Stunting Risk Factors Based on Priority Region in Indonesia: 2018 National Basic Health Survey

by Review Pak

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Abstract. Current study aimed to explore the risk factors of stunting based on priority-region status in Indonesia. We extracted national basic health survey in 2018. We defined stunting based on height for age, which Z-score<-2.0, was categorized as stunting. Priority-region categorized by the National Team for Acceleration of Poverty Reduction, Republic of Indonesia, i.e., 100 priority-regions determined. We also observed children's characteristics, i.e., age, sex, birth weight and height, gestational age, weaning age, diarrhea, immunization, breastfeeding, and supplementary feeding. Parent's and household's characteristics were observed as well. Binary regression logistic was performed to conclude risk factors of stunting. We concluded that male children, lower mother's and father's height were the consistent risk factors for priority-, non-priority, and total-regions. Without consider priority-region, we concluded that family members, sex, access to health services, antenatal-care, mother's- and father's-height, parent's education level, and ferrous-sulfate supplementation altogether were the risk factors for stunting in Indonesia.

Keywords: stunting, risk factors, priority region, Indonesia

1   Introduction

Stunting is a health problem in children that the most burdened in developing countries[1]. Decreasing stunting is one priority of the six goals of *the Global Nutrition Targets* in 2025.[2] Children are determined as stunted if their height for age Z-score were ≤2 from the standard deviations [SD][3]. Stunting causes 14.5% of deaths each year. Studies also concluded that there is a link between stunting and cognitive impairment[4][5][6]. Prolonged impairment of cognitive function in children with stunting will affect productivity and economic status[7][8][9]. Other studies have shown that school dropout rates for children with stunting are higher than for normal children[8].

The prevalence of stunting in Indonesia is 30.5%[10], placed comparable to other countries with high stunting burdens[11]. Indeed, the prevalence decreased compared to the previous Indonesia national basic health survey (riset kesehatan dasar:

RISKESDAS) 2013, i.e., 37.2%[12] but must still be concerned. In 2018 the government determined a hundred priority regions, i.e., districts/cities with the highest stunting prevalence. A hundred districts/cities are spread evenly throughout the province, which varies number in each province[13]. This region determination is needed for public health nutrition measures to decrease stunting cases.

Stunting in children developed during the first two years of life (0-23 months). The pivotal causes of stunting are malnutrition[14], non-exclusive breastfeeding[15][16][17], low economic status of the family[18][19][20][21], premature births[21], low birth weight[16][20], low parental education level[18][22][23][24], living in households with 3 or more under 5 years old children[25], households with 5 - 7 family members[25], poor sanitation[20][26], and low access to the health services[20][26][27].

The determinants of stunting are well-established; however, little is known regarding the determinants in the region with a different rate of prevalence, especially in Indonesia. The current study aimed to explore the risk factors of stunting according to priority region in Indonesia based on RISKESDAS 2018. In addition, the current study updated the information regarding stunting in Indonesia from the previous RISKESDAS.

2 Methods

Present study analyzed secondary data obtained from the results of RISKESDAS conducted by the Ministry of Health, the Republic of Indonesia, in 2018. This survey was a nationally representative survey with a cross-sectional study conducted every five years. The population includes households in all provinces and districts/cities, i.e., 34 provinces, 416 districts, and 98 cities in Indonesia. Data collection was done by interview, measurement, and physical examination. Interviews using two instruments, i.e., Household Instruments and Individual Instruments. Details about sampling techniques, survey design, survey instruments, measurement systems, ethical clearance, and quality control have been explained elsewhere[10]. In this analysis, we use information gathered from 27,280 women with children aged 0-23 months who have fulfilled the questionnaire.

2.1 Data management

We defined stunting status data based on obtained RISKESDAS data of children aged 0-23 months. We determined stunting on Z-score with the [SD] calculated from height for age. Stunting determined when Z-score < -2.0. We also analyzed the factors provided based on the latest research related to stunting conducted in Indonesia. [25][28] We identified parameters provided in RISKESDAS data to be analyzed. We concern about the fundamental factors, i.e., priority region as an important parameter for the stunting cases. Priority region selected and determined by the National Team for the Acceleration of Poverty Reduction (Tim Nasional Percepatan Penanggulangan Kemiskinan: TNP2K) in 2018, i.e., 100 priority region[29]. We determined 150 control regions chosen from non-priority regions randomly. We also observed children's characteristics, i.e., age, sex, birth weight, birth height, gesta-

tional age, weaning age, history of diarrhea within two weeks, history of immunization, initiation of early breastfeeding, exclusive breastfeeding, and supplementary feeding. Supplementary feeding determined as adequate supplementation of extra feeding, i.e., biscuits, milk, and other forms administered for the last 12 months.

