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Original Article

Risk factors for malnutrition in under-five children: one year after the Yogyakarta earthquake

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Abstract

Background Malnutrition in children under the age of five remains a major health problem, since half of mortality cases in this age group involve malnutrition. The 2006 earthquake caused destruction of physical, biological and socio-economic environments, potentially leading to malnutrition in Yogyakarta children.

Objective To identify the prevalence and risk factors of malnutrition in Yogyakarta children under five years of age, one year after the 2006 earthquake.

Methods We conducted a cross-sectional study among children aged 0 to 60 months in the Bambanglipuro Subdistrict, Bantul Regency, Yogyakarta from September to October 2007. Nutritional status was determined using weight for height Z-scores, according to the WHO 2006 Child Growth Standards.

Results Out of 666 subjects, we found severe malnutrition, undernutrition, normal weight, and overweight status in 1.7%, 4.8%, 88.6% and 4.8%, respectively. By multivariate analysis, risk factors for malnutrition were not having been weighed during the previous three months (OR 0.35; 95% CI 0.1 to 0.8) and having acute respiratory infection in the previous two weeks (OR 1.99; 95% CI 1.1 to 3.8)

Conclusion One year following the 2006 earthquake, acute respiratory infection in the previous two weeks and unmonitored growth in the previous three months were risk factors for malnutrition in children under five years. **[Paediatr Indones. 2011;51:327-31]**.

Keywords: *malnutrition, under five years old, earthquake*

The first aim of the *Millennium Development Goals (MDGs)* is to overcome famine and poverty, the main causes of malnutrition.[1] The term "malnutrition" includes both undernutrition and severe malnutrition, and is a major public health problem in developing countries for children under five years. More than one-third of children under five in developing countries are malnourished.[2-5] In Indonesia, the prevalence of severe and moderate malnutrition are 8.8% and 19.2%, respectively.[6] Around 54% of all deaths in children under five in developing countries are associated with malnutrition. Severe and recurrent infections are risk factors of malnutrition.[7-9] Children who suffer from malnutrition early in life have greater risk of development delays in the motor system, language, cognition, personal and social behaviors, all of which may result in poor school achievement.[10-12]

Malnutrition is caused by various factors, namely intrinsic and environmental factors, such as socio-economic state and demography. In developing countries, the main causes of malnutrition are inadequate supply of food and severe infection.[4,5]

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Infants with low birth weight are particularly susceptible to malnutrition.[13,14]

On May 27, 2006, a major earthquake struck Yogyakarta Province and the surrounding areas. The impact of the earthquake on health was immense and long-lasting. The devastation of houses, environment, and socio-economic state resulted in a decreased food supply. That prevailing condition became a risk factor for health problems related to infectious diseases, especially diarrhea and measles, as well as non-infectious diseases, such as malnutrition.[15] Children under five are especially susceptible to health problems. In the disaster area, malnutrition emerged after one month.[16] A year after the earthquake, we conducted an evaluation of the health status of children under five living in the region. In addition, we attempted to identify risk factors for malnutrition, so that comprehensive intervention may be implemented to prevent or overcome malnutrition.

Methods

From September to October 2007, we conducted a cross-sectional study in Bambanglipuro Subdistrict, Bantul Regency, Yogyakarta Province. We recruited 666 children aged 0 to 60 months, using random sampling, including babies (0-12 months) and children (13-60 months).

Nutritional status was determined using weight-for-height Z-scores (WHZ) based on WHO 2006 Child Growth Standards. Nutritional states were classified as severe malnutrition (WHZ <-3 SD), undernutrition (-3 SD<WHZ<-2 SD), normal (-2 SD <WHZ<2 SD), and overweight (WHZ >2 SD).[17] Weight was measured using electronic scales with a precision of 0.1 kg. Children were weighed with minimal clothing. Length and height were measured using infantometer and microtois, respectively.

