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# The Determinants of Stunting for Children Aged 24-59 Months in Kulon Progo District 2019

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## Abstract

This study pertains to stunting in children in Indonesian with z-scores of less than -2 Standard Deviation (SD) and less than -3 SD. The preliminary study results showed the highest prevalence of stunting to be 22.6%, at the Temon II Primary Health Care in Kulon Progo District. The study aimed to assess the determinants of stunting children aged 24–59 months. This study was conducted from September 2018–May 2019. The design of this study was analytical observational with study design case-control. The sample was 60 children aged 24–59 months. The method utilized proportional sampling, whereas the data analysis applied chi-square and logistic regression. The analysis of statistical tests showed a significant correlation between the stunting children and energy intake factor ( $p$ -value = 0.030;  $\alpha$  = 0.05; CI = 95%). Risk factors were energy intake, protein intake, suffering from acute respiratory tract infections, and suffering diarrhea. A non-risk factor was immunization status. Protective factors were access to clean water and the history of exclusive breastfeeding. The most influential factor for stunting children aged 24–59 months was energy intake.

**Keywords:** determinant, energy intake, stunting

## Introduction

Stunting is a nutrient issue that concerns developing countries, especially.<sup>1</sup> Stunting, or being too short for one's age, is defined as a height of more than two standard deviations (SD) below the World Health Organization (WHO) Child Growth Standards median.<sup>2</sup> Malnutrition occurs during pregnancy and the newborn period.

Children are considered stunted and severely stunted if the body length and the height based on the age range are less than the WHO-Multicentre Growth Reference Study (MGRS) median standard.<sup>3</sup> The Indonesia Ministry of Health considers the value of the z-score of stunted children is less than -2 SD and severely stunted children is less than -3 SD.<sup>4</sup> Wasting in children is a symptom of acute undernutrition, usually due to insufficient food intake or a high incidence of infectious disease, as indicated by a weight-to-height ratio less than -2 SD of the WHO Child Growth Standards median.<sup>5</sup>

Children who suffer from growth retardation due to low diets or recurrent infections tend to be at greater risk for illness and death. Stunting is the result of long-term nutritional deprivation and often results in delayed men-

tal development, poor school performance, and reduced intellectual capacity. These, in turn, affect economic productivity at the national level. Women of short stature are at greater risk for obstetric complications due to smaller pelvis. Small women are at greater risk of delivering infants with low birth weights, contributing to the intergenerational cycle of malnutrition. As infants of low birth weight or retarded intrauterine growth, they tend to be smaller as adults.<sup>5</sup>

According to the National Basic Health Research (*Riset Kesehatan Dasar/Riskesdas*) by the National Institute of Health Research and Development, Ministry of Health, the prevalence of stunting in Indonesia as a whole fell from 37.2% in 2013 to 30.8% in 2018.<sup>6</sup> Annual stunting percentage, according to the Nutritional Monitoring Status (*Pemantauan Status Gizi/PSG*) was 28.9% in 2014, 29% in 2015, 27.5% in 2016, and 29.6% in 2017. In the province of Yogyakarta, the prevalence of stunting was quite a bit lower—13.86% in 2017, dropping to 12.37 in 2018.<sup>6</sup>

Based on Rahmayana's study,<sup>7</sup> children aged 24–59 months from Bangladesh, India, and Pakistan were at greater risk of obstruction. The causative factors must

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be known to control the incidence of stunting. Those are insufficient food intake, infectious diseases, lack of mother's knowledge, bad parenting, unsanitary conditions, and low health services.<sup>1,8</sup> Of those, according to the United Nations Children's Fund (UNICEF), direct and indirect factors most influence the nutritional status of children and the causes of malnutrition. Food intake and disease could directly cause low nutrients, while there are three indirect causes of malnutrition—food security, child care patterns, and health and environmental services. Based on those problems and the continuing high prevalence of stunting in children, further investigation is needed to determine its causes.<sup>9</sup> The study aimed to determine the determinants of stunting children aged 24–59 months.

