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Original Research

Deficit Consumption of Protein and Calcium on Children Aged 2-5 years old in Yogyakarta Indonesia

Kurangnya Konsumsi Protein dan Kalsium pada Anak Usia 2-5 tahun di Yogyakarta Indonesia

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Abstract*: In Indonesia, stunting cases are estimated to be a problem and some areas are likely to experience stunting due to its high prevalence including Yogyakarta Province. There are several causes of stunting, including a lack of macro and micronutrients.* ***Objectives:*** *To determine the relationship between protein and calcium intake in children aged 2-5 years height.* ***Method:*** *This research was an analytical survey research with a cross-sectional approach. In this study, the primary data was collected using the SQ-FFQ questionnaire to determine the intake of protein and calcium. Stunting was measured using height for age (standard deviation). Subjects were 64 children as respondents and were distributed using a purposive sampling method. The data was processed with the help of SPSS software by performing multiple regression tests.* ***Result:*** *In normal children, they tend to have higher average protein adequacy (111.1±84.5g) than stunted children (25.4±6.3g). Hence, the average calcium intake was 1707,3±1273,88mg in normal children and 291,2±253.8mg in stunted children. The results of the regression test explained that there was a significant relationship between children's height and protein and calcium intake ($p<0.05$). The relationship between protein and calcium intake with children's height is shown in the percentage of 10.3% and the other 89.7% is explained by variables outside the study.* ***Conclusion:*** *There is a significant relationship between protein and calcium intake with stunting and non-stunted children's height at the age of 2-5 years in Yogyakarta.*

Key word: Stunting, Protein Intake, Calcium Intake

1. INTRODUCTION

Stunting is a national problem that has become a main concern since high data appeared in the 2013 Basic Health Research, namely 37.2%, which means that almost 4 out of 10 toddlers are at risk of experiencing stunting (1). The Indonesian Health Survey (SKI) of the Ministry of Health showed there was 21.5% of stunting children in 2023 (2). Even though there was a decline in percentage of about 9.3% from 2018 to 2023, the prevalence is still high. Indonesia aims to reduce up to 10% in the number of children under 5 who are stunted by 2030 (3). However, it is currently unknown whether this can be achieved. The prevalence of stunting under five in the Special Province of Yogyakarta (DIY) in 2022 was 16.4%. The prevalence of short toddlers in Sleman Regency was 15.0% (4). In the 2022 Sleman Health Profile, the prevalence of very short and short toddlers according to the public health center (Puskesmas) with the top 5 highest incidence was in the Godean I Health Center, which was 9.49% (5).

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Lack of macro and micronutrients is one of the triggers for the problem of stunting in the Godean area. In 2015, as many as 18% of children aged 0-59 months lacked protein in Sidoagung Village (6). According to Sari (2016), there is a relationship between intake of protein, calcium, and phosphorus with the incidence of stunting in Pontianak (7). Astutik's research (2018) also proves that there is a relationship between protein and zinc intake and the incidence of stunting (8). From this background, the researchers were interested in knowing the relationship between protein and calcium intake and height in children aged 2-5 years in Yogyakarta, Indonesia.

2. METHODS

Research Design

The type of research used was an analytic survey with a cross-sectional approach which was carried out in December 2020-February 2021 at the Integrated Health Care Center (Posyandu) Working Area of the Godean 1 and 2 Health Centers. This research obtained an ethics number 1336/KEP-UNISA/VIII/2020. This research was conducted while the COVID-19 pandemic was ongoing, so it was carried out by implementing health protocols, including washing hands before entering the Posyandu, using a mask, not shaking hands, keeping a distance from cadres and mothers, using a hand sanitizer before and after taking height measurements.

Data Collection

The population of this study was around 5,655 in Godean Posyandu. The number of subjects in this study was 64 respondents, with a minimum number of 58 calculated using Fisher's formula or sample size to test the correlation coefficient hypothesis with a significance level (α) of 5% and a power of test (1-β) of 95%. The sampling technique used purposive sampling due to the pandemic condition so that not all toddlers could attend according to the Posyandu implementation with the inclusion criteria of not having leg defects and being willing to be respondents with mothers of toddlers filling out informed consent.