Socio-economic status was classified based on the family's total expenditure per month, according to criteria of a national survey conducted by The Central Bureau of Statistics (2004).[18] The average family's total expenditure per month in Bantul Regency was reported to be IDR 860,000. Families with a monthly total expenditure less than IDR 860,000 were categorized as having low socio-economic status, while families with a monthly total expenditure of equal or greater than IDR 860,000 were categorized as having adequate socio-economic status. Anthropometry, demography, breastfeeding and infant delivery information were collected from parents through home visits by trained students from the Mother and Child Health Master's Program of the Medical Faculty of Gadjah Mada University. Degree

Table 1. Basic characteristics of subjects and their families

Characteristics	n (%)
Gender	
Male	341 (51.2)
Female	325 (48.8)
Age, months	
0 – 12	168 (25.2)
13 – 24	159 (23.9)
25 – 36	121 (18.2)
37 – 60	218 (32.7)
Birth weight, grams	
<2500	64 (9.7)
>2500	596 (90.3)
*Nutritional status	
Severely wasted (severe malnutrition)	11 (1.7)
Wasted (undernutrition)	32 (4.9)
Normal	573 (88.6)
Overweight	31 (4.8)
Weighed in the past 3 months	
Yes	605 (90.8)
No	58 (8.7)
Breastfed for 6 months	
Yes	204 (30.6)
No	363 (54.5)
Illness in the past two weeks	
Diarrhea	37 (5.6)
Measles	6 (0.9)
Fever	159 (23.9)
Acute respiratory infection	321 (48.2)
Child's birth order	
First	316 (47.4)
Second	212 (31.8)
Third or more	138 (20.8)
Degree of house destruction	
Bad	541 (81.2)
Average	65 (9.8)
Minor	53 (8.0)
No damage	7 (1.1)
Mother's level of education	
Low	123 (18.5)
Middle	168 (25.2)
High	375 (56.3)
Mother's occupation	
Housewife	490 (73.6)
Work outside the home	176 (26.4)
Family's socioeconomic status	
High	337 (51)
Low	322 (49)

*severely wasted: WHZ <-3SD, wasted: -3 SD< WHZ< -2 SD, normal: -2 SD < WHZ < 2 SD

of destruction of the family home was obtained from local government data.

Statistical comparisons of the two dichotomous variables were calculated by Chi square test. Univariate analysis was performed to calculate the impact of risk factors on malnutrition, as shown by odds ratio (OR) with a 95% confidence interval (95% CI). Significant risk factors from the univariate analysis were included in a multivariate analysis using multiple logistic regressions to calculate adjusted OR (AOR).

Informed consent was obtained from parents. This study was approved by the Human Ethics Committee on Biomedical Research of the Medical Faculty, Gadjah Mada University.

Table 2. Univariate analysis of risk factors for malnutrition in children aged 0– 60 months

Risk factors	Prevalence (%)	OR (95% CI)
Gender		
Boys	53.5	0.9 (0.4 to 1.7)
Girls	46.5	
Weighed in the past 3 months		
Yes	80.5	0.3 (0.1to 0.8)
No	19.5	
Exclusively breastfed		
Yes	26.3	0.6 (0.2 to 1.2)
No	73.7	
Diarrhea in the past two weeks		
Yes	2.3	0.5 (0.06 to 4)
No	97.7	
Measles in the past two weeks		
Yes	0	0
No	100	
Fever in the past two weeks		
Yes	25.6	0.9 (0.4 to 2.1)
No	74.4	
Acute respiratory infection in the past two weeks		
Yes	65.1	2.65 (1.1 to 6.3)
No	34.9	
Birthweight		
Normal	85.4	1.5 (0.5 to 3.9)
Low	14.6	
Child's birth order		
First and second	74.5	1.2 (0.5 to 2.9)
Third or more	25.5	
Degree of house destruction		
Severe	88.4	1.32 (0.4 to 3.6)
Moderate	11.6	
Mother's level of education		
Low	62.8	0.5 (0.1to 1.4)
High	37.2	
Mother's occupation		
Housewife	83.7	0.6 (0.2 to 1.4)
Work outside the home	16.3	
Family's socioeconomic status		
High	37.2	1.2 (0.6 to 2.6)
Low	62.8	

