The Effect of Nutrient Intake and Socioeconomic Factor toward Stunting Incidence among Primary School Students in Surakarta

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ABSTRACT

Background: It is estimated there are 156 million of children or as much as (23%) all over the world who endure stunting. Stunting prevalence in Indonesia reaches 29%, the figure is the highest among South East Asia countries. Whereas stunting can cause the escalating mortality and morbidity rate on children, delayed mental development, and reduced intellectual capacity. The study aimed to elaborate the effect of nutrient intake and socioeconomic factor toward stunting incidence among primary school students.

Subjects and Method: The study used analytic observational study with cross sectional design. The location of the study was in the city of Surakarta in February up to March 2017. There was a total of 145 subjects of the study. The sampling technique used was multi stage random sampling. Independent variables of the study were protein intake, energy intake, maternal education, maternal occupational status and family income. Dependent variable was stunting. The study used questionnaires and body height measurement for data collection. The data processing used was path analysis.

Results: Statistical result showed that Stunting Incidence was affected by energy intake (b=0.02,p<0.001), protein intake (b=0.02; p<0.001), maternal education (b=0.23; p=0.187), family income (b=0.01; p=0.051). Energy intake was affected by maternal education (b=9.56; p=0.77) and family income (b=1.81; p=0.0.05). Protein intake was affected by maternal education (b=1.75; p=0.051), maternal occupational status (b=-2.30; p=0.33) and family income (b=0.12; p=0.11).

Conclusion: Height per age was affected by energy intake, protein intake, maternal education and family income. Energy intake was affected by maternal education and family income. Protein intake was affected by maternal education, maternal occupational status, and family income.

Key words : Primary school students, Nutrient Intake, Stunting

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BACKGROUND

Stunting is one of the most significant impediment toward human development. Globally, stunting affects 162 million children under five worldwide. Stunting or too short for their age is marked by the height that is more than two standard deviations values below the World Health Organization children growth standard average (WHO, 2017).

Nutritional problem is the main health problem happens in developing countries. Nutritional problem may occur during pregnancy up to adult age. The most vulnerable age group to nutritional problem is school age (Kemenkes RI, 2013). Nutritional disorders occur on children consist of underweight, wasting, stunting and overweight as well as obesity. Double burden of malnutrition is still the primary health problem in Indonesia which is charac-

terized by under nutrition problem along with the increasing incidence of overweight and obesity, or poor diet-related non-communicable disease across human life course (Kemenkes RI, 2013; WHO, 2017).

Stunting occurs as the result of in-appropriate nutrient intake and it is irreversible during the first 1000 days of life. Stunting is also caused by chronic mal-nutrition in the initial stage of life even before birth that may lead to less optimal physical and cognitive development (World bank, 2015).

Stunting prevalence in 2015 is globally estimated as many as 156 million children or (23%) out of the entire children in the world who suffer from stunting, with the highest prevalence is in African region as many as 60 million children (38%) and in South East Asian region is 59 million (33%). WHO aimed to reduce 40% out of the number of stunting incidents among children by 2025, from 162 million in 2013 to 100 million in 2015. Children in rural area, with less educated mothers, are more likely to be at risk of suffering from stunting (WHO, 2016; World bank, 2015).

Stunting prevalence in Indonesia reached 29% in 2015, the figure was the highest among other South East Asian countries such as Myanmar, Vietnam, Malaysia and Thailand (World Bank, 2015). Riskesdas (2013) stated that the prevalence of stunting among children of 5 up to 18 years was as much as 30.7%. In Central Java province stunting incidences are 27.6% out of all children, meanwhile in the city of Surakarta stunting prevalence reached 17.6%, it shows that the prevalence of stunting is quite high that is as much as 15% (Kemenkes RI, 2016).

Delayed growth has been the main indicator of chronic under nutrition on children, that is related to troubled cognitive development and physical capa-

city (Pehlke et al., 2016). A study by Mustaq et al. (2011), shows that stunting may cause the escalating number of children mortality and morbidity rate, delayed mental development, and reduced intellectual capacity. Stunting on children may lead to the increasing risk for diseases, irreversible body impairment, less optimal brain development, reduced cognitive capacity as well as increasing risk of death (Tiwari *et al*, 2014).