The data collected included primary data, namely intake of protein, calcium, and height. Data on protein and calcium intake were obtained from the Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ) with a list of 109 foods. This list of foods was taken from the Indonesian Food Composition Table with a calcium content of >500g per 100 g of food or food ingredients. List of important foods in the SQ-FFQ adjusted for research purposes (9). The SQ-FFQ questionnaire was filled out by the respondents themselves and confirmed by the researcher or enumerator. Some foods such as rice, fish, meat, and fruit are assisted using the Food Photo Book. The questionnaire contains daily, weekly, monthly, and quarterly patterns, which have also been given Household Size (URT) according to standard portions which are then converted into grams by the researcher or enumerator. Furthermore, nutrition content was analyzed using Nutrisurvey.

Height data were measured using a microtoise with an accuracy of 0.1 cm. Measurements were carried out by trained enumerators with the criteria of 3 students having passed the Nutritional Status Assessment (PSG) course and 3 lecturers, and training was held before the research was conducted. The measurement mechanism is by the Book of Stimulation, Detection, Early Intervention of Growth and Development (SDIDTK) (10), namely 1) installation of microtoise using nails or duct tape on a straight, flat wall with a height of exactly 2 meters and the number 0 on a flat and even floor, 2) the child takes off his shoes, 3) the child must stand straight, legs, heels,

buttocks, back, and the back of the head must be against the wall and face facing straight, or looking ahead, 4) the enumerator or researcher lowers the stature meter until it sticks on the top of the respondent's head, and measured from the highest point of the top of the head to the lowest point of the calcaneus bone, 5) the researcher or enumerator checked the spine, buttocks, and heels parallel to the wall, 6) the researcher or enumerator read at eye level. The possibility of error is also considered when measuring height, such as height correction (11). Additional structured questionnaires to find out the characteristics of the respondents, such as name, age, address, date of birth, and mother's cell phone number.

Data Analysis

Data analysis included univariate and bivariate analysis. Univariate analysis categorized total protein intake, total calcium intake, and height data. Intake data were obtained from the results of the SQ-FFQ and compared with the cut-off intake of protein and calcium according to the Adequacy of Nutritional Rate (RDA) (12). Height data were processed using software to determine the z-score value. Data on intake and height were normal ($p>0.05$) after being tested with the Kolmogorov Smirnov, which was then carried out with multiple regression tests to determine the relationship between protein and calcium intake and height. In the multiple regression test stage, 4 stages of assumption are used, namely the normality test, multicollinearity test, normal residual test, and heteroscedasticity assumption, then read the significance of the parameters simultaneously.

3. RESULTS

Respondent Characteristics

The results of the study on the characteristics of the respondents were that the number of female respondents was more than that of males, and the age of 1-3 years was more than the age of 4-6 years in the research respondents. The proportion of girls is higher than boys. The proportion of girls is 56.25% and boys are 43.75%. With a total of 36 girls and 28 boys. The stunted children were all 3 boys, whilst 6 boys and 6 girls were at risk of stunting. Meanwhile, there were 30 children (46.9%) with normal nutritional status (Table 1).

Table 1. Respondent Characteristics

Characteristics	Stunting		Risk of Stunting		Normal	
	n	%	n	%	n	%
Sex						
Male	3	4.6	6	9.4	19	29.7
Female	0	0.0	6	9.4	30	46.9
Age						
1-3 years old	2	3.1	6	9.4	34	53.1
4-5 years old	1	1.6	6	9.4	15	23.4
Protein Intake						
Moderate	0	0.0	0	0.0	47	73.5
Less	3	4.6	12	18.8	2	3.1
Calcium Intake						
Moderate	0	0.0	0	0.0	41	64.1
Less	3	4.6	12	18.8	8	12.5
Mean ± SD						
Protein Intake*	25.4±6.3		26.1±3.5		111.1±84.5	
Calcium Intake*	349.1±216.8		291.2±253.8		1707.3±1273.88	

*Normal distribution (p>0.05)

