

Determinants of treatment outcomes of severe acute malnutrition among under-5 children in Yekatit 12 Hospital, Addis Ababa, Ethiopia: a retrospective cohort study

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Keywords: Treatment outcome, severe acute malnutrition, under-5 children, Ethiopia

Posted Date: May 27th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-30080/v1>

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Abstract

Background

Devastatingly, the number of children with SAM is still growing globally. Severe acute malnutrition is the third most common contributing factor to the deaths of under-5 children worldwide. According to the World Health Organization, severe acute malnutrition causes 1 million deaths annually via increased susceptibility to death from severe infection. Ethiopia is one of the countries with highest under-5 child mortality rate, with malnutrition underlying to 28% of all children deaths. In Ethiopia, some studies reported an alarming death and default rates which indicate the need for further study to assess contributing factors to the treatment outcomes of severe acute malnutrition. Therefore, the intention of this research is to determine the treatment outcomes of severe acute malnutrition and identify predictors of nutritional recovery.

Method:

A retrospective cohort study was conducted among 423 under-5 children with severe acute malnutrition. Logistic regression analysis was performed and an adjusted odd ratio with 95%CI was used to determine independent predictors.

Result

The overall recovery, death and default rates were 81.3%, 11.1% and 7.6% respectively. Age, vaccination status, HIV/AIDS, pneumonia, diarrhea and stunting were found to be significant independent predictors of treatment outcomes. The adjusted odd ratio (AOR) for nutritional recovery increased by 14.6% for every 1-month increase in child age (AOR = 1.146; 95%CI: 1.052–1.249). Regarding vaccination status, those under-5 children who were fully vaccinated for their age were about 4 time more likely to recover than their counterparts (AOR = 4.242; 95%CI: 1.566–11.491)

Conclusion

In conclusion, the overall nutritional recovery and default rate in this study were in the acceptable range of international standard even though the death rate was higher. Age and full vaccination were proven to increase nutritional recovery. Conversely, the presence of HIV/AIDS, pneumonia, diarrhea and stunting were proven to decrease nutritional recovery.

Background

Malnutrition is a multifaceted phenomenon. It encompasses overnutrition, which manifests as overweight or obesity; undernutrition, which includes acute and chronic malnutrition; and micronutrient

deficiencies. In developing countries, undernutrition is associated with > 50% of deaths caused by infectious disease. Worldwide, there were around 60 and 20 million children with moderate acute malnutrition and severe acute malnutrition (SAM), respectively, in 2013 (1, 2).

SAM is defined as a weight-for-height (WFH) measurement below 70% or a WFH Z-score below 3 standard deviations (SD) from the mean. It can also be defined as the presence of bilateral pitting edema of nutritional origin or a mid-upper arm circumference (MUAC) of less than 11 cm in children aged 1–5 years (3).

Devastatingly, the number of children with SAM is still growing globally. SAM is the third most common contributing factor to the deaths of under-5 children worldwide. According to the World Health Organization, SAM causes 1 million deaths annually via increased susceptibility to death from severe infection (4). Globally, children suffering from SAM have a risk of death that is 5 to 20 times greater than that of well-nourished children. SAM can directly cause death, or it can indirectly increase the fatality rate among children suffering from diarrhea and pneumonia (2). Although SAM is considered a minor issue in developed countries, it poses a major problem in Asia and Africa (5).

Based on the 2016 Ethiopian Demographic Health Survey (EDHS) report, Ethiopia has the region's highest rate of acute malnutrition, with 3% of under-5 children identified as severely wasted. The prevalence of SAM showed little change from the 2011 EDHS data(6, 7). Additionally, Ethiopia has one of the highest under-5 child mortality rates in the region, with malnutrition underlying 28% of all child deaths (8).

Management of SAM is critical for child survival and is a key cost-effective component for scaling up nutritional framework to address malnutrition. Governments face great challenges in building capacity and providing sufficient resources to prevent and treat acute malnutrition(8). Majorities of children with SAM are presented to hospital or health center to be treated at TFU and OTP. However, due to many factors including late presentation of cases, co-morbidities and error in managing; many children are dying any way(9).

A few studies in different regions of Ethiopia reported higher percentages of death and default (10–14). According to the report death and default rates are alarming in the country which needs further study to describe the treatment outcome of SAM in other hospitals and to determine contributing factors. Therefore, the intention of this research is to determine treatment outcomes of under-5 children with SAM and associated factors using the inpatient program at Yekatit 12 hospital, Addis Ababa, Ethiopia.

Materials And Methods

Study design, area, and period

A facility-based retrospective cohort study was conducted at Yekatit 12 Hospital in Addis Ababa between February 2019 and March 2019. Addis Ababa is the capital city of Ethiopia and the seat of both the

African Union and the Economic Commission for Africa. It had an estimated population of over 7 million people as of the end of 2019 (15).