## Method

This study was an observational analytic study with a case-controlled design. The study was conducted between September 2018–May 2019 in Temon II Primary Health Care, Kulon Progo District. The population was all children aged 24–59 months. The case sample was 30 stunted children; the control sample was 30, not stunted children. Respondents were the mothers of the cases and the control sample children. Sampling in this study was proportional sampling, taken from seven villages in Temon II Primary Health Care (PHC). Examinations of children in each village were performed according to inclusion and exclusion criteria. The inclusion criteria were children aged 24–59 months residing in the study area, with z-score limits of  $\geq -2$  SD to  $2$  SD. The mothers were willing to follow the study by signing informed consent. They were randomly chosen following a proportional distribution determined by each village to be equally represented.

The histories of exclusive breastfeeding variable is obtained from the respondent's acknowledgment of breastfeeding for 0–6 months. Energy intake pertained to the total energy sourced from respondents' food and beverages, as inputted in the NutriSurvey 2007. “Low” was  $<80\%$ , sufficient was  $\geq 80\%$ . Protein intake was drawn from total protein sourced from animal and vegetable proteins and inputted in the Nutrisurvey 2007, again with a low category of  $<80\%$  and sufficient  $\geq 80\%$ . Immunization status was based on the Mother and Child Health/MCH (*Kesehatan Ibu dan Anak/KIA*) book following the basic immunization requirements, as obtained according to age and the Immunization Development Program's government policy. Suffering from acute respiratory infections (ARIs) was obtained from the respondent's recognition of the frequency of sick children affected by ARIs (tuberculosis (TB), cough, colds, and other respiratory diseases) in the past year with categories of frequent ( $\geq 6$  times a year) and rare ( $<6$  times a year).

Incidence of diarrhea was obtained from the respondents' recognition of the frequency of sick children affected by diarrhea in the past year, with “frequent” being  $\geq 3$  times a year and “rare”  $<3$  times a year. Testimony regarding access to clean water was obtained from the respondent's acknowledgment and inspection of the respondent's house.

Data were obtained from interviews with the questionnaire. Data of respondents' food intake were obtained from interviews based on a 24-hour food recall questionnaire. Those were then analyzed by NutriSurvey 2007 software to obtain the percentage of energy intake and protein intake, compared with the nutritional adequacy rate. Data on infectious diseases (incidence of diarrhea and ARI, September 2018 to May 2019) were collected from respondent testimonies and the PHC register book from the previous year (2018). Primary immunization data is collected from the MCH handbook and the register of Temon II Primary Health Care immunizations. Environmental sanitation was based on toilet use and access to clean water.

This study data retrieval is done by an enumerator, with a nutrition team consisting of two nutrition experts and three applied nutrition students. Initial preparation was data collection at the PHC, then the inclusion and exclusion criteria from select respondents. If the respondent matches the inclusion, then an interview is conducted using a questionnaire. The immunization status in the questionnaire is secondary data from the MCH book. Then the nutrition team conducted a direct interview to fill in 24-hour food recall. Interviews with the 24-hour food recall method were conducted twice in one week with an interval of two days.

Data analysis included univariate, bivariate, and multivariate. Univariate involved a frequency distribution test. The bivariate analysis used a chi-square test with a significance level ( $p$ -value = 0.05) and 95%CI. Interpretation of odd ratio (OR) values was used to determine the risk of each factor and the most influential factors. A multivariate logistic regression analysis was performed on the variable results of the bivariate analysis with values of  $p$ -value  $< 0.25$  to see the most dominant factors. This study has been approved by the Health Research Ethics Committee (KEPK) of the Health Ministry of Health Polytechnic, Yogyakarta No.LB.01.01/KE-01/VII/249/2019.

## Results

Table 1 showed that gender could affect the level of children stunting. Male children experience stunting (53.3%) more than female children, while those who were not stunted were found to be more in the female by (46.7%) than male children. The mother's work can also affect the level of children stunting. It is known that

stunted and non-stunted children have unemployed mothers higher (66.7%) than employed mothers (63.3%). Maternal education can also influence the level of children stunting. It is known that children who are stunting and not stunting have mothers with secondary education (80%) higher than mothers who have low education (83.3%).

