Correlation between Energy and Protein Intake with Stunting Incidence in Toddlers

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ABSTRACT

Background: Stunting is a nutritional problem that occurs in Indonesia. Stunting is a condition of physical growth failure caused by chronic nutritional problems that occur for a long time. The purpose of this study was to determine the relationship between energy and protein intake with the incidence of stunting. **Methods**: The design of this study used a cross-sectional study design with a sample of 41 toddlers. The results obtained were analyzed using the Spearman Rank correlation test and multiple linear regression tests. **Results**: There is a positive and significant relationship between energy intake and the incidence of stunting as shown by the correlation coefficient of 0.72 (p value = 0.00), in other words, the better the nutritional status (not stunting). There is a positive and significant relationship between protein intake and stunting as indicated by a correlation coefficient of 0.79 (p value = 0.00), in other words, the better the nutritional status (not stunting). Based on the results of multiple linear regression tests, a coefficient of determination of R Square = 0.79 was obtained, which means that the variables of energy intake and protein intake affect the incidence of stunting by 79%.

Keywords: energy, protein, stunting, toddlers,

INTRODUCTION

Stunting is a failure in physical growth based on height according to the measurement of Age (TB/U) less than -2 Standard Deviations (SD) (Ministry of Health, 2020). Stunting includes chronic nutritional problems caused by insufficient intake of nutrients in infants, lack of maternal nutritional intake during pregnancy, and socio-economic. Toddlers who are stunted will have difficulty in achieving optimal physical and cognitive development in the future (Ayuningtyas, et al, 2019).

The prevalence of stunting toddlers aged 0-59 months in North Sumatra in 2019 was 30,11%. This condition showed that the prevalence of stunting toddlers aged 0-59 months in North Sumatra is greater than the national prevalence (Ministry of Health of the Republic of Indonesia, 2020). Based on the results of Riskesdas (2019), the prevalence of stunting toddlers in Humbang Hasundutan Regency is very short at 25,89% and short at 20,71%.

Based on the results of research by Astutik, et al (2019), two of the prominent factors that increase the incidence of stunting is insufficient energy and protein intake[SC1]. Protein is a nutrient that is very important in the growth process. Sufficient protein will be able to perform its function for

the growth process (Muchtadi, 2019). Low protein consumption will cause protein deficiency that leads to height growth disorders or stunting. Protein deficiency itself is a risk factor for stunting (Mitra, 2019).

Based on observations made in June 2022 at the Bonandolok Health Center (Puskesmas Bonandolok), Sijamapolang District, Humbang Hasundutan Regency, the prevalence of toddlers suffering from stunting reached 23,83%. The high percentage of stunting is presumbaly caused by insufficient consumption of energy and protein intake. Based on this, researchers are interested in conducting research on the relationship between energy and protein intake with the incidence of stunting in toddlers.

METHODS

This research was carried out in the Working Area of the Bonandolok Health Center (Puskesmas Bonandolok), Sijamapolang District, Humbang Hasundutan Regency. The time of this study was carried out from June 2022 to July 2022. The population in this study amounted to 41 toddlers living in the area of Bonandolok Health Center.

The sampling technique is carried out by means of total sampling. A total of 41 toddlers living in the Bonandolok Health Center Working Area were sampled for this study.

The research instrument used in this study was a questionnaire. The data collected are primary data and secondary data. Data primer is data obtained from questionnaires in the form of respondent characteristics such as toddler age, toddler gender, mother's age, mother's last education, father and mother's occupation, monthly income, and family size. Secondary data is data obtained from the Bonandolok Health Center.

This study used a cross-sectional research design. Data analysis techniques are carried out using SPSS. The descriptive respondents' characteristic data were categorized into toddler age, toddler gender, maternal age, mother's last education, father and mother's occupation, monthly income, and family size. The relationship between the independent variable and the dependent variable can be calculated using the Spearman Rank test. This test was used to see the relationship between the two independent variables with the dependent variable. Multiple linear regression test was also performed.

