

Treatment outcomes of severe acute malnutrition children aged 1 month - 5 years hospitalized at Mohammad Hoesin Hospital in Palembang, Indonesia



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ABSTRACT

Background: Severe acute malnutrition (SAM) is one of major cause of morbidity and mortality in children, especially under 5 years old. Successful management of SAM can be determined by many factors. Therefore, the purpose of this study was to identify the factors associated with outcome of inpatient SAM management.

Methods: The present study performed a cohort study on children with SAM admitted to dr. Mohammad Hoesin Hospital Palembang (RSMH) from January to July 2021. Outcome was weight gain during 14 days of observation period and rehabilitation phase, defined in g/kg body weight (BW)/day, and was categorized as follows: poor (<5 g/kg BW/day) and moderate-good (≥ 5 g/kg BW/day).

Results: There were 87 children, 62% were female, and median age was 14 (1-60) months old. Moderate-good outcome was found in 31 subjects (36%) with weight gain during rehabilitation phase was 2.10 (0-71.4) g/kg BW/day. The highest mean weight gain was in subjects aged 6-<12 months which was 7.6 \pm 8.2 g/kg BW/day. Most subjects had good acceptability with median 100% (44.4-100%) (p=0.696), while 36% showed diet intolerance such as vomiting (24%) and diarrhea (17%) (p=0.656). Most common associated symptom was shortness of breath (32%) (p=0.066). Non-infectious was more common than infectious disease (47% vs 44%) with p=0.470 and p=0.110, respectively. All of subjects with tuberculosis showed poor outcome (RR 1.70; 95% CI 1.41-2.06; p=0.004).

Conclusion: In this study, SAM treatment outcome was not influenced by associated symptoms, accompanying disease, diet intolerance, and acceptability. However, tuberculosis in SAM patients significantly raised the poor outcome.

Keywords: children, outcomes, severe acute malnutrition, tuberculosis, weight gain.

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INTRODUCTION

Severe acute malnutrition (SAM), which is more common in children aged four to six years, is still a major problem in the global health sector due to high impact on child morbidity and mortality. In 2013 and 2014, 35% of 7.6 million deaths in children under 5 years old were caused by nutritional problems, and 4.4% was primarily related to malnutrition.^{1,2} Indonesian Ministry of Health Basic Health Research (Risksedas) showed that in 2013 prevalence of infants under 5 years of age (toddlers) with SAM were 5.7% and toddlers with wasted were 13.9%. In 2018, the prevalence of infants under 5 years of age (toddlers) with SAM were decreased become 3.9% and toddlers with wasted were become 13.8%.

However, this percentage still does not meet the target of the Term Development Plan National Medium Term (RPJMN) 2019 which is 17%.³

In 2019, the latest guideline on the prevention and management of SAM children has been published by Ministry of Health of Indonesia. Based on the guideline, all of SAM infants who are less than six months old (with/without complications), all infants aged >6 months who have weight ≤ 4 kg, and toddlers 6-59 months with certain complications, should be hospitalized to accept inpatient treatment. The management consists of stabilization, transition, and rehabilitation phase. In the stabilization phase, priority is given to the management of life-threatening

symptoms, such as hypoglycemia, hypothermia, dehydration and electrolytes imbalance and infection. Moreover, next phase is the transition phase which begins when medical complications have resolved and marked by the change of formula and gradually increased of the volume. Thus, when the appetite has restored and edema has reduced, patients will enter the rehabilitation phase and experience weight gain. World Health Organization (WHO) indicates that through the application of existing guidelines for the management of malnourished children, the mortality rate can be reduced by around 10%.³⁻⁵

A study in Addis Ababa showed that several factors influenced the success of SAM inpatient management,

such as presence or absence of edema, hypothermia, anemia, length of stay (LoS), and accompanying disease i.e. pneumonia, tuberculosis, diarrhea, and HIV infection. Tigray health facility in West Ethiopia reported that antibiotics and vitamin A were respectively given to 72.13% and 59.17% patient from November 2015 to April 2017, and those were identified as the positive approach for successful management of malnourished patients.⁶ Study on 195 malnourished patients in Bandung, Indonesia, showed several factors that influenced the success of malnutrition therapy and related to the weight gain. Those were immunization history ($p < 0.001$), HIV ($p = 0.048$), administration of antibiotics ($p = 0.001$) and multivitamin such as folic acid ($p = 0.023$) and zinc ($p < 0.001$).⁷ Management of 186 SAM patients hospitalized between February 2019 and February 2020 at Mohammad Hoesin Hospital (RSMH) showed moderate outcome with the average weight gain was 6.67 (0.88–44.34) g/kg BW/day. Research in Ethiopia from July 2013 to July 2015 observed 413 children with SAM and revealed that the mean weight gain for recovered children was 15.61 g/kg/day (95% CI, 14.15–17.07).⁸