Based on Table 2, the history of exclusive breastfeeding, according to the statistical test results, showed no relationship between exclusive breastfeeding history and stunted children (p-value = 0.588, 95%CI). Children who are not given exclusive breastfeeding have 0.64 times greater risk of stunting than those who are given exclusive breastfeeding, meaning exclusive breastfeeding is a protection factor, although it is not statistically significant.

The factor of energy intake from the statistical test results showed differences in the incidence of stunted children (p-value = 0.017, 95%CI). Children with low energy intake have six times the chance of experiencing stunting compared to children with sufficient energy intake. According to these results, low energy intake is a risk factor for stunting children. In the factor of protein intake from the results of the statistical test, there is no correlation between protein intake and stunting children (p-value = 0.605, 95%CI). Children who have low protein intake have a chance of 3.22 times to experience stunting than children who have enough protein intake. It means that low protein intake is a risk factor for stunting children.

Immunization factors have no significant relationship with stunting children (p-value = 1.00, 95%CI). However children who do not have complete basic immunizations have a chance of 1.00 stunting compared to children who have complete basic immunizations.

According to a statistical test analysis, complete basic immunizations are not a risk factor for stunting.

Based on the statistical tests, no relationship was found between stunted children who often suffer from ARIs and children who rarely suffer from them (p-value = 0.210, 95%CI). Children who often suffer from ARI have a 2.78 times greater chance of stunting than children who rarely suffer from ARI. This result means that children who suffer from ARIs have a high-risk factor for the occurrence of stunting. Children who often –or rarely–suffer from diarrhea showed no difference between children who were stunting or not stunting (p-value = 1.00, 95%CI). However, children who often suffer from diarrhea have a slightly higher 1.38 times chance of experiencing stunting than children who rarely suffer from diarrhea. This finding means that children who suffer from frequent diarrhea carry risk factors for stunting.

Based on the results of statistical tests, access to clean water factor found that there was no significant relationship between access to clean water and stunted children (p-value = 0.422, 95%CI). Children who consume un-

Table 1. Characteristics of Stunted Children Aged 24-59 Months in the Work Area of Temon II Public Health Care in Kulon Progo District

Variable	Category	Stunting		Not Stunting	
		n	%	n	%
Gender	Male	16	53.3	14	46.7
	Female	14	46.7	16	53.3
Mother's work status	Employed	10	33.3	11	36.7
	Unemployed	20	66.7	19	63.3
Mother's education level*	Lower	4	13.3	3	10
	Secondary	24	80	25	83.3
	Tertiary	2	6.7	2	6.7

Note: \*Education level: Lower = Less than junior high school; Secondary = Senior high school; Tertiary = College or higher.

Table 2. Relation of Risk Factors of Stunted Children Aged 24–59 Months in Temon II Primary Health Care in Kulon Progo District

Variable	Category	Stunting		Not Stunting		p-value	OR	95%CI
		n	%	n	%			
Exclusive breastfeeding history	Exclusive breastfeeding	9	30	12	40	0.588	0.643	0.221–1.873
	Not exclusive breastfeeding	21	70	18	60			
Energy intake	Low	12	40	3	10	0.017	6.000	0.047–0.782
	Sufficient	18	60	27	90			
Protein intake	Low	3	10	1	3.3	0.605	3.222	0.050–3.168
	Sufficient	27	90	29	96.7			
Immunization status	Complete	29	96.7	29	96.7	1.000	1.000	0.060–16.763
	Incomplete	1	3.3	1	3.3			
Suffer from diarrhea	Often	4	13.3	3	10	1.000	1.385	0.282–6.796
	Rare	26	86.7	27	90			
Suffer from ARI	Often	9	30	4	13.3	0.210	2.786	0.751–10.331
	Rare	21	70	26	86.7			
Access to clean water	Yes	17	56.7	21	70	0.422	0.560	0.193–1.623
	No	13	43.3	9	30			
Toilet	Yes	29	96.7	29	96.7	1.000	1.000	0.060–16.763
	No	1	3.3	1	3.3			

Notes: \*means p-value < 0.05; OR = Odd Ratio; CI = Confidence Interval; ARI = Acute Respiratory Infection

