



Correlation between Food Intake and Health Status with the Nutritional Status of School Children Age 9-11 in Semarang City

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Abstract

Malnutrition, a major risk factor for a number of infectious diseases, including acute upper respiratory tract infections (AURTI), is common in developing countries. Nutritional status is an important index of the quality of life. Objectives: To analyze the correlation between food intake and health status to nutritional status of 9-11 years old children in Semarang. The study was a correlation study carried among school children in Semarang aged 9-11 years old. Data are presented in the descriptive analyses and Spearman correlation. Overall, food intake (energy and protein) of 9-11 years old children in Semarang is normal with $\geq 90\%$ RDA, health status of them was satisfactory (very low AURTI incidence), and their nutritional status were mostly normal. There was a correlation between energy intake with nutritional status with indicators BMI, and z-score of W/A and H/A, but there was no correlation between protein intake and AURTI with nutritional status. Energy and food intake of the children correlate with all nutritional status being studied. It should be suggested to parents to implement balanced diet, to avoid the development of obesity among elementary school children through nutrition education to prevent malnutrition as well as obesity.

How to Cite

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INTRODUCTION

Elementary school children is one of the groups vulnerable to malnutrition among the causes is the low economic level and food intake were less balanced and low parental knowledge. School children with a balanced diet are likely to have good nutritional status. According Departemen Kesehatan RI (2010), people who consume food below 70% of the Nutrition Adequacy Score recommended in 2004 as much as 40.6%. This situation is common in school-age children (41.2%), teenagers (54.5%) and pregnant women (44.2%). Basic Health Research data showed a children of primary school age the prevalence of nutritional status (BMI/A) with thin category above the national prevalence (7.6%). According to gender, the prevalence stands at a boy higher at 36.5% than girls, is 34.5%. According to the shelter, the prevalence of child stands lower in urban areas (29.3%) than rural children (41.5%). The prevalence of stunted children is inversely proportional to the level of education of family. The higher prevalence in children with household heads W/H low education level (elementary school and never went to school) compared with the least junior secondary education. The prevalence stunted has declined with increasing household economic status. The highest prevalence (45.6%) was seen in the economic situation of households in the lowest quintile and the lowest prevalence of 21.7% in the economic situation of households highest quintile (Departemen Kesehatan RI, 2010).

Every year about 13 million infants and children die in developing countries. Most of these deaths caused by infectious and parasitic diseases, and most children died of malnutrition. The precise contribution of malnutrition as the cause of death is not known, nor would it be the only figure relevant for poor country's children from birth or shortly after getting stuck in a cycle of malnutrition and infection, which many do not survive. The "malnutrition-infection" remains a complex public health problem most common in the world today. Nutrition and health are closely linked, but advances in nutritional knowledge must be implemented at the same level as those in the health field (Tomkins & Watson, 1989).

Malnutrition, a major risk factor for a number of infectious diseases, including influenza, are common in developing countries⁴. Therefore, it is important to understand the consequences of malnutrition on morbidity and mortality associated with influenza infection. Although studies using murine models have addressed the

impact of some aspects of malnutrition on respiratory viral pathogens (Smith et al, 2007). PEM (Protein-energy malnutrition), a common cause of secondary immune deficiency in children, defined as an imbalance between food intake (protein and energy) and the body needs to ensure the most favorable growth (Beck et al., 2004). PEM is the most fatal form of malnutrition in developing countries, with more than 150 million children <5 years of suffering throughout the world (WHO, 2002). That the cause of the infection and the nutritional effects and results of the episodes become part of conventional wisdom. Protein-energy malnutrition known to have a depressive effect on the immunity. Especially the effects on different elements of the immune system can be distinguished. Therefore, growth failure associated with lowered immunity. Indeed, it seems that even mild degrees of malnutrition began to influence immune competence, the morbidity and mortality, shifting attention to protein-energy malnutrition mild-moderate and severe. Acute Upper respiratory tract infections (AURTI) continue leading infectious cause of morbidity and mortality among children <5 years in developing countries (WHO, 2012). In Indonesia, AURTI contributed 16% of deaths among children, respectively. Based on data Basic Health Research in 2007, the incidence of AURTI for school age children 5-14 years in Central Java province is 32% (Ministry of Health Republic Indonesia, 2007).

School age is the active growth phase of childhood. Primary school age is a period of dynamic physical growth and mental development of children. Research shows that health problems due to the nutritional status of sad at primary school age children is one of the most common causes of low school enrollment, high absenteeism, dropping out early and classroom performance is not satisfactory (IIPS, 2007).

