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Original Article

Nutrient intake and stunting in children aged 2-5 years in a slum area of Jakarta

Ratnayani Ratnayani[1], Diana Sunardi[1], Fadilah[2], Badriul Hegar[3]

Abstract

Background Stunting is one of the problems that occurs in children who live in slum areas. Inadequate nutrient intake has been associated with stunting in children.

Objective To assess nutrient intake and analyze the differences between stunted and non-stunted children aged 2-5 years.

Methods This comparative cross-sectional study compared nutrient intake and stunting among children 2-5 years in slum areas in Kebon Bawang Village North Jakarta. Subjects' nutrient intake was assessed using the *Semiquantitative-Food Frequency Questionnaire* (SQ-FFQ). To analyze differences in subject characteristics and nutrient intake in the stunted and non-stunted groups, Chi-square, Mann-Whitney test, and independent T-test were used.

Results From a total of 42 respondents, the characteristics of subjects were not significantly different between the stunted and non-stunted groups, in age (P=0.120), gender (P=0.126), maternal occupation (P=0.729), or maternal education (P=0.127). The stunted group had significantly lower intake of energy (P=0.003), carbohydrates (P=0.024), protein (P=0.005), and fat (P=0.001) than that of the non-stunted group. However, the majority of subjects had protein adequacy above the sufficiency level in both groups (P=0.638), while significantly more subjects in the stunted group had insufficient carbohydrate adequacy than in the non-stunted group (P=0.032).

Conclusion Overall, nutrient intake in the stunted group is lower than that of the non-stunted group. Protein adequacy is above sufficient for most subjects in both groups, while the significantly more stunted subjects have insufficient carbohydrate adequacy. In carrying out interventions, it is necessary to consider fulfilling a balance of nutrients, especially macronutrients. **[Paediatr Indones. 2024;64:132-8; DOI: 10.14238/pi64.2.2024.132-8**].

Keywords: *children; macronutrients; nutrient intake; slums; stunting*

Population growth in urban areas is a problem in developing countries, including in Indonesia,[1] because of a lack of affordable housing. Such growth leads to increasing the number of slum areas. In 2017, the *Central Bureau of Statistics* (BPS) reported that in DKI Jakarta Province, there were 445 slum hamlets (RW). North Jakarta has the largest number of slum RWs in DKI Jakarta.[2] Increases number of slums in slum areas are related to residents' poor health and nutritional status. *Riset Kesehatan Dasar 2018* (*Riskesdas 2018/2018 Basic Health Research*) showed that 11.5% of children under five were very short and 19.3% of them were short. Based on Regulation of The Minister of Health of The Republic of Indonesia Number 2/2020 regarding Child Anthropometry Standards, children are said to be stunted (short) if they have a height per age (HAZ) value of -3 SD to <-2 SD and severely stunted (very short) if <-3 SD.[3] In addition, in DKI Jakarta 6.1% of children under five were very short and 1.5% of children were short.[4] When a child's height is less

From the Department of Nutrition[1], Department of Chemistry[2], and Department of Child Health[3], Universitas Indonesia Medical School/ Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Corresponding author: Diana Sunardi, Department of Nutrition, Faculty of Medicine Universitas Indonesia/Dr. Cipto Mangunkusumo Hospital. Jl. Salemba Raya No 6. Jakarta Pusat 10430/Telp. (021) 31930208. Email: diana_sunardi@yahoo.com.

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than -2SD of the WHO child growth standards, the condition is known as stunting.[5] Stunting can have both short- and long-term consequences, such as increased morbidity and mortality, poor child development, increased risk of infection and non-communicable diseases in adulthood, and decreased productivity and economic capacity.[6]

There are many factors that cause stunting, both directly and indirectly. The direct factors include inadequate nutrient intake from the food consumed.[7] Several studies have shown that nutrient intake in stunted children is below the recommended dietary allowance (RDA).[8,9] In the long term, insufficient nutrient intake can result in an inadequate immune system response that can lead to susceptibility to disease. Further impacts can inhibit the absorption of nutrients.[10] Macronutrients are needed for the growth of a child. Lack of macronutrients, especially during the golden period, can cause nutritional problems. The golden age is the early period of life at the age of 0 to 5 years and is an important period for optimizing the best development for children's physical and intelligence.[11] Studies on macronutrient intake have shown an inconclusive relationship with the incidence of stunting.[12,13]

Slum areas go hand in hand with low income and nutritional problems in children. However, several studies in various Indonesian regions reported that there are many children with normal nutritional status in areas with low incomes.[14-16] In light of such contradictions, we aimed to assess intake of energy and macronutrients in children with and without stunting aged 2-5 years. This study was done in the hope of providing an overview of nutritional intake in children with and without stunting in the same area in order to determine how to provide nutritional interventions to limit stunting in children.

