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Original Article

Socio-economic and environmental factors affecting the rehabilitation of children with severe malnutrition

Felliyani, MD; Sri S Nasar, MD; Taralan Tambunan, MD

ABSTRACT

Background Poor diet and high infection rates inflicted by low socio-economic status and poor environments among infants and young children appear to be major causes of severe malnutrition.

Objective To determine the practical and likely effectiveness in rehabilitation of severe malnutrition.

Methods A descriptive observational study was conducted on 27 children at three different sites: (1) Five inpatients at the Inpatient Ward, Cipto Mangunkusumo Hospital, Jakarta (IP-CM); (2) 8 outpatients at the Metabolic and Nutrition Clinic, Cipto Mangunkusumo Hospital (OP-CM); (3) 14 outpatients at the Nutrition Clinic, Bogor (NC). All the patients followed were aged <60 months and suffered from severe malnutrition (weight for length index <-3 NCHS Z-score). Subjects were followed for 12 weeks. The IP-CM group received standard treatment following the WHO recommendation, while the OP-CM and NC group received proper medical treatment and nutrition education for mothers. The OP-CM group underwent more extensive laboratory investigations.

Results All children generally had low socio-economic status. Most children experienced poor feeding, child care, and other health practices. A tendency of increased prevalence, number of episodes, and duration of infectious diseases was noted in the majority of subjects. However, an improvement of nutritional status was observed during treatment in all groups, particularly in the IP-CM group.

Conclusion Socio-economic status and environmental factors must be considered in the management of severe malnutrition. Educating parents concerning proper feeding and child care practices appears to be of permanent nutritional benefit for the children. **[Paediatr Indones 2005;45:99-106].**

Keywords: *severe malnutrition, infectious disease, socio-economic status, environment*

The lowering economic status which resulted from the monetary crisis that began in mid-1997 has an adverse impact on the welfare of the Indonesian population, including the health and nutrition of children. The prevalence of undernourished children based on a survey carried out by the National Bureau of Statistics (NBS) was 33.4%, and that of severe malnutrition has increased from 1.2% in 1997 to 6.9% in 2001.[1]

Besides poor diet due to the crisis, poor sanitation and low socio-economic conditions are important factors for transmission of infection.[2] Interaction between severe malnutrition and infection is well-known. On one side, severe malnutrition results in morphological and functional changes of all organ systems and weakening of the immune system; on the other side, infection greatly affects nutritional status due to reduced food intake, increased need for nutrients, and loss of endogenous nutrients. Severe malnutrition increases duration of illness and severity of infectious disease.[2] A UNICEF publication in 1993 reported that annually, about 12 million infants and

From the Department of Child Health, Medical School, University of Indonesia, Jakarta, Indoneaia.

Reprint requests to: Felliyani, MD, Department of Child Health, Medical School, University of Indonesia, Jl. Salemba No. 6, Jakarta, Indonesia. Tel. 62-21-3907742; Fax. 62-21-3907743; Email: Fell_harnoko@yahoo.com.

under-five children were presumed to die in developing countries. Severe malnutrition contributed to approximately 50% of deaths of infants and under-five children.[3]

Today, despite increased knowledge of management of severe malnutrition and prevention of infection by immunization, severe malnutrition is still an unsolved problem. It is difficult to manage because it is related to poverty, low educational level, high population density, poor supply of clean water, poor personal hygiene, inadequate breastfeeding and supplementary feeding, and difficult access to health services.[4] In Indonesia, with the present economic, social, and political conditions, environmental factors may be among the strongest contributing factors to malnutrition. The study was carried out to investigate the factors strongly associated with severe malnutrition which may play a role in its treatment.

Methods

This was a descriptive observational study carried out at the Inpatient Ward and Metabolic and Nutrition Clinic, Department of Child Health, Cipto Mangunkusumo Hospital, Jakarta, and at the Nutrition Clinic of Food and Nutrition Research and Development Center, Bogor, from January to June 2004. Children who were less than 60 months old, suffered from severe malnutrition based on WHO criteria (weight-for-length <-3 NCHS z-score and/or edematous malnutrition), and did not have cerebral palsy, severe congenital anomaly, nephrotic syndrome, or HIV/AIDS, served as subjects for the study. They were recruited from January to March 2003. Parental written informed consent was obtained for all children who participated. The subjects were followed up for 12 weeks. The study was approved by the Committee of the Medical Research Ethics, Medical School, University of Indonesia.