Malnutrition in children and is one reason behind the high child mortality rates were observed in developing countries. Chronic malnutrition in children associated with slower cognitive development and serious health problems later in life that reduce the quality of life of individuals. Nutritional status is an important index of this quality. In this case, understanding the nutritional status of children has implications for better development of future generations distant. Monitoring growth is universally used to assess nutritional status, health and development of children of individuals, and also to estimate the overall nutritional status and health of the population. Compared with other health assessment tool, measuring the growth of children is relatively inex-

pensive, easy to perform and non-invasive process (IIPS, 2007).

The prevalence of child stunting in Indonesia is still high. In 2014 the prevalence of stunting in children 6-12 years of age is 35.6% with the details of 15.1% and 20.5% very short. This figure is high considering the WHO standards for child stunting (very short and short) is 20% (Departemen Kesehatan RI, 2010). The prevalence of stunting in school-age children in Central Java at 28% (Nix, 2005). According to the research conducted by Anggraheni and Pramono (2015) in the North Semarang region of 40 children aged 9-12 years showed that the prevalence of Z-Score H/A < -2 SD is 29 children (72.5%). Most of the 18 children (78.26%) who have a Z-Score H/A < -2 SD are male (Ganong, 2001).

This study purposed to analyze and association between food intake and health status to nutritional status of 9-11 years old children in Semarang.

METHODS

The study was a correlation study using cross sectional data collection. The population in the study were all students in elementary school of urban area in Semarang namely students of SDN 01 Rejosari. Subjects taken randomly from the study age 9-11 years old (class 4,5,6) enrolled in SDN 01 Rejosari, to meet the sample size calculation. Children who were not well during the time of study were excluded for being the subject of the study.

Independent variable was food intake and health status (AURTI) and dependent variable was nutritional status. Food intake measured by percentage of RDA (Recommended Dietary Allowances). Upper respiratory tract infection measured by the counting the experience of AURTI in the least 2 months. Nutritional status is measured with anthropometric indicators namely BMI, and z-score of W/A, H/A, W/H), using WHO anthropometric standard.

Univariate analyzes performed on each variable of the research results in the form of distribution of variables: age, body weight, height, health status (AURTI) and nutritional status. The analysis was performed to determine whether or not the relationship between independent and dependent variables. Bivariate analysis used was Spearman's test.

RESULT AND DISCUSSION

The subjects were 90 children of primary school in SDN 01 Rejosari Semarang. Table 1. showed the description of variable in this research. Majority of respondents has age mean 10,8 years with standard deviation 1, minimum 9 years old and maximum 11 years old. Energy intake has mean and standard deviation 94.2 ± 6.6 with minimum value 72.5 and maximum value 130. Protein intake has mean and standard deviation 97.1 ± 3.1 with minimum value 86 and maximum value 97.1. Birth weight has mean and standard deviation 3212.2 ± 465.1 with minimum value 1800 gram and maximum 4400 gram. BMI/A (WHO Anthro) has mean and standard deviation 18.1 ± 4.3 . W/A (Z Score) has mean and standard deviation -0.1 ± 1.3 . H/A (Z score) has mean and standard deviation -0.6 ± 0.9 . AURTI has mean and standard deviation 1.7 ± 0.7 . Mother education has mean and standard deviation $11.1\text{ years}\pm 2,6$.

Subjects in this study were 90 children of primary school in SDN 01 Rejosari Semarang. Characteristics of research subjects can be seen in Table 2. The age of the research subjects were 9-11 years old, with percentage of 9 years old is 25.6%, 10 years old is 41.1% and 11 years old is 33.3%. The percentage characteristic of male is 54.4% and female is 45.6%. This showed that majority of respondents are 10 years old and male.

Number of mother education ≤ 6 years is 13.3%, 7-9 years is 16.7%, and the majority had more than 10 years schooling (70%), number of families with per capita income <Rp. 388.518 are 71.1% and families with per capita income \geq Rp. 388.518 are 28.9%, subjects born with low birth weight are (4.4%) and the rest 95.6% is normal born weight. Majority of respondents also normal H/A (94.5%) and normal BMI/A (66.7), also normal W/A (75.6%).

Number of mother education with elementary school is 15.6%, junior high school is 20%, and the majority had more than 9 years schooling (74%), number of families with low income are 34.4% and families with high income are 65.6%, subjects born with low birth weight are (4.4%) (Table 3).

The correlation between energy intake, protein intake, born birth weight, URTI (Upper Respiratory Tract Infection), mother education, family income and nutritional status showed in Table 4.

