OPEN ACCESS
Freely Available Online

INTERNATIONAL JOURNAL OF NUTRITION
ISSN NO: 2379-7835

Short Communication

DOI: 10.14302/issn.2379-7835.ijn-19-2599

Recovery Time From Severe Acute Malnutrition And Development Of Complementary Food Supplement For Affected Ethiopian Children

Desalegn Gebrezgi[1], Degnet Teferi[2], Prasad PCJ Reddy[3,*]

[1]Lecturer-Department of Applied Human Nutrition, Faculty of Chemical and Food Engineering, Bahir Dar Institute of Technology, Bahir Dar University, Bahir Dar, Ethiopia

[2]Researcher-Mekelle Agricultural Mechanization and Rural Energy Research Center, Tigray Agricultural Research Institute, Mekelle, Ethiopia

[3]Professor,–Department of Applied Human Nutrition, Faculty of Chemical and Food Engineering, Bahir Dar Institute of Technology, Bahir Dar University, Bahir Dar, Ethiopia

Abstract

Background: Severe acute mal nutrition (SAM) among children still remains the major problem in Ethiopia. The shortening of the SAM recovery time by applying appropriate dietary means during treatment and also after recovery, can save huge sums of public health spending.

Objectives: Determining the recovery time of SAM affected children and developing complementary food supplement (CFS).

Methods: Hospital based retrospective cohort study was carried out on 401 SAM affected children. A structured and pre tested data abstraction form was used for data collection. The data were entered into Epi info and exported to SPSS for analysis. All of the nutritional properties of the developed product in three different ratios of the flours of maize, soybean and powder of moringaolifera leaves were assessed and compared to the control (100% maize).

Results: The median recovery time was 16 days. There was a significant increase in protein, mineral and beta carotene content with increasing level of Moringaolifera leaf powder in the CFS.

Conclusion: To increase the rate of recovery from sever acute malnutrition and also to prevent relapsing, moringa incorporated cheaper complementary fod supplements could be recommended for SAM affected children.

Correspondig author: Prasad PCJ Reddy, Professor,–Department of Applied Human Nutrition, Faculty of Chemical and Food Engineering, Bahir Dar Institute of Technology, Bahir Dar University, Bahir Dar, Ethiopia, Email: professor_rpcjp@yahoo.com

Citation: Desalegn Gebrezgi, Degnet Teferi, Prasad PCJ Reddy (2019) Recovery Time from Severe Acute Malnutrition and Development of Complementary Food Supplement For Affected Ethiopian Children. International Journal of Nutrition - 3(3):1-6. https://doi.org/10.14302/issn.2379-7835.ijn-19-2599

Keywords: Severe acute malnutrition, recovery time, complementary food supplement, Moringa powder

Received: Jan 10, 2019 **Accepted:** Jan 16, 2019 **Published:** Jan 26, 2019

Editor: María López, Universidad Francisco de Vitoria, Spain.

Introduction

Severe Acute Malnutrition (SAM) is defined as weight-for height ratio of less than -3 standard deviations below the median reference population or weight-for-height ratio of below 70% or Mid Upper Arm Circumference (MUAC) <110 mm or presence of nutritional edema[1].

Until recently, acute malnutrition was seen primarily as a feature of humanitarian emergencies. This is despite of the fact that most cases occur in non-emergency contexts. But in recent years, donors, as well as developing countries with a high-burden of undernutrition, have started to pay more attention to the issue[2].

While the treatment of SAM is well established and evidence-based [3, 4], achieving desired outcomes has proven to be challenging. Particularly , effective management of SAM is a huge challenge in low resource healthcare settings and more effective strategy is needed urgently[5].

On the other hand, even after children are recovered from SAM, attention is required at home in order to prevent relapsing. For instance, from a study conducted in Shebedido district, Southern Ethiopia; of the total admissions to the OTP, 22% were readmitted cases[6]. The observed high proportion of readmission may be due to lack of affordable complementary food supplements at home [7].

Aim and objectives: Determine recovery time from severe acute malnutrition among children and develop soy bean and maize-based complementary food supplements fortified with Moringaoleifera.

Material & Methods

Study area and design: Institution based retrospective cohort study was conducted from March– April, 2016 at Felegehiwot referral hospital, in Bahir Dar city administration, Northwest Ethiopia. Currently, the hospital is the only health facility which provides inpatient services for the management of severe acute malnutrition in the study area.

Sample size and sampling procedure: Using Epi info version 6 StatCalc programs, a double population proportion formula was employed to calculate the sample size and it was estimated to be 401. All children 6-59 months of age with SAM who had been admitted and treated at therapeutic feeding unit (TFU) of the selected hospital from October 2012 to April 2016 were eligible for the study. The total admitted children during this period were 526. Since the difference between the calculated sample size and total admitted SAM cases was small, all SAM cases were considered until the sample size got saturated.