Regarding parent's characteristics, we observed the educational status of parents, employment status of parents, maternal and paternal stature, maternal age of first birth, desired pregnancy status, administration of ferrous-sulfate tablets, the number of antenatal care (ANC) visits during pregnancy, and the history of pregnancy complication. Pregnancy complications were defined as the presence of gestational related-problems during pregnancy, delivery, and puerperium could be the infection, bleeding, or eclampsia.

We also observed household characteristics, i.e., the number of all family members, the number of children under five years in the household, access to the health services (Public Health Services=Pusat Kesehatan Masyarakat [Puskesmas]), fecal disposal status, and type of drinking water used. Fecal disposal categorized as standardized based on latrine usage, while the type of drinking water categorized as secured when satisfied with the criteria of secured drinking water, i.e., from branded bottled water, governmental drinking water company, and secured water springs.

2.2   Data analysis

Data were presented in frequency and percentage based on case and control status due to categorical data types. *Chi-square* analysis was performed to determine the relationship between determinants and stunting status. P- values <0.05 were considered statistically significant. Factors that have a p-value lower than 0.25 were involved in multivariable analysis. We analyze the final model using *Binary Regression Logistics*. All analyses were performed by SPSS 16.0 (IBM Corporation, NY, USA).

3   Results

Data were extracted from the RISKESDAS 2018, and we got a total of 27,280 children 0-23 months that met the criteria. Of them, 8,537 experienced stunting mean the prevalence based on this subset was 31.29 %. Based on the priority region category, most of them living in the non-priority region, i.e., 21,424 (78.5%), and the rest 21.5 % living in the priority region (Table 1a.)

Table 1a. also shows that the proportion of priority region was significantly higher in the stunting group. The proportion of aged <12 months was significantly lower in the case group compared to the control group. The proportion of males was also remarkable higher in the stunting group. History of diarrhea within the two weeks proportion was significantly higher in the case group, while the history of diarrhea after two weeks was not significantly different between groups. Gestational age < 37 weeks proportion was higher in the stunting group. Birth weight and birth height also demonstrated significant differences between groups. The proportion of lower birth weight was higher in the case group, as well as the proportion of lower birth

height. However, the missing values (not applicable data) of these two parameters were quite high. Weaned age proportion notably different as well, i.e., weaning age of < 12 months tend to be lower in the case group. The other parameters in the children's domain, i.e., supplementary feeding, immunization history, early breastfeeding initiation, and exclusive breastfeeding, were comparable between groups.

Table 1b demonstrated the characteristics in the domain of parents. Mothers and fathers who had lower education levels were higher proportion in the stunting group. There was a significant difference between the mother's employment status proportion, i.e., tend to be lower for stunting group, while the father's employment status was comparable between groups. The mother's age of first labor under 20 years tends to have a higher proportion in the case group.