Yekatit 12 Hospital is an organized health facility with 12 isolated beds. The facility employs well-equipped health care workers trained in the management of SAM using a standardized management protocol that was updated by the Federal Ministry of Health in 2014(16). The hospital also has an isolated therapeutic feeding unit (TFU), assigned nurses, and necessary equipment for the preparation of formula milk in the pediatric ward.

Source and study population

All under-5 children who were admitted to Yekatit 12 Hospital for management of SAM between January 1, 2016 and December 30, 2018 were used as the source population. The study population comprised randomly selected under-5 children from the source population who were admitted to and treated at Yekatit 12 Hospital.

Sample size determination

The sample size in this study was determined using a single-proportion formula:

$$n = \frac{(Z_{\alpha/2})^2 p(1-p)}{d^2}$$

Here, p is an estimate of the recovery rate (assumed to be 52%). This value was obtained from a retrospective study in Bahir Dar, since the was conducted recently (2018), and the choice of this value resulted in a larger sample size (11).

$$n = 1.96^2 \times 0.52(0.48) / 0.05^2 = 384$$

After addition of 10% to the sample size to account for missing and incomplete data, the final sample size was 423 under-5 children with SAM.

Sampling procedures

Three consecutive years (2016, 2017, and 2018) were purposively selected for record reviews because they provided the most recent available information about the problem under investigation at the selected institution.

All SAM cases were obtained from the TFU register book. There was no cyclic pattern in the ordering of the subjects on the list. Hence, systematic sampling was employed to select a sufficient number of samples starting from the most recent month and going backwards, based on the sequence of medical card numbers. The total number of under-5 SAM admissions during the 3-year period was 1050. The total

sample size for each year was allocated proportionally by calculating the interval from the total population (N) of the sampling frame (2016, N = 254; 2017, N = 356; 2018, N = 440) and the sample size n ($k = N/n$). The interval ($k = 2$) was similar for each year. The first number was selected randomly.

Table 1
Distribution of sample size across admission period in Yekatit 12 hospital.

S. no	Period	Total number of SAM admitted	Number of samples selected
1	2016	254	103
2	2017	356	143
3	2018	440	177
Total		1050	423

Methods of data collection

A structured data abstraction form was used for data collection. The data abstraction form was adopted from the Ethiopian protocol for the management of SAM (17) and from previous studies (11, 18–20). Data regarding baseline characteristics such as sociodemographic status, immunization status, and baseline anthropometric measurements; type of malnutrition; comorbidities; routine medications, supplements and therapeutic feedings; and recovery time were retrieved from the clinical records of patients by trained health professionals. Moreover, the data abstraction form was pre-tested in 5% of the sample at Zewditu Memorial Hospital.

Data collection procedure

The data collectors were 2 master's degree students and 2 BSc nurses. One supervisor was needed to manage the overall data collection process.

Medical card reviewers were provided with 2 days of training. A separate orientation was given to the supervisor regarding how to oversee the data collectors and how to check the completion of the data abstraction forms.

Dependent and independent variables

The outcome variable was treatment outcomes of SAM and independent variables included socio-demographic variables, type of malnutrition, base line anthropometric measurements, immunization status, comorbid medical conditions, treatments, supplements and therapeutic feeding.

Operational definitions

In this study, recovered children were those who became free from medical complications and edema and achieved and maintained a sufficient MUAC (≥ 12.5 cm) and WFH ($\geq 85\%$); these children were described as cured or recovered on their medical charts (21).

Died were those children who passed away and whose death report is recorded on the patient's chart.

Defaulted children were those children that were against medical advice (caregivers sign on behalf of their child to leave the treatment before recovery) or that were lost during treatment with unknown status.

A comorbidity was defined as a medical problem present in addition to severe acute malnutrition before or after admission. Finally, baseline anthropometric measurements (e.g., MUAC, weight, and height values) were those recorded at the time of admission.

Data quality control

To ensure data quality, a pre-test was conducted on 5% of the sample. Any error found in the data abstraction format during the pre-test process was corrected. Then, the actual data were collected under close supervision. After collection, the data were carefully entered, cleaned, coded, and analyzed with SPSS version 25 (IBM Corp., Armonk, NY, USA). Afterward, the investigator cleaned the data in an orderly fashion by first sorting each variable in ascending order to check for unexpected cases.

Methods of data analysis

The data were checked, coded, and entered into EpiData version 4.2 (EpiData Association, Odense, Denmark) and exported to SPSS for analysis. Graphs and frequency tables were used to report the descriptive data. Bivariate logistic regression analysis was performed for each predictor variable regarding treatment outcomes of SAM. An adjusted odd ratio (AOR) with 95% CI was used to identify predictor variables of treatment outcome, and P values < 0.05 were considered to indicate statistical significance.

