnutrition during this period can still be corrected. This study analyzed the dominant factors associated with stunting in two-year-old children from five provinces: Aceh, NTB, NTT, West Sulawesi, and Southeast Sulawesi. This cross-sectional study used secondary data from the SSGI 2021. The subjects were 4,554. Children (0-23 months) under five. The 2021 SSGI study was conducted in 34 provinces and 514 regencies/cities from January to December 2021. Data were collected through interviews using the SSGI 2021 questionnaire and anthropometric measurements. Statistical applications were used for data processing. Data analysis was performed using multiple logistic regression tests with the criteria of p<0,05 and a confidence interval (CI) of 95%. The risk factors associated with stunting in children from the five provinces were underweight (OR=9,367), age 6-11 months (OR=1,386), age 12-23 months (OR=1,386), diagnosis of measles (2,5681 CI), male sex (OR=1,400), family size ≥ 8 people (OR=1,612), poor sanitation (OR=1,273 CI 95% 1,041-1,556), and the father's occupation as a farmer/occupation/fisherman/driver (OR=1,278). In conclusion, being underweight is the dominant factor associated with stunting in toddlers.
Keywords: Father's occupation, measles, sanitation, stunting, underweight

Abstrak

Stunting masih menjadi masalah kekurangan gizi utama di Indonesia. Studi Status Gizi Indonesia (SSGI) 2021 melaporkan bahwa ada lima provinsi dengan prevalensi stunting tinggi (>30%). Usia dibawah dua tahun (baduta) merupakan periode emas dimana terjadi pertumbuhan anak yang pesat dan kekurangan gizi pada masa ini masih dapat diperbaiki. Penelitian bertujuan untuk menganalisis faktor-faktor dominan yang berhubungan dengan stunting pada baduta di lima provinsi tersebut yaitu Aceh, NTB, NTT, Sulawesi Barat, dan Sulawesi Tenggara. Desain penelitian menggunakan studi cross-sectional menggunakan data sekunder hasil SSGI 2021. Subjek adalah baduta (0-23 bulan) berjumlah 4554 anak. Penelitian SSGI 2021 dilakukan di 34 Provinsi dan 514 Kabupaten/Kota pada bulan Januari-Desember 2021. Pengumpulan data dilakukan dengan wawancara menggunakan kuesioner SSGI 2021 dan pengukuran anthropometri. Pengolahan data menggunakan aplikasi statistic. Analisis data menggunakan uji Regresi Logisitik berganda dengan kriteria p<0,05 dan confident interval (CI) 95%. Faktor-faktor risiko yang berhubungan dengan stunting pada baduta lima provinsi tersebut adalah underweight (OR=9,367), usia 6-11 bulan (OR=1,386), usia 12-23 bulan (2,477), diagnosis campak (2,5681 CI), laki-laki (OR=1,400), besar keluarga ≥ 8 orang (OR=1,612), sanitasi tidak baik (OR=1,273; CI-95%= 1,041-1,556), dan pekerjaan ayah petani/buruh /nelayan/ sopir (OR=1,278). Kesimpulan, underweight merupakan faktor dominan yang berhubungan dengan stunting pada baduta.
Kata Kunci: Campak, pekerjaan ayah, sanitasi, stunting, underweight

Introduction

Improving the growth and development of children during early life is essential and has become a global policy agenda. One hundred and fifty million children under five years of age worldwide are stunted, 45,4 million children experience wasting, and 15,9 million are underweight (World Bank et al., 2021). As stated in the 2021 Indonesian Nutrition Status Study (SSGI), the prevalence of stunted children under five years of age in Indonesia was 24,4%. The five provinces of Indonesia classified as high-stunting (>30%) are East Nusa Tenggara, West Sulawesi, West Nusa Tenggara, Southeast Sulawesi, and Aceh (Kemenkes, 2021).

Linear growth failure or stunting is a chronic nutritional problem marked by children's height compared to age below -2 SD. The direct causes of stunting include insufficient food intake and infectious disease incidents (UNICEF, 2013). The harmful effect of stunting is a delay in the linear growth of children's early life, associated with morbidity and mortality, a decrease in physical activity, cognitive and economic development, and an increased risk of metabolic disease in adulthood (Prendergast & Humphrey, 2014).