Data Collection and Quality Control Measures: A structured data abstraction form (pretested on 10 charts) was used for data collection. Data were abstracted from client cards.

Data processing and analysis: Data were checked and entered in to Epi-info version 7 statistical software and then exported to Statistical Package for Social Science (SPSS) version 20 for analysis. Recovery time from SAM was estimated using Kaplan-Meier procedure.

Ethical Consideration

Appropriateness and ethical approval was obtained from Ethical review committee for postgraduate studies and research projects of Faculty of Chemical anf food Engineering, Bahir Dar Technology Institute, Bahir Dar University. Permission to conduct the study was obtained from regional health research bureau and the hospital administrative bodies through formal letter.

Development of Complementary Food Supplements

The raw materials for development of complementary food supplements included maize (Zea mays, MELKASSA-6 variety), soybean (glycine max, Wagaye variety) and moringaolifera. The products were developed and formulated with ratios of 65:30:5(R65), 60:30:10(R60) and 55:30:15(R55) with maize flour, soybean flour and Moringaolifera powder respectively. Each of these cereals was mixed with predetermined portions of seeds in order to obtain enriched flour. Nutritional compositions of these enriched flours were assessed and compared to control (100% maize); the existing local complementary flour. The values of nutritional compositions were means of triplicate. Data obtained were subjected to appropriate statistical analysis (SAS 9.1) and the means were separated by

Duncan Multiple Range Test where significant difference occurs at P-value <0.05.

Results

Out of the total 401 children in the cohort; 208 (51.9%), 17(4.2%), 143(35.7%), 6(1.5%) and 27 (6.7%) were cured, died, defaulted, not responded and transferred respectively (table 1). The nutritional recovery rate was 2.27 (95 % CI: 1.55– 3.43) per 100 person day observations among entire subjects in the cohort. The median nutritional recovery time was estimated to be 16 days (IQR: 95% CI; 14.233-17.767) (figure 1).

Regarding to the complementary food supplements, there was significant ($p < 0.05$) increase in protein content with increasing level of Moringaolifera leaf powder from 8.2% in 100% maize (control) to 17.2% in (55:30:15) R55, with maize, soybean and Moringaolifera leaf power blend (table 2).

The mineral content of the samples increased significantly ($p < 0.05$) (table 3). Zinc content was increased from 0.84 in the control (maize) to 1.29mg in R65, 1.74mg in R60 and 1.25mg/100g in R55. Calcium (Ca) content was increased from 2.65mg/100g in the control (maize) to 11.33mg in R65, 10.52mg in R60 and 15.37mg/100g in R55. Iron (Fe) content was increased from 27.97mg in control to 49.17 in R60, 38.93mg in R55; however reduced to 27.47mg/100g in R55.

Beta-carotene content increased significantly ($p < 0.05$) from 0.035 to 0.4 mg/g with an increase in Moringa leaf powder (table 3). R55 had the highest β-carotene 0.4 mg/g while R60 had 0.21mg/100g and 0.14mg/g in R65.

Discussion

In this retrospective cohort study, the median nutritional recovery times was within the acceptable maximum international standards set at < 28 days[8]. It is consistent with other institution-based studies in Ethiopia, such as Mekelle City which reported 17 days [9]. However, it was higher than the study done in Zambia that reported 13 days[10].This might be related to differences in treatment and caring practices, health care settings and other socioeconomic factors among the study areas. Studies indicated that it is only by complying with the standard protocol for management of SAM, better program outcomes could be assured[11].

However, the median nutritional recovery time was lowest compared to the study reports from Kamba District, South West Ethiopia that indicated recovery time of 50 days [12]and Karat and Fasha stabilization Centers, Southern Ethiopia that reported 26 days [13].

However, though unpublished a study in Jimma, southwest Ethiopia indicated that current anthropometric criteria lead to discharge of children with incomplete recovery of some nutrition parameters including immunity, free fat mass and cellular electrical properties. Accordingly, the study warranted that those children discharged early as recovered from SAM are more vulnerable than their community peers during the

Table 1. Treatment outcomes of severe acute malnutrition among children, Bahir Dar, Northwest Ethiopia; October, 2012 to April, 2016

Variables	Frequency	Percent
Status at discharge		
cured	208	51.9
died	17	4.2
default	143	35.7
non-respondent	6	1.5
transfer	27	6.7