Results

The study included records of 423(100%) under-5 children with the diagnosis of SAM admitted in three consecutive years (2016, 2017, and 2018) at TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia. Out of the total 423 children in the cohort, 241(57%) were males and more than two-third or 289(68.3%) of children were urban residents. The age of children ranges from 1 month to 59 months with a median age of 11 months (Table 2).

Table 2

Distribution of socio-demographic characteristics among malnourished children in Yekatit 12 Hospital, Addis Ababa, Ethiopia (N = 423)

Characteristics	Categories	Frequency(N = 423)	Percentage (%)
Age of the child	< 24 months	341	80.6
	≥ 24months	82	19.4
Sex of the child	Male	241	57
	Female	182	43
Residence	Urban	289	68.3
	Rural	134	31.7
Weight for age Z score at admission	<-3 Z score	277	65.5
	-3 to -2 Z score	102	24.1
	>-2 Z score	44	10.4
WFH Z score at admission	≤-3 Z score	291	68.8
	> -3 Z score	132	31.2
Admission MUAC in cm	< 11 cm	186	44
	11-12cm	39	9.2
	> 12 cm	72	17
	Under age(< 6 months) to Measure	126	29.8

About 313(74.0%) under-5 children admitted to TFU had marasmus and 69(16.3%) of them had kwashiorkor (Fig. 1).

Figure 1 shows distribution of type of malnutrition among children in TFU of Yekatit 12 hospital, Ethiopia.

Similarly, about 269(63.6%) of under-5 children vaccinated fully and about 66(15.6%) of them vaccinated partially (Fig. 2).

Figure 2 shows vaccination status of malnourished under-5 children admitted in TFU of Yekatit 12 hospital, Ethiopia.

Among all under-5 children selected for the study, 405(95.7%) of them had at least one form of comorbid disease. The most common medical comorbidities of under-5 children accompanied with SAM were diarrheal diseases (53.0%), anemia (42.8%), pneumonia (42.3%), and fever (33.1%).

Table 3
 Distribution of comorbid diseases among malnourished children in Yekatit
 12 Hospital, Addis Ababa, Ethiopia (N = 423)

Variables	Category	Frequency	Percentage (%)
HIV/AIDS	Yes	47	11.1
	No	376	88.9
Anemia	Yes	181	42.8
	No	242	57.2
Dehydration	Yes	83	19.6
	No	340	80.4
Fever	Yes	140	33.1
	No	283	66.9
Axillary temperature (°C)	< 38	62	14.7
	≥ 38	79	18.7
Congenital heart disease	Yes	40	9.5
	No	383	90.5
Diarrheal disease(s)	Yes	224	53.0
	No	199	47.0
Tuberculosis	Yes	24	5.7
	No	399	94.3
Pneumonia	Yes	177	41.8
	No	246	58.2
Gastroenteritis	Yes	202	47.8
	No	221	52.2
Sepsis	Yes	85	20.1
	No	338	79.9
Rickets	Yes	70	16.5
	No	353	83.5
Stunting	Yes	108	25.5
	No	315	74.5

Variables	Category	Frequency	Percentage (%)
Global developmental delay	Yes	42	9.9
	No	381	90.1
Shock	Yes	37	8.7
	No	386	91.3
Microcephaly	Yes	31	7.3
	No	392	92.7

Out of 423 children, whose medication records were selected for review, the most prescribed routine medication were IV antibiotics 378(89.4%), and PO antibiotics 205(48.5%) as shown in Table 4. Regarding deworming of children, only 85 (20.1%) children were eligible (≥ 2 years) to take Albendazole or Mebendazole as shown in Fig. 3.

Regarding special medications, majority of children were not given ReSoMal (Fig. 4).

Table 4
Distribution of treatments given for malnourished children in Yekatit 12 Hospital, Addis Ababa, Ethiopia (N = 423)

Variables	Category	Frequency	Percent (%)
Routine treatments			
IV antibiotic(s)	Yes	378	89.4
	No	45	10.6
Oral antibiotic(s)	Yes	205	48.5
	No	218	51.5
Deworming	Yes	22	5.2
	No	63	14.9
	Not applicable	338	79.9
Special medication			
Intravenous fluid	Yes	67	15.8
	No	356	84.2
ReSoMal	Yes	180	42.6
	No	243	57.4
Supplements given			
Vitamin A	Yes	69	16.3
	No	354	83.7
Iron	Yes	92	21.7
	No	331	78.3
Folic Acid	Yes	160	37.8
	No	263	62.2
Zink	Yes	61	14.4
	No	362	85.6
Therapeutic foods given			
Formula-75	Yes	310	73.3
	No	113	26.7

ReSoMal, rehydration solution for malnutrition; RUTF, ready-to-use therapeutic food.