Table 1. Description of variable

Variable	Mean	Std. Deviation	Minimum	Maximum
Age	10.8	1.0	9.0	11.0
Energy intake (%RDA)	94.2	6.6	72.5	130
Protein intake (%RDA)	97.1	3.1	86	97.1
Birth weight (gram)	3212.2	465.1	1800	4400
BMI/A (WHO anthro)	18.1	4.3	11.1	37.8
W/A (Z score)	-0.1	1.3	-2.9	4.6
H/A (Z score)	-0.6	0.9	-5.3	1.3
AURTI (frequency)	1.7	0.7	0	4
Mother education (years)	11.1	2.6	6	16
Per capita income (Rupiah)	388,518	235,306	62,500	1,250,000

Table 2. Frequency distribution of subjects' characteristics'

Variable	N	(%)
Energy Intake		
Low (<90% RDA)	15	16.7
Normal (\geq 90% RDA)	75	89.3
Protein Intake		
Low (<90% RDA)	2	2.2
Normal (\geq 90% RDA)	88	97.8
BMI/A (Centile WHO Anthro)		
Underweight	1	1.1
Wasting	1	1.1
Normal	60	66.7
Overweight	8	8.9
Obese	10	10.2
W/A		
Wasting	5	5.6
Normal	68	75.6
Overweight	17	18.9
H/A		
Severely Stunting	2	2.2
Stunting	3	3.3
Normal	85	94.5
AURTI		
>2 times	8	8.9
\leq 2 times	82	91.9

The energy intake has significant and positive correlation with nutritional status in all BMI/A, W/A, H/A ($r=0.330$, $p=0.002$; $r=0.392$, $p=0.000$; $r=0.425$, $p=0.000$). Meanwhile, another variable such as protein intake, born birth weight, URTI, mother education, family income has no significant correlation with nutritional status because the p value higher than 0.05. This mean

that only energy intake has significant correlation with nutritional status. Nutrients are substances or chemical elements contained in the food necessary for normal metabolisms in the body. Weight was included because it reflects the recent and present balance between energy intake and energy expenditure. Weight is positively associated with survival in the elderly (Burr et al.,

Table 3. Frequency distribution of subjects' mothers' characteristics

Parameter		N=90	%
Childrens' age (Y)	9	23	25.6
	10	37	41.1
	11	30	33.3
Sex	Male	49	54.4
	Female	41	45.6
Mother Education	Elementary school	14	15.6
	Junior high school	18	20.0
	Senior high school	49	54.4
	Academic / Bachelor degree	9	10.0
Per capita income	< 388.518	31	34.4
	≥ 388.518	59	65.6
Birth Weight	< 2500 g	4	4.4
	≥ 2500 g	86	95.6
Total		90	100.0

1984; Agarwal et al., 1988; Cornoni-Huntley et al., 1994; Subramanian, 2003). A loss of weight (mainly lean mass) is common in the elderly but this is not seen in some groups, particularly if they are physically active.

Good adherence to the nutritional treatment in the sample can also be observed in the energy intake. The mean intake of the subjects in this study is tend to be normal energy intake ($\geq 90\%$ RDA) that is 89.3% and the rest that are 16,7% respondents has low intake energy ($< 90\%$ RDA). Being cross-sectional, the present study only suggests associations. It is impossible to establish a cause-and-effect relationship between food intake and the impairment of the nutritional status. Based on the result of this study, from relationship analysis using Spearman correlations and also multivariate analysis using regression with a confidence level of 95% was obtained which indicates that only energy intake has significant relationship and affecting nutritional status (W/A, H/A and BMI). Energy requirements vary according to gender, age, body size and level of physical activity. In healthy children and young people, including the energy needs of the energy needed for growth and the energy required to balance energy expenditure. Non-growth-related energy expenditure has three main components: basal metabolic rate (BMR), diet-induced thermogenesis and physical activity (Suchdev, 2008; Supariasa, 2001). So more higher energy intake will affecting more better nutritional status.

Analyses results by using multivariate re-

gression for W/A, showed that energy intake has significant effect on W/A (Table 5). Meanwhile protein intake and mother education has no significant effect on W/A. The value of R^2 is 0.296 in the first step this means that energy intake, protein intake, mother education affecting W/A 29.6%. In the second step, the value of R^2 is 0.300 this means that energy intake and mother education affecting W/A 30%. In the third step, the value of R^2 is 0.295 this means that energy intake contribute 29.5% variance affecting W/A. In the second step, the coefficient value of R^2 is 0.300 this means that energy intake and mother education affecting W/A 30%. In the third step, the coefficient value of R^2 is 0.295 this means that energy intake affecting W/A 29.5%. The prevalence of ARI among school children in Semarang is very high and there are many student with low / poor food intake and nutritional status. So this research purposed to analyze the association between food intake and health status to nutritional status of 9-11 years old children in Semarang. Nutritional status is a picture of the balance between the need for macro and micro nutrients for the maintenance of life, development, growth, maintenance of normal function of the body and for the production of energy and other nutrients intake (Almatsier, 2009). According to the framework of UNICEF (1998) issue of nutrition is influenced by direct and indirect factors. Direct factor of food intake and infectious diseases which both are interrelated. Lack of food intake can cause the body susceptible to disease infec-