Table 1. a. Subject Characteristics of children

Characteristics	Stunting status		P-value *	OR [95% CI]
	Yes N = 8,537	No N = 18,743		
Priority region				
Yes n; %	1996; 23.4	3860; 20.6	**0.001**	1,117 (1,107-1,251)
No n; %	6541; 76.6	14883; 79.4		
Age				
<12 months n; %	3174; 37.2	10533; 56.2	**0.001**	0.461 (0.438-0.486)
12-23 months n; %	5363; 62.8	8210; 43.8		
Sex				
Male n; %	4730; 55.4	9235; 49.3	**0.001**	1.279 (1.215-1.347)
Female n; %	3807; 44.6	9508; 50.7		
History of diarrhea				
Yes in <2 weeks n; %	715; 8.4	1324; 7.1	**0.001**	1.208 (1,099-1,328)
Yes in> 2 weeks n; %	351; 4.1	706; 3.8	0.119	1.112 (0,976-1,268)
Never n; %	7471; 87.5	16713; 89.2	Ref	Ref
Supplementary feeding				
No n; %	4948; 58.0	10985; 58.6	0.320	0.974 (0.974-1.026)
Yes n; %	3589; 42.0	7758; 41.4		
History during birth				
Gestational age				
<37 weeks n; %	2918; 34.2	5996; 32.0	**0.001**	1.104 (1.046-1.166)
≥ 37 weeks n; %	5619; 65.8	12747; 68.0		
Birth weight				
N/A n; %	3486; 40.8	6961; 37.1		
≤ 2500 g n; %	804; 9.4	1005; 5.4	**0.001**	2.030 (1.838-2.242)
> 2500 g n; %	4247; 49.7	10777; 57.5		
Birth height				
N/A n; %	4339; 50.8	8736; 46.6		
≤ 44.2 cm n; %	415; 4.9	574; 3.1	**0.001**	1.803 (1.580-2.057)
> 44.2 cm n; %	3783; 44.3	9433; 50.3		
Immunization history				
N/A n; %	5475; 64.1	12779; 68.2		
No n; %	884; 10.4	1615; 8.6	0.076	1.093 (0.992-1.204)
Yes n; %	2178; 25.5	4349; 23.2		
Early breastfeeding initiation				
No n; %	3844; 45.0	8300; 44.3	0.257	1.031 (0.979-1.085)
Yes n; %	4693; 55.0	10443; 55.7		
Exclusive breastfeeding				
No n; %	3844; 45.0	8300; 44.3	0.257	1.031 (0.979-1.085)
Yes n; %	4693; 55.0	10443; 55.7		
Weaned age				
N/A n; %	215; 2.5	459; 2.4		
<12 months n; %	3978; 46.6	10170; 54.3	**0.001**	0.731 (0.694-0.770)
≥ 12 months n; %	4344; 50.9	8114; 43.3		

* Chi-Square test

The proportion of pregnant mothers with less than four visits tends to be higher in the stunting category. Lower height, both of the mother and father tend to have a higher proportion in the stunting group. Ferrous-sulfate supplementation group tends

to be lower in the case group, significantly. Pregnancy status and pregnancy complication proportions were comparable between groups.

A household with had three or more under-five years old children significantly had a higher proportion in the case group. (Table 1c.) Similarly, family members five to seven members, as well as eight members or more, tend to be higher in the stunting category. Families with have difficulty accessing public health services tend to have a higher proportion of stunting. Secured drinking water usage tends to have a lower proportion in the stunting cases. Fecal disposal management in the household proportion was comparable between groups.

Table 1. b. Subject Characteristics of parents conditions

Characteristics	Stunting status		P value *	OR [95% CI]
	Yes N = 8,537	No N = 18,743		
Mother's level of education				
High school or lower n; %	7456; 87.3	15851; 84.6	**0.001**	1.258 (1.167-1.357)
Higher education; %	1081; 12.7	2892; 15.4		
Mother's employment status				
Unemployed n; %	4933; 57.8	11111; 59.3	**0.021**	0.940 (0.893-0.990)
Employed n; %	3604; 42.2	7632; 40.7		
Mother's age of first labor				
< 20 years n; %	2651; 31.1	5301; 28.3	**0.001**	1.141 (1.078-1.207)
≥ 30 years n; %	5467; 64.0	12474; 66.6	0838	1.013 (0.899-1.140)
20 - 29 years n; %	419; 4.9	968; 5.2	Ref	Ref
Pregnancy status				
Undesired n; %	310; 3.6	682; 3.6	1.000	0.998 (0.87-1.144)
Desired n; %	8227; 96.4	18061; 96.4		
Number of ANC visits				
<4 times n; %	2001; 23.4	3856; 20.6	**0.001**	1.182 (1.112-1.257)
≥ 4 times n; %	6536; 76.6	14887; 79.4		
Mother's height				
<150 cm n; %	3766; 44.1	6133; 32.7	**0.001**	1.623 (1.540-1.710)
≥ 150 cm n; %	4771; 55.9	12610; 67.3		
Ferrous sulfate supplementation				
No n; %	1275; 14.9	2400; 12.8	**0.001**	1.196 (1.111-1.287)
Yes n; %	7262; 85.1	16343; 87.2		
Pregnancy complication				
Yes (at least one or more) n; %	987; 11.6	2290; 12.2	0.127	0.939 (0.868-1.017)
No n; %	7550; 88.4	16453; 87.8		
Father's level of education				
High school or lower n; %	7636; 89.4	16249; 86.7	**0.001**	1.301 (1.200-1.410)
Higher education n; %	901; 10.6	2494; 13.3		
Father's employment status				
Unemployed n; %	203; 2.4	454; 2.4	0885	0.981 (0.830-1.160)
Employed n; %	8334; 97.6	18289; 97.6		
Father's height				
< 160 cm n; %	2798; 32.8	4618; 24.6	**0.001**	1.491 (1.410-1.577)
≥ 160 cm n; %	5739; 67.2	14125; 75.4		