Variables	Category	Frequency	Percent (%)
Formula-100	Yes	390	92.2
	No	33	7.8
RUTF	Yes	145	34.3
	No	278	65.7
ReSoMal, rehydration solution for malnutrition; RUTF, ready-to-use therapeutic food.			

Figure 3 shows deworming status of malnourished under-5 children admitted in TFU of Yekatit 12 hospital, Ethiopia.

Treatment outcome compared to international standard by time series

Regarding the overall treatment outcomes of children with SAM, about 344 (81.3%) children were recovered, 47 (11.1%) were died and the rest 32 (7.6%) were defaulted their treatment. When we see treatment outcome by time series, the recovery, death and default rates showed major to slight variations from year to year as shown in Table 5.

Table 5
Distribution of treatment outcomes among malnourished children in Yekatit 12
Hospital, Addis Ababa, Ethiopia (N = 423)

Variables		Frequency	Percent	Sphere Standard	
				Acceptable	Alarming
Outcomes of treatment 2016	Recovery	80	77.7	> 75%	< 50%
	Death	15	14.6	< 10%	> 15%
	Default	8	7.8	< 15%	> 25%
2017	Recovery	117	81.8	> 75%	< 50%
	Death	16	11.2	< 10%	> 15%
	Default	10	7.0	< 15%	> 25%
2018	Recovery	146	82.5	> 75%	< 50%
	Death	20	11.3	< 10%	> 15%
	Default	11	6.2	< 15%	> 25%
Overall	Recovery	344	81.3	> 75%	< 50%
	Death	47	11.1	< 10%	> 15%
	Default	32	7.6	< 15%	> 25%

Factors associated with treatment outcomes of severe acute malnutrition

Thirty-nine independent variables were analyzed using binary logistic regression analysis with the dependent variable. Twenty-four variables, which have a P value of < 0.25 in the bivariate analysis, were entered in to a multivariable analysis. However, only six variables such as age, vaccination status, HIV/AIDS, Diarrhea, pneumonia, and stunting, were independent predictors of treatment outcomes of SAM. For every 1-month increase in child's age, nutritional recovery rate was increased by 14.6% (AOR = 1.146; 95%CI: 1.052–1.249). Regarding to vaccination status of children, those under-5 children who were fully vaccinated for their age were about 4 time more likely to recover than children who were not fully vaccinated according to their age(AOR = 4.242; 95%CI: 1.566–11.491).

Depending on children's exposure for different comorbid diseases, children who were HIV positive were about 83% less likely to recover than their counterparts (AOR = 0.171; 95%CI: 0.044–0.666). Similarly, children who were developed pneumonia were about 66% less likely to recover than those children who didn't develop it (AOR = 0.343; 95% CI: 0.175–0.671). Likewise, compared to children who were not stunted, stunted children were 60% less likely to recover (AOR = 0.396; 95% CI: 0.189–0.831). Additionally,

children who experienced diarrhea during hospital stay were about 72% less likely to recover than those who did not experience it (AOR = 0.277; 95% CI: 0.083–0.930).

Table 6
Factors associated with treatment outcomes of malnourished children (N = 423)

Covariates	Category	p-value	AOR(95%CI)
Age	< 24 months	.002	1.146 (1.052–1.249)**
	≥ 24months		
Vaccination status	Fully vaccinated	.004	4.242 (1.566–11.491)**
	Partially vaccinated	.017	3.599 (1.255-10.3231)*
	Not vaccinated		1
HIV/AIDS	Yes	.011	0.171 (.044-.666)*
	No		1
Diarrhea	Yes	.038	0.277 (.083-.930)*
	No		1
Pneumonia	Yes	.002	0.343 (.175-.671)**
	No		1
Stunting	Yes	.014	0.396 (.189-.831)*
	No		1
* $P < 0.05$ in multivariable logistic regression analysis.			
** $P < 0.01$ in multivariable logistic regression analysis			

Bivariate logistic regression analysis was done for each predictor variable. Then, variables that had $P \leq 0.25$ in the binary logistic regression analysis were entered into the multivariate logistic regression analysis.

AOR, adjusted odd ratio; CI, confidence interval.

Discussions

The aim of the study was to determine treatment outcomes of SAM and identify the major predictors of treatment outcome. From the total of 423 under-5 children included in the study, 81.3% of children were recovered, 11.1% were died and 7.6% of children were default their treatment. Compared to the sphere project value, the overall recovery and default rate were in acceptable ranges (> 75% and < 15% respectively). However, the death rate was somewhat higher than acceptable death figure (< 10%) even though it was not alarming (> 15%) (21). Compared to other studies in different countries, the recovery

rate in this study was higher than studies done in Indonesia, Zambia, Bahir Dar city, Ayder hospital, Gedeo Zone-health, Wolaita Zone, Debre Markos and Finote Selam hospitals Dilchora Dawa and North Shoa Zone (10, 11, 20, 22–27)

Differences in sample size, socio-demography and health care setup might be possible reasons for difference of recovery rate in Indonesia, Zambia and Ayder referral hospital. However, the low recovery rate observed in Felege-Hiot referral hospital Gedeo Zone, Wolaita Zone, Debre Markos and Finote Selam hospital, Dilchora hospital and North Shoa Zone might be due to the health care setup (these studies include HC, primary hospitals and general hospitals with no TFU).

