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Intake of Protein and Calcium and Serum Albumin of Stunted Elementary School Children in Bengkulu

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***Abstract*— The level of adequacy of protein nutrients, calcium is an essential nutrient in the growth of children. Low protein and calcium intake is a risk factor for stunting. Albumin has a function to help the formation of new cellular tissues in the body at the time of growth and speed up the healing process of body tissues. The purpose of this study is to determine the difference of protein intake, calcium intake and serum albumin levels of stunted Elementary School 27, Bengkulu City. I am using the case-control design on the total sample consist of 20 children *stunting* and 20 children not *stunting*. The results of *independent t-test* to indicate that there is a difference of protein intake in *stunting* and not *stunting children*, but no difference in calcium intake and serum albumin levels in *stunting* and not *stunting*. The next researchers can associate other biomarkers such as serum zinc, serum calcium, and growth hormone in children *stunting*.**

***Keywords*— Protein Intake, Calcium Intake, Serum Albumin, Stunting, Not Stunting**

I. INTRODUCTION

Stunting is one of the nutritional problems that are being faced in Indonesia. *Stunting* describes the problem of chronic malnutrition that occurs due to a lack of nutrient intake or infectious disease that has been going on for a long time [1]. By doing anthropometric measurements, which are expressed by z-score height according to age (TB / U) which is less than -2 SD that has been determined [2]. According to WHO (2010) showed a low prevalence of ≥ 40% [3]. Data from Riskesdas (2013) shows a low national prevalence for school-age children 31.7% consisting of short 20% and very short 11.7%. The prevalence of stunting in the age group 5-12 years according to the Total Diet Study (2014) in Bengkulu province shows that stunting in the city of Bengkulu is 32.1% [4].

Stunting in elementary school children is the development and impact of stunting in infancy because there is no improvement in catch up growth. Growth rate increases during puberty and at the age of 6-9 years the growth period slows down both men and women [5]. The age of a boy's height growth starts at around 11 years of age while in girls occurs at the age of 10-15 years. The highest height increase occurs at puberty and girls experience puberty faster than men [6].

Risk factors that influence stunting are poor nutrient intake and nutrients consumed do not reach the body's cells [7]. The level of adequacy of protein nutrients, calcium is an essential nutrient in the growth of children. Low protein intake is a risk factor for stunting. Albumin is an essential protein found in blood plasma produced in the liver. The cause of the decrease in plasma albumin occurs due to low protein intake, digestion or absorption of protein that is not adequate. Research conducted by Nurahmatika et al. (2017) showed that there was a relationship between protein intake and decreased serum albumin levels [8].

Growth is also influenced by minerals, minerals that play a role, namely calcium. Calcium deficiency can inhibit growth. Calcium mostly binds to serum proteins, primarily albumin, so that total serum calcium levels are strongly influenced by albumin. Albumin is a transport, and the central place for plasma calcium, half the total amount of calcium in the plasma binds to albumin [9].

Albumin has a function to help the formation of new cell tissue in the body during growth and accelerate the healing process of body tissues. Your immune system will improve if you increase albumin levels; an increase in albumin indicates proper liver function and makes the child's growth and development period good [10].

Two factors that influence the regulation of albumin synthesis are nutritional intake, especially protein consumption and disease [11]. Albumin levels can also decrease in patients with inflammatory disorders and other illnesses. Decreased albumin levels in the body are associated with an increased risk of infection. Changes in albumin levels will affect total protein values. Research in Cairo showed that the serum values of albumin, TSH, T3, T4, Ca, Zn and Vitamin A was significantly lower among the groups stunting compared to the control group [12].

II. METHODS

The research design used is case control. The population in the study were 248 elementary school children. The research sample was taken by calculating the number of cases and controls namely 20 samples of children stunting and 20 samples of not stunting, sampling using purposive sampling

the technique that was by the desired criteria. The sample inclusion criteria used in this study were parents agreeing to their children being involved in the study and willing to sign an informed consent, students aged 8-11 years (grade 3 until 5), in good health, not physically disabled, TB / U located <-2 SD (Case), TB / U is -2 to 2 SD (Control). While the exclusion criteria for this study were students who did not attend school at the time of the study and resigned while being researched. The Human Ethics Committees from the Poltekkes Kemenkes Bengkulu approved the study protocol.

