DOI: 103126/JNPS.V4113

Original Article

Benefit of Oral Nutrition Supplement for Children with Acute Malnutrition at Hospital Outpatient

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Article History

Received on - 2023 Dec 23
Accepted on - 2024 Aug 10

Keywords:

Acute malnutrition; Oral nutrition supplement; Nutritional status

Online Access

DOI: https://doi.org/10.60086/jnps1227

Abstract

Introduction: Acute malnutrition in children is still high in our country. It needs optimal nutrition support during and after discharge from the hospital. We evaluated the benefit of oral nutrition supplements (ONS) in improving acute malnutrition in children in a hospital outpatient setting.

Methods: A retrospective cohort study was conducted among 124 children under five with acute malnutrition (weight - for - height < - 2 SD, according to the WHO growth standard). All the children were followed during six months of treatment. At the end, the change of nutritional status was calculated and associated factors were studied.

Results: Among 124 children, 70 (56.5%) were males and 54 (43.5%) were females with a median age of nine months. On recruitment, 41 children (33.1%) had severe acute malnutrition (SAM) and 83 children (66.9%) had moderate acute malnutrition (MAM). In the end, five children (4.1%) improved from SAM to well-nourished, 22 children (17.7%) improved from MAM to well-nourished, and 13 children (10.5%) improved from SAM to MAM, respectively. Initial SAM status and frequent visits were significantly associated with the improvement in nutritional status.

Conclusions: Treatment with ONS for six months in children under five with acute malnutrition improved their nutritional status by approximately 32.3%, in which 21.8% had complete improvement. Independent factors for improvement were initial SAM status and frequent visits to the outpatient clinic.

Introduction

Children with acute malnutrition in our country and hospital is still high, and its prevalence is approximately 48.1% in children with intracranial infection and 64% in children with congenital heart disease, respectively.[1] It can occur acutely, chronically or combination of both. Malnutrition aggravates the condition of infectious diseases, including intracranial infections. Hereby we aimed to determine the prevalence and factors associated with malnutrition in paediatric patients with intracranial infections in Sanglah Central General Hospital. This cross-sectional analytic study was conducted in patients with final diagnosis intracranial infection whom were treated from January 2019 to March 2021. The study was conducted in paediatric patients aged one month - 18 years old and patient would be excluded if had any of these conditions.[1,2] Other studies reported the prevalence of around 24.0% to 26.9%.[3,4] A higher prevalence of acute malnutrition in our hospital is associated with the presence of underlying diseases, mostly chronic diseases like congenital heart disease, childhood malignancies, chronic liver diseases, and chronic renal

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failure. Acute malnutrition, which is related to the underlying diseases is known as secondary acute malnutrition.[5] The pathophysiology of secondary acute malnutrition is abnormal nutrient loss, increased energy expenditure, and decreased food intake.[5] Acute malnutrition in sick children is known to be associated with increased length of hospital stay, hospital cost, morbidity, and mortality rate.[6,7] Children with severe acute malnutrition (SAM) have a three times risk of higher mortality than children without SAM and the risk increases with the presence of oedema.[8] These findings need for policies and programs emphasizing identification and treatment of acute malnutrition during and after discharge from hospitals.

Nutrition support in malnourished sick children is essential in improving their nutrition status as well as the prognosis of the underlying diseases.[9] Underweight, and wasting is observed in any country in the world. The levels of over-nutrition are also on a rise. Prevention of child malnutrition require diets providing adequate energy and essential nutrients to promote catch-up growth, strengthen resistance to infection, and support normal mental, physical and metabolic development.[10-11] Oral nutrition supplement (ONS) are foods for special medical purposes that are rich in calories and nutrients to prevent and treat childhood malnutrition.[12] ONS can be in the form of ready-to-drink liquids or powders to be mixed with fluids. The indications of ONS use in children are faltering weight, moderate or severe acute malnutrition, and stunting.[12] A lot of studies have shown the clinical effectiveness of ONS in increased calorie and nutrient intake, weight gain, lower risk of complications, decreased length of hospital stay, and hospital cost.[13] In our hospital, all sick children were given ONS and started at around 30% of their total energy requirement, which could be increased according to their tolerance. All children were given ONS based on their needs, regardless of their underlying disease. After being discharged from the hospital, the ONS treatment was suggested to be continued by their parents at home. Sometimes the ONS treatment was not continued by parents because either the child refused or the parents could not afford the ONS.

The objective of this current study was to evaluate the benefit of an ONS on improving the nutritional status of children under five with acute malnutrition or weight-for-height z-scores (WHZ) $<$ - 2 SD according to the WHO growth standard during six months of treatment.