Therefore, this study aimed to determine the inpatient management outcomes of severe acute malnutrition children aged one month to five years, and to identify the influence of some risk factors to the outcomes.

METHODS

We conducted a cohort study at Child Health Department dr. Mohammad Hoesin Hospital Palembang from January to July 2021. Subjects were SAM patients aged one month to five years who were hospitalized, and their parents agreed to participate in the study by signing the informed consent. Anthropometric measurements were performed at the time of admission and defined as severe acute malnutrition if the weight for length (WLZ) or weight for height (WHZ) Z scores were < -3 SD according to World Health Organization (WHO) standard growth charts, and/or mid-upper arm circumference (MUAC) < 11.5 cms. Subjects with massive organomegaly or edema were excluded, and they who were

discharged from the hospital or died in the first three days were dropped out from the study. All subjects will be given pediatric nutritional care following the guidelines for managing SAM in children (Ministry of Health 2013 and 2019).

Weight and all of signs and symptoms that appeared were documented every day start from the admission date until fourteenth days of hospitalization. Outcome was the mean weight gain during rehabilitation phase which were categorized as moderate to good, if the weight gain reached ≥ 5 g/kilogram body weight (kg BW)/day, and poor, if it was < 5 g/kg BW/day. Identified risk factors were associated symptoms, types of accompanying diseases, acceptability and tolerance to the given formulas or diet.

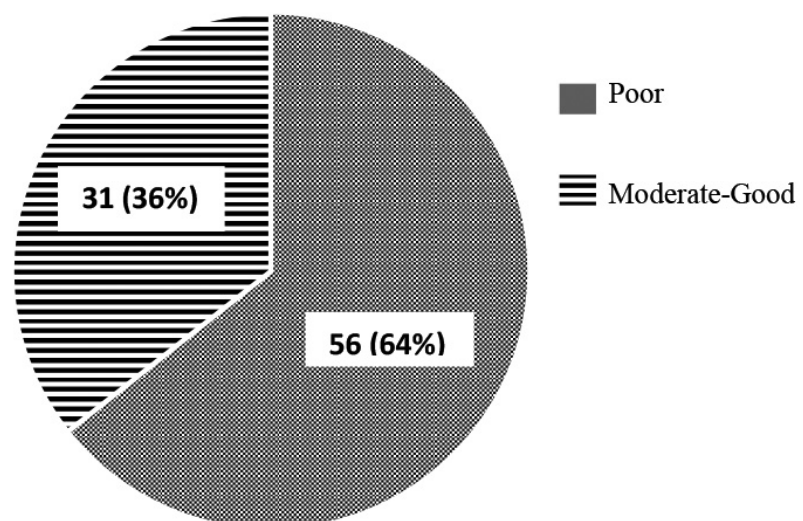
Associated symptoms such as diarrhea, vomit, fever, dyspnea, pale, cough, lethargy, edema, were assessed as the chief complains of hospitalization. Thus, types of accompanying diseases were classified into infection, for instance pneumonia, tuberculosis, acute/chronic diarrhea, human immunodeficiency virus (HIV) infection and sepsis, and non-infection (malignancy and non-malignancy). Acceptability was good if the food intake $\geq 80\%$ and poor when it was $< 80\%$ of the targeted calories. Diet intolerance was defined as present of diarrhea, vomit or allergic reaction, during formula/diet consumption.

Outcomes of SAM management and risk factors that influenced were analyzed using chi-square or Fisher's exact test. In addition, multivariate analysis was performed using binary logistic regression for all variables with p value < 0.25 on bivariate analysis in order to determine significant risk factors that affect the outcome. The result would be considered as significant if p -value < 0.05 .