Table 3. Multivariate analysis of risk factors for malnutrition in children aged 0-60 months

Risk Factors	OR	95% CI
Weighed in the past 3 months	0.3	0.1 to 0.8
Acute respiratory infection in the past two weeks	1.9	1.1 to 3.8

Results

Subjects' characteristics are shown in **Table 1**. Out of 666 children, only 11 (1.7%) were severely malnourished, while 31 (4.8%) were overweight. None of the infants aged 0-6 months suffered from malnutrition. Children aged 19-24 months had the highest prevalence of malnutrition. There were missing data on birth weight, nutritional status, weighed in the past 3 months, breastfed for 6 months and family's socioeconomic status . However, there were no significant differences results in variables with missing data. All infants aged 0-6 months were breastfed, while 91% of children aged 6-60 months were breastfed. Average period of breastfeeding lasted 8.3 (SD 9.7) months. Of note, only 30.6% of those children were exclusively breastfed up to 6 months of age. Nearly all of respondents' houses (91%) were seriously damaged in the quake.

From the univariate and multivariate analyses, we found that acute respiratory infection in the 2 weeks prior to our study and not being weighed during the last three months were both risk factors for malnutrition (**Tables 2 and 3**).

Discussion

We found severe malnutrition and undernutrition in 1.7% and 4.8% of our subjects, respectively. According to Susenas 2005,[6] the prevalence of severe malnutrition and undernutrition in Yogyakarta Special Province was 4.1% and 11%, respectively. Malnutrition in children under five could have become a substantial health problem a year after the earthquake. Malnutrition following a natural disaster may be due to a direct cause, such as unavailability of food, or indirect causes, such as financial problems and poor sanitation that would increase the risk of infection, particularly diarrhea and measles.[15,16]

We identified two possible risk factors for malnutrition: respiratory infection during the preceding two weeks and lack of weight monitoring during the prior three months. Malnutrition, respiratory infection, and lack of weight monitoring may be interrelated in a cyclic fashion.[7,8,19]

Children of low birth weight had 1.5 times the risk of malnutrition compared to those of normal weight, however, this finding was not statistically significant. Low birth weight, especially in a short pregnancy period, suggests intrauterine chronic malnutrition. If this condition is not well managed, intrauterine growth retardation may continue to the next period of growth.[15,20]

Children who were weighed during the three months prior to our study were 70% less likely to have malnutrition (OR 0.35; 95% CI 0.1 to 0.8). This finding illustrates the need to monitor weight gain on a regular basis to prevent malnutrition or to allow for earlier intervention.

Previous studies have shown that a family's socioeconomic state and a child's birth order are risk factors for malnutrition in children under five. A study in Ghana reported that large families of low socioeconomic state had poor food supply, both quantitatively and qualitatively. [21] However, we did not observe this effect in our study.

In our study, none of the infants up to 6 months of age had malnutrition, but the p revalence of malnutrition increased as the children got older, similar to the studies of Shrimpton *et al.*[23] and Julia *et al.*[22] Breastfeeding of infants aged up to 6 months may have prevented malnutrition. After 6 months of age, food supplementation may not have been adequate. We found that breast milk was not a risk factor for malnutrition, as almost all babies were given breast milk.

Having an acute respiratory infection in the two weeks prior to the study and unmonitored growth for the preceding three months were risk factors for malnutrition in children under five. Comprehensive intervention is required to prevent malnutrition through the improvement of health status and environmental sanitation, as well as promotion of family planning and revitalization of health centers to monitor children's weight.

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