Methods

This was a retrospective cohort study conducted between October 2021 and October 2022 at Prof. Ngoerah Hospital, a tertiary referral hospital in Bali, Indonesia. The study included children with acute malnutrition who were monitored in the outpatient clinic. Acute malnutrition was defined according to the weight-for-height Z score (WHZ) $<$ - 2SD but $\geq$ -3SD (moderate acute malnutrition or MAM) and Z score $<$ -3SD (severe acute malnutrition or SAM).[5] The study was approved by The Research Ethics Committee Faculty of Medicine Universitas Udayana, Bali with registration number 1755/UN14.2.2.VII.14/LT/2023.

Sample size was calculated with:

$$(n = \frac{Z\alpha^2 PQ}{d^2})$$

The alpha was 0.05, the prevalence of nutritional status improvement in the previous study was 37%,[16] and the precision was 15% , and hence the minimal sample was 37. After divided with 37% prevalence and 10% dropped out probability, minimum of 117 subjects will be added to this study. Continuous variables were summarized by descriptive statistics and the characteristics of the groups were compared using a two-sided t-test. Categorical variables were summarized in a cross-classification frequency table and analyzed by a Chi-square test. Nutritional status improvement from moderate or severe malnutrition to well-nourishment was summarized by descriptive statistics. The characteristics differences between the improvement and non-improvement subjects were defined as significant if p-value $<$ 0.05.

Results

A total of 124 children under five years of age who met the study criteria were included, of which 83 children (66.9%) were MAM and 41 children (33.1%) were SAM respectively. Among 124 subjects, 70 (56.5%) were males, and 54 (43.5%) were females. The median age was nine months. Baseline characteristics of the subjects are shown in Table 1 below. Table 2 showed the percentage of nutritional status improvement from SAM to MAM or well-nourished. Most of the subjects could not improve their nutritional status in the study period.

Table 1: Baseline characteristics of subjects

Characteristic	N = 124
Male (%)	70 (56.5)
Female (%)	54 (43.5)
Age (Month), median (Min - max)	9 (1 - 59)
Infants (%)	68 (54.8)
Toddlers (%)	43 (34.7)
Children (%)	13 (10.5)
Weight (kg), median (Min - max)	6.4 (1.9 - 39.0)
Height (cm), median (Min - max)	67.0 (45.0 - 170.0)
MAM, n (%)	83 (66.9)
SAM, n (%)	41 (33.1)
Stunting, n (%)	90 (72.6)
Visiting frequency, median (Min - max)	2 (1 - 12)
Calories intake (%RDA), median (Min - max)	90.5 (45.0 - 132.0)

MAM, moderate acute malnutrition; RDA, recommended dietary allowance; SAM, severe acute malnutrition; SD, standard deviation.

Table 2: Change of nutritional status

Change of nutritional status	N = 124
SAM to well-nourished (%)	5 (4.1)
MAM to well-nourished (%)	22 (17.7)
SAM to MAM (%)	13 (10.5)
No-improvement (%)	84 (67.7)

*MAM, moderate acute malnutrition; SAM, severe acute malnutrition.

The study evaluated several factors related to the improvement of nutritional status. A bivariate analysis found gender, age, calorie intake, degree of acute malnutrition, and with or without stunting were not statistically significant, while the number of visits was statistically significant (Table 3). A multivariate analysis found the degree of acute malnutrition and the number of visits to be statistically significant (Table 4). The recovery rate of those children with MAM was three times higher than children with SAM.

Table 3: Multivariate analysis of factors related to the improvement of nutritional status

Factor	OR	95% CI	p
MAM	3.2	1.1 to 9.6	0.038
Frequent visit	3.1	1.2 to 7.7	0.016
High calories intake	1.6	0.5 to 5.3	0.461

Discussion

The present study subjects mostly had MAM rather than SAM and approximately 72.6% of them also had stunting. Stunting is a big problem in our hospital. Previous studies in the past had found that 33.3% of toddlers who complained of feeding difficulty were stunted, and nearly 51% of children under five with congenital heart disease (CHD) were stunted.[2,17] Childhood stunting as a part of childhood chronic malnutrition needs nutritional support similar to acute malnutrition.

Childhood malnutrition in our hospital are mostly secondary malnutrition, resulting mainly from acute or chronic diseases such as CHD, liver disease, kidney disease, malignancy, meningitis, pneumonia, HIV infection, tuberculosis, dengue infection, and others.[18] Our previous study evaluated 200 children under five years with CHD and found underweight, stunted, and wasted children to be 54%, 51%, and 64%, respectively.[2] Acyanotic CHD more commonly had underweight and wasting, while stunting was seen more commonly in cyanotic CHD.[2] Another study in children with intracranial infection found the prevalence of acute and chronic malnutrition to be 31.3% and 32.5% respectively.[1] It can occur acutely, chronically or combination of both. Malnutrition aggravates the condition of infectious diseases, including intracranial infections. Most of the malnutrition occurred in children under five and mortality rate was around 22.9%.[1] Malnutrition aggravates the condition of infectious diseases, including intracranial infections.