The children's golden period starts from conception to two years of age. This is a critical time when rapid growth and development of children occurs (Indrio et al., 2023). Studies on factors associated with stunting in children under two years of age in Bangladesh revealed age, gender, geographic distribution, and household position in the wealth index as common determinants of child stunting in Bangladesh (Choudhury et al., 2017). A study conducted in Indonesia found that the determinants of stunting in children under five years of age in West Sulawesi were wealth, maternal education, maternal weight, maternal Body Mass Index (BMI), child's age, gender, and history of Upper Respiratory Tract Infection (URTI) (Anastasia et al., 2023). Meanwhile, a study in East Nusa Tenggara found that the dominant factors causing stunting were children aged 24-35 months, mothers with low education, children living in rural areas and the highest prevalence of stunting in children aged 12-23 months (Suratri et al., 2023).

The Indonesian government has made many efforts to deal with the stunting problem through a national strategy to accelerate the stunting prevention program in the form of convergent nutritional interventions, including nutrition-specific and nutrition-selective interventions (TNP2K, 2018).

However, the prevalence of stunting remains relatively high in these provinces. In addition, no research has analyzed the dominant factors of stunting using SSGI 2021 data. Most research subjects related to the determinants of stunting in Indonesia are children under the age of five. Meanwhile, children under two years of age are in the golden period, where rapid growth occurs. Appropriate interventions during this period can improve children's nutritional status in the future.

Therefore, the findings on the determinants of stunting in this study can be used as a basis by the government to determine policies to reduce the prevalence of stunting in the five provinces. Apart from that, there are no studies that analyze 2021 SSGI data in five areas with a high prevalence of stunting in Indonesia, so these findings can also be an illustration for the government regarding factors related to stunting in children under two years old during the Covid 19 pandemic in 2021.

Methods

The design of SSGI 2021 was a cross-sectional study. The 2021 SSGI research was conducted in 34 provinces and 514 regencies/cities from January to December 2021. The entire data research employed secondary data derived from the 2021 Indonesian Nutrition Status Study (SSGI) conducted by the Health Research and Development Agency (Balitbangkes) of the Indonesian Ministry of Health. All data for this study were obtained in the form of electronic files from the Health Development Policy Agency (BKPK).

The SSGI 2021 data used in this study consisted of five provinces that had a high stunting prevalence (>30%) (De Onis et al., 2019): East Nusa Tenggara (37,8%), West Sulawesi (33,8%), Aceh (33,2%), West Nusa Tenggara (31,4%), and Southeast Sulawesi (30,2%). The total number of participants in this study was 4,554 children aged 0-23 months. The SSGI 2021 population in Indonesia consists of households with children under five years of age.

SSGI 2021 secondary data were obtained in the form of electronic files. The independent

variables in this study were the sample characteristics (age and sex) and socioeconomic characteristics of the family (number of family members, parents' occupation, and parents' education). Sanitation facilities are divided into two categories: good and poor sanitation facilities. A sanitation facility is good when the waste disposal (excrement disposal) area is separated; therefore, it does not come into contact with humans. As viewed from the disposal facility, feces are channelled into sewer pipes, septic tanks, pit latrines, well-ventilated latrines (VIP), pit latrines with slabs, and compost toilets. Meanwhile, bad or poor sanitation is characterized by disposal where excrement is not disposed of in the pipe system, pit, open latrine, hanging latrine, or worse, no latrine facility (Wolf et al., 2014). In addition, the diagnosis of measles indicated that the children had been diagnosed with measles in the last six months. Anthropometric data included measurements of the children's body weight and height. Weight Age Z-score (WAZ) was grouped into two categories: normal (Z-score ≥-2 SD) and underweight (Z-score <-2 SD). Length Age Z-score (LAZ)was grouped into two groups: normal (Z-score ≥-2 SD) and stunting (Z-score <-2 SD)(Kemenkes RI, 2020).

The SSGI 2021 research team collected data through interviews using the SSGI-2021-RT-INDIVIDUAL Questionnaire with respondents who were heads of family, housewives, or household members. The children's height was measured using a multifunctional height measurement instrument with 196 a measuring capacity of 0.1 cm accuracy. Body weight data were measured, and brand digital weight scales with a capacity of 5-150 kg and accuracy of 50 g were calibrated.

The data processing and analysis included coding, cleaning, and analysis. Data analysis comprised descriptive analysis by presenting data in tabular format and multivariate analysis, namely, analysis of factors related to stunting using multiple logistic regression. Univariate, bivariate, and multivariate analyses were used in this study. The univariate analysis describes each dependent and independent variable by describing the frequency distribution in percentages and amounts. Next, bivariate analysis was carried out, namely, the difference in proportions test using chi-square to see the difference in the proportion of the independent variable to the dependent variable (stunting and non-stunting). Data processing was performed using statistical software.