**Table 3. Factors that Most Affect Stunting Toddler Aged 24–59 Months in the Temon II Primary Health Care Working Area of Kulon Progo District**

Variable	$\beta$	Wald	df	Sig.	Exp ( $\beta$ )	95%CI for Exp ( $\beta$ )	
						Lower	Upper
Energy intake	-1.637	0.740	1	0.027	0.195	0.046	0.830
Suffered from ARI	-0.537	0.534	1	0.465	0.584	0.138	2.467

Notes: \*p-value < 0.25; CI = Confidence Interval; ARI = Acute Respiratory Infection; df = degree of freedom

sanitized water have a 0.56 times greater chance of experiencing stunting than those who consume sanitized water. It means that access to clean water is a protective, or preventive, factor for stunting.

Based on Table 2, the toilet factor found no difference in stunting between children who had good toilets and those who did not (p-value = 1.00, 95%CI). Children who do not use good toilets have a 1.00 time chance of stunting than those who use good toilets. Judging from the odds ratio, the toilet is not a risk factor for stunting.

Based on Table 3, the variable energy intake (p-value = 0.027) is a factor that is significantly associated with stunting in children aged 24–59 months after being controlled with a history of exclusive breastfeeding, energy intake, protein intake, immunization status, the incidence of diarrhea, and ARI, and toilet conditions. That means that energy intake factors are protective or preventive factors to stunting in 24–59-months olds.

### Discussion

The factors examined in this study were feeding factors, including exclusive breastfeeding, energy intake, and protein intake. Health care factors include immunization status and infectious diseases, ARI, and diarrhea. Environmental sanitation factors consist of access to clean water and toilets.

The results of the study showed that children who did not receive exclusive breastfeeding during the first six months were at greater risk for stunting. Based on Table 2, the results of this study found no association between exclusive breastfeeding history and stunting children aged 24–59 months in the working area of Temon II Primary Health Care in Kulon Progo District. Exclusive breastfeeding factors are determined to be protective factors or preventive factors for stunting children. This study is in line with that of Tariku, *et al.*,<sup>9</sup> in Ethiopia that exclusive breastfeeding is not related to stunting. This may be caused by the condition of stunting not being determined solely by factors of exclusive breastfeeding status and other factors such as complementary food quality, adequate daily nutritional intake, and the health status of the baby.<sup>11</sup>

The results of this study indicate that there is a rela-

tionship between energy intake and stunting. Inadequate nutritional intake, especially from total energy, is directly related to physical growth deficits in children. Low energy consumption is a significant cause of children stunting in Indonesia.<sup>12</sup>

This study revealed that there was no relationship between protein intake for stunting children aged 24–59 months in the working area of Temon II Primary Health Care in Kulon Progo District. However, statistically, protein intake was still a risk factor for stunting. These results indicate that there is a significant relationship between protein consumption and the incidence of stunting in infants. The present study shows that most children had sufficient protein intake levels, but statistically, no association was found between the level of protein intake and stunting children aged 24–59 months. There are several possible reasons for not finding a relationship. Stunting occurs over a long time, so the protein intake level cannot be considered one of the causes. Also, protein intake is not the only factor that affects stunting.

Immunization is an attempt to raise or enhance one's immunity against a disease actively. If those are exposed to the disease one day, they will not get sick or only experience mild symptoms.<sup>13</sup> Immunization status in children is one indicator of contact with health services. It is hoped that contact with health services will help improve nutritional problems over the long term. Immunization status is also expected to have a positive effect on long term nutritional status.

The immunization status is in line with the results of this study. Statistical analysis does not show a relationship between immunization status and stunting in children aged 24–59 months. According to statistical tests, immunization factors are not a risk factor for stunting. Sutriyawan's study,<sup>14</sup> states that there is no meaningful immunization status with the incidence of stunting. Even though the child is given complete immunization, it does not mean that the child is protected from stunting. Some of the factors that can cause stunting are knowledge, exclusive breastfeeding, poor sanitation due to the absence of latrines, stagnant waterways, open trash cans, an unclean environment, parental education, parental work, parents' income, the sex of children under five, low birth

weight, the length of birth of children, and mothers who rarely wash their hands using clean water and soap.<sup>15</sup>