Delayed growth happens as the result of the growth and development process failure that is generated by poor health condition and deficient nutrient consumption may cause linear growth which is not optimal. Socioeconomic factors such as parental education and family income affect toward stunting incidences that leads to the poor quality and quantity of nutritional intake as well as the increasing incidences of diseases (Pehlke et al, 2016; WHO, 2017).

According to Rachmi et al (2016), some risk factors of stunting incidences come from child factor such as sexes, anthropometry at birth, breastfeeding history and the age of introduction of complementary food; parental factors including parental age, marital status, parental anthropometry such as weight and height, antenatal care history, parental education, and family wealth; also society factors such as place of living, type of place of living, class of caste, ecological environment, and geographical location. Other factors that affect toward stunting and underweight incidences are low level parental education, lack of knowledge on child nurturing, the use of unclean water, limited access to get food and community's low income that generate poor quality food (Unicef Indonesia, 2012).

Factors contributing to delayed growth and development incidences are

inferior maternal health and nutrition, inadequate infant and child feeding practice and infection, particularly about inferior health and nutritional status of mothers pre, during and post pregnancy that affect children's growth and development, which starts from the pregnancy phase, such as delayed intrauterine fetal growth as the result of malnourished mother that increases the risk of low birth weight and potentially suffering from stunting (WHO, 2014).

SUBJECTS AND METHOD

The study was analytic observational study that used cross sectional design. The study was conducted in four Primary Schools in the city of Surakarta in February up to March 2017.

The independent variables of the study were energy intake measured by using the amount of calorie within a day in kilocalorie, and protein intake in gram; socioeconomic factor including maternal occupational status (employed or unemployed), family income, the amount of wages earned within one month period based on Regional Minimum Wages and maternal education (higher or equal to high school). Dependent variable was stunting incidence measured by body height (cm) and grouped based on age in anthropometry table of WHO 2007. The study elaborate the effect of independent variables toward dependent variable by using the theory of behavior change *precede-proceed.*

The samples of the study were students of grade 4 and 5 of SD Kristen Banjarsari, SDN Pasar Kliwon, SDN Jagalan 81 and SDN Ngoresan 80 Kota Surakarta. There were a total of 145 subjects selected by means of multistage random sampling technique.

Data collection was conducted by using questionnaires to measure nutrient intake as well as physical activity by using recal method, and body height measuring.

Data processing technique used consisted of editing, that was re-checking the questionnaires already filled out by the subjects of the study during data collection; scoring, that was giving score for each item of question; coding, conducted by altering data into simpler form to facilitate statistical analysis; entering, that was inputting the data obtained into computer program; and tabulating, that was data processing in a form of tables to give statistical illustration.

Data analysis technique was by using univariate analysis, bivariate analysis, to analyze the effect of independent variables toward dependent variable by using Pearson test, and multivariate analysis with path analysis to analyze the effect of more than one independent variables toward dependent variable through intervening variable.

RESULT

The result of the study explained about univariate analysis, bivariate analysis, and path analysis. The characteristics of the subject of the study were presented in Table 1. Table 1. showed that most of the subjects, aged 10- 12 years old that was 90 (62.10%), most of the subjects were male, that was 75 (51.70%).

Most of the subjects were students of grade 4, that was 85 (58.60%). Most of the subjects' mothers had high level of education, as many as 107 (73.80%). Most of the subjects of the study belonged to families with income beyond Regional Minimum Wages (≥ Rp 1,534,985) that was as many as 101 (69.70%). From maternal occupational status, most of them were employed.

Table 1. Characteristics of the subjects of the study

Characteristics	Criteria	Frequency	Percentage
Age	7 – 9 years	55	37.90
	10 – 12 years	90	62.10
Maternal Education	<High School	38	26.20
	≥High School	107	73.80
Family Income	Low (Rp 1.534.985,00)	44	30.30
	High (≥ Rp 1.534.985,00)	101	69.70
Maternal Occupational	Employed	72	49.70
Status	Unemployed	73	50.30

Table 2. Univariate analysis on nutrient intake

Intake	Mean ± SD	Min	Max	% RDA		
				7-9 y.o	10-12 y.o female	10-12 y.o male
HAZ	-0.77 ± 1.07	- 3.22	2.87			
Family Income (Rp 100,000)	25.77 ± 15.75	5	110			
Protein (g)	61.75 ± 14.19	34.50	95.80	124.48	102.92	110.27
Energy (kcal)	2093.82±174.23	1823.70	2248.00	113.00	104.65	99.66

Table 2. showed the average Z-score of H/A was categorized as normal that was ≥2 SD, the average family income was categorized as families with high income that was ≥ (Rp 1.534.985,00), the average nutrient intake of primary school students was already above 80% RDA even more than 110% RDA, therefore nutrient intake of primary school students was excessive, meanwhile snack intake was still within normal limit that was below 20% RDA.