RESULTS & DISCUSSION

Characteristics of Research Subject

Family characteristics consist of the mother's age, mother's last education, father and mother's occupation, monthly income, and family size. Data on the distribution of family characteristics can be seen in Table 1. The average age of mothers with stunted toddlers is 33,18 years and the average age of mothers with non-stunted toddlers is 32,68 years. The education of mothers with stunted toddlers is dominated by mothers with the last high school education as many as 11 people (26,81%)

and mothers with toddlers who were not stunted were dominated by mothers with the last high school education as many as 14 people (34,14%). Parents with stunted and non-stunted toddlers mostly work as farmers, which are 39,03% and 41,6% respectively. The average income of fathers and mothers with stunted toddlers respectively is Rp.925.000 and Rp.387.500 and the average income of fathers and mothers with non-stunted toddlers respectively is Rp.1.502.000 and Rp.740.000. The size of families with stunted and non-stunted toddlers are both dominated by medium-sized families.

Table 1. Distribution of Family Characteristics

Respondent Characteristics	Stunting		Not Stunting	
	n	%	n	%
Mother's Ager				
Late Teens (age 17-25)	1	2,44	2	4,88
Early Adult (age 26-35)	11	26,82	16	39,02
Late Adult (age 36-45)	4	9,75	7	17,07
Total	16	39,03	25	60,97
Min-Max	25 - 41		24 - 43	
Mean ± Sd	33,18 ± 4,50		32,68 ± 4,99	
Mother's Educational Background				
Primary School (age 6)	1	2,44	2	4,88
Secondary School (age 7-9)	4	9,75	3	7,32
High School (age 10-12)	11	26,81	14	34,14
College (age >12)	0	0	6	14,63
Total	16	39,03	25	60,97
Min-Max	45266		42522	
Mean ± Sd	11 ± 1,85		12 ± 2,84	
Father's Occupation				
Farmer	16	39,03	17	41,6
Enterpreneur	0	0	3	7,31
Private workers	0	0	2	4,88
Civil servant	0	0	3	7,31
Total	16	39,03	25	60,97
Mother's Occupation				
Farmer	16	39,03	17	41,6
Enterpreneur	0	0	3	7,31
Private workers	0	0	2	4,88
Civil servant	0	0	3	7,31
Stay-at-home mother	0	0	0	0
Total	16	39,03	25	60,97
Father's Income				
High (>2 million)	0	0	4	9,75
Medium (1-2 million)	8	19,51	16	39,02
Low (<1 million)	8	19,51	5	12,19
Total	16	39,02	25	60,97

Respondent Characteristics	Stunting		Not Stunting	
	n	%	n	%
Min-Max	500.000 – 2.000.000		500.000 – 3.500.000	
Mean ± Sd	925.000 ± 375055,5		1.502.000 ± 859563,8	
Mother's Income				
High (>2 million)	0	0	2	4,88
Medium (1-2 million)	1	2,44	5	12,19
Low (<1 million)	15	36,58	18	43,9
Total	16	39,02	25	60,97
Min-Max	0 – 1.000.000		0 – 3.200.000	
Mean ± Sd	387.500 ± 250.000		740.000 ± 813.941	
Family Size				
Small (<4 people)	1	2,44	1	2,44
Medium (5-6 people)	12	29,26	19	46,34
Large (>7 people)	3	7,33	5	12,19
Total	16	39,03	25	60,97
Min-Max	45172		45141	
Mean ± Sd	6 ± 1,50		5 ± 1,42	

Toddler Characteristics

The characteristics of toddlers consist of the age of toddlers, the sex of toddlers, and stunting nutritional status. Data on the distribution of family characteristics can be seen in Table 2. The average age of stunted toddlers is 45,15 months. The average age of toddlers who are not stunted is 38,28 months. A total of 8 toddlers (19,51%) were male and 8 toddlers (19,51%) were female. While the gender of toddlers is not stunting, as many as 10 toddlers (24,39%) are male and 15 toddlers (36,58%) are female. A total of 10 toddlers (24,03%) in the short category, 6 toddlers (15%) in the very short category. The average Z-Score [SC2] TB/U of stunted toddlers is -2,77 SD. While toddlers with normal nutritional status as many as 25 children (60,98%) with an average Z-score TB/U -1.24 SD.