Methods

We used a comparative cross-sectional study design. This study was part of a study on the analysis of gut microbiota composition in stunted children under five in a slum area of Jakarta. Therefore, the determination of the sample size followed the main study. Estimation of sample size to assess the bacterial ratio (**Table 1**) between stunted and non-stunted children based on this equation:

$$n1 = n2 = 2\left[\frac{(Z\alpha + Z\beta)\ SD^2}{X_1 - X_2}\right]$$

n1 = n2 = minimal sample size
$Z\alpha$ = for α 0,05, the value of $Z\alpha$ is 1.96
$Z\beta$ = for 80% power, the value of $Z\beta$ is 0.842
$X_1 - X_2$ = mean between group
SD = standard deviation between group

Based on the calculation above, to assess the ratio of bacteria, the minimum sample size was 18 children for each group. With 10% drop out, the total minimal sample for each group was 20 subjects. In this study, 42 children were selected which were divided into 21 stunted and 21 non-stunted group.

Subject inclusion criteria were children aged 2-5 years with height for age Z score (HAZ) ≤ -2SD for the stunted group and -1SD ≤ HAZ ≤ 2SD in the non-stunted group. Based on WHO criteria -2SD ≤ HAZ ≤ 2SD for normal children. We used criteria -1SD ≤ HAZ ≤ 2SD as the non-stunted group because we aimed to get non-stunted children whose HAZ value were clearly diffencerent from stunted children so we didn't take normal children who had HAZ score between -2SD and -1SD. Based on this, we set the minimum score in non-stunted group is -1 HAZ.

We collected subjects' characteristics, maternal characteristics, and subjects' food intake. The age of subjects was categorized into 2-3 years and 4-5 years. Maternal occupation was divided into working and not working. Educational level was categorized as low (elementary school to junior high school) and high (senior high school and above). Data collection was carried out through interviews mother of children using a questionnaire. Assessment of nutrient intake was carried out using the *Semi Quantitative Food Frequency Questionnaire* (SQ-FFQ).[18]

Nutrient intake was processed using Nutrisurvey 2007. Our food composition analysis was based on the Indonesian food composition database.[19] Energy and macronutrient intake were compared to the recommended dietary allowance (RDA) to assess nutrient intake adequacy (**Table 2**). Energy and macronutrient intake was categorized as insufficient if the values were < 77% of the RDA,[20] sufficient if the values were ≥ 77%,[20] and above sufficient if > 120%.[21]

Table 1. Sample size to assess the ratio of bacteria in stunted and non-stunted children[17]

Genus	Standard deviation	n
Bifidobacterium	0.76	9.05
Lactobacillus	0.96	14.45
Enterobacter	0.73	8.35
E. coli	1.07	17.95

Table 2. Recommended dietary allowance for children[22]

Nutrients	2-3 years	4-5 years
Energy, cal	1,350	1,400
Protein, g	20	25
Fat, g	45	50
Carbohydrate, g	215	220

Differences in subject characteristics were analyzed using Chi-square, while nutrient intake and nutritional adequacy were analyzed using independent T-test for normally distributed data and Mann-Whitney test for non-normally distributed data. All data obtained were processed using *Statistical Science for Social Science (SPSS) version 20.0* software. This study was approved by the Ethics Committee of the Faculty of Medicine, Universitas Indonesia.

Results

A total of 42 children were divided into stunted and non-stunted groups. Most subjects were aged 2–3-years (34; 81.0%), and age categories were similar between those with and without stunting (P=0.120). Most of the stunted group were female and the non-stunted group were male. However, there was no significant difference in gender between the stunted and non-stunted groups (P=0.126). **Table 3** shows the characteristics of subjects and their mothers.

Non-working mothers comprised 16/21 of the stunted group and 15/21 of the non-stunted group. There was no significant difference in maternal occupation between the two groups (P=0.729). While there was no significant difference in maternal education level between the stunted and non-stunted groups (P=0.127), 15/21 of mothers in the stunted group had low education and 13/21 of mothers in the non-stunted group had high education (**Table 3**).

Energy and macronutrient intake (carbohydrates, protein, fat) were obtained from the SQ-FFQ and shown in **Table 4**. Energy and macronutrient intake in the stunted group was lower than that of the non-stunted group. Mann-Whitney test revealed that energy intake of the stunted group was significantly lower than that of the non-stunted group (P=0.003). Likewise, independent T-test revealed significantly lower carbohydrate, protein, and fat intake in the stunted group than in the non-stunted group (P=0.024, P=0.005, and P=0.001, respectively).

We assessed the adequacy of energy and nutrients by comparing the intake of nutrients with the RDA. **Table 5** shows that energy sufficiency was found in 13/21 of the stunted group and 19/21 of the non-stunted group, with a significantly higher percentage of subjects in the non-stunted group (P=0.002). Significantly more subjects in the non-stunted group had sufficient carbohydrate level than in the stunted group (P=0.030).

Protein consumption was mostly above sufficient in both groups (18/21 in stunted group and 19/21 in non-stunted group). However, protein consumption was not significantly different between groups. There were more children with insufficient fat intake in the stunted group compared to the non-stunted group (7/21 *vs.* 1/21), as well as fewer children with fat adequacy level above sufficient in the stunted group compared to the non-stunted group (0 *vs.* 6/21, respectively). The differences in fat adequacy between the two groups were significant (P=0.005).