In the hospital, the children received standard treatment following WHO recommendation.[5] Children whose parents objected to hospitalization were asked to visit the outpatient clinic weekly until the children recovered. The physicians established the diagnosis of underlying disease based on clinical and laboratory findings, gave the treatment and determined the required energy and protein intake according to catch-up growth requirement. Dietitians controlled the food given to the patients and gave education on feeding practice to the mothers. Outpatients at Cipto Mangunkusumo Hospital who were less than 12 months old received 500 g infant porridge weekly, and those above 12 months old received 450 g noodles weekly. At the Nutrition Clinic in Bogor, physicians gave medical care to the subjects, and dietitians gave education on feeding practice and provided 250 g skim milk weekly per child at every visit. The children and their mothers visited the Nutrition Clinic weekly during the first three months, biweekly during the fourth to fifth month, and monthly during the sixth month.

On the first visit to hospital or clinic, each mother/caretaker was interviewed on socio-economic level, history of present illness, and feeding practice at home including practices of child feeding, child care, and food hygiene. If the children had other illnesses, particularly cough and diarrhea, their duration and frequency were also recorded. Additional information on environmental density, exposure to cigarette smoke, sanitation, and immunization were also recorded.

The subjects' mothers were asked to complete a questionnaire consisting of 12 items of socio-economic and environmental variables. The socio-economic data of the subjects covering the educational level of parents and per capita income was classified according to the 2002 NBS classification.[1] Environmental density was also grouped according to the above classification.[1] Exposure to cigarette smoke was defined as the presence of family members who smoked. Data on mother's hygiene practices included washing hands before feeding, washing of feeding utensils and/or milk bottles, habits of buying snack food, methods of boiling water and cooking of food, and methods of storing of food. Data on sources of clean water included sources for drinking, cooking, washing, and bathing water. Data on environmental sanitation included the means of disposing household wastes and human excrement. Data on breastfeeding pattern included the duration of exclusive breastfeeding and mother's knowledge on the benefit of breastfeeding. Data on supplementary feeding and foods for the children included mother's knowledge on types of supplementary food, time of feeding, and types of food for children. Data on immunizations included types and time of immunization. Environmental aspects were classified as poor if the total of score was <60% of the high-

est total score; fair if the total score was between 60 and 80% of the highest total score; and good if the total score was >80% of the highest total score.

Anthropometric data including weight and height measurements were obtained from all subjects at the first visit and on the 5th, 9th, and 13th week of the course of treatment. Anthropometric measurements were performed using standard anthropometric procedures.[6] Nutritional status was classified as severe malnutrition if weight for height (W/H) index was <-3 z-score, mild-moderate malnutrition if W/H index was between ≥-3 z-score and <-2 z-score, and adequate nutrition if ≥-2 z-score. [7]

Clinical examination was performed on all children; and clinical data which was obtained at the time of the anthropometric measurements were recorded. Cough was considered as a symptom of acute respiratory infection (ARI) if it lasted for 14 days, and was classified into chronic cough (due to asthma, tuberculosis, or sinobronchitis) if it lasted for more than two weeks. Cold was defined as nasal discharge or runny nose as commonly occurs in common cold.[8] Diarrhea was defined as > 3 stools in 24 hours that were more watery than usual, with/without blood or mucus.[9] Episodes were defined as periods of sickness at least 3 days apart and were ended by 24 symptom-free hours. Prevalence was the number of affected persons in the study population in the study period divided by number of persons in the study population at the same time.[10] Dietary intake was obtained by 24-hour recall and was calculated using Nutri-soft® program. Energy and protein intake were determined by the percentages of actual energy and protein intake divided by energy and protein requirements recommended for catch-up growth. The catch-up growth requirement was calculated from the recommended dietary allowance for a child's age according to height, multiplied by the child's ideal weight for height.[11]

Data collection was supervised by the principal investigators to maintain the consistency and accuracy of the obtained data. The data were processed using SPSS 12.0.