Multiple Logistic Regression analysis was used for multivariate analysis to determine the values of risk factors or odds ratios (OR). The initial stage of this analysis was a simple logistic regression test, namely, testing the relationship between each independent variable and the dependent variable. If the p-value was <0,25, it was included in the multiple logistic regression analysis using the backward walk method. The criteria for the results of this analysis were a p-value <0,05 and a confidence interval (CI) of 95%.

Result and Discussion

The socioeconomic characteristics of the family include the size of the sample family, parents' occupation, and parents' educational level. Table 1 shows that half of the sample (46,8%) had to 5-7 family members, and nearly two-thirds of the fathers' occupations (63,2%) were farmers, fishermen, and drivers. Likewise, nearly two-thirds of mothers (64,5%) were unemployed or had no occupation.

In general, almost half (46,95%) of the fathers'education level graduated from junior school to high school, and likewise, about half (52,7%) of the mothers' education level was junior school to high school. Almost all (98%) children were not diagnosed with measles. Similarly, the majority (84,4%) of household sanitation facilities were classified as good facilities.

Table 2 shows that the proportion of stunted children with underweight issues (46,5%) was higher than that of normal children (7,8%), indicating a significant difference (p<0,001) in body weight according to age between the stunted and normal children. Similarly, stunted children were found in higher numbers in males children (58,2%) than in females. Meanwhile, the number of normal children was higher than that of the female children (52,0%).

The proportion of children with normal nutritional status and stunting who were diagnosed with measles was significant. Where 3,3% of stunted children were diagnosed with measles; however, only 1,5% of children with

normal nutritional status were diagnosed with measles. Similarly, there was a significant difference (p<0,005) in sanitary conditions between the normal and the stunted children, with the percentage of poor sanitation among children classified as stunted being 18,4%; meanwhile, of children with normal nutritional status who had poor sanitation was 14,5 %.

Table 1. The sample characteristics, socioeconomic, sanitation, and measles of children under two years old in five provinces of Indonesia (n= 4.554)

Variable	Category	n	%
Age	< 6 months	1.125	24,7
	6-12 months	949	20,8
	12-23 months	2.480	54,5
Gender	Male	2.310	50,7
	Female	2.244	49,3
LAZ	Normal	3.328	73,1
	Stunting	1.226	26,9
WAZ	Normal	3.725	81,8
	Underweight	829	18,2
Family Size	≤ 4 family members	2.050	45,0
	5-7 family members	2.131	46,8
	≥ 8 family members	373	8,2
Father's Occupation	Civil Servant/Private Employee/Entrepreneur	1.452	31,9
	Farmer/Laborer/Fisherman/Driver	2.876	63,2
	Not Occupation ing/ No Occupation	226	5,0
Mother's Occupation	Civil Servant/Private Employee/Entrepreneur	650	14,3
	Farmer/Laborer/Fisherman/Driver	967	21,2
	Not Occupation ing/ No Occupation	2.937	64,5
Father's Education Level	University	445	9,8
	Junior-Senior High School	2.136	46,9
	Elementary School	1.973	43,3
Mother's Education Level	University	753	16,5
	Junior-Senior High School	2.401	52,7
	Elementary School	1.400	30,7
Sanitation	Good Sanitation Facility	3.845	84,4
	Poor/Bad Sanitation Facility	709	15,6
Measles Diagnosis	No	4.463	98,0
	Yes	91	2,0

There was also a significant difference (p<0,001) in the age categories of the stunted and normal children. The proportion of stunted children was 69,2% at the age of 12-23 months, a higher number than non-stunted children (49%), and there was a significant difference (p<0,001) found in the family size of stunted and normal children, where most stunted children (48,2%) lived in families consisting of to 5-7 members of the family. Meanwhile, the majority of children with normal nutritional status (46,4%) belonged to a family with ≤ 4 members. Another significant difference (p<0,001) was found in the category of fathers' occupation of normal and stunted children. Fathers who have stunted children occupation as farmers, laborers, fishermen, and drivers with a higher percentage (67,9%) compared to those who have normal children (only 61,4%) occupation in this field.

Data on factors related to stunting incidence are presented in Table 3, where body weight according to age was found to be a factor related to stunting. The risk of underweight children undergoing stunting is 9,367 times that of children of normal weight. Male children were 1,4 times more likely to have a risk of stunting compared to female children. Likewise, children

diagnosed with measles are more than twice as likely to be stunted as those who are not diagnosed with measles. Furthermore, stunted children are affected by poor sanitation facilities. Residences with poor sanitation facilities have an increased risk of stunting at 1,273. compared to children residing in good sanitation facilities.