Relationship of Protein and Calcium Intake with Height

Based on the average adequacy of protein and calcium intake, normal children tend to have a higher average of protein and calcium adequacy than stunted children. The results of the partial regression test explained that there was no relation between protein intake and height (p>0.05) and calcium intake had no relationship with height (p>0.05). However, if protein and calcium intake were treated simultaneously, there was a significant relationship to height (p<0.05). The relationship between protein and calcium intake with height was 10.3% and 89.7% was explained by variables outside the study. The results of this study also prove that for every 1-gram increase in protein, the height will increase by 0.004 cm, and for an increase of 1 mg of calcium, the height will increase by 0.002 cm (Table 2).

Table 2. Multiple Regression Linear Test

Variables	Coefficient	Standard of Error	P>t	R-squared
Protein to Height	0.00357	0.0180	0.844	
Calcium to Height	0.00194	0.0011	0.102	
Protein and Calcium to Height	91.4	1.2	0.036*	10.3

*sig (p<0.05)

4. DISCUSSION

The results of this study are that children who experience stunting are male. The proportion of boys who experience stunting is higher, namely 32.1% compared to girls, which is 16.7%. Several studies explain that boys are prone to malnutrition compared to girls. This condition can occur due to differences in eating practices given by parents (13,14). There were 3 children (4.6%) who were stunted, 12 children (18.8%) who were at risk of stunting, and 49 children (76.6%) who were not stunted. Children who are stunted and at risk of stunting have insufficient protein intake and calcium intake. This research is in line with Sumarni's research (2019) that the average intake of protein and calcium in stunted children is insufficient intake (15). Apri's research (2016) also explained that 17 out of 34 stunted children had a protein intake that was less than the RDA (16).

From the SQ-FFQ analysis, the average protein intake of respondents in the stunting category was 25.4 ± 6.3 g., both stunting and risk of stunting category 26.1 ± 3.5 g., and the normal category 111.1 ± 84.5 g. Adequacy of protein intake in the stunting category with a percentage of fulfillment of intake of 71% of the RDA, fulfillment of the risk category for stunting of 74% of the RDA, and the normal category of the fulfillment of the percentage of intake of 317% of the RDA. Headey's research (2018) shows that countries with low consumption of animal-based foods containing protein, such as milk, meat/fish, and eggs are significantly associated with stunting (17). Protein is a macro-nutrient that functions as a form of new tissue during the growth and development of the body, repairs, and replaces damaged or dead tissue and provides the amino acids needed to form digestive and metabolic enzymes. Children with protein intake deficiency that lasts a long time even though their energy intake is sufficient will experience stunted growth in height. The growth that occurs in children requires an increase in the total amount of protein in the body so that it requires greater protein intake than adults who have stopped their growth. A child who lacks protein intake will grow slower than a child whose protein intake is sufficient (18). Low

protein intake can impair the mineral acquisition of bone mass by impairing the production and effects of Insulin-like Growth Factor-1 (IGF-1). IGF-1 affects bone growth by stimulating the proliferation and differentiation of chondrocytes in the epiphyseal growth plate and directly affects osteoblasts. The hormone IGF-1 also known as somatomedin is a polypeptide protein hormone that has a molecular structure like insulin which acts as a mediator of GH (Growth Hormone) work. This hormone plays an important role in the growth of childhood and continues into adulthood. The concentration of the hormone IGF-1 in the blood is low at birth, then increases gradually during infancy and childhood, and reaches its peak in adolescence. After that, IGF-1 levels gradually decline during adulthood (19). Another research also explains that the average protein intake is higher in stunted children than in children who are not stunted. In East Nusa Tenggara the risk of stunting is 5.34 times for toddlers with low protein intake. In Maluku, protein intake is less at risk of experiencing stunting 4 times compared to toddlers with adequate protein intake (20). In this study, the most frequently consumed source of protein is eggs, while a study in Myanmar showed that eggs were also being dietary diversity group eaten by school children (21).