Table 3. Bivariate analysis on the effect of energy intake, protein intake, maternal education, maternal occupational status and family income toward height per age of primary school students

Variables	Correlation Coefficient (r)	p
Protein intake (gr)	0.37	< 0.001
Energy Intake (kkal)	0.34	< 0.001
Maternal Education (high ≥SMA)	0.09	0.301
Maternal Occupational Status (employed)	0.07	0.423
Family Income (high≥Rp 1.534.985,-)	0.23	0.005

Table 3. showed the result of bivariate analysis on the effect of protein intake, energy intake, maternal education, maternal occupational status and family income toward height per age of primary school student. Protein intake (r=0.37; p<0.001), energy intake (r=0.34; p<0.001) and family income (r=0.23; p=0.005) had positive effect toward height per age and statistically significant. Maternal education (r= 0.09; p=0.301) and maternal occupational status (r=0.07; p= 0.423) had positive effect toward height per age although statistically insignificant.

Table 4. showed the result of multivariate analysis by using path analysis model. It was found that the value of path coefficient (b) of the effect of energy intake toward height per age (b=0.02, SE<0.01, p<0.001). It meant every unit increase of energy intake increased the height per age or reduced stunting incidence by 0.02 unit.
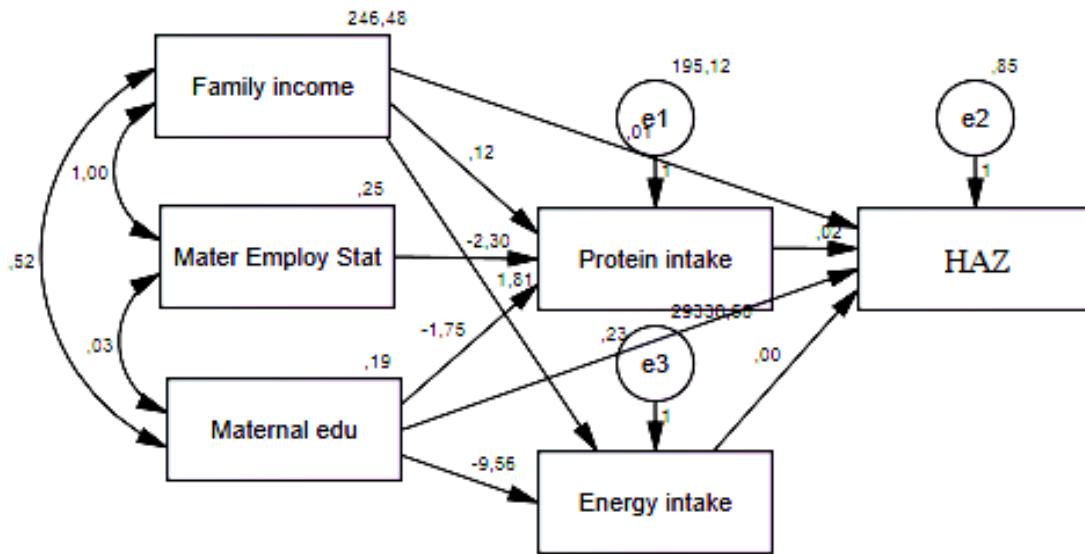
Figure 1. Structural model of path analysis with estimation