Table 2. The relathionship between WAZ, Sex, Measles diagnosis, sanitation, age, family size, and father occupation with stunting

Variable	Normal		Stunting		p-value
	n	%	n	%	
WAZ					
Normal	3.069	92,2	656	53,5	
Underweight	259	7,8	570	46,5	0,000
Sex					
Female	1.731	52,0	513	41,8	
Male	1.597	48,0	713	58,2	0,000
Measles Diagnosis					
No=0	3.278	98,5	1185	96,7	
Yes	50	1,5	41	3,3	0,000
Sanitation					
Good Sanitation =0	2.845	85,5	1.000	81,6	
Poor/Bad Sanitation	483	14,5	226	18,4	0,001
Age					
<6 months	960	28,8	165	13,5	
6-11 months	736	22,1	213	17,4	0,000
12-23 months	1.632	49,0	848	69,2	
Family Size					
≤4 members=0	1.545	46,4	505	41,2	
5-7 members	1.539	46,2	592	48,3	0,000
≥8 members	244	7,3	129	10,5	
Father Occupation					
Civil Servant/Employee Private/Entrepreneur	1.119	33,6	333	27,2	
Farmer/Laborer/Fisherman/Driver	2.044	61,4	832	67,9	0,004
Not Occupation ing/No Occupation	165	5,0	61	5,0	0,497

The probability of a child aged 12-23 months with stunting is 2,477 compared to children aged less than six months. Likewise, children with ages 6-11 months are at risk of stunting 1,386 times compared with children aged < six months. Children with a family size of more than eight people were 1,612 times more likely to experience stunting than were children whose family size consisted of fewer than four people. Likewise, children with family members of 5-7 individuals are at risk of experiencing stunting 1,176 times when compared to children with ≤ 4 family members. Fathers who occupation as farmers, laborers, fishermen, and drivers are at risk of having stunted children 1,278 times compared to fathers who occupation as civil servants, private employees, and entrepreneurs.

The children's age had a significant relationship with the incidence of stunting. The older the age, the more likely it is for children to be at risk of stunting compared to younger children. Children with ages of 6-12 months and 12-23 months are at a higher risk of stunting than children with ages of 0-6 months. This finding is in line with that of other studies (Toma et al., 2023; Mulyani et al., 2022). A cohort study of children's growth and development in Bogor also found that the Z-score for height according to children's age tended to decrease as the children aged. Until the age of 17 months, the Z-score of children tends to decrease, and the Z-score for height according to age tends to stagnate(Riyadina & Sudikno, 2018). Recent studies from low- and middle-income countries also reported that the highest incidence of stunting occurred at the age of two years, from

birth to the age of 3 months, with higher incidences among children born stunted (Benjamin-Chung et al., 2023).

Male children had a higher risk of stunting than did female children. This finding is in line with a research report stating that male children have a higher chance of experiencing stunting than female children (Thurstans et al., 2020; Soofi et al., 2023). This is because boys are biologically more susceptible to malnutrition in the womb. This condition places men at a greater risk of infection and malnutrition. However, a household context shaped by social and cultural norms can influence parenting and feeding practices over time (Thompson 2021).

Furthermore, children with measles have a greater risk of stunting than those without measles. This indicated that infectious diseases can increase nutrient absorption (Maigoda et al., 2023). This results in a lack of nutrients for growth, because the intake of these nutrients is utilized to cure infectious diseases. This is supported by research conducted in Uganda on children aged 6–59 months, which found that children who did not suffer from measles were protected against stunting (Nsubuga et al., 2022).

The number of family members is related to stunting. Children who have more than eight family members are at risk of experiencing stunting. Children with more than eight family members were at risk of experiencing stunting (Rahmad & Miko, 2016). Many family members encourage children to share food; therefore, the intake obtained by children is not optimal. This finding is consistent with that of a study conducted in Pakistan (Soofi et al., 2023). In addition, a study on factors related to stunting in children by the age–6-59 months in Northwest Ethiopia also found that children in a family consisting of more than six family members are at risk of experiencing stunting (Geberselassie et al., 2018).