Discussion

Most of our stunted subjects were female, and most non-stunted subjects were male, but the difference was not significant. In contrast, two studies in Ethiopia reported that stunting occurred mostly in boys.[23] However, a previous study also shows that there is no relationship between gender and the incidence of stunting.[24]

Both the stunted and non-stunted groups mostly had mothers who did not work outside the home. We noted a tendency for non-stunted children to have mothers with higher education level than in the stunted group, but the difference was not significant (P=0.127). Parental education level, in

Table 3. Characteristics of subjects and their mothers

Characteristics	Stunted (n=21)	Non-stunted (n=21)	P value*
Gender, n			0.126
Female	12	7	
Male	9	14	
Age, n		15	0.120
2-3 years	19	6	
4-5 years	2		
Maternal occupation, n			0.729
Not working	16	15	
Working	5	6	
Maternal education, n			0.127
Low	13	8	
High	8	13	

*Chi-square

Table 4. Intake of energy and macronutrients in stunted and non-stunted

Variables	Stunted	Non-stunted	P value*
Mean energy (SD), Cal	1,043 (191)	1,266 (178)	0.003
Mean carbohydrate (SD), g	142.7 (35.2)	165.4 (26.9)	0.024
Mean protein (SD), g	32.2 (7.9)	39.9 (8.9)	0.005
Mean fat (SD), g	37.3 (8.9)	48.4 (11.1)	0.001

*Analyzed by independent T-test for normally distributed data and Mann-Whitney test for non-normally distributed data

Table 5. Energy and macronutrient adequacy levels in stunted and non-stunted children

Variables	Stunted (n=21)	Non-stunted (n=21)	P values*
Energy adequacy, n			0.002
Insufficient	8	2	
Sufficient	13	19	
Carbohydrate adequacy, n			0.030
Insufficient	13	6	
Sufficient	8	15	
Protein adequacy, n			1.000
Sufficient	3	2	
Above sufficient	18	19	
Fat adequacy, n			0.005
Insufficient	7	1	
Sufficient	14	14	
Above sufficient	0	6	

*Chi-square test

our study the mother, has been related to knowledge of nutrition, especially in choosing food consumed by the family. A previous study showed a significant relationship between maternal education level and incidence of stunting.[25] Some studies even showed a relationship between the severity of stunting and maternal education.[23,26,27] Another study in South Jakarta showed that children whose mothers had low educational level had a 2.4 times higher risk of stunting compared to children whose mothers had high educational level.[28]

Stunting is a nutritional problem in children and is caused by many factors, especially inadequate nutrient intake. Although studies on the relationship

between nutrient intake and stunting have differing results, children whose nutritional needs are not met over a long period will likely experience malnutrition.[8,9,12] In our study, the intake of energy and macronutrients was significantly lower in the stunted group than in the non-stunted group.

Analysis of nutrient adequacy revealed differences in energy and macronutrient adequacy between the two groups. Macronutrients are needed for normal childhood growth and development. Inadequate macronutrient intake can have a long-term adverse impact, especially on cognitive development in the first 1,000 days of life.[29] In Indonesia, research conducted in 48 districts in urban and rural areas showed that with increasing age, nutrient insufficiency is increasing from 8 month to 12 year old.[30]

We found it interesting that protein consumption in both the stunted and non-stunted groups was above sufficient, while the carbohydrate adequacy, especially in the stunted group, was insufficient. Likewise, the stunted group had significantly more children with insufficient fat intake than did the non-stunted group. Most non-stunted subjects above sufficient or sufficient fat intake. Even though the total protein intake in both groups was quantitatively met, further analysis showed that consumption of plant protein in the stunted group was higher compared to the non-stunted group. Based on the ratio of animal protein to plant protein, the non-stunted group has a ratio of 1.7. This figure is higher compared to the stunted group which has a ratio of animal protein to plant protein of 1.2. This shows that consumption of animal protein in the non-stunted group is higher than in the stunted group.

Protein has a primarily role as a growth factor. Protein is also a macronutrient and have function as source of energy when intake of carbohydrates and fats is not met.[13] Protein is divided into two types, namely plant and animal protein. Apart from that, protein also has an important function as a source of amino acids which can increase the absorption of zinc and iron which can affect children's growth.[31] Animal protein has more complete amino acid composition compared to plant protein. Consumption of animal protein is associated with improved nutrition for children.The study conducted in Central Jakarta, Indonesia shows that stunted children aged 25-30 months consume less animal protein than the non-stunted group.[32] Other study related to animal protein consumption was conducted in the Masenjere region which showed that animal protein consumption was associated with increased linear growth in children aged 12-36 months.[31]

In conclusion, intake of energy and macronutrients is significantly lower in the stunted group than in the non-stunted group. Even though the total protein intake in both groups has met adequacy level, based on the type of protein, the ratio between animal and plant protein in the non-stunted group is lower than in the stunted group. However, carbohydrate and fat are still insufficient in the stunted group. Education and food interventions are needed, with a focus on balanced nutrition to improve children's nutritional status.

Conflict of interest

None declared.

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