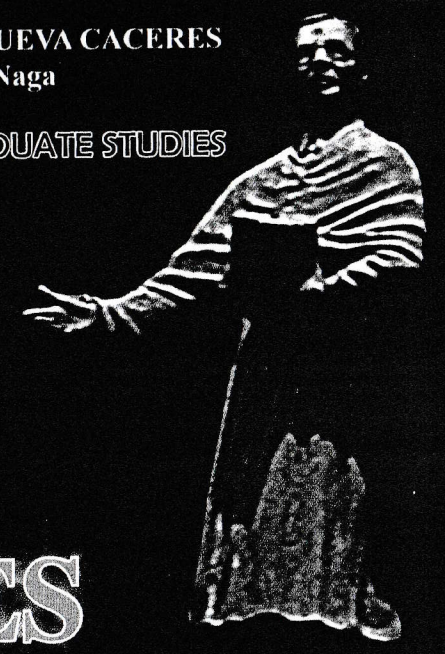




UNIVERSITY OF NUEVA CACERES
City of Naga

SCHOOL OF GRADUATE STUDIES



NUEVA CACERES REVIEW



VOL. XXIX, No. 29
2013



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Nueva Caceres Review

The **Nueva Caceres Review Vol. XXIX, No. 29**, is an interdisciplinary publication of the UNC School of Graduate Studies.

Editor: Atty. Clarita B. Padilla, Ed.D.

Interdisciplinary Editors: Nora Elizabeth F. Maniquiz, Ph.D.

Merlinda C. Cantre, Ed.D.

Manuscripts should be submitted in duplicate. They will be reviewed on the literary, creative, and substantial merits. **Submission deadlines:** 5:00 P.M. on the 1st Monday of July and the 2nd Friday of January, each school year. **Send** manuscripts to: NCR Editor, c/o Dean's Office, School of Graduate Studies, 3rd Floor, AMS Bldg., University of Nueva Caceres, Naga City 4400.



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**THE CORRELATION BETWEEN ENERGY, PROTEIN, AND ZINC INTAKE AND NUTRITIONAL STATUS OF PRESCHOOL CHILDREN
(Case Study in Aisiah Blimbing Sukoharjo Kindergarten)**

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(Paper presented during the **16th Research Paper Lecture Series of the School of Graduate Studies, University of Nueva Caceres, Naga City, Philippines held at Ahmad Dahlan University, Yogyakarta, Indonesia, October 23-25, 2013**)

ABSTRACT

BACKGROUND: Preschool children are one of the vulnerable groups when it comes to malnutrition. Common problems that occur in pre-school children are the lack of nutrition and the growing trend of obesity. These problems occur because of imbalance between energy in and energy out. Typical characteristic of children at this age is that they have become active consumers in the selection of food. Lack of nutritional education of these children will increase the tendency to choose only the foods they like that will eventually lead to malnutrition. Basic Health Research (*Riskesdas*) in 2010 showed 17.9% prevalence of underweight, 35.6% stunting, 13.3% wasted and 14% obesity. Nutritional problems of children are closely related to the intake of energy, protein and zinc (micronutrients that are associated with the growth of children is zinc). The research focused on finding the correlation between the intake of energy, protein and zinc minerals and nutritional status of pre-school children using the index as BMI/age.

Methods: The research method used in this study was cross-sectional in which cause and effect variables were measured in one point in time. Food intake was measured using 24-hour food recall method; the nutritional status was measured using an index BMI/age with WHO reference standard plus antro 2007.

Result: The results showed that the correlation between energy intake and nutritional status (z score BMI/age with p value 0.016 and R 0.260). There was a correlation between protein intake and nutritional status with p value 0.013 and R 0.264 and there was also a correlation between zinc intake and nutritional status with p value 0.013 and R 0.264.

Conclusion: There was a correlation between the intake of energy, protein, and zinc minerals and nutritional status (z score BMI/age).



BACKGROUND

Indonesia is currently facing double burden along health problems. Infectious diseases such as acute respiratory infections (ARI), diarrhea, and measles are directly related to poor nutrition; the prevalence is still high. On the other hand, trend of obesity began to increase dramatically. This is a problem for the Indonesian nation and the enormous costs required to resolve both of these issues (Hadi, 2005).