RESULTS

There were 87 subjects, 62% were female with a median age of 14 (1–60) months. Most of the subjects came from Palembang (28%) and Komerang (25%). Weight gain for all age group during observation period was 1.9 (0–38.7) g/kg BW/day, while in the rehabilitation phase, weight gain was 2.10 (0–71.4) g/kg BW/day. If we look at the weight gain based on age classification, the average weight gain of SAM children aged < 6 months, the median value was 3.06 g/kg BW/day, aged 6– < 12 months, the mean value was 7.62 g/kg BW/day, age 12– < 24 months, the median value was 0 gr/kg BW/day, and age 24–60 months the median value was 0.39 gr/kg BW/day. This shows that SAM children under 12 months of age have a better weight gain than SAM children aged over 12 months.

The most common symptom that the subject had was shortness of breath (32%). The most infectious diseases were pneumonia with 26 subjects (30%) and



Picture 1. Distribution of SAM Management Outcomes (n=87)

the most non-infectious diseases were malignancy (35%). The most common diet intolerance was vomiting (24%), while the percentage of subject acceptability obtained a median value of 100% (44.4%-100%).

DISCUSSION

The results of this research showed that the majority of the subjects in this study were girls, as many as 54 children (62%). Choudhury et al in Bangladesh showed the incidence of children with SAM 54.2% were girls, and 45.8% were boys. Analysis of the study showed that girls were 1.44 times more likely to be severely malnourished than boys (OR 1.44; 95% CI; 1.17-1.77).⁹ These results are the same as those of a study conducted by Fikrie et al in Southern Ethiopia, with a total of 381 research subjects with more female subjects than men, namely 192 subjects (50.4%). This is different from the research conducted by Kumar et al in India which stated that the majority of malnourished subjects under 5 years of age were male. In this study, the research sample amounted to 110 people, while in this study the number of samples was less than 100 people. The age of the research subjects used by Kumar et al and Fikrie et al was 6-60 months, whereas, in this study, researchers still included the age of fewer than 6 months, the same as the age of the research subject in Choudhury et al.^{9,10}

The median age of the subjects in this study was 14 months with an age range of 1 - 60 months. This is no different from the research conducted by Nabukeera-Barungi et al in 2014-2015 in Uganda, where from 400 children studied, the average age value was 17 ± 8.5 months. Palembang area as many as 24 subjects (28%) followed by the Komering area as many as 22 subjects (25%). This is because the research was conducted in the Palembang area covering the area of South Sumatra and its surroundings. However, the ethnic groups of the research subjects obtained were quite diverse, of which there were 2 subjects with Javanese ethnicity.

Management outcomes from 87 subjects, 56 subjects (64%) with poor management outcomes, and 31 subjects (36%) with moderate-good management

Table 1. Distribution of General Characteristics, Associated Symptoms, Accompanying disease, Diet Intolerance, and Acceptability of Research Subjects (n=87)

Characteristics	n (%)	Median (Min-Max) ^a
Sex		
Girl	54 (62%)	
Boy	33 (38%)	
Age (months)		14 (1–60)
Ethnic's and cultural origin		
- Banyuasin	13 (15%)	
- Bengkulu	1 (1%)	
- Empat Lawang	1 (1%)	
- Jambi	5 (6%)	
- Jawa	2 (2%)	
- Komering	22 (25%)	
- Lahat	6 (7%)	
- Muara Enim	7 (8%)	
- Musi Rawas	2 (2%)	
- Pagar Alam	1 (1%)	
- Palembang	24 (28%)	
- Prabumulih	2 (2%)	
- Riau	1 (1%)	
Associated Symptoms*		
- Diarrhea (n,%)	9 (10%)	
- Vomit (n,%)	16 (18%)	
- Cough (n,%)	19 (22%)	
- Pale (n,%)	26 (30%)	
- Shortness of breath (n,%)	28 (32%)	
- Fever (n,%)	18 (21%)	
- Edema (n,%)	1 (1%)	
Infectious Disease*		
- Diarrhea (n,%)	8 (9%)	
- Pneumonia (n,%)	26 (30%)	
- HIV (n,%)	5 (6%)	
- Tuberculosis (TB) (n,%)	12 (14%)	
- Sepsis (n,%)	3 (3%)	
Non-Infectious Disease		
- Congenital Heart Disease (n,%)	9 (10%)	
- Malignancy (n,%)	30 (35%)	
Diet Intolerance*		
- Diarrhea (n,%)	15 (17%)	
- Vomit (n,%)	21 (24%)	
- Allergy (n,%)	1 (1%)	
Acceptability Percentage		100% (44.4% –100%)