Table 4: Bivariate analysis of factors related to the improvement of nutritional status

Factor	Improvement to well-nourished		p
	YES (N = 27)	No (N = 97)	
Gender			
Male (%)	14 (20.0)	56 (80.0)	0.586
Female (%)	13 (24.1)	41 (75.9)	
Age (months), mean (SE)	16.2 (2.9)	14.9 (1.4)	0.712
Age group			
Infants (%)	15 (22.1)	53 (77.9)	0.983
Toddlers (%)	9 (20.9)	34 (79.1)	
Children (%)	3 (23.1)	10 (76.9)	
Number of visits (%)	3.7 (0.4)	2.6 (0.2)	0.024
Calories intake (%RDA), mean (SE)	94.7 (3.1)	88.4 (1.6)	0.078
SAM (%)	5 (12.2)	36 (87.8)	0.069
MAM (%)	22 (26.5)	61 (73.5)	
With stunting (%)	20 (22.2)	70 (77.8)	0.844
Without stunting (%)	7 (20.6)	27 (79.4)	

MAM, moderate acute malnutrition; RDA, recommended dietary allowance; SAM, severe acute malnutrition; SE, standard error.

The pathophysiology of secondary malnutrition or illness related malnutrition in children is due to increased energy expenditure, inadequate nutrient intake, malabsorption, and altered utilization of nutrients.[19] For relevant references, five domains of the definition of malnutrition that were identified: anthropometric parameters, growth, chronicity of malnutrition, etiology and pathogenesis, and developmental/ functional outcomes. Based on available evidence and an iterative process to arrive at multidisciplinary consensus in the group, these domains were included in the overall construct of a new definition. This study found that around 32.3% children improved their nutritional status during the six months follow up. Approximately 17.7% children improved their nutritional status from MAM to well-nourished, 10.5% improved from SAM to MAM, and 4% improved from SAM to well-nourished, respectively. Most of our children did not improve their nutritional status during the six month follow-up.

A study in Nigeria reported that among 229 children under five with SAM, around 48.1% were cured.[20] This study aimed to assess the treatment outcomes and its associated factors among children aged six – 59 months attending the outpatient therapeutic programme in Zaria LGA, Kaduna, Nigeria. Information on household sociodemographic characteristic, anthropometric measurements, clinical and medical history of the children with SAM was collected using pre-tested questionnaires administered by trained interviewers. Biochemical parameters were assessed using standard laboratory procedures. Among the 229 admitted children with SAM, 48.10% were cured (their condition improved during the study period Another study in Malawi reported a recovery rate of 75.7% of those with SAM and 85.2% of those with MAM.[21] Other studies in children under five with acute malnutrition in the outpatient clinic also reported a similar outcome.[22-24] In our study, the lower recovery rate could have been due to the underlying diseases or secondary acute malnutrition. It is well known that secondary acute malnutrition is more difficult to recover because the underlying diseases have not yet been treated.

This study evaluated several factors related to the improvement of nutritional status and found the degree of acute malnutrition and the number of clinical visits to be statistically significant. The recovery rate of those children with MAM was found to be three times higher than children with SAM. Children with acute malnutrition who visited more frequently into the clinic had a higher recovery rate. A study in Burkina Faso reported similar results.[25] Those with skipped or missed visits and being admitted with WHZ < -3 were independent factors of a longer time to recovery or non-response. More missed visits predicted longer treatment duration and higher non-response treatment.[25] Other studies reported independent factors of recovery rate included family income,[26] weaning before two years of age and tuberculosis,[27] presence of diarrhoea, and use of amoxicillin[28] and it is a leading cause of mortality in many countries, including Pakistan. The difference in independent factors of recovery rate from acute malnutrition between studies may be due to the difference in the clinical setting such as underlying disease, degree of malnutrition, and availability of ONS of every study.

In our hospital, children under five with acute malnutrition were commonly admitted to the in-hospital due to their underlying diseases, such as pneumonia, HIV infection, anaemia, CHD, malignancy, and others. Most of them could be discharged from the hospital by the doctors, although their nutritional status had not yet improved. Their nutrition support was continued in the outpatient clinics. Patients who routinely visited the outpatient clinic had a higher improvement in their nutritional status. Our study found that children under five with MAM had a higher improvement in nutritional status compared with children under five with SAM, especially if they visited more frequently in an outpatient clinic after being discharged from the hospital.

The acceptability of nutrition support in this study is more than 80% of the dietary recommended. Children who improve their nutritional status during treatment have a higher nutrient acceptability percentage than children with non-response, however, the differences are not significant. The limitation of the study was not being able to evaluate the side effects of nutrition support that could occur during the treatment.

Conclusions

This study concludes that ONS in children under five with acute malnutrition can improve their nutritional status by 32.3% through the outpatient clinic setting. Children with moderate acute malnutrition have higher improvement than children with severe acute malnutrition, especially in children who visit the outpatient clinic more frequently after discharge from the hospital.

Acknowledgement

The authors would like to thank the Rector of Udayana University and the head of Lembaga Penelitian dan Pengabdian Masyarakat of Udayana University for funding this research.

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