However, the recovery rate for the present study was lower than studies done India, Wolisso St. Luke catholic hospital and Ghana (28–30). The higher recovery rate in St. Luke catholic hospital might be due to greater sample size (855). Nevertheless, differences in socio-economic status, quality of care provided in each hospital, the health seeking behavior and accessibility of different medications and therapeutic foods to treat SAM might be reasons for higher recovery rates in India and Ghana.

The present study also reported a death rate higher than reported from the study done in India, Gambia, Bahir Dar City, North Shoa, Debre Markos and Finote Selam hospitals, and Wolaita zone (8, 11, 20, 26, 27, 31). The possible reason for lower death rate in India and Gambia might be only case specific mortality will be recorded and there might be differences in socio-economic status, treatment and caring practice. The possible variations for other Ethiopian studies might be in the present study setting, debilitated children referred from different parts of the country and the case becomes complicated in this way. As a result, the death rate might be higher.

Regarding predictors of nutritional recovery time, from all socio-demographic characteristics, age was the only significant factor for treatment outcomes of SAM. For every 1-month increase in child's age, nutritional recovery rate was increased by 14.6% (AOR = 1.146; 95%CI: 1.052–1.249). The scientific explanation for this might be due to discontinuation of breastfeeding and inappropriate complementary feeding practices as children's age increases. The present study was consistent with the study done in Debre Markos and Finote Selam hospitals, and Northern India (20, 28). However, this study is contrary to studies done in Malawi, Wolisso St. Luke catholic hospital, Gamo-Gofa Zone and Shebedido woreda OTP center (30, 32–34). This difference may be due to differences in research design, and health care setting.

Related to immunization status, those under-5 children who were fully vaccinated for their age were about 4 time more likely to recover than children who were not fully vaccinated according to their age. Scientifically, the body of un-vaccinated children could not fight major childhood diseases like malaria, pneumonia, diarrhea, and measles. The condition of immune-suppression becomes worse when the child is under starvation. As result, the chance of recovery become lower and lower (35, 36). The present study is consistent with a study finding in Bahir Dar (19). Nevertheless, studies done in North Shoa as well as Enderta Woreda, Tigray, did not show any association between vaccination status and nutritional recovery time (26, 33). The reason for variation could be deference in health care setup and sample size.

Among all comorbidities, comorbid diseases like HIV/AIDS, pneumonia, diarrhea and stunting, were the only significant predictors of treatment outcomes of SAM. Depending on children's exposure for different comorbid diseases, children who were HIV positive were about 83% less likely to recover than their counter-parts. It is obvious that HIV/AIDS can compromise the child's immune status and expose children for different opportunistic infection. This may result in devastating outcomes of SAM like prolonged hospitalization and death. The present study is in line with studies done in West Ethiopia, and Finote-selam and Debre-Markos hospitals(20, 37) and contrary to studies done in northwest Ethiopia (14, 38).

Relative to children who did not have pneumonia, children with pneumonia were 66% likely to recover. This could be explained in terms of the synergistic relationship between pneumonia and malnutrition. Children with respiratory infections like pneumonia may present with tachypnea, retractions, and other signs of respiratory distress, but these are undetectable signs in children with SAM. Therefore, health care providers cannot early detect and treat early and result in an evil outcome.

The present study is in line with a retrospective cohort study done in Zambia and Debre Berhan referral hospital, Enat general hospital and Mehal Meda primary hospital(25, 26, 39). However, pneumonia was not a significant predictor of nutritional recovery time in a retrospective cohort study done in Southern Ethiopia, Wolaita Zone and Bahir Dar city(11, 23, 40). The reason for difference might be in those hospitals pneumonia might be detected and treated early compared to the present study setting since it is referral for malnutrition.

Similarly, children who were stunted were 60% less likely to recover compared to children who were not stunted. The explanation for this association might be, management of acute malnutrition is similar regardless of whether there is stunting, although obviously the most stunted children will have the highest risk of failing to respond to therapy and die in hospital. Around 25% of under-5 children in the present study were stunted, however none of studies done in Bahir Dar city, Debre Markos and Finote Selam, Debre Berhan referral, Enat general and Mehal Meda primary hospitals(11, 20, 26) included stunting as co-factor.