^aKolmogorov-Smirnov

*Research subjects can have more than 1 combination of risk factors

outcomes. The median value of the subject's weight gain was 1.9 g/kg BW/day with a minimum value of 0 and a maximum of 38.65 g/kg BW/day. Researchers also observed the average weight gain of subjects only during the rehabilitation phase, which was obtained a median value of 2.10 g/kg BW/day with a value range of 0–71.43 g/kg BW/day. This result is very different from the results of a study in Southern Ethiopia which stated that the average daily weight gain in this

study was 12.7 (± 8.9) g/kg/day. This could be due to differences in the number of samples, differences in the characteristics of the subjects, and the length of treatment days. In this study, the length of time the subject was treated with a median value of 17 (10-24) days. While in this study, subjects were studied for a maximum of 14 days of treatment so that it is still possible that the rehabilitation phase has not been achieved and there has been no weight gain in the subject.¹¹

Table 2. The relationship between the management outcomes of SAM and the risk factors that influenced it (n=87)

Characteristics	Outcome		Total	p	RR (CI 95%)
	Poor (N = 56)	Moderate-Good (N = 31)			
Infectious Disease					
Yes (n, %)	28 (50%)	10 (32%)	38 (44%)	0,110^a	1.29 (0.94-1.75)
No (n, %)	28 (50%)	21 (68%)	49 (56%)		
Non-infectious Disease					
Yes (n, %)	28 (50%)	13 (42%)	41 (47%)	0,470 ^a	1.12 (0.82-1.53)
No (n, %)	28 (50%)	18 (58%)	46 (53%)		
Associated symptoms					
Yes (n, %)	46 (82%)	20 (65%)	66 (76%)	0,066^a	1.46 (0.90-2.35)
No (n, %)	10 (18%)	11 (35%)	21 (24%)		
Diet Intolerance					
Yes (n, %)	19 (34%)	12 (39%)	31 (36%)	0,656 ^a	0.92 (0.66-1.29)
No (n, %)	37 (66%)	19 (61%)	56 (64%)		
Acceptability					
Yes (n, %)	4 (7%)	3 (10%)	7 (8%)	0,696 ^b	0.87 (0.45-1.70)
No (n, %)	52 (93%)	28 (90%)	80 (92%)		

a. *Chi-square*b. *Fisher's Exact Test***Table 3.** The relationship between the SAM management outcomes and the risk factors that influenced it (n=87)

Associated Symptoms	Outcomes		p	RR (CI 95%)
	Poor (N = 56)	Moderate - Good (N = 31)		
Diarrhea				
Yes (n,%)	7 (13%)	2 (7%)	0,481 ^a	1.23 (0.83 -1.82)
No (n,%)	49 (87%)	29 (93%)		
Vomit				
Yes (n,%)	11 (20%)	5 (16%)	0,685 ^b	1.08 (0.74-1.57)
No (n,%)	45 (80%)	26 (84%)		
Cough				
Yes (n,%)	14 (25%)	5 (16%)	0,337 ^b	1.19 (0.86-1.65)
No (n,%)	42 (75%)	26 (84%)		
Pale				
Yes (n,%)	17 (30%)	9 (29%)	0,897 ^b	1.02 (0.73-1.43)
No (n,%)	39 (70%)	22 (71%)		
Shortness of breath				
Yes (n,%)	19 (34%)	9 (29%)	0,640 ^b	1.08 (0.78-1.49)
No (n,%)	37 (66%)	22 (71%)		
Fever				
Yes (n,%)	13 (23%)	5 (16%)	0,435 ^b	1.15 (0.82-1.62)
No (n,%)	43 (77%)	26 (84%)		
Edema				
Ada (n,%)	1 (2%)	0	1,000 ^a	1.54 (1.33-1.83)
Tidak Ada (n,%)	55 (98%)	31 (100%)		

a. *Fisher's Exact Test*b. *Chi-square*

Table 4. Relationship between SAM management outcomes and accompanying disease (n=87)