Table 4. Result of path analysis

Dependent Variables		Independent Variables	b	S.E	p	β
Direct effect						
HAZ	←	Energy intake (kcal)	0.02	<0.01	<0.001	0.27
	←	Protein Intake (g)	0.02	0.01	<0.001	0.32
	←	Maternal Education (≥Senior High School)	0.23	0.18	0.187	0.10
	←	Family Income (≥Regional Minimum Wages)	0.01	0.01	0.051	0.15
Indirect Effect						
Energy Intake	←	Family Income (≥ Regional Minimum Wage)	1.81	0.91	0.05	0.16
	←	Maternal Education (≥Senior High School)	9.56	32.55	0.77	0.02
Protein Intake	←	Maternal Education (≥Senior High School)	1.75	2.67	0.51	0.05
	←	Maternal Occupational Status (Employed)	-2.30	2.36	0.33	-0.08
	←	Family Income (≥ Regional Minimum Wage)	0.12	0.08	0.11	0.13
Fit Model						
CMIN(x²)= 1.273		P = 0.282 (>0.05)				
CFI = 0.981		(≥ 0.90)				
NFI = 0.934		(≥ 0.90)				
GFI = 0.991		(≥ 0.90)				
RMSEA= 0.044		(≤ 0.08)				

Height per age was directly affected by energy intake (b=0.02, SE<0.01, p< 0.001), protein intake (b= 0.02, SE=0.01, p<0.001), maternal education (b=0.23, SE=0.18, p=0.187) and family income (b= 0.01, SE=0.01, p=0.051).

Energy intake was affected by maternal education (b=9.56, SE=32.55, p=0.77)

and family income (b=1.81, SE=0.91, p= 0.05), whereas protein intake was affected by maternal education (b=1.75, SE=2.67, p=0.51), maternal occupational status (b=-2.30, SE=2.36, p=0.33) and family income (b=0.12, SE=0.08, p=0.11).

The model had met the requirement of conformity to path analysis model with CMIN was as much as 1.273, p= 0.282 > 0.05; NFI= 0.934 ≥ 0.90; CFI= 0.981 ≥ 0.90; GFI ≥ 0.991; RMSEA = 0.044 ≤ 0.08.

DISCUSSION

1. The effect of energy intake toward height per age

There was a positive direct effect of energy intake toward height per age. The entire energy intake comes from carbohydrate, fat and protein intake as well as some other nutrients. Carbohydrate intake needed by a body within normal level which is 60-75% out of recommended daily allowance whereas fat intake is as much as 10-25%. Carbohydrate plays in providing glucose for body cells that will be turned into energy. Glucose contributes in carbohydrate metabolism. Some tissues that obtain the energy from carbohydrate are red blood cell, some part of brain and nerve system (Kemenkes RI, 2014b).

2. The effect of protein intake toward height per age

There was a positive direct effect of protein intake toward height per age. Protein intake is needed to build and maintain the entire cells inside body. During growth period, protein is badly needed, the protein is extremely needed for the development of new cells. Protein consists of long chain of amino acids that are connected together. Some amino acids are generated within human body, however there are some others that human body cannot manufacture it, they are called essential amino acid. Essential amino acids can be obtained

from dairy products such as milk, egg, meat and fish (More, 2014).

Protein is a nutrient needed by body to grow, build body structure (muscles, skin, and bones) as well as a substitute for damaged tissue. The close relationship between protein and growth cause a child who lacks of protein intake will endure slower growth than other kids whose amount of protein intake is adequate (Almatsier, 2010).

The result of the study showed that the protein intake of primary school students that was categorized as low below the recommended daily allowance, the majority was from SDN Ngoresan 80, the result was accompanied by the number of children who suffered from stunting in the school was the highest compared to other primary schools. The result of study was supported by a study conducted by Dewi dan Adhi (2016), that children who lack of protein intake have 10.26 times bigger risk for stunting compared to other children with adequate protein intake (Dewi dan Adhi, 2016). Most of the subjects of the study had normal height, it was because there were more students of primary school who obtained protein intake more than recommended daily allowance based on age.

Similar study conducted by Esfarjani *et al* (2013), find that there is a positive effect and statistically significant of nutrient intake (carbohydrate and protein) toward the risk of stunting on children. The result of the study showed that high carbohydrate and protein intake are related to the reduced risk of stunting on children by 0.31 time (Esfarjani *et al*, 2013).

The result of the study showed that the subjects of the study had enough protein intake and it was even more than recommended daily allowance, however there were some primary school students who were suffering from stunting and the

number was quite high above WHO target. Body cannot keep the protein in long period of time, therefore the excess protein will be stored inside the body in a form of fat that will lead to the risk of obesity.