The primary data included protein intake and calcium intake using the Semi Quantitative Food Frequency Questionnaires (SQ-FFQ) form, albumin levels using architect plus c4000. Secondary data includes student names, age, number of students and classes obtained from school or staff at elementary school 27 Bengkulu City. Data on protein intake, calcium intake and albumin levels that have been collected are then processed and analyzed. The statistical test used was variable univariate analysis to describe the frequency distribution of protein intake, calcium intake, albumin levels stunting and non- stunting, number of children stunting in elementary school 27 Bengkulu City. The bivariate analysis aimed to determine differences in protein intake, calcium intake, and serum albumin levels in stunting and not stunting children. Data analysis using the Independent T-test.

III. RESULT

In table 1, it can be seen that the data in elementary school 27 Bengkulu City in 2018 found that there were 11 boys in stunting (27.5%) and girls who were not stunting, nine people (22.5%). Whereas in table 2 the age of children is categorized in the age range 8-9 years and 10-11 years. The percentage in the age range of 10-11 years is 27.5% with the number of children 11 people and the percentage in the age range 8-9 years there are 22.5% with the number of children nine people.

Based on the results of Table 3 shows that the average protein intake of children stunting is lower, namely 44.78 g / day compared to not stunting namely 50.25 g / day. Moreover, the average calcium intake is higher in children, stunting that is 498.13 mg/day compared to not stunting which is 483.07 mg /day. While the average serum albumin level was lower in children, stunting which was 4.23 g / dL compared to not stunting which was 4.34 g / dL.

TABLE 1. FREQUENCY DISTRIBUTION BASED ON GENDER ON STUNTING AND NOT STUNTING OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY

Gender	Variables				Total	
	Stunting		Not Stunting			
	n	%	n	%	N	%
Boy	11	27,5	11	27,5	22	55
Girl	9	22,5	9	22,5	18	45

TABEL 2. FREQUENCY DISTRIBUTION OF CHARACTERISTICS OF RESPONDENTS BY AGE IN STUNTING AND NOT STUNTING OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY

Age	Variables				Total	
	Stunting		Not Stunting			
	n	**%**	**n**	**%**	**N**	**%**
8- Nine age	9	22,5	9	22,5	18	45
10- 11 age	11	27,5	11	27,5	22	55

TABEL 3. FREQUENCY DISTRIBUTION OF PROTEIN, CALCIUM AND SERUM ALBUMIN LEVELS IN STUNTING AND NOT STUNTING OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY

Variables	Stunting			Not Stunting		
	Mean ± SD	Min	Max	Mean± SD	Min	Max
Protein Intake (g)	44,78 ± 5,57	30,70	52.10	50,25 ± 8,51	31,20	73,70
Calsium intake (mg)	498,13 ± 201,56	156,70	944,30	483,07 ± 188,8	128,20	962
Serum Albumin (g/dL)	4,23 ± 0,165	3,9	4,5	4,34 ± 0,225	3,9	4,8

Table 4 shows that there are differences in protein intake in *stunting* and non- *stunting children* in elementary school 27 Bengkulu City. This is evidenced by the *p* value of 0.017 (<0.05). Moreover, the results of Table 5 show that there is no difference in calcium intake in *stunting* and non- *stunting children* in elementary school 27 Bengkulu City. The *p*-value of 0.809 pieces of evidence. While the results of table 6 note that there is no difference in serum albumin levels in *stunting* and non-*stunting children* in elementary school 27 Bengkulu City. The *p*-value of 0.087 pieces of evidence.

TABLE 4. DIFFERENCES IN PROTEIN INTAKE IN STUNTING AND NOT STUNTING CHILDREN OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY IN 2018

Variables	n	Mean ± SD	*p Value*
Stunting	20	44,78 ± 5,57	0,017
Not Stunting	20	50,25 ± 8,51	

TABLE 5. DIFFERENCES IN CALCIUM INTAKE IN STUNTING AND NOT STUNTING CHILDREN OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY IN 2018

Variables	n	Mean ± SD	*p value*
Stunting	20	498,13 ± 201,56	0,809
Not Stunting	20	483,07 ± 188,8	

TABLE 6. DIFFERENCE IN SERUM ALBUMIN LEVEL IN STUNTING AND NOT STUNTING CHILDREN OF ELEMENTARY SCHOOL CHILDREN AT 27 BENGKULU CITY IN 2018

Variables	n	Mean ± SD	*p value*
Stunting	20	4,23 ± 0,165	0,087
Not Stunting	20	4,34 ± 0,225	

IV. DISCUSSION

Differences in Protein Intake in Children *Stunting* and Not *Stunting*

Based on the results *of an independent t-test* that there was a difference between protein intake in *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City, with a *p value* 0.017 which means there is a significant difference between protein intake of *stunting* children and not s*tunting* in elementary school 27 Bengkulu City.