Comorbid	Outcomes		P	RR (CI 95%)
	Poor (N = 56)	Moderate-Good (N = 56)		
Pneumonia				
Yes (n,%)	18 (32%)	8 (26%)	0,536 ^a	1.11 (0.80-1.53)
No (n,%)	38 (68%)	23 (74%)		
HIV				
Yes (n,%)	4 (7%)	1 (3%)	0,651 ^b	1.26 (0.79-2.01)
No (n,%)	52 (93%)	30 (97%)		
Tuberculosis (TB)				
Yes (n,%)	12 (21%)	0	0,004^b	1.70 (1.41-2.06)
No (n,%)	44 (79%)	31 (100%)		
Sepsis				
Yes (n,%)	1 (2%)	2 (6%)	0,288 ^a	0.50 (0.10-2.54)
No (n,%)	55 (98%)	29 (94%)		
Diarrhea				
Yes (n,%)	7 (12%)	1 (3%)	0,250 ^b	1.41 (1.03-1.93)
No (n,%)	49 (88%)	30 (97%)		
Congenital Heart Disease				
Yes (n,%)	6 (11%)	3 (10%)	1,000 ^b	1.04 (0.63-1.69)
No (n,%)	50 (89%)	28 (90%)		
Malignancy				
Yes (n,%)	22 (40%)	8 (26%)	0,205 ^a	1.29 (0.90-1.66)
No (n,%)	34 (60%)	23 (74%)		

a. Chi-square,

b. Fisher's Exact Test

Table 5. Relationship between management outcomes and diet intolerance (n=87)

Diet Intolerance	Outcomes		P	RR (CI 95%)
	Poor (N = 56)	Moderate-Good (N = 56)		
Vomit				
Yes (n,%)	13 (23%)	8 (26%)	0.787 ^a	0.95 (0.65-1.38)
No (n,%)	43 (77%)	23 (74%)		
Diarrhea				
Yes (n,%)	11 (20%)	4 (13%)	0.475 ^a	1.17 (0.82-1.67)
No (n,%)	45 (80%)	27 (87%)		
Allergy				
Yes (n,%)	0	1 (3%)	0.356 ^b	2.86 (2.14-3.82)
No (n,%)	56 (100%)	30 (97%)		

a. Chi-square

b. Fisher's Exact Test

Table 6. Relationship between SAM management outcomes with associated symptoms, accompanying disease, and diet intolerance of more than 2 components (n=87)

Combination Type Risk Factor	Outcomes		P	RR (CI 95%)
	Poor (N = 56)	Moderate-Good (N = 56)		
Associated Symptoms				
≥ 2 combination (n,%)	25 (45%)	11 (36%)	0.406 ^a	1.14 (0.83-1.55)
< 2 combination (n,%)	31 (55%)	20 (64%)		
Accompanying Diseases				
≥ 2 combination (n,%)	14 (25%)	2 (6%)	0.032^a	1.48 (1.13-1.93)
< 2 combination (n,%)	42 (75%)	29 (94%)		
Diet Intolerances				
≥ 2 combination (n,%)	5 (9%)	1 (3%)	0.415 ^b	1.32 (0.89-1.96)
< 2 combination (n,%)	51 (91%)	30 (97%)		

a. Chi-square

b. Fisher's Exact Test

During the treatment period, there were 66 of 87 subjects had comorbid symptoms with the majority of comorbid symptoms being shortness of breath (32%). Other accompanying symptoms were pallor (20%), cough (22%), fever (21%), vomiting (18%), diarrhea (10%) and only 1% of subjects had accompanying symptoms of edema. In a study conducted in Uganda, the most common accompanying symptoms were edema (65.8%) and cough (65.5%). Symptoms of shortness of breath are also present but in that study only 14.7%.² Research in Ethiopia (2013-2014) showed that the most common symptoms were fever (86.2%) and diarrhea (53.1%).⁸ Research in Ethiopia in 2013 showed the incidence of diarrhea in children under 5 years of age was quite high related to environmental sanitation conditions and the lack of availability of clean water.¹³

In this study, 1 subject could have more than 1 comorbidity. There were 54.6% of subjects who had more than one comorbid symptom and 88% of subjects with 3 combinations of comorbid symptoms such as shortness of breath, cough, and fever had poor management outcomes. In a study in Uganda, of the 400 subjects studied, 62% had symptoms of edema and 28% with symptoms of shortness of breath had poor management outcomes and even died. in the form of diarrhea, vomiting, cough, pallor, shortness of breath, fever, and edema with a p-value > 0.05 . In Derseh et al's study, the results also showed that there was no significant relationship between treatment outcomes and symptoms in the form of pallor or anemia which was indicated by a p-value = 0.155.¹⁴