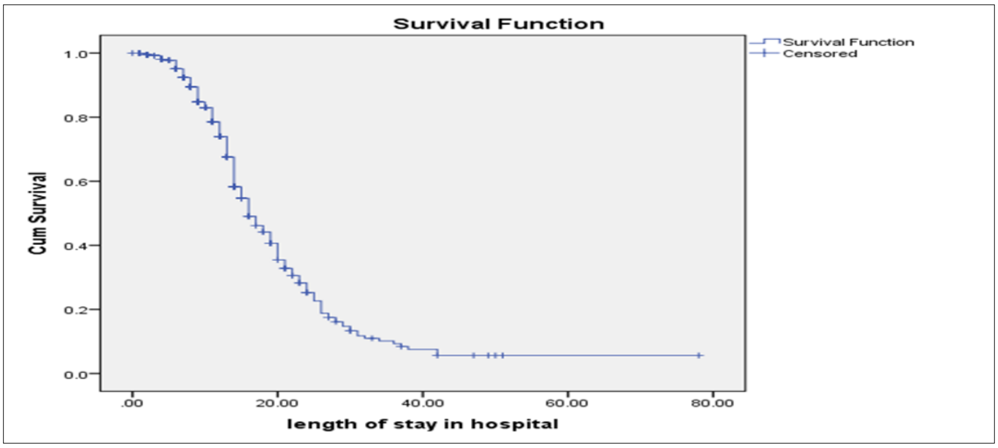

Figure 1. Median time of recovery among children with SAM managed at Felegehiwot referral hospital; Bahir Dar, Northwest Ethiopia, October, 2012 to April, 2016

Table 2. Proximate and energy composition of the control and composite flour

Samples	Proximate values						
	Ash (%)	Moisture (%)	Protein (g/100g)	Fat (g/100g)	Fiber (g/100g)	CHO (g/100g)	Energy (Kcal.)
Maize	1.3[c]	7.8±0.18[a]	8.2±0.1[b]	4.58±0.2[c]	11.12±0.2a	67±0.06[a]	345.9±0.8[d]
R65	3.5±0.46[b]	6.7±0.8[b]	16.6±0.2[a]	10.5±0.19[b]	2.96±0.17d	66.1±0.6[a]	429.5±1.9[a]
R60	4±0.26[ab]	6.2±0.48[bc]	16.98±0.17[a]	10.7±0.1[ab]	6.75±0.2[c]	61.1±0.49[b]	412.5±0.9[b]
R55	4.3±0.33a	5.6±0.40[c]	17.2±1.4	10.99±0.1[a]	9.95±0.27[b]	57.3±0.7[c]	399.8±2[c]
Rec.	≤3	≤5	≥15	10-15		64	400-425

Values are means of triplicate samples (± SD). Means not sharing a common letter are significantly different at $p < 0.05$.

Table 3. Mineral, β-carotene and phytate composition of control and composite flour

Samples	Minerals, β-carotene and anti-nutritional factors				
	Zn-mg/100g	Fe-mg/100g	Ca mg/100g	β-carotene mg/g	Phytate mg/100g
Maize	0.84±0.16[b]	27.97±12.55[a]	2.65±1.25[c]	0.037±0.001[d]	208.5±14[a]
R_{65}	1.74±0.44[ab]	49.17±20.55[a]	11.33±0.04[b]	0.14±0.0065[c]	36±3.35[d]
R_{60}	1.25±0.04[b]	38.93±8.65[a]	10.52±2.87[b]	0.21±0.004[b]	70±6[b]
R_{55}	1.29±0.05[a]	25.47±0.95[a]	15.37±1.55[a]	0.4±0.010[a]	46±15[c]

Values are means of triplicate samples (± SD). Means not sharing a common letter are significantly different at $p < 0.05$.

first months post-discharge.

Regarding to the complementary food supplements, there was significant ($p < 0.05$) increase in protein content with increasing level of Moringaolifera leaf powder supplementation (table 2). This could be due to substitution effect caused by Moringa leaf powder and soybean. Abraham I. Sengev et al also reported the same effect in wheat flour and Moringa powder blended bread [14]. This finding was found to be higher in protein content than that was reported by Onojo US., et al who prepared gruel from sorghum, soybean and plantain [15]. It was also three fold than that was reported by M.C. Ojinnaka et al. who developed a complementary food from soybean and ginger [16]. However, it was lower in protein content than that was reported by Erikhun of complementary food prepared from maize, soybean and Moringa leaf powder [17].

The ash and fat contents also increased significantly (table 2). Abraham I. Sengev et al. also reported the same effect in wheat flour and Moringa powder blended bread[14]. Similarly, the mineral content of the samples increased significantly (table 3). Erkihun had also reported an increase in mineral content as ratio of Moringaolifera powder increased[17].

Beta-carotene content increased significantly (table 3). Nwosu Odinakachukwu I.C., et al., also reported that there was an increase in beta-carotene in the porridge prepared from maize and soybean as a control and a blend of maize, soybean and Moringaolifera powder as test diet [17]. While Onojo US., et al., had reported higher than of this finding[15].