Pre-school children of 4-6 years old are vulnerable to nutritional problems. At this age, they are able to act as active consumers who can choose certain food according to their taste (Cipto Mangun Kusumo Hospital, 2003). Nutritional problems that arise in pre-school children are the problem of under nutrition and over nutrition (Arisman, 2002). Under nutrition is usually experienced by children whose parents have a low economic status, while over nutrition (obesity) is usually experienced by children whose parents have high economic status. *Riskesdas* in (2010) showed 17.9% prevalence of underweight, 35.6% stunting, 13.3% wasted and 14% obesity; while *Riskesdas* in (2007) showed underweight, 18.4%; stunting, 35.6%; wasting, 13.3% and overweight 14%. These showed that the overweight children have the tendency to increase through the years.

Under nutrition in children will affect the child's quality of life in the present and in his adulthood. Children who are malnourished have low immune system so they are more vulnerable to diseases. At the chronic levels, it will cause stunting problems in children who will have long-term effects along occurrence of degenerative disease during old age, such as diabetes mellitus, hypertension, coronary heart disease, etc. (Naidoo, 2012). Under nutrition in children can also lead to decreased cognitive abilities of children at the time of entering school age (Sanchez, 2009). Over nutrition affects child, obesity also gives long term and short term negative impact on children. In obese children, the ability to hone gross motor movement is impaired, because of his heavy burden. Obesity in children also trigger metabolic syndrome in early age. Problems of under nutrition and obesity are both serious and need serious treatments to prevent loss of future generations.

Under nutrition and obesity in children are closely related to the intake of energy, protein and zinc. These three things have an important role in their growth stages. Previous studies conducted in children aged 2-5 years showed that the average energy intake in undernourished children only reached 50.32% of RDA (Sunarti, 2010). This study indicates that the energy intake from food for under nutrition children is also less than the standard recommended dietary allowance. Herdinsyah (2001) states that animal protein intake of the people of Indonesia is still low. It is 4% of total calories. For zinc intake deficiency category in children, Indonesia was second in rank after Bangladesh.



Adequate intake of energy, protein, and zinc is an essential component in the growth and development of children. In this study, researchers wanted to examine the correlation between energy, protein and zinc intake and nutritional status (BMI / age).

RESEARCH METHODOLOGY

This study used observational with cross sectional approach where the independent and dependent variables was measured at one point in time. Subjects in this study were 76 kindergarten children residing in the branch chief Aisiah Blimbing Sukoharjo. Probability sampling with proportional random sampling was used. Seventy-one samples were used at the time of data analysis.

In this study, BMI index/age using WHO 2007 standards was used to determine nutritional status. Measurement of energy, protein and zinc minerals intake was calculated using food 2 x 24-hour recall method. Nutritional food recall results were analyzed by using Nutri Survey 2007. The data analysis used univariate and bivariate. Person correlation was also used to analyze the data.

RESULTS

a. Characteristics of the Research Subjects

Table1. Characteristics of the Research Subjects

Variable	Mean	Minimal	Maximal	Standard Deviation
Age (month)	5.8	5	6	0.34
Weight (Kg)	18.66	14	30	3.13
Height (Cm)	112,3	102,5	124.1	5.23
Z-Score(BMI/A)	-0.57	-3.09	2	0.98



b. Description of Energy, Protein and Mineral Zinc Intake Compared with Recommended Daily Intake

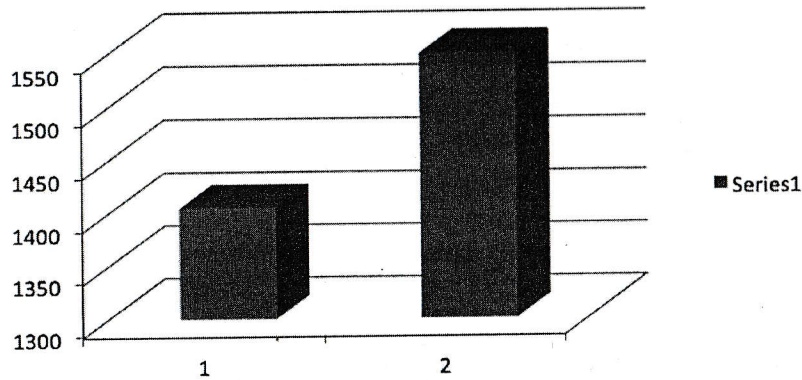


Figure 1. Energy Intake Compare With Recommended Daily Intake

Figure 1 showed that the average energy adequacy of pre-school children was still below the Standard Daily Intake. The average energy intake was 1405.4 kcal per day, while the standard is 1550 kcal per day.