The average protein intake for children *stunting* is lower than for non-children *stunting*. The source of protein consumed by *stunting* and non- *stunting children is* not much different. Based on protein sources, the variety of food consumed is the same as beef, chicken, fish, meatballs, chicken eggs, quail eggs, chicken liver, sausage, tempeh, knowing that what distinguishes them is the frequency of food consumed.

The child *stunting* average non-often consumes chicken, catfish, chicken eggs, sausages, and occasionally consume beef, tilapia, tuna, salted fish, quail eggs, shrimp, meatballs, chicken liver, tempeh, and tofu. While the consumption pattern ofchildren *stunting* on average often consume tuna, sardines, chicken eggs, tofu, tempeh and occasionally consume beef, chicken, catfish, tilapia, salted fish, quail eggs, shrimp, sausages, meatballs, chicken's liver. The amount of food or the portion is eaten by a child *stunting* and non-is *stunting* on average the same and only the portion of meat, chicken, sausage, meatballs, chicken liver, tofu, and tempeh is more than thechild *stunting*. The average consumption pattern that a stunting and non-stunting child has never eaten is crabs and snapper because they do not like it, and are rarely cooked at home.

The portion of animal side dish consumed by non-children is *stunting* more than thechild, *stunting* namely meat (50-100 grams), chicken (50-100 grams), sausages (30-40 grams), meatballs (50-100 grams), chicken liver (30-100 grams), while the portion of tempe vegetable dishes (50-75 gram) and tofu (50-100 grams). This research is in line with the research conducted by Cahya (2014) which shows that there is a a difference in the level of protein intake between elementary school children *stunting* and non- *stunting* in Kartasura sub-a district with a *p-value of* 0,000, a protein intake patternless in this study was more common in elementary school children who *stunting* than those who were not *stunting* [13].

Research which is also in line with Sufaera et al. (2016) which showed significant differences between protein intake in *stunting* and non- *stunting children in* grades 4 and five at elementary school 01 Pejaten Barat, South Jakarta with *p value* 0.001, mean daily protein intake of elementary school children the *stunting* is lower than elementary school children who are not *stunting* [14].

According to other researchers who are also in line with what Rahmawati et al. (2017) which shows that there is a difference between the level of protein adequacy in *stunting* moreover, non- with a *p-value of* 0.007 [15].

Another study that showed a correlation between the level of protein consumption and nutritional status in grade 4, 5 and 6 children at Ngesrep Elementary School 02 Banyumanik District, Semarang City [16]. Lack of protein intake will experience slower growth than children with a sufficient amount of protein intake and in worse circumstances protein deficiency over a long period can lead to the cessation of the growth process [17, 18].

Differences in Calcium Intake in *Stunting* and Non-*Stunting*

Based on the results *of an independent t-test* that there was no difference between calcium intake in *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City, with *a p-value of* 0.809 which means there is no significant

difference between the calcium intake of *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City.

The results of research will be undertaken in line with the research Aprilitasari (2017) about the differences in zinc and calcium intake among children under five *stunting* and *stunting* in urban panuran Surakarta, the results showed no difference in calcium intake among children under five *stunting* and *stunting* with *p-value* 0.058 and there is no difference between zinc intake between *stunting* and non-*stunting children* [19] This study is also in line with the results of research conducted by Sari et al. (2010) showing that there was no significant difference between calcium intake with nutritional status (TB / U) *stunting* and regular in children 7-12 years [20]

The results of research conducted were not in line with the research of Wibowo H (2018) which showed a pattern of calcium intake that was lacking in *stunting* children compared to children who did not experience *stunting* or impaired growth [21]. The amount of calcium intake for a child is *stunting* not much different from non-child *stunting*. Both of them consume calcium sources such as milk, anchovy, and seafood sources that contain calcium, tofu, tempeh and green vegetables, what distinguishes them is the amount of food that children eat. Onchildren *stunting* averageoften consume sweetened condensed milk, milo milk, milkuat and sometimes consume spinach, bananas, ice cream, indomilk milk, milk dancow. While the consumption patterns of non-children *stunting* on average often consume sweetened condensed milk and sometimes consume spinach, bananas, ice cream, industrial milk, milo milk, milk.