Likewise, children who experienced diarrhea during hospital stay were about 72% less likely to recover than those who did not experience it. Unless it is prevented and detected early diarrhea could result in many evil complications including metabolic complications like acidosis and alkalosis. As a result the child may end up with death(1). The present study is in line with studies done in Zambia and Ethiopia (24–26, 41). However, diarrhea was not a significant determinant of treatment outcome in studies done in Zambia teaching hospital and in Woldia hospital, Ethiopia (42, 43). The difference with Zambia teaching Hospital might be explained with difference in sample size, but the difference with Woldia Hospital might be, since the present study setting is referral, diarrhea might not be early identified and treated and result in dehydration and death.

Conclusions

Generally, performance indicators like recovery, and default rates were within the acceptable range values except the overall death rate. From the multivariable logistic regression model, older age and full vaccination were proven to increase the chance of nutritional recovery. Conversely, the presence of HIH/AIDS, pneumonia, diarrhea and stunting were proven to diminish the chance of nutritional recovery. Therefore, to prevent complications; to reduce death rate; and to escalate recovery rate, emphasis should be given for primary prevention like immunization programs and improving early detection and treatment of SAM to prevent stunting; and comorbidities like HIV/AIDS, pneumonia and diarrhea.

List Of Abbreviations

AOR- Adjusted Odd Ratio

CD - Comorbid Diseases

COR- Crude Odd Ratio

EDHS- Ethiopian Demographic and Health Survey

FMOH- Federal Ministry of Health

IV- Intravenous

MUAC- Mid Upper Arm Circumference

OTP- Out Patient Program

ReSoMal- Rehydration Solution for Malnutrition

RUTF- Ready to Use Therapeutic Food

SAM- Severe Acute Malnutrition

SD- Standard Deviation

TFC- Therapeutic Feeding Center

TFU- Therapeutic Feeding Unit

WFH- Weight- for -Height

WHO - World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board of Addis Ababa University, College of health sciences, school of nursing and midwifery with 035/19/SMN reference number. Permission was obtained from Yekatit 12 Hospital board. Privacy and confidentiality of study participants were maintained by making the data abstraction form anonymous and protecting our personal computers by strong password.

Consent for publication

“Not applicable” in this section.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests in this section.

Funding

The study was funded by Addis Ababa University, Ethiopia. The funder had no role in the study design, data collection, and analysis, interpretation of data, the decision to publish, or preparation of the manuscript.

Authors' contributions

MA and GS conceptualized the research; MA, and GS served as project administrator; MA, GS, and FA wrote the methodology; MA and MB analyzed the data; visualization was done by MA, FA and MB; MA wrote the original draft and was the major contributor in writing the manuscript; MB, GS, FA reviewed the draft; all authors read and approved the final manuscript.

Acknowledgements

First, we would like to express our deepest gratitude and appreciation to Addis Ababa University, College of Health Sciences for providing financial support to complete this research project. We would like to sincerely acknowledge the data collectors and supervisors for their careful work. We would also like to extend our appreciation to staffs of Yekatit 12 Hospital for providing some necessary information for writing this paper.