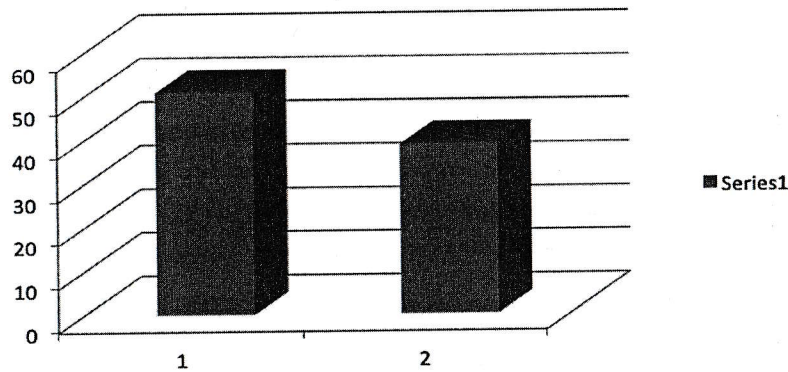


Figure 2. Protein Intake Compared With Recommended Daily Intake

Figure 2 shows the protein intake in pre-school children was quite good and the value was above the nutritional adequacy. The average of protein intake was 51.12 grams, was much higher compared with the standard Recommended Daily Intake, 39 grams.

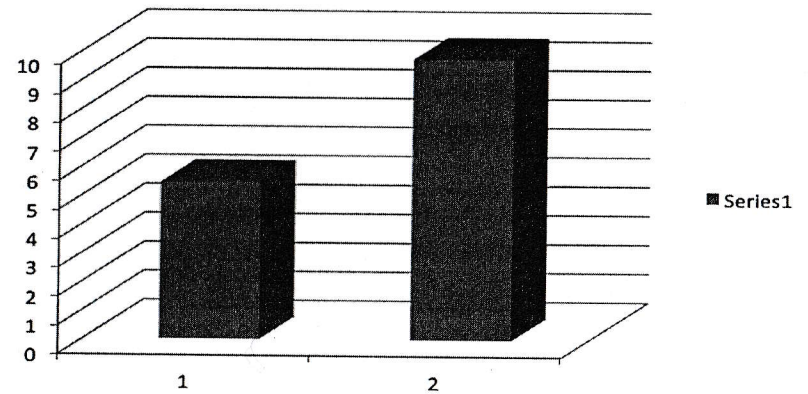


Figure 3. Zinc intake compared with Recommended Daily Intake

Figure 3, the average intake of zinc was still far below the Recommended Daily Intake. The average of Zinc intake was 5.41 while the adequacy assessment based on Standard Recommended Daily Intake was 9.7 mg.

C. Normality Test

Table 2. Normality test of variables (Kolmogorov Smirnof Test)

Research Variable	Mean	DS	P value
Energy intake	1405.4	366.97	0.999
Protein intake	51.12	15.15	0.798
Zinc	5.41	2.02	0.648
Z score (BMI/A)	-0.57	0.98	0.482

The results of normality test showed that p value was more than 0.05. It can be concluded that all variables were normally distributed, thus the requirements for correlation test were met.



Table 3. The Correlation of Energy Intake With Nutritional Status (BMI/A) of Pre-School Age Children (Pearson correlation test)

	Z-score (IMT/U)
Asupan Energi (kcal)	
P Value	0.016
R	0.260
N	68

The results showed that energy intake had positive correlation with BMI z score /A with p value 0.016. The R value of 0.225 meant that the strength of correlation was weak.

Table 4. The Correlation of Protein Intake With Nutritional Status (BMI/A) of Pre-School Age Children (Pearson correlation test)

	Z-score (IMT/U)
Asupan Energi (kcal)	
P Value	0.013
R	0.264
N	68

The results showed that protein intake was also positively correlated with BMI z score / U with p value 0.013 and the value of R 0.264. R value 0.264 also showed a weak correlation because its value was below 0.5. However, when compared with the correlation of energy and BMI z score /A, the power of relations was still higher for protein intake.

Table 5. The Correlation of Protein Intake With Nutritional Status (BMI/A) of Pre-School Age Children (Pearson correlation test)

	Z-score (IMT/U)
Asupan Energi (kcal)	
P Value	0.013
R	0.264
N	68



Table 5 showed the correlation between zinc intake and BMI z score / A. The results were 0.015 for p value and 0.264 for R value. It can be concluded that there was a positive correlation of zinc intake and BMI z score / A although the correlation value was relatively weak.

DISCUSSION

a. The Correlation of Energy Intake and Nutritional Status (BMI /A)

Energy is needed for human survival, activities and growth. Energy is derived from the breakdown of nutrients such as carbohydrates, fats and proteins (Almatsir, 2002). Adequacy of energy is needed, especially in early life because the energy is needed for growth both tissue and linear growth (Barasi, Merri E).