Table 2. Distribution of Toddler Characteristics

Toddlers Characteristics	Stunting		Not Stunting	
	n	%	n	%
Toddlers Age				
Age 2 (24-35 months)	2	4,88	10	24,39
Age 3 (36-47 months)	8	19,52	11	26,83
Age 4 (48-59 months)	6	14,63	4	9,75
Total	16	39,03	25	60,97
Min-Max	28 - 59		25 – 56	

Toddlers Characteristics	Stunting		Not Stunting	
	n	%	n	%
Mean ± Sd	45,15 ± 9,35		38,28 ± 8,69	
Toddlers Sex				
Male	8	19,51	10	24,39
Female	8	19,51	15	36,58
Total	16	39,02	25	60,98
Nutritional Status Category				
Normal (-2 SD - +1 SD)	0	0	25	60,97
Short (-3 SD - -2 SD)	10	24,03	0	0
Very Short (> -3 SD)	6	15	0	0
Total	16	39,03	25	60,97
Min-Max	-3,79 – -2,24		-1,94 – 0,45	
Mean ± Sd	-2,77 ± 0,48		-1,24 ± 0,60	

Energy Intake

In Table 3, the energy intake of *stunted* toddlers are categorized into 3 groups; 15 toddlers (36,58%) lacks energy intake, 1 toddler (2,44%) has enough energy intake, and no toddlers (0%) have excessive energy intake. The average energy intake of *stunted toddlers* is 57,28%. Non-stunted toddlers are categorized into 3 groups; no toddlers (0%) lacks energy intake, 21 toddlers (51,22%) have enough energy intake, and 4 toddlers (9,76%) have excessive energy intake. The average energy intake of non-stunted toddlers is 94,02%.

Table 3. Energy Intake Category

Nutritional Status Category	Stunting		Not Stunting	
	n	%	n	%
Lacking (<80% DRI)	15	36,58	0	0
Sufficient (80-110% DRI)	1	2,44	21	51,22
Excessive (>110% DRI)	0	0	4	9,76
Total	16	39,02	25	60,98
Min-Max	51,09 – 82,57		81,33– 112,80	
Mean ± Sd	57,28 ± 6,82		94,02 ± 10,16	

Protein Intake

According to Table 4, the data show that there are 15 toddlers (36.58%) with low protein intake, 1 toddler (2.44%) with sufficient protein intake, and no toddler (0%) has excessive protein intake. The average protein intake of stunted toddlers is 43.97%. Based on Table 4 for not-stunted toddlers, none of the toddlers (0%) has low protein intake, 17 toddlers (41.46%) have sufficient

protein intake, and 8 toddlers (19.51%) have excessive more protein intake. The average protein intake of stunted toddlers is 98.21%.

Table 4. Respondent Distribution Based on Protein Intake

Nutritional Status Category	Stunting		Not Stunting	
	n	%	n	%
Lacking (<80% DRI)	15	36,58	0	0
Sufficient (80-110% DRI)	1	2,44	17	41,46
Excessive (>110% DRI)	0	0	8	19,52
Total	16	39,02	25	60,98
Min-Max	23,41 – 80,32		80,60 – 133,80	
Mean ± Sd	43,97 ± 14,31		98,21 ± 15,52	

Correlation between Energy Intake and Stunting Incidence

Based on the results of the Spearman Rank correlation test analysis, there is a positive and significant relationship between energy intake and stunting events which is shown by a correlation coefficient of 0.72 (p value = 0.00) at a significant level of 0.05, which means that as the energy intake gets better, the nutritional status of toddlers also follows (not stunting). The results of this study are in accordance with the results of research conducted by Elsa (2019) which shows a positive and significant relationship between energy intake and the incidence of stunting indicated by p value = 0.001 which means that the lower the energy consumption, the higher the incidence of stunting.

