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Phosphorus and calcium intake of stunted toddlers aged 24-59 months: A case-control study in Sinar Bahagia Village, Simeulue

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Abstract

Stunting is still a serious problem in toddlers and is usually caused by insufficient calcium and phosphorus intake, which plays an important role in bone formation. This study aimed to analyze the phosphorus and calcium intake of stunted toddlers aged 24-59 months in Sinar Bahagia Village, Simeulue Barat District, Simeulue Regency. This research was a case-control study. The sample of this study was stunted and non-stunted children. Each case and control group consisted of 62 subjects who were selected using the simple random sampling technique. Food recall and food frequency questionnaire (FFQ) were used to investigate nutrient intake. NutriSurvey was used to analyze the content of nutrient intake. Meanwhile, the chi-square test was used to analyze the effects of calcium and phosphorus intake on the incidence of stunting. Stunted children had lower calcium and phosphorus intakes than non-stunted children (P-value <0.05). Stunted children had 2.879 times lower phosphorus than the control group. Moreover, they had 35 times lower calcium intake than the control group. Serious stunting problems in children require a nutritional counseling program that trains mothers to meet children's daily food intake, especially high calcium and phosphorus.

Keywords: calcium, phosphorus, stunting, toddlers

Introduction

Stunting is a linear growth disorder mostly occurring in children aged two years old or less. Stunting is caused by several factors, such as malnutrition, chronic nutrient intake, and chronic infectious diseases (WHO, 2010). The 2013 Indonesia Health Survey reported that the prevalence of stunting was 37.2%. This number showed an increase from 36.8% in 2007. The prevalence of stunting in Aceh Province is 44.6% while the prevalence of stunted children aged five years in Simuelue Regency is 28.6%. This is a very important number to note. One of the risk factors for stunting is lack of nutritional intake in a long term. Therefore, slow growth can occur and affect nutritional status. Inadequate intake of energy and nutrients as well as infectious diseases are factors that greatly cause stunting. In addition, the Lancet Series describes several pivotal micronutrients to prevent stunting, such as vitamin A, zinc, iron, and iodine (Souganidis E., 2012). Other micronutrients, such as calcium and phosphorus, also play a crucial role in the linear growth of children (Mikhail WZA, 2013).

Stunting in children under five years old will affect their health problems, education, and productivity for the long term. Stunted toddlers have difficulty in achieving optimal physical and psychomotor growth and development (Dewey KG and Begum K., 2011). High calcium intake is required for children's growth and mineralizes new bone deposits and osteoblast dysfunctions (Khairy SAM et al., 2010). Insufficient calcium intake will affect linear growth in toddlers if the calcium content is 50% lower than the normal content.

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Calcium forms complex bonds with phosphate that can provide strength to bones; thus, phosphorus deficiency can interfere with growth. Meanwhile, prolonged phosphorus deficiency will cause osteomalacia and release calcium from bones (Mikhail WZA et al., 2013).

Methods

This study employed a case-control design to investigate the relationship between calcium and phosphorus intake as well as the incidence of stunting. The sample of this study was two groups: the case group and the control group. The case group referred to the group of stunted while the control group referred to the group with normal nutritional status. Microtoise was a tool used to measure the height of toddlers anthropometrically. Nutritional status data were based on height/age categories: the short category from -3 SD to <-2 SD and the normal category from -2 SD to +3 SD (WHO, 2019). 1x24 hour food recall and semi-food frequency questionnaire were employed to explore the phosphorus and calcium intakes. The research sample was 62 children aged 24-59 months. The data were collected by interviewing mothers of toddlers in Sinar Bahagia Village. A Chi-square test was used to analyze the effects of phosphorus and calcium intake on the incidence of stunting in under-five-year-old children.

Result

This study revealed that the data were classified into age, gender, height, and numbers of sibling categories. The data showed that the majority of the respondents, 34 people, were aged > 36 months (54.8%). The data on gender showed that 38 children were male (61.3%). Meanwhile, the data on height showed that most of the children, 52 people, had >90 cm totaling (83.9%). Meanwhile, the data on numbers of siblings showed that 31 respondents had only one sibling (50%).

Table 1. Characteristics of Respondents (n = 60)

Age (Months)	f	%
> 36	34	54.8
< 36	28	45.2
Gender	f	%
Boy	38	61.3
Girl	24	38.7
Height	f	%
> 90 cm	52	83.9
< 90 cm	10	16.1
Parity	f	%
1st child	31	50.0
2nd child	18	29.0
3rd child	13	21.0

Table 2 shows the characteristics of the parents of 62 respondents. Most of the sample's fathers were above 30 years (49 people or 79.0%). Meanwhile, 42 fathers had height for > 170 cm (67.7%). The majority of the fathers works as a farmer (83.9%) and earned high school education (62.9%). The data showed that most respondents' maternal age was more than 30 years (35 people or 56.5%). Moreover, Table 2 shows the characteristics of the mothers. The highest height of the mothers was more than 150 cm (64.5%). Most of the mothers graduated from high school (67.7%). Meanwhile, the data on family income showed that 51 people earned more than IDR1,000,000 (82.3%).