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Figures

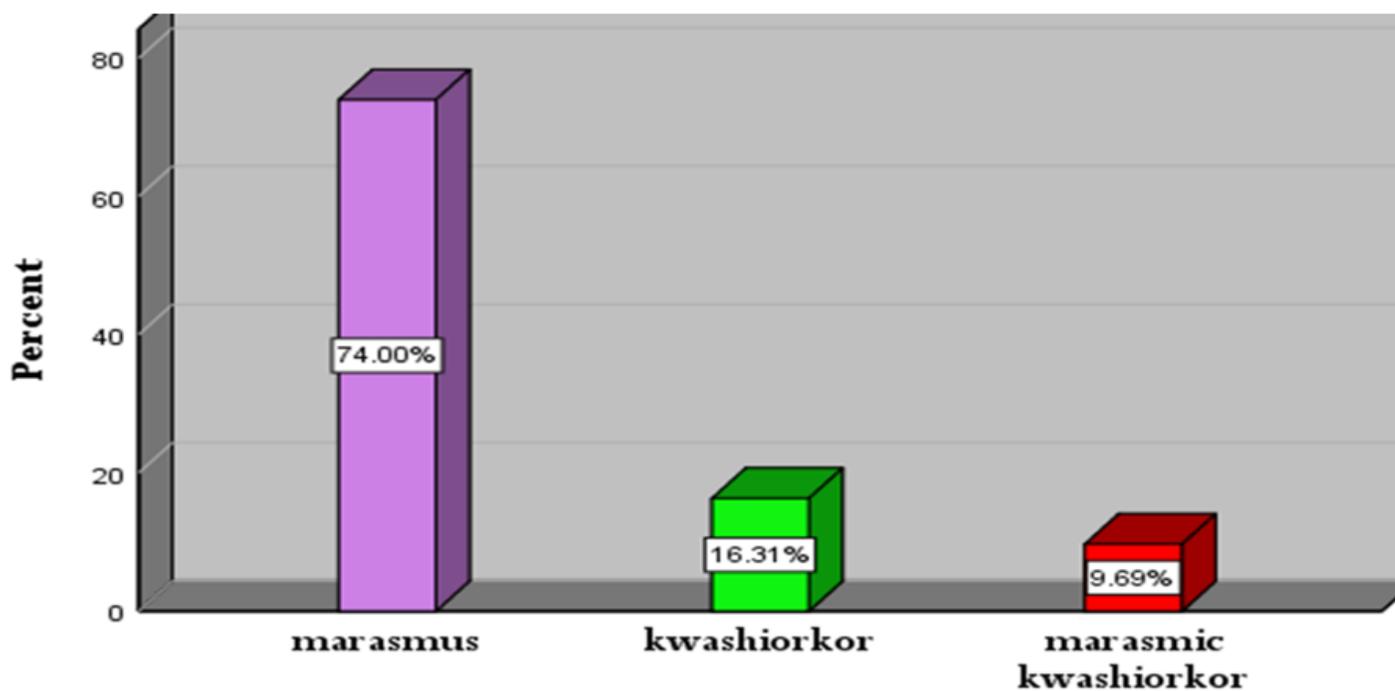


Figure 1

Shows distribution of type of malnutrition among under-5 children in TFU of Yekatit 12 hospital, Ethiopia.

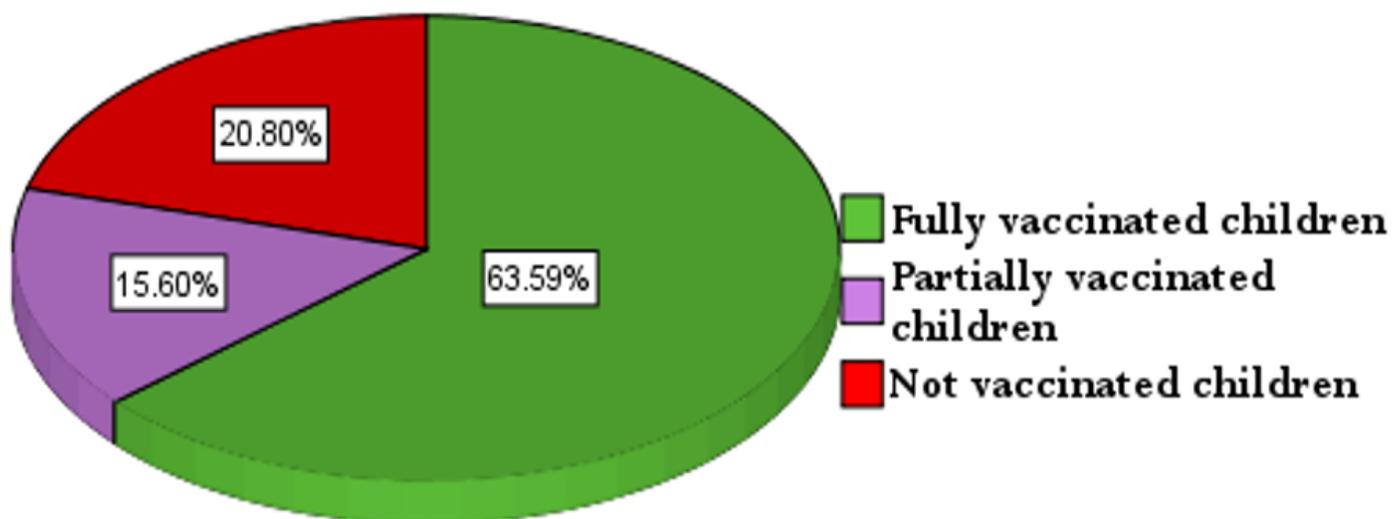


Figure 2

Shows vaccination status of malnourished under-5 children admitted in TFU of Yekatit 12 hospital, Ethiopia.