Table 4. Analysis of spearman correlation

Variable	Nutritional Status		
	BMI/A	W/A	H/A
Energy intake	r = 0.330	r = 0.392	r = 0.425
	p = 0.002*	p = 0.001*	p = 0.001*
	n = 90	n = 90	n = 90
Protein intake	r = 0.099	r = 0.164	r = 0.204
	p = 0.353	p = 0.123	p = 0.054
	n = 90	n = 90	n = 90
Born Birth Weight	r = 0.042	r = 0.070	r = 0.109
	p = 0.697	p = 0.511	p = 0.305
	n = 90	n = 90	n = 90
AURTI	r = -0.137	r = -0.089	r = 0.097
	p = 0.199	p = 0.403	p = 0.363
	n = 90	n = 90	n = 90
Mother Education	r = 0.205	r = 0.133	r = 0.004
	p = 0.052	p = 0.211	p = 0.972
	n = 90	n = 90	n = 90
Per Capita Income	r = 0.073	r = 0.092	r = 0.066
	p = 0.496	p = 0.389	p = 0.536
	n = 90	n = 90	n = 90

*= Significant

Table 5. Multivariate regression analysis of nutritional status (W/A)

Step	Variable	Coefficients	Coefficients correlation	p	R ²
Step 1	Energy intake	0.107	0.551	0.001*	0.296
	Protein intake	0.028	0.079	0.443	
	Mother education	0.059	0.121	0.183	
	Constant	-13.634			
Step 2	Energy intake	0.106	0.545	0.001*	0.300
	Mother education	0.055	0.111	0.213	
	Constant	-10.712			
Step 3	Energy intake	0.107	0.551	0.001*	0.295
	Constant	-10.211			

*= Significant

tion and even aggravate the condition of infectious disease, and vice versa. In addition, there are also factors that influence indirectly, namely food availability, parenting, the environment and health care as well as education and knowledge of the mother (Schroeder, 2001).

From Table 6 by using multivariate analysis with regression in nutritional status H/A showed that energy intake has significant effect on H/A. Meanwhile protein intake has no significant effect on H/A. Value of R² is 0.096 this

means that energy intake and protein intake affecting H/A 9.6%.

Table 7 shows that by using multivariate analysis with regression in nutritional status BMI/A showed that energy intake has significant effect on BMI/A. Meanwhile mother education and URTI has no significant effect on BMI/A. The value of R² is 0.297 this means that energy intake, mother education and URTI affecting BMI/A 29.7%. In multivariate analysis, the variables such as protein intake, mother education,

Table 6. Multivariate regression analysis of nutritional status (H/A) and energy and protein intake

Step	Variable	Coefficients	Coefficients correlation	P	R ²
Step 1	Energy intake	0.045	0.300	0.004*	
	Protein intake	0.061	0.197	0.055	0.096
	Constant	-10.765			

Table 7. Multivariate regression analysis of nutritional status (BMI) and energy, URTI and maternal education

Step	Variable	Coefficients	Coefficients Correlation	P	R ²
Step 1	Energy intake	0.170	0.522	0.000*	
	Mother education	0.147	0.178	0.051	0.297
	URTI	-0.489	-0.165	0.071	
	Constant	-10.765			

URTI, born birth weight and family income has no correlation with nutritional status ($p > 0.05$). Protein is part of living cells and is a major part after water. All enzymes, hormones, transporting nutrients and blood, and so is protein. The main function of protein is to build and maintain body tissues. But this result findings showed that there is no relationship between protein intake with nutritional status. The reason is because the mother education and born birth weight majority of respondents is normal so not affecting significant on nutritional status. This findings is supported by previous study done by Dina (2014) that concluded there is no relationship between protein intake and nutritional status also no relationship between the incidence of stunting with a history of infectious disease URTI in children aged 13-36 months in Puskesmas Tuminting city of Manado (Dina, 2014). Results of research conducted by Welasasih & Wirjatmadi (2013) states that, the incidence of stunting in children aged 12-60 months there was no significant association with the frequency of infectious diseases that occur in Kembangan Village, District Kebomas Gresik.

CONCLUSION

Overall, food intake (energy and protein) of 9-11 years old children in Semarang is good with $\geq 90\%$ RDA. Health status measured from AURTI in the last 2 months was good enough. The majority of the children have good nutritional status, with only 2 children (2.2%) were underweight/wasted by BMI, only 5.6% were wasted by W/A and 18.9% were obese' while 5.5 were stunted and severely stunted. There was only relationship between energy intake with nutritional

status with all nutritional status indicators

The school authority should pay special attention to the malnourished and overweight + obese children by informing the parents to implement balanced diet for their children or provide more physical education hours to the obese children. Further studies should examine factors associated with the inappropriate nutritional status of children in their early school age, to be able to correct the problem.

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