Calcium consumption in stunted children is also significantly lower than in children who are not stunted, the mean calcium intake in a normal category is 1,707.3±1,273.88mg., the risk of the stunting category is 349.1±216.8mg., the stunting category 291.2±253.8mg. Adequacy of calcium intake in the stunting category with an intake fulfillment percentage of 44% of the RDA, in the stunting risk category the intake fulfillment percentage is 53% of the RDA, and in the normal category, the intake fulfillment percentage is 170% of the RDA. According to research in Bantul, low calcium intake is 5 times more likely to be found in stunted toddlers than toddlers who are not stunted (22). In this study, it was shown that from the results of the SQ-FFQ interviews, there were 38 out of 41 children who had sufficient calcium intake had a habit of drinking milk. There were 34 out of 41 children who had a habit of drinking milk and had a good z-score. The body's need for calcium is influenced by biological availability, physical activity, and the presence of other nutrients and is closely related to bone health. The large consumption of carbonated soft drinks is one of the factors in decreasing calcium intake. Consumption of other nutrients that can inhibit calcium absorption includes deficiency of vitamin D in its active form, high oxalic acid and phytic acid, high consumption of fiber and phosphorus consumption which is higher than the optimal ratio of calcium to phosphorus, as well as high intake of vitamin A in supplement form (19,23).

In this study, there were also 15 out of 23 children who had insufficient calcium intake and consumed high phytic acid and there were 18 out of 23 children who had low calcium intake, had low fiber intake. Lack of calcium during growth can cause a reduction in the mass and hardness of the bones that are being formed. In addition to affecting the growth of bones and teeth, calcium deficiency also causes a decrease in the immune system, nervous system barriers, and impaired heart muscle contraction power. Lack of calcium intake in children will cause disturbances in bone health and metabolism so growth and peak bone mass will be disrupted (19). Children's linear growth has a significant relationship with the level of calcium adequacy and consumption of foods that are low in calcium, especially at a growth age, will cause growth retardation in the future or adulthood (24). The results of this study follow the results of a study conducted by Endah (2016) which examined the relationship between protein, calcium, and phosphorus intake in stunted and non-stunted children aged 24-59 months. The results of this study were $p < 0.005$ for the relationship

between protein intake and calcium intake with stunting which indicated that calcium intake was significantly lower in stunted children compared to children who were not stunted (7).

The relationship between protein and calcium intake with height was 10.3% and 89.7% was explained by variables outside the study. Research related to the factors that cause stunting can explain this. The research of Aisyah (2012), Aridiyah (2015), Setiawan (2018), and Rosselo (2019) shows that the influencing factors include the mother's education, family income, mother's knowledge about nutrition, exclusive breastfeeding, age at which complementary food is given, level of adequacy of iron and zinc, history of infectious diseases, and genetic factors, birth weight, mother's height <145 cm. Aisyah's research (2012) shows that economic status is the dominant factor, and Setiawan's research (2018) shows the mother's education level is the most dominant factor (20,25–27). In terms of intake, there is a significant relationship between iron intake and the incidence of stunting (28).

The results of this study also prove that for every 1 gram of protein added, height will increase by 0.004 cm and 1 gram of calcium will increase by 0.002 cm. The results of this study are in line with Aridiyah's research (2015) that for every addition of one gram of protein, height will increase by 0.024 cm and the addition of 1 mg of calcium will increase height by 0.002 cm (26). The limitation of this research is that it was not conducted on all toddlers in stunting locus due to limited costs and the use of an infantometer which requires experienced staff at Posyandu. In addition, the definition of stunting obtained from Fikawati, et al (2017) is the final indicator of all the factors that influence a child's growth and development in the first 2 years of life which will then have a negative impact on the child's physical and cognitive development when they get older. Thus, two years is the right time to identify stunting which is a long-term manifestation of the First 1000 Days of Life (29).

5. CONCLUSION

There is a significant relationship between protein and calcium intake with the height of stunted and non-stunted children aged 2-5 years in areas prone to stunting in the working area of the Godean Health Center, Sleman. For every 1 gram of protein added, the height will increase by 0.004 cm, and with the addition of 1 mg of calcium, the height will increase by 0.002 cm.

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