In contrast to this study, however, one of the study conducted by Neldawati in Mugianti, *et al.*,<sup>21</sup> showed that immunization status had a significant relationship to the nutritional status index. Children who were not given complete primary immunization did not immediately suffer from infectious diseases. Children immunity is influenced by other factors such as nutritional status and the presence of pathogens. There are forms of herd immunity or immunity in immunization, where individuals who are not immunized are still protected because most of the other individuals in the group are immune to the disease after receiving immunization.<sup>11</sup>

Infection is a factor that directly affects nutritional status in addition to adequate nutrition. Infection decreases food intake, interferes with nutrient absorption, causes direct loss of nutrients, increases metabolic requirements or catabolic loss of nutrients, and interferes with nutrient transport to target tissues, including food intake. One infectious disease, including diarrhea, is a symptom of gastrointestinal disease or other diseases outside the digestive tract.

The study was not in line with the results of this study that there was no association between diarrheal infections in stunting children aged 24–59 months. However, in Table 3, children who suffered from frequent diarrhea have a 1.38 times greater risk of stunting, meaning diarrheal infections are a risk factor for stunting. The absence of a meaningful relationship in this study was due to the direct impact of diarrhea, that is weight loss compared to stunting. Children who experience diarrhea are usually also found with anorexia and dehydration. If not properly treated, diarrhea impact on weight loss, which is a sign of acute malnutrition, while stunting signifies repeated chronic malnutrition. The other factor is the duration of the infection experienced.<sup>11</sup>

Acute Respiratory Infections (ARI) and diarrhea are among the infectious diseases to which children under the age of five are especially prone. The children period is a vulnerable age for health problems, especially ARI, because of their undeveloped immune systems. Acute respiratory infections are acute inflammation of the upper and lower respiratory tracts caused by bacterial, viral, or ricketts infections, both with or without inflammation of pulmonary parenchyma.<sup>16</sup>

The results of this study do not indicate a significant relationship between ARI infectious disease and stunting in children aged 24–59 months. Nonetheless, infectious disease is a risk factor for stunting. The results of this study are following study conducted by Nasikhah in East Semarang Subdistrict,<sup>16</sup> which shows that a history of infectious diseases, in this case, acute upper respiratory tract infection, is a non-significant risk factor for stunting.

Unlike the Agrina and Ameliwati's study,<sup>13</sup> there is a significant influence between the nutritional status of toddlers with ARI. This is due to stunting being affected by the frequency of infectious diseases and the duration of the and nutrient intake during infectious disease episode.<sup>17</sup> Access to clean water and sanitation is the sixth target of SDGs. Without clean water and adequate sanitation, a decrease in the prevalence of stunting will not be achieved.<sup>18</sup> Exposure to the environment and poor hygiene can result in stunting due to inadequate nutrition absorption and the intestines' inability to function as a disease barrier.<sup>19</sup> It is not in line with this study that there is no relationship between access to clean water and stunting in children aged 24–59 months in the Temon II Primary Health Care work area. However, it is a protective or preventive factor for the occurrence of stunting.

In Kusumawati, *et al.*,<sup>11</sup> Van der Hoek's study finds that children from families with clean water facilities have a lower prevalence of diarrhea and stunting than those from families without clean water and toilet facilities. The indicators for the short-term number of children are due to the lack of availability of clean, decent drinking water. As many as 47% of the population of Indonesia drink water containing germs, even though the water has been boiled and 340 children die from diarrhea every week in Indonesia.<sup>12</sup> There is no relationship between stunting and access to clean water as a source of drink.

Exposure to the environment and cleanliness are in line with primary sanitation factors. According to Yulestari's study,<sup>20</sup> children with stunting were more prevalent in families with poor basic sanitation. Households with poor sanitation are 1.3 times more likely to have children with stunting than households with adequate basic sanitation. In this study, there was no relationship between toilet ownership and stunted children aged 24–59 months, meaning that this toilet factor was not a risk factor for stunting. According to this study, the proportion of respondents with good toilets and clean water sources (sanitation) was more significant than poor sanitation.