The amount of food or portion eaten by achild *stunting* and non-is *stunting* the same average and the difference is only in the frequency of food. The average portion ofchildren's food *stunting* such as spinach (30 grams), banana (104 grams), sweetened condensed milk (80 ml), indomilk milk (49 ml), milo milk (117 ml), dancow milk (129 ml), milkuat (23 ml) while non-children *stunting* consumed spinach (20 grams), banana (109 gr), sweetened condensed milk (63 ml), indomilk milk (47 ml), milo milk (106 ml), dancow milk (233 ml), milkuat (17 ml).

The habit of children in consuming milk contributes enough calcium that is 1000 mg (7-9 years) and 1200 mg (10-12 years), and in this studychildren *stunting* more or moreconsume milk than non-children *stunting*. Calcium intake is consumed more by children *stunting*, due to calcium source food habits such as mills milk, sweetened condensed milk, ice cream, milk and hindmilk milk, and the influence of his friends in the selection of calcium foods.

This research is in line with Agustiani's research (2010) which shows the proportion of female students who get influence from friends for calcium consumption is higher than the proportion of female students who do not get influence from friends. Moreover, according to Savitri's research (2009), it was found that peers significantly influence individual consumption behavior in choosing food types. Friends also affect the consumption of calcium, because of generally more independent in choosing food but the influence of peers increasingly influences the selection of food to eat [22],[23],[24]

Differences in Serum Albumin *Level in Stunting* and Non-*Stunting*

Based on the results *of the independent t-test* showed that there was no difference between serum albumin levels in *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City, with a *p* value of 0.087, which means that there is no significant difference between serum albumin levels *stunting* and not *stunting* in elementary school 27 Bengkulu City.

The results of this study do not concur with those of Mikhail, *et al* (2013) in Cairo with the title *"EffectOf Nutritional Status On Growth Pattern Of Stunted Preschool Children In* Egypt"which indicates that there are differences in serum albumin child *stunting* significantly lower than the child is not *stunting* even in the normal range [12].

The results of this study showed an average lower serum albumin level in children, *stunting* which was 4.23 g / dL compared to non-children, *stunting* which was 4.34 g / dL. The cause of the decrease in serum albumin levels is the length of albumin synthesis with a long half-life for 20 days so that it takes at least 7-10 days to reach normal plasma albumin levels again. The function of blood albumin as a reserve of amino acids for the body, and if there is a lack of protein in food for a more extended period, then albumin will be broken down into amino acids used by body cells to synthesize various proteins that are needed for life. As a result, hypoalbuminemia occurs [22].

Serum albumin is a marker of nutritional status. According to research conducted by Ryusaku, *et al*. (2017) shows that there is a positive relationship between serum albumin and *Insulin-like Growth Factor-1 level* (IGF-1) because IGF-1 is also a marker of nutritional status. If there is a decrease in serum albumin, there is a response from nutrition *Sirtuin 1* (SIRT1) to regulate the synthesis of IGF-1 which depends on GH in the liver. Moreover, if there is a decrease in IGF-1, there will be a decrease in serum albumin [23].

The rate of albumin production varies depending on disease conditions and nutrient rates because albumin is only formed in suitable osmotic, hormonal and nutritional environments [22]. Albumin levels can also decrease in patients with inflammatory disorders and the presence of diseases that cause loss of serum albumin [11].

V. CONCLUSION

Based on the results of the study and discussion of differences in protein, calcium, and serum albumin levels in stunting and non-stunting children in elementary school 27 Bengkulu City in 2018 there was a significant difference between protein intake of *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City in 2018 , there was no significant difference between the calcium intake of *stunting* children and non-children *stunting* in elementary school 27 Bengkulu City in 2018, there was no significant

difference between serum levels of *stunting* with non-children *stunting* in elementary school 27 Bengkulu City in 2018.

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