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Table 2. Characteristics of Respondents' Parents (n = 60)

Fathers' Age (Years)	**f**	**%**
> 30	49	**79.0**
< 30	13	**21.0**
Height	f	**%**
> 170 cm	42	**67.7**
< 170 cm	20	**32.3**
Fathers' Occupation	f	**%**
Civil servants	2	**3.2**
Farmers	52	**83.9**
Fishermen	8	**12.9**
Fathers' Education	f	**%**
Bachelor degree	2	**3.2**
Senior high schools	39	**62.9**
Junior high/elementary schools	21	**33.9**
Mothers' Age (Years)	f	**%**
> 30	27	**43.5**
< 30	35	**56.5**
Mothers' Height	f	**%**
> 150 cm	40	**64.5**
< 150 cm	22	**35.5**
Mother's Education	f	**%**
Bachelor degree	4	**6.5**
Senior high schools	42	**67.7**
Junior high/elementary schools	16	**25.8**
Family income	f	**%**
> IDR 1,000,000	51	**82.3**
< IDR 1,000,000	**11**	**17.7**

Table 3 shows that the majority of the respondents (42 people or 67.7%) had less sufficient phosphorus intake. In contrast, only 20 children had sufficient phosphorus intake (32.3%). The data also showed that most of the children had less sufficient calcium intake (46 people or 74.2%). While the number of sufficient intake of 16 people (25.8%).

Table 3. Univariate Analysis (n=60)

Phosphorus Intake	**f**	**%**
Less sufficient	42	**67.7**
Sufficient	20	**32.3**
Calcium Intake	f	**%**
Less sufficient	46	**74.2**
Sufficient	**16**	**25.8**

Table 4 shows that there were more stunted children with less sufficient of phosphorus (42%) and Calcium intakes (46%) than non-stunted children. The chi-square test obtained p-value = 0.075 (<0.05). Moreover, this research revealed that phosphorus intake significantly affected the incidence of stunting in under-five children. Phosphorus intake is a risk factor for stunting in under-five children. The analysis obtained that the OR value was 2.879. This number interprets that toddlers with low phosphorus intake had a 2.879 more risk of

experiencing stunting than toddlers with adequate phosphorus intake.

Table 4. Bivariate Analysis of Phosphorus Intake on Stunting Incidence

Phosphorus Intake	**Stunting incident**						**OR (95% CI)**	**P-Value**
	Stunting		No Stunting		Total			
	n	%	n	%	n	%		
Less sufficient	20	66.7	10	33.3	32	100	2.879	0.075
Sufficient	11	34.4	21	65.6	30	100	1.026 – 8.074	
Total	31	101.1	31	98.9	62	100		

Table 5. Bivariate Analysis of Calcium Intake on Stunting Incidence

Calcium Intake	**Stunting incident**						**OR (95% CI)**	**P-Value**
	Stunting		Not Stunting		Total			
	n	%	n	%	n	%		
Less sufficient	26	86.7	4	13.3	30	100	35	0.000
Sufficient	5	15.6	27	84.4	32	100	8.477 - 145.330	
Total	31	102.3	31	97.7	62	100		

Table 5 shows that there were more stunted respondents with there were with less sufficient and sufficient calcium intake (102.3%) than non-stunted children (97.7%). The chi-square test obtained a p-value of 0.000 (<0.05). Moreover, this study found that calcium intake significantly affected the incidence of stunting in under-five children. The results of the analysis showed that the OR value was 35.

Discussion

This research shows that toddlers with insufficient calcium intake had 35 times more risk of experiencing stunting than toddlers with sufficient calcium intake. Sudiarmanto A., R. (2020) discovered that 7.4% of the research participants had sufficient calcium intake, while 92.6% had less sufficient intake. An average intake of 336.7 ± 326.2 mg/day caused stunting incidence. Meanwhile, Kusuma H. (2018) revealed that 39 samples were stunted children; 72.2% of them had insufficient calcium intake, and 26% of them had an adequate calcium intake.

Calcium intake in infancy is necessary for their growth period. Lack of calcium intake in children can lead to bone fractures that disable them to grow optimally (Goulding et al. in Ferani OA, 2019). Calcium is the main mineral needed in the process of bone formation. Calcium can be found in daily food. Dairy products and calcium-processed products are high sources of calcium. Besides, green vegetables, fish, seafood, and soybeans are good sources of calcium. Adequate calcium intake is required to maintain several physiological functions of the body, especially for bone growth and development. Monitoring children's growth is substantial because their growth in this stage can affect their growth and health conditions in adulthood and future life. The data on average intake of phosphorus and calcium were collected twice a day using the food recall method and the semi-food frequency questionnaire

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method. The results showed that stunted children had significantly lower phosphorus and calcium levels than non-stunted children. This difference occurred because various food sources provide high calcium but low phosphorus.

Conclusion

The results of this study indicated that calcium and phosphorus intake influenced the nutritional status, and height of children aged 24-59 months and led to stunting. It is necessary to conduct a nutrition education program to train mothers to fulfill their children's daily food intake, especially calcium and phosphorus. As a result, stunting can be detected quickly, and intervention can be given immediately. Lack of phosphorus and calcium consumption are the causes of stunting in children. In fact, children's growth needs to be considered better.

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