Results

Thirty-five children with weight for length <-3 NCHS z-score were included in the study. These consisted of 8 inpatients at Inpatient Ward, Cipto Mangunkusumo Hospital (IP-CM), 9 outpatients at Metabolic and Nutrition Clinic, Cipto Mangunkusumo Hospital (OP-CM), and 18 outpatients from Nutrition Clinic, Nutrition and Food Research and Development Center, Bogor (NC). From the IP-CM group, 3 subjects dropped out because they were discharged at parents' request; from the OP-CM group, 1 subject was lost to follow-up; and from the NC group, 1 subject died and 3 were lost to follow-up. Hence, only 27 children (5 in IP-CM group, 8 in OP-CM group, and 14 in NC group) were followed for 12 weeks treatment.

Table 1 shows that the children studied were generally from low socio- economic status. All subjects in IP-CM and OP-CM group were from urban areas, while those in NC group were mostly from rural areas. The highest level of education of the fathers was generally similar that of the mothers. However, the education level of parents in urban areas (IP-CM and OP-CM) was generally higher than that in rural areas (NC). Most parents in rural areas had ≤6 years of schooling, while those in urban areas had 7-12 years of schooling.

Clinical data in **Table 2** shows that the most prevalent infections among children with severe malnutrition were gastrointestinal and respiratory illnesses. The most frequently occurring respiratory illness were tuberculosis in rural areas and non-pneumonia acute respiratory infections (ARI) in urban areas. In urban areas, the prevalence of gastroenteritis was much higher than that in rural areas. Other diseases such as skin infection, worm infection, eye infection, ear infection, and other infections were relatively scarce.

As illustrated in **Table 3**, children in rural area lived in more dense populations and were more exposed to cigarette smoke, poor environmental sanitation, and poor hygiene practices. It is very interesting to note that in urban area where the availability of clean water and the environmental sanitation were relatively good, severe malnutrition existed. Most children suffering from severe malnutrition experienced poor breastfeeding practice and incomplete immunization.

As shown in **Figure 1,** there were clear improvements in the children's nutritional status. The improvement was most pronounced in IP-CM group (**Figure 1a**), in which all children became were well-

TABLE 1. GENERAL CHARACTERISTIC OF SUBJECTS STUDIED

Variables	Sub-variables	Number of children		
		IP-CM (N=5)	OP-CM (N=8)	NC (N=13)
Sex	Male	2	4	5
	Female	3	4	9
Age	< 12 months	3	2	2
	1-5 years	2	6	12
Residence	Rural	0	0	12
	Urban	5	8	2
Father's education	Primary	0	2	8
	Secondary	1	3	2
	Higher	4	3	4
Mother's education	Primary	0	4	11
	Secondary	3	0	1
	Higher	2	4	2
SES status	Poor	1	4	12
	Middle lower	4	4	2

Note: IP-CM : Inpatients at Cipto Mangunkusumo Hospital Jakarta.
OP-CM : Oupatients at Clinic of Nutrition and Metabolic Cipto Mangunkusumo Hospital Jakarta.
NC : Outpatients at Nutrition Clinic Food and Nutrition Research and Development Center Bogor.
SES : Socio-economic status.

TABLE 2. NUMBER OF CHILDREN BY ILLNESS

Illness	Number of children		
	IP-CM (N=5)	OP-CM (N=8)	NC (N=14)
Gastroenteritis	5	6	8
ARI non pneumonia	2	6	13
Tuberculosis	2	3	14
Pneumonia	2	1	2
Skin infection	2	0	4
Worm infestation	0	2	4
Urinary tract infection	0	3	0
Mouth and tooth infection	0	0	3
Ear infection	0	0	2
Eye infection	1	1	1
Exanthem disease	1	1	1

Note: IP-CM: Inpatients at Cipto Mangunkusumo Hospital Jakarta.
OP-CM: Oupatients at Clinic of Nutrition and Metabolic Cipto Mangunkusumo Hospital Jakarta.
NC: Outpatients at Nutrition Clinic Food and Nutrition Research and Development Center Bogor.
ARI: Acute respiratory infection..

nourished at the end of the study period. In OP-CM and NC groups (**Figures 1b** and **1c**), nearly all subjects' nutritional status improved, with the exception of 1 child with severe malnutrition in NC group.