According to Hardinsyah (2017), toddlers need a lot of energy during their growth and development. Energy is obtained from the consumption of foods that contain macronutrients, including carbohydrates, proteins, and fats. Carbohydrates are the main source of energy needed by the body. Carbohydrates provide energy used for growth, development, body functions, and for activity. Energy also serves to form new body tissues along with proteins. According to Wulandary and Sudiarti (2021), toddlers need adequate energy intake. [SC3]Inadequate energy intake causes toddlers to be 1.86 times at risk of stunting compared to toddlers who consume energy adequately. Inadequate energy intake interferes with the bone growth of toddlers. Inadequate energy intake leads to decreased synthesis of insulin growth factor (IGF-1) which plays a role in the function of IGF binding protein-1, thyroid hormone[SC4], and other systemic factors related to fibroblast growth factor (FGF-21) that account for many important roles in linear growth (Gat-Yablonski and Phillip, 2015).

Correlation between Protein Intake and Stunting Incidence

Spearman Rank correlation test analysis shows that there is a positive and significant relationship between protein intake and stunting incidence which is shown by a correlation coefficient of 0.79 (p value = 0.00) at a significant level of 0.05, which means that the better the protein intake, the better the nutritional status of toddlers (not stunting). The results of this study are also in-line with the results by Elsa (2019), which exhibits a positive and significant relationship between protein

intake and the incidence of stunting, indicated by p value = 0.000 which means that the lower the protein consumption, the higher the incidence of stunting.

The results of this study are also in accordance with the results of research by Aisyah and Yunianto (2021), which shows a relationship between protein intake and the incidence of stunting by showing p value = 0.000 which means that the higher the protein consumption, the better the nutritional status of TB / U. According to Tessema et al (2013), adequate protein intake is required to promote linear growth of toddlers. Inadequate protein intake can increase the incidence of stunting in toddlers by 5.16 times higher than toddlers with adequate protein intake. This happens because protein poses an effect on plasma levels of insulin growth factor, bone matrix protein, and growth factor, as well as calcium and phosphorus which play an important role in bone formation and linear growth and development of toddlers.

Correlation between Energy Intake and Stunting Incidence

Based on the results of the multiple linear regression test, the regression equation is obtained as follows:

$$Y = \alpha (-3,30) + \beta_1 X_1 (0,03) + + \beta_2 X_2 (0,01)$$

The coefficient of determination obtained from the multiple linear regression test is R Square = 0.79 [SC5]which means that energy intake and protein intake affect the incidence of stunting by 79%. The results of this study are in accordance with the results of research conducted by Elsa (2019), which shows a positive and significant relationship between protein intake and the incidence of stunting indicated by p value = 0.000 which means that the lower the consumption of energy and protein, the higher the incidence of stunting. The results of this study are also in line with research conducted by Ayuningtyas et al. (2018) which shows a positive and significant relationship between energy and protein intake indicated by p value = 0.003 which means that the better the energy and protein intake, the incidence of stunting will be lower.

The results of this study are in accordance with the results of research conducted by Wulandary and Sudiarti (2021) which shows the relationship between energy intake and the incidence of stunting in toddlers in Bogor City which is indicated by p value = 0.012 and the relationship between protein intake and the incidence of stunting indicated by p value = 0.018, meaning that the more adequate energy and protein intake, the better the nutritional status of toddlers. According to Wulandary and Sudiarti (2021), toddlers with inadequate energy intake are at risk of suffering from stunting by 1.86 times higher than toddlers with adequate energy intake and toddlers with inadequate protein intake are at risk of suffering from stunting by 1.03 times higher than toddlers with adequate protein intake.[SC6]

CONCLUSION

Based on the results of this study, it can be concluded that there is a positive and significant relationship between energy intake and the incidence of stunting as shown by a correlation coefficient of 0.72 (p value = 0.00). From the correlation value, a positive value is obtained which

means unidirectional, so the higher the energy intake, the better the nutritional status (not stunting). Based on the results of the Spearman Rank correlation test, there is a positive and significant relationship between protein intake and the incidence of stunting as shown by a correlation coefficient of 0.79 (p value = 0.00). From the correlation value, a positive value is obtained which means unidirectional, so the higher the protein intake, the better the nutritional status (not stunting). The value of the coefficient of determination obtained is R Square = 0.79 which means that the variables of energy intake and protein intake affect the incidence of stunting by 79%. Based on the coefficient of determination, it is known that 21% of stunting events are influenced by other variables.

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