3. The effect of maternal education toward height per age

There was a positive indirect effect of maternal education toward height per age through children's energy intake and protein intake. The result of the study showed that the majority of mothers had high level of education that was more than high school, however stunting incidences on primary school students were still quite high. Almost all of mothers of the study subjects had high level of education, however mothers with high level of education are not necessarily knowledgeable, since knowledge is not only obtained from formal education but also from non formal education (Senbanjo, 2011). Unawareness of information about nutrition can lead to less qualified food intake which is consumed by children. The higher maternal education, the higher also mothers' knowledge on good nutrient for their children, hence will reduce the risk of having children with stunting (Ni'mah dan Nadhiroh, 2015).

Children who have mothers with high level of education (>high school) who take care of their children by themselves have less risk of suffering from stunting compared to children who are not directly taken care by their own mother. Education will affect mothers' acceptance toward nutritional information, as the result people with high education will be easier to change their les healthy feeding habit into more healthy feeding habit (Kuntari *et al*, 2011).

Stunting incidence is usually accompanied by other nutritional problems such as over nutrition or under nutrition. Based on the measuring of body mass index per age, more than a half of study subjects were enduring over weight and obesity, and there were some subjects who were thin and very thin. The incidence of thin condition and obesity can affect the stunting incidence on children (WHO, 2016).

Study conducted by Omondi dan Kirabira (2016) also states there is an strong effect of maternal education toward stunting on children. Mothers who have high level of education are estimated will have good nutritional knowledge. Having good knowledge a mother will be more able to provide nutritious meal for family members. Unawareness of information on nutrition can lead to less qualified food intake consumed by children. The higher maternal education, the higher also mothers' knowledge on good nutrient for their children, hence will reduce the risk of having children with stunting (Ni'mah dan Nadhiroh, 2015).

The study is also supported by the result of a study by Karimawati (2013), that mothers' knowledge affects maternal attitude in giving nutrient intake to preschool children. Knowledge can be obtained from formal education as well as non formal. Maternal education and occupational status can affect mother's knowledge and attitude in giving nutrient intake for their children. Health education is one of the effort to increase knowledge and alteration of mother's attitude on good nutrient intake for children, as well as foods that should be avoid. Therefore, with good nutritional knowledge, the risk for children to endure stunting will be reduced (Karimawati, 2013).

4. The effect of family income toward height per age

There was an indirect effect of family income toward height per age through children's energy intake and protein intake. Stunting incidence depends on socioeconomic, demography, and environmental fac-

tors. Indicators of socioeconomic status, such as maternal education, maternal occupation, and household income, are some determining factors that are directly related to stunting (Keino, 2014).

Family income significantly affects stunting incidence on children. Family income is related to family meal provision, food access within the family and adequate distribution of food for family. Quality and quantity of nutrient intake for the entire family members are affected by income. Family with low income is 3.25 times at risk for having child with stunting (Ni'mah K dan Nadhiroh SR, 2015). Family with high income will afford to buy food with good quality and nutrient for family's nutrient intake (Omondi dan Kirabira, 2016). Children who obtain higher intake of protein, calcium, iron, and zinc will have higher H/A values, whereas carbohydrate intake has negative effect toward H/A of children (Roosita *et al*, 2014).

5. The effect of maternal occupational status toward height per age

There was a negative indirect effect of maternal occupational status toward height per age through protein intake. The result of the study showed that most of maternal occupational status was employed, as the result they had less time at home to take care of their children especially in providing food for their children therefore there were still children with low protein intake below recommended daily allowance.

Picauly dan Toy (2013) shows that working mothers have the bigger possibility for their children to endure stunting compared to unemployed mothers, if mothers work, it will increase stunting incidence by 3.623 times compared to unemployed mothers (Picauly dan Toy, 2013).

Working mothers do not have enough time to pay attention whether the food meets their children needs and adequacy neither to nurture their children. It gives description that level of education and nutritional knowledge do not guarantee good parenting pattern. Mothers who spend more time outside the home to work cannot control well their children's food consumption pattern. It has an implication toward children's less optimal nutrient intake. However, high level of education still is an important factor as the effort to reduce stunting incidence. Mothers with high level of education will be able to easily absorb and adopt the information so it is expected to establish good and healthy habit pattern.

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