In all sites, there was a high number of illness episodes. In IP-CM, OP-CM and NC groups, the average numbers of cough and cold episodes during a three-month period were 2.0, 3.1, and 4.9, respectively; while the average numbers of diarrheal episodes during the same period were 1.4, 2.8, and 2.5, respectively. Durations of illness episodes were also quite high. In IP-CM, OP-CM, and NC groups, the mean durations of cough and cold episodes were 37.5, 28.8, and 31.6 days, respectively; while the mean durations of diarrheal episodes were 27.2, 8.8, and 13.0 days, respectively.

At the beginning of the study, the average energy intake in IP-CM, OP-CM and NC groups were 35.2%, 40.8%, and 40.1% of the catch-up growth requirement, respectively; while the average protein intake were 39.6%, 58.9%, and 49.0% of the catch-up growth requirement, respectively. At the end of the study, the average energy intake in IP-CM, OP-CM, and NC groups reached 101.4%, 91.2%, and 68.4% of the catch-up growth requirement, respectively; and protein intake reached 133.0%, 162.3%,

TABLE 3. ENVIRONMENT AND HEALTH PRACTICES BY STUDY SITE

Variables	Sub-variables	Number of children		
		IP-CM(N=5)	OP-CM(N=8)	NC(N=13)
Environmental density	Dense	3	7	10
	Non dense	2	1	4
Expose to cigarette smoke	Expose	3	6	12
	Non expose	2	2	2
Mother's behavior on hygiene	Fair	1	4	11
	Good	4	4	3
Sources of clean water	Bad	0	0	7
	Fair	0	0	3
	Good	5	8	4
Environmental sanitation	Bad	0	0	6
	Fair	0	2	5
	Good	5	6	3
Breastfeeding pattern	Bad	4	8	13
	Fair	1	0	1
Supplementary feeding	Bad	0	0	3
	Fair	1	3	7
	Good	4	5	4
Immunization	Bad	3	3	7
	Fair	0	2	2
	Good	2	1	5
	Missing	0	2	0

Note: IP-CM: Inpatients at Cipto Mangunkusumo Hospital Jakarta.
OP-CM: Oupatients at Clinic of Nutrition and Metabolic Cipto Mangunkusumo Hospital Jakarta.
NC: Outpatients at Nutrition Clinic Food and Nutrition Research and Development Center Bogor.

and 103.5% of the catch-up growth requirement, respectively.

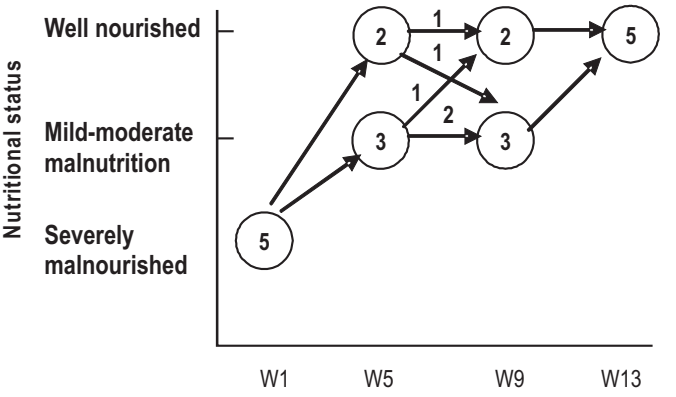
Discussion

Clinical pediatricians have long realized that nutritional status is determined by disease as well as by food consumption.[2,12] Several studies in developing countries have analyzed the effect of economic conditions on child growth. Most of these studies have also emphasized the importance of environmental factors and health behavior in mitigating childhood infection.[13-17]