Poor sanitation is the dominant factor associated with stunting. Children living in poor sanitation facilities are 1.273 times more likely to experience stunting than those living in poor sanitation facilities. Sanitation facilities were categorized as poor when seen from the location of the excrement flow. They were neither covered nor protected. This allows pathogenic bacteria from feces to spread, which causes disease vectors to emerge, making children susceptible to infectious diseases. A prospective cohort study of children aged 6-72 months in Sudan found that children in the intervention group who were provided with water and sanitation facilities experienced an increase in LAZ compared with the group that did not receive the intervention. Research conducted on children in Ethiopia, India, Peru, and Vietnam also found better access to sanitation, often associated with a reduced risk of stunting, than access to clean water (Dearden et al., 2017).

The fathers' occupation is related to the possibility of stunting. Children whose fathers occupation as farmers, laborers, fishermen, and drivers are likely to be stunted compared to those whose fathers occupation as civil servants, private employees, and entrepreneurs. Father's occupation was a factor with a significant relationship ($p<0,001$) with stunting (Das & Gulshan, 2017). Occupation is related to income earned by the household head. The father's income from occupation as a farmer, labourer, and fisherman is relatively low, and the father's income will not be sufficient to meet the family's food necessities. This condition encourages food insufficiency within the family so that their children are vulnerable to malnutrition. Low-income households have a higher risk of stunting (Soofi et al. 2023) .

Inappropriate body weight with age is also associated with stunting. Children who are underweight have a nine likely risk of stunting compared with normal children. Underweight refers to acute malnutrition. If the situation persists for a long time, it will cause linear growth failure because inadequate nutritional intake must compensate for weight gain; therefore, nutritional intake will be insufficient for linear growth. One study in South Kalimantan also found that being underweight was a decisive key to the incidence of stunting in children under five years of age(Noor et al., 2022). An analysis of the relationship between stunting and underweight in Malawi children under five years of age also found a significant relationship between these two nutritional status indicators (Ngwira et al., 2017).

Multivariate Analysis

Table 3. Final model of stunting-related factors

Variable	β	OR (95% CI)	p-value
BB/U			
Normal			
Underweight	2,237	9,367 (7,874-11,144)	0,000
Gender			
Female			
Male	0,336	1,400 (1,205-1,626)	0,000
Measles Diagnosis			
No=0			
Yes	0,943	2,568 (1,601-4,121)	0,000
Sanitation			
Good Sanitation =0			
Poor/Bad Sanitation	0,241	1,273 (1,041-1,556)	0,018
Age			
<6 months			
6-11 months	0,907	1,386 (1,083-1,774)	0,010
12-23 months	0,326	2,477 (2,026-3,028)	0,000
Family Size			
≤4 members=0			
5-7 members	0,162	1,176 (1,005-1,377)	0,043
≥8 members	0,478	1,612 (1,231-2,113)	0,001
Father Occupation			
Civil Servant/Employee Private/Entrepreneur			
Farmer/Laborer/Fisherman/Driver	0,245	1,278 (1,081-1,511)	0,004
Not Occupation ing/No Occupation	0,126	1,134 (0,788-1,633)	0,497

This study employed a relatively large sample from five provinces in Indonesia with a high prevalence of stunting (≤ 30%). However, this research has limitations because it was unable to explain the cause and effect of existing relationships because it applied a cross-sectional research design. It is important to conduct cohort research that follows the health of pregnant women and children's growth from birth to two years of age so that the starting point where linear growth failure occurs can be identified. The dominant cause of the incident can be understood, so that appropriate interventions can be formulated.

Conclusion

Risk factors associated with stunting in children from the five provinces were underweight, age 6-11 months, age 12-23 months, diagnosis of measles, male sex, family size ≥ 8 people, poor sanitation, and father's occupation as farmer/laborer/fisherman/driver. Being underweight is the dominant factor associated with stunting in toddlers.

Advice, support government intervention programs are being implemented to address stunting among children aged 0-23 in five provinces. These programs aim to ensure adequate nutritional intake and regularly monitor children's nutritional status to detect deficiencies. Assistance programs for mothers provide weaning food and promote growth in proportion to age. Pregnancy-fetal nutrition was optimized to prevent intake gap. Economic stimulation is crucial for improving household incomes and food sufficiency. Increased immunization coverage is necessary to prevent infectious diseases. Household sanitation has also improved to prevent malnutrition. These interventions aim to improve the nutritional status of children under the age of five, encourage household welfare, and provide adequate food and sanitation facilities. Nutritional education for pregnant women and toddlers is essential.

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This research has passed Ethical approval was obtained from the Health Research Ethics Committee, National Institute of Health Research and Development (HREC-NHRD) (No: LB.02.01/2/KE.248/2021), in accordance with the Helsinki Declaration.

Conflict of Interest Declaration: The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript. The authors declare that they have no conflicts of interest.

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