Pre-school age children belong to the growing period, although the speed of their growth is not as fast as 6 months-1 year of age, so that the energy needed are necessary for optimal growth. Results of this study showed that the average energy intake of pre-school children was still below standard intake. Compared with RDA levels, the average consumption of energy was 90% of RDA. According to Supriasa (2002), energy consumption levels in this study were moderate.

Correlation test results showed that there was significant correlation between energy intake with nutritional status (BMI/A). Almatsir (2002) said that energy intake should be adjusted to the energy needs. Energy intake and nutritional status are proportional. If someone has energy deficiency, then the weight will be less, but if someone has energy excess, energy will be converted into fat and stored in the body, and the result is being overweight.

b . The Correlation of Protein Intake with Nutritional Status (BMI / A)

Protein is a macro nutrient element which is important and needed for growth. Adequate protein intake is necessary for the growth, development and body functions (Hidayat, et al., 2011). Protein is important in the daily diet as a source of amino acids needed for growth and maintenance of muscles and tissues of the body (Gibson, 2005).

WHO recommends that the intake of energy derived from protein should range from 10-15 % of total calories (Almatsir, 2002). In this study, the average protein intake of pre-school children was at 51.12. It is good compared with the standard of protein intake on the nutritional adequacy pre-school children. However, this study found out that there were still some pre-school age children who have 19.10 grams of protein intake per day. This suggested that the distribution of protein intake was uneven.



Results of the bivariate analysis showed that there was correlation between protein intake and BMI Z score value / A. The results were consistent with the previous research of Sulistiya, et al., (2013) who said that there was a relation between protein intake and nutritional status of children aged 2-5 years. The children with protein deficiency intake had 5.8 times the risk of experiencing malnutrition than children with adequate protein intake. Gibson (1991) stated that the energy and protein deficiency in the chronic phase is closely related to the incidence of stunting (HAZ Score z) in children with poor zinc intake. The results of this study are contrary to the previous research of Atkin (2000) who said that there was no correlation of energy intake, protein and fat to body fat percentage. Body fat had better relation with physical activity in preschool-aged children.

c. The Correlation of Zinc Intake With Nutritional Status (BMI/A) of the Pre-School Age Children

Zinc is an essential micromineral needed on the child's growth phase. This micronutrient has a crucial role in almost all biological systems required for division, differentiation, and cell growth (Hidayati, 2011). Mineral zinc has recently become a trend in the world of nutrition issues. Besides an important role in the growth process, zinc deficiency is also a national problem in some countries. Zinc deficiency commonly occurs in developing countries with high mortality rates (Shrimpton, 2005). Indonesia is one country that has a low zinc intake. High rates of stunting phenomenon in Indonesia are closely associated with zinc and protein energy deficiency in the chronic stage.

The results showed that the average intake of zinc in pre-school children was 5.41mg. It is still below the standard of nutritional adequacy rate of 9.7 mg. This suggested that the average intake of zinc in pre-school age were still very low. In the data collected there was a child who has zinc intake 1:45 mg per day. Low intake of zinc is caused by low intake of animal source in their food dishes. *Tofu* and *tempeh* are mostly the sources of protein.

Bivariate analysis results also showed a positive correlation of zinc intake with nutritional status (BMI/A). Hidayati (2011) said that the beginning of a zinc deficiency is characterized by decreased growth rate, or the cessation of growth. The results are consistent with research of Lind, et al., (2004) which showed that 10mg of zinc supplementation in infants aged 6-12 months had a significant effect to increase in nutritional status (z score W/A). Children who had zinc supplementation had a longer arm compared with placebo. This is in contrast to the results of the research study from Taufiqurrohman, et al. (2009) which found out that zinc is not a risk factor for the incidence of stunting in children under five in West Nusa Tenggara. Taufiqurrohman said that the risk factors for stunting in NTB are breastfeeding status. Infants who are not exclusively breastfed has 2.06 times risk of experiencing stunting compared to infants who are breastfed exclusively.



CONCLUSION AND RECOMMENDATION

Conclusions:

1. Energy and zinc intake in pre-school children were below the standard nutritional adequacy rate.
2. There was a positive correlation of energy, protein and zinc intake with nutritional status (BMI Z score/A).

Recommendation

Kindergarten teachers of PCA Blimbing Sukoharjo are expected to educate the childrens' parents actively in order to provide a balanced diet according to the needs of their children.

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