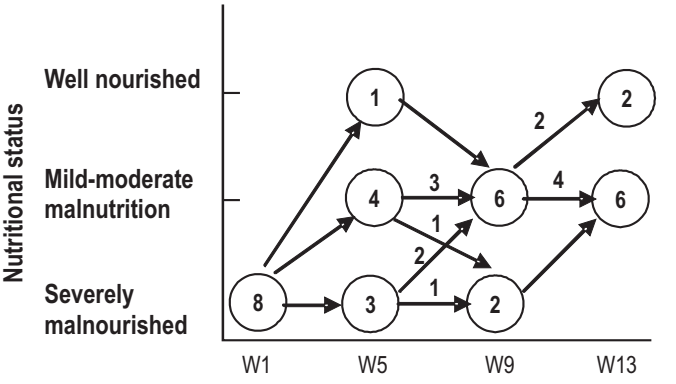
According to WHO, there is a relationship between changes in income (usually at the national level, for example during the economic crisis) with changes in nutritional status, though interpretation has often been difficult.[18] In this study, the proportion of fathers and mothers who had $\leq$6 years of schooling (equivalent to primary school) were very high. Low occupational and income levels are correlated with limited education,[13,14] implying that a significant number of households in this study had limited financial resources as well.

On the other hand, an increase of income is not enough to improve nutritional status, because there are important non-food factors, such as environmental hygiene and health care, which may not improve with increased income.[15-17,19,20] This study demonstrated that exposure to cigarette smoke, personal hygiene, sanitation, and feeding behavior were poor among many subjects in rural areas and some subjects in the urban areas. It is very interesting to note that in urban area where the availability of clean water and the environmental sanitation were relatively good, severe malnutrition existed. Most children suffering from severe malnutrition experienced poor breastfeeding practice and incomplete immunization. Poor feeding, child care, and other health practices by mothers resulted in a very low energy and protein consumption and a tendency of higher prevalence as well as more frequent and prolonged episodes of infectious diseases those in the general population[9,21,22]. These are very important considerations in treatment and rehabilitation. Mothers need to be empowered with knowl-

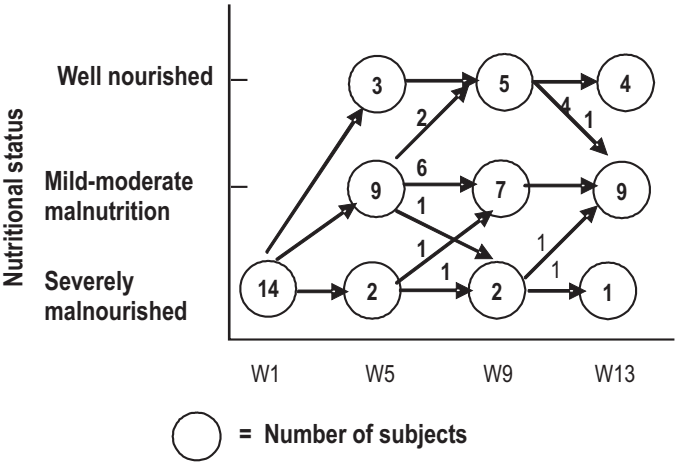
a. **Inpatients at Cipto Mangunkusumo Hospital**



b. **Outpatients at Cipto Mangunkusumo Hospital**



c. **Outpatients at Nutrition clinic Bogor**



W1= first week, W5= fifth week, W9= ninth week, W13= thirteenth week

FIGURE 1. CHANGES IN THE NUMBER OF SUBJECTS BY WEEKS OF TREATMENT AND BY NUTRITIONAL STATUS IN 3 GROUPS.

edge and skills on proper feeding and and child care; otherwise, severe malnutrition cases will still be prevalent in this country.

Studies in Bangladesh and Malawi showed that the best treatment for severe malnutrition is hospitalization with proper management for a period of time.[23,24] Such treatment was demonstrated in IP-CM group. However, this approach is costly and is often impeded by its potential to reduce family productive capacity and to promote malnutrition in siblings due to the mothers' absence in the family to care for the hospitalized child.[23,25] This was the case in OP-CM and NC groups. The study showed improvement of nutritional status in all groups, although a stronger effect was demonstrated in the hospitalized group. However, the small sample size precludes us from drawing any strong conclusions.

In this study, it was evident that socio-economic and environmental factors should be considered in the management of severe malnutrition. We have shown that curative medical care, nutritional education for mothers, regular visits to the clinic, and an appropriate schedule of home visits form an effective approach in the rehabilitation of severe malnutrition. The importance of education concerning child care and proper feeding using local foods while considering cultural practices appears to be of permanent nutritional benefit.

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