ANC: ante-natal care * Chi-Square test

Table 1. c. Subject Characteristics regarding household conditions

Characteristics	Stunting status		P-value *	OR [95% CI]
	Yes **N = 8,537**	**No** **N = 18,743**		
Number of under-fives in household				
≥ 3 n; %	316; 3.7	513; 2.7	**0.001**	1.368 (1.185-1.579)
2 n; %	2119; 24.8	4678; 25.0	0844	1.006 (0.948-1.068)
1 n; %	6102; 71.5	13552; 72.3	Ref	Ref
Members in household				
≥ 8 members n; %	840; 9.8	1719; 9.2	**0.020**	1.116 (1.018-1.224)
5 - 7 members n; %	4400; 51.5	9495; 50.7	**0.041**	1.058 (1.002-1.117)
1 - 4 members n; %	3297; 38.6	7529; 40.2	Ref	Ref
Limited access to health services				
Yes n; %	483; 5.7	825; 4.4	**0.001**	1.302 (1.161-1.462)
No n; %	8054; 94.3	17918; 95.6		
Fecal disposal				
Non latrine usage n; %	51517; 60.4	11517; 61.4	0.105	0.957 (0.908-1.009)
Latrine usage n; %	3380; 39.6	7226; 38.6		
Drinking water				
Unsecured n; %	1536; 18.0	2933; 15.6	**0.001**	1.183 (1.105-1.266)
Secured n; %	7001; 82.0	15810; 84.4		

under-fives: under five years old children   * *Chi-Square test*

Table 2. Binary logistic regression of parameters based on priority region

Variable	Non-priority region		Priority region		Total region	
	p	Adjusted OR (95% CI)	p	Adjusted OR (95% CI)	p	Adjusted OR (95% CI)
Priority region					0.001	1.141 (1.072-1.214)
5/more family members	0.024	1.072 (1.009-1.139)			0.018	1.066 (1.011-1.124)
Male	0.001	1.281 (1.207-1.358)	0.001	1.308 (1.172-1459)	0.001	1.288 (1.223-1.357)
Limited access to health services	0.014	1.191 (1.035-1.369)			0.006	1.180 (1.018-1.163)
ANC visits <4	0.032	1.081 (1.007-1.162)			0.013	1.088 (1.018-1.163)
Mother's height < 150 cm	0.001	1.589 (1.496-1.689)	0.001	1.436 (1.285-1.604)	0.001	1.556 (1.476-1.641)
Father with high school or lower educational level	0.008	1.156 (1.039-1.287)			0.001	1.185 (1.092-1.287)
Father's height < 160cm	0.001	1.138 (1.294-1.479)	0.001	1.444 (1.285-1.622)	0.001	1.400 (1.322-1.482)
No ferrous-sulfate supplementation			0.001	1.419 (1.200-1.678)	0.005	1.200 (1.034-1.213)
Constant	0.001	0.232	0.001	0.542	0.001	0.236

ANC: ante-natal care

Present study also grouping all characteristics based on priority region status as a fundamental determinant of stunting. (Table 2.) We analyzed the characteristics in three groups, i.e., non-priority region, priority region, and total region. Present study

342

identified seven risk factors in the non-priority group, four risk factors in the priority group, and nine risk factors in the total group. We found that male children, mother's height < 150 cm, father's height < 160 cm were consistent risk factors either in non-priority, priority, or total groups. There were four risk factors associated with stunting in non-priority and total group, i.e., five or more family members, limited access to health services, ANC visits <4, and father with high school or lower education level, while no ferrous-sulfate supplementation was the only risk factors in the priority region and total group. The odds ratio (OR) and confidence interval (CI) for each risk factors presented in Table 2.