The logistic regression test results in Table 3 show that energy intake is the dominant factor associated with stunting in children aged 24–59 months in the Temon II Primary Health Care work area. In Yensasnidar's study,<sup>18</sup> there is a significant relationship between energy intake and the incidence of stunting in these students. Study by Tessema, *et al.*,<sup>15</sup> shows that inadequate protein and energy intake may be a predictor of childhood linear growth failure in rural Ethiopia. Most children's energy intake in stunted and non-stunted children was below the estimated average requirement. All children with protein deficiency were also energy deficient. The median energy density of the child's complementary foods was 1.4 kcal/g, with no significant difference between stunted

and non-stunted children. Nova and Afriyanti's study,<sup>19</sup> showed that the incidence of stunting in children is mostly in children whose energy intake is less than children with sufficient intake energy. Children with energy intake less than 1.2 times that of children with sufficient energy intake, experienced stunting.<sup>11</sup> Based on the theoretical and factual results, authors assume that low energy intake is the factor with the highest percentage as a factor in stunting because total energy is directly related to physical growth deficits in children.

The efforts to increase energy intake in children are by making foods that make children interested in consuming them. Infectious diseases that occur in stunting children result in a loss of appetite, such that children's food consumption decreases.<sup>12</sup> Contrarily, coaching families to improve the nutritional status of children is critical. Development of health promotion media related to children nutrition and counseling to families with malnutrition problems in children needs to be adjusted to the characteristics of the family. Extension media and material must be adjusted to the level of family education so that the effectiveness of the information delivery runs optimally. For example, a flip sheet with sentence selection is easy to understand. Besides that, refreshment for cadres providing health education, especially nutrition for children, is critically important.

### Conclusion

Respondent characteristics in Temon II Primary Health Care, Kulon Progo, according to gender, stunted children were more likely to be male while those who were not stunted were female. Employed mothers contributed to stunting rather than unemployed mothers with secondary education. Energy intake factor has a significant relationship to stunting children aged 24–59 months, while feeding factors (exclusive breastfeeding history and protein intake), immunization status, infectious diseases (suffered from diarrhea and ARI), and toilets are not associated with stunting children aged 24–59 months.

Risk factors in stunting children aged 24–59 months in the Temon II Primary Health Care working area in Kulon Progo District are feeding factors (energy and protein intake), infectious diseases (suffered from diarrhea and ARI). Non-risk factors are immunization and toilet status, while the protective factor is the history of exclusive breastfeeding and access to clean water. The most influential stunting factor in Temon II Primary Health Care working area in Kulon Progo District is energy intake.

### Recommendation

Increase revitalization efforts for nutrition-conscious families on the importance of increasing the balanced nu-

tritional needs of children to prevent stunting. Increase information dissemination to the community regarding stunting, through media booklets or counseling and make policies for the first one thousand days of a child's life to improve the nutritional status of pregnant women, nursing mothers, and children under five. Provide information and education counseling for practitioners about providing balanced, dietary needs for children under five to prevent stunting. Then give education for mothers with children under five, including prevention following pregnancy, which in turn encourages them to actively participate in Maternal and Child Health Services. This way, children's growth and development can be monitored to support stunting prevention efforts. Improve the ability of Maternal and Child Health Services cadres through guidance and training on monitoring the growth and development of children under five, so that they are not overly dependent on Maternal and Child Health Services officers.

### Abbreviations

WHO: World Health Organization; SD: Standard Deviation; UNICEF: United Nations Children's Fund; ARI: Acute Respiratory Infection; SDG: Sustainable Development Goals; WHO-MGRS: World Health Organization Multicentre Growth Reference Study; MCH: Mother Child Health; OR: Odd Ratio; CI: Confidence Interval.

### Ethics Approval and Consent to Participate

This study has been approved by the Health Research Ethics Committee (KEPK) of the Health Ministry of Health Polytechnic Yogyakarta No.LB.01.01/KE-01/VII/249/2019.

### Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### Authors' Contribution

CAH, YEP, TM, and YW were involved in the design study, analyze data, compile, and revise the script. SH was involved in preparing the publication journal. All authors read and approved the final manuscript.

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