The outcome of malnutrition management is also influenced by the accompanying disease possessed by the subject. In this study, 70 of 87 subjects with SAM had accompanying disease. Most of the subjects were found to have malignancy (35%) and pneumonia (30%), while other accompanying disease were pulmonary TB (14%), CHD (10%), diarrhea (9%), HIV (6%), and sepsis (3%). Accompanying disease are grouped into infectious and non-infectious diseases. Malnourished subjects with poor management outcomes, 50% of them were accompanied by infectious diseases

and the other 50% were accompanied by non-infectious diseases. In the Ugandan study, the most common accompanying disease were diarrhea (61%), sepsis (24%), pneumonia (17%), and HIV (11.7%).²

Research in Southern Ethiopia (2015-2017) showed the most common accompanying disease was pneumonia (41.5%), while other co-morbidities were TB (22.8%), sepsis (8.4%), CHD (7.9%), malaria (2.6%), and HIV (0.8%). In the study of Kusnandi et al in Bandung, Indonesia, similar results were obtained where the majority of accompanying disease in the malnourished subjects studied were pneumonia, which was 35.4%. In addition, it was found that co-morbidities were anemia 31.3%, TB 15.4%, sepsis 11.3%, diarrhea 9.2%, CHF 4.1%, and HIV 1%. the data in this study, where the majority of accompanying disease were pneumonia.³⁵ The results of the Basic Health Research in Indonesia in 2007 showed that pneumonia was the second leading cause of infant and under-five mortality for infectious diseases. The 2013 Basic Health Research in Indonesia also showed a high prevalence of pneumonia in children under five, namely 4.5 per 100 children under five.

In this study, 24.2% of subjects had more than 1 type of comorbidity and 100% of subjects with 3 combinations of accompanying disease had poor management outcomes. The results showed that there was no significant relationship between treatment outcomes and pneumonia, HIV, sepsis, diarrhea, CHD, and malignancy, which was indicated by a p-value > 0.05 . However, unlike the case with TB, there was a statistically significant relationship with the treatment outcome for malnutrition subjects, which was indicated by a p-value = 0.04. The results showed that subjects with severe malnutrition with TB disease had a 1.7 times risk of having poor management outcomes compared to subjects with malnutrition without TB disease (RR 1.70; 95% CI 1.41-2.06). This is reinforced by the results of the analysis on subjects who have more than 1 type of comorbidity with an RR value of 1.48 (95% CI; 1.13-1.93, p = 0.032) which states that subjects with more than 2 combinations of accompanying disease have a 1.48 times risk of having

poor management outcomes. This is different from the study of Kusnandi et al., TB disease did not statistically have a significant relationship with the treatment outcome of poor nutrition subjects, while HIV had a statistically significant relationship with the outcome of the subject's treatment, indicated by a p-value = 0.048. However, for other diseases, such as diarrhea, pneumonia, anemia, sepsis, and heart failure, there was no statistically significant relationship with the treatment outcome. This is similar to this study.⁷

During treatment, observations were made of any diet intolerance that occurred. Diet intolerance were found in the form of vomiting (24%), diarrhea (17%), and allergic reactions (1%). Six subjects also experienced more than 1 tolerance disorder, namely in addition to experiencing vomiting, subjects also experienced diarrhea and 83% of them had poor management outcomes. The same thing was also found in a study in Southern Ethiopia, where the most malnourished subjects studied experienced impaired vomiting tolerance (78.6%). which is indicated by p-value > 0.05 . Research in Southern Ethiopia stated that there was a significant relationship between treatment outcomes and diarrhea, indicated by the p-value = 0.002. However, this study also found that there was no relationship between vomiting and the management outcomes of malnutrition subjects.¹²

Research subjects with more than 1 combination of associated symptoms, accompanying disease, or diet intolerance at most have poor management outcomes. However, until now there has been no research on malnourished children with a combination of more than 1 symptom, accompanying disease, or diet intolerance during treatment.