4   Discussion

The present study reports the risk factors of stunting in Indonesia. To the best of our knowledge, the present study was the first report of stunting risk factors that differentiated based on priority region status. This study also provided the prevalence of stunting based on the population study, i.e., 31.29%, means consistent with the number in total RISKESDAS 2018 survey, i.e., 30.5%[10]. TNP2K divided region based on stunting problems into priority and non-priority regions. Priority regions consist of 100 districts/cities in Indonesia. These priority regions located in Java and Bali islands, i.e., 40 regions, while 60 regions were outside Java and Bali islands[29]. There were more regions outside Java and Bali islands as priority regions, that related to socioeconomic conditions, especially those in eastern Indonesia. Indeed, development priority in all aspects is concerned in eastern Indonesia; however, appropriate strategies must be improved. Previous studies reported that resources and facilities are limited, especially in the health care services in these regions[25,30].

In this study, in all regions we found consistently, that male children were more likely to get stunting, with also the consistent OR in the non-priority region, priority region, and the total group of 1.28 (95% CI: 1.207-1.358), 1.30 (95% CI: 1.172-1459), and 1.29 (95% CI; 1.223-1.357), respectively. These results were also consistent with the 2013 RISKESDAS data [25] as well as other studies[31][32][33]. Studies also reported that boys are more susceptible to infectious diseases caused by environmental conditions and their mobilitities[34][35]. Mother's height <150 cm and father's height <160 cm in this analysis have a significant relationship. Other studies have found a strong relationship between father's short stature and stunting in children 24-59 months[16]. Current study showed that OR of mother's height less than 150 cm were comparable, i.e. 1.59 (95% CI: 1.496-1.689) 1.44 (95% CI:1.285-1.604) 1.56 (95% CI: 1.476-1.641), respectively. Regarding father's height < 150cm, the OR in the non-priority region, priority region, and total region were 1.14 (95% CI: 1.294-1.479), 1.44 (95% CI: 1.285-1.622), and 1.40 (95% CI:1.322-1.482), respectively.

In the priority and total region population, we found that no ferrous-sulfate supplementation were the only risk factors with the OR of 1.42 (1.200-1.678) and 1.20 (1.034-1.213) in priority and total region, respectively. Our findings indicated that administration of ferrous-sulfate tablets is important to support optimal maternal nutrition because this supplementation is needed to ensure optimal intra-uterine fetal growth[36][30] Trials have examined the benefits of iron/folic acid and micronutri-

ents supplementations during pregnancy in promoting fetal growth, birth length and postnatal growth[37][38]. There is a strong relationship between stunting and consumption of animal proteins, especially various types of animal proteins[14][39]. We did not find the relationship between ferrous-sulfate supplementation and stunting in the non-priority region, but lack of additional data founded in the study to conclude the possible cause of this condition.

In the total region from the current study showed that father with high school or lower of education level was related to stunting (OR=1.19 (95% CI: 1.092-1.287), but nor in mother's education level. Previous studies[40] concluded that low education related to stunting. The relationship between parent's education level and stunting is well elucidated but did not differentiate which is the most influenced, whether their father or mother [19][20] In general, the chance of stunting for children is twice higher in the lower level of parental education[40], while this study just showed 1.19 times for lower father's education level.

The family member consists of five or more members was the risk factors as well in the total region with the OR of 1.07 (95% CI: 1.011-1.124). This condition also corresponded with household issues, i.e., the number of under-five years children living in the house. Previous studies[25] concluded; accordingly, this can be due to a location in the availability of food, improper childcare practices, and accessibility of suboptimal family facilities[32][41] Limited access to the health services and ANC visits less than four times were the risk factors for stunting both in non-priority and total regions. These two parameters were related to healthcare services. These findings were the classical problems and still existed to date, as reported previously[40][25]. Poor access to health services and living in remote rural areas were the crucial determinants in the household level [25].

Other studies concluded the other risk factors, i.e., low birth weight and height[7] [24][34], age, and maternal age during pregnancy. Studies reported that children aged <12 months tend to get stunting[15] [24][25], while other studies concluded that aged 12-23 years more likely to get stunting[25][7]. However, we did not find any relationship between the age of children, birth weight/ height, and maternal age during pregnancy to stunting status. Future studies that involved more parameters such as genetic factors and molecular biomarkers should be conducted to elucidate the risk factors of stunting in Indonesia and globally.

5   Conclusion

The present study concluded that there were different risk factors for stunting based on priority region status. Male children, mother's height < 150 cm, and father's height < 160 cm were the constant risk factors for stunting in all region groups. In the total group, we concluded that priority region, five or more family members, male children, limited access to health services, ANC visits < 4, mother's height <150cm, the father with high school or lower educational level, father's height < 160cm, and no ferrous-sulfate supplementation altogether were the risk factors for stunting in Indonesia.

344

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