Conclusions

In this study, the median nutritional recovery times was within the acceptable maximum international standards and indicated that children were recovered fast. Moringa leaf powder as a fortificant gave promising result in improving the protein and micronutrient content of the complementary food supplements.

Recommendations

Attention should be given as current anthropometric criteria might lead to early discharge of children with incomplete recovery of some nutrition parameters. Developing complementary food supplements from locally available stables fortified with nutrient rich non-conventional foods (Moringa leaf powder) is important as a strategy for effective treatment of SAM and preventing possible relapsing.

Limitation of the Study

The effect of complementary food supplements in treatment of severe acute malnutrition and prevention of relapsing was not tested.

Relevance of the Study

This study is the first study in the study area which developed complementary food supplements for SAM affected children using locally available stables fortified with nutrient rich non-conventional foods (i.e. Moringa leaf powder).

Authors Contribution

All the three authors have contributed equally in the preparation of the manuscript of this article.

References

1. WHO, UNICEF, WFP. Community-based management of severe acute malnutrition. Geneva, Switzerland. 2007.
2. Hobbs B, Bush A, Shaikh B, Azmat S, Mazhar A, Solter S, et al. Acute malnutrition: an everyday emergency. A 10-point plan for tackling acute malnutrition in under-fives. JPMA Journal of the Pakistan Medical Association. 2013;63(4 Suppl 3):S67-72.
3. Black RE CS, Johnson HL, Lawn JE, Rudan I, Bassani DG et al.;. Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality in 2008: a systematic analysis.. Lancet. 2010;375((9730)): 1969–87.
4. Black RE VC, Walker SP, Bhutta ZA, Christian P, de Onis M etal.;. Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382((9890):427–51.
5. Kramer CV, Allen S. Malnutrition in developing countries. Paediatrics and Child Health. 2015;25 (9):422-7.
6. Mengesha MM, Deyessa N, Tegegne BS, Dessie Y. Treatment outcome and factors affecting time to

recovery in children with severe acute malnutrition treated at outpatient therapeutic care program. Global Health Action. 2016;9.

7. Goossens S, Bekele Y, Yun O, Harczi G, Ouannes M, Shepherd S. Mid-upper arm circumference based nutrition programming: evidence for a new approach in regions with high burden of acute malnutrition. PloS one. 2012;7(11):e49320.
8. WHO, UNICEF. child growth standards and the identification of severe acute malnutrition in infants and children: joint statement by the World Health Organization and the United Nations Children's Fund. 2009.
9. Gebremichael M, Bezabih AM, Tsadik M. Treatment Outcomes and Associated Risk Factors of Severely Malnourished under Five Children Admitted to Therapeutic Feeding Centers of Mekelle City, Northern Ethiopia. Open Access Library Journal. 2014;1(04):1.
10. Munthali T, Jacobs C, Sitali L, Dambe R, Michelo C. Mortality and morbidity patterns in under-five children with severe acute malnutrition (SAM) in Zambia: a five-year retrospective review of hospital-based records (2009–2013). Archives of Public Health. 2015;73(1):23.
11. Yebyo HG, Kendall C, Nigusse D, Lemma W. Outpatient therapeutic feeding program outcomes and determinants in treatment of severe acute malnutrition in tigray, northern ethiopia: a retrospective cohort study. PloS one. 2013;8 (6):e65840.
12. Shanka NA, Lemma S, Abyu DM. Recovery Rate and Determinants in Treatment of Children with Severe Acute Malnutrition using Outpatient Therapeutic Feeding Program in Kamba District, South West Ethiopia. Journal of Nutritional Disorders & Therapy. 2015;2015.
13. 13.Gebremichael DY. 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. 2015;15(1):1.
14. Sengev AI, Abu JO, Gernah DI. Effect of Moringa oleifera leaf powder supplementation on some quality characteristics of wheat bread. Food and Nutrition Sciences. 2013;4(3):270.
15. Ojinnaka M, Ebinyasi C, Ihemeje A, Okorie S. Nutritional evaluation of complementary food gruels formulated from blends of soybean flour and ginger modified cocoyam starch. Advance Journal of Food Science and Technology. 2013;5(10):1325-30.
16. Odinakachukwu I, Ngozi NN, Ngozi I, Aloysius NM. Analysis of the Nutrient Content of Infant Complementary Food Fortificant-Moringa oleifera Leaves with the Commonly Consumed Local Infants Foods in Nigeria: Zea mays and Glycine max. 2014.
17. Erkihun M. Development of supplementary food from blends of maize and soybean flour with moringa powder: aau; 2011.