The median value of the acceptability percentage that occurred while the subject was hospitalized was 100% (44.44% -100%). This shows that the majority of the subjects have good acceptability. Only 7 subjects (8%) of 87 subjects with malnutrition were found with a poor acceptability percentage. There was no significant relationship between treatment outcome and acceptability in malnourished subjects aged 1 month - 5 years. This is indicated by the p-value > 0.05 .

CONCLUSION

No significant relationship was found between the treatment outcomes and the grouped risk factors. However, a significant relationship was found between treatment outcomes and pulmonary TB disease. There was no relationship between the existing risk factor groups and the outcome of the treatment of malnutrition subjects.

The limitation of this study is the time of the study which started during the stabilization phase and the observation time was set for 14 days, while weight gain began to occur during the rehabilitation phase. Research subjects can have different times to enter the rehabilitation phase and experience rapid weight gain.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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ETHICAL CLEARANCE

This study's ethical clearance was provided by Health Research Ethics Committee RSUP Dr. Mohammad Hoesin Palembang No.05/kepkrsmh/2021.

REFERENCES

1. Adal TG, Kote M. Incidence and predictors of mortality among severe acute malnourished under-five children admitted to Dilla university referral hospital: a retrospective longitudinal study. *J Biol*. Published online 2016;14. <https://www.researchgate.net/publication/311717386>.
2. Nabukeera-Barungi N. et al. Predictors of mortality among hospitalized children with severe acute malnutrition: a prospective study from Uganda. *Pediatr Res*. Published online 2018;7. doi: <https://doi.org/10.1038/s41390-018-0016-x>.
3. Ministry of Health of the Republic of Indonesia. Guidelines for the prevention and management of malnutrition in toddlers. Jakarta. 2019;10-1.
4. WHO. Guideline: Updates on the management of severe acute malnutrition in infants and children. Geneva: World Health Organization; 2013.
5. Tickell KD, Denno DM. Inpatient management of children with severe acute malnutrition: a review of WHO guidelines. Published online 2013;10.
6. MB DMM, Billoro BB. Treatment outcome of severe acute malnutrition and its determinants among pediatric patients in West Ethiopia. *Int J Pediatrics*. 2018;1-7. doi: <https://doi.org/10.1155/2018/8686501>.
7. Wiramihardja S. KV, Adhuya AP. GDA. Factors influencing outcomes of children hospitalized with acute severe malnutrition. *Althea Med J*. 2018; 5: 87-92. doi: <http://dx.doi.org/10.15850/amj.v5n2.1246>.
8. Derseh B, et al. Co-morbidity, treatment outcomes and factors affecting the recovery rate of under-five children with severe acute malnutrition admitted in selected hospitals from Ethiopia: a retrospective follow-up study. Published online 2018;8. <https://doi.org/10.1186/s12937-018-0423-1>.
9. Choudhury K., Hanifi M., Rasheed S., Bhuiya A. Gender inequality and severe malnutrition among children in a remote rural area of Bangladesh. *J Health Popul Nutr*. 2000. Dec;18(3): 123-130. <http://www.jstor.org/stable/23498867>.
10. Kumar D., Kumar R., Kumar A., Singh T.B. Risk factors of mortality in hospitalized children with severe acute malnutrition. *The Indian Journal of Pediatrics* (November 2019). 86(11):1069. <https://doi.org/10.1007/s12098-019-03016-0>.
11. Fikrie A, et al. Treatment outcomes and factors affecting time-to-recovery from severe acute malnutrition in 6-59 months old children admitted to a stabilization center in Southern Ethiopia: A retrospective cohort study. Published online 2019;9. <https://doi.org/10.1186/s13052-019-0642-x>.
12. Gebremichael D.Y. Predictors of nutritional recovery time and survival status among children with severe acute malnutrition who have been managed in therapeutic feeding centers, Southern Ethiopia: retrospective cohort study. *BMC Public Health*. Published online 2015;15:1267. DOI: <http://dx.doi.org/10.1186/s12889-015-2593-5>.
13. Mengistie, et al. Prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia: A cross-sectional study. *Open Journal of Preventive Medicine* 3. 2013. Vol.3 No.7. p.446-453. <http://dx.doi.org/10.4236/ojpm.2013.37060>.
14. Kurniawan R. Y, Hardhana B. ST. Indonesia's 2018 health profile. Ministry of Health of the Republic of Indonesia; 2019.



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