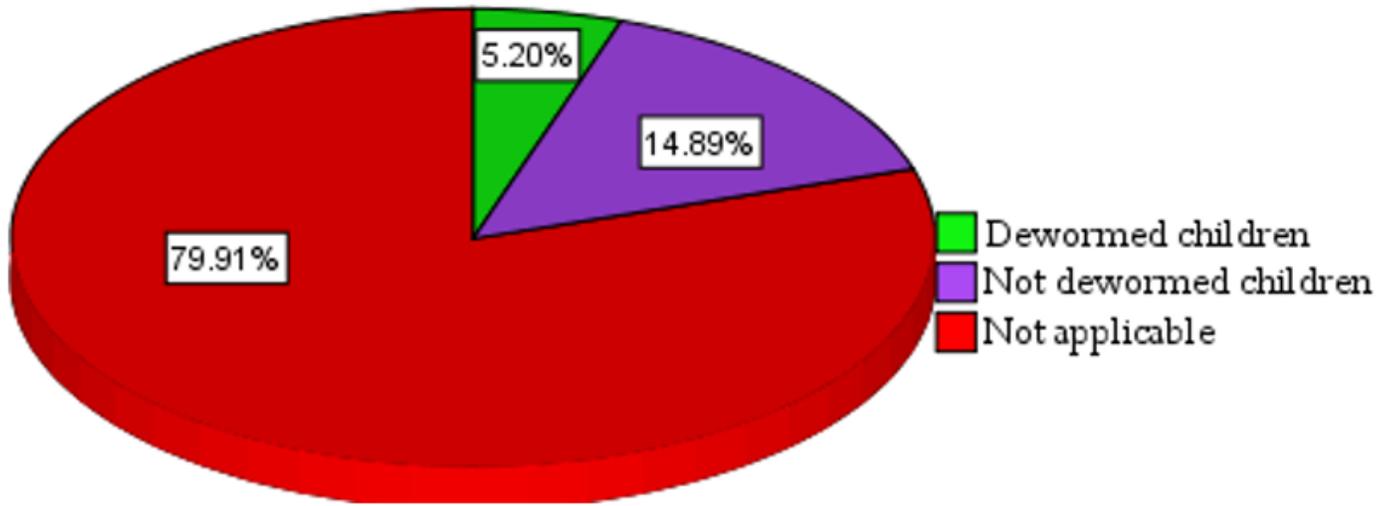


Figure 3

Shows deworming status of malnourished under-5 children admitted in TFU of Yekatit 12 hospital, Ethiopia.

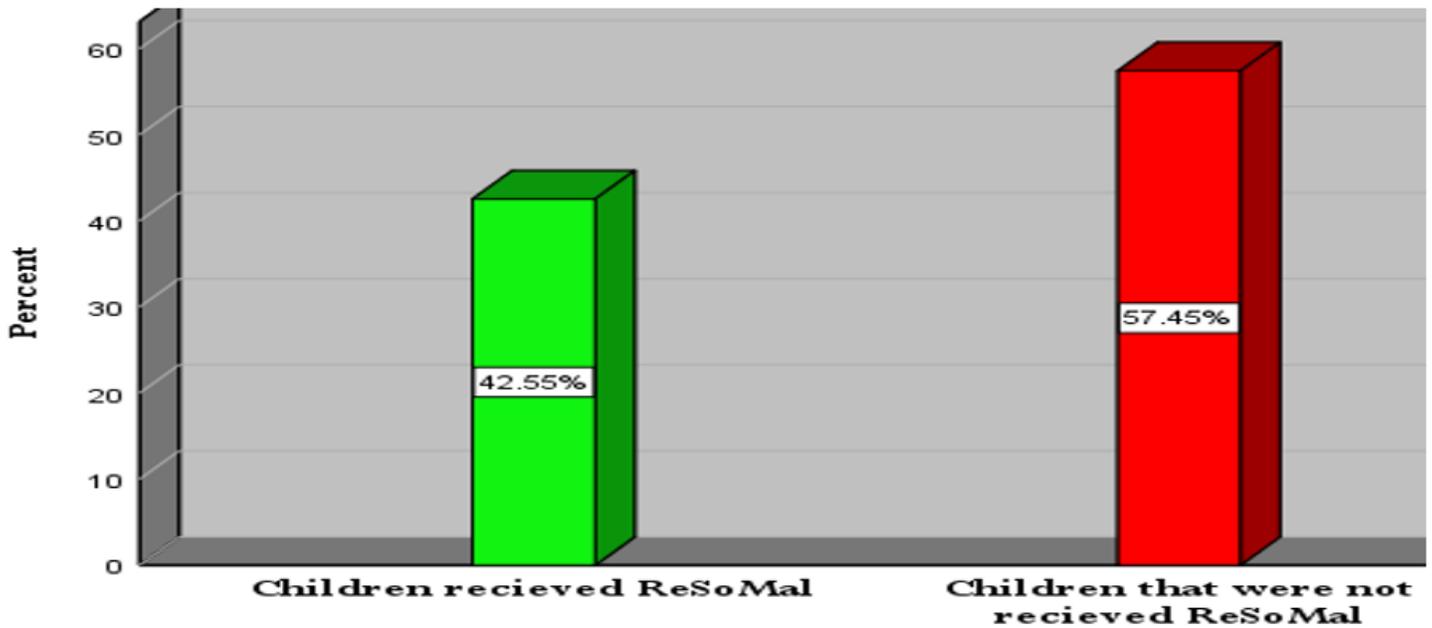


Figure 4

Shows percentage of malnourished children given ReSoMal in TFU of Yekatit 12 hospital, Ethiopia.

Supplementary Files

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